

# Hunter WoronStructuralSpring 2012Professor Parfitt

# Elotel Holland, Michigan





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# CITYFLATSHOTEL



#### CityFlatsHotel - Holland, MI

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Function:

Building



# Project Background

**Downtown Holland Michigan** Intersection of 7th Street and College Ave

Eco-Boutique Hotel with 56 Guestrooms Restaurant, Fitness Center, Cinema Room, Bar & Lounge

65,000 Square Feet Statistics: 5 Stories Above Grade

Overall Height of 67'-2"

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Owner: Charter House Innovations Contract: Design-Build Delivery Method Architect / GMB Architecture + Engineering Engineer: Construction **GDK Construction** Manager: Cost: \$7.2 Million Schedule: February 2007 to February 2008

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# Project Background

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# Project Background

# Existing Structural System



Foundation:	4" Concret
Gravity System:	CMU Load
	8" Precast w/ 2
	Steel Merr
Lateral System:	Reinforced
	Shear Wal Typically 8

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- te Slab
- Bearing Walls
- Hollow Core Planking ' Concrete Topping nbers Where Required
- d Concrete Masonry
- ' or 12" Thick CMU
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Project Statement:

**Project Solution:** 

# Scope of Work

Existing Structural System is the Most Efficient and Economical

Design a Viable Alternative System

Girder-Slab Composite Steel and Precast System



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![](_page_6_Picture_3.jpeg)

# Scope of Work

# Project Goals

![](_page_6_Picture_6.jpeg)

![](_page_6_Picture_7.jpeg)

#### Structural Depth:

- Reduce Overall Building Weight **Optimize Gravity and Lateral Systems** Verify Impact on Foundation

- Architectural / Façade Breadth:
  - Research Various Façade Options
  - Address Thermal and Sound Effects
- Construction Management Breadth: Impact on Overall Schedule and Cost
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#### Gravity System:

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![](_page_7_Picture_4.jpeg)

# Structural Depth Study

![](_page_7_Picture_6.jpeg)

- Composite Steel and Precast System
- Lightweight
- **Offers Quick Construction**
- Increases Overall Building Height
- Requires Fireproofing

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tv+	ats	Hotel	- H(	olla	nd.	

Live Loads (LL)									
Area	Design Load (PSF)								
Private Guest Rooms	40	40	40						
Public Spaces	100	100	100						
Corridors	100	40 (Private Corridor) /	40 (Private Corridor) /						
		100 (Public Corridor)	100 (Public Corridor)						
Lobbies	100	100	100						
Stairs	100	100	10						
Storage/Mechanical	125	125 (Light)	125						
Theater (Fixed)	60	60	60						
Restaurant/Bar	100	100	100						
Patio (Exterior)	100	100	100						
	Dead Load	ds (DL)							
Material	GMB Design Loads (PSF)	ASCE 7-05 Load (PSF)	Design Load (PSF)						
8" Precast w/ Topping	Unknown		81						
Steel	Unknown		Varies						
Partitions	Unknown	Castion 2.1	10						
MEP	Unknown	Section 5.1	10						
Finishes/Miscellaneous	Unknown		5						
Roof	Unknown		20						
	Snow Load	d (SL)							
Area	GMB Design Loads (PSF)	ASCE 7-05 (PSF)	Design Load (PSF)						
Flat Roof	35	35	35						

![](_page_8_Picture_0.jpeg)

Framing Plan:

Deflection Criteria:

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# Structural Depth Study

Typical Bay Size - 18' x 24' Beam Size: W18x40 Columns Aligned with Partition Walls Increased Floor-to-Ceiling Height

Controlling Load Combination:

 $1.2D + 1.6L + 0.5L_r$ Live Load: L/360 Total Load: L/240

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![](_page_8_Figure_13.jpeg)

Typical Floor Plan Layout

![](_page_8_Picture_15.jpeg)

#### Framing Plan

![](_page_9_Picture_0.jpeg)

Column Design:

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![](_page_9_Picture_8.jpeg)

# Structural Depth Study

- Comply with LRFD methods and AISC Steel Manual
- Optimal Members Designed by ETABS
- Resist Gravity Loads Only
- Typical Size W8x31

![](_page_9_Figure_15.jpeg)

