

JESSE BORDEAU
FINAL THESIS PRESENTATION

ADVISORS: SPRING 2016- DR. LINDA HANAGAN, PHD, P.E.
FALL 2015- PROF. HEATHER SUSTERSIC, P.E.

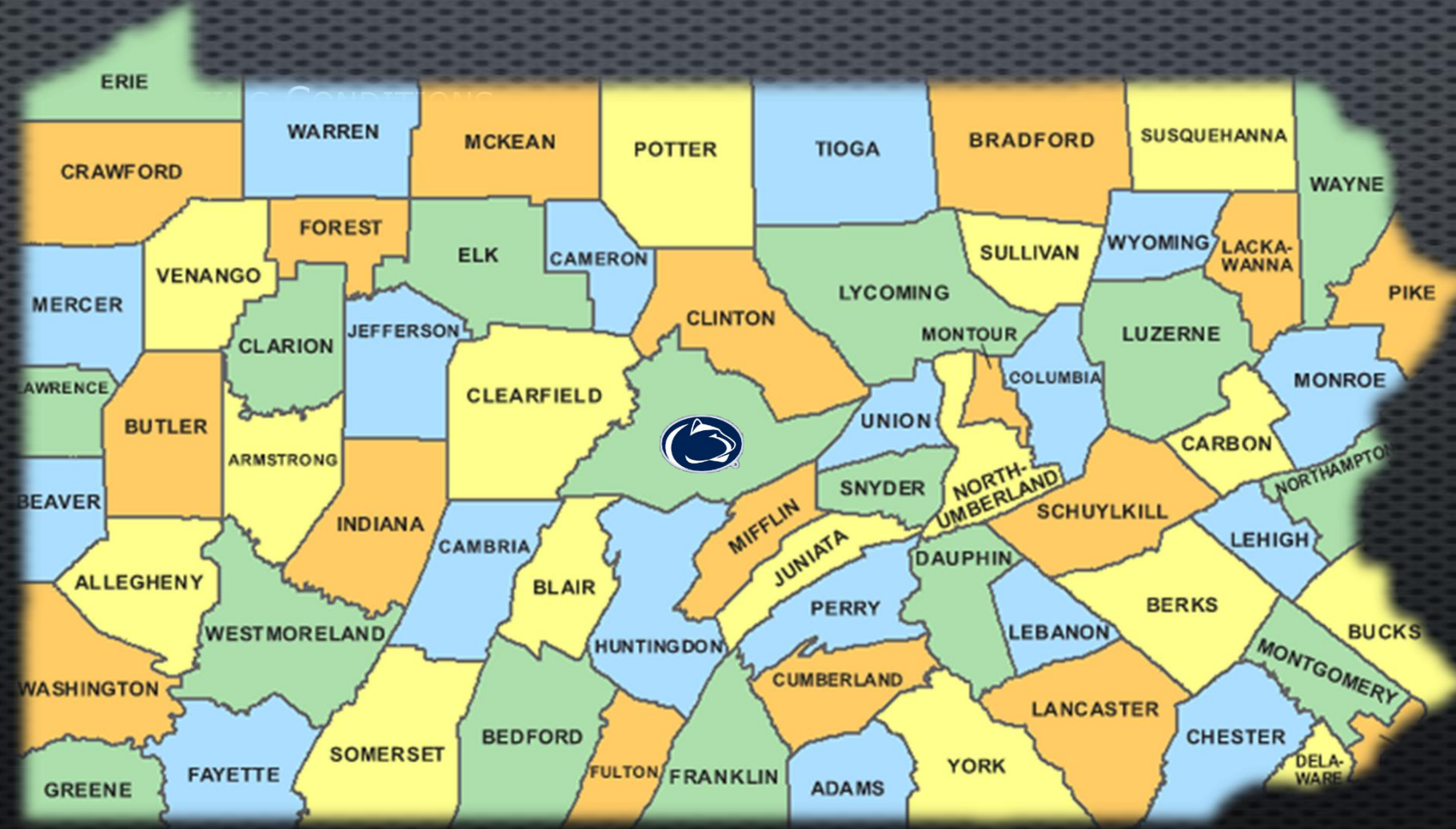
DEPARTMENT OF ARCHITECTURAL ENGINEERING
STRUCTURAL OPTION
SPRING 2016



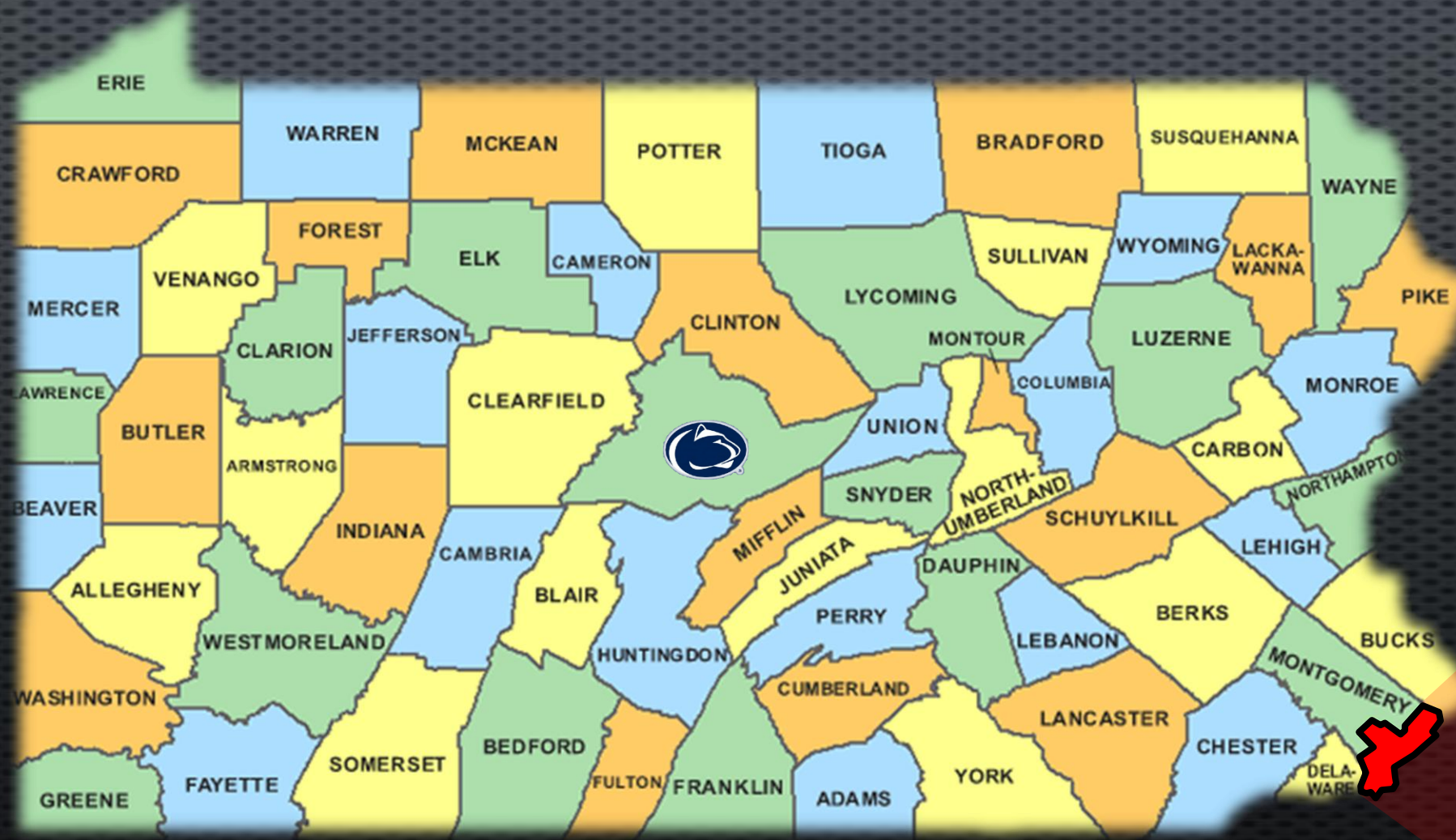
AC HOTEL
PHILADELPHIA
BY MARRIOTT

230 NORTH 13TH STREET, PHILADELPHIA PA

PRESENTATION OVERVIEW



- EXISTING CONDITIONS
 - **SITE LOCATION**
 - BUILDING INFORMATION
 - EXISTING STRUCTURE
- PROPOSAL
- STRUCTURAL REDESIGN
 - GRAVITY
 - LATERAL
- BREADTH TOPICS
 - CONSTRUCTION MANAGEMENT
- CONCLUSION
 - APPENDIX



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PAST

- PRIOR USES (BUILT IN 1946)
 - NFL FILM STUDIO
 - WARNER BROS. DISTRIBUTION CENTER
 - BIG BROTHERS BIG SISTERS' NAT'L HEADQUARTERS (1984-2014)



COURTESY OF PHILLY.CURBED.COM

PRESENT

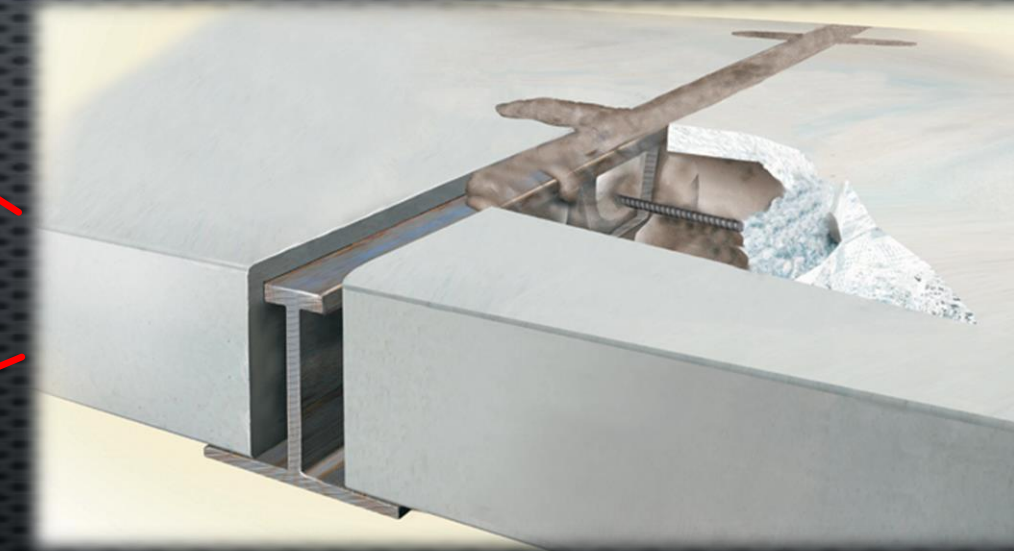
- **RESIDENTIAL TRANSIENT HOTEL (R-1)**
 - TYPE 1-B
 - EXTERIOR WALLS
 - CEILING/FLOOR SEPARATION } 2 HR.
 - STRUCTURAL FRAME
 - CEILING/ROOF ASSEMBLY } 1 HR.
- **192'** ABOVE SIDEWALK GRADE
 - GARAGE + 14 LEVELS ABOVE GRADE + PENTHOUSE+ MECH. PENTHOUSE
- **107,680 SF**
- **PROPOSED CONSTRUCTION:**
FALL 15'- SUMMER 17'
- **FEATURES:**
 - VALET PARKING VIA CAR LIFT
 - 150 GUEST ROOM UNITS
 - RESTAURANT, FITNESS CENTER & INDOOR POOL
 - MULTIPLE GREEN ROOFS (INTENSIVE & EXTENSIVE)



