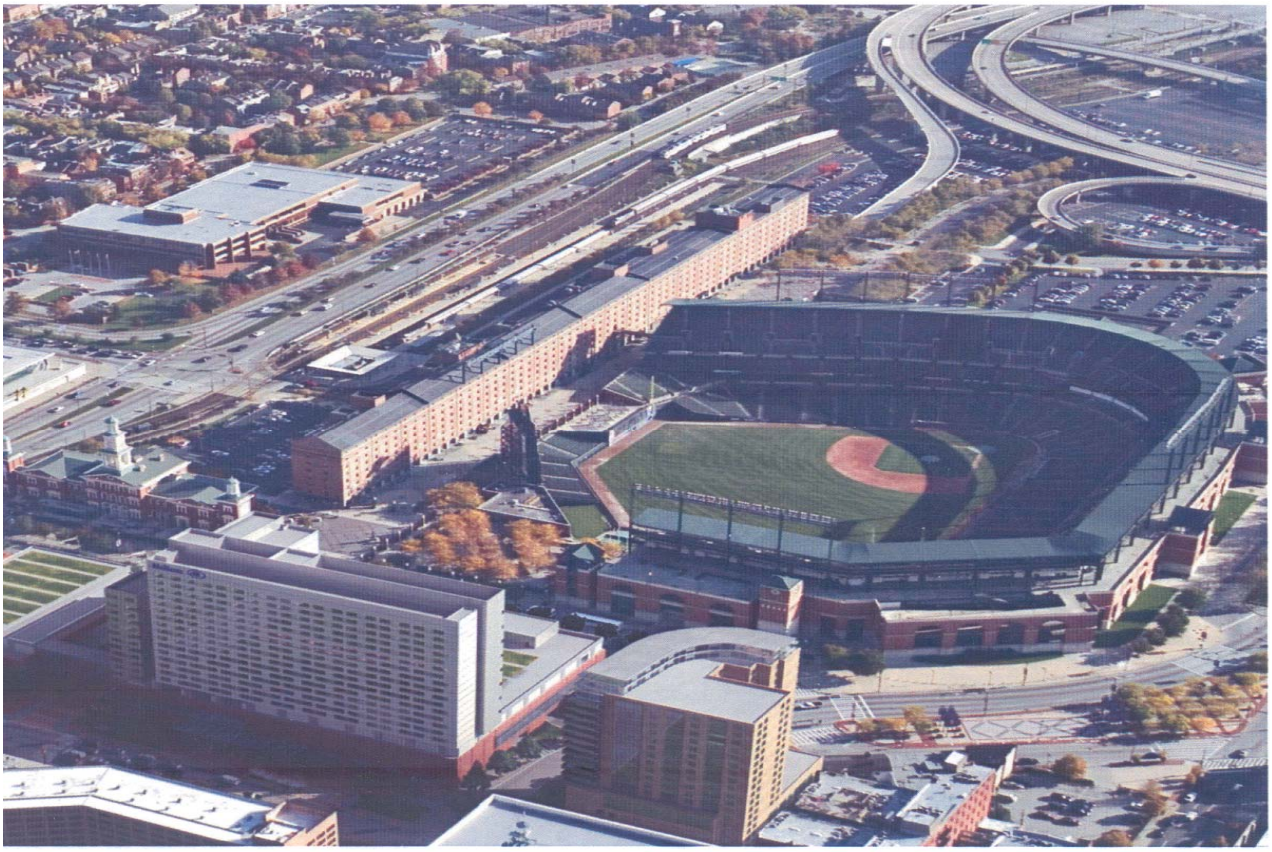
Hilton Baltimore Convention Center Hotel

Western Podium

Baltimore, MD



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Final Report

April 2, 2010

Baltimore Hilton
Baltimore, MD

Project Overview
Size: 850,000 Sq. Feet
Cost: $250 Million
Construction Dates: February 2006- August 2008
Delivery Method: Design-Build
Building Use: 757 hotel guest rrooms, grand/junior ballrooms, conference/meeting rooms

Project Team
Owner: Baltimore Hotel Corp.
Architecture: RTKL
Structural: RTKL, Hope Furrer
Mechanical: Southland Industries
Electrical: M.C. Dean
GC: Hensel Phelps

Architecture
-Walking bridge over Eutaw St. connecting 3-story east podium and 21 story west podium
-Lower levels enclosures are brick and glazed aluminum curtain wall, while towers are metal panel walls with fixed aluminum windows
-Green roof utilized, and towers have PVC membrane roof

MEP
-8 AHU's (274,000 cfm) serving VAV systems in public spaces and lower levels
-4 MAU's (86,000 cfm) supply conditioned outdoor air to guest rooms
-1100 KW Emergency Generator
-2000A 480/277 serves the East Podium
-Two 4000A 480/277 serves the West Podium

Structural
Foundation
- -Columns bearing on drilled caissons
- -Spread footings bearing on reinforced soil

Lateral Systems
- -Curtain walls
- -Stairwells and Elevator Shaft walls are shear walls

Gravity System
- -Concrete columns
- -Concrete frames
- -Steel brace frames and trusses

Christopher A. Simmons
Structural Option
http://www.engr.psu.edu/ae/thesis/portfolios/2010/cas5098/index.html

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EXECUTIVE SUMMARY

The goal of the redesigning of the floor system was to decrease the slab thicknesses of each floor, while affecting the column and beam systems as little as possible. This was achieved by changing the existing two-way flat plate floor system to a two-way post-tensioning system. Each floor decreased by 1 to 2 inches except for the first floor and the third floor which increased by 2 inches and 1 inch respectively. This system was designed with the original column and beam layout and sizes, satisfying that part of the goal of the design. The post-tensioning floor system decreased the overall weight of the building by about 12000 kips. With this decrease in building weight the seismic base shear and overturning moment decreased by 140 kips and 20300 foot-kips respectively compared to the existing structure. Also with the decrease in building weight, the foundation system had to be looked at and analyzed to see if any changes needed to be made. It was noted that a decrease in weight wouldn't provide any need to change the existing caisson foundation system.

Changing the floor system to post-tensioning created a change in the floor system costs and construction time. A cost and schedule analysis was done for both the existing two-way flat plate and the post-tensioning system. The PT system was found to cost less but take 22 more working days to construct. It cost about $1.1 million less than the two-way system, but would cost the hotel money for not being able to be opened for those 22 plus days.

There was an area in the building that needed to be looked at acoustically. That area was the pool and fitness room area on the fourth floor. Directly below the pool and fitness areas are meeting rooms. With the current floor system in that area of a concrete slab on metal decking, it was noticed that the pool wouldn't provide an acoustical problem to the meeting room below because the water would absorb the sound. However the fitness room needed to have the floor redesigned to a floating floor so that the transmission of sound down into the meeting room would decrease.

INTRODUCTION

The Hilton Baltimore Convention Center Hotel (HBCCH) is located right in downtown Baltimore next to the Baltimore Orioles stadium Camden Yards, and located blocks away from Inner Harbor. HBCCH is broken up into two podiums, East and West. The eastern podium is a 4-story building that houses a junior ballroom, meeting rooms and a multipurpose restaurant. The western podium is a 21-story building that houses the main hotel lobby, parking garage, grand ballroom with corresponding kitchen, meeting rooms, pool/health club, and 757 hotel rooms. The grand ballroom has moveable partitions located in the ceiling that allow multiple events to take place there. The western podium offers over 900,000 SF of hotel space. The structure of the western podium consists of concrete beams, columns and shear walls to resist lateral loading. The green roof above the grand ballroom is supported by special joists and whiles the pool above the grand ballroom is supported by steel beams.

FOUNDATION SYSTEMS

The foundation of the western podium consists of caissons and spread footings. The spread footings will bear on firm natural soils and have a minimum bearing capacity of 4ksf. The drilled caissons will have straight shafts to bear on gneiss rock and have a minimum safe bearing capacity of 100ksf. The depths of the bottoms of the caissons vary from 14 feet all the way up to 32 feet below level B2's floor slab. The compressive strength of the drilled caissons and spread footings are 3500 psi, while the caisson caps that the columns bear on have a compressive strength of 4000 psi. A typical caisson section is shown in figure 1.

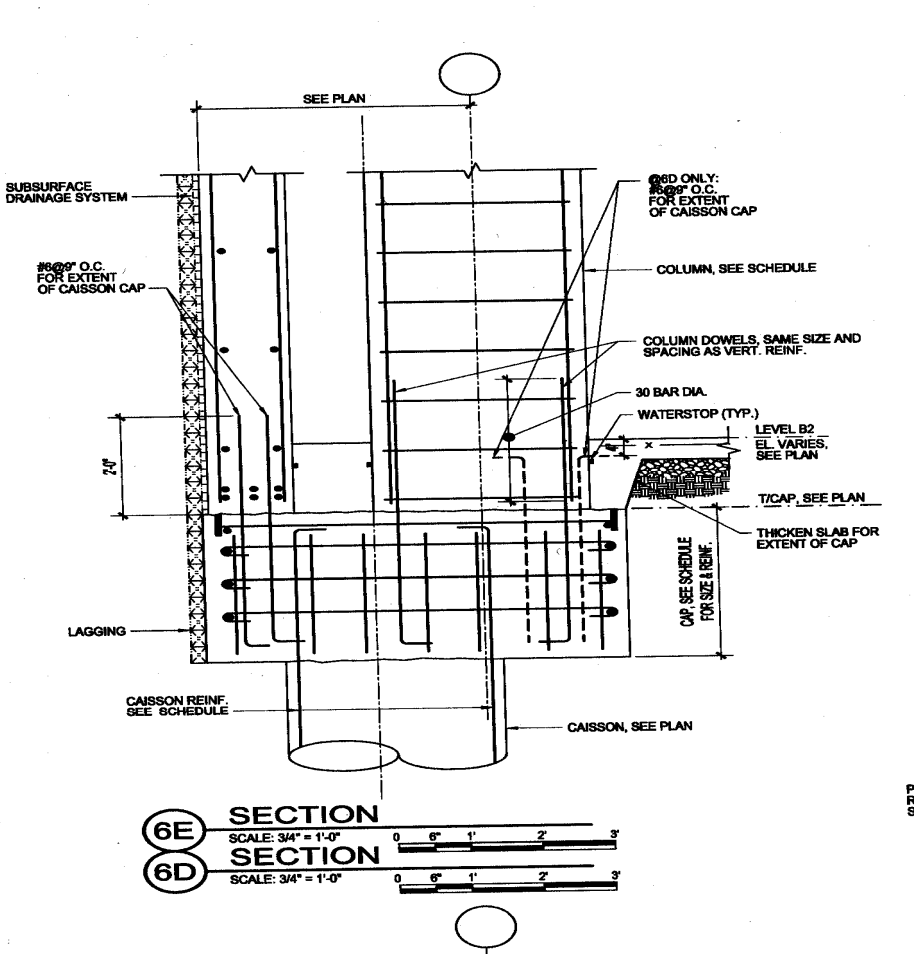

Figure 1 – Caisson Section

FLOOR SYSTEM

The floor system consists of two-way slabs whose thicknesses range from 8" thick on the floors with hotel rooms to 11" in the underground parking garage. The slabs are reinforced with 6x6-W1.4xW1.4 WWF, except for the slab-on-grade which is reinforced with 6x6-W2.1xW2.1 WWF as seen in Fig. 2. Drop panels are located on the B1, 1st, Mezzanine level, 2nd, 3rd, and 15th floors. The drop panels vary from 5" up to 11" in thickness. Typical spans for floors consisting of hotel rooms are 26'-10". On the fourth floor, the floor system changes to a concrete slab on metal decking. This is because of the pool area as well as the weight room area. A detail of the floor system for that area is shown in Fig. 2

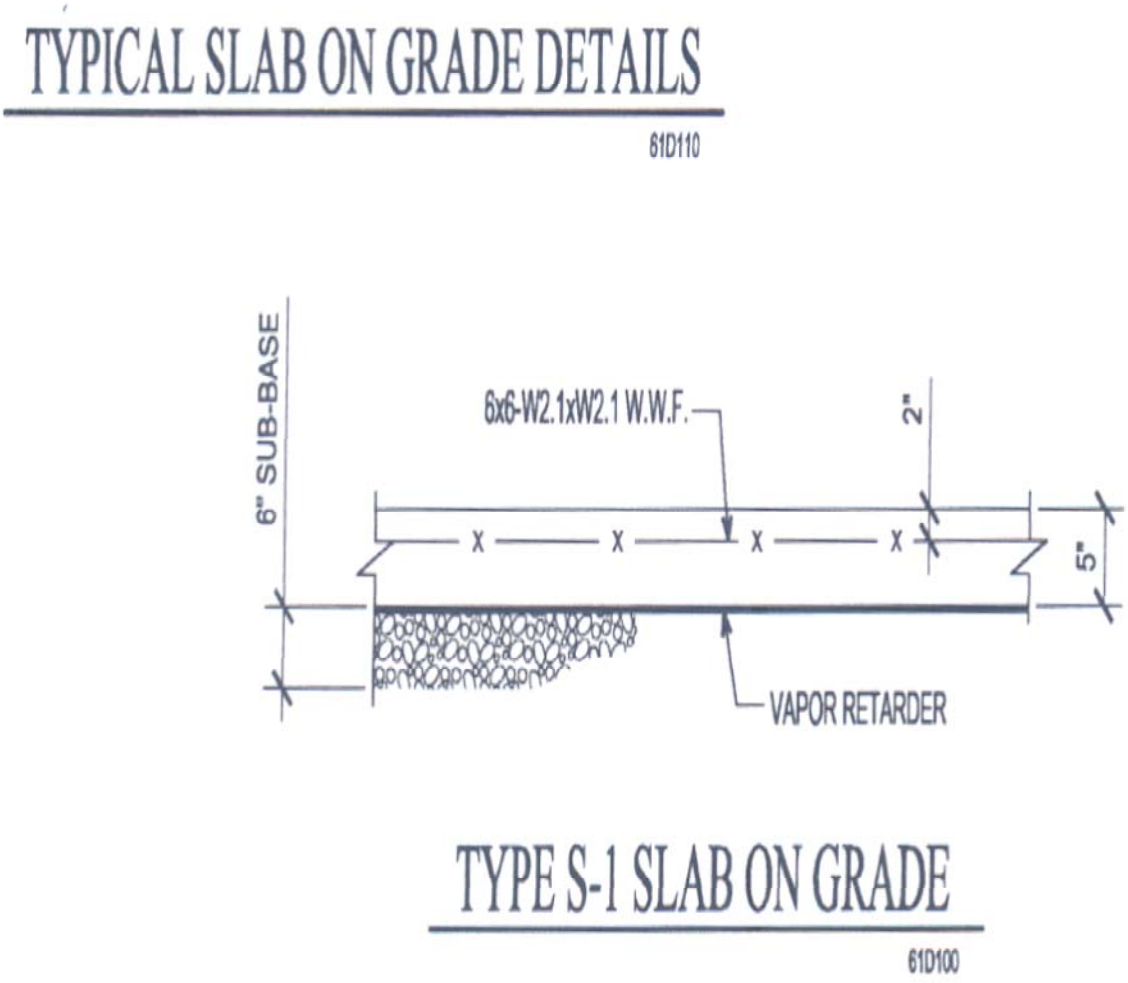

Figure 2 – Slab on Grade Detail

ROOF SYSTEM

As shown in Fig. 3, the roof system is either type R-1 or R-2 roof construction. Type R-2 roof construction is used for the green roof above the grand ballroom and exercise room while type R-1 roof construction is used for the roofs located on the 15th and 21st floors. Fig. 4 shows the transition from the green roof assembly to the corresponding roof construction assembly.

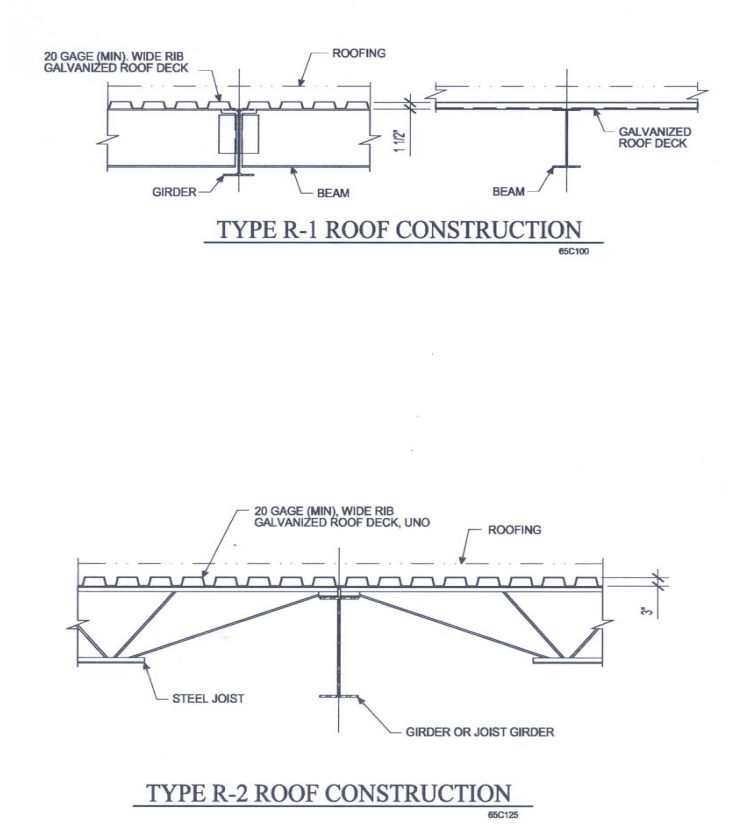

Figure 3 - Roof Construction Details

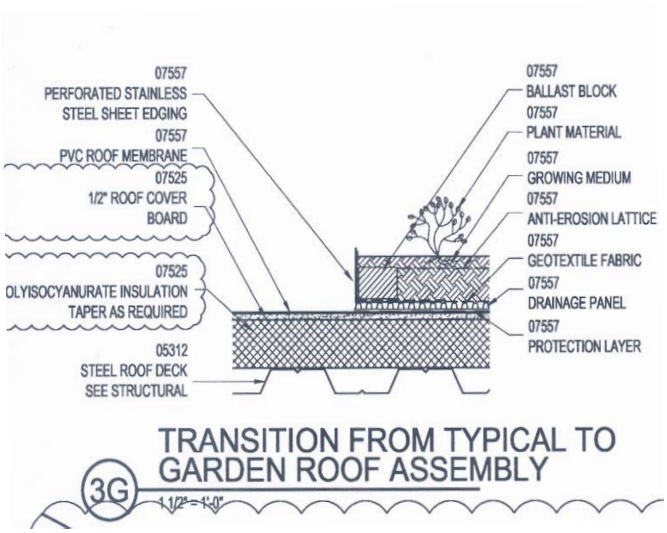

Figure 4 – Green Roof Transition

LATERAL SYSTEM

The lateral resisting system for wind and seismic loads consist of a number of steel brace frames that are located between the 3rd floor and the 4th floor roof. The load that is from wind and seismic is also transferred from each individual floor to the concrete beams and then to the concrete columns. A shear wall system is used as well for resisting wind and seismic loads. Shear walls are located around the elevator shafts and stairwells as shown in the ETABS model in Fig. 5

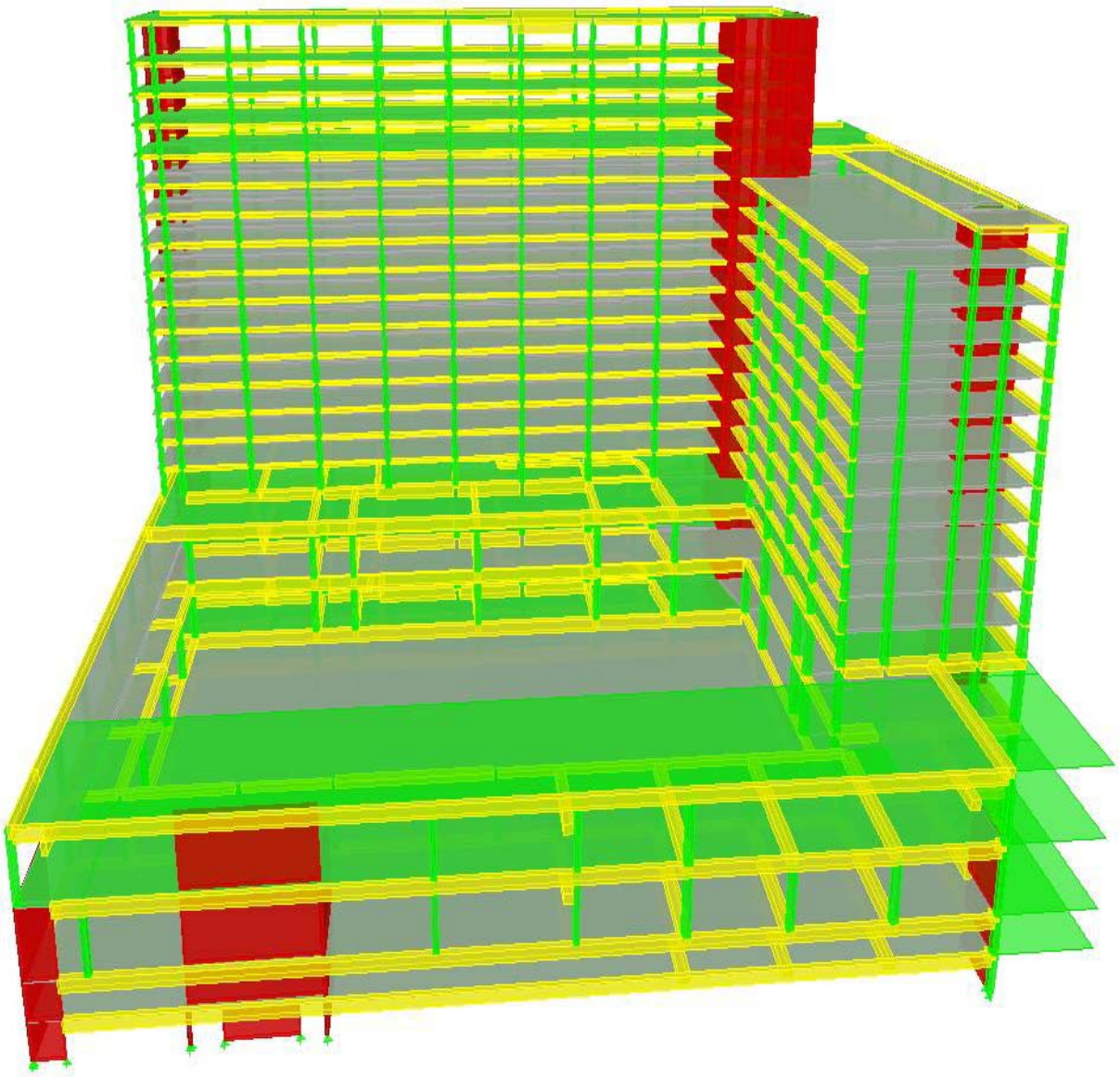

Figure 5

COLUMN SYSTEM

The layout of the column system is a very uniform layout consisting of typical exterior bays of 26’-10” x 18’-8” and interior bays of 26’-10” x 19’-7”. All columns consist of either a gravity resisting member or a combination of lateral and gravity resisting members. Column sizes vary from 12” x 18” columns to 44” x 30” Columns. Sloped columns can be found on the second and third floors of the western podium. A typical column layout for the hotel room floors is shown in Fig. 6.

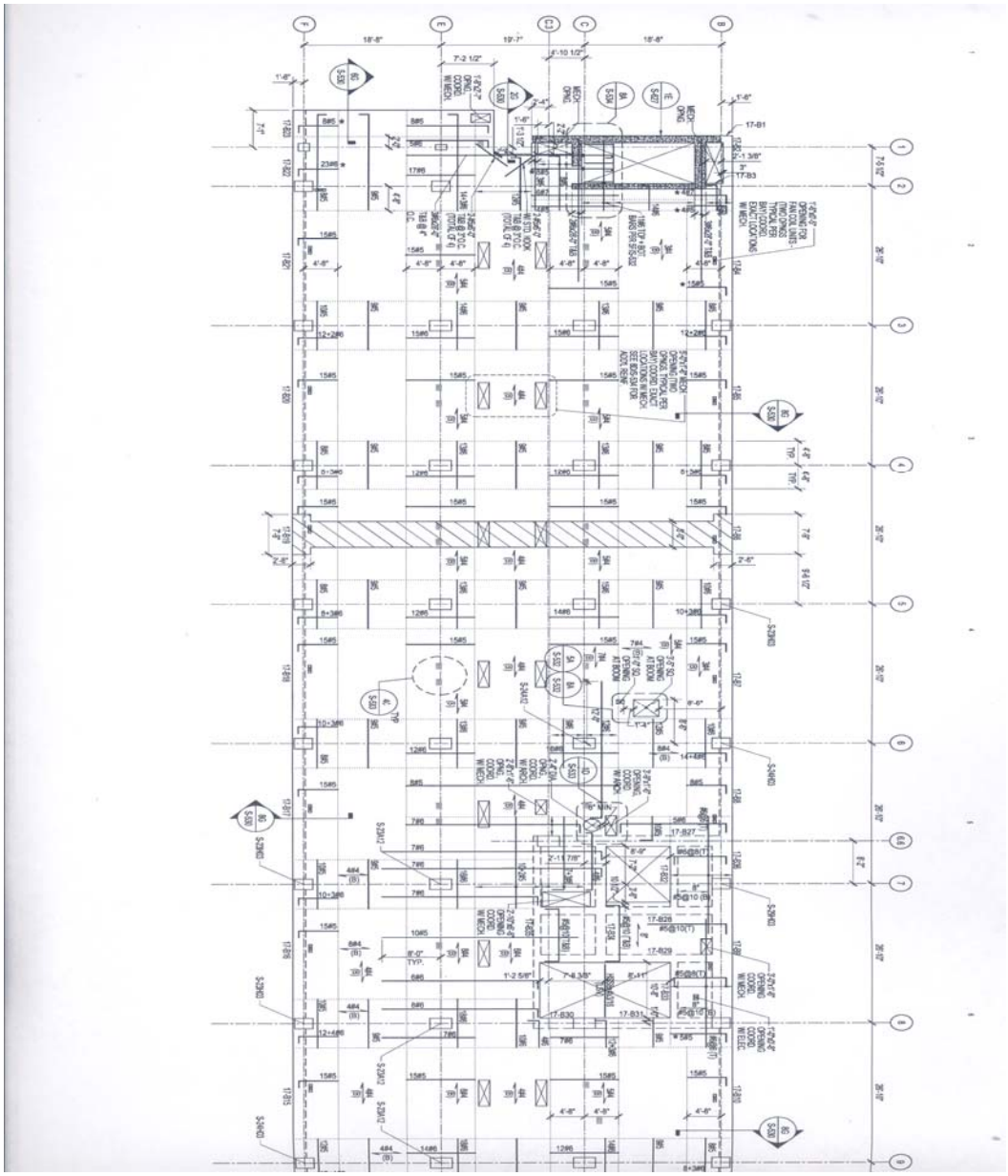

Fig. 6 – Typical Framing Plan

PROBLEM STATEMENT

The Baltimore Hiltons current gravity system design is a two-way flat plate slab with drop panels on six floors. This gravity system was found to be the most efficient system available. During Technical Report II, A Structural Study of Alternative Floor Systems, it was found to be the most effective out of the four systems analyzed. However a fifth system, post-tensioned concrete slab, was mentioned but not analyzed. A post-tensioned floor system would hopefully allow a larger floor-to-ceiling height as well as longer spans, faster construction and reduced weight compared to two-way flat plate slabs. The framing system underneath the pool and fitness room consists of steel beams and joists. Around and underneath the pool there are two levels of steel beams. One level is around the pool while there is another level of steel beams that run directly beneath the pool. A different system that could be instead of the beams is staggered trusses. Staggered Trusses would allow for a larger span between members as well as a reduced weight compared to just using steel beams.

PROPOSED SOLUTION

As stated above a proposed solution for the gravity system would be to redesign all the floor slabs using post-tensioning design. It was noted in Technical Report II that this could be a more efficient system than two-way flat plate slabs but it was never analyzed. Using post-tensioned slabs would allow for smaller slab thickness, which in turn create larger floor-to-ceiling heights and decrease the weight of the building. The slabs will be designed so as not to disrupt the current column and beam layout as much as possible. With a decrease in slab thickness and weight of the building, the foundations will be looked at to see if any changes need to be made to the existing foundational structure. Also a seismic analysis will be determined to see how much the base shear changed with the change of floor system.

STRUCTURAL DEPTH STUDY - FLOOR SLAB REDESIGN

DESIGN LOADS

In order to redesign the floor system from two-way flat plate to a two-way post-tensioned system, first the loads on the system were to be determined. All of the design loads for this technical report were calculated referencing ASCE 7-05: *Minimum Design Loads for Buildings and Other Structures*. All dead, live and snow loads can be seen in Table 1 below. Note that there is no live load reduction considered in any of the live loads shown.

Table 1 - Gravity Loads

Description	ASCE 7-05	RTKL Value	Design Value
DEAD (DL)			
Concrete	150pcf	150pcf	150pcf
Ceiling, Mech, Ducts, etc.	20-25psf	5-20psf	20psf
LIVE (LL)*			
Private Hotel Rooms	40psf	40psf	40psf
Ballroom	100psf	100psf	100psf
Corridors (first floor, main lobby)	100psf	100psf	100psf
Corridors (serving private hotel rooms)	100psf	40psf	100psf
Aerobic/Exercise Rooms	100psf	100psf	100psf
Pool Deck	75psf	80psf	75psf
Green Roof	100psf	100psf	100psf
Exterior Balconies (East Tower)	100psf	100psf	100psf
Roofing	20psf	30psf	20psf
SNOW (S)			
Snow	20psf	20psf	20psf
* Live load reductions were not taken into consideration in the design.			

Design Process

Slab Design

ADAPT-PT 8.00 was used as the primary analysis software for the post-tensioning floor system design. ACI 318-05 and IBC 2006 were selected as the code design criteria for the ADAPT system. Each floor was analyzed separately with each analyzed multiple times depending on the slab thickness chosen. Each floor was then taken and separated into individual bays depending on tributary width of the column lines. A smaller slab thickness than the current designs slab thickness was chosen and analyzed. When a chosen slab thickness didn't work at first the PT force was changed so that P/A was above the code minimum of 125 kips and below the recommended maximum of 300 kips. If changing the PT force didn't work, the tendon layout was changed. Both of those were changed until the service and initial stresses in both tension and compression were ok according to ADAPT, as can be seen in Fig. 7 and Fig. 8 below. When that didn't solve the problem the slab thickness was increased. Sometimes a floor had to be broken into multiple slabs to allow for certain slab thicknesses to work. This was done for each tributary column width of each floor. From that the most critical design was taken as the design for that floor. After all floors were designed according to ADAPT, hand calculations were done of the upper hotel floors to see if analysis by hand was consistent with the output determined from ADAPT. Fig. 10 shows an image of one of the areas taken into account while using ADAPT for analysis. The area is on the upper hotel room floors, between column lines B-3 and F-3.

