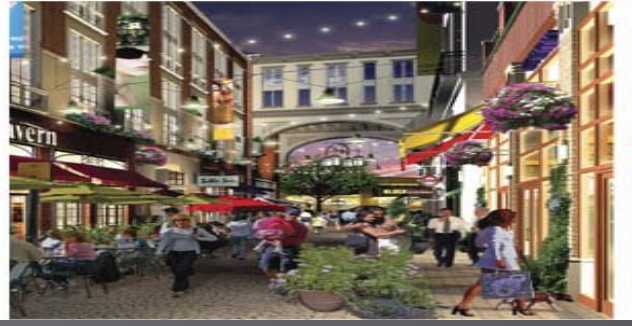


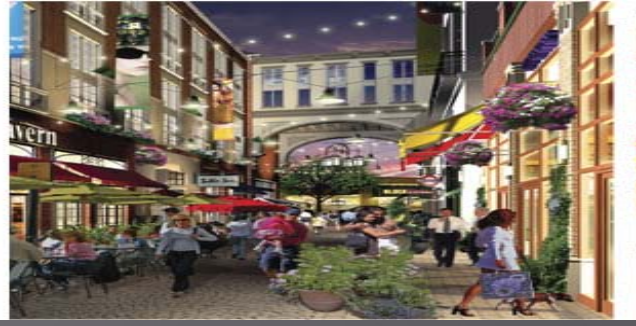



JIM GARZON

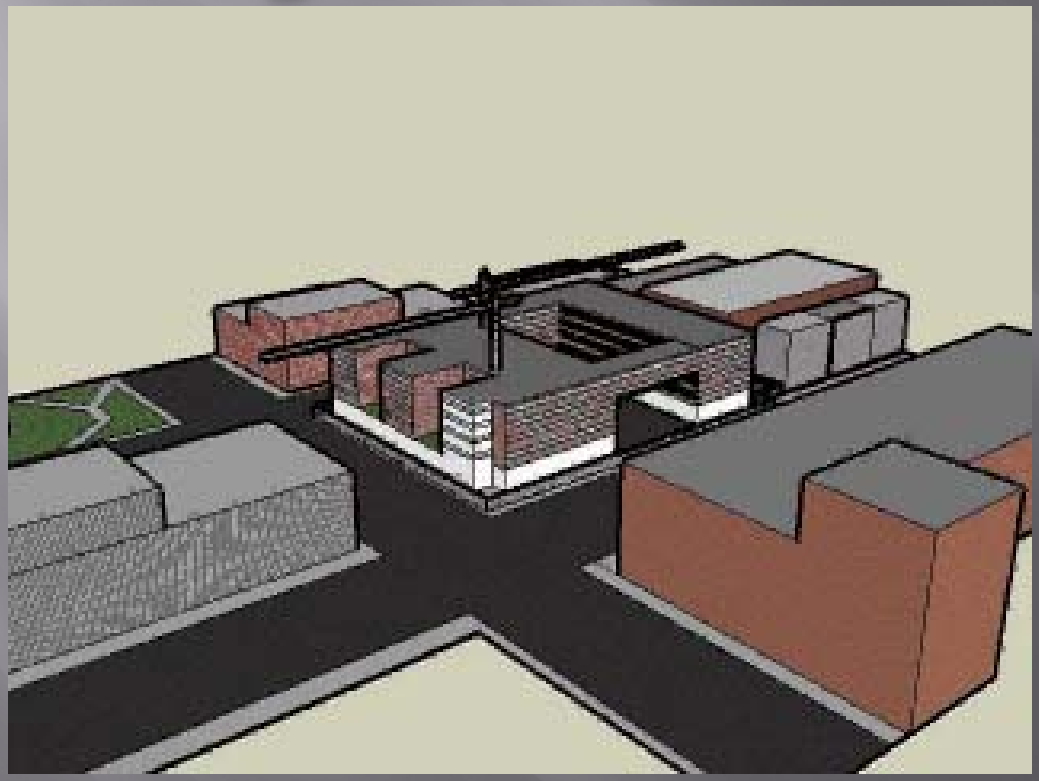
PENN STATE. AE CONSTRUCTION MANAGEMENT

APARTMENT COMPLEX ANYTOWN, USA





PROJECT BACKGROUND



Type of building:
Mixed-use residential building
(Retail, and residential)