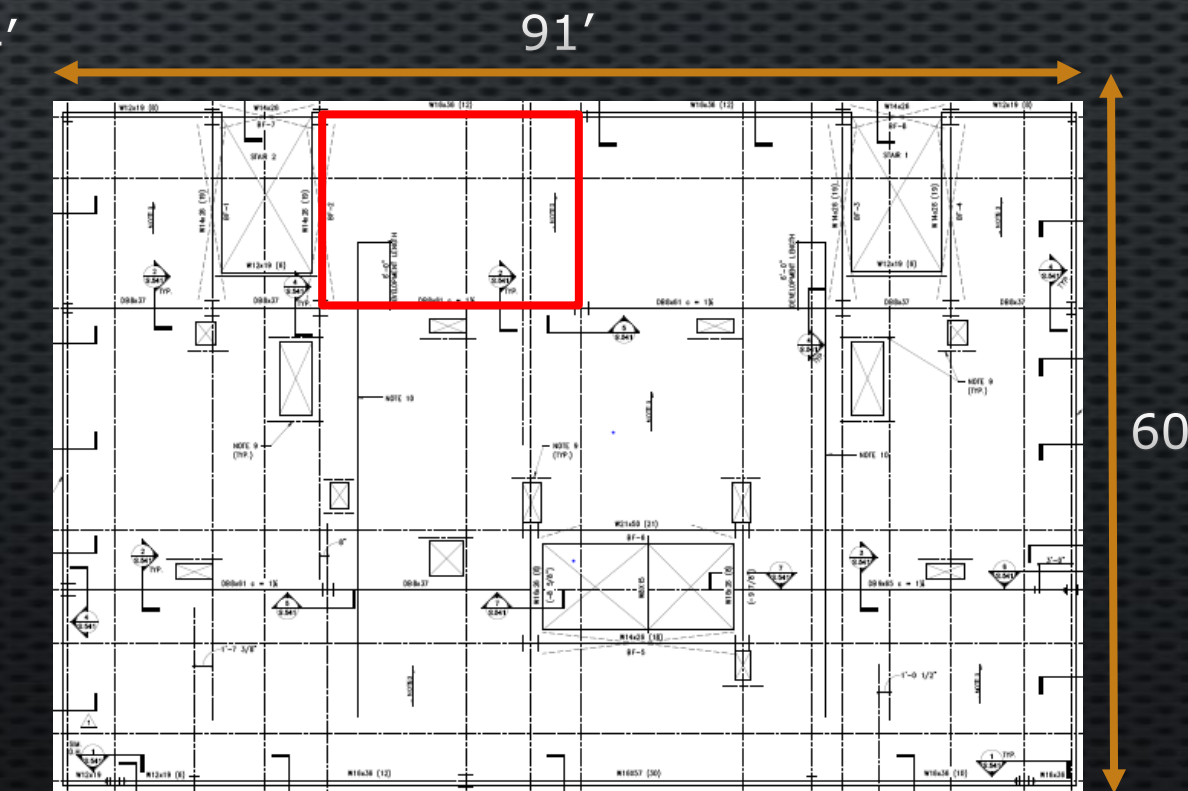
COURTESY OF HAA

GRAVITY SYSTEM

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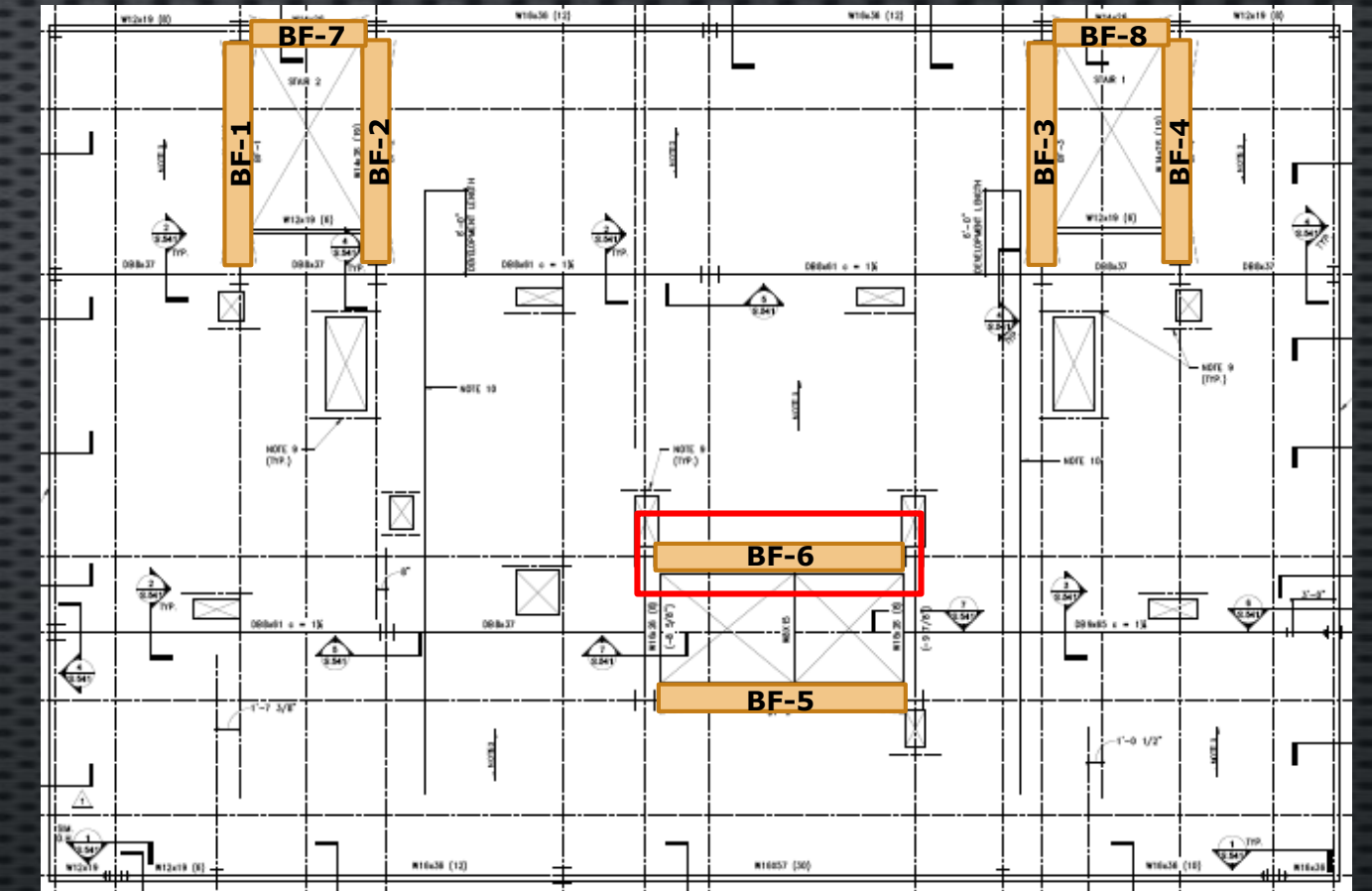
- FLOOR SYSTEM: GIRDER-SLAB
 - D-BEAM
 - 8" HOLLOW-CORE PLANK (4'0" TYP)
- COLUMNS: WIDE FLANGE MEMBERS (W14 TYP.)
- TYPICAL BAY: 17.5' x 24'



TYP. FLOOR PLAN

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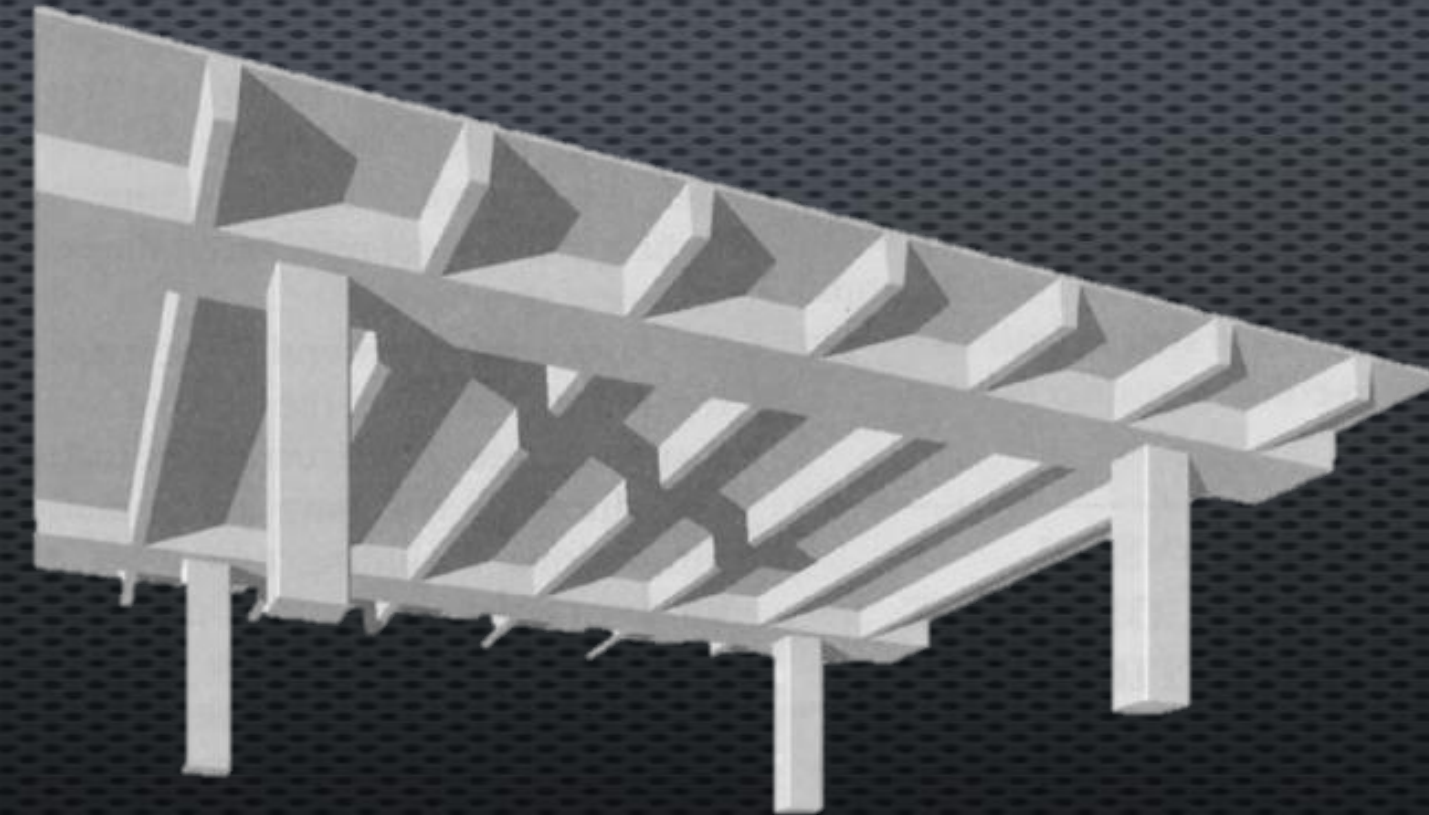
LATERAL SYSTEM