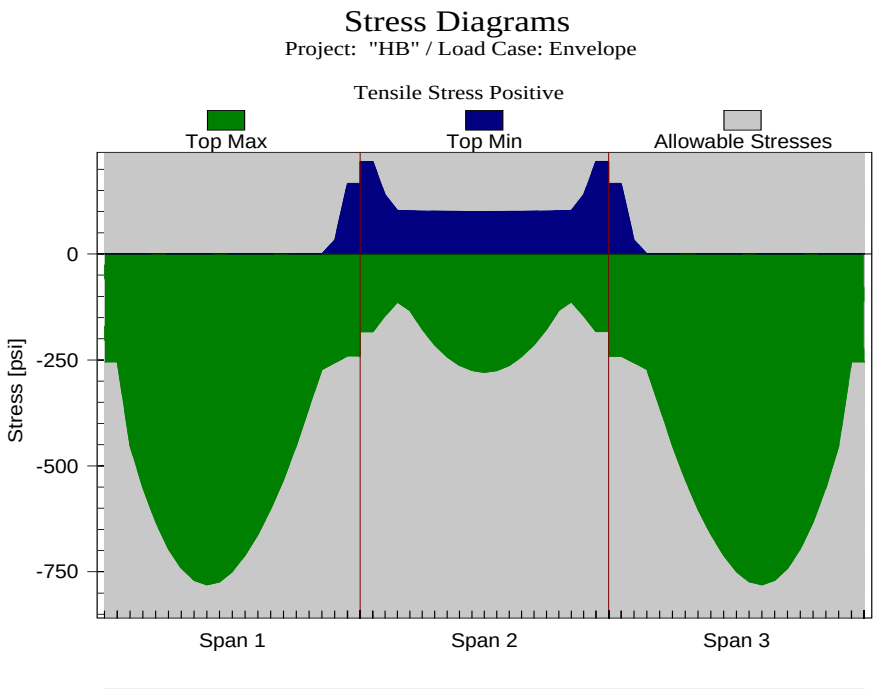

Figure 7

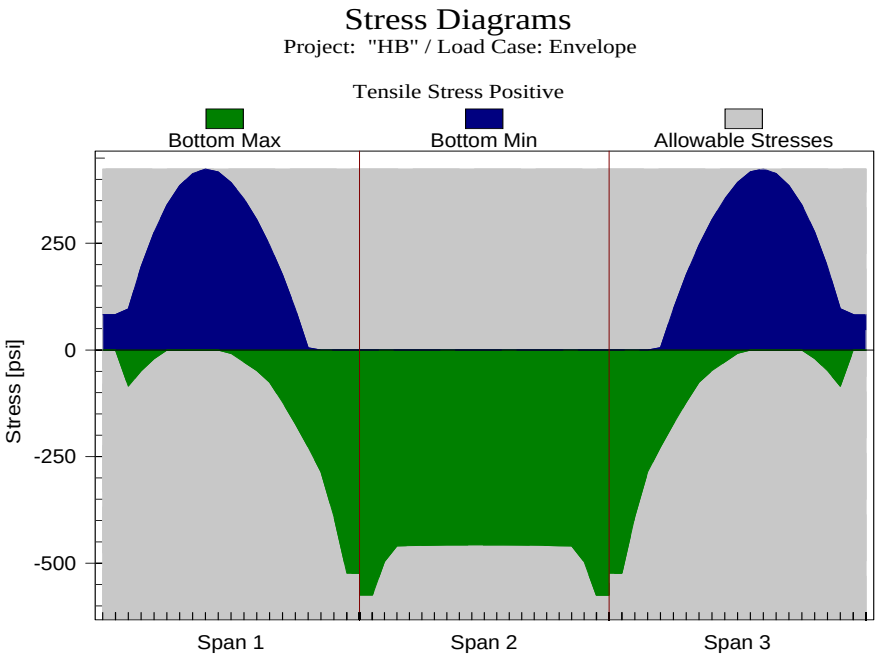

Figure 8

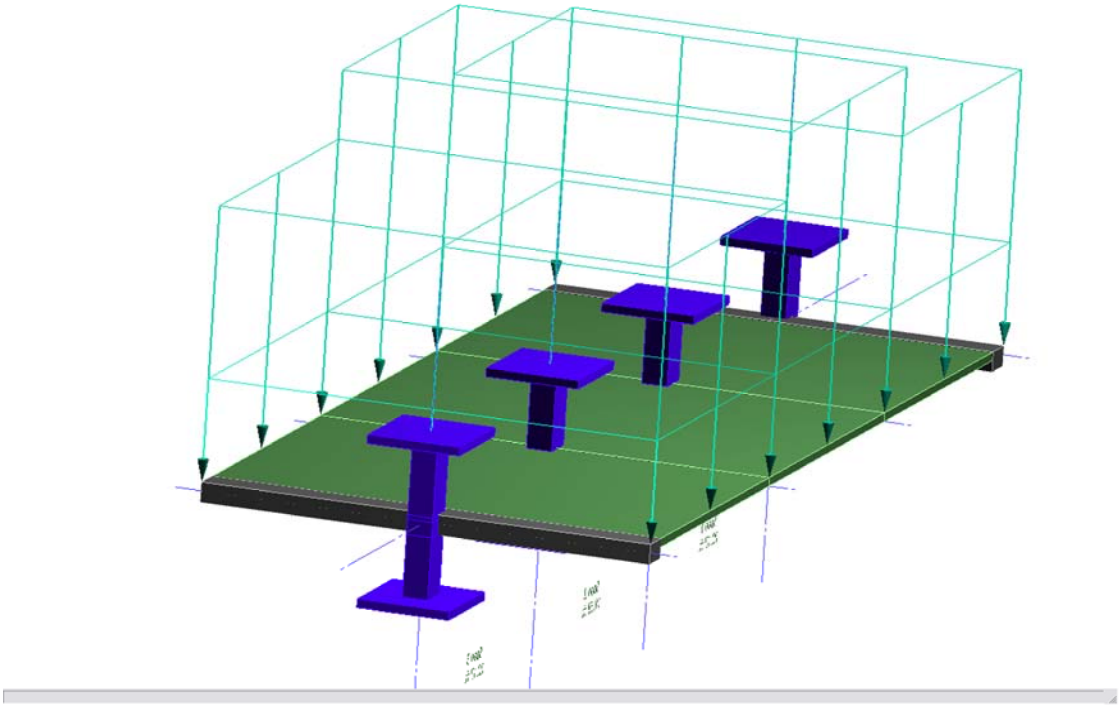

Figure 9

After ADAPT was finished analyzing a report was obtained with all information regarding the slab design, ranging from number of tendons, amount of rebar needed to deflection. The floor slabs deflection was observed to see if any other changes needed to be made in case the deflection was above the limit.
Fig. 10 shows the deflection diagram from the slab area in Fig. 9 above.

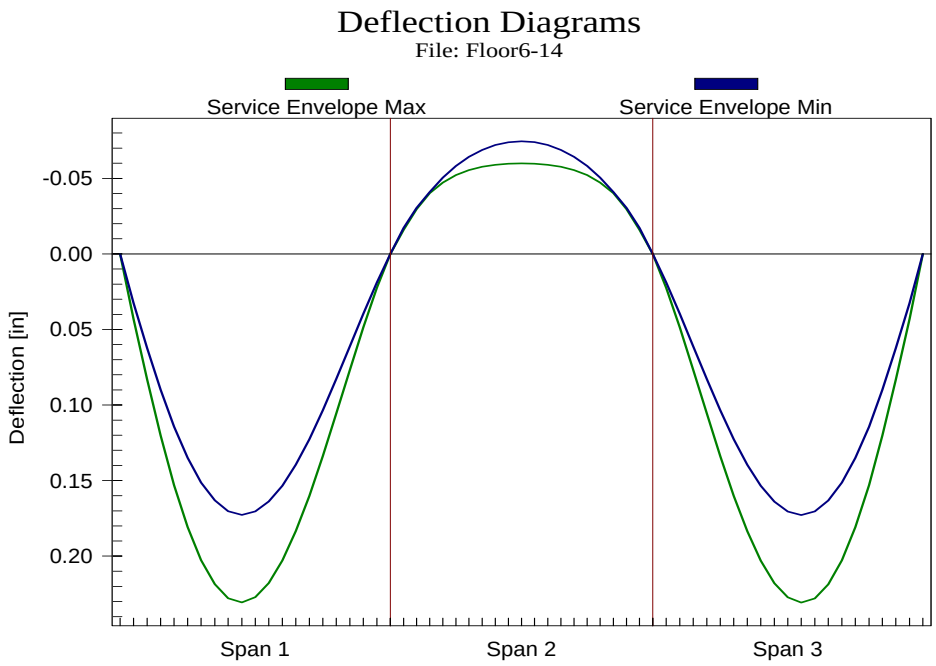

Figure 10 – Deflection Diagram

Once all column tributary widths on each floor were analyzed with the most critical design was taken and then compared to the existing structures slab thickness. Table 2 shows the comparison between the designed post-tensioning floor system and the existing two-way flat plate floor system.

Table 2 - Floor Slab Thickness Comparison			
Level	Designed Two-Way Post-tensioning Thickness (in)	Existing Two-Way Flat Plate Thickness (in)	Change in Thickness (in)
Floor 1	11	9	2
Mezzanine	8	9	-1
Floor 2	8	9	-1
Floor 3	10	9	1
Floor 4	6	8	-2
Floor 5	6	8	-2
Floor 6	6	8	-2
Floor 7	6	8	-2
Floor 8	6	8	-2
Floor 9	6	8	-2
Floor 10	6	8	-2
Floor 11	6	8	-2
Floor 12	6	8	-2
Floor 13	6	8	-2
Floor 14	6	8	-2
Floor 15	6	8	-2
Floor 16	6	8	-2
Floor 17	6	8	-2
Floor 18	6	8	-2
Floor 19	6	8	-2
		Total	-31

From this comparison table it was seen that the designed two-way post-tensioning floor slabs were smaller in thickness on all floors except Floor 1 and Floor 3 and the existing two-way flat plate floor system. This resulted in a total change in floor slab thicknesses of 31 inches.

Column Design

While using ADAPT-PT 8.00 the original column layout and sizes were used during the analysis, so therefore no new column designs or layouts were used in the design of the two-way PT floor system.

Beam Design

While using ADAPT-PT 8.00 the original column layout and sizes were used during the analysis, so therefore no new beam designs or layouts were used in the design of the two-way PT floor system.

SEISMIC ANALYSIS

After the slab thicknesses were determined and designed, a seismic analysis was done to see if the new building would the seismic requirements according to code. With the decrease in slab thicknesses the building weight decreased, therefore decreasing the story forces, shear and moments on the building. In order to calculate the seismic forces on HBCCH, Chapters 11 and 12 were referenced from ASCE 7-05. HBCCH was assumed to have a rigid diaphragm which allowed for the use of the Equivalent Lateral Force Procedure found in Section 12.8 of ASCE 7-05. The variables used in this procedure are located in Table 3a.

Table 3a - Seismic Design Variables			ASCE Reference
Soil Classification		B	Table 20.3-1
Occupancy		II	Table 1-1
Importance Factor		1.00	Table 11.5-1
Structural System		Building Frame System: Ordinary Reinforced Concrete Moment Frames	Table 12.2-1
Spectral Response Acceleration, short	S_s	0.196	USGS
Spectral Response Acceleration, 1 s	S_1	0.064	USGS
Site Coefficient	F_a	1.2	Table 11.4-1
Site Coefficient	F_v	1.7	Table 11.4-2
MCE Spectral Response Acceleration, short	S_{MS}	0.2352	Eq. 11.4-1
MCE Spectral Response Acceleration, 1 s	S_{M1}	0.1088	Eq. 11.4-2
Design Spectral Acceleration, short	S_{DS}	0.1568	Eq. 11.4-3
Design Spectral Acceleration, 1 s	S_{D1}	0.0725	Eq. 11.4-4
Seismic Design Category	S_{DC}	B	Table 11.6-2
Response Modification Coefficient	R	5	Table 12.2-1
Approximate Period Parameter	C_t	0.016	Table 12.8-2
Building Height (above grade)	h_n	203 ft	
Approximate Period Parameter	x	0.9	Table 12.8-2
Calculated Period Upper Limit Coefficient	C_u	1.7	Table 12.8-1
Approximate Fundamental Period	T_a	1.9s	Eq. 12.8-7
Fundamental Period	T	1.9s	Sec. 12.8.2
Long Period Transition Period	T_L	8.00s	Fig. 22-15
Seismic Response Coefficient	C_s	0.01	Eq. 12.8-2
Structure Period Exponent	k	2	Sec. 12.8.3

The seismic design variables Z, I, S, R_w, h_n, and C can be found in the Appendix on pages 39 and 40. Table 3b shows the story forces, shear and moments. Fig. 11 shows the story forces and the story shear found during seismic design.

Table 3b Story Shear and Story Moments

Floor	Fx(kips)	hx	Story Shear, Vx (kips)	Moment (k-ft)
20 (roof)	104.7579	203	-	-
19	87.6453	191	104.76	21265.85773
18	82.8415	182	192.40	16740.25816
17	74.1798	173	275.24	15077.16061
16	78.6658	164	349.42	12833.10129
15	86.8712	155	428.09	12901.18675
14	79.8417	146	514.96	13465.04258
13	70.3016	137	594.80	11656.88145
12	61.3683	128	665.10	9631.313376
11	53.0664	119	726.47	7855.136229
10	45.3220	110	779.54	6314.898908
9	38.2091	101	824.86	4985.421334
8	31.7029	92	863.07	3859.116894
7	25.8036	83	894.77	2916.669998
6	20.5110	74	920.58	2141.697301
5	15.9320	65	941.09	1517.815458
4	26.2134	56	957.02	1035.582775
3	20.1565	38	983.23	1467.948807
2	4.7757	20	1003.39	765.9451222
Mezzanine	0.9344	10	1008.17	95.51337115
Base	1009.10	-	1009.10	9.34415581
			Overturning Moment(k-ft)	146535.8923

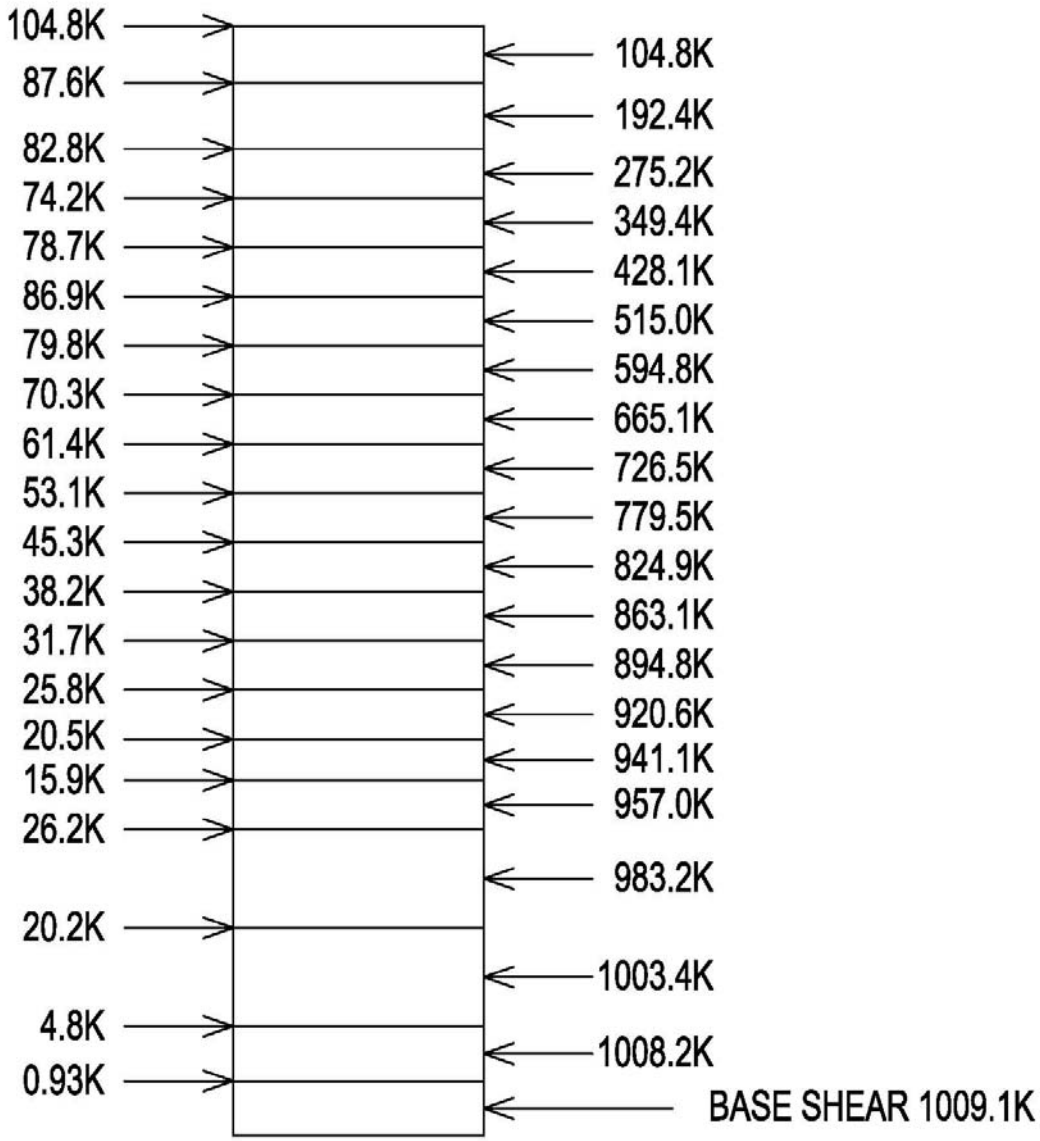

Figure 11 Seismic Design Diagram

After running the seismic analysis it was seen that the base shear decreased by over 140 kips, while the overturning moment decreased by about 20300 foot-kips. This was all due to the decrease in weight of the building by decreasing the floor thickness.

Construction Management Breadth

The construction management breadth consists of a basic schedule analysis and a basic cost analysis. The schedule compared how long each floor system would take to construct. The cost analysis compared how much each floor systems materials and labor costs would cost to construct.

Cost Analysis

The purpose of the cost analysis is to compare how much more or less the designed two-way post-tensioning system will cost compared to the existing two-way flat plate concrete system. Each system was broken down into each individual portion of the construction elements needed for each system. A few examples of the materials needed are rebar, concrete mix, and materials needed for the curing process. Materials that both systems need the same amount of like formwork were not taken into the cost comparison as both costs would cancel out when the comparisons were made. *RSMeans CostWorks* was used for the cost analysis. The following table shows the cost comparison

Table 4 - Floor System Cost Comparison

Material	Designed Two-Way Post-tensioning (Dollars)	Existing Two-Way Flat Plate (Dollars)	Change in Cost
Concrete Mix (4000 PSI for Existing and 5000 PSI for PT)	1,853,245.98	2,121,912.45	-$268,666.47
Mild Reinforcing Steel	299,136.16	1,585,937.40	-$1,286,801.24
Prestressing Steel Tendons	541,451.52	0	$541,451.52
Concrete Placing	358,553.79	431,761.05	-$73,207.26
Concrete Curing	32,463.20	51,312.80	-$18,849.60
		Total	-$1,106,073.05

From this table it is shown that the cost of the Post-tensioning system costs about $1.1 million less than the existing two-way flat plate system. This could be because there was a smaller amount of cubic yards of concrete used in the post-tensioning system than there was in the two-way flat plate system.

Schedule Analysis

After the cost analysis of both floor systems was finished, a schedule was created for each system. *Microsoft Project* was used to create each schedule. Each schedule took into account the laying of formwork, reinforcing, placing of concrete and the curing of the concrete according to the daily output of the crews assigned from *RSMeans*. The post-tensioning system also had to take into account the tensioning of the tendons as well as the time it takes for the concrete to reach its strength to where the tendons can be stressed. It takes 5000 psi type III concrete approximately 3 days to reach a strength of 3000 psi, which is the strength needed according to ADAPT for the concrete to be ready to have the tendons tensioned. The equation used to find how many days it took the concrete to is $f'_{c(t)} = f'_{c(28)}[t/(2.3+0.92t)]$, on page 51 and 52 of *Reinforced Concrete: Mechanics and Design*. As seen on pages 120 and 121 of the appendix it took the post-tensioning system approximately 23 working days longer to construct than the existing two-way flat plate system. This is due to the fact that the tendons can't be tightened until 3 full days after the concrete has been poured.

Acoustics Breadth

There was one are of concern acoustically in the Baltimore Hilton Convention Center and that area was the pool and fitness room area. Beneath the pool and fitness rooms there are meeting and conference rooms. After looking at the pool area it was determined that the floor system provided enough sound isolation with help from the water in the pool so that the meeting rooms underneath weren't going to experience any harmful sound transfer from above. That left the fitness room as an area of concern. It was determined that there would be harmful sound transference from the fitness room down into the meeting rooms. The existing floor system is a 4.5 inch concrete slab on 2 inch metal decking. One solution to fix this is to change the floor to a floating floor. This would add a 1 inch air gap or insulation filled gap on top of the existing floor system, then on top of the gap 2 more inches of concrete would be added. This would increase the floor thickness to 9.5 inches but would increase the impact isolation class or IIC rating. With a higher IIC rating the amount of impact noise caused in the fitness room transferred to the structure would decrease, therefore decreasing the amount of sound transmitted down into the conference rooms allowing meetings to be uninterrupted by people lifting weights in the fitness room. Fig. 12 shows a cut-away section of the floating floor. Fig. 13 shows a detail of the existing floor system. Fig. 14 shows 3 different floor types on a Transmitted Impact Noise vs. Frequency graph. Fig. 15 shows how 4 different floor types how they compare to each other in sound-isolating effectiveness.

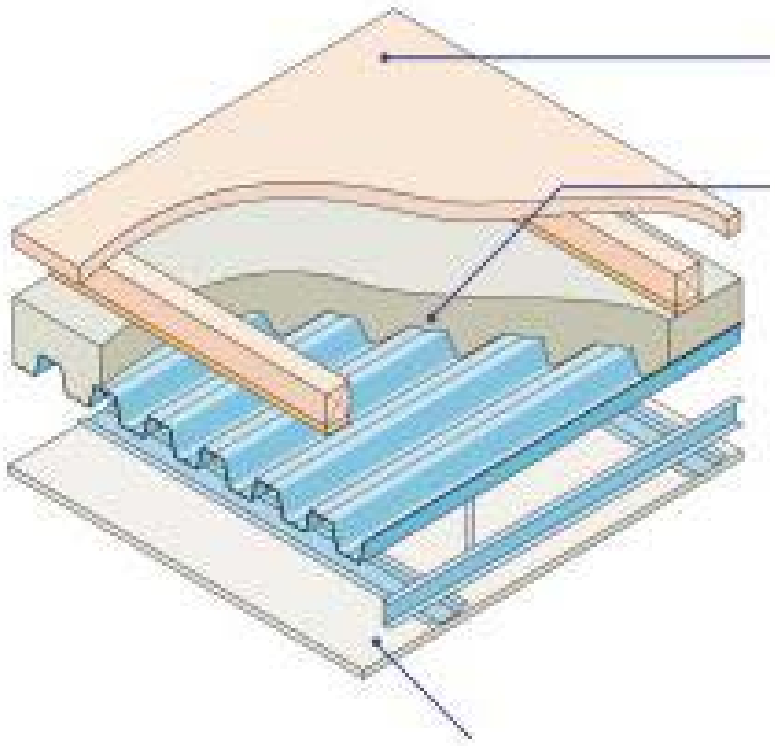

Figure 12

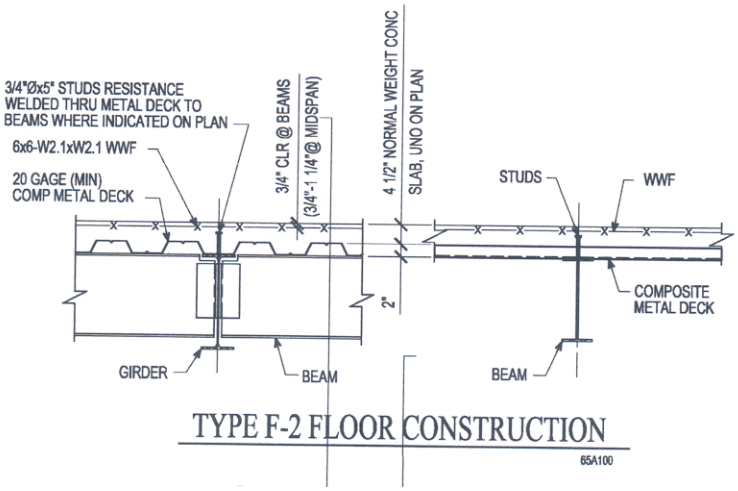

Figure 13

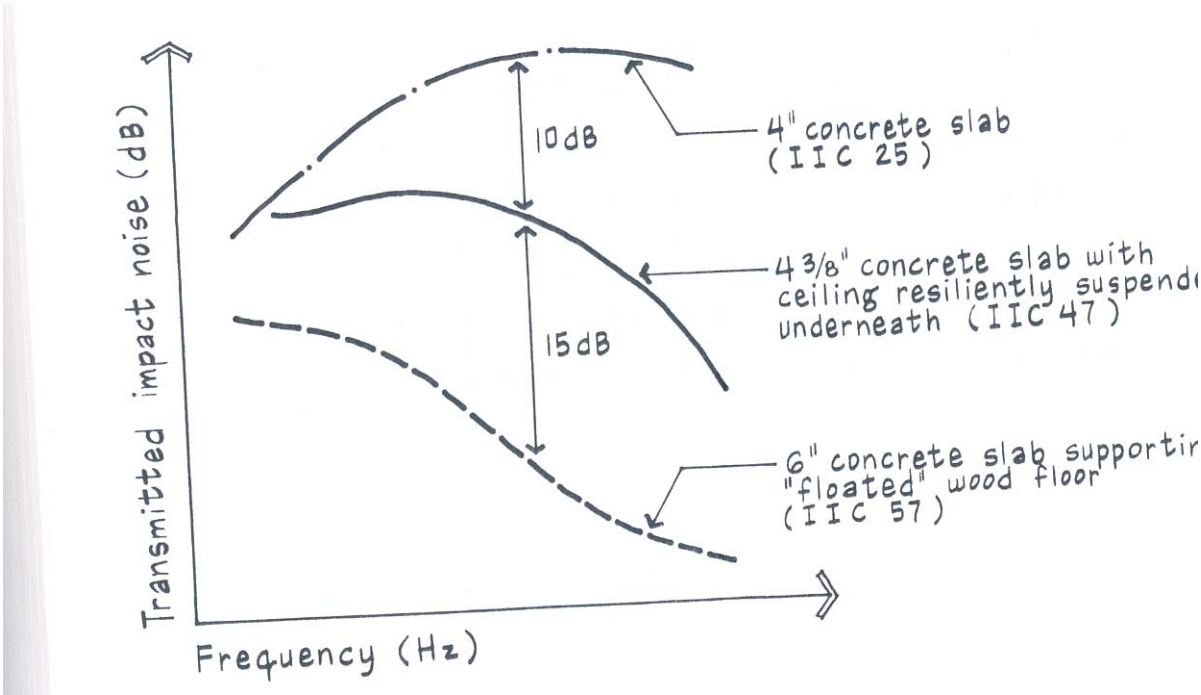

Figure 14

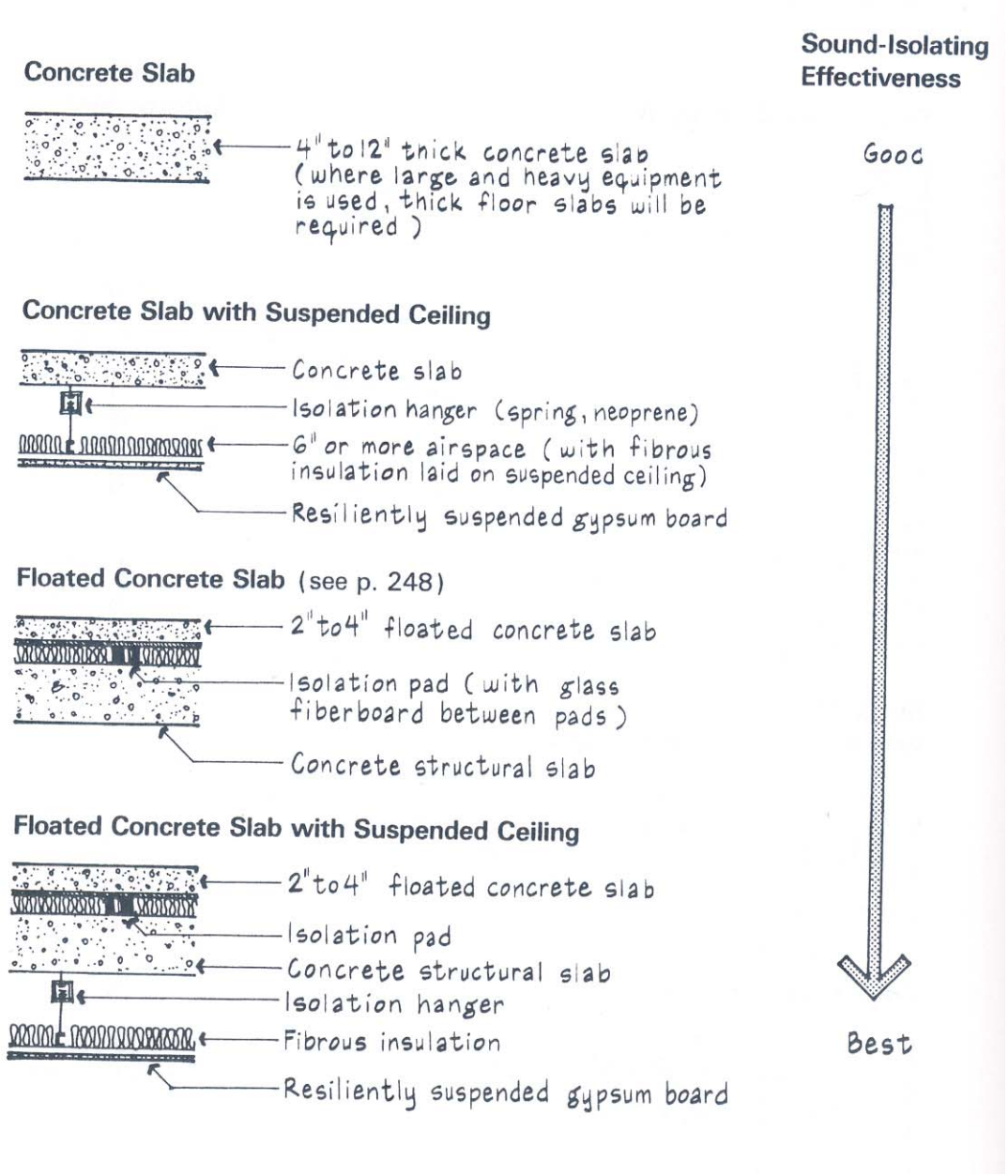
Concrete Slab
4" to 12" thick concrete slab (where large and heavy equipment is used, thick floor slabs will be required)
Concrete Slab with Suspended Ceiling
Concrete slab
Isolation hanger (spring, neoprene)
6" or more airspace (with fibrous insulation laid on suspended ceiling)
Resiliently suspended gypsum board
Floated Concrete Slab (see p. 248)
2" to 4" floated concrete slab
Isolation pad (with glass fiberboard between pads)
Concrete structural slab
Floated Concrete Slab with Suspended Ceiling
2" to 4" floated concrete slab
Isolation pad
Concrete structural slab
Isolation hanger
Fibrous insulation
Resiliently suspended gypsum board
Sound-Isolating Effectiveness
Good
Best

Figure 15

CONCLUSION

After redesigning the floor system of the Baltimore Hilton Convention Center Western Podium from a two-way flat plate system to a two-way post-tensioning system, it was determined that each floor slab would decrease in thickness except for the first floor and the third floor which increased by 2 inches and 1 inch respectively, and a total decrease in thickness of all the slabs of 31 inches. The majority of the decrease in slab thickness was located on the floors with the hotel rooms, each one of those floors decreased by 2 inches in thickness. The decrease in thickness increases the floor to ceiling height of the floors allowing for a more spacious feel in the hotel rooms and grand ballroom. The original column and beam layout and sizes were kept. With the decrease in weight of the floor slabs the overall building weight decreased therefore the existing foundation system is adequate for the new floor system. Also the decrease in weight reduced the buildings base shear and overturning moment due to seismic forces.

After determining the cost of the existing floor system and the post-tensioning floor system and determining the construction schedule for each it was found that that both floor systems have their own positives and negatives. The post-tensioning floor system was cheaper due to the decrease in the amount of concrete and mild reinforcing needed. The existing two-way flat plate system cost more but took less time to construct. The difference in cost was about $1.1 million and the difference in construction time was 22 working days. This saved the company money for construction costs but they would be charged more from the hotel due to the fact that the construction time is longer and the hotel is losing money for those days lost.

After looking at what the current floor systems were for the pool and fitness rooms it was determined that there wouldn't need to be any acoustical change for the floor system for the pool area; however, the floor system needed to be changed for the fitness room area. The floor was changed from a 4.5 inch slab on 2 inch metal decking to a floating floor system consisting of the 4.5 inch slab, 2 inch metal decking, a 1 inch air gap or gap filled with insulation, then a 2 inch slab to top it off.

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APPLICABLE CODE

Design Codes used for Original Design:

- International Building Code, 2000 Edition
- City of Baltimore Code
- American Society of Civil Engineers (ASCE)
    - ASCE 7 – 05, Minimum Design Loads for Buildings and Other Structures
- American Institute of Steel Construction (AISC)
    - Steel Construction Manual, 13th Edition (LRFD)
- American Concrete Institute (ACI)
    - Building Code Commentary 318-08

Code Substitutions/ Additional References used for Thesis Design:

- International Building Code, 2006 Edition
- Reinforced Concrete: Mechanics & Design, Fifth Edition
    - By: James K. Wight, James G. MacGregor

APPENDIX

DEAD WEIGHT CALCULATIONS

Assume Beams are 29' in length, 24" in Width and 32" in depth

Dead Loads

MEP = 15 psf - includes rooftop mechanical units

Green Roof = 109 psf

Roofing and Insulation = 15 psf

Walls = 20 psf

Perimeters (ft)	Areas (sf)
Floors Mid 2 (33)	
258'-8" + 293'-2½" + 258'-8" + 293'-2½" = 1103'-9"	1103'-9" × 33 = 36423.75 sf
Floor 3 (18)	
(202'-1¾") × 2 + (288'-8") × 2 = 981'-4½"	981'-4½" × 18' = 17669.25 sf
Floors 4-14 (9)	
212'-6⅝" + 60'-6½" + 141'-5" + 233'-1⅜" + 60'-6½" + 289'-3⅜" ≈ 994'-6"	994'-6" × 9 × 14 floors = 98432.5 sf
Floors 15-16 (2)	
(293'-7⅞" + 60'-6½") × 2 = 708'-4¾"	708'-4¾" × 9 × 2 = 12751.125 sf
Floors 17-19 (3)	
(261'-11⅝") × 2 + (62'-4¾") × 2 = 649'-2¾"	649'-2¾" × 9 × 2 = 11686.125 sf

Green Roof Area Lvl 4

144'-2" × (58'-2" + 58'-2" + 29'-3¼") = 28271.46 sf

Roof Level Area

(26'-10" + 14'-4" + 18'-8" + 10'-⅜") × (214'-10" + 10'-6½" + 20'-6" + 8'-3" + 4'-6⅝" + 6'-9" + 18'-8") = 20141.42 sf

Roof Level Area Lvl 15

$(130'-4\frac{1}{4}") \times 60'-6\frac{1}{2}" = 7891.86$ sf

MEP Area

$258'8" \times 293'2\frac{1}{2}" = 78843.22_5$ sf

Beam Weight $\left(29 \times \frac{24}{12} \times \frac{33}{12}\right) = 154.67$ $ft^3 \times 150 = 23200$

Mezzanine

# of beams = 102 — 102 beams x 154.67 x 150 pcf = 2366400 lbs = 2366.4^k

Floor 2

# of beams = 140 — 140 beams x 154.67 x 150 = 3248000 lbs. = 3248^k

Floor 3

# of beams = 163 — 163 beams x 23200 = 3781600 lbs. = 3781.6^k

Floor 4

# of beams = 84 — 84 x 23200 = 1948800 lbs. = 1948.8^k

Floor 5-14

# of beams = 47 — 47 x 23200 = 1090400 lbs. = 1090.4^k

Floor 15

# of beams = 45 — 45 x 23200 = 1044000 lbs. = 1044^k

Floor 16

# of beams = 46 — 46 x 23200 = 1067200 lbs. = 1067.2^k

Floor 17, 19

# of beams = 37 — 37 x 23200 = 858400 lbs. = 858.4^k

Floor 18

# of beams = 38 — 38 x 23200 = 881600 lbs. = 881.6^k

Floor 20

# of beams = 31 — 31 x 23200 = 719200 lbs. = 719.2^k

Floor 21

# of beams = 6 — 6 x 23200 = 139200 lbs. = 139.2^k

Building Dead Weight

Floor slabs

Total weight = 69181.08 kips

Drop Panels

Total weight = 144.18 kips

Walls

Total weight = (30423.75 + 17669.25 + 9875.25 + 12751.125 + 11686.125) x 20 psf

= 3656.03 kips

Roofs

Green Roof Lvl 4 = 28241.46 x 109 psf = 3081.59 kips

Roof Lvl 20 = 20141.42 x 15 psf = 302.12 kips

Note: concrete slab for roofs already accounted for in slab calcs.