Size (total square feet):
423,469 SF

Number of stories above grade:
Five Floors above ground

Dates of construction (start – finish):
August 21, 2006 – April 11, 2008

Actual cost information:
Contract Amount: $ 50,047,750
General Conditions: $ 2,972,441
4.5% Fee

Project delivery method:
Design-Bid-Built

SCHEDULE

ID	Task Name	Duration	Start	Finish
1	Design/Preconstruction	166 days	Mon 6/6/05	Mon 1/23/06
2	Purchase Subs	23 days	Mon 1/16/06	Wed 2/15/06
3	Permitting	117 days	Wed 11/9/05	Thu 4/20/06
4	NTP	0 days	Mon 4/24/06	Mon 4/24/06
5	Sitework and Mobilization	48 days	Mon 4/24/06	Wed 6/28/06
6	Excavation	49 days	Fri 6/30/06	Wed 9/6/06
7	Foundations	57 days	Thu 8/3/06	Fri 10/20/06
8	Superstructure	140 days	Mon 10/23/06	Fri 5/4/07
9	Interior Framing	71 days	Thu 2/8/07	Thu 5/17/07
10	Concrete	136 days	Wed 8/2/06	Wed 2/7/07
11	Roof	12 days	Tue 5/22/07	Wed 6/6/07
12	Exterior Enclosure	168 days	Thu 2/22/07	Mon 10/15/07
13	Mechanical Rough in	10 days	Fri 9/21/07	Thu 10/4/07
14	Electrical Rough in	10 days	Fri 10/26/07	Thu 11/8/07
15	Plumbing Rough in	5 days	Fri 10/26/07	Thu 11/1/07
16	First Floor Complete	0 days	Wed 11/28/07	Wed 11/28/07
17	Second Floor Complete	0 days	Fri 12/7/07	Fri 12/7/07
18	Interior Finishes	131 days	Fri 9/14/07	Fri 3/14/08
19	Third Floor Complete	0 days	Thu 1/3/08	Thu 1/3/08
20	Fourth Floor Complete	0 days	Wed 2/20/08	Wed 2/20/08
21	Fifth Floor Complete	0 days	Fri 3/14/08	Fri 3/14/08
22	Final Cleaning	15 days	Mon 3/17/08	Fri 4/4/08
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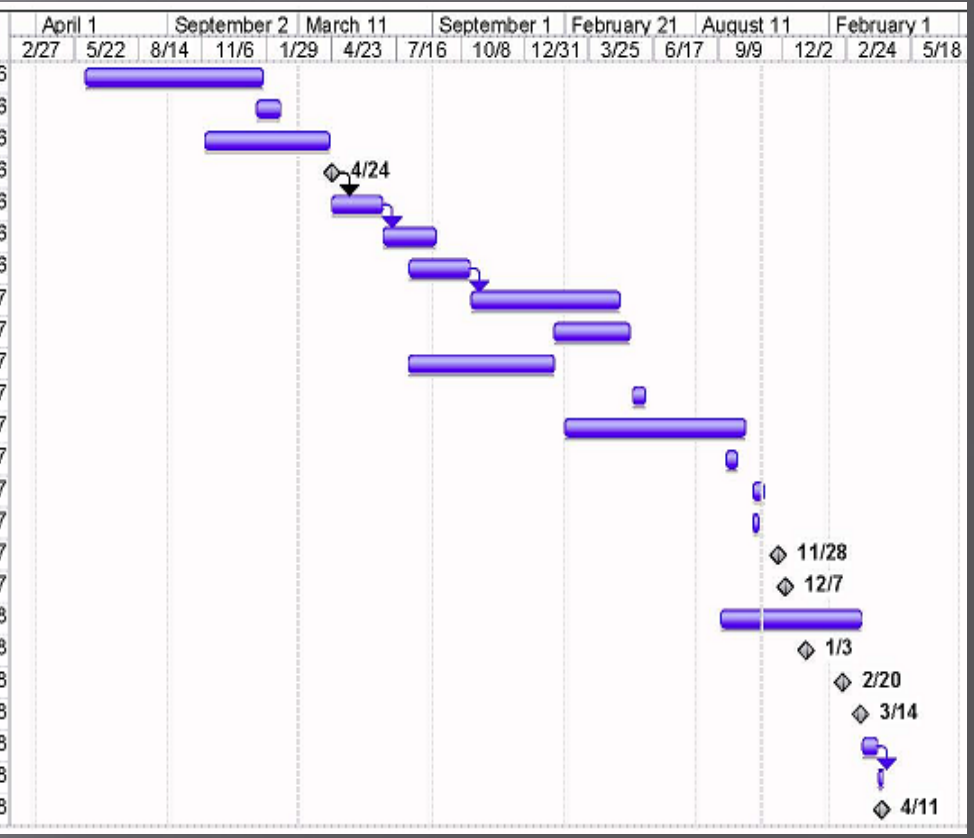