- BRACED FRAMES (BF)
 - EIGHT FRAMES, FOUR EACH DIRECTION
 - (7) CONCENTRIC, (1) ECCENTRIC
 - FLOOR 8-ROOF: HSS6x6x3/8
 - FLOOR 3-7: HSS6x6x1/2
 - FLOOR 1&2: HSS8x8x1/2

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THE MODIFIED STRUCTURE



SYSTEMS

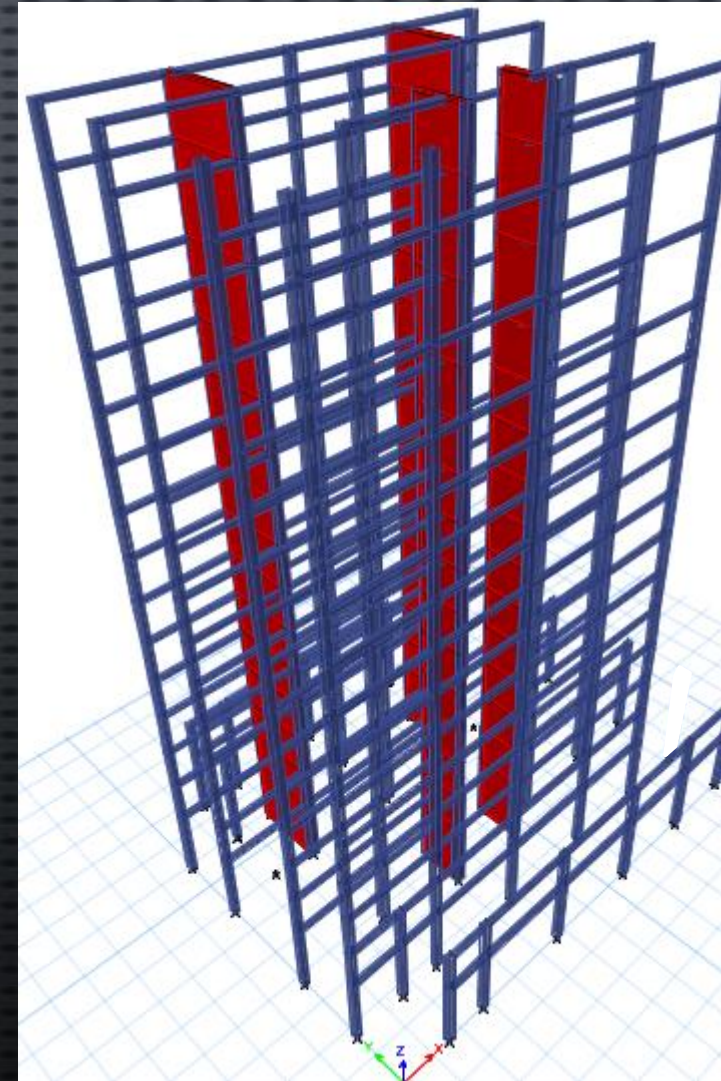
STEEL → CONCRETE

- GIRDER-SLAB → ONE-WAY SLAB W/ BEAMS
- CONCENTRIC BRACED FRAMES → CONCRETE SHEAR WALLS & MOMENT FRAMES

Design Loads						
Load Type	Unit	Lower Floors (1-3)	Upper Floors (4-14)	Roof	Green Roof	Pool Area
Dead	psf	85	72.5	140	140	400
Live	psf	100	50	30	100	100
Wall	plf	289	289	289	289	289
Controlling Load Case: 1.2DL+1.6LL+0.5Lr						

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REDESIGN

GOALS

- SIMPLIFY COLUMN LAYOUT
- MAINTAIN FLOOR-TO-CEILING HEIGHT (AC MARRIOTT STANDARD 9'0")
- PROVIDE COST-EFFICIENT SYSTEM

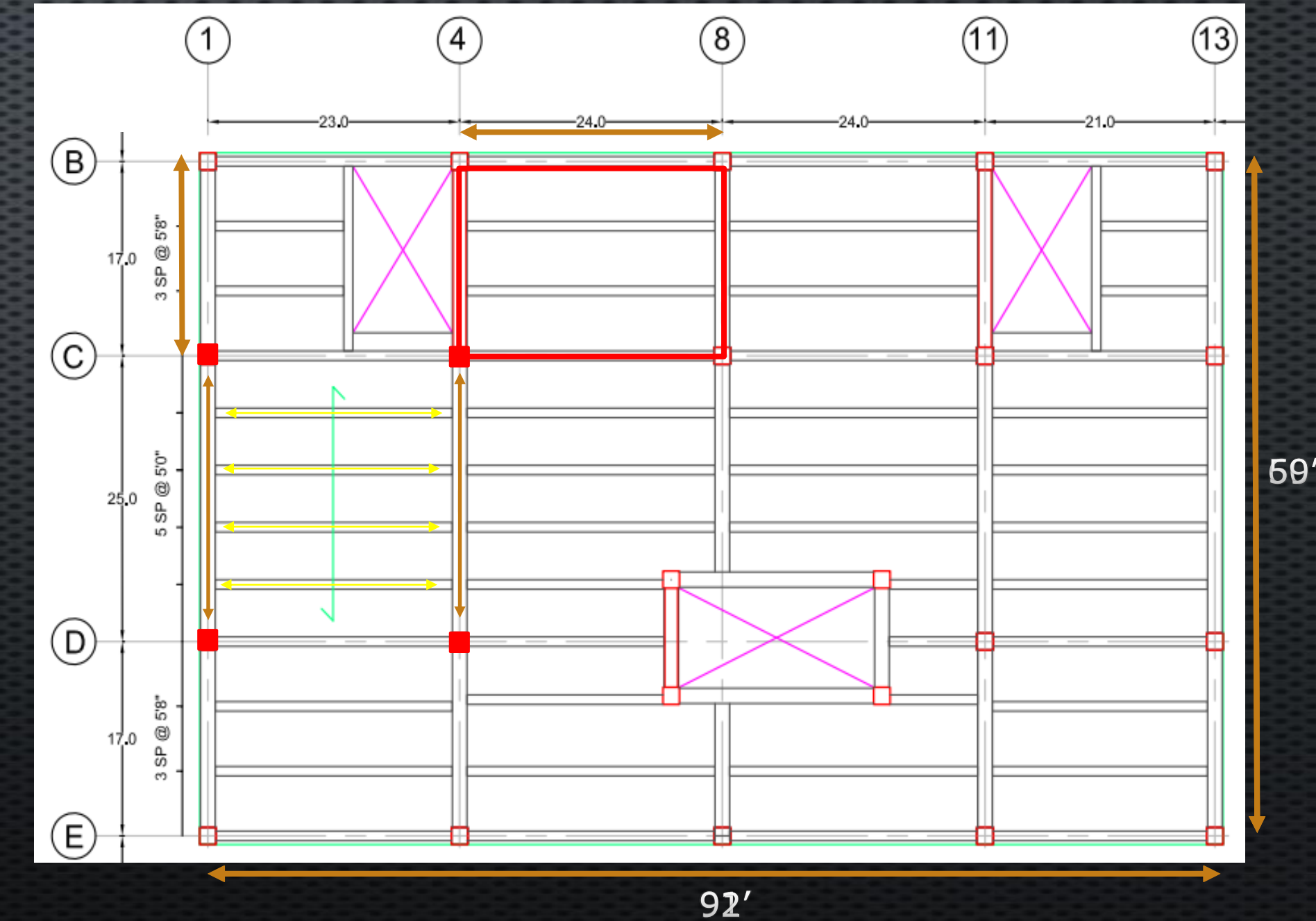
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GRAVITY SYSTEM – ONE-WAY SLAB W/ BEAMS

- SLAB DESIGN
 - MINIMUM SLAB THICKNESS – ACI 318-11 TABLE 9.5(A)
 - 11" MIN DUE TO 24' SPAN
 - #4 @ 12" O.C.
- INTERIOR BEAMS (4.5' TO 5.66' O.C.)
 - REDUCES THICKNESS TO 2.4"
 - TYP. FLOOR – 5" } ALLOWS FOR ADEQUATE REINFORCEMENT SPACE & PLACEMENT
 - LOWER FLOORS – 6"

TABLE 9.5(a) — MINIMUM THICKNESS OF NONPRESTRESSED BEAMS OR ONE-WAY SLABS UNLESS DEFLECTIONS ARE CALCULATED

Member	Minimum thickness, <i>h</i>			
	Simply supported	One end continuous	Both ends continuous	Cantilever
Solid one-way slabs	<i>l</i> /20	<i>l</i> /24	<i>l</i> /28	<i>l</i> /10
Beams or ribbed one-way slabs	<i>l</i> /16	<i>l</i> /18.5	<i>l</i> /21	<i>l</i> /8

