The Towers at Greenville Place
Tower 'B'

Wilmington, DE

Shawn M. Brandt

Structural

Outline

Introduction

Existing Structure
- Foundations
- Floor system
- Gravity system
- Lateral system

Proposal and Problem Statement
- Depth Topic
- Breadth Topics
  - Construction Management
  - Sustainability

Structural Redesign
- Gravity System
- Floor System
- Lateral System
- Weight Comparison
- Seismic Comparison

Construction Management Breadth
- Cost Comparison
- Schedule Comparison

Conclusions, Acknowledgements, Questions & Comments

Presentation Outline

- **Introduction**
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Introduction

Presentation Outline

- **Introduction**
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

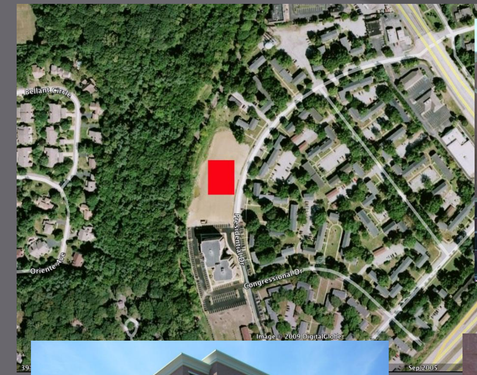
Location:
Wilmington Delaware

Owned and managed by:
Pettinaro Real Estate Development Company

Delivery Method:
Design-Bid-Build

Construction Time:
November 2006 – May 2008

Cost:
$11.5 Million



Presentation Outline

- **Introduction**
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Occupancy:

Upscale Residential Apartment Building (89 Units)

Size:

180,000 Square Feet

Stories:

7 Stories above grade
1 Story partially below grade

Major Building Codes:

IBC and amendments adopted by New Castle County (DE)

Presentation Outline

- Introduction
- **Existing Structure**
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Existing Structure

Presentation Outline

- Introduction
- **Existing Structure**
  - **Foundations**
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Foundations:

3000 psf allowable soil bearing capacity

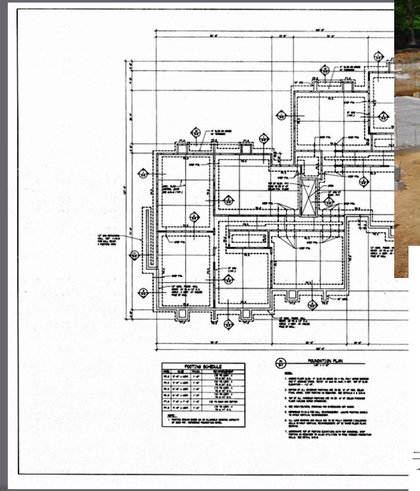
3000 psi concrete spread footings

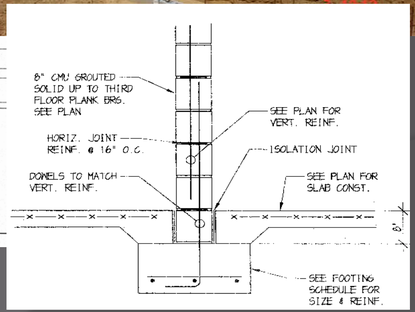
4 inch thick slab on grade

3500 psi concrete

On 4 inches of crushed stone

6x6 W1.4xW1.4 WWF





Presentation Outline

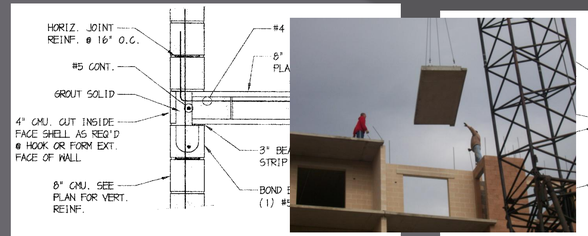
- Introduction
- **Existing Structure**
  - Foundations
  - **Floor system**
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

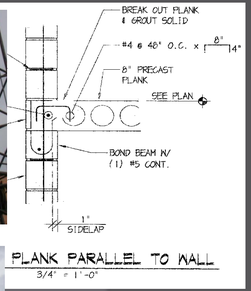
Floor System:

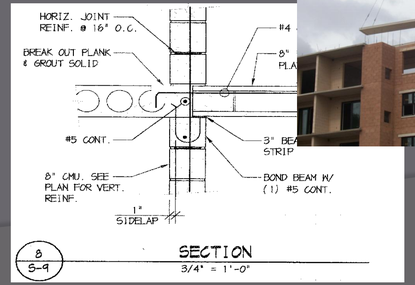
Precast Hollow Core Plank

Rest on 3 inch bearing plate on CMU bond beam

Tied in with #4 reinforcing bars spaced at 48 inches







Presentation Outline

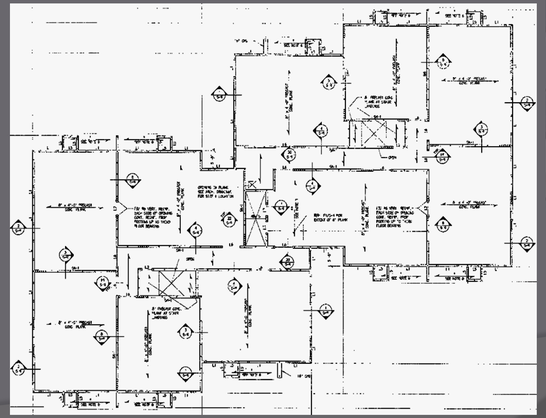
- Introduction
- **Existing Structure**
  - Foundations
  - Floor system
  - **Gravity system**
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

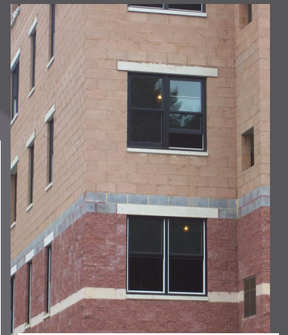
Gravity System:

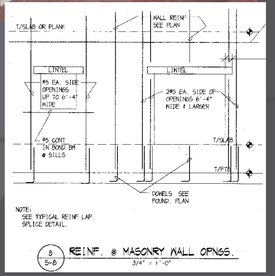
8 inch CMU
Decorative CMU on exterior walls

#4 reinforcing bars spaced at 32 or 48 inches (depending on level) in grouted cells

Window and door openings supported by precast lintels







Presentation Outline

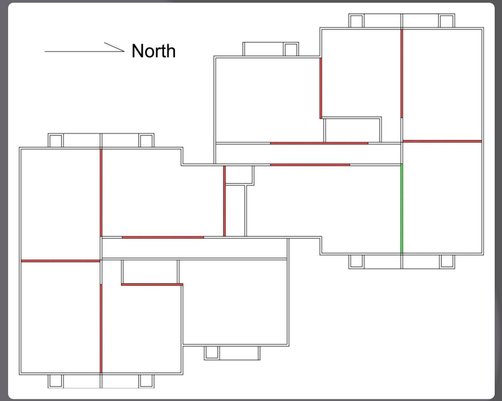
- Introduction
- **Existing Structure**
  - Foundations
  - Floor system
  - Gravity system
  - **Lateral system**
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

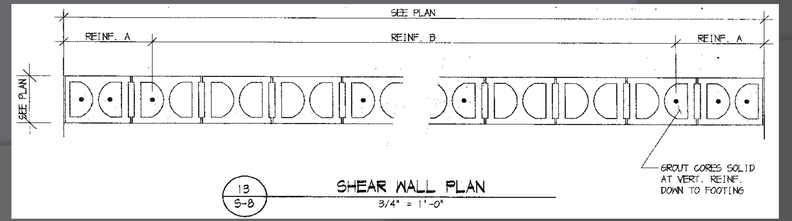
Lateral System:

8 inch CMU walls

Reinforced cells grouted solid all the way down to foundation

Reinforced according to level and load





Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- **Proposal and Problem Statement**
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Proposal and Problem Statement

Presentation Outline

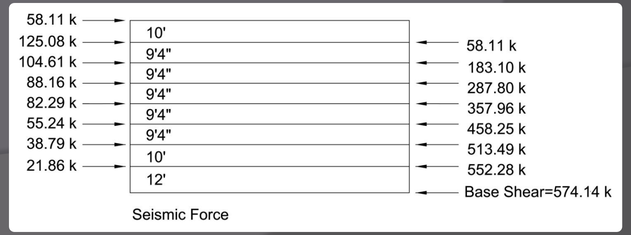
- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- **Proposal and Problem Statement**
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Problem Statement:

Large building self-weight

Lateral system design controlled by seismic force

Level	Dead Loads
Roof	821.30
7	1788.24
6	1738.89
5	1738.89
4	1738.89
3	1738.89
2	1738.89
1	1788.24
Ground	1685.56
Total Dead Load	14777.80



Seismic Force

Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- **Proposal and Problem Statement**
  - **Depth Topic**
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Proposed Solution:

Reduce building self-weight

Redesign entire structural system using the *Infinity Structural System*

Reduce seismic load

INFINITY STRUCTURES

Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- **Proposal and Problem Statement**
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Breadth Topics:

Construction Management
- **Cost Comparison**
- **Schedule Comparison**

Sustainability
- **Green roof**
- **Rainwater collection**

Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- **Structural Redesign**
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Depth Topic:
Structural Redesign

Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- **Structural Redesign**
  - **Gravity System**
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Gravity System:

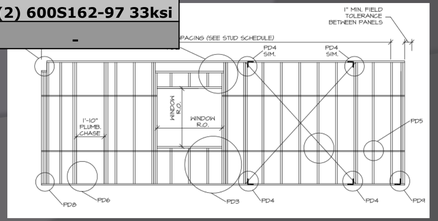
Ground floor structural system would remain similar to existing

"Pre-panelized" metal stud wall system

Additional walls added due to alternative floor system considerations

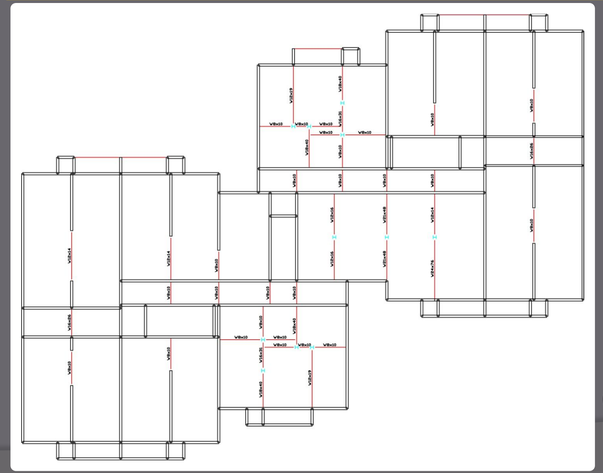
Studs sized according to manufacturer specs

Level	Floor Height	Total Load per Stud(s) (kips)	Stud Spacing (in)	Stud Type
Roof	-	-	-	-
7	10	1.36	16	600S162-54 33ksi
6	9.33	2.84	16	600S162-54 33ksi
5	9.33	4.32	16	600S162-68 33ksi
4	9.33	5.80	16	600S162-97 33ksi
3	9.33	7.28	16	600S162-97 33ksi
2	9.33	8.76	16	(2) 600S162-97 33ksi
1	10	10.24	16	(2) 600S162-97 33ksi
Ground	12	11.72	-	-

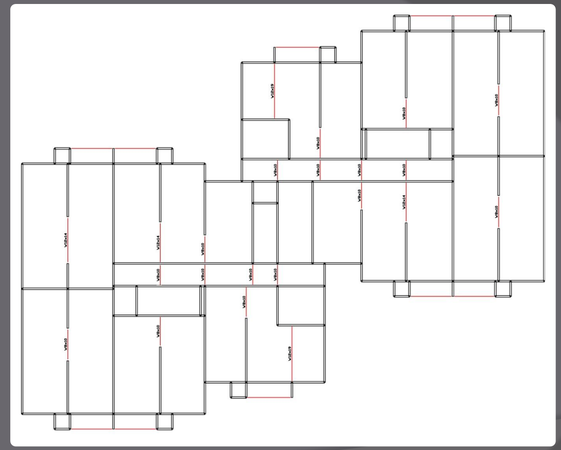


Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- **Structural Redesign**
  - **Gravity System**
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments



Ground Level Layout



Typical Level Layout

Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- **Structural Redesign**
  - Gravity System
  - **Floor System**
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

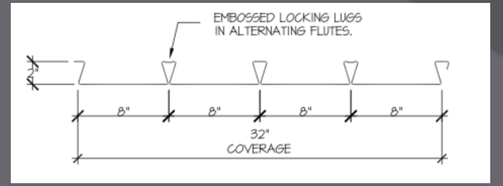
Floor System:

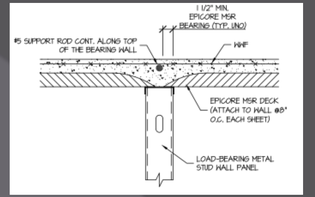
Slab on deck system
4 inch total system depth

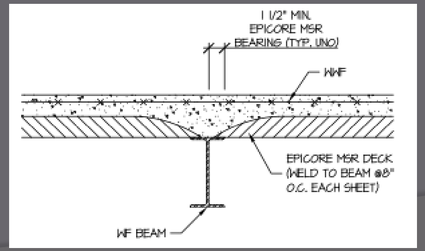
Epicore MSR 20 gage composite deck

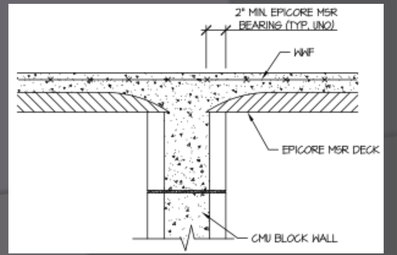
Dovetail shaped composite decking flutes provides sufficient reinforcement across spans without need for reinforcing bar

4000 psi concrete









Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- **Structural Redesign**
  - Gravity System
  - **Floor System**
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

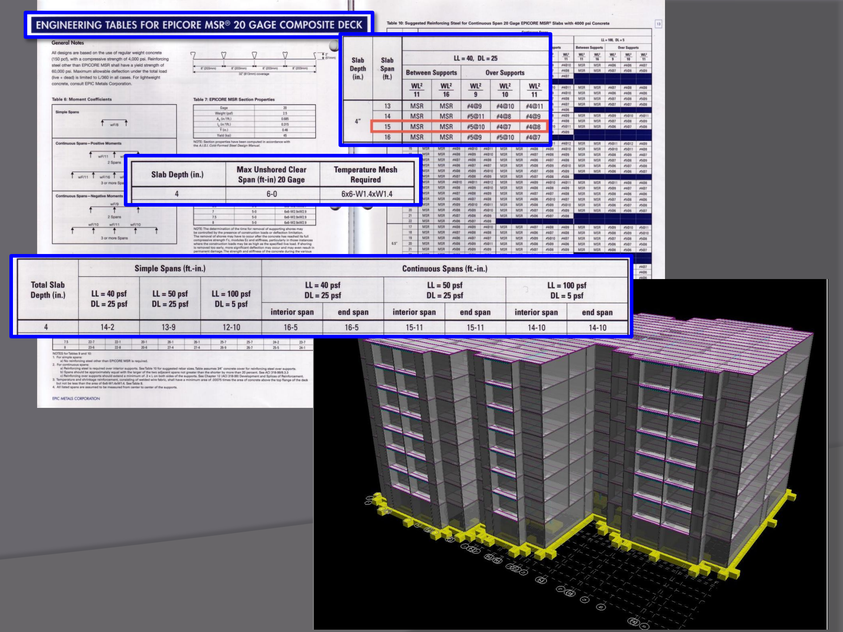
Floor System:

#4 reinforcing bars spaced at 8 inches over supports

6x6-W1.4xW1.4 WWF

Slab and deck sized from Epicore MSR catalog

Beams and columns sized in RAM Structural System program

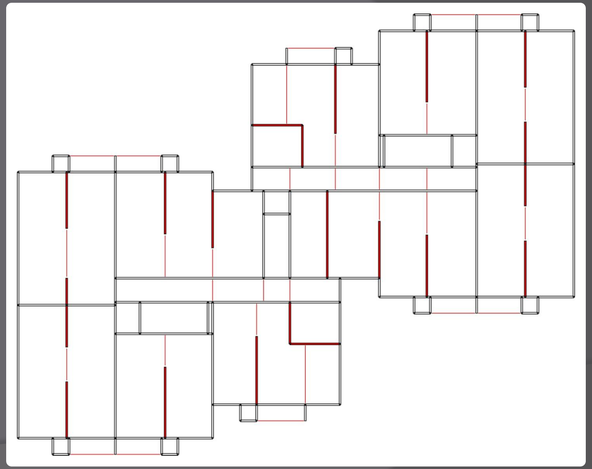


Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- **Structural Redesign**
  - Gravity System
  - **Floor System**
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Floor System:

Interior partition walls reassigned as load bearing



Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- **Structural Redesign**
  - Gravity System
  - Floor System
  - **Lateral System**
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Lateral System:

"Infinity Shear Panels" (ISP)

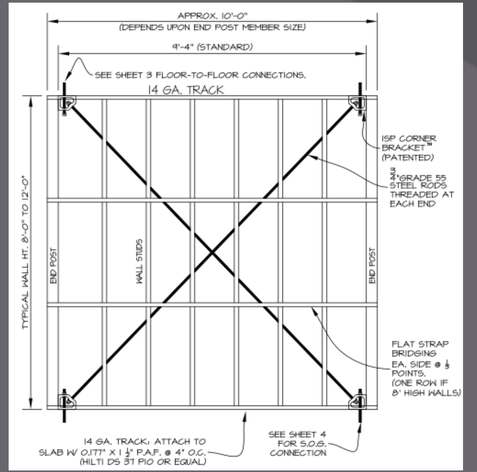
¾ inch round threaded grade 55 steel rods

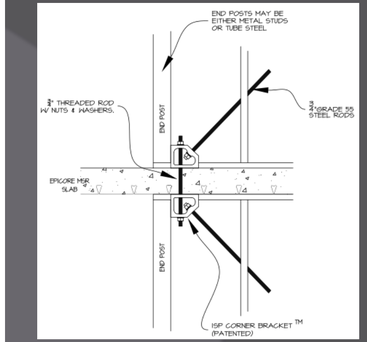
10 ft wide panels

Thru-bolted assembly from level to level for continuously braced lateral system

Rods inside wall, no surface bulging

Metal stud size and spacing match gravity system





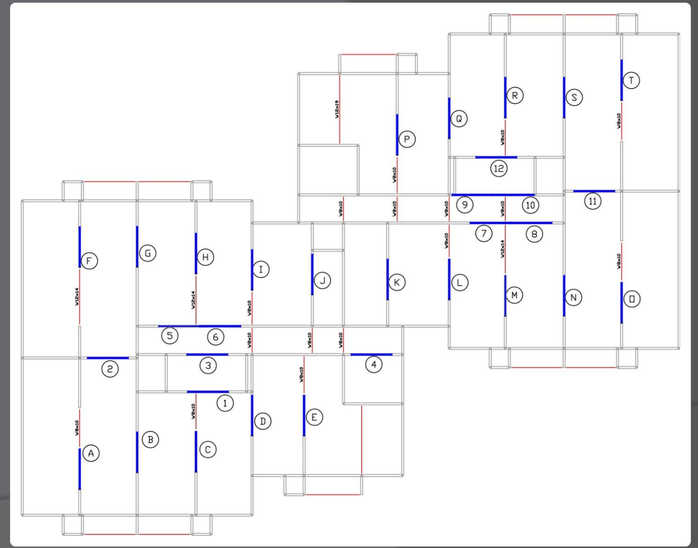
ISP HEIGHT	ALLOWABLE
8'- 0"	9.40K
8'- 6"	9.13K
9'- 0"	8.87K
9'- 6"	8.61K
10'- 0"	8.36K
10'-6"	8.13K
11'- 0"	7.90K
11'- 6"	7.68K
12'- 0"	7.47K

Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- **Structural Redesign**
  - Gravity System
  - Floor System
  - **Lateral System**
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Lateral System:

Shear wall layout



Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- **Structural Redesign**
  - Gravity System
  - Floor System
  - Lateral System
  - **Weight Comparison**
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Weight Comparison:

Level	Dead Loads
Roof	821.30
7	1788.24
6	1738.89
5	1738.89
4	1738.89
3	1738.89
2	1738.89
1	1788.24
Ground	1685.56
Total Dead Load	14777.80

Existing Weight

Level	Dead Loads
Roof	1025.82
7	873.75
6	872.41
5	877.05
4	886.22
3	886.22
2	918.69
1	922.36
Ground	1503.82
Total Dead Load	8766.34

Redesigned Weight (including wet green roof deal load)

Self weight Comparisons	
Existing	14,777.80 Kips
Redesigned	8,766.34 Kips
Difference	-6,011.46 Kips
Percent Reduction	41% Reduction

Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- **Structural Redesign**
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - **Seismic Comparison**
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

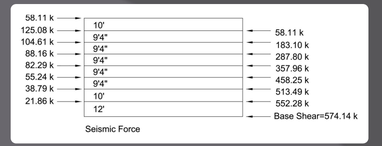
Seismic Comparison:

Level	Fx (Kips)	Vx (Kips)	Overturning Moment (ft-k)
Roof	58.11	-	-
7	125.08	58.11	3990.20
6	104.61	183.18	10868.27
5	88.16	287.80	14389.83
4	82.29	375.96	17545.99
3	55.24	458.25	14356.95
2	38.79	513.49	11296.82
1	21.86	552.28	6627.40
Ground	0.00	574.14	-
		Total Overturning Moment=	79075.45

Existing Seismic

Level	Fx (Kips)	Vx (Kips)	Overturning Moment (ft-k)
Roof	86.86	-	-
7	62.95	86.86	5964.94
6	54.29	149.81	8888.20
5	46.03	204.10	10204.86
4	43.49	250.13	11673.57
3	29.19	293.62	9199.08
2	21.37	322.81	7101.89
1	11.71	344.19	4130.25
Ground	0.00	355.90	-
		Total Overturning Moment=	57162.78

Redesigned Seismic



Existing Seismic

Redesigned Seismic

Seismic Comparisons	
Existing	574.14 Kips
Redesigned	355.90 Kips
Difference	-218.24 Kips
Percent Reduction	38% Reduction

Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- **Construction Management Breadth**
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Breadth Topic:
Construction Management

Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- **Construction Management Breadth**
  - **Cost Comparison**
  - Schedule Comparison
- Conclusions – Acknowledgements – Questions & Comments

Cost Comparison:

Quantity	Description	Ext. Mat. O&P	Ext. Labor O&P	Ext. Equip. O&P	Ext. Total O&P
1130 SFCA	C.I.P. concrete forms	9266	5650	0	14916
3390 C.Y.	Structural concrete, 3000 psi	376290	0	0	376290
480 C.Y.	Structural concrete, 4000 PSI	55680	0	0	55680
179014 Ea.	Concrete block	270311.14	0	0	270311.14
90895 S.F.	Precast slab	731704.75	154521.5	59081.75	945308
5.2 Ton	Reinforcing steel #4 to #7, footings	8450	5720	0	14170
7.7 Lb.	Reinforcing steel, #3 to #7, floors, walls	6.85	6.01	0	12.86
129.85 C.S.F.	Welded wire fabric 6 x 6 - W1.4 x W1.4	2577.52	4349.98	0	6927.5
362 L.F.	Concrete block, lintel	1339.4	2298.7	184.62	3822.72
Total		$1455625.66	$172546.19	$59266.37	$1,687,438.22

Existing Structural Costs

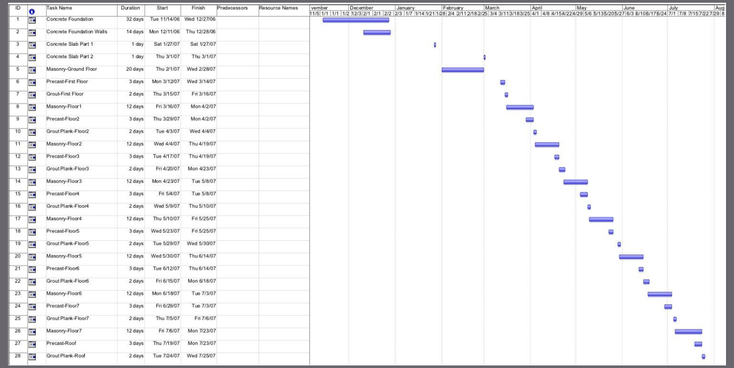
Quantity	Description	Ext. Mat. O&P	Ext. Labor O&P	Ext. Equip. O&P	Ext. Total O&P
4200 C.Y.	Structural concrete, 3000 psi	466200	0	0	466200
1130 SFCA	concrete forms	9266	5650	0	14916
10770 L.F.	Metal studs	200860.5	146472	0	347332.5
1039 C.S.F.	Welded wire fabric 6 x 6 - W1.4 x W1.4	20624.15	34806.5	0	55430.65
10.1 Ton	Reinforcing steel, footings, #4 to #7	16412.5	11110	0	27522.5
103880 S.F.	Metal decking	470576.4	78948.8	4155.2	553680.4
1642 L.F.	W8x10	29802.3	11411.9	5237.98	46452.18
58 L.F.	W18x40	4205	368.3	124.7	4698
530 L.F.	W12x16	15370	2512.2	1155.4	19037.6
16.5 L.F.	W16x26	775.5	68.81	31.68	875.99
20.08 L.F.	W16x31	1134.52	92.97	42.77	1270.26
25 L.F.	W18x35	1587.5	158.75	53.75	1800
3847 C.Y.	Structural concrete, 4000 PSI	446252	0	0	446252
82 L.F.	W10x45	6683	331.28	152.52	7166.8
36 L.F.	W12x87	5688	152.64	70.2	5910.84
44.3 Ton	Reinforcing steel, #7 to #11	2347.9	0	0	2347.9
Total		$1697785.27	$292084.14	$11024.20	$2,000,893.61