Roof Lvl 15 = 7891.86 x 15 psf = 119.43 k

Note: concrete slab already accounted for in slab calcs.

MEP

78843.22 sf x 15 = 1182.65 kips

Columns

½(916.23) + 777.58 + 1825.88 + 4327.54 + 209.85 + 130.07 = 7729.04 k

Beams

= 2366.4 + 3248 + 3781.6 + 1948.8 + 10(1090.4) + 1014 + 1067.2 + 2(858.4) + 881.6 + 719.2 + 139.2

= 27816.8 k

Total Dead Weight = 113102.85 k

Table 5									
		12x18 Columns				18x18 Columns			
	Height (ft)	No.	Total Area (sf)	Volume (ft^3)	Weight (kips)	No.	Total Area (sf)	Volume (ft^3)	Weight (kips)
Level 20	10.5	1	1.5	15.75	2.36	1	2	24	4
Level 19	12	1	1.5	18	2.70	1	2	27	4
Levels 18-4	9	15	22.5	202.5	30.38	15	34	304	46
Levels 3-2	18	0	0	0	0	12	27	486	73
Level Mezz.	10	0	0	0	0	5	11	113	17
Level 1	10	0	0	0	0	8	18	180	27
Level B1	16	0	0	0	0	7	16	252	38
Level B2	10	0	0	0	0	6	14	135	20
Total		17	26	236	35	55	124	1520	228

		16x24 Columns				22x24 Columns			
	Height (ft)	No.	Total Area (sf)	Volume (ft^3)	Weight (kips)	No.	Total Area (sf)	Volume (ft^3)	Weight (kips)
Level 20	10.5	0	0	0	0	0	0	0	0
Level 19	12	0	0	0	0	0	0	0	0
Levels 18-4	9	12	32	288	43.2	0	0	0	0
Levels 3-2	18	0	0	0	0	3	11	198	29.7
Level Mezz.	10	0	0	0	0	0	0	0	0
Level 1	10	0	0	0	0	0	0	0	0
Level B1	16	0	0	0	0	0	0	0	0
Level B2	10	0	0	0	0	0	0	0	0
Total		12	32	288	43.2	3	11	198	29.7

		30x30 Columns				30x36 Columns			
	Height (ft)	No.	Total Area (sf)	Volume (ft^3)	Weight (kips)	No.	Total Area (sf)	Volume (ft^3)	Weight (kips)
Level 20	10.5	0	0	0	0	0	0	0	0
Level 19	12	0	0	0	0	0	0	0	0
Levels 18-4	9	0	0	0	0	0	0	0	0
Levels 3-2	18	0	0	0	0	1	7.5	0	0
Level Mezz.	10	0	0	0	0	2	15	0	0
Level 1	10	0	0	0	0	1	7.5	0	0
Level B1	16	1	6.25	100	15	4	30	30	4.5
Level B2	10	1	6.25	62.5	9.38	4	30	30	4.50
Total		2	12.5	162.5	24.38	12	90	60	9.00

		44x30 Columns			
	Height (ft)	No.	Total Area (sf)	Volume (ft^3)	Weight (kips)
Level 20	10.5	0	0	0	0
Level 19	12	0	0	0	0
Levels 18-4	9	0	0	0	0
Levels 3-2	18	0	0	0	0
Level Mezz.	10	1	9.17	91.67	13.75
Level 1	10	1	9.17	91.67	13.75
Level B1	16	0	0	0	0
Level B2	10	0	0	0	0
Total		2	18.33	183.33	27.50

Table 5 (con't)											
18x24 Columns				18x30 Columns				18x36 Columns			
No.	Total Area (sf)	Volume (ft^3)	Weight (kips)	No.	Total Area (sf)	Volume (ft^3)	Weight (kips)	No.	Total Area (sf)	Volume (ft^3)	Weight (kips)
21	63	662	99	0	0	0	0	0	0	0	0
31	93	1116	167	0	0	0	0	0	0	0	0
415	1245	11205	1681	0	0	0	0	0	0	0	0
9	27	486	73	3	11	203	30	0	0	0	0
23	69	690	104	4	15	150	23	5	23	380	57
21	63	630	95	0	0	0	0	11	50	1337	200
26	78	1248	187	0	0	0	0	16	72	2722	408
26	78	780	117	0	0	0	0	17	77	1549	232
572	1716	16817	2522	7	26	353	53	49	221	5987	898

24x24 Columns				24x30 Columns				24x36 Columns			
No.	Total Area (sf)	Volume (ft^3)	Weight (kips)	No.	Total Area (sf)	Volume (ft^3)	Weight (kips)	No.	Total Area (sf)	Volume (ft^3)	Weight (kips)
1	4	42	6.3	0	0	0	0	0	0	0	0
2	8	96	14.4	0	0	0	0	0	0	0	0
244	976	8784	1317.6	73	365	3285	492.75	35	210	1890	283.5
11	44	792	118.8	56	280	5040	756	46	276	4968	745.2
5	20	200	30	28	140	1400	210	36	216	2160	324
5	20	200	30	20	100	1000	150	43	258	2580	387
3	12	192	28.8	18	90	1440	216	44	264	4224	633.6
3	12	120	18	16	80	800	120	45	270	2700	405
274	1096	10426	1563.9	211	1055	12965	1944.75	249	1494	18522	2778.3

36x36 Columns				12x71 Columns				12x137 Columns			
No.	Total Area (sf)	Volume (ft^3)	Weight (kips)	No.	Total Area (sf)	Volume (ft^3)	Weight (kips)	No.	Total Area (sf)	Volume (ft^3)	Weight (kips)
0	0	0	0	2	11.83	124.25	18.64	0	0	0	0
0	0	0	0	2	11.83	142	21.3	0	0	0	0
0	0	0	0	8	47.33	426	63.9	24	274	2466	369.9
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
1	9	90	13.5	0	0	0	0	0	0	0	0
4	36	576	86.4	0	0	0	0	0	0	0	0
4	36	360	54.00	0	0	0	0	0	0	0	0
9	81	1026	153.90	12	71.00	692.25	103.84	24	274	2466	369.9

	Total Columns			
Level	No.	Total Area (sf)	Volume (ft^3)	Weight (kips)
Level 20	26	82.58	867.13	130.07
Level 19	37	116.58	1399.00	209.85
Levels 18-4	841	3205.58	28850.25	4327.54
Levels 3-2	141	683.75	12172.50	1825.88
Level Mezzanine	109	517.92	5183.85	777.58
Level 1	111	534.17	6108.17	916.23
Level B1	123	604.00	10783.60	1617.54
Level B2	122	602.25	6536.63	980.49
Total	1510	6347	71901	10785

Table 6								
Level	Thickness (in)	Thickness(ft)	Length	Width	Area(sf)	Dry Unit Wgt(pcf)	Total Load(lbs)	Total Load (kips)
Mezzanine	8	0.666666667	256.61|188.875	253.75	56520.90938	150	5652090.94	5652.09
2	8	0.666666667	261.6666667	291.5833333	76297.63889	150	7629763.89	7629.76
3	10	0.833333333	257.4583333	289.4583333	74523.46007	150	9315432.51	9315.43
4.1	6	0.5	59.91666667	288.09375	17261.61719	150	1294621.29	1294.62
4.2	6	0.5	56.1	208.0416667	11671.1375	150	875335.31	875.34
4.3	6	0.5	287.75	42.6	12258.15	150	919361.25	919.36
5.1	6	0.5	59.9	233.1	13962.69	150	1047201.75	1047.20
5.2	6	0.5	299.8125	54.97	16480.69313	150	1236051.98	1236.05
6.1	6	0.5	59.91666667	211.9895833	12701.7092	150	952628.19	952.63
6.2	6	0.5	228.1770833	76.22604167	17393.03586	150	1304477.69	1304.48
7.1	6	0.5	59.91666667	211.9895833	12701.7092	150	952628.19	952.63
7.2	6	0.5	228.1770833	76.22604167	17393.03586	150	1304477.69	1304.48
8.1	6	0.5	59.91666667	211.9895833	12701.7092	150	952628.19	952.63
8.2	6	0.5	228.1770833	76.22604167	17393.03586	150	1304477.69	1304.48
9.1	6	0.5	59.91666667	211.9895833	12701.7092	150	952628.19	952.63
9.2	6	0.5	228.1770833	76.22604167	17393.03586	150	1304477.69	1304.48
10.1	6	0.5	59.91666667	211.9895833	12701.7092	150	952628.19	952.63
10.2	6	0.5	228.1770833	76.22604167	17393.03586	150	1304477.69	1304.48
11.1	6	0.5	59.91666667	211.9895833	12701.7092	150	952628.19	952.63
11.2	6	0.5	228.1770833	76.22604167	17393.03586	150	1304477.69	1304.48
12.1	6	0.5	59.91666667	211.9895833	12701.7092	150	952628.19	952.63
12.2	6	0.5	228.1770833	76.22604167	17393.03586	150	1304477.69	1304.48
13.1	6	0.5	59.91666667	211.9895833	12701.7092	150	952628.19	952.63
13.2	6	0.5	228.1770833	76.22604167	17393.03586	150	1304477.69	1304.48
14.1	6	0.5	59.91666667	211.9895833	12701.7092	150	952628.19	952.63
14.2	6	0.5	228.1770833	76.22604167	17393.03586	150	1304477.69	1304.48
15.1	6	0.5	59.91666667	212.0416667	12704.82986	150	952862.24	952.86
15.2	6	0.5	228.1770833	67.125	15316.38672	150	1148729.00	1148.73
16	6	0.5	294.625	67.125	19776.70313	150	1483252.73	1483.25
17	6	0.5	254.25	67.125	17066.53125	150	1279989.84	1279.99
18	6	0.5	254.25	67.125	17066.53125	150	1279989.84	1279.99
19	6	0.5	254.25	67.125	17066.53125	150	1279989.84	1279.99
20	6	0.5	254.25	67.125	17066.53125	150	1279989.84	1279.99
Total					665893.0464		56988615.19	56988.62
Note: Floors 4-15 were broken into multiple areas for ease of calculation								

Table 7								
Level	Thickness(in)	# of Panels	Area/Panel (sf)	Total Area (SF)	Volume (ft^3)	Unit Weight (pcf)	Weight (lbs)	Weight (kips)
Mezzanine	5	1	66.5	66.5	27.71	150	4156.25	4.16
	9	2	78	156	117.00	150	17550.00	17.55
2	6	2	84	168	84.00	150	12600.00	12.60
	9	1	162.65	162.65	121.99	150	18298.44	18.30
	9	4	100	400	300.00	150	45000.00	45.00
	11	2	100	200	183.33	150	27500.00	27.50
3	6	1	138	138	69.00	150	10350.00	10.35
	6	1	65.16666667	65.16666667	32.58	150	4887.50	4.89
	6	1	27.19444444	27.19444444	13.60	150	2039.58	2.04
15	4	1	36	36	12.00	150	1800.00	1.80
						Total	144181.77	144.18

Table 8								
Floor Dead Weight								
Level	Walls	MEP	Columns	Beams	Slabs	Drop Panels	Roof	Total
Mezzanine	331.13	59.13	1235.69	2366.4	5652.09	21.71	0	9666.15
2	397.35	59.13	912.94	3248	7629.76	103.40	0	12350.58
3	353.39	59.13	912.94	3781.6	9315.43	17.28	0	14439.76
4	179.55	59.13	288.50	1948.8	3089.32	0	3081.59	8646.89
5	179.55	59.13	288.50	1090.4	2283.25	0	0	3900.84
6	179.55	59.13	288.50	1090.4	2257.11	0	0	3874.69
7	179.55	59.13	288.50	1090.4	2257.11	0	0	3874.69
8	179.55	59.13	288.50	1090.4	2257.11	0	0	3874.69
9	179.55	59.13	288.50	1090.4	2257.11	0	0	3874.69
10	179.55	59.13	288.50	1090.4	2257.11	0	0	3874.69
11	179.55	59.13	288.50	1090.4	2257.11	1.80	0	3876.49
12	179.55	59.13	288.50	1090.4	2257.11	0	0	3874.69
13	179.55	59.13	288.50	1090.4	2257.11	0	0	3874.69
14	179.55	59.13	288.50	1090.4	2257.11	0	0	3874.69
15	127.51	59.13	288.50	1044	2101.59	0	119.73	3740.47
16	127.51	59.13	288.50	1067.2	1483.25	0	0	3025.60
17	77.91	59.13	288.50	858.4	1279.99	0	0	2563.93
18	77.91	59.13	288.50	881.6	1279.99	0	0	2587.13
19	77.91	59.13	209.85	858.4	1279.99	0	0	2485.28
20	0	59.13	130.07	858.4	1279.99	0	302.12	2629.71
Total	3545.66	1182.65	7729.02	27816.80	56988.62	144.18	3503.44	100910.36

① Seismic

Seismic Ground Motion Values

$S_S = 0.196$ $S_1 = 0.064$

Site Classification of Soil

C

S_{MS} and S_{M1} $F_a = 1.2$ $F_v = 1.7$

$S_{MS} = F_a S_S = 1.2(0.196) = .2352$

$S_{M1} = F_v S_1 = 1.7(0.064) = .1088$

S_{DS} and S_{D1}

$S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3}(.2352) = .1568$

$S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3}(.1088) = .0725$

Occupancy Category

II

Seismic Design Category

B

$T_S = \frac{S_{D1}}{S_{DS}} = \frac{0.0725}{0.1568} = .462\ s$

$T_a = C_t h_n^x = 0.016(203)^{0.9} = 1.9\ s = T$

$h_n = 203'$

$x = 0.9$ ← Concrete Moment-Resisting Frames

$C_t = 0.016$ ← Concrete Moment-Resisting Frames

$T < 3.5 T_S$

$1.9 < 3.5(.462)$

$1.9 < 1.62$ ∴ Use • Modal Response Spectrum
• Seismic Response History Procedures
• Equivalent Lateral Force Procedure
· Simplicity Reasons

② Seismic

$S_S = 0.196$

$S_1 = 0.064$

$S_{DS} = 0.1568$

$S_{D1} = 0.0725$

SDC = Category A

$R = 5$
$I = 1.0$
$T_a = 1.9_5 = T$
$C_u = 1.7$
$T_L = 8s$

$C_u T_a = 1.7(1.9) = 3.23 > 1.9 \quad \therefore T = 1.9_5$

$T = 1.9_5 < T_L = 8_s$

$$C_S = \frac{S_{DS}}{\left(\frac{R}{I}\right)} \leq \frac{S_{D1}}{T\left(\frac{R}{I}\right)}$$

$$\frac{.1568}{\left(\frac{5}{1}\right)} \leq \frac{0.0725}{(1.9)\left(\frac{5}{1}\right)}$$

$.031 \geq .008 \quad \therefore$ Use $.008 < .01 \quad \therefore$ Use $C_S = .01$

Weight $W = 100910.36^k$

Base Shear

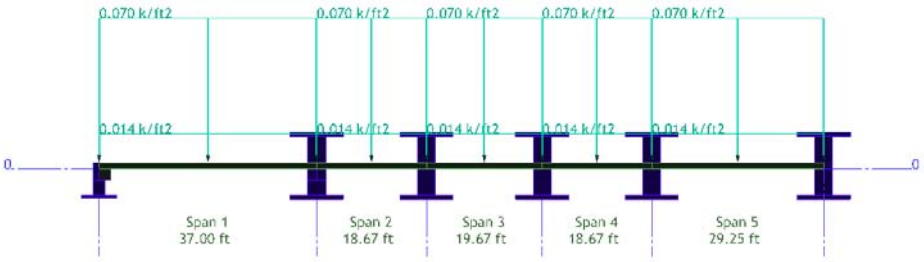
$V = C_S W = .01(100910.36) = 1009.1^k$

$K = 2$

$$F_x = C_{vx} V = \frac{w_x h_x^k}{\sum_{i=1} w_i h_i^k} V$$

$$C_{vx} = \frac{w_x h_x^k}{\sum_{i=1} w_i h_i^k}$$

39 tendons



Wednesday, March 24, 2010

A. Design Parameters and Load Combinations

A.1 Project Design Parameters

Parameter	Value	Parameter	Value
Concrete		Minimum Cover at BOTTOM	1.00 in
F'c for BEAMS/SLABS	5000.00 psi	Post-tensioning	
For COLUMNS/WALLS	4000.00 psi	SYSTEM	UNBONDED
Ec for BEAMS/SLABS	4030.50 ksi	Fpu	270.00 ksi
For COLUMNS/WALLS	3605.00 ksi	Fse	175.00 ksi
CREEP factor	2.00	Strand area	0.153 in 2
CONCRETE WEIGHT	NORMAL	Min CGS from TOP	1.00 in
UNIT WEIGHT	150.00 pcf	Min CGS from BOT for interior spans	1.00 in
Tension stress limits / (f'c)1/2		Min CGS from BOT for exterior spans	1.75 in
At Top	6.000	Min average precompression	125.00 psi
At Bottom	6.000	Max spacing / slab depth	8.00
Compression stress limits / f'c		Analysis and design options	
At all locations	0.450	Structural system	TWO-WAY
Reinforcement		Moment of Inertia over support is	NOT INCREASED
Fy (Main bars)	60.00 ksi	Moments reduced to face of support	YES
Fy (Shear reinforcement)	60.00 ksi	Moment Redistribution	NO
Minimum Cover at TOP	1.00 in	DESIGN CODE SELECTED	ACI-318 (2005)

A.2 Load Combinations

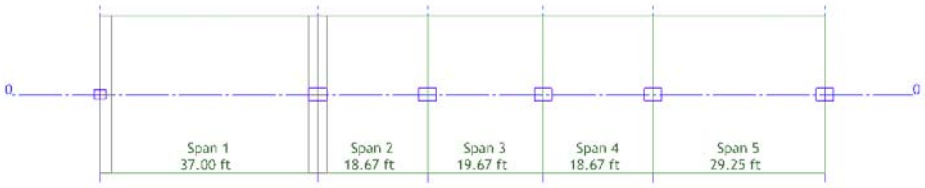
Strength load combinations
1. 1.2 SW + 1.6 LL + 1.2 SDL + 1.6 X + 1 HYP

Service load combinations
Sustained Load
1. 1 SW + 0.3 LL + 1 SDL + 0.3 X + 1 PT
Total Load
3. 1 SW + 1 LL + 1 SDL + 1 X + 1 PT

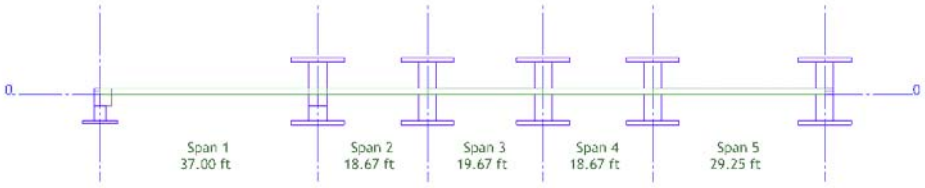
Initial load combinations
1 SW + 0 LL + 0 SDL + 0 X + 1.15 PT

B. Design Strip Report:
B.1 Geometry

- Plan

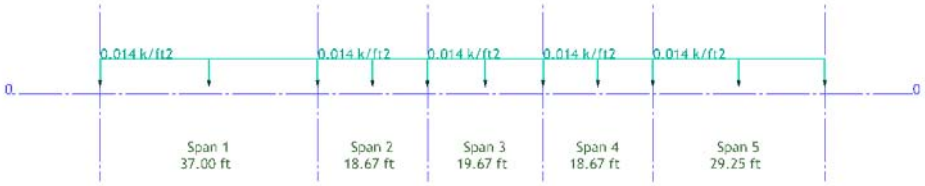


- Elevation

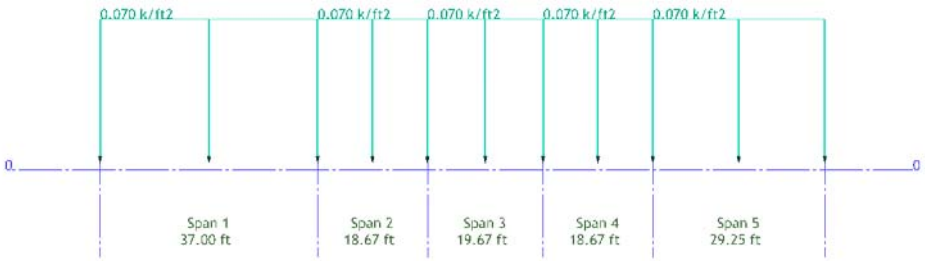


B.2 Applied loads

- Superimposed Dead Load

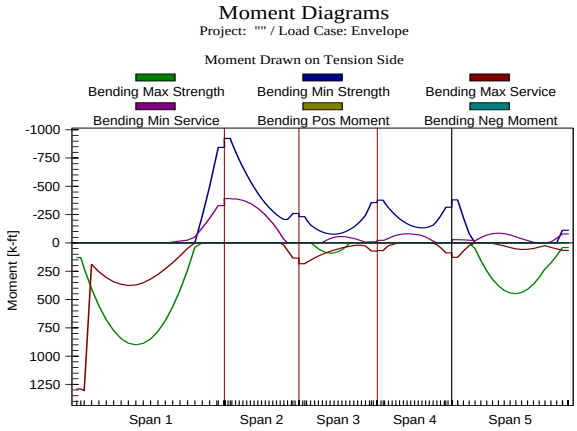


- Live Load



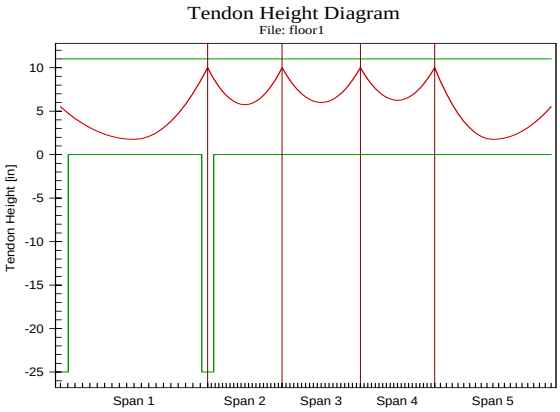
B.3 Design Moment

LOAD COMBINATION: Envelope



DESIGN MOMENT
(Moment is drawn on tension side)

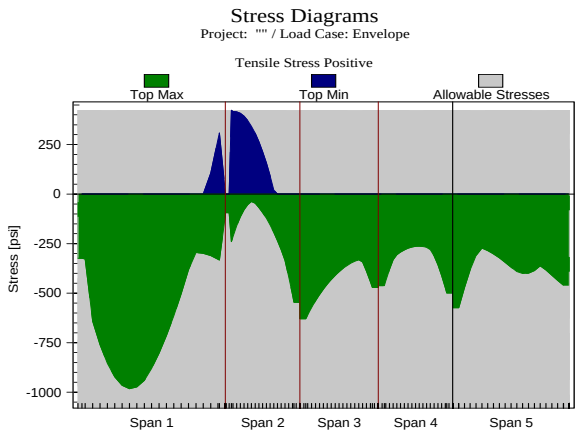
B.4 Tendon Profile

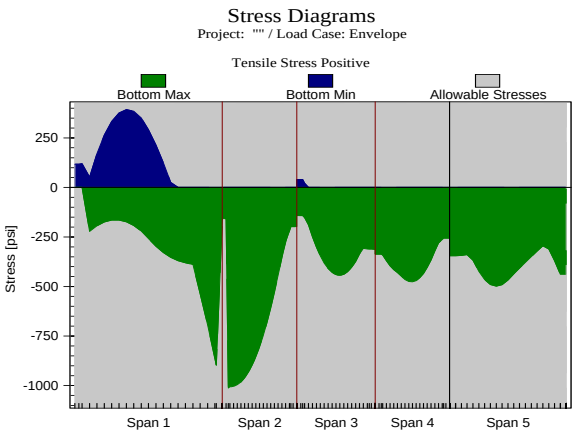


POST-TENSIONING
PROFILE

B.5 Stress check results / Code check

LOAD COMBINATION: Envelope





SERVICE COMBINATION STRESSES
(Tension stress positive)

B.6 Rebar Report

Base Reinforcement
Isolated bars
Mesh Reinforcement

Total Strip Provided Rebar

Span	ID	Location	From	Quantity	Size	Length	Area
			ft			ft	in2
1	1	TOP	0.00	29	5	7.50	8.99
1	2	TOP	29.60	9	5	19.00	2.79
2	3	TOP	14.93	9	5	8.00	2.79
3	4	TOP	15.73	9	5	8.00	2.79
4	5	TOP	14.93	9	5	10.00	2.79
5	6	TOP	23.40	9	5	6.00	2.79
1	7	TOP	34.14	9	5	12.50	2.79
1	8	BOT	4.55	5	8	19.00	3.95
1	9	BOT	10.10	4	8	11.50	3.16

B.7 Punching Shear

Critical Section Stresses

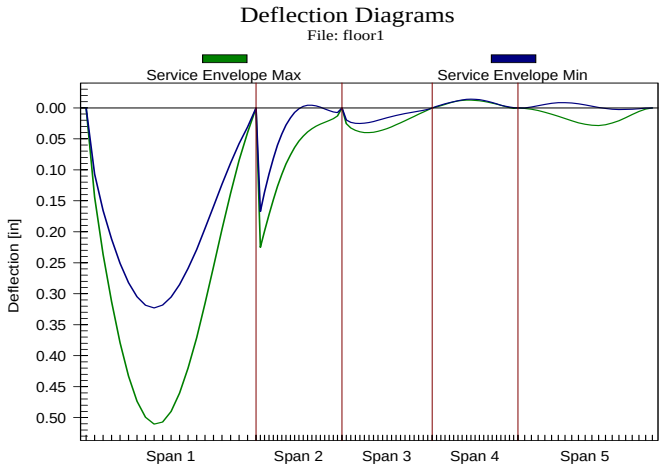
Label	Layer	Cond.	Factored shear	Factored moment	Stress due to shear	Stress due to moment	Total stress	Allowable stress	Stress ratio
			k	k-ft	ksi	ksi	ksi	ksi	
1	1	2	-137.38	+0.01	0.17	0.049	0.222	0.130	1.712
2	1	1	-329.80	-0.02	0.22	0.000	0.223	0.130	1.721
3	1	1	-130.38	-0.00	0.09	0.000	0.088	0.252	0.350
4	1	1	-174.64	+0.00	0.12	0.000	0.118	0.252	0.469
5	1	1	-161.36	+285.71	0.11	0.072	0.181	0.252	0.718
6	1	2	-105.30	-258.85	0.10	0.068	0.165	0.212	0.780

Punching Shear Reinforcement
Reinforcement option: Shear Studs
Stud diameter: 0.38
Number of rails per side: 2

Col.	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist
	in	in	in	in	in	in	in	in	in	in
1	2.3	4.7	7.0	9.4	11.7	14.1	18.8	23.4	28.1	32.8
2	1.6	3.1	4.7	7.0	9.4	11.7	14.1	18.8	23.4	
3										
4										
5										
6										

Dist. = Distance measured from the face of support
Note: Columns with --- have not been checked for punching shear.
Note: Columns with *** have exceeded the maximum allowable shear stress.

B.8 Deflection



DEFLECTION

B.9 Quantities

CONCRETE
112.29 yd3

MILD STEEL
1138.81 lbs

PRESTRESSING MATERIAL
2498.4 lb

1 - USER SPECIFIED GENERAL ANALYSIS AND DESIGN PARAMETERS

Parameter	Value	Parameter	Value
Concrete		Minimum Cover at BOTTOM	1.00 in
F'c for BEAMS/SLABS	5000.00 psi	Post-tensioning	
For COLUMNS/WALLS	4000.00 psi	SYSTEM	UNBONDED
Ec for BEAMS/SLABS	4030.50 ksi	Fpu	270.00 ksi
For COLUMNS/WALLS	3605.00 ksi	Fse	175.00 ksi

CREEP factor	2.00	Strand area	0.153 in 2
CONCRETE WEIGHT	NORMAL	Min CGS from TOP	1.00 in
UNIT WEIGHT	150.00 pcf	Min CGS from BOT for interior spans	1.00 in
Tension stress limits / (f'c)1/2		Min CGS from BOT for exterior spans	1.75 in
At Top	6.000	Min average precompression	125.00 psi
At Bottom	6.000	Max spacing / slab depth	8.00
Compression stress limits / f'c		Analysis and design options	
At all locations	0.450	Structural system	TWO-WAY
Reinforcement		Moment of Inertia over support is	NOT INCREASED
Fy (Main bars)	60.00 ksi	Moments reduced to face of support	YES
Fy (Shear reinforcement)	60.00 ksi	Moment Redistribution	NO
Minimum Cover at TOP	1.00 in	DESIGN CODE SELECTED	ACI-318 (2005)

2 - INPUT GEOMETRY

2.1 Principal Span Data of Uniform Spans

Span	Form	Length	Width	Depth	TF Width	TF Thick.	BF/MF Width	BF/MF Thick.	Rh	Right Mult.	Left Mult.
		ft	in	in	in	in	in	in	in		
1	1	37.00	322.00	11.00					11.00	0.50	0.50
2	1	18.67	322.00	11.00					11.00	0.50	0.50
3	1	19.67	322.00	11.00					11.00	0.50	0.50
4	1	18.67	322.00	11.00					11.00	0.50	0.50
5	1	29.25	322.00	11.00					11.00	0.50	0.50

2.5 Drop Cap and Drop Panel Data

Joint	Cap T	Cap B	Cap DL	Cap DR	Drop TL	Drop TR	Drop B	Drop L	Drop R
	in	in	in	in	in	in	in	in	in
1	36.00	322.00	0.00	24.00	0.00	0.00	0.00	0.00	0.00
2	36.00	322.00	18.00	18.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2.7 Support Width and Column Data

Joint	Support Width	Length LC	B(DIA.) LC	D LC	% LC	CBC LC	Length UC	B(DIA.) UC	D UC	% UC	CBC UC
	in	ft	in	in			ft	in	in		
1	24.0	5.0	18.0	24.0	100	(2)	5.0	0.0	0.0	100	(2)
2	36.0	5.0	24.0	36.0	100	(2)	5.0	24.0	36.0	100	(2)
3	36.0	5.0	24.0	36.0	100	(2)	5.0	24.0	36.0	100	(2)
4	36.0	5.0	24.0	36.0	100	(2)	5.0	24.0	36.0	100	(2)
5	36.0	5.0	24.0	36.0	100	(1)	5.0	24.0	36.0	100	(1)
6	36.0	5.0	24.0	36.0	100	(1)	5.0	24.0	36.0	100	(1)

3 - INPUT APPLIED LOADING

3.1 Loading As Appears in User's Input Screen

Span	Class	Type	W	P1	P2	A	B	C	F	M
			k/ft2	k/ft	k/ft	ft	ft	ft	k	k-ft
1	LL	U	0.070							
1	SDL	U	0.014							
2	LL	U	0.070							
2	SDL	U	0.014							
3	LL	U	0.070							
3	SDL	U	0.014							
4	LL	U	0.070							
4	SDL	U	0.014							
5	LL	U	0.070							
5	SDL	U	0.014							

NOTE: SELFWEIGHT INCLUSION REQUIRED (SW= SELF WEIGHT Computed from geometry input and treated as dead loading. Unit selfweight W = 150.0 pcf
NOTE: LIVE LOADING is SKIPPED with a skip factor of 1.00

3.2 Compiled loads

Span	Class	Type	P1	P2	F	M	A	B	C	Reduction Factor
			k/ft	k/ft	k	k-ft	ft	ft	ft	%
1	LL	P	1.878				0.000	37.000		0.000
1	SDL	P	0.376				0.000	37.000		
1	SW	P	12.075				0.000	2.000		
1	SW	P	3.690				2.000	35.500		
1	SW	P	12.075				35.500	37.000		
2	LL	P	1.878				0.000	18.670		0.000
2	SDL	P	0.376				0.000	18.670		
2	SW	P	12.075				0.000	1.500		
2	SW	P	3.690				1.500	18.670		
3	LL	P	1.878				0.000	19.670		0.000
3	SDL	P	0.376				0.000	19.670		
3	SW	P	3.690				0.000	19.670		
4	LL	P	1.878				0.000	18.670		0.000
4	SDL	P	0.376				0.000	18.670		
4	SW	P	3.690				0.000	18.670		
5	LL	P	1.878				0.000	29.250		0.000
5	SDL	P	0.376				0.000	29.250		
5	SW	P	3.690				0.000	29.250		

4 - CALCULATED SECTION PROPERTIES

4.2 Section Properties for Non-Uniform Spans

Span	Segment	Area	I	Yb	Yt
		in2	in4	in	in
1	1	11592.00	0.13E+07	18.00	18.00
1	2	3542.00	0.36E+05	5.50	5.50
1	3	11592.00	0.13E+07	18.00	18.00
2	1	11592.00	0.13E+07	18.00	18.00
2	2	3542.00	0.36E+05	5.50	5.50
3	1	3542.00	0.36E+05	5.50	5.50
4	1	3542.00	0.36E+05	5.50	5.50
5	1	3542.00	0.36E+05	5.50	5.50

5 - MOMENTS, SHEARS AND REACTIONS

5.1 Span Moments and Shears (Excluding Live Load)

Span	Load Case	Moment Left	Moment Midspan	Moment Right	Shear Left	Shear Right
		k-ft	k-ft	k-ft	k	k
1	SW	0.00	363.29	-562.38	-69.63	96.23
2	SW	-562.38	-115.57	0.28	-76.65	4.81
3	SW	0.28	105.18	-146.80	-28.81	43.76
4	SW	-146.80	40.14	-94.43	-37.25	31.64
5	SW	-261.50	135.57	-256.54	-54.13	53.79
1	SDL	0.00	36.47	-55.63	-5.45	8.45
2	SDL	-55.63	-11.52	-0.15	-6.48	0.54
3	SDL	-0.15	10.65	-14.90	-2.94	4.44
4	SDL	-14.90	4.10	-9.64	-3.79	3.23
5	SDL	-26.63	13.80	-26.12	-5.51	5.48
1	XL	0.00	0.00	0.00	0.00	0.00
2	XL	0.00	0.00	0.00	0.00	0.00
3	XL	0.00	0.00	0.00	0.00	0.00
4	XL	0.00	0.00	0.00	0.00	0.00
5	XL	0.00	0.00	0.00	0.00	0.00