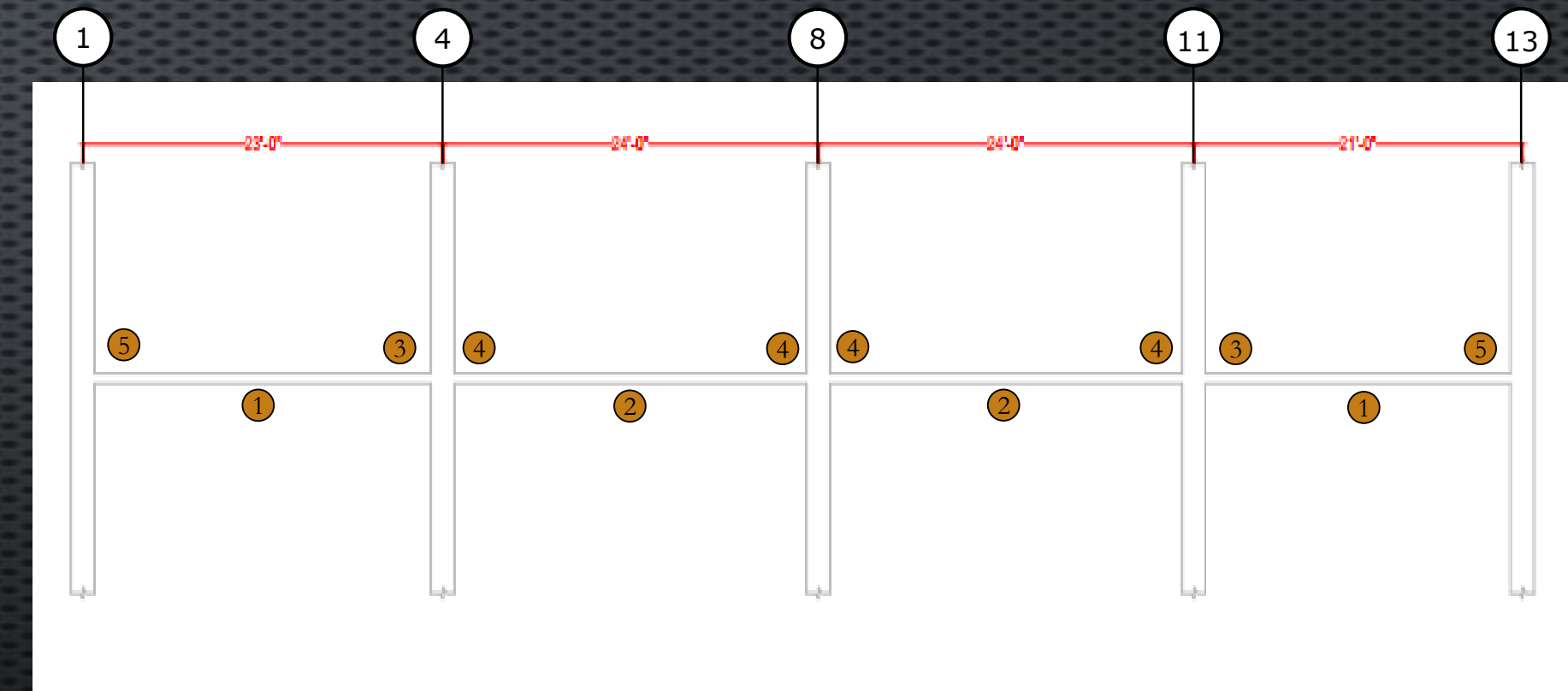


GRAVITY SYSTEM – ONE-WAY SLAB W/ BEAMS

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- BEAM DESIGN
 - MINIMUM THICKNESS – ACI 318-11 TABLE 9.5(A)
 - MOMENT APPROXIMATIONS – ACI 318-11 SECTION 8.3.3

Positive moment		
End spans		
Discontinuous end unrestrained	$w_u \ell_n^2 / 11$	1
Discontinuous end integral with support	$w_u \ell_n^2 / 14$	2
Interior spans	$w_u \ell_n^2 / 16$	3
Negative moments at exterior face of first interior support		
Two spans	$w_u \ell_n^2 / 9$	4
More than two spans	$w_u \ell_n^2 / 10$	5
Negative moment at other faces of interior supports	$w_u \ell_n^2 / 11$	6
Negative moment at interior face of exterior support for members built integrally with supports		
Where support is spandrel beam	$w_u \ell_n^2 / 24$	7
Where support is a column	$w_u \ell_n^2 / 16$	8

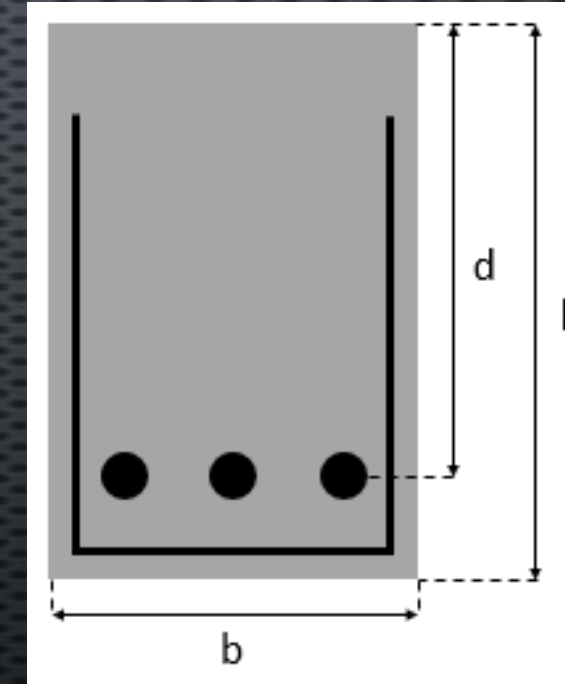


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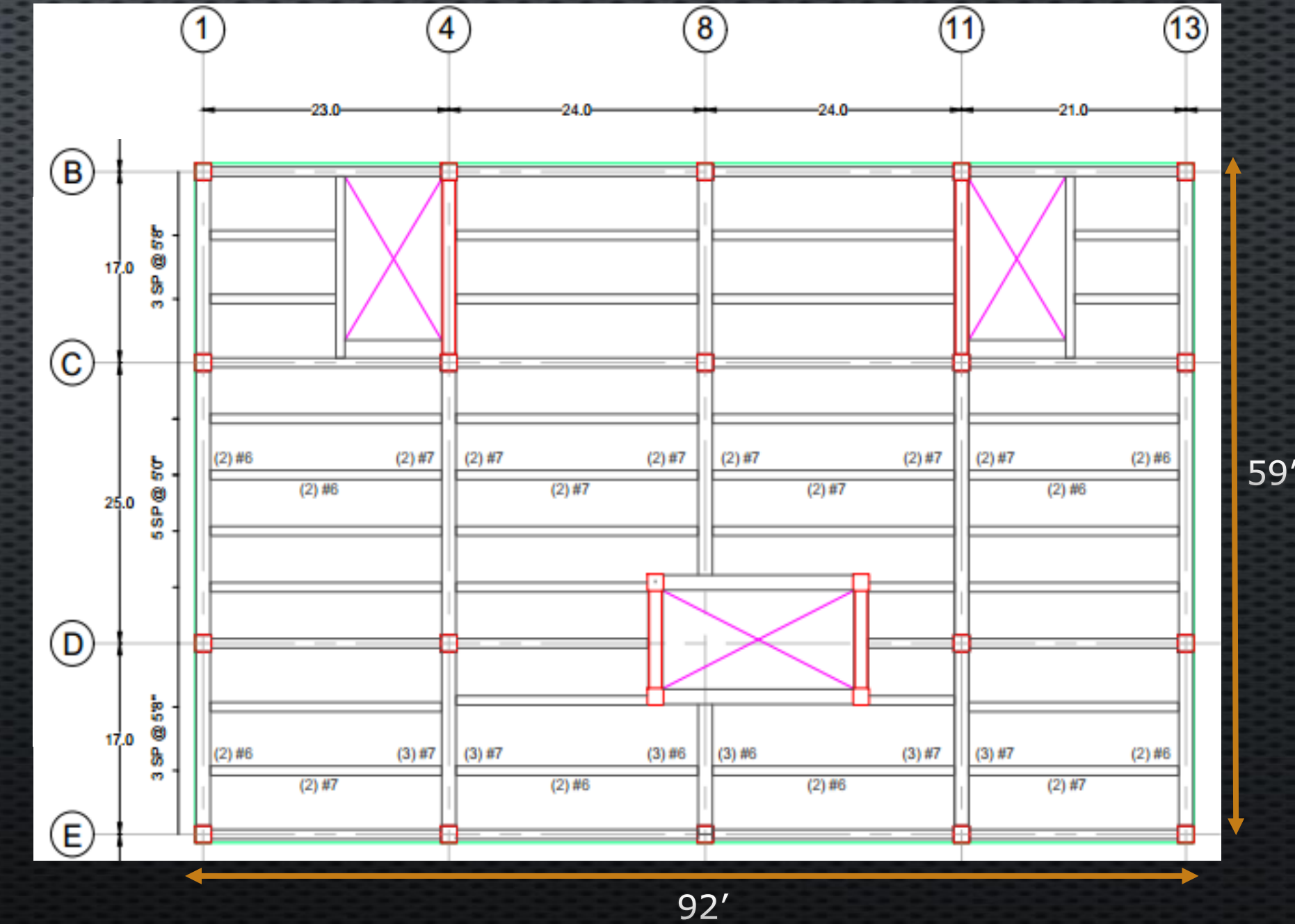
- BEAM DESIGN CONT.

- BEAM DIMENSIONS
 - BEAM → $d < 1.5b$
 - GIRDER → $d < 2b$



$$20Mu < bd^2 \longrightarrow A_{s_{reqd}} = \frac{Mu}{4d}$$

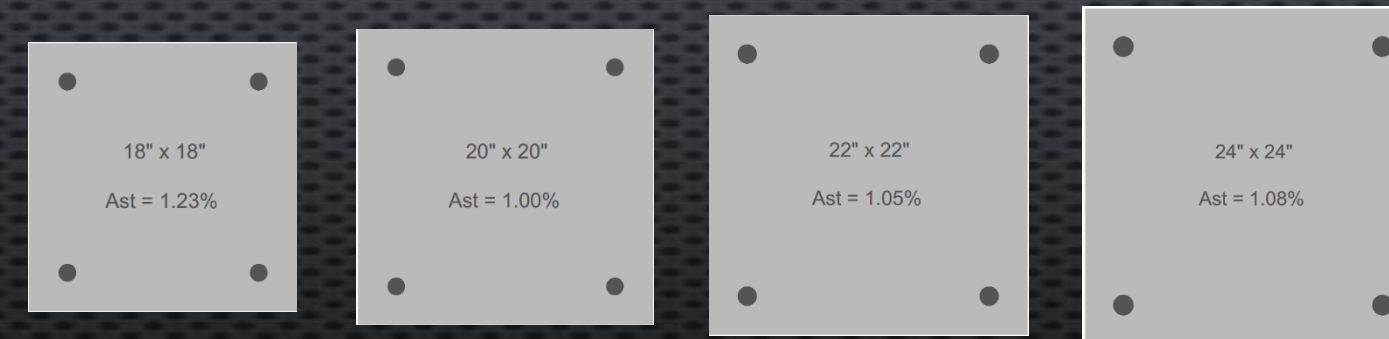
$$A_{s_{reqd}} = \frac{Mu}{0.9fyjd} \rightarrow a = \frac{Asfy}{0.85f'cb} \rightarrow c = \frac{a}{\beta} \rightarrow \epsilon_s = 0.005 < \epsilon_c \left(\frac{d-c}{c} \right) \rightarrow \text{if } \epsilon_c > \epsilon_s \therefore \phi = 0.9$$