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#### Typical Section of Structural Components

I. Project Background	
II. Scope of Work	Pre-Cast Pla
III. Structural Depth Study	Live Lo
i. Gravity System	Dead L
ii. Lateral Force Resisting System	Superir
iii. Recommendation & Conclusion	
IV. Architectural/Façade Breadth	PCI Design
V. Construction Management Breadth	66-S St
VI. Summary of Conclusions	6 Stran
VII. Acknowledgments	

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![](_page_10_Picture_3.jpeg)

# Structural Depth Study

- ank Design:
- bad: 40 PSF
- oad: 15 PSF
- mposed Dead: 25 PSF
- Handbook Results:
- trands
- nds @ 6/16" Diameter
- eight of 81 PSF

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![](_page_10_Figure_14.jpeg)

Strength is based on strain compatibility; bottom tension is limited to 7.5  $\sqrt{\xi}$  ; see pages 3-8 through 3-11 for explanation. See item 3, note 4, Section 3.3.2 for explanation of vertical line.

78-3

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2 in. Normalweight Toppi

3	14	15	15	17	18	19	20	21	22	4	24	2	26	27	28	29	30	31	32	33	34	35	36	37	38	19	40
1	365	333	308	282	256	224	197	173	153	12	119	10	- 93	- 82	- 68	56	45	36	26								
2	0.2	0.2	9.2	0.2	0.2	0.3	0.0	0.0	0.0	• •	0.2	0.	0.2	0.1	0.0	-0.0	-0.1	-0.2	-0.3	- 1							
2	0.2	0.2	0.2	02	0.2	0.2	0.2	0.1	0.1	0	-0.1	-0.	-0.3	-0.4	-0.6	-0.7	-0.9	-1.2	-1.4								
1	435	396	366	340	304	267	235	208	184	16-2	140	100	116	103	- 88	-74	62	- 51	- 41	- 31							
2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.1	0.0	-0.1	-0.2							
2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.0	-0.1	-0.2	-0.4	-0.5	0.7	0.9	-1.2	-14							
5	406	374	342	318	298	275	260	243	228	217	196	177	168	143	120	110	- 66	- 62	70	- 69	- 40	-40	32				
١.	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.1	0.3	0.2	0,1	0.0	-0.1				
1	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.4	0.3	0.3	0.3	0.2	0.1	-0.1	0.2	0.4	-0.5	-0.9	-1.2	-1.5	-1.8				
	463	426	393	366	342	319	299	282	267	251	239	216	195	177	158	140	124	110	97	- 84	73	62	53	-44	35	28	
	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	07	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	8.0	0.7	0.7	0.6	0.5	0.4	0.2	0.1	-0.1	
_	0.4	0.6	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.4	0.3	0.2	0.0	-0.2	-0.4	-4.6	-0.0	-1.2-	-1.6	-2.0	-2.4	
	472	435	402	315	348	325	305	288	273	257	245	232	220	207	186	167	149	133	119	108	94	83	73	64	55	46	38
	0.0	0.5	0.5	0.6	0.7	0.7	8.0	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	0.9	0.9	0.7	0.8	0.5	9.3
_	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.4	0.3	0.1	-0.1	0.3	0.6	0.9	-1.3	-1.7 -	2.2

![](_page_11_Picture_0.jpeg)

#### Lateral Force Resisting System:

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![](_page_11_Picture_4.jpeg)

# Structural Depth Study

![](_page_11_Figure_6.jpeg)

#### Assumptions and Considerations:

Modeled Lateral Members Only

Columns Pinned at Base

Beams and Braces Pinned

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- Floor Diaphragms Modeled as Rigid Elements
- Accidental and Inherent Torsion was Considered

# Structural Depth Study

I. Project Background II. Scope of Work III. Structural Depth Study i. Gravity System ii. Lateral Force Resisting System iii. Recommendation & Conclusion IV. Architectural/Façade Breadth V. Construction Management Breadth VI. Summary of Conclusions VII. Acknowledgments

Wind / Seismic Effects:

Design Wind and Seismic Load Cases Were Used

**Building We** Base She **Total Mom** 

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![](_page_12_Picture_6.jpeg)