5.2 Reactions and Column Moments (Excluding Live Load)

Joint	Load Case	Reaction	Moment Lower Column	Moment Upper Column
		k	k-ft	k-ft
1	SW	69.63	0.00	0.00
2	SW	172.89	0.00	0.00
3	SW	33.62	0.00	0.00
4	SW	81.01	0.00	0.00
5	SW	85.77	-83.53	-83.53
6	SW	53.79	128.27	128.27
1	SDL	5.45	0.00	0.00
2	SDL	14.93	0.00	0.00
3	SDL	3.48	0.00	0.00

4	SDL	8.23	0.00	0.00
5	SDL	8.74	-8.49	-8.49
6	SDL	5.48	13.06	13.06
1	XL	0.00	0.00	0.00
2	XL	0.00	0.00	0.00
3	XL	0.00	0.00	0.00
4	XL	0.00	0.00	0.00
5	XL	0.00	0.00	0.00
6	XL	0.00	0.00	0.00

5.3 Span Moments and Shears (Live Load)

Span	Moment Left Max	Moment Left Min	Moment Midspan Max	Moment Midspan Min	Moment Right Max	Moment Right Min	Shear Left	Shear Right
	k-ft	k-ft	k-ft	k-ft	k-ft	k-ft	k	k
1	0.00	0.00	195.09	-12.73	-285.40	-16.79	-27.92	42.46
2	-285.39	-16.79	54.16	-111.75	-74.77	36.87	-34.80	20.64
3	-74.77	36.87	75.57	-22.33	-86.78	-14.76	-20.77	24.74
4	-86.78	-14.76	38.74	-18.24	-71.44	23.25	-20.21	20.57
5	-133.83	-1.29	69.66	-0.64	-131.82	1.22	-27.59	27.51

5.4 Reactions and Column Moments (Live Load)

Joint	Reaction Max	Reaction Min	Moment Lower Column Max	Moment Lower Column Min	Moment Upper Column Max	Moment Upper Column Min
	k	k	k-ft	k-ft	k-ft	k-ft
1	27.92	-0.69	0.00	0.00	0.00	0.00
2	77.26	14.88	0.00	0.00	0.00	0.00
3	41.41	-3.35	0.00	0.00	0.00	0.00
4	44.95	13.73	0.00	0.00	0.00	0.00
5	47.03	14.93	34.47	-76.94	34.47	-76.94
6	27.51	-0.13	65.91	-0.61	65.91	-0.61

6 - MOMENTS REDUCED TO FACE OF SUPPORT

6.1 Reduced Moments at Face of Support (Excluding Live Load)

Span	Load Case	Moment Left	Moment Midspan	Moment Right
		k-ft	k-ft	k-ft
1	SW	63.59	363.25	-431.58
2	SW	-461.00	-115.58	3.35
3	SW	39.34	105.17	-85.33
4	SW	-95.08	40.14	-51.13
5	SW	-184.42	135.58	-180.00
1	SDL	5.26	36.48	-43.37
2	SDL	-46.33	-11.52	0.23
3	SDL	3.85	10.65	-8.65
4	SDL	-9.63	4.10	-5.22
5	SDL	-18.78	13.80	-18.32
1	XL	0.00	0.00	0.00
2	XL	0.00	0.00	0.00
3	XL	0.00	0.00	0.00
4	XL	0.00	0.00	0.00
5	XL	0.00	0.00	0.00

6.2 Reduced Moments at Face of Support (Live Load)

Span	Moment Left	Moment Left	Moment	Moment	Moment	Moment

	Max	Min	Midspan Max	Midspan Min	Right Max	Right Min
	k-ft	k-ft	k-ft	k-ft	k-ft	k-ft
1	-0.69	26.98	195.08	-12.73	-223.83	-16.11
2	-235.33	2.74	54.16	-111.75	-45.92	35.17
3	-45.73	52.65	75.57	-22.33	-51.78	-7.38
4	-58.58	4.87	38.73	-18.23	-42.70	16.58
5	-94.58	-1.19	69.66	-0.64	-92.67	1.03

7 - SELECTED POST-TENSIONING FORCES AND TENDON PROFILES

7.1 Tendon Profile

Tendon A

Span	Type	X1/L	X2/L	X3/L	A/L
1	1	0.000	0.500	0.000	---
2	1	0.000	0.500	0.000	---
3	1	0.000	0.500	0.000	---
4	1	0.000	0.500	0.000	---
5	1	0.000	0.500	0.000	---

7.2 Selected Post-Tensioning Forces and Tendon Drape

Tendon A

Span	Force	CGS Left	CGS C1	CGS C2	CGS Right	P/A	Wbal	WBal (%DL)
	k	in	in	in	in	psi	k/-	
1	1043.774	5.50	---	1.75	10.00	294.68	3.050	63
2	1043.774	10.00	---	5.75	10.00	294.68	8.484	179
3	1043.774	10.00	---	6.00	10.00	294.68	7.194	177
4	1043.774	10.00	---	6.25	10.00	294.68	7.486	184
5	1043.774	10.00	---	1.75	5.50	294.68	4.880	120

Approximate weight of strand: 2498.4 LB

7.4 Required Minimum Post-Tensioning Forces

	Based on Stress Conditions			Based on Minimum P/A		
Type	Left	Center	Right	Left	Center	Right
	k	k	k	k	k	k
1	0.00	871.86	920.54	1449.00	442.75	442.75
2	1042.73	78.44	0.00	442.75	442.75	442.75
3	0.00	0.00	0.00	442.75	442.75	442.75
4	0.00	0.00	0.00	442.75	442.75	442.75
5	165.58	0.00	171.95	442.75	442.75	442.75

7.5 Service Stresses (tension shown positive)

Envelope of Service 1

Span	Left Top Max-T	Left Top Max-C	Left Bot Max-T	Left Bot Max-C	Center Top Max-T	Center Top Max-C	Cetner Bot Max-T	Cetner Bot Max-C	Right Top Max-T	Right Top Max-C	Right Bot Max-T	Right Bot Max-C
	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi
1	-----	-285.45	105.37	-----	-----	-628.18	38.81	-76.41	18.64	-96.52	-----	-608.01
2	118.89	-13.10	-----	-708.26	69.28	-22.69	-----	-658.65	-----	-495.50	-----	-138.82
3	-----	-561.34	-----	-82.57	-----	-293.72	-----	-349.92	-----	-369.14	-----	-244.85
4	-----	-364.12	-----	-260.43	-----	-213.70	-----	-407.25	-----	-421.19	-----	-201.05
5	-----	-418.32	-----	-222.83	-----	-279.50	-----	-348.84	-----	-322.94	-----	-318.37

Envelope of Service 2

Span	Left Top Max-T	Left Top Max-C	Left Bot Max-T	Left Bot Max-C	Center Top Max-T	Center Top Max-C	Cetner Bot Max-T	Cetner Bot Max-C	Right Top Max-T	Right Top Max-C	Right Bot Max-T	Right Bot Max-C
	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi

1	-----	-288.71	108.63	-----	-----	-880.54	291.17	-92.87	308.19	-75.68	-----	-897.56
2	423.31	-16.65	-----	-1012.68	213.84	-92.76	-----	-803.21	-----	-540.99	-----	-198.23
3	-----	-629.45	40.08	-141.72	-----	-391.48	-----	-378.81	-----	-359.59	-----	-311.83
4	-----	-370.42	-----	-336.21	-----	-263.81	-----	-430.84	-----	-442.64	-----	-256.28
5	-----	-416.77	-----	-345.18	-----	-369.61	-----	-349.67	-----	-324.27	-----	-438.24

7.6 Post-Tensioning Balance Moments, Shears and Reactions
Span Moments and Shears

Span	Moment Left	Moment Center	Moment Right	Shear Left	Shear Right
	k-ft	k-ft	k-ft	k	k
1	1055.83	-277.83	372.58	-2.61	-2.61
2	354.17	-36.34	94.50	16.56	16.56
3	85.33	-139.00	136.50	-3.07	-3.07
4	140.83	-99.67	119.83	1.34	1.34
5	270.50	-178.50	213.33	-9.84	-9.84

Reactions and Column Moments

Joint	Reaction	Moment Lower Column	Moment Upper Column
	k	k-ft	k-ft
1	2.614	0.000	0.000
2	-19.180	0.000	0.000
3	19.640	0.000	0.000
4	-4.412	0.000	0.000
5	11.170	90.667	90.667
6	-9.836	-145.583	-145.583

Note: Moments are reported at face of support

8 - FACTORED MOMENTS AND REACTIONS ENVELOPE

8.1 Factored Design Moments (Not Redistributed)

Span	Left Max	Left Min	Middle Max	Middle Min	Right Max	Right Min
	k-ft	k-ft	k-ft	k-ft	k-ft	k-ft
1	84.13	128.41	840.16	507.66	-835.24	-502.88
2	-913.47	-532.55	-123.79	-389.24	-256.93	-127.19
3	-229.33	-71.93	77.14	-79.50	-353.13	-282.09
4	-374.39	-272.87	-50.35	-141.50	-311.77	-216.92
5	-376.96	-227.53	438.05	325.57	-109.84	40.07

8.2 Reactions and Column Moments

Joint	Reaction Max	Reaction Min	Moment Lower Column Max	Moment Lower Column Min	Moment Upper Column Max	Moment Upper Column Min
	k	k	k-ft	k-ft	k-ft	k-ft
1	137.38	91.60	0.00	0.00	0.00	0.00
2	329.83	230.02	0.00	0.00	0.00	0.00
3	130.42	58.80	0.00	0.00	0.00	0.00
4	174.60	124.65	0.00	0.00	0.00	0.00
5	199.83	148.47	35.44	-142.83	35.44	-142.83
6	105.30	61.08	129.44	23.01	129.44	23.01

8.3 Secondary Moments

Span	Left	Midspan	Right
	k-ft	k-ft	k-ft
1	2.61	48.36	92.83
2	71.87	-57.92	-187.75
3	-208.00	-182.75	-157.50

4	-155.00	-165.42	-175.83
5	18.22	147.33	276.42

Note: Moments are reported at face of support

10 - MILD STEEL - NO REDISTRIBUTION

10.1 Required Rebar

10.1.1 Total Strip Required Rebar

Span	Location	From	To	As Required	Ultimate	Minimum
		ft	ft	in2	in2	in2
1	TOP	0.00	5.55	8.69	0.00	8.69
1	TOP	31.45	37.01	3.19	3.19	2.76
2	TOP	0.00	10.27	5.44	3.59	5.44
2	TOP	15.87	18.67	2.66	0.00	2.66
3	TOP	0.00	2.95	2.66	0.00	2.66
3	TOP	16.72	19.67	2.66	0.00	2.66
4	TOP	0.00	2.80	2.66	0.00	2.66
4	TOP	15.87	18.67	2.66	0.00	2.66
5	TOP	0.00	4.39	2.66	0.00	2.66
5	TOP	24.86	29.25	2.66	0.00	2.66
1	BOT	7.40	20.35	6.62	3.98	6.62

10.2 Provided Rebar

10.2.1 Total Strip Provided Rebar

Span	ID	Location	From	Quantity	Size	Length	Area
			ft			ft	in2
1	1	TOP	0.00	29	5	7.50	8.99
1	2	TOP	29.60	9	5	19.00	2.79
2	3	TOP	14.93	9	5	8.00	2.79
3	4	TOP	15.73	9	5	8.00	2.79
4	5	TOP	14.93	9	5	10.00	2.79
5	6	TOP	23.40	9	5	6.00	2.79
1	7	TOP	34.14	9	5	12.50	2.79
1	8	BOT	4.55	5	8	19.00	3.95
1	9	BOT	10.10	4	8	11.50	3.16

10.2.2 Total Strip Steel Disposition

Span	ID	Location	From	Quantity	Size	Length
			ft			ft
1	1	TOP	0.00	29	5	7.50
1	2	TOP	29.60	9	5	7.40
1	7	TOP	34.14	9	5	2.86
2	2	TOP	0.00	9	5	11.60
2	3	TOP	14.93	9	5	3.74
2	7	TOP	0.00	9	5	9.64
3	3	TOP	0.00	9	5	4.26
3	4	TOP	15.73	9	5	3.94
4	4	TOP	0.00	9	5	4.06
4	5	TOP	14.93	9	5	3.74
5	5	TOP	0.00	9	5	6.26
5	6	TOP	23.40	9	5	6.00
1	8	BOT	4.55	5	8	19.00
1	9	BOT	10.10	4	8	11.50

10.3 Base Reinforcement
10.3.1 Isolated bars
10.3.2 Mesh Reinforcement

13 - PUNCHING SHEAR REINFORCEMENT

13.1 Critical Section Geometry

Column	Layer	Cond.	a	d	b1	b2
			in	in	in	in
1	1	2	4.69	9.38	28.69	27.38
2	1	1	4.69	9.38	45.37	33.38
3	1	1	4.69	9.38	45.37	33.38
4	1	1	4.69	9.38	45.37	33.38
5	1	1	4.69	9.38	45.37	33.38
6	1	2	4.69	9.38	40.69	33.38

13.2 Critical Section Stresses

Label	Layer	Cond.	Factored shear	Factored moment	Stress due to shear	Stress due to moment	Total stress	Allowable stress	Stress ratio
			k	k-ft	ksi	ksi	ksi	ksi	
1	1	2	-137.38	+0.01	0.17	0.049	0.222	0.130	1.712
2	1	1	-329.80	-0.02	0.22	0.000	0.223	0.130	1.721
3	1	1	-130.38	-0.00	0.09	0.000	0.088	0.252	0.350
4	1	1	-174.64	+0.00	0.12	0.000	0.118	0.252	0.469
5	1	1	-161.36	+285.71	0.11	0.072	0.181	0.252	0.718
6	1	2	-105.30	-258.85	0.10	0.068	0.165	0.212	0.780

13.3 Punching Shear Reinforcement

Reinforcement option: Shear Studs
Stud diameter: 0.38
Number of rails per side: 2

Col.	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist
	in	in	in	in	in	in	in	in	in	in
1	2.3	4.7	7.0	9.4	11.7	14.1	18.8	23.4	28.1	32.8
2	1.6	3.1	4.7	7.0	9.4	11.7	14.1	18.8	23.4	
3										
4										
5										
6										

Dist. = Distance measured from the face of support
Note: Columns with --- have not been checked for punching shear.
Note: Columns with *** have exceeded the maximum allowable shear stress.

14 - DEFLECTIONS

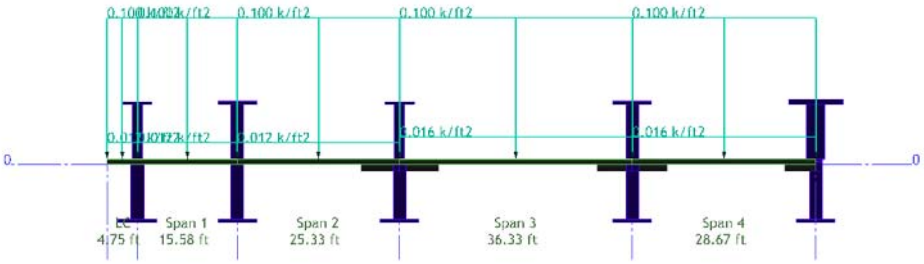
14.1 Maximum Span Deflections

Span	SW	SW+PT	SW+PT+SDL	SW+PT+SDL+Creep	LL	X	Total
	in	in	in	in	in	in	in
1	0.54	0.19	0.24	0.73(610)	0.27(1645)	0.00(****)	1.00(445)
2	-0.08	0.27	0.25	0.75(298)	-0.10(2357)	0.00(****)	0.67(335)
3	0.04	0.02	0.02	0.06(3941)	0.03(9266)	0.00(****)	0.08(3042)
4	0.01	-0.01	-0.01	-0.04(5068)	0.00(88684)	0.00(****)	-0.04(5336)
5	0.09	-0.03	-0.02	-0.06(5786)	0.04(7852)	0.00(****)	-0.02(****)

16 - Unbalanced Moment Reinforcement

16.1 Unbalanced Moment Reinforcement - No Redistribution

Joint	Gamma Left	Gamma Right	Width Left	Width Right	Moment Left Neg	Moment Left Pos	Moment Right Neg	Moment Right Pos	As Top	As Bot	n Bar Top	n Bar Bot
			ft	ft	k-ft	k-ft	k-ft	k-ft	in2	in2		
1	0.00	0.59	0.00	10.50	0.00	0.00	0.00	128.41	0.00	0.00	0	0
2	0.58	0.56	11.00	4.75	-78.19	0.00	-55.18	0.00	0.00	0.00	0	0
3	0.56	0.56	4.75	4.75	-9.27	0.00	-21.21	0.00	0.00	0.00	0	0
4	0.56	0.56	4.75	4.75	-65.15	0.00	-109.83	40.08	0.00	0.00	0	0
5	0.56	0.56	4.75	4.75	0.00	0.00	-37.12	0.00	0.00	0.00	0	0
6	0.56	0.00	4.75	0.00	-62.58	22.84	0.00	0.00	0.00	0.00	0	0



Wednesday, March 24, 2010

A. Design Parameters and Load Combinations

A.1 Project Design Parameters

Parameter	Value	Parameter	Value
Concrete		Minimum Cover at BOTTOM	1.00 in
F'c for BEAMS/SLABS	5000.00 psi	Post-tensioning	
For COLUMNS/WALLS	4000.00 psi	SYSTEM	UNBONDED
Ec for BEAMS/SLABS	4031.00 ksi	Fpu	270.00 ksi
For COLUMNS/WALLS	3605.00 ksi	Fse	175.00 ksi
CREEP factor	2.00	Strand area	0.153 in 2
CONCRETE WEIGHT	NORMAL	Min CGS from TOP	1.00 in
UNIT WEIGHT	150.00 pcf	Min CGS from BOT for interior spans	1.00 in
Tension stress limits / (f'c)1/2		Min CGS from BOT for exterior spans	1.75 in
At Top	6.000	Min average precompression	125.00 psi
At Bottom	6.000	Max spacing / slab depth	8.00
Compression stress limits / f'c		Analysis and design options	
At all locations	0.450	Structural system	TWO-WAY
Reinforcement		Moment of Inertia over support is	NOT INCREASED
Fy (Main bars)	60.00 ksi	Moments reduced to face of support	YES
Fy (Shear reinforcement)	60.00 ksi	Moment Redistribution	NO
Minimum Cover at TOP	1.00 in	DESIGN CODE SELECTED	ACI-318 (2005)

A.2 Load Combinations

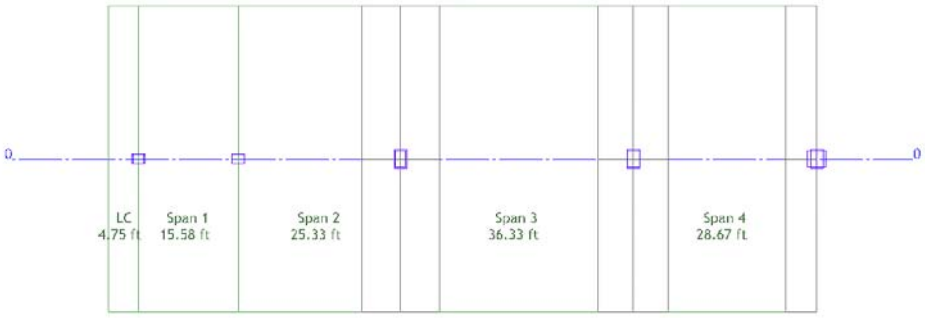
Strength load combinations
1. 1.2 SW + 1.6 LL + 1.2 SDL + 1.6 X + 1 HYP

Service load combinations
Sustained Load
1. 1 SW + 0.3 LL + 1 SDL + 0.3 X + 1 PT
Total Load
3. 1 SW + 1 LL + 1 SDL + 1 X + 1 PT

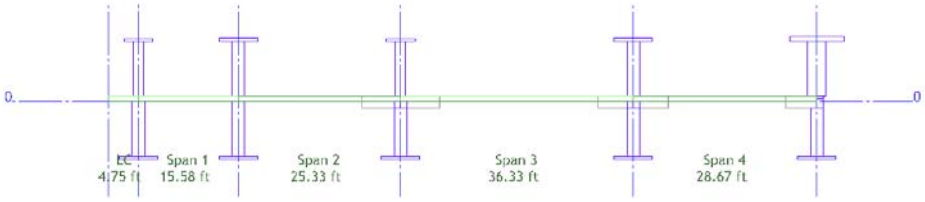
Initial load combinations
1 SW + 0 LL + 0 SDL + 0 X + 1.15 PT

B. Design Strip Report:
B.1 Geometry

- Plan

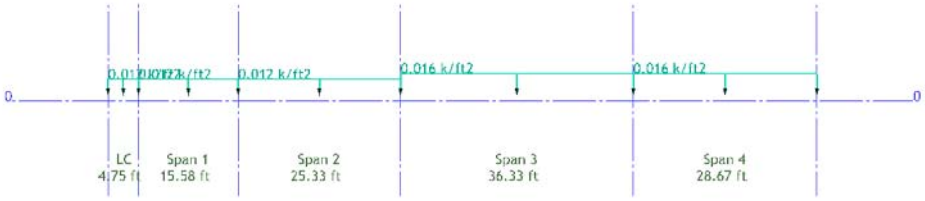


- Elevation

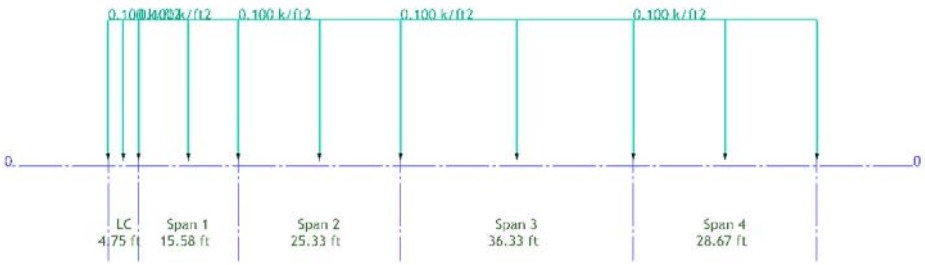


B.2 Applied loads

- Superimposed Dead Load

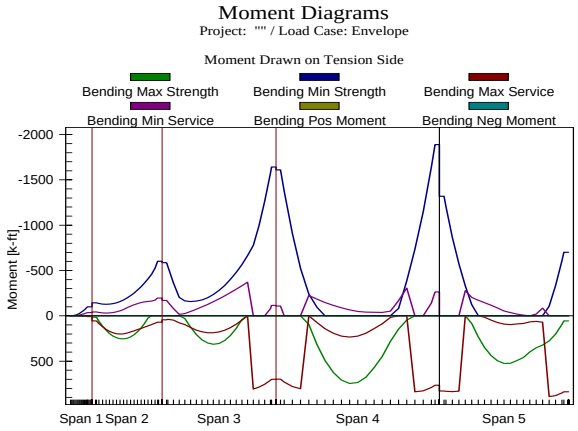


- Live Load



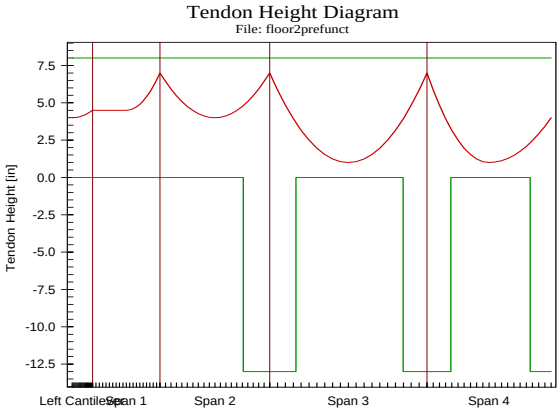
B.3 Design Moment

LOAD COMBINATION: Envelope



DESIGN MOMENT
(Moment is drawn on tension side)

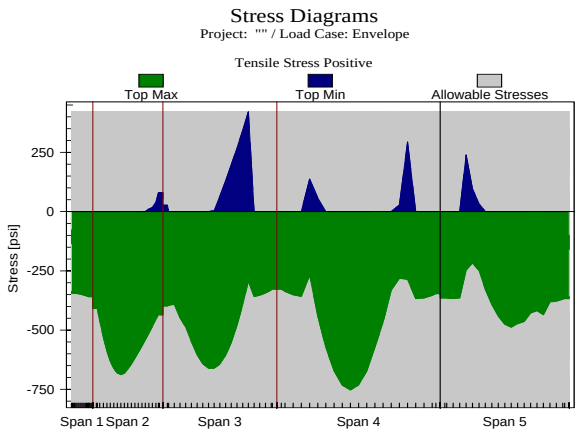
B.4 Tendon Profile

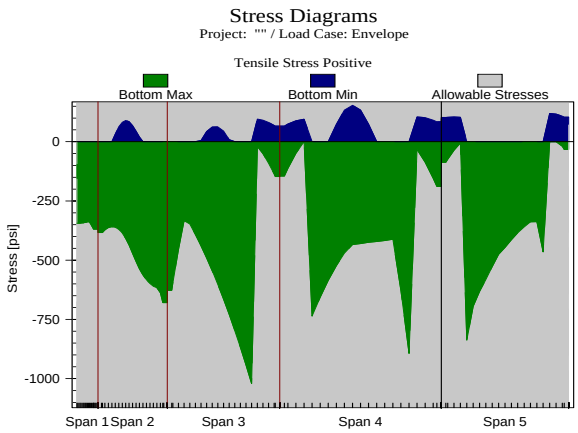


POST-TENSIONING
PROFILE

B.5 Stress check results / Code check

LOAD COMBINATION: Envelope





SERVICE COMBINATION STRESSES
(Tension stress positive)

B.6 Rebar Report

Base Reinforcement
Isolated bars
Mesh Reinforcement

Total Strip Provided Rebar

Span	ID	Location	From	Quantity	Size	Length	Area
			ft			ft	in2
CL	1	TOP	3.80	12	5	4.50	3.72
1	2	TOP	12.46	12	5	8.50	3.72
2	3	TOP	13.93	10	5	19.00	3.10
3	4	TOP	26.25	6	5	18.50	1.86
4	5	TOP	22.94	30	5	6.00	9.30
2	6	TOP	14.20	10	5	18.50	3.10
3	7	TOP	26.25	6	5	16.00	1.86
3	8	BOT	14.53	3	8	4.00	2.37

B.7 Punching Shear

Critical Section Stresses

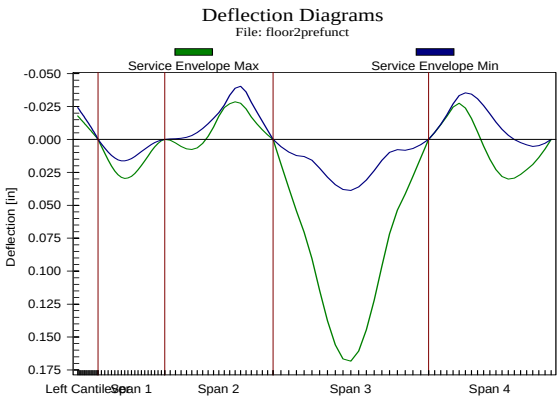
Label	Layer	Cond.	Factored shear	Factored moment	Stress due to shear	Stress due to moment	Total stress	Allowable stress	Stress ratio
			k	k-ft	ksi	ksi	ksi	ksi	
1	1	1	-168.45	+0.00	0.24	0.000	0.241	0.253	0.954
2	1	1	-321.65	+0.00	0.46	0.000	0.461	0.253	1.821
3	1	1	-603.68	+0.00	0.16	0.000	0.158	0.212	0.744
4	1	1	-508.56	-1121.37	0.13	0.082	0.215	0.212	1.012
5	1	2	-240.67	-922.55	0.09	0.062	0.149	0.212	0.700

Punching Shear Reinforcement
Reinforcement option: Shear Studs
Stud diameter: 0.38
Number of rails per side: 2

Col.	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist
	in	in	in	in	in	in	in	in	in	in
1										
2	***	***								
3										
4	1.6	3.2	4.8	6.5	8.1	9.7				
5										

Dist. = Distance measured from the face of support
Note: Columns with --- have not been checked for punching shear.
Note: Columns with *** have exceeded the maximum allowable shear stress.

B.8 Deflection



DEFLECTION

B.9 Quantities

CONCRETE
130.70 yd3

MILD STEEL
940.73 lbs

PRESTRESSING MATERIAL
2954.8 lb

1 - USER SPECIFIED GENERAL ANALYSIS AND DESIGN PARAMETERS

Parameter	Value	Parameter	Value
Concrete		Minimum Cover at BOTTOM	1.00 in
F'c for BEAMS/SLABS	5000.00 psi	Post-tensioning	
For COLUMNS/WALLS	4000.00 psi	SYSTEM	UNBONDED
Ec for BEAMS/SLABS	4031.00 ksi	Fpu	270.00 ksi
For COLUMNS/WALLS	3605.00 ksi	Fse	175.00 ksi
CREEP factor	2.00	Strand area	0.153 in 2
CONCRETE WEIGHT	NORMAL	Min CGS from TOP	1.00 in
UNIT WEIGHT	150.00 pcf	Min CGS from BOT for interior spans	1.00 in
Tension stress limits / (f'c)1/2		Min CGS from BOT for exterior spans	1.75 in
At Top	6.000	Min average precompression	125.00 psi
At Bottom	6.000	Max spacing / slab depth	8.00
Compression stress limits / f'c		Analysis and design options	
At all locations	0.450	Structural system	TWO-WAY
Reinforcement		Moment of Inertia over support is	NOT INCREASED
Fy (Main bars)	60.00 ksi	Moments reduced to face of support	YES
Fy (Shear reinforcement)	60.00 ksi	Moment Redistribution	NO
Minimum Cover at TOP	1.00 in	DESIGN CODE SELECTED	ACI-318 (2005)

2 - INPUT GEOMETRY

2.1 Principal Span Data of Uniform Spans

Span	Form	Length	Width	Depth	TF Width	TF Thick.	BF/MF Width	BF/MF Thick.	Rh	Right Mult.	Left Mult.
		ft	in	in	in	in	in	in	in		
C	1	4.75	574.00	8.00					8.00	0.50	0.50
1	1	15.58	574.00	8.00					8.00	0.50	0.50
2	1	25.33	574.00	8.00					8.00	0.50	0.50
3	1	36.33	574.00	8.00					8.00	0.50	0.50
4	1	28.67	574.00	8.00					8.00	0.50	0.50

2.5 Drop Cap and Drop Panel Data

Joint	Cap T	Cap B	Cap DL	Cap DR	Drop TL	Drop TR	Drop B	Drop L	Drop R
	in	in	in	in	in	in	in	in	in
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	21.00	574.00	73.00	73.00	0.00	0.00	0.00	0.00	0.00
4	21.00	574.00	66.00	66.00	0.00	0.00	0.00	0.00	0.00
5	21.00	574.00	58.00	0.00	0.00	0.00	0.00	0.00	0.00

2.7 Support Width and Column Data

Joint	Support Width	Length LC	B(DIA.) LC	D LC	% LC	CBC LC	Length UC	B(DIA.) UC	D UC	% UC	CBC UC
	in	ft	in	in			ft	in	in		
1	24.0	9.0	18.0	24.0	100	(2)	9.0	18.0	18.0	100	(2)
2	24.0	9.0	18.0	24.0	100	(2)	9.0	18.0	24.0	100	(2)
3	24.0	9.0	36.0	24.0	100	(2)	9.0	30.0	18.0	100	(2)
4	24.0	9.0	36.0	24.0	100	(1)	9.0	30.0	24.0	100	(1)
5	24.0	9.0	36.0	24.0	100	(1)	9.0	30.0	34.0	100	(1)

3 - INPUT APPLIED LOADING

3.1 Loading As Appears in User's Input Screen

Span	Class	Type	W	P1	P2	A	B	C	F	M
			k/ft2	k/ft	k/ft	ft	ft	ft	k	k-ft
CANT	LL	U	0.100							
CANT	SDL	U	0.012							
1	LL	U	0.100							
1	SDL	U	0.012							
2	LL	U	0.100							
2	SDL	U	0.012							
3	LL	U	0.100							
3	SDL	U	0.016							
4	LL	U	0.100							
4	SDL	U	0.016							

NOTE: SELFWEIGHT INCLUSION REQUIRED (SW= SELF WEIGHT Computed from geometry input and treated as dead loading. Unit selfweight W = 150.0 pcf
NOTE: LIVE LOADING is SKIPPED with a skip factor of 1.00

3.2 Compiled loads

Span	Class	Type	P1	P2	F	M	A	B	C	Reduction Factor
			k/ft	k/ft	k	k-ft	ft	ft	ft	%
CL	LL	P	4.783				0.000	4.750		0.000

CL	SDL	P	0.574				0.000	4.750		
CL	SW	P	4.783				0.000	4.750		
1	LL	P	4.783				0.000	15.580		0.000
1	SDL	P	0.574				0.000	15.580		
1	SW	P	4.783				0.000	15.580		
2	LL	P	4.783				0.000	25.330		0.000
2	SDL	P	0.574				0.000	25.330		
2	SW	P	4.783				0.000	19.247		
2	SW	P	12.556				19.247	25.330		
3	LL	P	4.783				0.000	36.330		0.000
3	SDL	P	0.765				0.000	36.330		
3	SW	P	12.556				0.000	6.083		
3	SW	P	4.783				6.083	30.830		
3	SW	P	12.556				30.830	36.330		
4	LL	P	4.783				0.000	28.670		0.000
4	SDL	P	0.765				0.000	28.670		
4	SW	P	12.556				0.000	5.500		
4	SW	P	4.783				5.500	23.837		
4	SW	P	12.556				23.837	28.670		

4 - CALCULATED SECTION PROPERTIES

4.2 Section Properties for Non-Uniform Spans

Span	Segment	Area	I	Yb	Yt
		in2	in4	in	in
CL	1	4592.00	0.24E+05	4.00	4.00
1	1	4592.00	0.24E+05	4.00	4.00
2	1	4592.00	0.24E+05	4.00	4.00
2	2	12054.00	0.44E+06	10.50	10.50
3	1	12054.00	0.44E+06	10.50	10.50
3	2	4592.00	0.24E+05	4.00	4.00
3	3	12054.00	0.44E+06	10.50	10.50
4	1	12054.00	0.44E+06	10.50	10.50
4	2	4592.00	0.24E+05	4.00	4.00
4	3	12054.00	0.44E+06	10.50	10.50