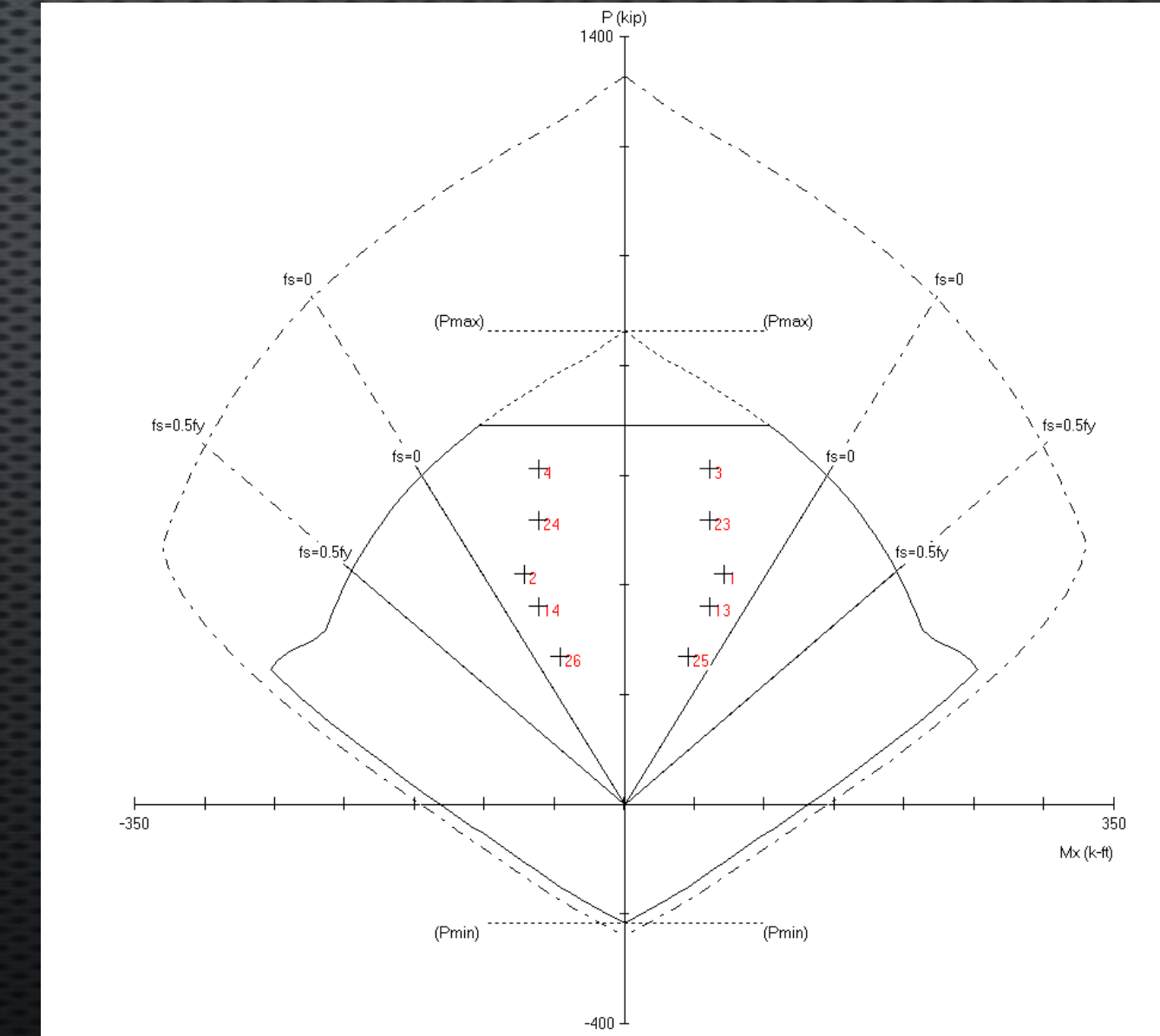
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GRAVITY SYSTEM – COLUMNS

- COLUMN DESIGN
 - CRSI MANUAL (TABLE 3-12)
 - CHECKED FOR SLENDERNESS → NOT SLENDER



CRSI Column Capacities		
Column	Rebar	ϕP_n [k]
18"x18"	(4) #9	691
20"x20"	(4) #9	825
22"x22"	(4) #10	1005
24"x24"	(4) #11	1202

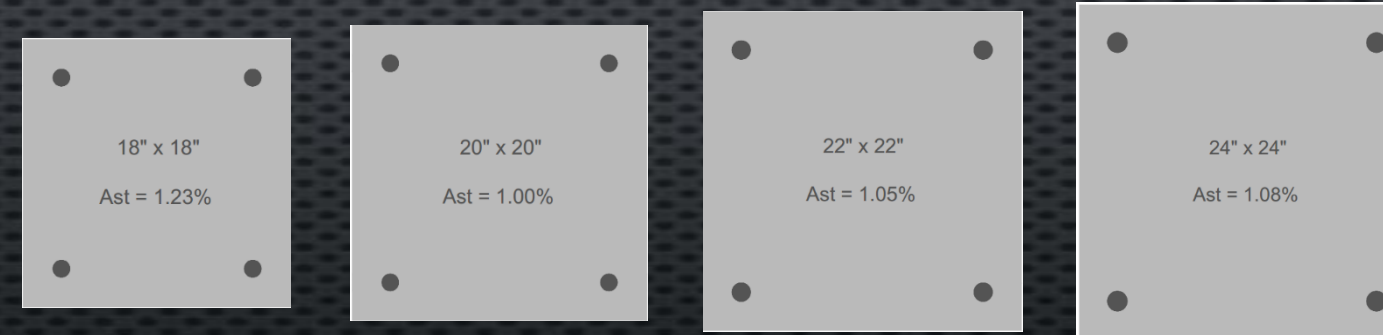


CAPACITY 
 LOAD BEING SEEN 

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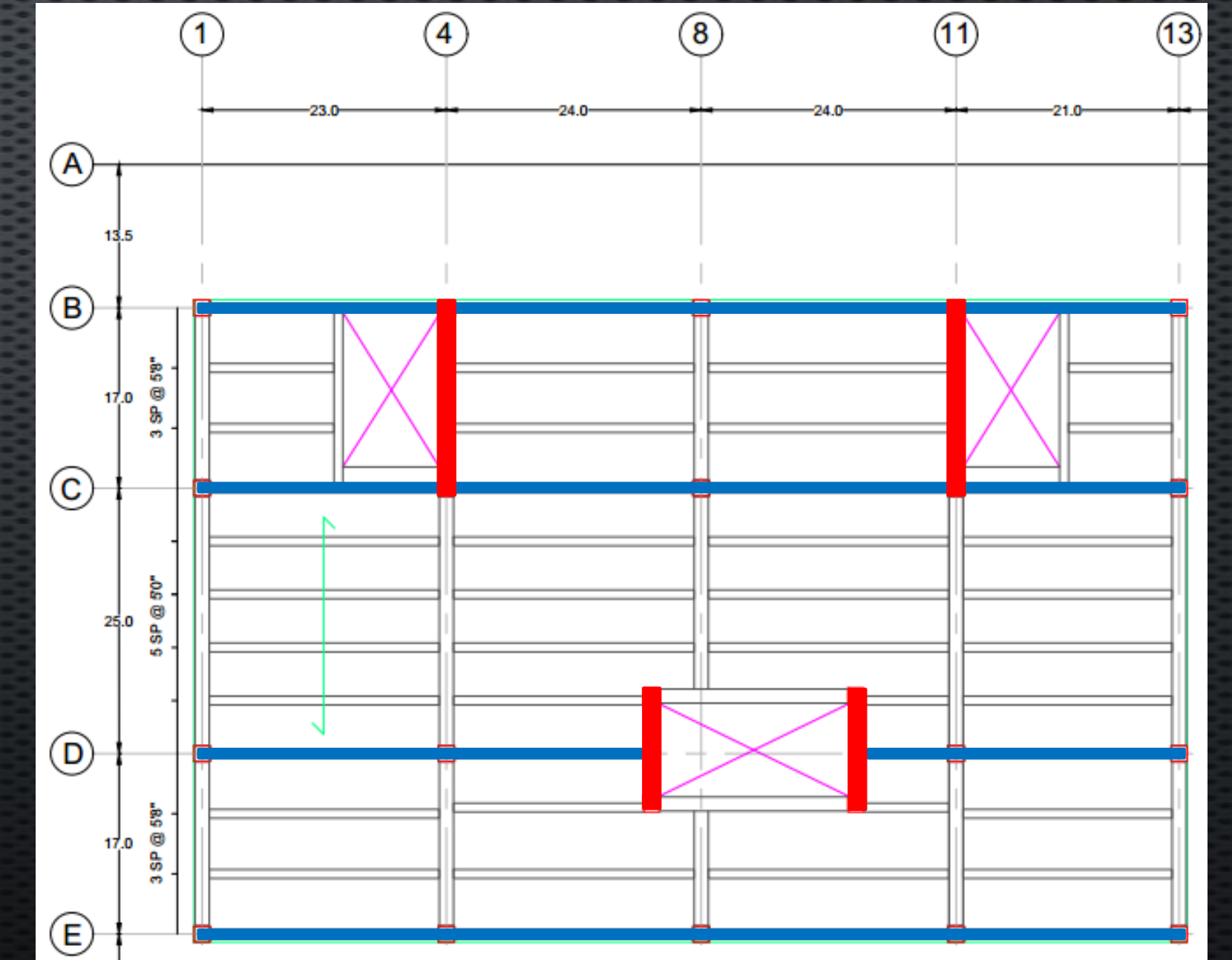
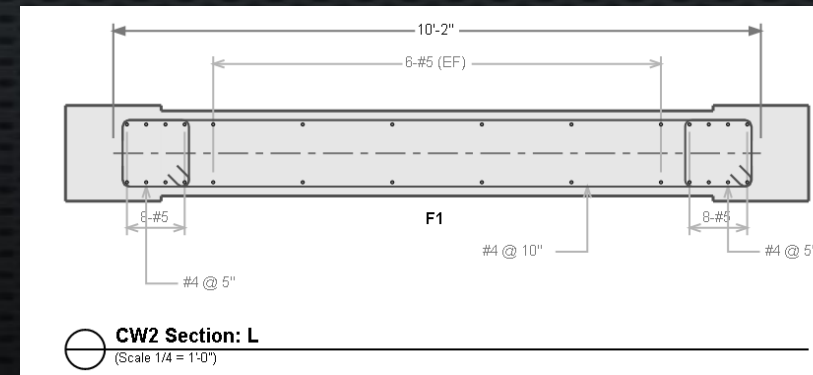
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Column						
Floor (Column Below)	C1 (Ext Col)			C4 (Int Col)		
	Pu	Column Selection	Rebar	Pu	Column Selection	Rebar
15 (Penthouse)	55	18"x18"	(4) #9	100	18"x18"	(4) #9
14	90	18"x18"	(4) #9	166	18"x18"	(4) #9
13	125	18"x18"	(4) #9	233	18"x18"	(4) #9
12	161	18"x18"	(4) #9	299	18"x18"	(4) #9
11	196	18"x18"	(4) #9	365	18"x18"	(4) #9
10	231	18"x18"	(4) #9	431	18"x18"	(4) #9
9	266	18"x18"	(4) #9	498	18"x18"	(4) #9
8	301	18"x18"	(4) #9	564	18"x18"	(4) #9
7	336	18"x18"	(4) #9	630	18"x18"	(4) #9
6	372	18"x18"	(4) #9	696	20"x20"	(4) #9
5	407	18"x18"	(4) #9	762	20"x20"	(4) #9
4	442	18"x18"	(4) #9	829	22"x22"	(4) #10
3	502	18"x18"	(4) #9	926	22"x22"	(4) #10
2	555	18"x18"	(4) #9	1024	24"x24"	(4) #11
1	608	18"x18"	(4) #9	1121	24"x24"	(4) #11