- $1.2D + 1.6 W_{y} + 1.0L + 0.5L_{r}$
- $0.9D + 1.0E_{x}$

Seismic Comparison								
	<b>Existing Building Design</b>	New Building Design						
eight	10258 kips	7913 kips						
ar	463.7 kips	200 kips						
ent	15745 ft-k	7983 ft-k						

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#### Wind / Seismic Drifts:

Controlling Wind Drift									
Level	Height Above Ground, h (ft)	Allowable Drift ∆allowable = h/400	Total Drift (X-Direction)	Total Drift (Y-Direction)	Adequate				
Roof	74.92	2.25	1.11	1.53	Yes				
Level 5	58.00	1.74	0.84	1.13	Yes				
Level 4	44.00	1.32	0.60	0.81	Yes				
Level 3	30.00	0.90	0.38	0.51	Yes				
Level 2	16.00	0.48	0.19	0.29	Yes				
Level 1	0.00	0.00	0.00	0.00	Yes				

Drift Criteria:
Wind - H/40
Seismic - 0.0

![](_page_12_Figure_14.jpeg)

D2H<sub>SX</sub>

Controlling Seismic Drift										
	Height of Story, h (ft)	Allowable Story Drift Δallowable = 0.02hsx	Total Drift (X-Direction)	Total Drift (Y-Direction)	Adequate					
	16.92	0.34	0.0085	0.026	Yes					
	14.00	0.28	0.0056	0.017	Yes					
	14.00	0.28	0.0056	0.014	Yes					
	14.00	0.28	0.0056	0.010	Yes					
	14.00	0.28	0.0042	0.008	Yes					
	16.00	0.32	0.0011	0.002	Yes					

Overturning Moments									
			N/S Win	d Forces	E/W Seismic Forces				
Floor	Height Above Ground Z (ft)	Story Height (ft)	Lateral Force Fx (k)	Total Moment Mx (ft-k)	Lateral Force F: (k)	Total Moment mx (ft-k)			
Top of Roof	77.17	2.25	4.0	0.0	-	-			
Roof	74.92	16.92	34.3	77.2	17.4	1173.9			
Fifth	58.00	14.00	54.4	997.7	74.9	3818.1			
Fourth	44.00	14.00	47.5	1662.8	55.1	2037.5			
Third	30.00	14.00	45.7	2302.5	35.5	815.8			
Second	16.00	14.00	43.1	2906.0	17.2	137.9			
First	0.00	16.00	20.8	3196.9	0.0	0.0			
		Total=	249.8	11143.1	200.0	7983.2			

Overturning NOT a Concern - Gravity Loads Much Larger

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![](_page_13_Picture_6.jpeg)

# Structural Depth Study

#### Impact of Lateral Loads:

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#### Impact on Foundation:

![](_page_13_Figure_11.jpeg)

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#### TYPICAL COLUMN FOOTING

SEE FOOTING SCHEDULE FOR SIZE & REINFORCING

FOR FOOTING ELEVATION

ANCHOR BOLTS AT COLUMN LOCATIONS WHERE NO PIER IS REQUIRED

4/S7.01 FOR REINFORCING

OUTLINE OF CONCRETE PIER OR WALL - SEE FOUND. PLANS WHERE REQUIRED & DETAIL

# Structural Depth Study

I. Project Background	
II. Scope of Work	Structural C
III. Structural Depth Study	Steel S
i. Gravity System	and Se
ii. Lateral Force Resisting System	Reduce
iii. Recommendation & Conclusion	Doduo
IV. Architectural/Façade Breadth	Reduce
V. Construction Management Breadth	Increas
VI. Summary of Conclusions	
VII. Acknowledgments	Avoido

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![](_page_14_Picture_3.jpeg)

#### Conclusion:

- Structure Sufficiently Designed for Strength erviceability Requirements
- ed the Overall Building Weight
- ed Base Shear and Overturning Moment
- se Floor-to-Ceiling Height
- Increase Overall Building Height
- Avoided Major Architectural Changes / Impacts

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#### Structural Recommendation:

#### Viable Option as an Alternative Structural System

# Architectural/Façade Breadth

I. Project Background II. Scope of Work III. Structural Depth Study i. Gravity System ii. Lateral Force Resisting System iii. Recommendation & Conclusion IV. Architectural/Façade Breadth V. Construction Management Breadth VI. Summary of Conclusions VII. Acknowledgments