5 - MOMENTS, SHEARS AND REACTIONS

5.1 Span Moments and Shears (Excluding Live Load)

Span	Load Case	Moment Left	Moment Midspan	Moment Right	Shear Left	Shear Right
		k-ft	k-ft	k-ft	k	k
CANT	SW	-----	-----	-53.96	-----	22.72
1	SW	-53.96	59.66	-117.00	-33.22	41.31
2	SW	-117.00	36.13	-721.82	-42.38	126.07
3	SW	-721.82	158.28	-801.36	-131.26	132.55
4	SW	-638.56	84.57	-383.60	-119.28	98.18
CANT	SDL	-----	-----	-6.48	-----	2.73
1	SDL	-6.48	9.33	-9.71	-4.26	4.68
2	SDL	-9.71	-1.66	-85.69	-4.27	10.27
3	SDL	-85.69	26.43	-113.98	-13.12	14.68
4	SDL	-84.00	12.54	-48.19	-12.22	9.72
CANT	XL	-----	-----	0.00	-----	0.00
1	XL	0.00	0.00	0.00	0.00	0.00
2	XL	0.00	0.00	0.00	0.00	0.00
3	XL	0.00	0.00	0.00	0.00	0.00

4	XL	0.00	0.00	0.00	0.00	0.00

5.2 Reactions and Column Moments (Excluding Live Load)

Joint	Load Case	Reaction	Moment Lower Column	Moment Upper Column
		k	k-ft	k-ft
1	SW	55.94	0.00	0.00
2	SW	83.69	0.00	0.00
3	SW	257.33	0.00	0.00
4	SW	251.83	88.80	74.00
5	SW	98.18	113.85	269.75
1	SDL	6.99	0.00	0.00
2	SDL	8.95	0.00	0.00
3	SDL	23.39	0.00	0.00
4	SDL	26.90	16.35	13.63
5	SDL	9.72	14.30	33.89
1	XL	0.00	0.00	0.00
2	XL	0.00	0.00	0.00
3	XL	0.00	0.00	0.00
4	XL	0.00	0.00	0.00
5	XL	0.00	0.00	0.00

5.3 Span Moments and Shears (Live Load)

Span	Moment Left Max	Moment Left Min	Moment Midspan Max	Moment Midspan Min	Moment Right Max	Moment Right Min	Shear Left	Shear Right
	k-ft	k-ft	k-ft	k-ft	k-ft	k-ft	k	k
CL	-----	-----	-----	-----	-53.96	-----	-----	22.72
1	-53.96	0.00	167.75	-106.97	-235.50	49.77	-43.92	52.38
2	-235.50	49.77	196.88	-164.78	-645.08	-178.33	-62.84	84.32
3	-645.08	-178.34	211.63	-55.89	-829.31	101.74	-87.94	100.00
4	-552.60	-143.29	111.37	-31.62	-427.38	120.96	-77.97	71.87

5.4 Reactions and Column Moments (Live Load)

Joint	Reaction Max	Reaction Min	Moment Lower Column Max	Moment Lower Column Min	Moment Upper Column Max	Moment Upper Column Min
	k	k	k-ft	k-ft	k-ft	k-ft
1	66.64	15.92	0.00	0.00	0.00	0.00
2	115.22	14.70	0.00	0.00	0.00	0.00
3	172.26	65.41	0.00	0.00	0.00	0.00
4	177.97	56.59	325.15	-237.03	270.97	-197.54
5	71.87	-10.64	126.84	-35.90	300.54	-85.06

6 - MOMENTS REDUCED TO FACE OF SUPPORT

6.1 Reduced Moments at Face of Support (Excluding Live Load)

Span	Load Case	Moment Left	Moment Midspan	Moment Right
		k-ft	k-ft	k-ft
CANT	SW	-----	-----	-33.63
1	SW	-23.13	59.66	-78.08
2	SW	-77.01	36.13	-602.00
3	SW	-596.83	158.25	-675.08

4	SW	-525.58	84.58	-291.67
CANT	SDL	-----	-----	-4.04
1	SDL	-2.50	9.32	-5.32
2	SDL	-5.72	-1.66	-75.71
3	SDL	-72.95	26.43	-99.67
4	SDL	-72.17	12.54	-38.85
CANT	XL	-----	-----	0.00
1	XL	0.00	0.00	0.00
2	XL	0.00	0.00	0.00
3	XL	0.00	0.00	0.00
4	XL	0.00	0.00	0.00

6.2 Reduced Moments at Face of Support (Live Load)

Span	Moment Left Max	Moment Left Min	Moment Midspan Max	Moment Midspan Min	Moment Right Max	Moment Right Min
	k-ft	k-ft	k-ft	k-ft	k-ft	k-ft
CL	-----	-----	-----	-----	-33.63	-----
1	-60.77	37.77	167.75	-107.00	-185.50	77.98
2	-175.08	33.86	196.92	-164.75	-563.17	-122.42
3	-559.50	-171.25	211.67	-55.89	-731.67	93.08
4	-477.00	-135.00	111.33	-31.62	-357.92	110.33

7 - SELECTED POST-TENSIONING FORCES AND TENDON PROFILES

7.1 Tendon Profile
Tendon A

Span	Type	X1/L	X2/L	X3/L	A/L
CL	1	---	---	0.000	---
1	1	0.000	0.500	0.000	---
2	1	0.000	0.500	0.000	---
3	1	0.000	0.500	0.000	---
4	1	0.000	0.500	0.000	---

7.2 Selected Post-Tensioning Forces and Tendon Drape
Tendon A

Span	Force	CGS Left	CGS C1	CGS C2	CGS Right	P/A	Wbal	WBal (%DL)
	k	in	in	in	in	psi	k/-	
CL	1375.000	4.00	---	---	4.50	299.43	5.078	95
1	1375.000	4.50	---	4.50	7.00	299.43	4.720	88
2	1375.000	7.00	---	4.00	7.00	299.43	4.286	59
3	1375.000	7.00	---	1.00	7.00	299.43	4.167	52
4	1375.000	7.00	---	1.00	4.00	299.43	5.018	60

Approximate weight of strand: 2954.8 LB

7.4 Required Minimum Post-Tensioning Forces

	Based on Stress Conditions			Based on Minimum P/A		
Type	Left	Center	Right	Left	Center	Right
	k	k	k	k	k	k
CL	-----	-----	0.00	-----	-----	574.00
1	0.00	137.80	316.12	574.00	574.00	574.00
2	233.44	98.10	0.00	574.00	1506.80	1506.80
3	0.00	753.68	12.38	1506.80	574.00	1506.80
4	0.00	0.00	0.00	1506.80	574.00	1506.80

7.5 Service Stresses (tension shown positive)
Envelope of Service 1

Span	Left	Left	Left	Left	Center	Center	Cetner	Cetner	Right	Right	Right	Right

	Top Max-T	Top Max-C	Bot Max-T	Bot Max-C	Top Max-T	Top Max-C	Bot Max-T	Bot Max-C	Top Max-T	Top Max-C	Bot Max-T	Bot Max-C
	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi
CL	-----	-----	-----	-----	-----	-----	-----	-----	-----	-295.59	-----	-323.05
1	-----	-356.85	-----	-299.95	-----	-436.47	-----	-323.93	-----	-329.33	-----	-424.45
2	-----	-335.05	-----	-386.67	-----	-373.47	-----	-438.04	-----	-231.08	2.94	-34.67
3	-----	-227.66	-----	-33.60	-----	-442.18	-----	-313.98	-----	-255.85	27.71	-42.67
4	-----	-265.57	37.43	-----	-----	-322.54	-----	-360.40	-----	-306.78	78.64	-----

Envelope of Service 2

Span	Left Top Max-T	Left Top Max-C	Left Bot Max-T	Left Bot Max-C	Center Top Max-T	Center Top Max-C	Cetner Bot Max-T	Cetner Bot Max-C	Right Top Max-T	Right Top Max-C	Right Bot Max-T	Right Bot Max-C
	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi
CL	-----	-----	-----	-----	-----	-----	-----	-----	-----	-295.59	-----	-369.19
1	-----	-408.68	-----	-383.32	-----	-666.61	67.74	-470.68	80.08	-436.32	-----	-678.94
2	28.00	-381.50	-----	-626.87	65.24	-643.57	44.71	-664.11	-----	-206.70	-----	-146.80
3	-----	-193.57	-----	-145.00	-----	-732.52	133.65	-390.66	-----	-274.38	46.24	-188.35
4	-----	-238.69	10.55	-86.73	-----	-475.33	-----	-403.77	-----	-328.75	100.61	-32.58

7.6 Post-Tensioning Balance Moments, Shears and Reactions

Span Moments and Shears

Span	Moment Left	Moment Center	Moment Right	Shear Left	Shear Right
	k-ft	k-ft	k-ft	k	k
CL	-----	-----	35.71	-----	19.04
1	43.60	-49.39	75.26	13.69	13.69
2	90.75	-55.76	1125.83	-12.44	-12.44
3	1120.83	-175.33	1245.00	-3.64	-3.64
4	1170.83	-118.75	975.00	-3.81	-3.81

Reactions and Column Moments

Joint	Reaction	Moment Lower Column	Moment Upper Column
	k	k-ft	k-ft
1	-13.690	0.000	0.000
2	26.140	0.000	0.000
3	-8.806	0.000	0.000
4	0.172	-34.817	-29.017
5	-3.810	-82.925	-196.500

Note: Moments are reported at face of support

8 - FACTORED MOMENTS AND REACTIONS ENVELOPE

8.1 Factored Design Moments (Not Redistributed)

Span	Left Max	Left Min	Middle Max	Middle Min	Right Max	Right Min
	k-ft	k-ft	k-ft	k-ft	k-ft	k-ft
CL	-----	-----	-----	-----	-99.02	-----
1	-141.68	15.99	244.51	-195.09	-596.46	-174.89
2	-580.25	-245.94	300.72	-277.94	-1624.90	-919.70
3	-1593.44	-972.24	728.20	300.11	-1869.95	-550.35
4	-1306.50	-759.30	519.52	290.80	-693.70	55.50

8.2 Reactions and Column Moments

Joint	Reaction Max	Reaction Min	Moment Lower	Moment Lower	Moment Upper	Moment Upper

			Column Max	Column Min	Column Max	Column Min
	k	k	k-ft	k-ft	k-ft	k-ft
1	168.45	87.30	0.00	0.00	0.00	0.00
2	321.63	160.83	0.00	0.00	0.00	0.00
3	603.70	432.68	0.00	0.00	0.00	0.00
4	619.41	425.16	611.67	-287.80	509.73	-239.87
5	240.66	108.65	273.77	13.40	648.66	31.73

8.3 Secondary Moments

Span	Left	Midspan	Right
	k-ft	k-ft	k-ft
1	-13.69	-106.67	-199.58
2	-200.83	-55.71	89.42
3	105.50	167.92	230.42
4	174.00	224.83	275.58

Note: Moments are reported at face of support

10 - MILD STEEL - NO REDISTRIBUTION

10.1 Required Rebar

10.1.1 Total Strip Required Rebar

Span	Location	From	To	As Required	Ultimate	Minimum
		ft	ft	in2	in2	in2
CL	TOP	4.04	4.75	3.44	0.00	3.44
1	TOP	0.00	2.34	3.44	0.00	3.44
1	TOP	13.24	15.58	3.44	0.00	3.44
2	TOP	0.00	3.80	3.44	0.00	3.44
2	TOP	15.20	19.00	4.87	3.70	4.87
2	TOP	21.53	25.33	3.44	0.00	3.44
3	TOP	0.00	5.45	3.44	0.00	3.44
3	TOP	29.06	36.32	3.44	2.39	3.44
4	TOP	0.00	5.73	3.44	0.00	3.44
4	TOP	24.37	28.67	9.04	0.00	9.04

10.2 Provided Rebar

10.2.1 Total Strip Provided Rebar

Span	ID	Location	From	Quantity	Size	Length	Area
			ft			ft	in2
CL	1	TOP	3.80	12	5	4.50	3.72
1	2	TOP	12.46	12	5	8.50	3.72
2	3	TOP	13.93	10	5	19.00	3.10
3	4	TOP	26.25	6	5	18.50	1.86
4	5	TOP	22.94	30	5	6.00	9.30
2	6	TOP	14.20	10	5	18.50	3.10
3	7	TOP	26.25	6	5	16.00	1.86
3	8	BOT	14.53	3	8	4.00	2.37

10.2.2 Total Strip Steel Disposition

Span	ID	Location	From	Quantity	Size	Length
			ft			ft

CL	1	TOP	3.80	12	5	0.95
1	1	TOP	0.00	12	5	3.55
1	2	TOP	12.46	12	5	3.12
2	2	TOP	0.00	12	5	5.38
2	3	TOP	13.93	10	5	11.40
2	6	TOP	14.20	10	5	11.13
3	3	TOP	0.00	10	5	7.60
3	4	TOP	26.25	6	5	10.08
3	6	TOP	0.00	10	5	7.37
3	7	TOP	26.25	6	5	10.08
4	4	TOP	0.00	6	5	8.42
4	5	TOP	22.94	30	5	6.00
4	7	TOP	0.00	6	5	5.92
3	8	BOT	14.53	3	8	4.00

10.3 Base Reinforcement
10.3.1 Isolated bars
10.3.2 Mesh Reinforcement

13 - PUNCHING SHEAR REINFORCEMENT

13.1 Critical Section Geometry

Column	Layer	Cond.	a	d	b1	b2
			in	in	in	in
1	1	1	3.19	6.38	30.38	24.38
2	1	1	3.19	6.38	30.38	24.38
3	1	1	9.69	19.38	43.37	55.37
4	1	1	9.69	19.38	43.37	55.37
5	1	2	9.69	19.38	43.69	55.37

13.2 Critical Section Stresses

Label	Layer	Cond.	Factored shear	Factored moment	Stress due to shear	Stress due to moment	Total stress	Allowable stress	Stress ratio
			k	k-ft	ksi	ksi	ksi	ksi	
1	1	1	-168.45	+0.00	0.24	0.000	0.241	0.253	0.954
2	1	1	-321.65	+0.00	0.46	0.000	0.461	0.253	1.821
3	1	1	-603.68	+0.00	0.16	0.000	0.158	0.212	0.744
4	1	1	-508.56	-1121.37	0.13	0.082	0.215	0.212	1.012
5	1	2	-240.67	-922.55	0.09	0.062	0.149	0.212	0.700

13.3 Punching Shear Reinforcement

Reinforcement option: Shear Studs
Stud diameter: 0.38
Number of rails per side: 2

Col.	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist
	in	in	in	in	in	in	in	in	in	in
1										
2	***	***								
3										
4	1.6	3.2	4.8	6.5	8.1	9.7				
5										

Dist. = Distance measured from the face of support
Note: Columns with --- have not been checked for punching shear.
Note: Columns with *** have exceeded the maximum allowable shear stress.

14 - DEFLECTIONS

14.1 Maximum Span Deflections

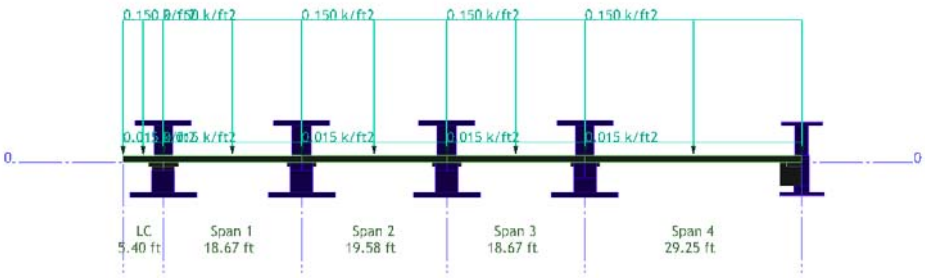
Span	SW	SW+PT	SW+PT+ SDL	SW+PT+SDL +Creep	LL	X	Total
	in	in	in	in	in	in	in
CL	-0.01	-0.01	-0.02	-0.05(1258)	-0.01(6259)	0.00(****)	-0.05(1047)
1	0.02	0.01	0.01	0.03(5777)	0.02(9579)	0.00(****)	0.05(3700)
2	0.02	-0.02	-0.02	-0.07(4154)	-0.02(16492)	0.00(****)	-0.09(3490)
3	0.19	-0.05	-0.02	-0.06(7835)	0.19(2353)	0.00(****)	0.13(3241)
4	0.06	-0.07	-0.04	-0.13(2716)	0.05(6654)	0.00(****)	-0.10(3289)

16 - Unbalanced Moment Reinforcement

16.1 Unbalanced Moment Reinforcement - No Redistribution

Joint	Gamma Left	Gamma Right	Width Left	Width Right	Moment Left Neg	Moment Left Pos	Moment Right Neg	Moment Right Pos	As Top	As Bot	n Bar Top	n Bar Bot
			ft	ft	k-ft	k-ft	k-ft	k-ft	in2	in2		
1	0.57	0.57	3.50	3.50	-45.20	0.00	-16.24	16.00	0.00	0.00	0	0
2	0.57	0.63	3.50	8.25	-71.03	0.00	-52.51	0.00	0.00	0.00	0	0
3	0.63	0.63	8.25	8.25	-563.47	0.00	-693.66	55.54	0.00	0.00	0	0
4	0.60	0.60	8.25	8.25	-357.40	0.00	-132.52	0.00	0.00	0.00	0	0
5	0.60	0.00	8.25	0.00	-423.33	33.89	0.00	0.00	0.00	0.00	0	0

41 tendons



Friday, March 26, 2010

A. Design Parameters and Load Combinations

A.1 Project Design Parameters

Parameter	Value	Parameter	Value
Concrete		Minimum Cover at BOTTOM	1.00 in
F'c for BEAMS/SLABS	5000.00 psi	Post-tensioning	
For COLUMNS/WALLS	4000.00 psi	SYSTEM	UNBONDED
Ec for BEAMS/SLABS	4031.00 ksi	Fpu	270.00 ksi
For COLUMNS/WALLS	3605.00 ksi	Fse	175.00 ksi
CREEP factor	2.00	Strand area	0.153 in 2
CONCRETE WEIGHT	NORMAL	Min CGS from TOP	1.00 in
UNIT WEIGHT	150.00 pcf	Min CGS from BOT for interior spans	1.00 in
Tension stress limits / (f'c)1/2		Min CGS from BOT for exterior spans	1.75 in
At Top	6.000	Min average precompression	125.00 psi
At Bottom	6.000	Max spacing / slab depth	8.00
Compression stress limits / f'c		Analysis and design options	
At all locations	0.450	Structural system	TWO-WAY
Reinforcement		Moment of Inertia over support is	NOT INCREASED
Fy (Main bars)	60.00 ksi	Moments reduced to face of support	YES
Fy (Shear reinforcement)	60.00 ksi	Moment Redistribution	NO
Minimum Cover at TOP	1.00 in	DESIGN CODE SELECTED	ACI-318 (2005)

A.2 Load Combinations

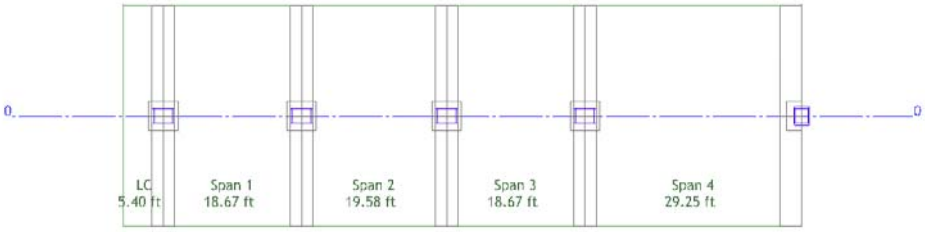
Strength load combinations
1. 1.2 SW + 1.6 LL + 1.2 SDL + 1.6 X + 1 HYP

Service load combinations
Sustained Load
1. 1 SW + 0.3 LL + 1 SDL + 0.3 X + 1 PT
Total Load
3. 1 SW + 1 LL + 1 SDL + 1 X + 1 PT

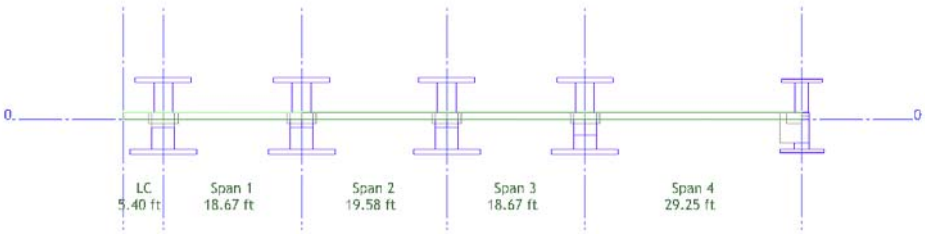
Initial load combinations
1 SW + 0 LL + 0 SDL + 0 X + 1.15 PT

B. Design Strip Report:
B.1 Geometry

- Plan

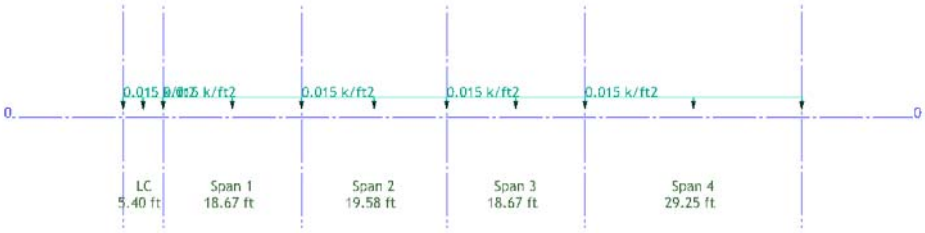


- Elevation

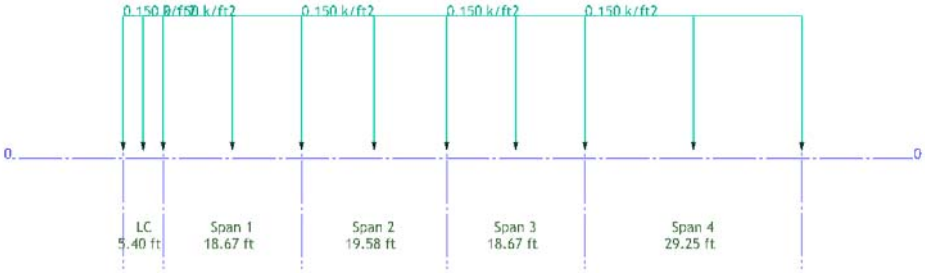


B.2 Applied loads

- Superimposed Dead Load

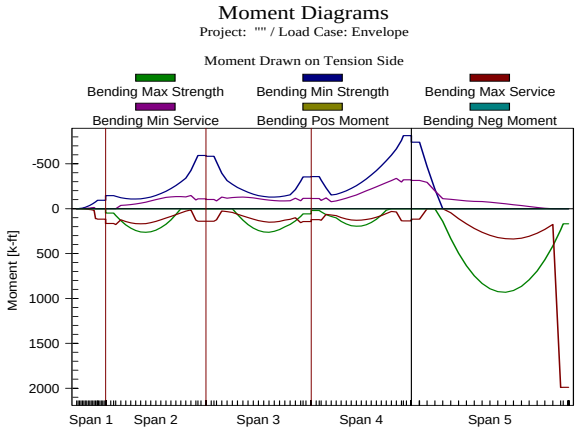


- Live Load



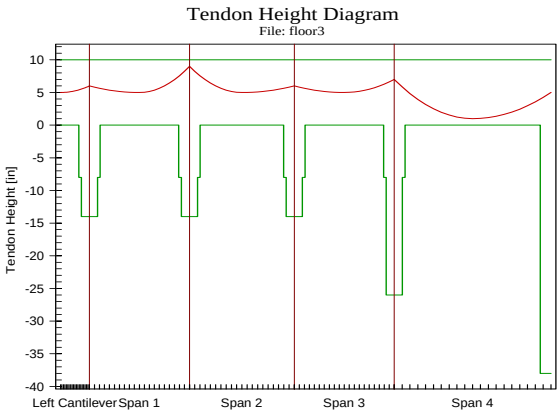
B.3 Design Moment

LOAD COMBINATION: Envelope



DESIGN MOMENT
(Moment is drawn on tension side)

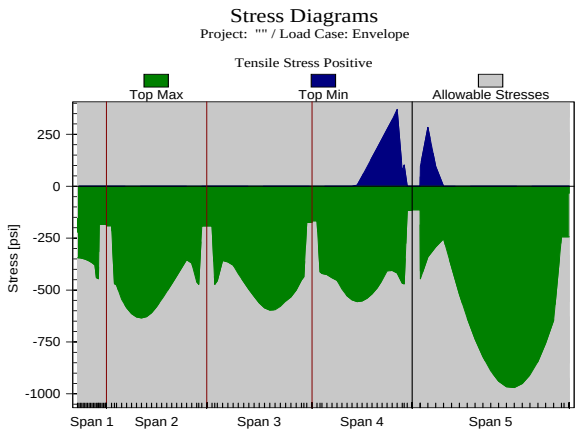
B.4 Tendon Profile

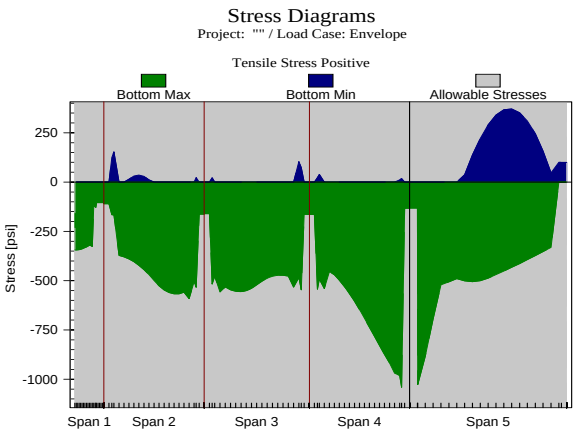


POST-TENSIONING
PROFILE

B.5 Stress check results / Code check

LOAD COMBINATION: Envelope





SERVICE COMBINATION STRESSES
(Tension stress positive)

B.6 Rebar Report

Base Reinforcement
Isolated bars
Mesh Reinforcement

Total Strip Provided Rebar

Span	ID	Location	From	Quantity	Size	Length	Area
			ft			ft	in2
CL	1	TOP	4.32	9	5	5.00	2.79
1	2	TOP	14.93	9	5	8.00	2.79
2	3	TOP	15.66	9	5	8.00	2.79
3	4	TOP	11.20	12	5	13.50	3.72
4	5	TOP	23.40	42	5	6.00	13.02
3	6	TOP	13.93	12	5	9.00	3.72
4	7	BOT	10.70	4	8	15.50	3.16
4	8	BOT	12.16	4	8	12.50	3.16

B.7 Punching Shear

Critical Section Stresses

Label	Layer	Cond.	Factored shear	Factored moment	Stress due to shear	Stress due to moment	Total stress	Allowable stress	Stress ratio
			k	k-ft	ksi	ksi	ksi	ksi	
1	1	1	-179.44	+0.02	0.06	0.000	0.059	0.127	0.464
2	1	1	-330.18	+0.00	0.11	0.000	0.109	0.127	0.854
3	1	1	-266.23	+0.00	0.09	0.000	0.088	0.127	0.688
4	1	1	-417.42	+0.00	0.14	0.000	0.137	0.127	1.079
5	2	2	-181.41	-0.03	0.02	0.006	0.028	0.134	0.210

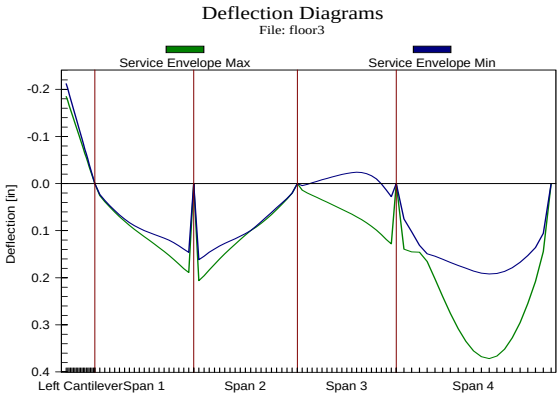
Punching Shear Reinforcement
Reinforcement option: Shear Studs
Stud diameter: 0.38
Number of rails per side: 2

Col.	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist
	in	in	in	in	in	in	in	in	in	in

1										
2										
3										
4	4.1	8.2								
5										

Dist. = Distance measured from the face of support
Note: Columns with --- have not been checked for punching shear.
Note: Columns with *** have exceeded the maximum allowable shear stress.

B.8 Deflection



DEFLECTION

B.9 Quantities

CONCRETE
86.33 yd3

MILD STEEL
988.17 lbs

PRESTRESSING MATERIAL
1911.6 lb

1 - USER SPECIFIED GENERAL ANALYSIS AND DESIGN PARAMETERS

Parameter	Value	Parameter	Value
Concrete		Minimum Cover at BOTTOM	1.00 in
F'c for BEAMS/SLABS	5000.00 psi	Post-tensioning	
For COLUMNS/WALLS	4000.00 psi	SYSTEM	UNBONDED
Ec for BEAMS/SLABS	4031.00 ksi	Fpu	270.00 ksi
For COLUMNS/WALLS	3605.00 ksi	Fse	175.00 ksi
CREEP factor	2.00	Strand area	0.153 in 2
CONCRETE WEIGHT	NORMAL	Min CGS from TOP	1.00 in
UNIT WEIGHT	150.00 pcf	Min CGS from BOT for interior spans	1.00 in
Tension stress limits / (f'c)1/2		Min CGS from BOT for exterior spans	1.75 in
At Top	6.000	Min average precompression	125.00 psi
At Bottom	6.000	Max spacing / slab depth	8.00
Compression stress limits / f'c		Analysis and design options	

At all locations	0.450	Structural system	TWO-WAY
Reinforcement		Moment of Inertia over support is	NOT INCREASED
Fy (Main bars)	60.00 ksi	Moments reduced to face of support	YES
Fy (Shear reinforcement)	60.00 ksi	Moment Redistribution	NO
Minimum Cover at TOP	1.00 in	DESIGN CODE SELECTED	ACI-318 (2005)

2 - INPUT GEOMETRY

2.1 Principal Span Data of Uniform Spans

Span	Form	Length	Width	Depth	TF Width	TF Thick.	BF/MF Width	BF/MF Thick.	Rh	Right Mult.	Left Mult.
		ft	in	in	in	in	in	in	in		
C	1	5.40	359.00	10.00					10.00	0.50	0.50
1	1	18.67	359.00	10.00					10.00	0.50	0.50
2	1	19.58	359.00	10.00					10.00	0.50	0.50
3	1	18.67	359.00	10.00					10.00	0.50	0.50
4	1	29.25	359.00	10.00					10.00	0.50	0.50

2.5 Drop Cap and Drop Panel Data

Joint	Cap T	Cap B	Cap DL	Cap DR	Drop TL	Drop TR	Drop B	Drop L	Drop R
	in	in	in	in	in	in	in	in	in
1	24.00	359.00	18.00	18.00	18.00	18.00	48.00	24.00	24.00
2	24.00	359.00	18.00	18.00	18.00	18.00	48.00	24.00	24.00
3	24.00	359.00	18.00	18.00	18.00	18.00	48.00	24.00	24.00
4	36.00	359.00	18.00	18.00	18.00	18.00	48.00	24.00	24.00
5	48.00	359.00	36.00	0.00	18.00	0.00	48.00	24.00	0.00

2.7 Support Width and Column Data

Joint	Support Width	Length LC	B(DIA.) LC	D LC	% LC	CBC LC	Length UC	B(DIA.) UC	D UC	% UC	CBC UC
	in	ft	in	in			ft	in	in		
1	36.0	4.5	24.0	36.0	100	(2)	4.5	24.0	30.0	100	(2)
2	36.0	4.5	24.0	36.0	100	(2)	4.5	24.0	30.0	100	(2)
3	36.0	4.5	24.0	36.0	100	(2)	4.5	24.0	30.0	100	(2)
4	36.0	4.5	24.0	36.0	100	(2)	4.5	24.0	30.0	100	(2)
5	24.0	4.5	30.0	24.0	100	(2)	4.5	24.0	22.0	100	(2)

3 - INPUT APPLIED LOADING

3.1 Loading As Appears in User's Input Screen

Span	Class	Type	W	P1	P2	A	B	C	F	M
			k/ft2	k/ft	k/ft	ft	ft	ft	k	k-ft
CANT	LL	U	0.150							
CANT	SDL	U	0.015							
1	LL	U	0.150							
1	SDL	U	0.015							
2	LL	U	0.150							
2	SDL	U	0.015							
3	LL	U	0.150							
3	SDL	U	0.015							
4	LL	U	0.150							
4	SDL	U	0.015							

NOTE: SELFWEIGHT INCLUSION REQUIRED (SW= SELF WEIGHT Computed from geometry

input and treated as dead loading. Unit selfweight W = 150.0 pcf
NOTE: LIVE LOADING is SKIPPED with a skip factor of 1.00

3.2 Compiled loads

Span	Class	Type	P1	P2	F	M	A	B	C	Reduction Factor
			k/ft	k/ft	k	k-ft	ft	ft	ft	%
CL	LL	P	4.488				0.000	5.400		0.000
CL	SDL	P	0.449				0.000	5.400		
CL	SW	P	8.975				0.000	1.500		
CL	SW	P	4.140				1.500	2.000		
CL	SW	P	3.740				2.000	5.400		
1	LL	P	4.488				0.000	18.670		0.000
1	SDL	P	0.449				0.000	18.670		
1	SW	P	8.975				0.000	1.500		
1	SW	P	4.140				1.500	2.000		
1	SW	P	3.740				2.000	16.670		
1	SW	P	4.140				16.670	17.170		
1	SW	P	8.975				17.170	18.670		
2	LL	P	4.488				0.000	19.580		0.000
2	SDL	P	0.449				0.000	19.580		
2	SW	P	8.975				0.000	1.500		
2	SW	P	4.140				1.500	2.000		
2	SW	P	3.740				2.000	17.580		
2	SW	P	4.140				17.580	18.080		
2	SW	P	8.975				18.080	19.580		
3	LL	P	4.488				0.000	18.670		0.000
3	SDL	P	0.449				0.000	18.670		
3	SW	P	8.975				0.000	1.500		
3	SW	P	4.140				1.500	2.000		
3	SW	P	3.740				2.000	16.670		
3	SW	P	4.140				16.670	17.170		
3	SW	P	13.463				17.170	18.670		
4	LL	P	4.488				0.000	29.250		0.000
4	SDL	P	0.449				0.000	29.250		
4	SW	P	13.463				0.000	1.500		
4	SW	P	4.140				1.500	2.000		
4	SW	P	3.740				2.000	27.250		
4	SW	P	17.950				27.250	29.250		