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LATERAL SYSTEM

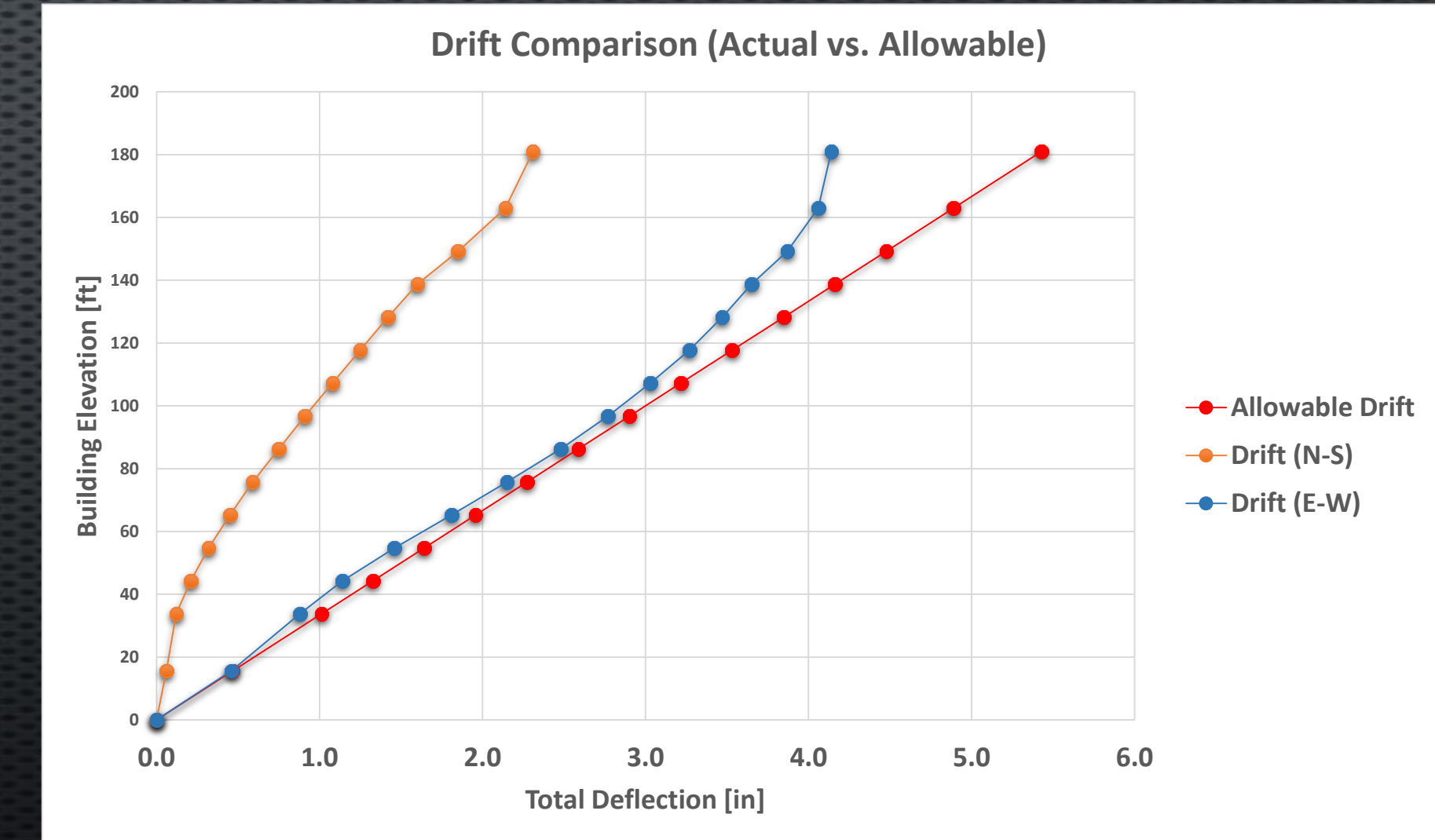
- WIND CONTROLLED
- LATERAL FORCE RESISTING ELEMENTS (LFRE) – FULL BUILDING HEIGHT
 - 14" SHEAR WALLS (N-S)
 - (2) 17' LONG
 - (2) 10' LONG
 - CONCRETE MOMENT FRAMES (E-W)
 - (4) 59' LONG



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CONSTRUCTION MANAGEMENT

- DETAILED COST ESTIMATE/COMPARISON
- GENERAL SCHEDULE IMPACTS



COURTESY OF WWW.GIRDER-SLAB.COM

VS



COURTESY OF WWW.GROUPEMAGMA.CA

LIGHTING REDESIGN

- LED → FLUORESCENT & COMPACT FLUORESCENT (CFL)
- FEASIBILITY → 20 - YEAR COST COMPARISON



DETAILED COST ESTIMATE

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- STRUCTURE ONLY
- BY CATEGORY
- RS MEANS (FACILITIES CONSTRUCTION COST DATA - 2014 EDITION)

Factors	
Location: Philadelphia, Pa	1.139
Time: Mid-Project (08/16), 3%	1.079
1.229	

ESTIMATES

- EXISTING CONDITIONS

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Category	Line Number	Description	Notes	Crew	Daily Output	Labor Hours	Unit	Material	Material Incr. From Tonnage	Labor	Equipment	Unit Total	Unit Total (O&P)	Quantity	Total
Slab	05 41 13.50.0100	Precast Structural Concrete, Slab, Hollow-Core Planks, 8" Thick		C-11	3200	0.023	SF	7.10	N/A	1.13	0.57	8.80	10.45	87098	\$766,462
Columns	05 12 23.17.4550	Structural Steel Framing, Columns, HSS6"x6"x1/4"x12'	for HSS6x6x3/8,6x6x1/2	E-2	54	1.037	EA	360.00	396.00	52.00	28.50	476.50	520.00	278	\$132,467
	05 12 23.17.4600	Structural Steel Framing, Columns, HSS8"x8"x3/8"x14'	for HSS8x8x1/2	E-2	50	1.12	EA	775.00	852.50	56.00	30.50	939.00	990.00	34	\$31,926
	05 12 23.17.5700	Structural Steel Framing, Columns, HSS12"x8"x1/2"x16'	for HSS12x8x1/2,12x6x1/2	E-2	48	1.167	EA	1425.00	1567.50	58.50	32.00	1658.00	1725.00	5	\$8,290
	05 12 23.17.7000	Structural Steel Framing, Columns, W10x45	for W10x33,49,54	E-2	1032	0.054	LF	65.50	72.05	2.72	1.48	76.25	78.50	1190	\$90,738
	05 12 23.17.7050	Structural Steel Framing, Columns, W10x68	for W10x60,77	E-2	984	0.057	LF	99.00	108.90	2.86	1.55	113.31	116.00	411	\$46,514
	05 12 23.17.7150	Structural Steel Framing, Columns, W12x50	for W12x40,50,58,65	E-2	1032	0.054	LF	73.00	80.30	2.72	1.48	84.50	86.50	378	\$31,912
	05 12 23.17.7200	Structural Steel Framing, Columns, W12x87	for W12x72,79,96	E-2	984	0.057	LF	127.00	139.70	2.86	1.55	144.11	146.00	131	\$18,806
	05 12 23.17.7350	Structural Steel Framing, Columns, W14x74	for W14x43,53,61,74,90,99	E-2	984	0.057	LF	108.00	118.80	2.86	1.55	123.21	126.00	628	\$77,376
	05 12 23.17.7400	Structural Steel Framing, Columns, W14x120	for W14x109,120,145	E-2	960	0.058	LF	175.00	192.50	2.93	1.59	197.02	199.00	1093	\$215,343
	05 12 23.17.7450	Structural Steel Framing, Columns, W14x176	for W14x176,211,257	E-2	912	0.061	LF	257.00	282.70	3.08	1.68	287.46	289.00	1135	\$326,267
	05 12 23.17.8090	Structural Steel Framing, Columns, For Projects 75-99 tons add	234 tons steel	N/A	N/A	N/A	ALL	10%	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	05 12 23.17.9000	Structural Steel Framing, Columns, Min. Labor/Equip. Charge			1 Ssk	1	8	JOB	0.00	0.00	410.00	0.00	410.00	750.00	1
05 12 23.75.0502	Structural Steel Framing, Members, W8x31	DB8x37=W8x35 DB8x61=W8x58 DB8x65=W8x67 W8x13,15		E-2	350	0.102	LF	45.00	49.50	5.10	2.78	57.38	61.50	2205	\$126,523
05 12 23.75.0702	Structural Steel Framing, Members, W10x22	for W10x15,22,33		E-2	600	0.093	LF	32.00	35.20	4.68	2.55	42.43	46.50	145	\$6,152
05 12 23.75.0902	Structural Steel Framing, Members, W10x49			E-2	550	0.102	LF	71.50	78.65	5.10	2.78	86.53	90.50	0	\$0

Category	Line Number	Description	Notes	Crew	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Unit Total	Unit Total (O&P)	Quantity	Total
Forms	03 11 13.20.1150	Forms in Place, Exterior Beam, Job-Built Plywood, 18" Wide, 4 Use		C-2	315	0.152	SFCA	0.88	6.80	0.00	7.68	12.15	31460	\$241,613
	03 11 13.20.2150	Forms in Place, Interior Beam, Job-Built Plywood, 12" Wide, 4 Use		C-2	377	0.127	SFCA	1.15	5.70	0.00	6.85	10.60	67718	\$463,868
	03 11 13.20.9000	Forms in Place, Interior Beam, Min. Labor/Equip. Charge		2 CARP	2	8	JOB	0.00	365.00	0.00	365.00	605.00	1	\$365
	03 11 13.25.6150	Forms in Place, Column (16"x16") 4 Use	use for 18"	C-1	235	0.136	SFCA	0.83	5.95	0.00	6.78	10.65	24048	\$163,045
	03 11 13.25.6650	Forms in Place, Column (24"x24") 4 Use	use for 20" & 22"	C-1	238	0.134	SFCA	0.93	5.85	0.00	6.78	10.65	5487	\$37,202
	03 11 13.25.9000	Forms in Place, Column, Min. Labor/Equip Charge		2 CARP	2	8	JOB	0.00	0.00	365.00	365.00	605.00	1	\$365
	03 11 13.35.1150	Forms in Place, Elevated Slabs, Flat Plate, Job-built Plywood, up to 15' high, 4 Use		C-2	560	0.086	SF	1.18	3.83	0.00	5.01	7.60	167308	\$838,213
	03 11 13.35.7000	Forms in Place, Elevated Slabs, Edge forms to 6" high, on elevated slab, 4 use		C-1	500	0.064	LF	0.18	2.79	0.00	2.97	4.78	2729	\$8,105
03 11 13.85.2550	Forms in Place, Walls, Job-Built Plywood 8'-16' high, 4 Use		C-2	395	0.122	SFCA	0.73	5.45	0.00	6.18	9.70	22546	\$139,334	