Goals:

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![](_page_15_Picture_4.jpeg)

- To Analyze the Thermal Effects of Alternative Facades
- Compare Construction Cost and Scheduling Impacts
- **Determine Additional Consequences of** Replacing the Existing Structure

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![](_page_15_Figure_9.jpeg)

#### www.masonrysystems.com

![](_page_15_Picture_11.jpeg)

www.kawneer.com

![](_page_15_Figure_14.jpeg)

![](_page_15_Figure_15.jpeg)

# Architectural/Façade Breadth

I. Project Background II. Scope of Work III. Structural Depth Study i. Gravity System ii. Lateral Force Resisting System iii. Recommendation & Conclusion IV. Architectural/Façade Breadth V. Construction Management Breadth VI. Summary of Conclusions VII. Acknowledgments

#### Thermal Gradients:

Existing CMU/Masonry System						
Between	ΣRo-x	Temperature				
Material	(°F-ft2-h/BTU)	(°F)				
0 - 1	0.17	0				
1 - 2	0.81	3.4				
2 - 3	1.79	7.6				
3 - 4	12.06	51.3				
4 - 5	15.26	64.9				
5 - I	15.82	67.3				
Total	16.46	70.0				
U-Va	lue = 0.0608 (BT®	ଥ7⊱ft2-h)				

1.Brick 2. Cavity 3. Insulation

4. CMU Block 5. Gyp Wall Board

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![](_page_16_Picture_7.jpeg)

![](_page_16_Figure_9.jpeg)

Brick Vaneer Ssytem					
Between	ΣRo-x	Temperature			
Material	(°F-ft2-h/BTU)	(°F)			
0 - 1	0.17	0			
1 - 2	0.81	3.4			
2 - 3	1.79	7.6			
3 - 4	3.11	13.2			
4 - 5	15.30	64.9			
5 - I	15.86	67.3			
Total	16.50	70.0			
U - Value = 0.0606 (BT PF - ft 2 - h)					

![](_page_16_Figure_11.jpeg)

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Curtain Wall System					
Between	ΣRo-x	Temperature			
Material	Material (°F-ft2-h/BTU)				
0 - 1	0.17	0			
1 - 2	2.27	26.5			
2 - 3	3.25	38.0			
3 - I	5.35	62.5			
Total	70.0				
U-Value = 0.167 (BT0F-ft2-h)					

![](_page_16_Figure_15.jpeg)

# Architectural/Façade Breadth

I. Project Background II. Scope of Work III. Structural Depth Study i. Gravity System ii. Lateral Force Resisting System iii. Recommendation & Conclusion IV. Architectural/Façade Breadth V. Construction Management Breadth VI. Summary of Conclusions VII. Acknowledgments

	Façade Comparisions							
	Façade of Exisiting System							
Wall System	S.F.	Crew Size	Material Cost , SF	Labor Cost , SF	Total Cost	Daily Output (SF)	Construction Time (Days)	
CMU/Brick System	8041	3 Bricklayers, 3 Bricklayer Helpers	\$7.65	\$14.90	\$181,325	130	62	
	Façade Systems for Redesigned System							
Wall System	S.F.	Crew Size	Material Cost , SF	Labor Cost / SF	Total Cost	Daily Output	Construction Time	
Brick Vaneer System / Metal Stud Backup	9183	3 Bricklayers, 2 Bricklayer Helpers	\$6.60	\$11.60	\$167,131	220	42	
Curtain Wall System	9183	2 Glazers, 2 Structural Stee Workers	\$24.50	\$8.85	\$306,253	205	45	

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![](_page_17_Picture_5.jpeg)

#### Cost and Time Comparison:

# Additional Concerns: Acoustics: Sound Absorbing Panels Hanging Ceilings Various Floor Coverings

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- Multiple Layers of Gypsum Wall Board

- Noise Limitations Important in Hotel

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# **Construction Management Breadth**

- Construction Schedule Impact:
  - Existing Structural System:
    - Start Date: March 23, 2007
    - End Date: August 23, 2007
  - Redesigned Structural System:
    - Start Date: March 23, 2007
    - End Date: July 26, 2007