4 - CALCULATED SECTION PROPERTIES

4.2 Section Properties for Non-Uniform Spans

Span	Segment	Area	I	Yb	Yt
		in2	in4	in	in
CL	1	8616.00	0.41E+06	12.00	12.00
CL	2	3974.00	0.60E+05	12.13	5.87
CL	3	3590.00	0.30E+05	5.00	5.00
1	1	8616.00	0.41E+06	12.00	12.00
1	2	3974.00	0.60E+05	12.13	5.87
1	3	3590.00	0.30E+05	5.00	5.00
1	4	3974.00	0.60E+05	12.13	5.87
1	5	8616.00	0.41E+06	12.00	12.00
2	1	8616.00	0.41E+06	12.00	12.00
2	2	3974.00	0.60E+05	12.13	5.87
2	3	3590.00	0.30E+05	5.00	5.00
2	4	3974.00	0.60E+05	12.13	5.87

2	5	8616.00	0.41E+06	12.00	12.00
3	1	8616.00	0.41E+06	12.00	12.00
3	2	3974.00	0.60E+05	12.13	5.87
3	3	3590.00	0.30E+05	5.00	5.00
3	4	3974.00	0.60E+05	12.13	5.87
3	5	12924.00	0.14E+07	18.00	18.00
4	1	12924.00	0.14E+07	18.00	18.00
4	2	3974.00	0.60E+05	12.13	5.87
4	3	3590.00	0.30E+05	5.00	5.00
4	4	17232.00	0.33E+07	24.00	24.00

5 - MOMENTS, SHEARS AND REACTIONS

5.1 Span Moments and Shears (Excluding Live Load)

Span	Load Case	Moment Left	Moment Midspan	Moment Right	Shear Left	Shear Right
		k-ft	k-ft	k-ft	k	k
CANT	SW	-----	-----	-60.76	-----	28.25
1	SW	-60.77	43.45	-190.70	-36.00	49.92
2	SW	-190.70	66.05	-48.09	-51.95	37.38
3	SW	-48.09	-45.07	-385.46	-25.16	67.49
4	SW	-385.46	227.05	-0.01	-83.24	69.35
CANT	SDL	-----	-----	-6.54	-----	2.42
1	SDL	-6.54	5.29	-21.98	-3.36	5.02
2	SDL	-21.98	7.77	-5.48	-5.24	3.55
3	SDL	-5.48	-4.95	-43.53	-2.15	6.23
4	SDL	-43.53	26.23	0.00	-8.05	5.07
CANT	XL	-----	-----	0.00	-----	0.00
1	XL	0.00	0.00	0.00	0.00	0.00
2	XL	0.00	0.00	0.00	0.00	0.00
3	XL	0.00	0.00	0.00	0.00	0.00
4	XL	0.00	0.00	0.00	0.00	0.00

5.2 Reactions and Column Moments (Excluding Live Load)

Joint	Load Case	Reaction	Moment Lower Column	Moment Upper Column
		k	k-ft	k-ft
1	SW	64.25	0.00	0.00
2	SW	101.87	0.00	0.00
3	SW	62.54	0.00	0.00
4	SW	150.73	0.00	0.00
5	SW	69.35	0.00	0.00
1	SDL	5.79	0.00	0.00
2	SDL	10.25	0.00	0.00
3	SDL	5.70	0.00	0.00
4	SDL	14.28	0.00	0.00
5	SDL	5.07	0.00	0.00
1	XL	0.00	0.00	0.00
2	XL	0.00	0.00	0.00
3	XL	0.00	0.00	0.00
4	XL	0.00	0.00	0.00
5	XL	0.00	0.00	0.00

5.3 Span Moments and Shears (Live Load)

Span	Moment Left Max	Moment Left Min	Moment Midspan Max	Moment Midspan Min	Moment Right Max	Moment Right Min	Shear Left	Shear Right
	k-ft	k-ft	k-ft	k-ft	k-ft	k-ft	k	k

CL	-----	-----	-----	-----	-65.43	-----	-----	24.23
1	-65.43	-0.01	146.16	-93.27	-277.68	-43.70	-39.06	56.76
2	-277.68	-43.71	159.49	-81.76	-231.94	63.88	-61.38	53.55
3	-231.94	63.88	125.14	-174.66	-461.51	-37.29	-52.32	69.74
4	-461.51	-37.28	300.25	-37.98	-0.01	0.00	-81.41	53.35

5.4 Reactions and Column Moments (Live Load)

Joint	Reaction Max	Reaction Min	Moment Lower Column Max	Moment Lower Column Min	Moment Upper Column Max	Moment Upper Column Min
	k	k	k-ft	k-ft	k-ft	k-ft
1	63.29	21.25	0.00	0.00	0.00	0.00
2	118.14	33.16	0.00	0.00	0.00	0.00
3	105.86	3.15	0.00	0.00	0.00	0.00
4	151.15	32.74	0.00	0.00	0.00	0.00
5	53.35	-2.60	0.00	0.00	0.00	0.00

6 - MOMENTS REDUCED TO FACE OF SUPPORT

6.1 Reduced Moments at Face of Support (Excluding Live Load)

Span	Load Case	Moment Left	Moment Midspan	Moment Right
		k-ft	k-ft	k-ft
CANT	SW	-----	-----	-28.49
1	SW	-16.86	43.45	-125.92
2	SW	-122.83	66.05	-2.12
3	SW	-20.44	-45.08	-299.33
4	SW	-275.75	227.08	60.37
CANT	SDL	-----	-----	-3.41
1	SDL	-2.00	5.29	-14.97
2	SDL	-14.63	7.77	-0.66
3	SDL	-2.76	-4.95	-34.69
4	SDL	-31.96	26.23	4.85
CANT	XL	-----	-----	0.00
1	XL	0.00	0.00	0.00
2	XL	0.00	0.00	0.00
3	XL	0.00	0.00	0.00
4	XL	0.00	0.00	0.00

6.2 Reduced Moments at Face of Support (Live Load)

Span	Moment Left Max	Moment Left Min	Moment Midspan Max	Moment Midspan Min	Moment Right Max	Moment Right Min
	k-ft	k-ft	k-ft	k-ft	k-ft	k-ft
CL	-----	-----	-----	-----	-34.13	-----
1	-69.90	49.85	146.17	-93.25	-197.58	-33.00
2	-190.67	2.72	159.50	-81.76	-156.67	98.58
3	-158.50	74.46	125.17	-174.67	-361.92	4.86
4	-344.42	-35.37	300.25	-37.98	-2.60	51.09

7 - SELECTED POST-TENSIONING FORCES AND TENDON PROFILES

7.1 Tendon Profile
Tendon A

Span	Type	X1/L	X2/L	X3/L	A/L
CL	1	---	---	0.000	---
1	1	0.000	0.500	0.000	---

2	1	0.000	0.500	0.000	---
3	1	0.000	0.500	0.000	---
4	1	0.000	0.500	0.000	---

7.2 Selected Post-Tensioning Forces and Tendon Drape
Tendon A

Span	Force	CGS Left	CGS C1	CGS C2	CGS Right	P/A	Wbal	WBal (%DL)
	k	in	in	in	in	psi	k/-	
CL	1075.000	5.00	---	---	6.00	299.44	6.144	108
1	1075.000	6.00	---	5.00	9.00	299.44	5.140	102
2	1075.000	9.00	---	5.00	6.00	299.44	4.673	93
3	1075.000	6.00	---	5.00	7.00	299.44	3.084	57
4	1075.000	7.00	---	1.00	5.00	299.44	4.188	74

Approximate weight of strand: 1911.6 LB

7.4 Required Minimum Post-Tensioning Forces

	Based on Stress Conditions			Based on Minimum P/A		
Type	Left	Center	Right	Left	Center	Right
	k	k	k	k	k	k
CL	-----	-----	0.00	-----	-----	448.75
1	0.00	0.00	0.00	496.75	448.75	496.75
2	0.00	92.97	0.00	496.75	448.75	496.75
3	0.00	70.43	589.87	496.75	448.75	496.75
4	546.87	899.57	0.00	496.75	448.75	2154.00

7.5 Service Stresses (tension shown positive)
Envelope of Service 1

Span	Left Top Max-T	Left Top Max-C	Left Bot Max-T	Left Bot Max-C	Center Top Max-T	Center Top Max-C	Cetner Bot Max-T	Cetner Bot Max-C	Right Top Max-T	Right Top Max-C	Right Bot Max-T	Right Bot Max-C
	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi
CL	-----	-----	-----	-----	-----	-----	-----	-----	-----	-379.25	-----	-70.58
1	-----	-420.97	40.44	-46.62	-----	-375.06	-----	-367.89	-----	-362.82	-----	-199.39
2	-----	-375.65	-----	-193.81	-----	-337.97	-----	-406.07	-----	-355.66	-----	-280.11
3	-----	-350.97	-----	-273.59	-----	-377.19	-----	-402.08	-----	-324.13	-----	-426.35
4	-----	-296.00	-----	-442.53	-----	-467.88	-----	-334.51	-----	-214.06	89.29	-----

Envelope of Service 2

Span	Left Top Max-T	Left Top Max-C	Left Bot Max-T	Left Bot Max-C	Center Top Max-T	Center Top Max-C	Cetner Bot Max-T	Cetner Bot Max-C	Right Top Max-T	Right Top Max-C	Right Bot Max-T	Right Bot Max-C
	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi
CL	-----	-----	-----	-----	-----	-----	-----	-----	-----	-379.25	-----	-128.47
1	-----	-461.89	125.01	-165.20	-----	-580.25	-----	-498.82	-----	-335.73	-----	-534.57
2	-----	-377.89	-----	-517.26	-----	-561.88	-----	-520.85	-----	-436.58	72.71	-545.88
3	-----	-412.09	22.09	-542.47	48.39	-552.87	-----	-647.28	101.99	-328.12	-----	-1040.31
4	95.45	-266.96	-----	-1026.80	-----	-889.39	290.51	-387.83	-----	-217.17	92.40	-----

7.6 Post-Tensioning Balance Moments, Shears and Reactions
Span Moments and Shears

Span	Moment Left	Moment Center	Moment Right	Shear Left	Shear Right
	k-ft	k-ft	k-ft	k	k
CL	-----	-----	124.67	-----	23.96
1	132.25	-54.88	229.50	5.87	5.87
2	226.33	-102.50	45.82	-0.74	-0.74
3	69.47	51.25	378.33	-15.68	-15.68
4	340.08	-259.33	1661.67	6.75	6.75

Reactions and Column Moments

Joint	Reaction	Moment Lower Column	Moment Upper Column
	k	k-ft	k-ft
1	-5.873	0.000	0.000
2	6.612	0.000	0.000
3	14.940	0.000	0.000
4	-22.430	0.000	0.000
5	6.746	0.000	0.000

Note: Moments are reported at face of support

8 - FACTORED MOMENTS AND REACTIONS ENVELOPE

8.1 Factored Design Moments (Not Redistributed)

Span	Left Max	Left Min	Middle Max	Middle Min	Right Max	Right Min
	k-ft	k-ft	k-ft	k-ft	k-ft	k-ft
CL	-----	-----	-----	-----	-92.89	-----
1	-143.28	48.32	237.53	-145.54	-586.03	-322.69
2	-578.61	-269.19	241.20	-144.81	-350.58	57.82
3	-353.42	19.32	191.14	-288.59	-806.06	-219.22
4	-733.15	-238.67	883.04	341.86	80.85	166.75

8.2 Reactions and Column Moments

Joint	Reaction Max	Reaction Min	Moment Lower Column Max	Moment Lower Column Min	Moment Upper Column Max	Moment Upper Column Min
	k	k	k-ft	k-ft	k-ft	k-ft
1	179.43	112.17	0.00	0.00	0.00	0.00
2	330.15	194.25	0.00	0.00	0.00	0.00
3	266.27	101.87	0.00	0.00	0.00	0.00
4	417.31	227.93	0.00	0.00	0.00	0.00
5	181.42	91.90	0.00	0.00	0.00	0.00

8.3 Secondary Moments

Span	Left	Midspan	Right
	k-ft	k-ft	k-ft
1	-8.81	-54.83	-100.83
2	-108.58	-102.58	-96.58
3	-71.97	50.91	173.83
4	187.17	98.67	6.75

Note: Moments are reported at face of support

10 - MILD STEEL - NO REDISTRIBUTION

10.1 Required Rebar

10.1.1 Total Strip Required Rebar

Span	Location	From	To	As Required	Ultimate	Minimum
		ft	ft	in2	in2	in2
CL	TOP	4.59	5.40	2.69	0.00	2.69
1	TOP	0.00	2.80	2.69	0.00	2.69
1	TOP	15.87	18.67	2.69	0.00	2.69
2	TOP	0.00	2.94	2.69	0.00	2.69
2	TOP	16.64	19.58	2.69	0.00	2.69
3	TOP	0.00	2.80	2.69	0.00	2.69

3	TOP	14.00	18.67	6.78	6.78	2.69
4	TOP	0.00	4.39	7.34	7.34	2.69
4	TOP	24.86	29.25	12.92	0.00	12.92
4	BOT	13.16	23.40	6.13	5.72	6.13

10.2 Provided Rebar

10.2.1 Total Strip Provided Rebar

Span	ID	Location	From	Quantity	Size	Length	Area
			ft			ft	in2
CL	1	TOP	4.32	9	5	5.00	2.79
1	2	TOP	14.93	9	5	8.00	2.79
2	3	TOP	15.66	9	5	8.00	2.79
3	4	TOP	11.20	12	5	13.50	3.72
4	5	TOP	23.40	42	5	6.00	13.02
3	6	TOP	13.93	12	5	9.00	3.72
4	7	BOT	10.70	4	8	15.50	3.16
4	8	BOT	12.16	4	8	12.50	3.16

10.2.2 Total Strip Steel Disposition

Span	ID	Location	From	Quantity	Size	Length
			ft			ft
CL	1	TOP	4.32	9	5	1.08
1	1	TOP	0.00	9	5	3.92
1	2	TOP	14.93	9	5	3.74
2	2	TOP	0.00	9	5	4.26
2	3	TOP	15.66	9	5	3.92
3	3	TOP	0.00	9	5	4.08
3	4	TOP	11.20	12	5	7.47
3	6	TOP	13.93	12	5	4.74
4	4	TOP	0.00	12	5	6.03
4	5	TOP	23.40	42	5	6.00
4	6	TOP	0.00	12	5	4.26
4	7	BOT	10.70	4	8	15.50
4	8	BOT	12.16	4	8	12.50

10.3 Base Reinforcement
10.3.1 Isolated bars
10.3.2 Mesh Reinforcement

13 - PUNCHING SHEAR REINFORCEMENT

13.1 Critical Section Geometry

Column	Layer	Cond.	a	d	b1	b2
			in	in	in	in
1	1	1	8.19	16.38	52.37	40.37
2	1	1	8.19	16.38	52.37	40.37
3	1	1	8.19	16.38	52.37	40.37
4	1	1	8.19	16.38	52.37	40.37
5	2	2	8.19	16.38	56.19	375.37

13.2 Critical Section Stresses

Label	Layer	Cond.	Factored shear	Factored moment	Stress due to shear	Stress due to moment	Total stress	Allowable stress	Stress ratio
			k	k-ft	ksi	ksi	ksi	ksi	
1	1	1	-179.44	+0.02	0.06	0.000	0.059	0.127	0.464
2	1	1	-330.18	+0.00	0.11	0.000	0.109	0.127	0.854

3	1	1	-266.23	+0.00	0.09	0.000	0.088	0.127	0.688
4	1	1	-417.42	+0.00	0.14	0.000	0.137	0.127	1.079
5	2	2	-181.41	-0.03	0.02	0.006	0.028	0.134	0.210

13.3 Punching Shear Reinforcement
Reinforcement option: Shear Studs
Stud diameter: 0.38
Number of rails per side: 2

Col.	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist
	in	in	in	in	in	in	in	in	in	in
1										
2										
3										
4	4.1	8.2								
5										

Dist. = Distance measured from the face of support
Note: Columns with --- have not been checked for punching shear.
Note: Columns with *** have exceeded the maximum allowable shear stress.

14 - DEFLECTIONS

14.1 Maximum Span Deflections

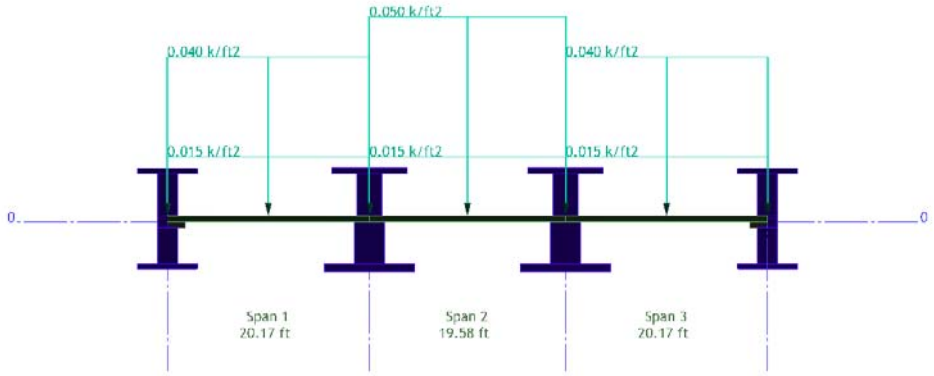
Span	SW	SW+PT	SW+PT+SDL	SW+PT+SDL +Creep	LL	X	Total
	in	in	in	in	in	in	in
CL	-0.01	-0.23	-0.22	-0.67(96)	0.04(1659)	0.00(****)	-0.63(102)
1	0.01	0.21	0.21	0.62(360)	-0.06(3672)	0.00(****)	0.56(399)
2	0.03	0.23	0.23	0.68(347)	-0.06(3679)	0.00(****)	0.61(383)
3	-0.05	0.19	0.17	0.51(436)	-0.16(1443)	0.00(****)	0.37(605)
4	0.25	-0.19	0.17	0.50(701)	0.26(1369)	0.00(****)	0.60(583)

16 - Unbalanced Moment Reinforcement

16.1 Unbalanced Moment Reinforcement - No Redistribution

Joint	Gamma Left	Gamma Right	Width Left	Width Right	Moment Left Neg	Moment Left Pos	Moment Right Neg	Moment Right Pos	As Top	As Bot	n Bar Top	n Bar Bot
			ft	ft	k-ft	k-ft	k-ft	k-ft	in2	in2		
1	0.57	0.57	8.00	8.00	-50.40	0.00	-53.59	48.31	0.00	0.00	0	0
2	0.57	0.57	8.00	8.00	0.00	0.00	-2.83	38.50	0.00	0.00	0	0
3	0.58	0.58	11.00	11.00	-72.95	0.00	-19.42	166.75	0.00	0.00	0	0
4	0.61	0.61	14.50	14.50	-42.58	0.00	-11.34	0.00	0.00	0.00	0	0
5	0.61	0.00	14.50	0.00	0.00	102.69	0.00	0.00	0.00	0.00	0	0

15 tendons per span



Wednesday, March 24, 2010

A. Design Parameters and Load Combinations

A.1 Project Design Parameters

Parameter	Value	Parameter	Value
Concrete		Minimum Cover at BOTTOM	1.00 in
F'c for BEAMS/SLABS	5000.00 psi	Post-tensioning	
For COLUMNS/WALLS	4000.00 psi	SYSTEM	UNBONDED
Ec for BEAMS/SLABS	4031.00 ksi	Fpu	270.00 ksi
For COLUMNS/WALLS	3605.00 ksi	Fse	175.00 ksi
CREEP factor	2.00	Strand area	0.153 in 2
CONCRETE WEIGHT	NORMAL	Min CGS from TOP	1.00 in
UNIT WEIGHT	150.00 pcf	Min CGS from BOT for interior spans	1.00 in
Tension stress limits / (f'c)1/2		Min CGS from BOT for exterior spans	1.75 in
At Top	6.000	Min average precompression	125.00 psi
At Bottom	6.000	Max spacing / slab depth	8.00
Compression stress limits / f'c		Analysis and design options	
At all locations	0.450	Structural system	TWO-WAY
Reinforcement		Moment of Inertia over support is	NOT INCREASED
Fy (Main bars)	60.00 ksi	Moments reduced to face of support	YES
Fy (Shear reinforcement)	60.00 ksi	Moment Redistribution	NO
Minimum Cover at TOP	1.00 in	DESIGN CODE SELECTED	ACI-318 (2005)

A.2 Load Combinations

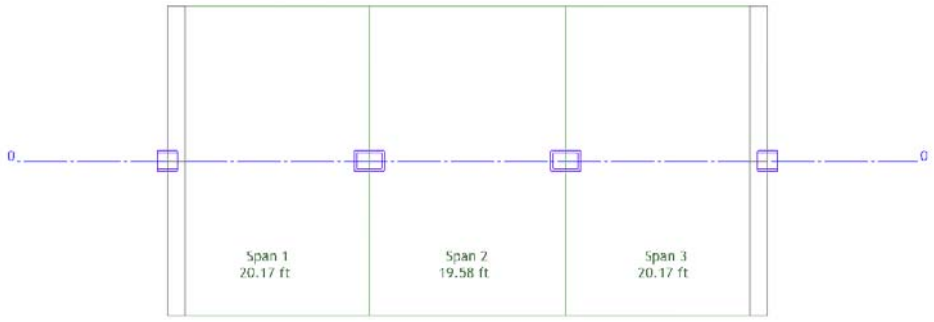
Strength load combinations
1. 1.2 SW + 1.6 LL + 1.2 SDL + 1.6 X + 1 HYP

Service load combinations
Sustained Load
1. 1 SW + 0.3 LL + 1 SDL + 0.3 X + 1 PT
Total Load
3. 1 SW + 1 LL + 1 SDL + 1 X + 1 PT

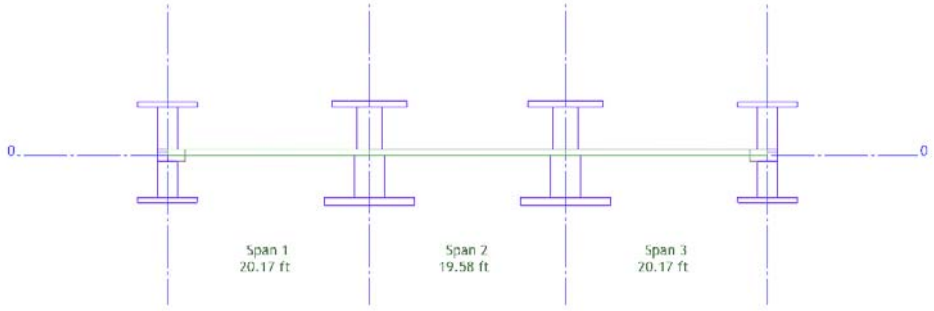
Initial load combinations
1 SW + 0 LL + 0 SDL + 0 X + 1.15 PT

B. Design Strip Report:
B.1 Geometry

- Plan

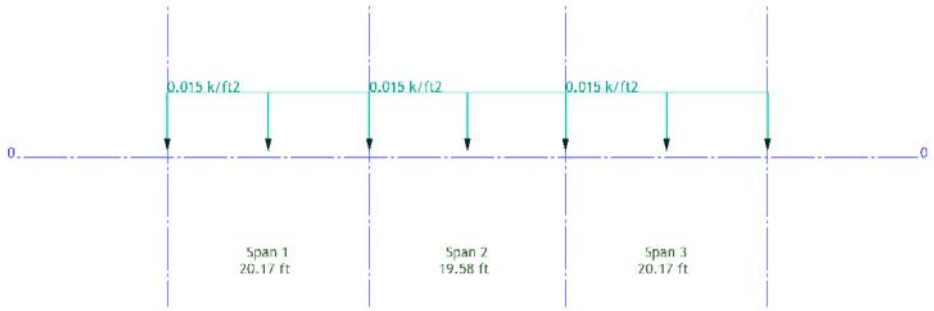


- Elevation

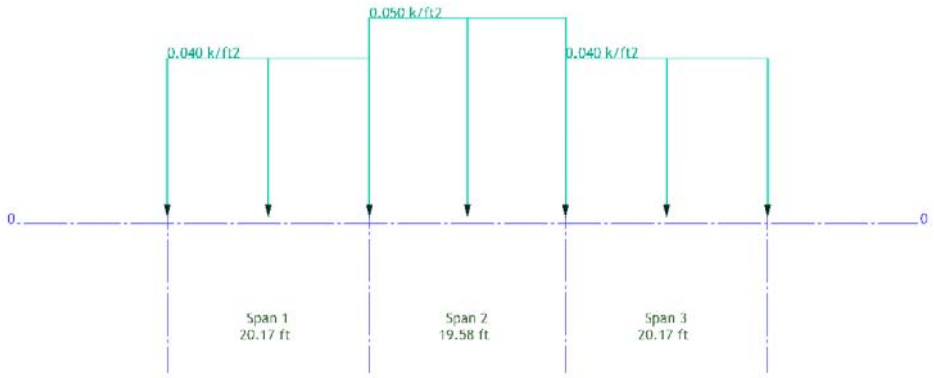


B.2 Applied loads

- Superimposed Dead Load

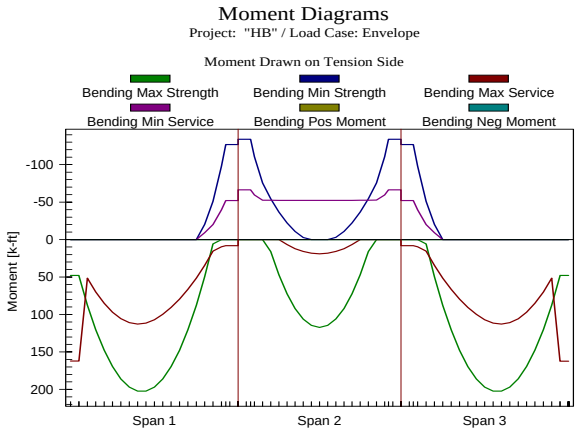


- Live Load



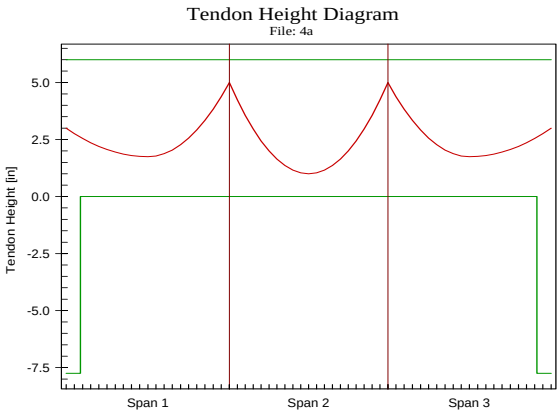
B.3 Design Moment

LOAD COMBINATION: Envelope



DESIGN MOMENT
(Moment is drawn on tension side)

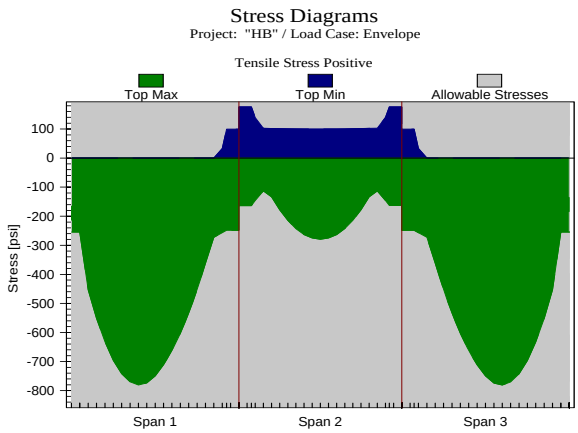
B.4 Tendon Profile

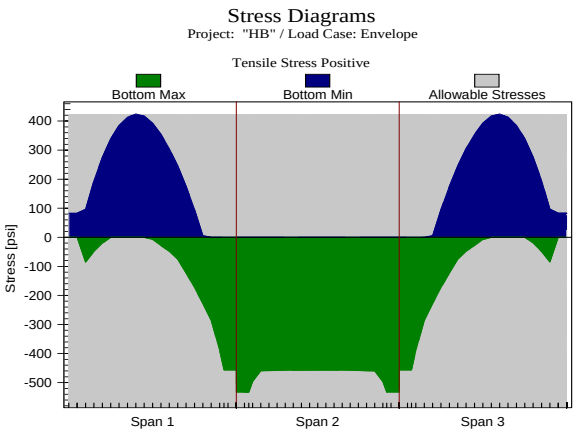


POST-TENSIONING
PROFILE

B.5 Stress check results / Code check

LOAD COMBINATION: Envelope





SERVICE COMBINATION STRESSES
(Tension stress positive)

B.6 Rebar Report

Base Reinforcement
Isolated bars
Mesh Reinforcement

Total Strip Provided Rebar

Span	ID	Location	From	Quantity	Size	Length	Area
			ft			ft	in2
1	1	TOP	0.00	13	5	4.00	4.03
1	2	TOP	16.14	6	5	8.00	1.86
2	3	TOP	15.66	6	5	8.00	1.86
3	4	TOP	16.14	13	5	4.00	4.03
1	5	BOT	1.02	4	8	14.50	3.16
3	6	BOT	5.05	4	8	14.50	3.16
1	7	BOT	5.05	4	8	9.50	3.16
3	8	BOT	6.06	4	8	9.50	3.16

B.7 Punching Shear

Critical Section Stresses

Label	Layer	Cond.	Factored shear	Factored moment	Stress due to shear	Stress due to moment	Total stress	Allowable stress	Stress ratio
			k	k-ft	ksi	ksi	ksi	ksi	
1	1	2	-51.90	-0.01	0.04	0.013	0.057	0.212	0.270
2	1	1	-124.99	+0.00	0.21	0.000	0.208	0.187	1.110
3	1	1	-125.00	-0.00	0.21	0.000	0.208	0.187	1.110
4	1	2	-51.89	+0.01	0.04	0.013	0.057	0.212	0.270

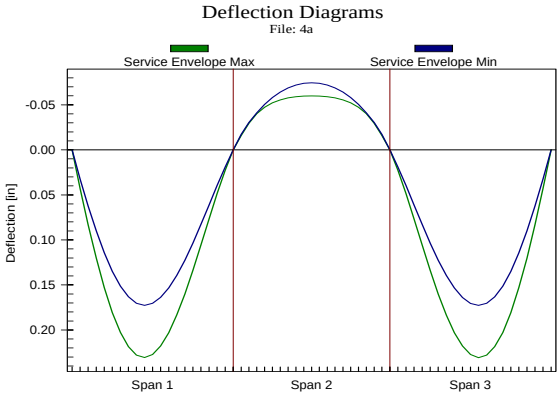
Punching Shear Reinforcement
Reinforcement option: Shear Studs
Stud diameter: 0.38
Number of rails per side: 2

Col.	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist
	in	in	in	in	in	in	in	in	in	in
1										

2	2.2	4.4	6.6	8.8	10.9	13.1	15.3	17.5		
3	2.2	4.4	6.6	8.8	10.9	13.1	15.3	17.5		
4										

Dist. = Distance measured from the face of support
Note: Columns with --- have not been checked for punching shear.
Note: Columns with *** have exceeded the maximum allowable shear stress.