Redesigned Structural Costs

Structural Cost Comparisons	
Existing	$1,687,438.22
Redesigned	$2,000,893.61
Difference	+$313,455.39
Percent Difference	19% Increase

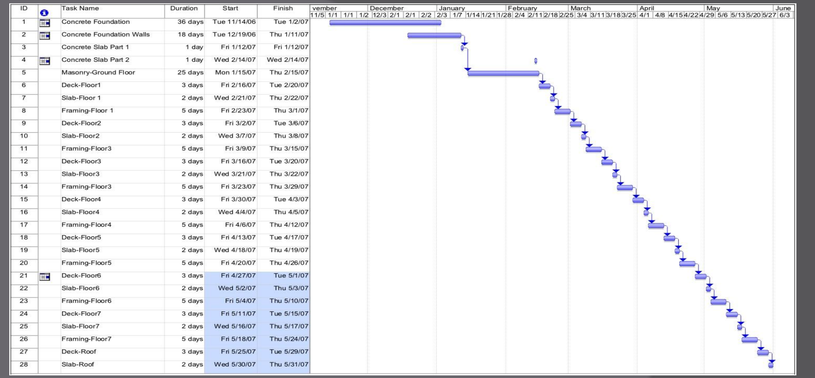
Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- **Construction Management Breadth**
  - Cost Comparison
  - **Schedule Comparison**
- Conclusions – Acknowledgements – Questions & Comments



ID	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1	Concrete Foundation	32 days	Tue 11/14/06	Wed 12/27/06		
2	Concrete Foundation Walls	14 days	Mon 12/11/06	Thu 12/28/06		
3	Concrete Slab Part 1	1 day	Sat 1/27/07	Sat 1/27/07		
4	Concrete Slab Part 2	1 day	Thu 3/1/07	Thu 3/1/07		
5	Masonry-Ground Floor	20 days	Thu 2/1/07	Wed 2/28/07		
6	Precast-First Floor	3 days	Mon 3/12/07	Wed 3/14/07		
7	Grout-First Floor	2 days	Thu 3/15/07	Fri 3/16/07		
8	Masonry-Floor1	12 days	Fri 3/16/07	Mon 4/2/07		
9	Precast-Floor2	3 days	Thu 3/29/07	Mon 4/2/07		
10	Grout Plank-Floor2	2 days	Tue 4/3/07	Wed 4/4/07		
11	Masonry-Floor2	12 days	Wed 4/4/07	Thu 4/19/07		
12	Precast-Floor3	3 days	Tue 4/17/07	Thu 4/19/07		
13	Grout Plank-Floor3	2 days	Fri 4/20/07	Mon 4/23/07		
14	Masonry-Floor3	12 days	Mon 4/23/07	Tue 5/8/07		
15	Precast-Floor4	3 days	Fri 5/4/07	Tue 5/8/07		
16	Grout Plank-Floor4	2 days	Wed 5/9/07	Thu 5/10/07		
17	Masonry-Floor4	12 days	Thu 5/10/07	Fri 5/25/07		
18	Precast-Floor5	3 days	Wed 5/23/07	Fri 5/25/07		
19	Grout Plank-Floor5	2 days	Tue 5/29/07	Wed 5/30/07		
20	Masonry-Floor5	12 days	Wed 5/30/07	Thu 6/14/07		
21	Precast-Floor6	3 days	Tue 6/12/07	Thu 6/14/07		
22	Grout Plank-Floor6	2 days	Fri 6/15/07	Mon 6/18/07		
23	Masonry-Floor6	12 days	Mon 6/18/07	Tue 7/3/07		
24	Precast-Floor7	3 days	Fri 6/29/07	Tue 7/3/07		
25	Grout Plank-Floor7	2 days	Thu 7/5/07	Fri 7/6/07		
26	Masonry-Floor7	12 days	Fri 7/6/07	Mon 7/23/07		
27	Precast-Roof	3 days	Thu 7/19/07	Mon 7/23/07		
28	Grout Plank-Roof	2 days	Tue 7/24/07	Wed 7/25/07		