BUILDING SYSTEM SUMMARY

- Structural System
- Mechanical System

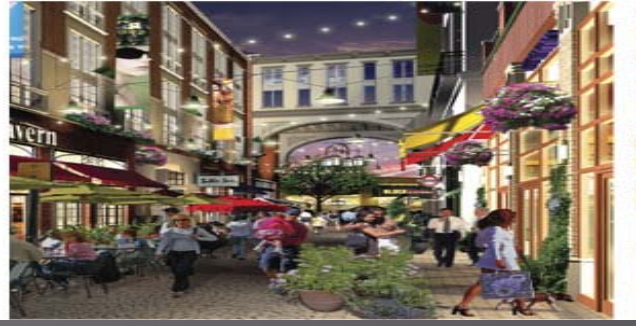
PROJECT COST EVALUATION

Actual Project Cost
Total Cost: $42,584,209
Square Foot Cost:
$100.56/SF

Total Project Cost
Total Cost: $50,047,750
Square Foot Cost:
$118.19/SF

	Total Cost of System	Square Foot Cost	% of Total Project Cost
Structural System	$11,661,204	$27.54	27.38%
Mechanical System	$4,304,705	$10.17	10.11%
Electrical System	$3,470,420	$8.20	8.15%
Roofing System	$1,709,289	$4.04	4.01%
Fire Protection	$1,491,035	$3.52	3.50%
Masonry	$2,367,829	$5.59	5.56%





MY FOUR ANALYSES

- Prefabrication of the Exterior wall
- Reduction of the HVAC system
- Redesign of the interior structure
- Research: The language barrier problem

ANALYSIS 1:

PREFABRICATION OF THE EXTERIOR WALL

PROBLEM BACKGROUND

Problem

Hand laid brick is the most common method when building the façade of a building. However, this method is slow and takes a lot of time of the schedule.

Goal

The goal of this analysis is to see if replacing the bricks with precast brick panels could reduce the schedule duration and cost of the project.