B.8 Deflection



DEFLECTION

B.9 Quantities

CONCRETE
34.31 yd3

MILD STEEL
683.58 lbs

PRESTRESSING MATERIAL
462.0 lb

1 - USER SPECIFIED GENERAL ANALYSIS AND DESIGN PARAMETERS

Parameter	Value	Parameter	Value
Concrete		Minimum Cover at BOTTOM	1.00 in
F'c for BEAMS/SLABS	5000.00 psi	Post-tensioning	
For COLUMNS/WALLS	4000.00 psi	SYSTEM	UNBONDED
Ec for BEAMS/SLABS	4031.00 ksi	Fpu	270.00 ksi
For COLUMNS/WALLS	3605.00 ksi	Fse	175.00 ksi
CREEP factor	2.00	Strand area	0.153 in 2
CONCRETE WEIGHT	NORMAL	Min CGS from TOP	1.00 in
UNIT WEIGHT	150.00 pcf	Min CGS from BOT for interior spans	1.00 in
Tension stress limits / (f'c)1/2		Min CGS from BOT for exterior spans	1.75 in
At Top	6.000	Min average precompression	125.00 psi
At Bottom	6.000	Max spacing / slab depth	8.00
Compression stress limits / f'c		Analysis and design options	
At all locations	0.450	Structural system	TWO-WAY
Reinforcement		Moment of Inertia over support is	NOT INCREASED

Fy (Main bars)	60.00 ksi	Moments reduced to face of support	YES
Fy (Shear reinforcement)	60.00 ksi	Moment Redistribution	NO
Minimum Cover at TOP	1.00 in	DESIGN CODE SELECTED	ACI-318 (2005)

2 - INPUT GEOMETRY

2.1 Principal Span Data of Uniform Spans

Span	Form	Length	Width	Depth	TF Width	TF Thick.	BF/MF Width	BF/MF Thick.	Rh	Right Mult.	Left Mult.
		ft	in	in	in	in	in	in	in		
1	1	20.17	371.00	6.00					6.00	0.50	0.50
2	1	19.58	371.00	6.00					6.00	0.50	0.50
3	1	20.17	371.00	6.00					6.00	0.50	0.50

2.5 Drop Cap and Drop Panel Data

Joint	Cap T	Cap B	Cap DL	Cap DR	Drop TL	Drop TR	Drop B	Drop L	Drop R
	in	in	in	in	in	in	in	in	in
1	13.75	371.00	0.00	21.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	13.75	371.00	21.00	0.00	0.00	0.00	0.00	0.00	0.00

2.7 Support Width and Column Data

Joint	Support Width	Length LC	B(DIA.) LC	D LC	% LC	CBC LC	Length UC	B(DIA.) UC	D UC	% UC	CBC UC
	in	ft	in	in			ft	in	in		
1	24.0	4.5	24.0	24.0	100	(2)	4.5	18.0	24.0	100	(2)
2	36.0	4.5	24.0	36.0	100	(2)	4.5	18.0	30.0	100	(2)
3	36.0	4.5	24.0	36.0	100	(2)	4.5	18.0	30.0	100	(2)
4	24.0	4.5	24.0	24.0	100	(2)	4.5	18.0	24.0	100	(2)

3 - INPUT APPLIED LOADING

3.1 Loading As Appears in User's Input Screen

Span	Class	Type	W	P1	P2	A	B	C	F	M
			k/ft2	k/ft	k/ft	ft	ft	ft	k	k-ft
1	LL	U	0.040							
1	SDL	U	0.015							
2	LL	U	0.050							
2	SDL	U	0.015							
3	LL	U	0.040							
3	SDL	U	0.015							

NOTE: SELFWEIGHT INCLUSION REQUIRED (SW= SELF WEIGHT Computed from geometry input and treated as dead loading. Unit selfweight W = 150.0 pcf
NOTE: LIVE LOADING is SKIPPED with a skip factor of 1.00

3.2 Compiled loads

Span	Class	Type	P1	P2	F	M	A	B	C	Reduction Factor
			k/ft	k/ft	k	k-ft	ft	ft	ft	%
1	LL	P	1.237				0.000	20.170		0.000
1	SDL	P	0.464				0.000	20.170		
1	SW	P	5.314				0.000	1.750		
1	SW	P	2.319				1.750	20.170		

2	LL	P	1.546				0.000	19.580		0.000
2	SDL	P	0.464				0.000	19.580		
2	SW	P	2.319				0.000	19.580		
3	LL	P	1.237				0.000	20.170		0.000
3	SDL	P	0.464				0.000	20.170		
3	SW	P	2.319				0.000	18.420		
3	SW	P	5.314				18.420	20.170		

4 - CALCULATED SECTION PROPERTIES

4.2 Section Properties for Non-Uniform Spans

Span	Segment	Area	I	Yb	Yt
		in2	in4	in	in
1	1	5101.25	0.80E+05	6.88	6.88
1	2	2226.00	0.67E+04	3.00	3.00
2	1	2226.00	0.67E+04	3.00	3.00
3	1	2226.00	0.67E+04	3.00	3.00
3	2	5101.25	0.80E+05	6.88	6.88

5 - MOMENTS, SHEARS AND REACTIONS

5.1 Span Moments and Shears (Excluding Live Load)

Span	Load Case	Moment Left	Moment Midspan	Moment Right	Shear Left	Shear Right
		k-ft	k-ft	k-ft	k	k
1	SW	0.00	73.84	-92.74	-23.80	28.21
2	SW	-92.74	18.38	-92.74	-22.70	22.70
3	SW	-92.74	73.84	0.00	-28.21	23.80
1	SDL	0.00	14.40	-18.36	-3.77	5.59
2	SDL	-18.36	3.86	-18.36	-4.54	4.54
3	SDL	-18.36	14.40	0.00	-5.59	3.77
1	XL	0.00	0.00	0.00	0.00	0.00
2	XL	0.00	0.00	0.00	0.00	0.00
3	XL	0.00	0.00	0.00	0.00	0.00

5.2 Reactions and Column Moments (Excluding Live Load)

Joint	Load Case	Reaction	Moment Lower Column	Moment Upper Column
		k	k-ft	k-ft
1	SW	23.80	0.00	0.00
2	SW	50.91	0.00	0.00
3	SW	50.91	0.00	0.00
4	SW	23.80	0.00	0.00
1	SDL	3.77	0.00	0.00
2	SDL	10.13	0.00	0.00
3	SDL	10.13	0.00	0.00
4	SDL	3.77	0.00	0.00
1	XL	0.00	0.00	0.00
2	XL	0.00	0.00	0.00
3	XL	0.00	0.00	0.00
4	XL	0.00	0.00	0.00

5.3 Span Moments and Shears (Live Load)

Span	Moment Left Max	Moment Left Min	Moment Midspan Max	Moment Midspan Min	Moment Right Max	Moment Right Min	Shear Left	Shear Right

	k-ft	k-ft	k-ft	k-ft	k-ft	k-ft	k	k
1	0.00	0.00	50.11	-14.63	-63.18	-20.91	-11.20	15.60
2	-63.18	-20.91	44.81	-25.56	-63.18	-20.91	-17.29	17.29
3	-63.18	-20.91	50.11	-14.63	0.00	0.00	-15.60	11.20

5.4 Reactions and Column Moments (Live Load)

Joint	Reaction Max	Reaction Min	Moment Lower Column Max	Moment Lower Column Min	Moment Upper Column Max	Moment Upper Column Min
	k	k	k-ft	k-ft	k-ft	k-ft
1	11.20	-1.45	0.00	0.00	0.00	0.00
2	32.90	13.74	0.00	0.00	0.00	0.00
3	32.90	13.74	0.00	0.00	0.00	0.00
4	11.20	-1.45	0.00	0.00	0.00	0.00

6 - MOMENTS REDUCED TO FACE OF SUPPORT

6.1 Reduced Moments at Face of Support (Excluding Live Load)

Span	Load Case	Moment Left	Moment Midspan	Moment Right
		k-ft	k-ft	k-ft
1	SW	21.14	73.84	-53.03
2	SW	-61.30	18.38	-61.30
3	SW	-53.03	73.84	21.14
1	SDL	3.53	14.40	-10.51
2	SDL	-12.07	3.86	-12.07
3	SDL	-10.51	14.40	3.53
1	XL	0.00	0.00	0.00
2	XL	0.00	0.00	0.00
3	XL	0.00	0.00	0.00

6.2 Reduced Moments at Face of Support (Live Load)

Span	Moment Left Max	Moment Left Min	Moment Midspan Max	Moment Midspan Min	Moment Right Max	Moment Right Min
	k-ft	k-ft	k-ft	k-ft	k-ft	k-ft
1	-1.45	10.59	50.11	-14.63	-41.17	-6.34
2	-38.98	-3.19	44.81	-25.56	-38.98	-3.19
3	-41.17	-6.34	50.11	-14.63	-1.45	10.59

7 - SELECTED POST-TENSIONING FORCES AND TENDON PROFILES

7.1 Tendon Profile
Tendon A

Span	Type	X1/L	X2/L	X3/L	A/L
1	1	0.000	0.500	0.000	---
2	1	0.000	0.500	0.000	---
3	1	0.000	0.500	0.000	---

7.2 Selected Post-Tensioning Forces and Tendon Drape
Tendon A

Span	Force	CGS Left	CGS C1	CGS C2	CGS Right	P/A	Wbal	WBal (%DL)
	k	in	in	in	in	psi	k/-	
1	397.010	3.00	---	1.75	5.00	178.35	1.464	48
2	397.010	5.00	---	1.00	5.00	178.35	2.761	99
3	397.010	5.00	---	1.75	3.00	178.35	1.464	48

Approximate weight of strand: 462.0 LB

7.4 Required Minimum Post-Tensioning Forces

	Based on Stress Conditions			Based on Minimum P/A		
Type	Left	Center	Right	Left	Center	Right
	k	k	k	k	k	k
1	0.00	361.53	119.80	637.66	278.25	278.25
2	167.71	0.00	167.83	278.25	278.25	278.25
3	119.78	361.70	0.00	278.25	278.25	637.66

7.5 Service Stresses (tension shown positive)

Envelope of Service 1

Span	Left Top Max-T	Left Top Max-C	Left Bot Max-T	Left Bot Max-C	Center Top Max-T	Center Top Max-C	Cetner Bot Max-T	Cetner Bot Max-C	Right Top Max-T	Right Top Max-C	Right Bot Max-T	Right Bot Max-C
	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi
1	-----	-230.93	75.28	-----	-----	-560.32	203.62	-----	-----	-111.84	-----	-301.19
2	29.09	-28.80	-----	-385.79	3.70	-110.11	-----	-360.40	29.37	-28.51	-----	-386.08
3	-----	-111.90	-----	-301.12	-----	-560.48	203.78	-----	-----	-230.99	75.34	-----

Envelope of Service 2

Span	Left Top Max-T	Left Top Max-C	Left Bot Max-T	Left Bot Max-C	Center Top Max-T	Center Top Max-C	Cetner Bot Max-T	Cetner Bot Max-C	Right Top Max-T	Right Top Max-C	Right Bot Max-T	Right Bot Max-C
	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi
1	-----	-238.54	82.89	-----	-----	-749.42	392.72	-----	99.83	-87.91	-----	-456.53
2	176.19	-16.77	-----	-532.90	100.15	-279.21	-----	-456.85	176.48	-16.48	-----	-533.18
3	99.77	-87.98	-----	-456.47	-----	-749.58	392.88	-----	-----	-238.60	82.95	-----

7.6 Post-Tensioning Balance Moments, Shears and Reactions

Span Moments and Shears

Span	Moment Left	Moment Center	Moment Right	Shear Left	Shear Right
	k-ft	k-ft	k-ft	k	k
1	121.33	-32.42	53.11	-0.89	-0.89
2	46.59	-48.34	46.53	0.00	0.00
3	53.12	-32.39	121.33	0.88	0.88

Reactions and Column Moments

Joint	Reaction	Moment Lower Column	Moment Upper Column
	k	k-ft	k-ft
1	0.886	0.000	0.000
2	-0.888	0.000	0.000
3	-0.881	0.000	0.000
4	0.883	0.000	0.000

Note: Moments are reported at face of support

8 - FACTORED MOMENTS AND REACTIONS ENVELOPE

8.1 Factored Design Moments (Not Redistributed)

Span	Left Max	Left Min	Middle Max	Middle Min	Right Max	Right Min
	k-ft	k-ft	k-ft	k-ft	k-ft	k-ft
1	28.18	47.44	195.00	91.41	-125.58	-69.85
2	-132.56	-75.29	116.22	3.63	-132.62	-75.34
3	-125.63	-69.91	194.96	91.38	28.17	47.44

8.2 Reactions and Column Moments

Joint	Reaction Max	Reaction Min	Moment Lower Column Max	Moment Lower Column Min	Moment Upper Column Max	Moment Upper Column Min
	k	k	k-ft	k-ft	k-ft	k-ft
1	51.89	31.64	0.00	0.00	0.00	0.00
2	125.00	94.34	0.00	0.00	0.00	0.00
3	125.01	94.35	0.00	0.00	0.00	0.00
4	51.88	31.64	0.00	0.00	0.00	0.00

8.3 Secondary Moments

Span	Left	Midspan	Right
	k-ft	k-ft	k-ft
1	0.89	8.93	16.54
2	17.87	17.84	17.81
3	16.48	8.90	0.88

Note: Moments are reported at face of support

10 - MILD STEEL - NO REDISTRIBUTION

10.1 Required Rebar

10.1.1 Total Strip Required Rebar

Span	Location	From	To	As Required	Ultimate	Minimum
		ft	ft	in2	in2	in2
1	TOP	0.00	3.03	3.83	0.00	3.83
1	TOP	17.15	20.17	1.67	0.00	1.67
2	TOP	0.00	2.94	1.67	0.43	1.67
2	TOP	16.64	19.58	1.67	0.43	1.67
3	TOP	0.00	3.03	1.67	0.00	1.67
3	TOP	17.15	20.17	3.83	0.00	3.83
1	BOT	3.03	13.11	5.54	3.54	5.54
3	BOT	7.06	17.15	5.54	3.54	5.54

10.2 Provided Rebar

10.2.1 Total Strip Provided Rebar

Span	ID	Location	From	Quantity	Size	Length	Area
			ft			ft	in2
1	1	TOP	0.00	13	5	4.00	4.03
1	2	TOP	16.14	6	5	8.00	1.86
2	3	TOP	15.66	6	5	8.00	1.86
3	4	TOP	16.14	13	5	4.00	4.03
1	5	BOT	1.02	4	8	14.50	3.16
3	6	BOT	5.05	4	8	14.50	3.16
1	7	BOT	5.05	4	8	9.50	3.16
3	8	BOT	6.06	4	8	9.50	3.16

10.2.2 Total Strip Steel Disposition

Span	ID	Location	From	Quantity	Size	Length
			ft			ft
1	1	TOP	0.00	13	5	4.00
1	2	TOP	16.14	6	5	4.03
2	2	TOP	0.00	6	5	3.97
2	3	TOP	15.66	6	5	3.92
3	3	TOP	0.00	6	5	4.08
3	4	TOP	16.14	13	5	4.00
1	5	BOT	1.02	4	8	14.50

1	7	BOT	5.05	4	8	9.50
3	6	BOT	5.05	4	8	14.50
3	8	BOT	6.06	4	8	9.50

10.3 Base Reinforcement
10.3.1 Isolated bars
10.3.2 Mesh Reinforcement

13 - PUNCHING SHEAR REINFORCEMENT

13.1 Critical Section Geometry

Column	Layer	Cond.	a	d	b1	b2
			in	in	in	in
1	1	2	6.06	12.13	30.06	36.13
2	1	1	2.19	4.38	40.37	28.38
3	1	1	2.19	4.38	40.37	28.38
4	1	2	6.06	12.13	30.06	36.13

13.2 Critical Section Stresses

Label	Layer	Cond.	Factored shear	Factored moment	Stress due to shear	Stress due to moment	Total stress	Allowable stress	Stress ratio
			k	k-ft	ksi	ksi	ksi	ksi	
1	1	2	-51.90	-0.01	0.04	0.013	0.057	0.212	0.270
2	1	1	-124.99	+0.00	0.21	0.000	0.208	0.187	1.110
3	1	1	-125.00	-0.00	0.21	0.000	0.208	0.187	1.110
4	1	2	-51.89	+0.01	0.04	0.013	0.057	0.212	0.270

13.3 Punching Shear Reinforcement

Reinforcement option: Shear Studs
Stud diameter: 0.38
Number of rails per side: 2

Col.	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist
	in	in	in	in	in	in	in	in	in	in
1										
2	2.2	4.4	6.6	8.8	10.9	13.1	15.3	17.5		
3	2.2	4.4	6.6	8.8	10.9	13.1	15.3	17.5		
4										

Dist. = Distance measured from the face of support
Note: Columns with --- have not been checked for punching shear.
Note: Columns with *** have exceeded the maximum allowable shear stress.

14 - DEFLECTIONS

14.1 Maximum Span Deflections

Span	SW	SW+PT	SW+PT+SDL	SW+PT+SDL+Creep	LL	X	Total
	in	in	in	in	in	in	in
1	0.18	0.11	0.15	0.44(546)	0.08(2918)	0.00(****)	0.53(459)
2	-0.01	-0.08	-0.08	-0.24(969)	0.02(11260)	0.00(****)	-0.22(1060)
3	0.18	0.11	0.15	0.44(545)	0.08(2919)	0.00(****)	0.53(459)

15 - FRICTION, ELONGATION AND LONG TERM LOSSES

15.1 Input Parameters

Parameter	Value	Parameter	Value
Long term Lump Loss	0.00 ksi	Ratio of Jacking Stress	0.80

Es of Strand	29000.00 ksi	Anchor Set	0.25 in
Coefficient of Angular Friction (meu)	0.07000 1/rad	Tendon_A Stressing Method	Both sides
Coefficient of Wobble Friction (K)	0.00140 rad/ft		

15.3 Calculated Stresses After Friction and Long-term Losses

Tendon	Span	Stress Left FL Only	Stress Center FL Only	Stress Right FL Only	Stress Left FL+LTL	Stress Center FL+LTL	Stress Right FL+LTL
		ksi	ksi	ksi	ksi	ksi	ksi
TENDON_A	1	24.23	20.91	17.16	24.23	20.91	17.16
TENDON_A	2	17.16	11.78	8.09	17.16	11.78	8.09
TENDON_A	3	8.09	3.03	0.00	8.09	3.03	0.00

15.4 Summary

Tendon	Avg. Initial Stress	LTL	Avg. Final Stress	Avg. Final Force	Elongation Left	Elongation Right	Elongation Total	Left Anchor Set	Right Anchor Set
	ksi	ksi	ksi	k	in	in	in	ft	ft
TENDON_A	11.94	0.00	11.94	1.83	4.80	-4.51	0.30	0.00	59.92

15.5 Critical Stress Ratios

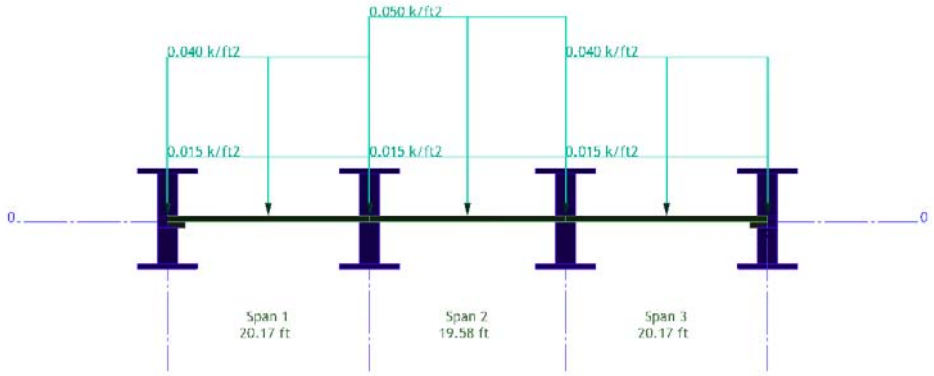
Tendon	Stressing Left	Stressing Right	Anchorage Left	Anchorage Right	Max
TENDON_A	0.09	0.00	0.09	0.00	0.09

16 - Unbalanced Moment Reinforcement

16.1 Unbalanced Moment Reinforcement - No Redistribution

Joint	Gamma Left	Gamma Right	Width Left	Width Right	Moment Left Neg	Moment Left Pos	Moment Right Neg	Moment Right Pos	As Top	As Bot	n Bar Top	n Bar Bot
			ft	ft	k-ft	k-ft	k-ft	k-ft	in2	in2		
1	0.00	0.60	0.00	5.44	0.00	0.00	0.00	47.45	0.00	0.00	0	0
2	0.56	0.56	3.50	3.50	-6.98	0.00	-6.98	0.00	0.00	0.00	0	0
3	0.56	0.60	3.50	5.44	0.00	47.44	0.00	0.00	0.00	0.00	0	0
4	0.60	0.00	5.44	0.00	0.00	28.75	0.00	0.00	0.00	0.00	0	0

13 tendons each span



Wednesday, March 24, 2010

A. Design Parameters and Load Combinations

A.1 Project Design Parameters

Parameter	Value	Parameter	Value
Concrete		Minimum Cover at BOTTOM	1.00 in
F'c for BEAMS/SLABS	5000.00 psi	Post-tensioning	
For COLUMNS/WALLS	4000.00 psi	SYSTEM	UNBONDED
Ec for BEAMS/SLABS	4030.50 ksi	Fpu	270.00 ksi
For COLUMNS/WALLS	3605.00 ksi	Fse	175.00 ksi
CREEP factor	2.00	Strand area	0.153 in 2
CONCRETE WEIGHT	NORMAL	Min CGS from TOP	1.00 in
UNIT WEIGHT	150.00 pcf	Min CGS from BOT for interior spans	1.00 in
Tension stress limits / (f'c)1/2		Min CGS from BOT for exterior spans	1.75 in
At Top	6.000	Min average precompression	125.00 psi
At Bottom	6.000	Max spacing / slab depth	8.00
Compression stress limits / f'c		Analysis and design options	
At all locations	0.450	Structural system	TWO-WAY
Reinforcement		Moment of Inertia over support is	NOT INCREASED
Fy (Main bars)	60.00 ksi	Moments reduced to face of support	YES
Fy (Shear reinforcement)	60.00 ksi	Moment Redistribution	NO
Minimum Cover at TOP	1.00 in	DESIGN CODE SELECTED	ACI-318 (2005)

A.2 Load Combinations

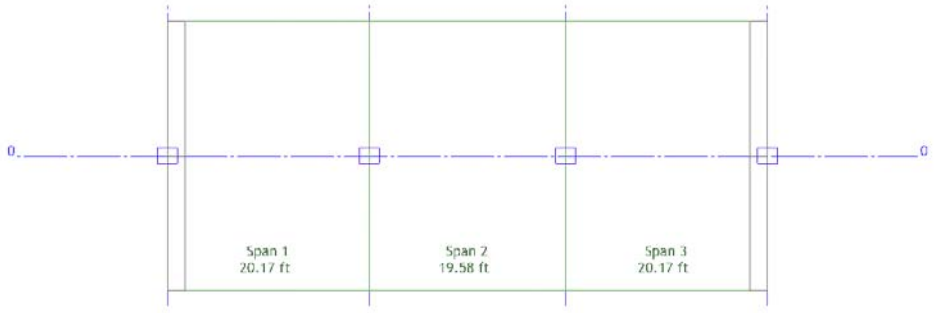
Strength load combinations
1. 1.2 SW + 1.6 LL + 1.2 SDL + 1.6 X + 1 HYP

Service load combinations
Sustained Load
1. 1 SW + 0.3 LL + 1 SDL + 0.3 X + 1 PT
Total Load
3. 1 SW + 1 LL + 1 SDL + 1 X + 1 PT

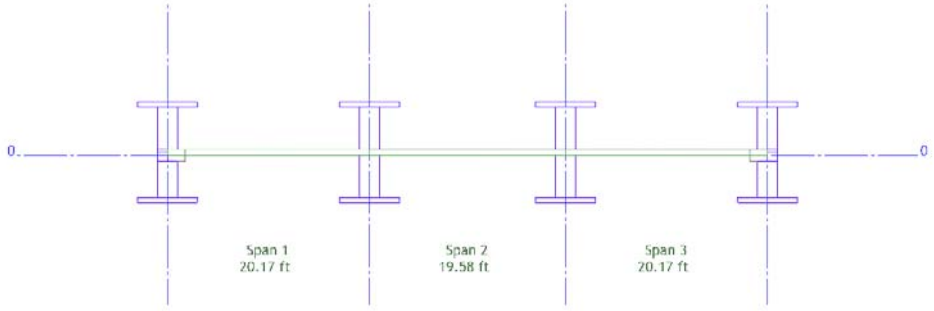
Initial load combinations
1 SW + 0 LL + 0 SDL + 0 X + 1.15 PT

B. Design Strip Report:
B.1 Geometry

- Plan

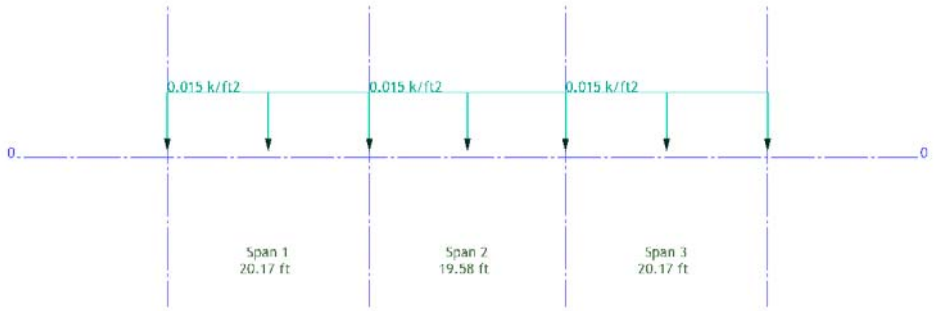


- Elevation

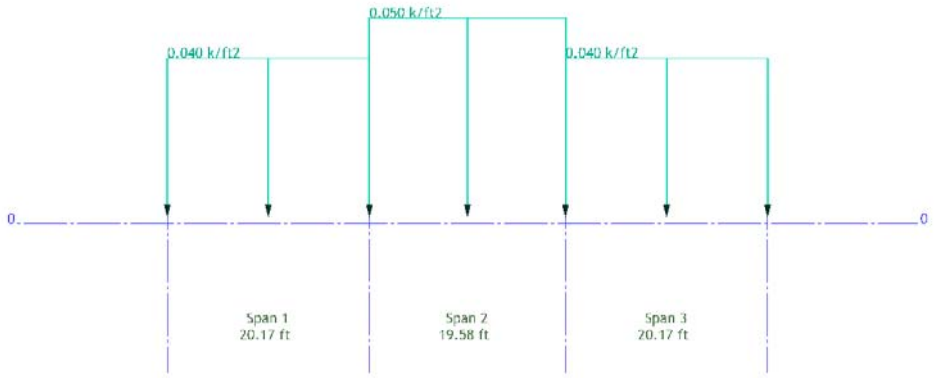


B.2 Applied loads

- Superimposed Dead Load

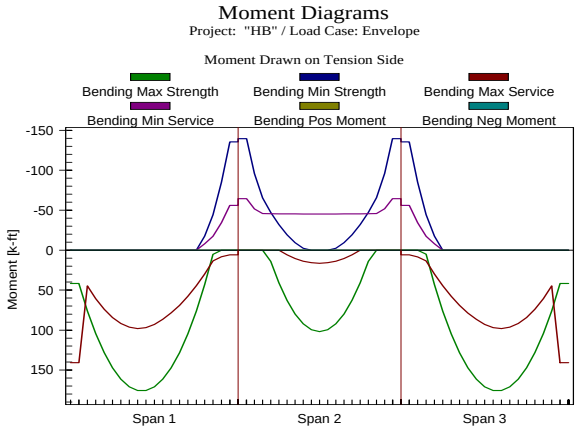


- Live Load



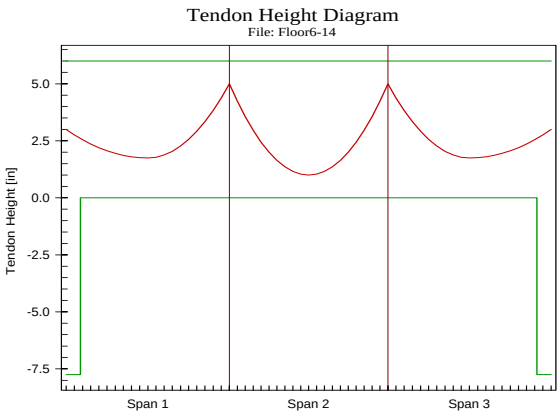
B.3 Design Moment

LOAD COMBINATION: Envelope



DESIGN MOMENT
(Moment is drawn on tension side)

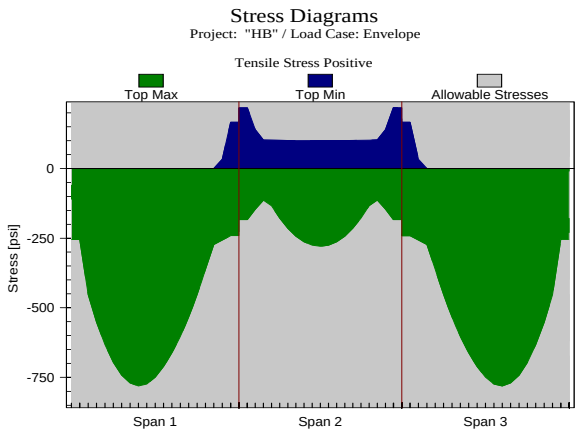
B.4 Tendon Profile

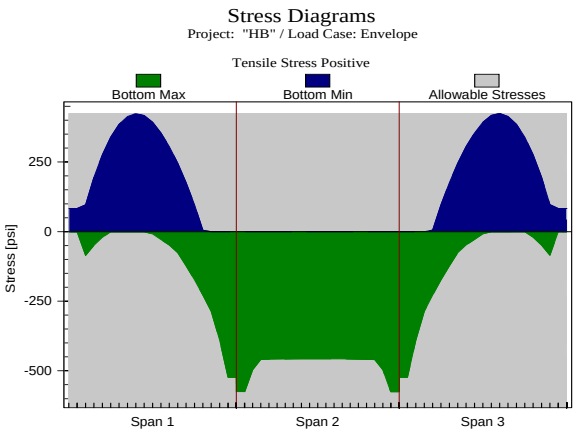


POST-TENSIONING
PROFILE

B.5 Stress check results / Code check

LOAD COMBINATION: Envelope





SERVICE COMBINATION STRESSES
(Tension stress positive)

B.6 Rebar Report

Base Reinforcement
Isolated bars
Mesh Reinforcement

Total Strip Provided Rebar

Span	ID	Location	From	Quantity	Size	Length	Area
			ft			ft	in2
1	1	TOP	0.00	11	5	4.00	3.41
1	2	TOP	16.14	5	5	8.00	1.55
2	3	TOP	15.66	5	5	8.00	1.55
3	4	TOP	16.14	11	5	4.00	3.41
1	5	BOT	1.02	4	8	14.50	3.16
3	6	BOT	5.05	4	8	14.50	3.16
1	7	BOT	5.05	3	8	8.50	2.37
3	8	BOT	7.07	3	8	8.50	2.37

B.7 Punching Shear

Critical Section Stresses

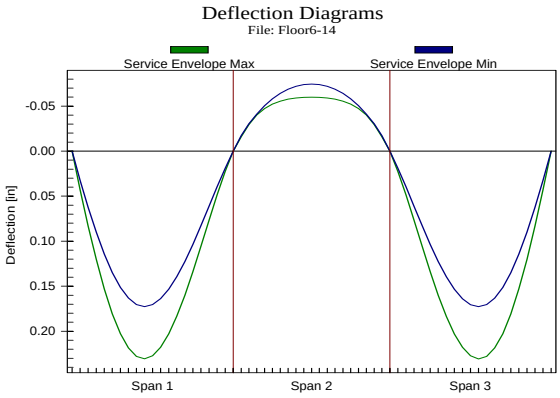
Label	Layer	Cond.	Factored shear	Factored moment	Stress due to shear	Stress due to moment	Total stress	Allowable stress	Stress ratio
			k	k-ft	ksi	ksi	ksi	ksi	
1	1	2	-45.05	-0.00	0.04	0.012	0.053	0.212	0.252
2	1	1	-108.48	+0.00	0.24	0.000	0.244	0.211	1.157
3	1	1	-108.48	+0.00	0.24	0.000	0.244	0.211	1.157
4	1	2	-45.05	+0.00	0.04	0.012	0.053	0.212	0.252

Punching Shear Reinforcement
Reinforcement option: Shear Studs
Stud diameter: 0.38
Number of rails per side: 2

Col.	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist
	in	in	in	in	in	in	in	in	in	in
1										
2	2.2	4.4	6.6	8.8	10.9	13.1	15.3	17.5		
3	2.2	4.4	6.6	8.8	10.9	13.1	15.3	17.5		
4										

Dist. = Distance measured from the face of support
Note: Columns with --- have not been checked for punching shear.
Note: Columns with *** have exceeded the maximum allowable shear stress.