### CityFlatsHotel - Holland, MI

	cipboard			Schedule	Taxa Insert
	Task Name	Duration	Start	Finish	
	·	*	*	*	ber Novembe/December/January February/March April May June July August Ser
70					152229 5 121926 3 1017243 17 142128 4 11825 4 11825 1 8 152229 6 132027 3 101724 1 8 15229 5 121926 2
72		005.1	E 1 0/4 0/07		Construction
13	Construction	225 days	Fri 2/16/07	Thu 12/27/07	
74	Foundation				Foundation U 3/22
75	Vibrocompaction	8 days	Fri 2/16/07	Tue 2/27/07	Vibrocompaction 2/27
76	Excavation & sheet pilings	2 wks	Wed 2/21/07	Tue 3/6/07	Excavation & sheet pilings and 3/6
77	Pour Foundations & Basement Walls	2 wks	Wed 3/7/07	Tue 3/20/07	Pour Foundations & Basement Walls 3/20
78	Backfil	2 days	Wed 3/21/07	Thu 3/22/07	Backfill   3/22
79	Sitework	184 days	Fri 3/23/07	Wed 12/5/07	Sitework
91	Structural				Structural 🗸 🖉 8
92	Basement Masonry	2 wks	Fri 3/23/07	Thu 4/5/07	Basement Masonry 💼 4/5
93	Basement Steel	1 wk	Fri 4/6/07	Thu 4/12/07	Basement Steel 👩 4/12
94	Precast for 1st floor	1 wk	Fri 4/13/07	Thu 4/19/07	Precast for 1st floor 📋 4/19
95	First Floor block walls	2 wks	Fri 4/20/07	Thu 5/3/07	First Floor block walls 📩 5/3
96	First Floor Steel	1 wk	Fri 5/4/07	Thu 5/10/07	First Floor Steel 🍙 5/10
97	Precast for 2nd floor	1 wk	Fri 5/11/07	Thu 5/17/07	Precast for 2nd floor 🍵 5/17
98	2nd floor block walls	2 wks	Fri 5/18/07	Thu 5/31/07	2nd floor block walls 5/31
99	2nd floor steel	1 wk	Fri 6/1/07	Thu 6/7/07	2nd floor steel 🧊 6/7
100	Precast for 3rd floor	1 wk	Fri 6/8/07	Thu 6/14/07	Precast for 3rd floor 📋 6/14
101	3rd Floor block walls	2 wks	Fri 6/15/07	Thu 6/28/07	3rd Floor block walls 👝 6/28
102	3rd Floor steel	1 wk	Fri 6/29/07	Thu 7/5/07	3rd Floor steel 🍙 7/5
103	Precast for 4th floor	1 wk	Fri 7/6/07	Thu 7/12/07	Precast for 4th floor 👩 7/12
104	4th Floor block walls	2 wks	Fri 7/13/07	Thu 7/26/07	4th Floor block walls 7/26
105	4th floor steel	1 wk	Fri 7/27/07	Thu 8/2/07	4th floor steel 🍈 8/2
106	Precast for 5th floor	1 wk	Fri 8/3/07	Thu 8/9/07	Precast for 5th floor 📋 8/9
107	5th Floor block walls	2 wks	Fri 8/10/07	Thu 8/23/07	5th Floor block walls 🚃 8/23
108	Roof joist & deck	1 wk	Fri 8/24/07	Thu 8/30/07	Roofjoist & deck 🔘 8/
109	Exterior Façade		Fri 5/18/07		Exterior Façade
110	Steel studs - 1st floor	1 wk	Fri 5/18/07	Thu 5/24/07	Steel studs - 1st floor 🍙 5/24
111	Steel studs 2nd floor	2 wks	Fri 6/15/07	Thu 6/28/07	Steel studs 2nd floor 👝 6/28
112	Steel studs 3rd floor	2 wks	Fri 7/13/07	Thu 7/26/07	Steel studs 3rd floor 📺 7/26
113	Steel studs 4th floor	2 wks	Fri 8/10/07	Thu 8/23/07	Steel studs 4th floor 🚃 8/23
114	Steel studs 5th floor	2 wks	Fri 8/31/07	Thu 9/13/07	Steel studs 5th floor
115	Storefronts	6 wks	Fri 9/14/07	Thu 10/25/07	Storefronts
116	Brick Veneer	5 wks	Fri 9/14/07	Thu 10/18/07	Brick Veneer
117	Metal Panels	2 wks	Fri 9/14/07	Thu 9/27/07	Metal Panels
118	Ceramic Panels	2 wks	Fri 9/14/07	Thu 9/27/07	Ceramic Panels
119	Roofing	1 wk	Fri 8/31/07	Thu 9/6/07	Roofing 🍙
120	Roof Equipment Enclosure	1 wk	Fri 9/7/07	Thu 9/13/07	Roof Equipment Enclosure
121	Interiors				Interiors