Category	Line Number	Description	Notes	Crew	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Unit Total	Unit Total (O&P)	Quantity	Total
Forms	03 11 13.20.1150	Forms in Place, Exterior Beam, Job-Built Plywood, 18" Wide, 4 Use		C-2	315	0.152	SFCA	0.88	6.80	0.00	7.68	12.15	31460	\$241,613
	03 11 13.20.2150	Forms in Place, Interior Beam, Job-Built Plywood, 12" Wide, 4 Use		C-2	377	0.127	SFCA	1.15	5.70	0.00	6.85	10.60	67718	\$463,868
	03 11 13.20.9000	Forms in Place, Interior Beam, Min. Labor/Equip. Charge		2 CARP	2	8	JOB	0.00	365.00	0.00	365.00	605.00	1	\$365
	03 11 13.25.6150	Forms in Place, Column (16"x16") 4 Use	use for 18"	C-1	235	0.136	SFCA	0.83	5.95	0.00	6.78	10.65	24048	\$163,045
	03 11 13.25.6650	Forms in Place, Column (24"x24") 4 Use	use for 20" & 22"	C-1	238	0.134	SFCA	0.93	5.85	0.00	6.78	10.65	5487	\$37,202
	03 11 13.25.9000	Forms in Place, Column, Min. Labor/Equip Charge		2 CARP	2	8	JOB	0.00	0.00	365.00	365.00	605.00	1	\$365
	03 11 13.35.1150	Forms in Place, Elevated Slabs, Flat Plate, Job-built Plywood, up to 15' high, 4 Use		C-2	560	0.086	SF	1.18	3.83	0.00	5.01	7.60	167308	\$838,213
	03 11 13.35.7000	Forms in Place, Elevated Slabs, Edge forms to 6" high, on elevated slab, 4 use		C-1	500	0.064	LF	0.18	2.79	0.00	2.97	4.78	2729	\$8,105
03 11 13.85.2550	Forms in Place, Walls, Job-Built Plywood 8'-16' high, 4 Use		C-2	395	0.122	SFCA	0.73	5.45	0.00	6.18	9.70	22546	\$139,334	
Rebar	03 21 11.60.0102	Plain Steel Reinforcement Bar, In Place, Beams & Girders (#3-#7)		4 Rodm	3200	0.01	LB	0.50	0.51	0.00	1.01	1.38	190294	\$192,197
	03 21 11.60.0152	Plain Steel Reinforcement Bar, In Place, Beams & Girders (#8-#18)		4 Rodm	5400	0.006	LB	0.50	0.30	0.00	0.80	1.04	56741	\$45,393
	03 21 11.60.0252	Plain Steel Reinforcement Bar, In Place, Columns (#8-#18)		4 Rodm	4600	0.007	LB	0.50	0.35	0.00	0.85	1.13	67380	\$57,273
	03 21 11.60.0402	Plain Steel Reinforcement Bar, In Place, Elevated Slab (#4-#7)		4 Rodm	5800	0.006	LB	0.50	0.28	0.00	0.78	1.01	55881	\$43,587
	03 21 11.60.0702	Plain Steel Reinforcement Bar, In Place, Walls (#3-#7)		4 Rodm	6000	0.005	LB	0.50	0.27	0.00	0.77	0.99	14343	\$11,044
03 21 11.60.9000	Plain Steel Reinforcement Bar, In Place, Min. Labor/Equip. Charge		1 Rodm	4	2	JOB	0.00	101.00	0.00	101.00	166.00	1	\$101	

ESTIMATES

- EXISTING CONDITIONS

- SITE LOCATION

- BUILDING INFORMATION

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- PROPOSAL

- STRUCTURAL REDESIGN

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Category	Line Number	Description	Notes	Crew	Daily Output	Labor Hours	Unit	Material	Material Incr. From Tonnage	Labor	Equipment	Unit Total	Unit Total (O&P)	Quantity	Total	
Slab	05 41 13.50.0100	Precast Structural Concrete, Slab, Hollow-Core Planks, 8" Thick		C-11	3200	0.023	SF	7.10	N/A	1.13	0.57	8.80	10.45	87098	\$766,462	
Columns	05 12 23.17.4550	Structural Steel Framing, Columns, HSS6"x6"x1/4"x12'	for HSS6x6x3/8,6x6x1/2	E-2	54	1.037	EA	360.00	396.00	52.00	28.50	476.50	520.00	278	\$132,467	
	05 12 23.17.4600	Structural Steel Framing, Columns, HSS8"x8"x3/8"x14'	for HSS8x8x1/2	E-2	50	1.12	EA	775.00	852.50	56.00	30.50	939.00	990.00	34	\$31,926	
	05 12 23.17.5700	Structural Steel Framing, Columns, HSS12"x8"x1/2"x16'	for HSS12x8x1/2,2,12x6x1/2	E-2	48	1.167	EA	1425.00	1567.50	58.50	32.00	1658.00	1725.00	5	\$8,290	
	05 12 23.17.7000	Structural Steel Framing, Columns, W10x45	for W10x33,49,54	E-2	1032	0.054	LF	65.50	72.05	2.72	1.48	76.25	78.50	1190	\$90,738	
	05 12 23.17.7050	Structural Steel Framing, Columns, W10x68	for W10x60,77	E-2	984	0.057	LF	99.00	108.90	2.86	1.55	113.31	116.00	411	\$46,514	
	05 12 23.17.7150	Structural Steel Framing, Columns, W12x50	for W12x40,50,58,65	E-2	1032	0.054	LF	73.00	80.30	2.72	1.48	84.50	86.50	378	\$31,912	
	05 12 23.17.7200	Structural Steel Framing, Columns, W12x87	for W12x72,79,96	E-2	984	0.057	LF	127.00	139.70	2.86	1.55	144.11	146.00	131	\$18,806	
	05 12 23.17.7350	Structural Steel Framing, Columns, W14x74	for W14x43,53,61,74,90,99	E-2	984	0.057	LF	108.00	118.80	2.86	1.55	123.21	126.00	628	\$77,376	
	05 12 23.17.7400	Structural Steel Framing, Columns, W14x120	for W14x109,120,145	E-2	960	0.058	LF	175.00	192.50	2.93	1.59	197.02	199.00	1093	\$215,343	
	05 12 23.17.7450	Structural Steel Framing, Columns, W14x176	for W14x176,211,257	E-2	912	0.061	LF	257.00	282.70	3.08	1.68	287.46	289.00	1135	\$326,267	
	05 12 23.17.8090	Structural Steel Framing, Columns, For Projects 75-99 tons add	234 tons steel	N/A	N/A	N/A	ALL	10%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	05 12 23.17.9000	Structural Steel Framing, Columns, Min. Labor/Equip. Charge			1 Ssk	1	8	JOB	0.00	0.00	410.00	0.00	410.00	750.00	1	\$410

Category	Line Number	Description	Notes	Crew	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Unit Total	Unit Total (O&P)	Quantity	Total
Forms	03 11 13.20.1150	Forms in Place, Exterior Beam, Job-Built Plywood, 18" Wide, 4 Use		C-2	315	0.152	SFCA	0.88	6.80	0.00	7.68	12.15	31460	\$241,613
	03 11 13.20.2150	Forms in Place, Interior Beam, Job-Built Plywood, 12" Wide, 4 Use		C-2	377	0.127	SFCA	1.15	5.70	0.00	6.85	10.60	67718	\$463,868
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	03 11 13.25.6150	Forms in Place, Column (16"x16") 4 Use	use for 18"	C-1	235	0.136	SFCA	0.83	5.95	0.00	6.78	10.65	24048	\$163,045
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	03 11 13.35.7000	Forms in Place, Elevated Slabs, Edge forms to 6" high, on elevated slab, 4 use		C-1	500	0.064	LF	0.18	2.79	0.00	2.97	4.78	2729	\$8,105
03 11 13.85.2550	Forms in Place, Walls, Job-Built Plywood 8'-16' high, 4 Use		C-2	395	0.122	SFCA	0.73	5.45	0.00	6.18	9.70	22546	\$139,334	

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	03 21 11.60.0702	Plain Steel Reinforcement Bar, In Place, Walls (#3-#7)		4 Rodm	6000	0.005	LB	0.50	0.27	0.00	0.77	0.99	14343	\$11,044
03 21 11.60.9000	Plain Steel Reinforcement Bar, In Place, Min. Labor/Equip. Charge		1 Rodm	4	2	JOB	0.00	101.00	0.00	101.00	166.00	1	\$101	

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 - SITE LOCATION
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ESTIMATES

System	Structure Cost	Difference
Steel	\$3,135,153	1.9%
Concrete	\$3,193,185	

SCHEDULE IMPACTS

STEEL

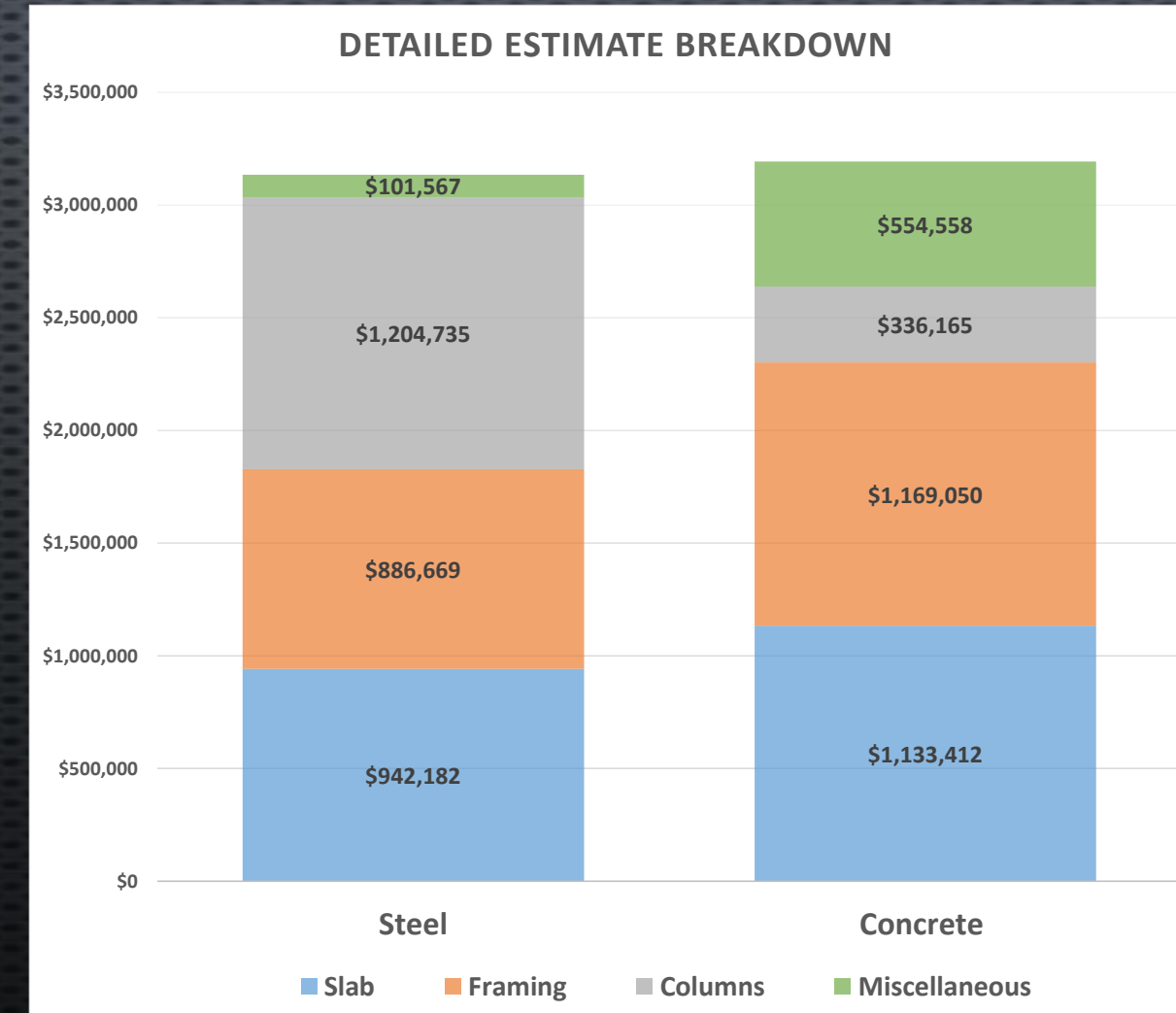
- STIMULANTS
 - GIRDER-SLAB
 - MORE SLIM
 - MATERIAL CONSISTENCY
- SETBACKS
 - ERECTING STEEL PIECES
 - WELDING