B.8 Deflection



DEFLECTION

B.9 Quantities

CONCRETE
29.78 yd3

MILD STEEL
588.67 lbs

PRESTRESSING MATERIAL
401.0 lb

1 - USER SPECIFIED GENERAL ANALYSIS AND DESIGN PARAMETERS

Parameter	Value	Parameter	Value
Concrete		Minimum Cover at BOTTOM	1.00 in
F'c for BEAMS/SLABS	5000.00 psi	Post-tensioning	
For COLUMNS/WALLS	4000.00 psi	SYSTEM	UNBONDED
Ec for BEAMS/SLABS	4030.50 ksi	Fpu	270.00 ksi
For COLUMNS/WALLS	3605.00 ksi	Fse	175.00 ksi
CREEP factor	2.00	Strand area	0.153 in 2
CONCRETE WEIGHT	NORMAL	Min CGS from TOP	1.00 in

UNIT WEIGHT	150.00 pcf	Min CGS from BOT for interior spans	1.00 in
Tension stress limits / (f'c)1/2		Min CGS from BOT for exterior spans	1.75 in
At Top	6.000	Min average precompression	125.00 psi
At Bottom	6.000	Max spacing / slab depth	8.00
Compression stress limits / f'c		Analysis and design options	
At all locations	0.450	Structural system	TWO-WAY
Reinforcement		Moment of Inertia over support is	NOT INCREASED
Fy (Main bars)	60.00 ksi	Moments reduced to face of support	YES
Fy (Shear reinforcement)	60.00 ksi	Moment Redistribution	NO
Minimum Cover at TOP	1.00 in	DESIGN CODE SELECTED	ACI-318 (2005)

2 - INPUT GEOMETRY

2.1 Principal Span Data of Uniform Spans

Span	Form	Length	Width	Depth	TF Width	TF Thick.	BF/MF Width	BF/MF Thick.	Rh	Right Mult.	Left Mult.
		ft	in	in	in	in	in	in	in		
1	1	20.17	322.00	6.00					6.00	0.50	0.50
2	1	19.58	322.00	6.00					6.00	0.50	0.50
3	1	20.17	322.00	6.00					6.00	0.50	0.50

2.5 Drop Cap and Drop Panel Data

Joint	Cap T	Cap B	Cap DL	Cap DR	Drop TL	Drop TR	Drop B	Drop L	Drop R
	in	in	in	in	in	in	in	in	in
1	13.75	322.00	0.00	21.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	13.75	322.00	21.00	0.00	0.00	0.00	0.00	0.00	0.00

2.7 Support Width and Column Data

Joint	Support Width	Length LC	B(DIA.) LC	D LC	% LC	CBC LC	Length UC	B(DIA.) UC	D UC	% UC	CBC UC
	in	ft	in	in			ft	in	in		
1	24.0	4.5	18.0	24.0	100	(2)	4.5	18.0	24.0	100	(2)
2	24.0	4.5	18.0	24.0	100	(2)	4.5	18.0	24.0	100	(2)
3	24.0	4.5	18.0	24.0	100	(2)	4.5	18.0	24.0	100	(2)
4	24.0	4.5	18.0	24.0	100	(2)	4.5	18.0	24.0	100	(2)

3 - INPUT APPLIED LOADING

3.1 Loading As Appears in User's Input Screen

Span	Class	Type	W	P1	P2	A	B	C	F	M
			k/ft2	k/ft	k/ft	ft	ft	ft	k	k-ft
1	LL	U	0.040							
1	SDL	U	0.015							
2	LL	U	0.050							
2	SDL	U	0.015							
3	LL	U	0.040							
3	SDL	U	0.015							

NOTE: SELFWEIGHT INCLUSION REQUIRED (SW= SELF WEIGHT Computed from geometry input and treated as dead loading. Unit selfweight W = 150.0 pcf
NOTE: LIVE LOADING is SKIPPED with a skip factor of 1.00

3.2 Compiled loads

Span	Class	Type	P1	P2	F	M	A	B	C	Reduction Factor
			k/ft	k/ft	k	k-ft	ft	ft	ft	%
1	LL	P	1.073				0.000	20.170		0.000
1	SDL	P	0.403				0.000	20.170		
1	SW	P	4.612				0.000	1.750		
1	SW	P	2.013				1.750	20.170		
2	LL	P	1.342				0.000	19.580		0.000
2	SDL	P	0.403				0.000	19.580		
2	SW	P	2.013				0.000	19.580		
3	LL	P	1.073				0.000	20.170		0.000
3	SDL	P	0.403				0.000	20.170		
3	SW	P	2.013				0.000	18.420		
3	SW	P	4.612				18.420	20.170		

4 - CALCULATED SECTION PROPERTIES

4.2 Section Properties for Non-Uniform Spans

Span	Segment	Area	I	Yb	Yt
		in2	in4	in	in
1	1	4427.50	0.70E+05	6.88	6.88
1	2	1932.00	0.58E+04	3.00	3.00
2	1	1932.00	0.58E+04	3.00	3.00
3	1	1932.00	0.58E+04	3.00	3.00
3	2	4427.50	0.70E+05	6.88	6.88

5 - MOMENTS, SHEARS AND REACTIONS

5.1 Span Moments and Shears (Excluding Live Load)

Span	Load Case	Moment Left	Moment Midspan	Moment Right	Shear Left	Shear Right
		k-ft	k-ft	k-ft	k	k
1	SW	0.00	64.09	-80.49	-20.66	24.48
2	SW	-80.49	15.95	-80.50	-19.70	19.70
3	SW	-80.49	64.09	0.00	-24.48	20.66
1	SDL	0.00	12.50	-15.94	-3.27	4.85
2	SDL	-15.94	3.35	-15.94	-3.94	3.94
3	SDL	-15.94	12.50	0.00	-4.85	3.27
1	XL	0.00	0.00	0.00	0.00	0.00
2	XL	0.00	0.00	0.00	0.00	0.00
3	XL	0.00	0.00	0.00	0.00	0.00

5.2 Reactions and Column Moments (Excluding Live Load)

Joint	Load Case	Reaction	Moment Lower Column	Moment Upper Column
		k	k-ft	k-ft
1	SW	20.66	0.00	0.00
2	SW	44.19	0.00	0.00
3	SW	44.19	0.00	0.00
4	SW	20.66	0.00	0.00
1	SDL	3.27	0.00	0.00
2	SDL	8.79	0.00	0.00
3	SDL	8.79	0.00	0.00
4	SDL	3.27	0.00	0.00
1	XL	0.00	0.00	0.00
2	XL	0.00	0.00	0.00

3	XL	0.00	0.00	0.00
4	XL	0.00	0.00	0.00

5.3 Span Moments and Shears (Live Load)

Span	Moment Left Max	Moment Left Min	Moment Midspan Max	Moment Midspan Min	Moment Right Max	Moment Right Min	Shear Left	Shear Right
	k-ft	k-ft	k-ft	k-ft	k-ft	k-ft	k	k
1	0.00	0.00	43.49	-12.70	-54.83	-18.15	-9.72	13.54
2	-54.83	-18.15	38.89	-22.18	-54.84	-18.15	-15.01	15.01
3	-54.84	-18.15	43.49	-12.70	0.00	0.00	-13.54	9.72

5.4 Reactions and Column Moments (Live Load)

Joint	Reaction Max	Reaction Min	Moment Lower Column Max	Moment Lower Column Min	Moment Upper Column Max	Moment Upper Column Min
	k	k	k-ft	k-ft	k-ft	k-ft
1	9.72	-1.26	0.00	0.00	0.00	0.00
2	28.55	11.92	0.00	0.00	0.00	0.00
3	28.55	11.92	0.00	0.00	0.00	0.00
4	9.72	-1.26	0.00	0.00	0.00	0.00

6 - MOMENTS REDUCED TO FACE OF SUPPORT

6.1 Reduced Moments at Face of Support (Excluding Live Load)

Span	Load Case	Moment Left	Moment Midspan	Moment Right
		k-ft	k-ft	k-ft
1	SW	18.35	64.09	-57.01
2	SW	-61.79	15.95	-61.80
3	SW	-57.02	64.08	18.35
1	SDL	3.07	12.50	-11.29
2	SDL	-12.20	3.35	-12.20
3	SDL	-11.29	12.50	3.07
1	XL	0.00	0.00	0.00
2	XL	0.00	0.00	0.00
3	XL	0.00	0.00	0.00

6.2 Reduced Moments at Face of Support (Live Load)

Span	Moment Left Max	Moment Left Min	Moment Midspan Max	Moment Midspan Min	Moment Right Max	Moment Right Min
	k-ft	k-ft	k-ft	k-ft	k-ft	k-ft
1	-1.26	9.19	43.49	-12.70	-41.83	-10.79
2	-40.50	-7.56	38.89	-22.18	-40.50	-7.56
3	-41.83	-10.79	43.49	-12.70	-1.26	9.19

7 - SELECTED POST-TENSIONING FORCES AND TENDON PROFILES

7.1 Tendon Profile
Tendon A

Span	Type	X1/L	X2/L	X3/L	A/L
1	1	0.000	0.500	0.000	---
2	1	0.000	0.500	0.000	---
3	1	0.000	0.500	0.000	---

7.2 Selected Post-Tensioning Forces and Tendon Drape
Tendon A

Span	Force	CGS Left	CGS C1	CGS C2	CGS Right	P/A	Wbal	WBal (%DL)
	k	in	in	in	in	psi	k/-	
1	344.581	3.00	---	1.75	5.00	178.35	1.270	48
2	344.581	5.00	---	1.00	5.00	178.35	2.397	99
3	344.581	5.00	---	1.75	3.00	178.35	1.270	48

Approximate weight of strand: 401.0 LB

7.4 Required Minimum Post-Tensioning Forces

	Based on Stress Conditions			Based on Minimum P/A		
Type	Left	Center	Right	Left	Center	Right
	k	k	k	k	k	k
1	0.00	313.81	173.00	553.44	241.50	241.50
2	200.47	0.00	200.62	241.50	241.50	241.50
3	173.03	313.92	0.00	241.50	241.50	553.44

7.5 Service Stresses (tension shown positive)

Envelope of Service 1

Span	Left Top Max-T	Left Top Max-C	Left Bot Max-T	Left Bot Max-C	Center Top Max-T	Center Top Max-C	Cetner Bot Max-T	Cetner Bot Max-C	Right Top Max-T	Right Top Max-C	Right Bot Max-T	Right Bot Max-C
	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi
1	-----	-230.94	75.28	-----	-----	-560.33	203.62	-----	-----	-73.04	-----	-341.50
2	41.95	-19.43	-----	-398.66	3.69	-110.11	-----	-360.40	42.29	-19.09	-----	-399.00
3	-----	-73.09	-----	-341.46	-----	-560.48	203.77	-----	-----	-230.99	75.34	-----

Envelope of Service 2

Span	Left Top Max-T	Left Top Max-C	Left Bot Max-T	Left Bot Max-C	Center Top Max-T	Center Top Max-C	Cetner Bot Max-T	Cetner Bot Max-C	Right Top Max-T	Right Top Max-C	Right Bot Max-T	Right Bot Max-C
	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi
1	-----	-238.55	82.89	-----	-----	-749.43	392.72	-----	166.64	-26.12	-----	-523.35
2	218.04	-----	-----	-574.75	100.14	-279.21	-----	-456.85	218.37	-----	-----	-575.08
3	166.64	-26.17	-----	-523.35	-----	-749.58	392.87	-----	-----	-238.60	82.95	-----

7.6 Post-Tensioning Balance Moments, Shears and Reactions

Span Moments and Shears

Span	Moment Left	Moment Center	Moment Right	Shear Left	Shear Right
	k-ft	k-ft	k-ft	k	k
1	105.25	-28.14	54.58	-0.77	-0.77
2	50.67	-41.96	50.63	0.00	0.00
3	54.60	-28.11	105.33	0.77	0.77

Reactions and Column Moments

Joint	Reaction	Moment Lower Column	Moment Upper Column
	k	k-ft	k-ft
1	0.769	0.000	0.000
2	-0.770	0.000	0.000
3	-0.765	0.000	0.000
4	0.766	0.000	0.000

Note: Moments are reported at face of support

8 - FACTORED MOMENTS AND REACTIONS ENVELOPE

8.1 Factored Design Moments (Not Redistributed)

Span	Left Max	Left Min	Middle Max	Middle Min	Right Max	Right Min

	k-ft	k-ft	k-ft	k-ft	k-ft	k-ft
1	24.46	41.18	169.25	79.35	-134.14	-84.49
2	-138.08	-85.38	100.87	3.15	-138.14	-85.44
3	-134.21	-84.55	169.22	79.31	24.45	41.17

8.2 Reactions and Column Moments

Joint	Reaction Max	Reaction Min	Moment Lower Column Max	Moment Lower Column Min	Moment Upper Column Max	Moment Upper Column Min
	k	k	k-ft	k-ft	k-ft	k-ft
1	45.04	27.47	0.00	0.00	0.00	0.00
2	108.49	81.88	0.00	0.00	0.00	0.00
3	108.49	81.88	0.00	0.00	0.00	0.00
4	45.04	27.47	0.00	0.00	0.00	0.00

8.3 Secondary Moments

Span	Left	Midspan	Right
	k-ft	k-ft	k-ft
1	0.77	7.75	14.74
2	15.51	15.48	15.46
3	14.69	7.73	0.77

Note: Moments are reported at face of support

10 - MILD STEEL - NO REDISTRIBUTION

10.1 Required Rebar

10.1.1 Total Strip Required Rebar

Span	Location	From	To	As Required	Ultimate	Minimum
		ft	ft	in2	in2	in2
1	TOP	0.00	3.03	3.32	0.00	3.32
1	TOP	17.15	20.17	1.45	0.59	1.45
2	TOP	0.00	2.94	1.45	1.07	1.45
2	TOP	16.64	19.58	1.45	1.07	1.45
3	TOP	0.00	3.03	1.45	0.59	1.45
3	TOP	17.15	20.17	3.32	0.00	3.32
1	BOT	3.03	13.11	4.81	3.07	4.81
3	BOT	7.06	17.15	4.81	3.07	4.81

10.2 Provided Rebar

10.2.1 Total Strip Provided Rebar

Span	ID	Location	From	Quantity	Size	Length	Area
			ft			ft	in2
1	1	TOP	0.00	11	5	4.00	3.41
1	2	TOP	16.14	5	5	8.00	1.55
2	3	TOP	15.66	5	5	8.00	1.55
3	4	TOP	16.14	11	5	4.00	3.41
1	5	BOT	1.02	4	8	14.50	3.16
3	6	BOT	5.05	4	8	14.50	3.16
1	7	BOT	5.05	3	8	8.50	2.37
3	8	BOT	7.07	3	8	8.50	2.37

10.2.2 Total Strip Steel Disposition

Span	ID	Location	From	Quantity	Size	Length
			ft			ft
1	1	TOP	0.00	11	5	4.00

1	2	TOP	16.14	5	5	4.03
2	2	TOP	0.00	5	5	3.97
2	3	TOP	15.66	5	5	3.92
3	3	TOP	0.00	5	5	4.08
3	4	TOP	16.14	11	5	4.00
1	5	BOT	1.02	4	8	14.50
1	7	BOT	5.05	3	8	8.50
3	6	BOT	5.05	4	8	14.50
3	8	BOT	7.07	3	8	8.50

10.3 Base Reinforcement
10.3.1 Isolated bars
10.3.2 Mesh Reinforcement

13 - PUNCHING SHEAR REINFORCEMENT

13.1 Critical Section Geometry

Column	Layer	Cond.	a	d	b1	b2
			in	in	in	in
1	1	2	6.06	12.13	30.06	30.12
2	1	1	2.19	4.38	28.38	22.38
3	1	1	2.19	4.38	28.38	22.38
4	1	2	6.06	12.13	30.06	30.12

13.2 Critical Section Stresses

Label	Layer	Cond.	Factored shear	Factored moment	Stress due to shear	Stress due to moment	Total stress	Allowable stress	Stress ratio
			k	k-ft	ksi	ksi	ksi	ksi	
1	1	2	-45.05	-0.00	0.04	0.012	0.053	0.212	0.252
2	1	1	-108.48	+0.00	0.24	0.000	0.244	0.211	1.157
3	1	1	-108.48	+0.00	0.24	0.000	0.244	0.211	1.157
4	1	2	-45.05	+0.00	0.04	0.012	0.053	0.212	0.252

13.3 Punching Shear Reinforcement

Reinforcement option: Shear Studs
Stud diameter: 0.38
Number of rails per side: 2

Col.	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist	Dist
	in	in	in	in	in	in	in	in	in	in
1										
2	2.2	4.4	6.6	8.8	10.9	13.1	15.3	17.5		
3	2.2	4.4	6.6	8.8	10.9	13.1	15.3	17.5		
4										

Dist. = Distance measured from the face of support
Note: Columns with --- have not been checked for punching shear.
Note: Columns with *** have exceeded the maximum allowable shear stress.

14 - DEFLECTIONS

14.1 Maximum Span Deflections

Span	SW	SW+PT	SW+PT+ SDL	SW+PT+SDL +Creep	LL	X	Total
	in	in	in	in	in	in	in
1	0.18	0.11	0.15	0.44(545)	0.08(2919)	0.00(****)	0.53(459)
2	-0.01	-0.08	-0.08	-0.24(969)	0.02(11256)	0.00(****)	-0.22(1060)
3	0.18	0.11	0.15	0.44(545)	0.08(2919)	0.00(****)	0.53(459)

15 - FRICTION, ELONGATION AND LONG TERM LOSSES

15.1 Input Parameters

Parameter	Value	Parameter	Value
Long term Lump Loss	0.00 ksi	Ratio of Jacking Stress	0.80
Es of Strand	29000.00 ksi	Anchor Set	0.25 in
Coefficient of Angular Friction (meu)	0.07000 1/rad	Tendon_A Stressing Method	Both sides
Coefficient of Wobble Friction (K)	0.00140 rad/ft		

15.3 Calculated Stresses After Friction and Long-term Losses

Tendon	Span	Stress Left FL Only	Stress Center FL Only	Stress Right FL Only	Stress Left FL+LTL	Stress Center FL+LTL	Stress Right FL+LTL
		ksi	ksi	ksi	ksi	ksi	ksi
TENDON_A	1	24.23	20.91	17.16	24.23	20.91	17.16
TENDON_A	2	17.16	11.78	8.09	17.16	11.78	8.09
TENDON_A	3	8.09	3.03	0.00	8.09	3.03	0.00

15.4 Summary

Tendon	Avg. Initial Stress	LTL	Avg. Final Stress	Avg. Final Force	Elongation Left	Elongation Right	Elongation Total	Left Anchor Set	Right Anchor Set
	ksi	ksi	ksi	k	in	in	in	ft	ft
TENDON_A	11.94	0.00	11.94	1.83	4.80	-4.51	0.30	0.00	59.92

15.5 Critical Stress Ratios

Tendon	Stressing Left	Stressing Right	Anchorage Left	Anchorage Right	Max
TENDON_A	0.09	0.00	0.09	0.00	0.09

16 - Unbalanced Moment Reinforcement

16.1 Unbalanced Moment Reinforcement - No Redistribution

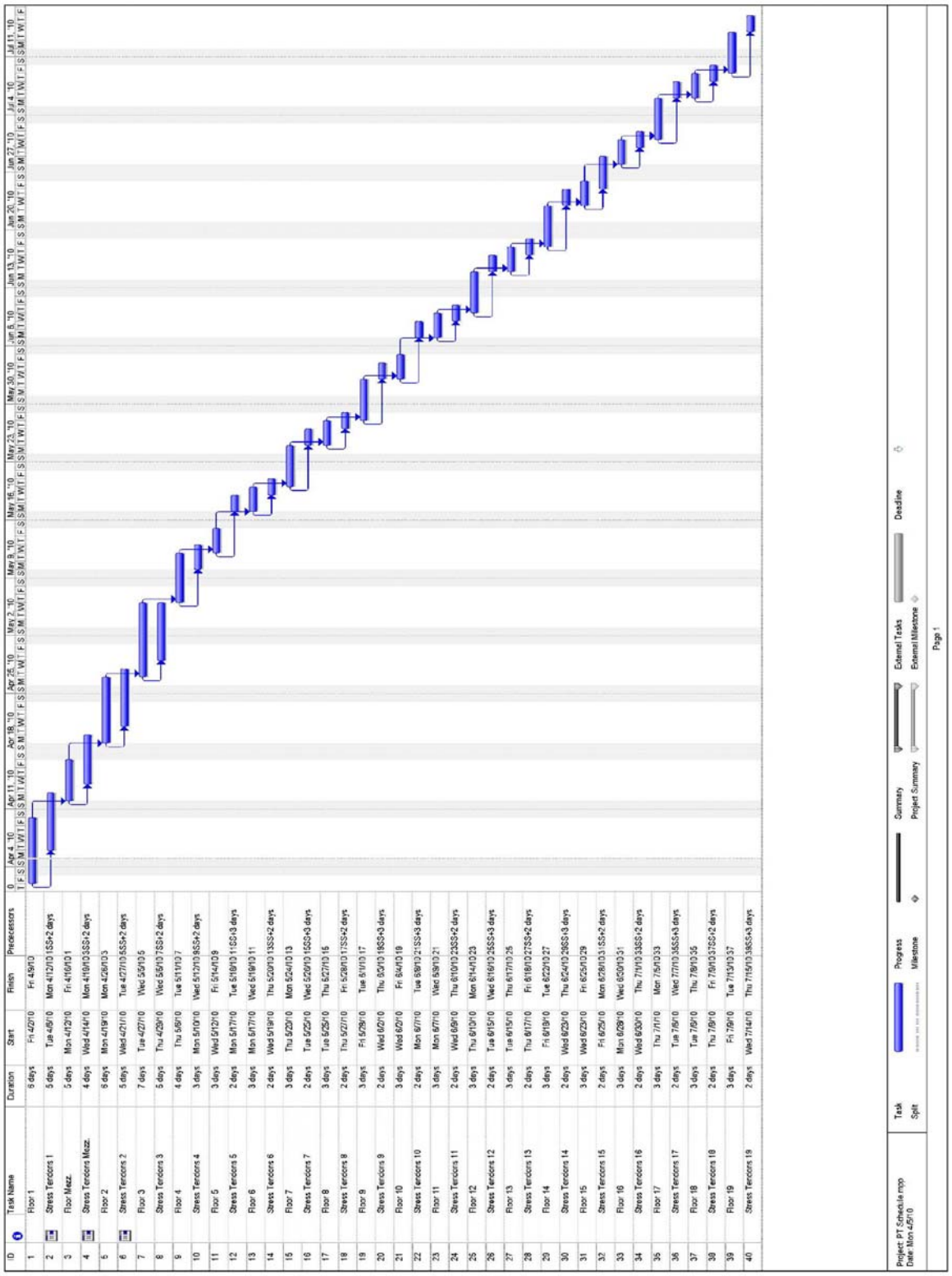
Joint	Gamma Left	Gamma Right	Width Left	Width Right	Moment Left Neg	Moment Left Pos	Moment Right Neg	Moment Right Pos	As Top	As Bot	n Bar Top	n Bar Bot
			ft	ft	k-ft	k-ft	k-ft	k-ft	in2	in2		
1	0.00	0.58	0.00	4.94	0.00	0.00	0.00	41.18	0.00	0.00	0	0
2	0.57	0.57	3.00	3.00	-3.94	0.00	-3.92	0.00	0.00	0.00	0	0
3	0.57	0.58	3.00	4.94	0.00	41.17	0.00	0.00	0.00	0.00	0	0
4	0.58	0.00	4.94	0.00	0.00	24.08	0.00	0.00	0.00	0.00	0	0

Quantity	LineNumber	Source	SubC	Description	Crew	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Total	Ext. Mat.	Ext. Labor	Ext. Equip.	Ext. Total
166500	032305501250			Prestressing steel, ungrouted strand, 50' span, 300 kip, post-tensioned in field	C4	1475	0.022	Lb.	$ 0.63	$ 0.85	$ 0.02	$ 1.50	$ 104,895.00	$ 141,525.00	$ 3,330.00	$ 249,750.00
15957	033105350400			Structural concrete, ready mix, normal weight, 5000 psi, includes local aggregate, sand, Portland cement and water, delivered, excludes all additives and treatments				C.Y.	$ 105.67	$ -	$ -	$ 105.67	$ 1,686,176.19	$ -	$ -	$ 1,686,176.19
1705	033923130800			Concrete surface treatment, curing compound, water based, 250 S.F. per gallon, 55 gallon drum, includes material only				Gal.	$ 17.42	$ -	$ -	$ 17.42	$ 29,701.10	$ -	$ -	$ 29,701.10
15957	033105701500			Structural concrete, placing, elevated slab, pumped, 6" to 10" thick, includes vibrating, excludes material	C20	160	0.4	C.Y.	$ -	$ 10.81	$ 5.18	$ 15.99	$ -	$ 172,495.17	$ 82,657.26	$ 255,152.43
116	032110601150			Reinforcing steel, in place, typical, average, over 100 ton job, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	4 Rodm	2.3	13.913	Ton	$1,538.73	$ 537.54	$ -	$ 2,076.27	$ 178,492.68	$ 62,354.64	$ -	$ 240,847.32
Total													$1999264.97	$376374.81	$85987.26	$2461627.04

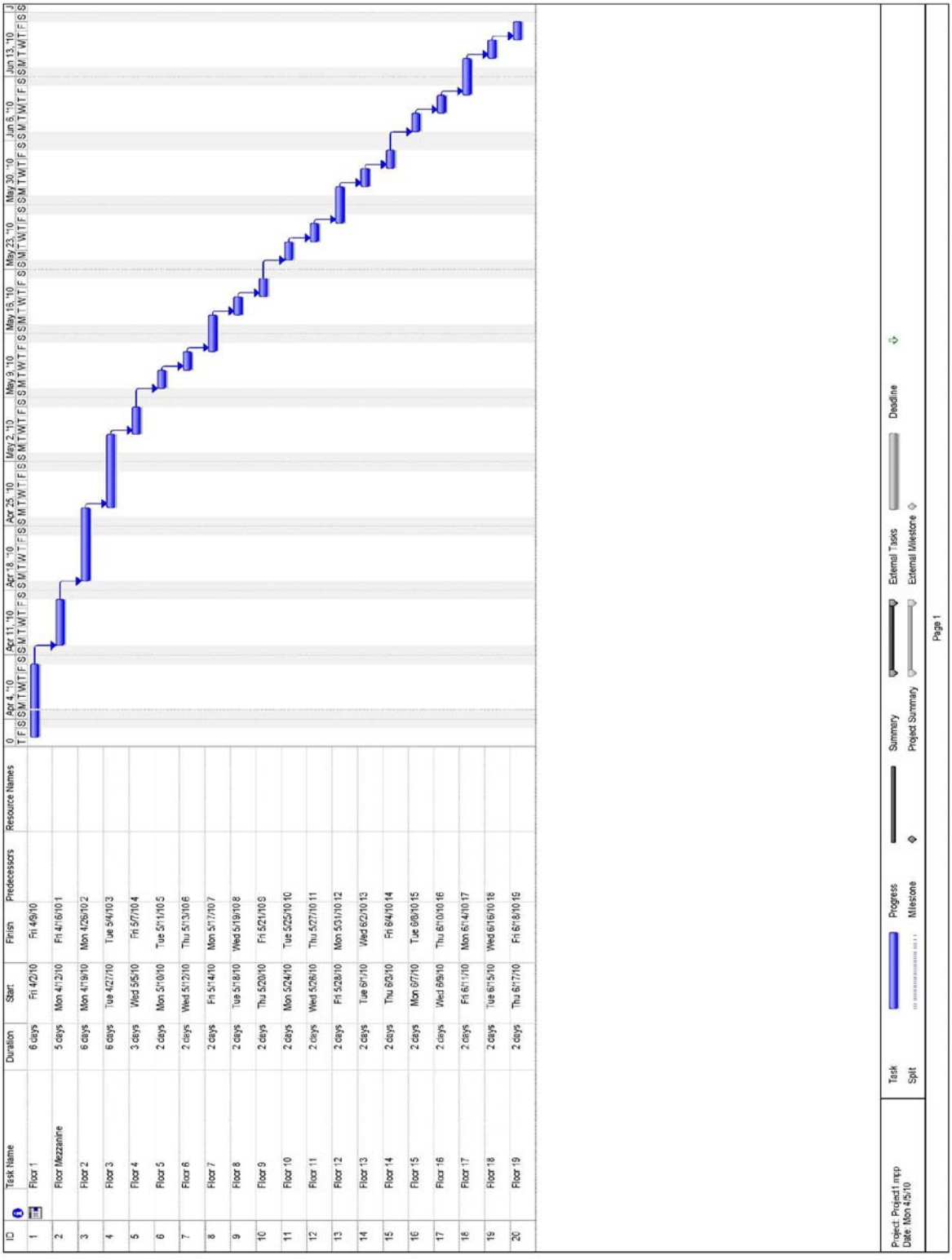
Mat. O&P	Labor O&P	Equip. O&P	Total O&P	Ext. Mat. O&P	Ext. Labor O&P	Ext. Equip. O&P	Ext. Total O&P	Labor Type	Data Release	Zip Code
$ 0.69	$ 1.39	$ 0.02	$ 2.10	$ 114,885.00	$ 231,435.00	$ 3,330.00	$ 349,650.00	STD	Year 2009	210-212
$ 116.14	$ -	$ -	$ 116.14	$ 1,853,245.98	$ -	$ -	$ 1,853,245.98	STD	Year 2009	210-212
$ 19.04	$ -	$ -	$ 19.04	$ 32,463.20	$ -	$ -	$ 32,463.20	STD	Year 2009	210-212
$ -	$ 16.76	$ 5.71	$ 22.47	$ -	$ 267,439.32	$ 91,114.47	$ 358,553.79	STD	Year 2009	210-212
$ 1,690.08	$ 888.68	$ -	$ 2,578.76	$ 196,049.28	$ 103,086.88	$ -	$ 299,136.16	STD	Year 2009	210-212
				$2196643.46	$601961.20	$94444.47	$2893049.13			

Quantity	LineNumber	Source	SubC	Description	Crew	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Total	Ext. Mat.	Ext. Labor	Ext. Equip.	Ext. Total
19215	033105350300			Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, Portland cement and water, delivered, excludes all additives and treatments				C.Y.	$ 100.91	$ -	$ -	$ 100.91	$ 1,938,985.65	$ -	$ -	$ 1,938,985.65
19215	033105701500			Structural concrete, placing, elevated slab, pumped, 6" to 10" thick, includes vibrating, excludes material	C20	160	0.4	C.Y.	$ -	$ 10.81	$ 5.18	$ 15.99	$ -	$ 207,714.15	$ 99,533.70	$ 307,247.85
2695	033923130800			Concrete surface treatment, curing compound, water based, 250 S.F. per gallon, 55 gallon drum, includes material only				Gal.	$ 17.42	$ -	$ -	$ 17.42	$ 46,946.90	$ -	$ -	$ 46,946.90
615	032110601150			Reinforcing steel, in place, typical, average, over 100 ton job, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	4 Rodm	2.3	13.913	Ton	$1,538.73	$ 537.54	$ -	$ 2,076.27	$ 946,318.95	$ 330,587.10	$ -	$ 1,276,906.05
Total													$2932251.50	$538301.25	$99533.70	$3570086.45

Mat. O&P	Labor O&P	Equip. O&P	Total O&P	Ext. Mat. O&P	Ext. Labor O&P	Ext. Equip. O&P	Ext. Total O&P	Labor Type	Data Release	Zip Code
$ 110.43	$ -	$ -	$ 110.43	$ 2,121,912.45	$ -	$ -	$ 2,121,912.45	STD	Year 2009	210-212
$ -	$ 16.76	$ 5.71	$ 22.47	$ -	$ 322,043.40	$ 109,717.65	$ 431,761.05	STD	Year 2009	210-212
$ 19.04	$ -	$ -	$ 19.04	$ 51,312.80	$ -	$ -	$ 51,312.80	STD	Year 2009	210-212
$ 1,690.08	$ 888.68	$ -	$ 2,578.76	$ 1,039,399.20	$ 546,538.20	$ -	$ 1,585,937.40	STD	Year 2009	210-212
				$3212624.45	$868581.60	$109717.65	$4190923.70			



ID	Task Name	Duration	Start	Finish	Predecessors
1	Floor 1	6 days	Fri 4/2/10	Fri 4/9/10	
2	Stress Tendons 1	5 days	Tue 4/6/10	Mon 4/12/10	1SS+2 days
3	Floor Mezz.	5 days	Mon 4/12/10	Fri 4/16/10	31
4	Stress Tendons Mezz.	4 days	Wed 4/14/10	Mon 4/19/10	3SS+2 days
5	Floor 2	6 days	Mon 4/19/10	Mon 4/26/10	3
6	Stress Tendons 2	5 days	Wed 4/21/10	Tue 4/27/10	5SS+2 days
7	Floor 3	7 days	Tue 4/27/10	Wed 5/5/10	5
8	Stress Tendons 3	5 days	Thu 4/29/10	Wed 5/6/10	7SS+2 days
9	Floor 4	4 days	Thu 5/6/10	Tue 5/11/10	7
10	Stress Tendons 4	3 days	Mon 5/10/10	Wed 5/12/10	9SS+2 days
11	Floor 5	3 days	Wed 5/12/10	Fri 5/14/10	9
12	Stress Tendons 5	2 days	Mon 5/17/10	Tue 5/18/10	11SS+3 days
13	Floor 6	3 days	Mon 5/17/10	Wed 5/19/10	11
14	Stress Tendons 6	2 days	Wed 5/19/10	Thu 5/20/10	13SS+2 days
15	Floor 7	3 days	Thu 5/20/10	Mon 5/24/10	13
16	Stress Tendons 7	2 days	Tue 5/25/10	Wed 5/26/10	15SS+3 days
17	Floor 8	3 days	Tue 5/25/10	Thu 5/27/10	15
18	Stress Tendons 8	2 days	Thu 5/27/10	Fri 5/28/10	17SS+2 days
19	Floor 9	3 days	Fri 5/28/10	Tue 6/1/10	17
20	Stress Tendons 9	2 days	Wed 6/2/10	Thu 6/3/10	18SS+3 days
21	Floor 10	3 days	Wed 6/2/10	Fri 6/4/10	19
22	Stress Tendons 10	2 days	Mon 6/7/10	Tue 6/8/10	21SS+3 days
23	Floor 11	3 days	Mon 6/7/10	Wed 6/9/10	21
24	Stress Tendons 11	2 days	Wed 6/9/10	Thu 6/10/10	23SS+2 days
25	Floor 12	3 days	Thu 6/10/10	Mon 6/14/10	23
26	Stress Tendons 12	2 days	Tue 6/15/10	Wed 6/16/10	25SS+3 days
27	Floor 13	3 days	Tue 6/15/10	Thu 6/17/10	25
28	Stress Tendons 13	2 days	Thu 6/17/10	Fri 6/18/10	27SS+2 days
29	Floor 14	3 days	Fri 6/18/10	Tue 6/22/10	27
30	Stress Tendons 14	2 days	Wed 6/23/10	Thu 6/24/10	29SS+3 days
31	Floor 15	3 days	Wed 6/23/10	Fri 6/25/10	29
32	Stress Tendons 15	2 days	Fri 6/25/10	Mon 6/28/10	31SS+2 days
33	Floor 16	3 days	Mon 6/28/10	Wed 6/30/10	31
34	Stress Tendons 16	2 days	Wed 6/30/10	Thu 7/1/10	33SS+2 days
35	Floor 17	3 days	Thu 7/1/10	Mon 7/5/10	33
36	Stress Tendons 17	2 days	Tue 7/6/10	Wed 7/7/10	35SS+3 days
37	Floor 18	3 days	Tue 7/6/10	Thu 7/8/10	35
38	Stress Tendons 18	2 days	Thu 7/8/10	Fri 7/9/10	37SS+2 days
39	Floor 19	3 days	Fri 7/9/10	Tue 7/13/10	37
40	Stress Tendons 19	2 days	Wed 7/14/10	Thu 7/15/10	39SS+3 days


ID
Task Name
Duration
Start
Finish
Predecessors
Resource Names
1 Floor 1 6 days Fri 4/2/10 Fri 4/9/10
2 Floor Mezzanine 5 days Mon 4/12/10 Fri 4/16/10 1
3 Floor 2 6 days Mon 4/19/10 Mon 4/26/10 2
4 Floor 3 6 days Tue 4/27/10 Tue 5/4/10 3
5 Floor 4 3 days Wed 5/5/10 Fri 5/7/10 4
6 Floor 5 2 days Mon 5/10/10 Tue 5/11/10 5
7 Floor 6 2 days Wed 5/12/10 Thu 5/13/10 6
8 Floor 7 2 days Fri 5/14/10 Mon 5/17/10 7
9 Floor 8 2 days Tue 5/18/10 Wed 5/19/10 8
10 Floor 9 2 days Thu 5/20/10 Fri 5/21/10 9
11 Floor 10 2 days Mon 5/24/10 Tue 5/25/10 10
12 Floor 11 2 days Wed 5/26/10 Thu 5/27/10 11
13 Floor 12 2 days Fri 5/28/10 Mon 5/31/10 12
14 Floor 13 2 days Tue 6/1/10 Wed 6/2/10 13
15 Floor 14 2 days Thu 6/3/10 Fri 6/4/10 14
16 Floor 15 2 days Mon 6/7/10 Tue 6/8/10 15
17 Floor 16 2 days Wed 6/9/10 Thu 6/10/10 16
18 Floor 17 2 days Fri 6/11/10 Mon 6/14/10 17
19 Floor 18 2 days Tue 6/15/10 Wed 6/16/10 18
20 Floor 19 2 days Thu 6/17/10 Fri 6/18/10 19
Apr 4, '10
Apr 11, '10
Apr 18, '10
Apr 25, '10
May 2, '10
May 9, '10
May 16, '10
May 23, '10
May 30, '10
Jun 6, '10
Jun 13, '10
Project: Project1.mpp
Date: Mon 4/5/10
Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline
Page 1