#### Redesigned Schedule

· · · · · · · · · · · · · · · · · · ·				
ask Name 👻	Duration 🖕	Start 👻	Finish 🗸 🗸	ry 1 March 1 April 1 May 1 June 1 July 1 August 1
Structural	90 days	Fri 3/23/07	Thu 7/26/07	Structural V 7/26
Basement Masonry	10 days	Fri 3/23/07	Thu 4/5/07	Basement Masonry 24/5
Basement Steel	5 days	Fri 4/6/07	Thu 4/12/07	Basement Steel 🚺 4/12
1st Floor Precast Plank	5 days	Fri 4/13/07	Thu 4/19/07	1st Floor Precast Plank 🛄 4/19
1st Floor Steel Columns	5 days	Fri 4/20/07	Thu 4/26/07	1st Floor Steel Columns 🚺 4/26
1st Floor Girders & Lat Bracing	5 days	Fri 4/27/07	Thu 5/3/07	1st Floor Girders & Lat Bracing 🚺 5/3
2nd Floor Precast Plank	5 days	Fri 5/4/07	Thu 5/10/07	2nd Floor Precast Plank 5/10
2nd Floor Steel Columns	5 days	Fri 5/11/07	Thu 5/17/07	2nd Floor Steel Columns 🚺 5/17
2nd Floor Girders & Lat Bracir	5 days	Fri 5/18/07	Thu 5/24/07	2nd Floor Girders & Lat Bracing 🔚 5/24
3rd Floor Precast Plank	5 days	Fri 5/25/07	Thu 5/31/07	3rd Floor Precast Plank 5/31
3rd Floor Steel Columns	5 days	Fri 6/1/07	Thu 6/7/07	3rd Floor Steel Columns [36/7
3rd Floor Girders & Lat Bracin	5 days	Fri 6/8/07	Thu 6/14/07	3rd Floor Girders & Lat Bracing 1/14
4th Floor Precast Plank	5 days	Fri 6/15/07	Thu 6/21/07	4th Floor Precast Plank
4th Floor Steel Columns	5 days	Fri 6/22/07	Thu 6/28/07	4th Floor Steel Columns 5/28
4th Floor Girders & Lat Bracin	5 days	Fri 6/29/07	Thu 7/5/07	4th Floor Girders & Lat Bracing 1/5
5th Floor Precast Plank	5 days	Fri 7/6/07	Thu 7/12/07	5th Floor Precast Plank
5th Floor Steel Columns	5 days	Fri 7/13/07	Thu 7/19/07	5th Floor Steel Columns [1] 7/19
Roof Joist and Deck	5 days	Fri 7/20/07	Thu 7/26/07	Roof Joist and Deck
Exterior Façade	20 days	Mon 7/9/07	Fri 8/3/07	Exterior Façade 🗸 8/3
Roofing	6 days	Fri 7/27/07	Fri 8/3/07	Roofing 8/3
Masonry Veneer	20 days	Mon 7/9/07	Fri 8/3/07	Masonry Veneer 28/3

![](_page_18_Figure_19.jpeg)

#### **Existing Schedule**

**Overall Cost Impact:** 

Compon CMU Wa Steel Brad Steel Fram Total

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![](_page_19_Picture_5.jpeg)

# **Construction Management Breadth**

Overall Cost Comparison							
ont	Existing	Redesigned	Additional Coc				
ent	System	System	Auditional Cos				
alls	\$701,125	\$160,975	-\$540,150				
cing	\$0	\$206,250	\$206,250				
ning	\$130,134	\$524,358	\$394,224				
	\$831,259	\$891,583	\$60,324				