Existing Structural Construction Time



ID	Task Name	Duration	Start	Finish
1	Concrete Foundation	36 days	Tue 11/14/06	Tue 1/2/07
2	Concrete Foundation Walls	18 days	Tue 12/19/06	Thu 1/11/07
3	Concrete Slab Part 1	1 day	Fri 1/12/07	Fri 1/12/07
4	Concrete Slab Part 2	1 day	Wed 2/14/07	Wed 2/14/07
5	Masonry-Ground Floor	25 days	Mon 1/15/07	Thu 2/15/07
6	Deck-Floor1	3 days	Fri 2/16/07	Tue 2/20/07
7	Slab-Floor 1	2 days	Wed 2/21/07	Thu 2/22/07
8	Framing-Floor 1	5 days	Fri 2/23/07	Thu 3/1/07
9	Deck-Floor2	3 days	Fri 3/2/07	Tue 3/6/07
10	Slab-Floor2	2 days	Wed 3/7/07	Thu 3/8/07
11	Framing-Floor3	5 days	Fri 3/9/07	Thu 3/15/07
12	Deck-Floor3	3 days	Fri 3/16/07	Tue 3/20/07
13	Slab-Floor3	2 days	Wed 3/21/07	Thu 3/22/07
14	Framing-Floor3	5 days	Fri 3/23/07	Thu 3/29/07
15	Deck-Floor4	3 days	Fri 3/30/07	Tue 4/3/07
16	Slab-Floor4	2 days	Wed 4/4/07	Thu 4/5/07
17	Framing-Floor4	5 days	Fri 4/6/07	Thu 4/12/07
18	Deck-Floor5	3 days	Fri 4/13/07	Tue 4/17/07
19	Slab-Floor5	2 days	Wed 4/18/07	Thu 4/19/07
20	Framing-Floor5	5 days	Fri 4/20/07	Thu 4/26/07
21	Deck-Floor6	3 days	Fri 4/27/07	Tue 5/1/07
22	Slab-Floor6	2 days	Wed 5/2/07	Thu 5/3/07
23	Framing-Floor6	5 days	Fri 5/4/07	Thu 5/10/07
24	Deck-Floor7	3 days	Fri 5/11/07	Tue 5/15/07
25	Slab-Floor7	2 days	Wed 5/16/07	Thu 5/17/07
26	Framing-Floor7	5 days	Fri 5/18/07	Thu 5/24/07
27	Deck-Roof	3 days	Fri 5/25/07	Tue 5/29/07
28	Slab-Roof	2 days	Wed 5/30/07	Thu 5/31/07

Redesigned Structural Construction Time

Structural Construction Time Comparison	
Existing	**192 Days**
Redesigned	**156 Days**
Difference	**-36 Days**
Percent Difference	**19% Reduction**

Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- **Conclusions** – Acknowledgements – Questions & Comments

Conclusions:

Depth Topic

Advantages:

-Successfully reduced weight and
-Seismic forces

Disadvantages:

-Partition walls must be reassigned as load bearing
-Columns placed in open areas

Conclusions:

Construction Management Breadth

Advantages:

-Faster construction time

Disadvantages:

-Greater cost of construction

Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – **Acknowledgements** – Questions & Comments

Acknowledgments

Baker, Ingram, and Associates:
Larry Baker
Tom Woods
Mary Longenecker

Infinity Structures:
Jeffrey Hundley

Abel Consulting Engineers:
Brian Abel
Nate Boczkowski

Pettinaro :
William Netta

The Pennsylvania State University :
Professor M. Kevin Parfitt
Dr. Richard Behr
Professor Robert Holland

A special thank you to my family, friends, and classmates for their continued and ongoing support

Presentation Outline

- Introduction
- Existing Structure
  - Foundations
  - Floor system
  - Gravity system
  - Lateral system
- Proposal and Problem Statement
  - Depth Topic
  - Breadth Topics
    - Construction Management
    - Sustainability
- Structural Redesign
  - Gravity System
  - Floor System
  - Lateral System
  - Weight Comparison
  - Seismic Comparison
- Construction Management Breadth
  - Cost Comparison
  - Schedule Comparison
- Conclusions – Acknowledgements – **Questions & Comments**

Questions
&
Comments