CONCRETE

- STIMULANTS
 - SIMPLIFIED LOAD PATH
 - FIRE-PROOFING
 - THERMAL PROPERTIES
- SETBACKS
 - LOCATING A CONTRACTOR
 - FORMWORK/CURING TIME

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ESTIMATES



SCHEDULE IMPACTS

STEEL

- STIMULANTS
 - GIRDER-SLAB
 - MORE SLIM
 - MATERIAL CONSISTENCY
- SETBACKS
 - ERECTING STEEL PIECES
 - WELDING

CONCRETE

- STIMULANTS
 - SIMPLIFIED LOAD PATH
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GOAL REVIEW

- SIMPLIFY COLUMN LAYOUT
- MAINTAIN FLOOR-TO-CEILING HEIGHT (AC MARRIOTT STANDARD 9'0")
- PROVIDE COST-EFFICIENT SYSTEM

- EXISTING CONDITIONS
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GOAL REVIEW

✓ SIMPLIFY COLUMN LAYOUT

MAINTAIN FLOOR-TO-CEILING HEIGHT (AC MARRIOTT STANDARD 9'0")

PROVIDE COST-EFFICIENT SYSTEM

- EXISTING CONDITIONS
 - SITE LOCATION
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GOAL REVIEW

- ✓ SIMPLIFY COLUMN LAYOUT
- ✓ MAINTAIN FLOOR-TO-CEILING HEIGHT (AC MARRIOTT STANDARD 9'0")
- PROVIDE COST-EFFICIENT SYSTEM

- EXISTING CONDITIONS
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GOAL REVIEW

- ✓ SIMPLIFY COLUMN LAYOUT
- ✓ MAINTAIN FLOOR-TO-CEILING HEIGHT (AC MARRIOTT STANDARD 9'0")
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- EXISTING CONDITIONS
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- FRIENDS, CLASSMATES & COLLEAGUES
- PARENTS

- EXISTING CONDITIONS
 - SITE LOCATION
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QUESTIONS/COMMENTS?



- EXISTING CONDITIONS
 - SITE LOCATION
 - BUILDING INFORMATION
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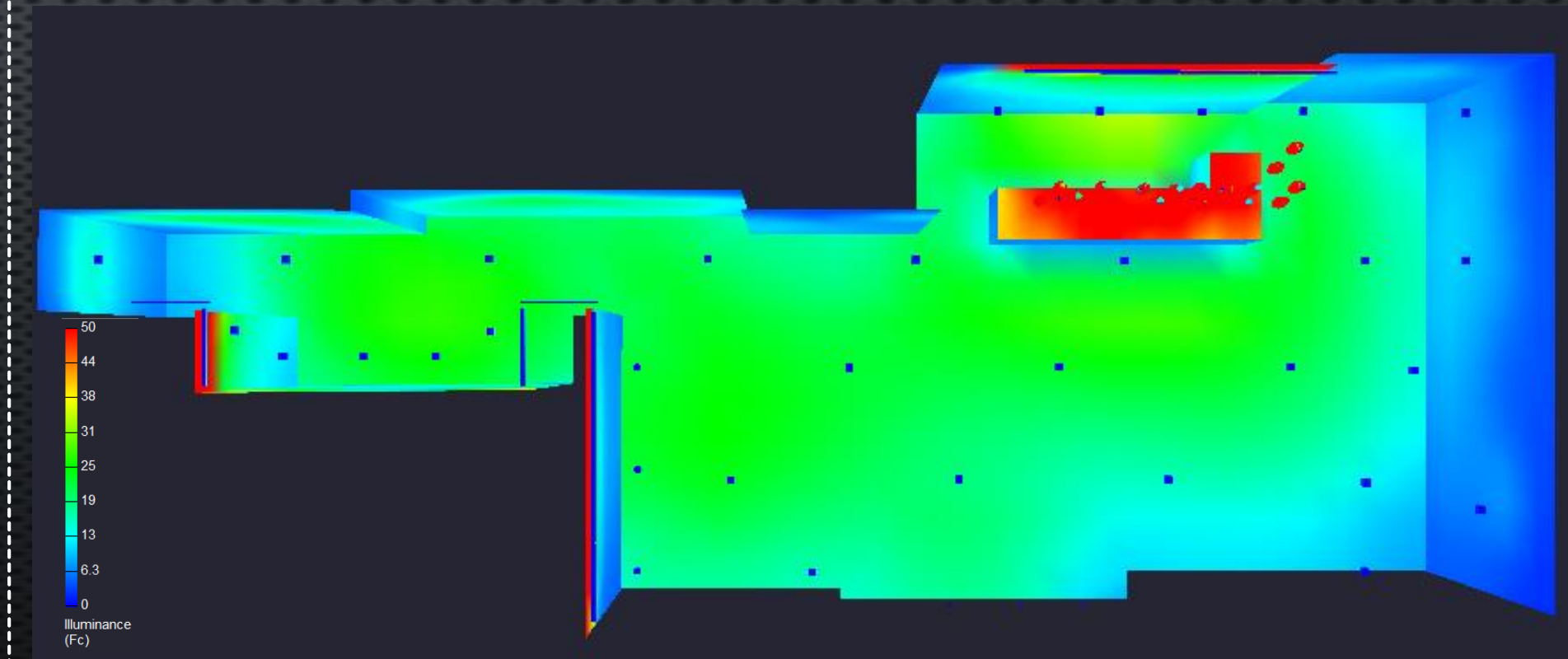
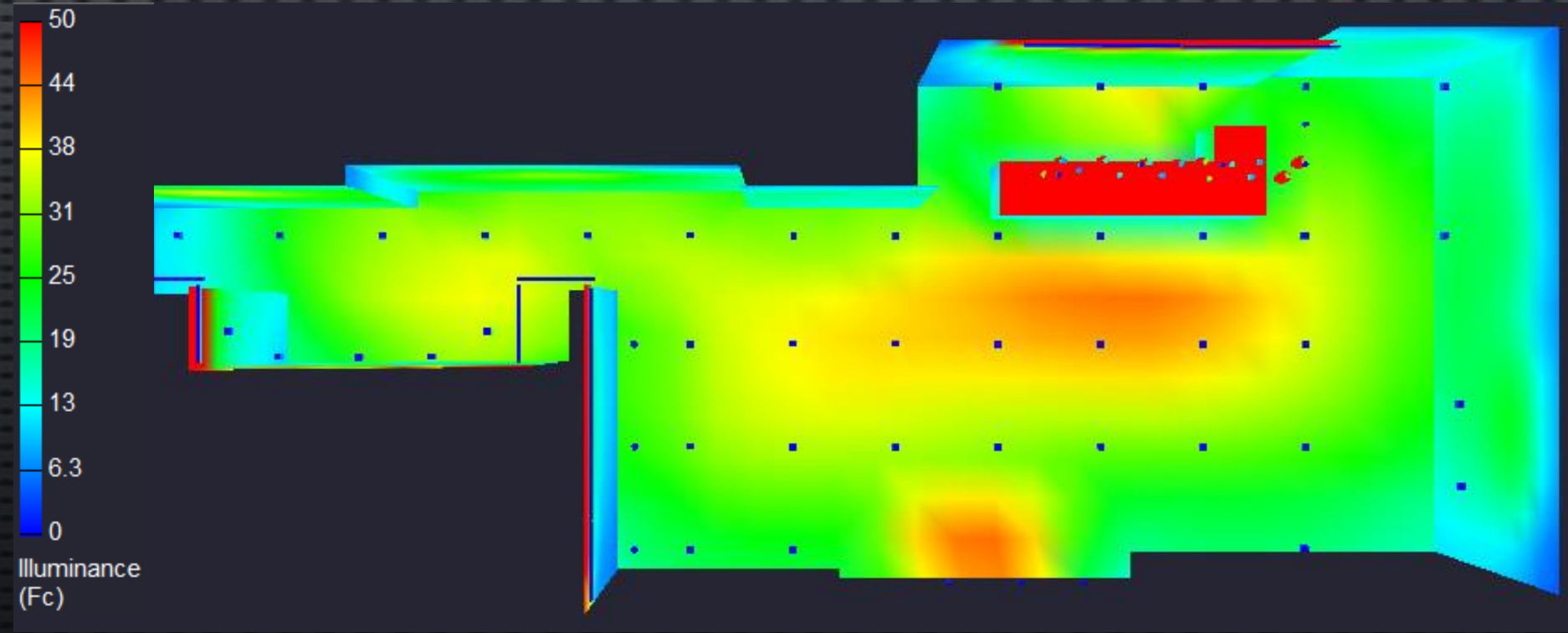
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- EXISTING CONDITIONS
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LIGHTING REDESIGN

Statistics			
Project 1			
Calc Pts			
Lobby_Workplane			
Illuminance (Fc)	Average=31.57	Maximum=54.3	Minimum=8.5
	Avg/Min=3.71	Max/Min=6.39	
Object_1_Top			
Illuminance (Fc)	Average=85.01	Maximum=108	Minimum=66.4
	Avg/Min=1.28	Max/Min=1.63	
Uniformity			
Illuminance (Fc)	Average=37.35	Maximum=46.5	Minimum=29.5
	Avg/Min=1.27	Max/Min=1.58	

Statistics			
Project 1			
Calc Pts			
Lobby_Workplane			
Illuminance (Fc)	Average=20.37	Maximum=37.4	Minimum=6.3
	Avg/Min=3.23	Max/Min=5.94	
Reception Desk_1_Top			
Illuminance (Fc)	Average=49.52	Maximum=55.8	Minimum=40.8
	Avg/Min=1.21	Max/Min=1.37	
Uniformity			
Illuminance (Fc)	Average=22.23	Maximum=31.4	Minimum=15.7
	Avg/Min=1.42	Max/Min=2.00	



LIGHTING REDESIGN

- EXISTING CONDITIONS
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System Comparison			
Cost	LED	Fluorescent	Fluorescent Option
Luminaires	\$15,887	\$7,732	51.3% cheaper
Annual Energy [kWh]	\$1,841	\$2,464	33.9% more expensive