Cost Estimate of Existing System								
Chao muo llo	Amount	lloit	Material	Labor Cost	Equipment	Total	Total Cost	Total Cost
Silearwalls	Amount	Unit	Cost/Unit	/Unit	Cost/Unit	Cost/Unit	w/O&P	Total Cost
8" CMU, reinforced	59500	SF	2.15	2.71	-	4.86	6.85	\$407,575
12" CMU, reinforced	28500	SF	3.11	4.16	-	7.27	10.30	\$293,550
Stool	Amount	lloit	Material	Labor Cost	Equipment	Total	Total Cost	Tabal Cash
Steer		Unit	Cost/Unit	/Unit	Cost/Unit	Cost/Unit	w/O&P	Total Cost
Columns	1400	LF	41.50	2.78	2.86	47.14	54.00	\$75,600
Baseplates	140	SF	21.00	-	-	21.00	23.00	\$3,220
Beams	1945	LF	12.30	2.09	2.15	16.54	19.90	\$38,706
Fireproofing	10420	SF	0.45	0.38	0.08	0.91	1.21	\$12,608
	Total Cost of Existing Systel \$831,259							

Cost Estimate of Redesigned System								
Shoompills	Amount	Unit	Material	Labor Cost	Equipment	Total	Total Cost	Total Cost
Silediwalis	Amount	Unit	Cost/Unit	/Unit	Cost/Unit	Cost/Unit	w/O&P	Total Cost
12" CMU, reinforced	23500	SF	2.15	2.71	_	4.86	6.85	\$160,975
Stool	Amount	Unit	Material	Labor Cost	Equipment	Total	Total Cost	Total Cost
Sleer	Amount	Unit	Cost/Unit	/Unit	Cost/Unit	Cost/Unit	w/O&P	Total Cost
Columns	6300	LF	41.50	2.78	2.86	47.14	54.00	\$340,200
Baseplates	520	SF	21.00	-	-	21.00	23.00	\$11,960
Beams	6750	LF	12.30	2.09	2.15	16.54	19.90	\$134,325
Braces	2500	LF	31.00	28.50	_	59.50	82.5	\$206,250
Fireproofing	31300	SF	0.45	0.38	0.08	0.91	1.21	\$37,873
Total Cost of Redesigned Syster \$891,583							esigned Syste	\$891,583

### CityFlatsHotel - Holland, MI

I. Project Background	
II. Scope of Work	Structural C
III. Structural Depth Study	Steel S
i. Gravity System	and Se
ii. Lateral Force Resisting System	Reduce
iii. Recommendation & Conclusion	Dedue
IV. Architectural/Façade Breadth	Reduc
V. Construction Management Breadth	Increas
VI. Summary of Conclusions	
VII. Acknowledgments	

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![](_page_20_Picture_3.jpeg)

# Summary of Conclusions

#### Conclusion:

- Structure Sufficiently Designed for Strength erviceability Requirements
- ed the Overall Building Weight
- ed Base Shear and Overturning Moment
- se Floor-to-Ceiling Height
- Increase Overall Building Height
- Avoided Major Architectural Changes / Impacts
  - CityFlatsHotel Holland, MI

Architectural / Façade Conclusions: Brick Veneer System Most Efficient Additional Acoustical Elements Required **Construction Management Conclusions** Reduced Schedule Period Minimal Increase of Up Front Cost

![](_page_20_Picture_14.jpeg)

CityFlatsHotel:

GDK Construction:

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![](_page_21_Picture_6.jpeg)

# Acknowledgments

- **Charter House Innovations:** 
  - Chuck Reid

  - Sara Lilly

  - Kara Slater
- GMB Architecture + Engineering
  - CityFlatsHotel Holland, MI

- The Pennsylvania State University:
  - •Professor Kevin Parfitt
  - •Professor Robert Holland
  - •The Entire AE Faculty and Staff
  - unconditional support and encouragement.

![](_page_21_Picture_21.jpeg)

# All my friends, family, and classmates for their

![](_page_22_Picture_0.jpeg)

![](_page_22_Picture_1.jpeg)

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![](_page_22_Picture_3.jpeg)

### Questions and Comments

![](_page_22_Picture_5.jpeg)

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