RESEARCH METHOD STEPS

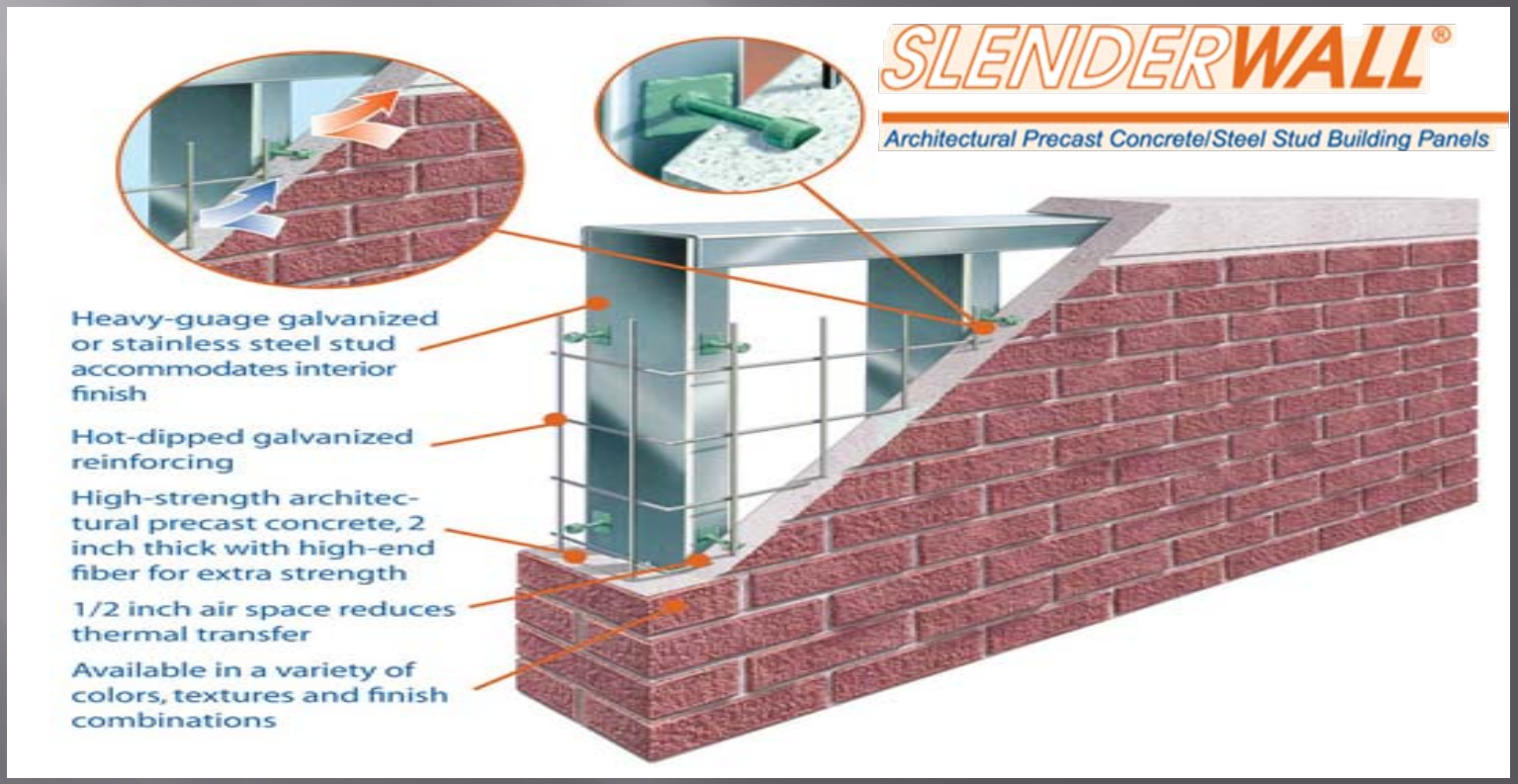
- Perform a Quantity Take-Off of the Existing Façade
- Select an Architectural Precast Brick Panel system to replace the current system.
- Perform a Cost & Schedule Comparison of both Systems



CURRENT SYSTEM

Category	CSI	Type	Quantity	Unit	Material	Labor	Tot. Unit Price	Total Cost
Masonry	5350	EIFS	14,000	SF	5.7	14.40	20.1	$281,400
	1400	Brick	47,000	SF	15.05	18.35	33.40	$1,569,800
	2750	CMU	3,000	SF	3.05	5.9	8.95	$26,850
Doors	5100	Overhead door	32	EA	1752	703	$2,455	$78,560
	1980	Storefronts	32	EA	743	351	$1,694	$54,208
Windows	5850	Type 1	250	EA	1400	294	1694	$423,500
	5500	Type 2	115	EA	975	243	1218	$140,070
	5250				535	120	655	$49,125
							Total	**$2,632,513**

PROPOSED SYSTEM



PROPOSED SYSTEM

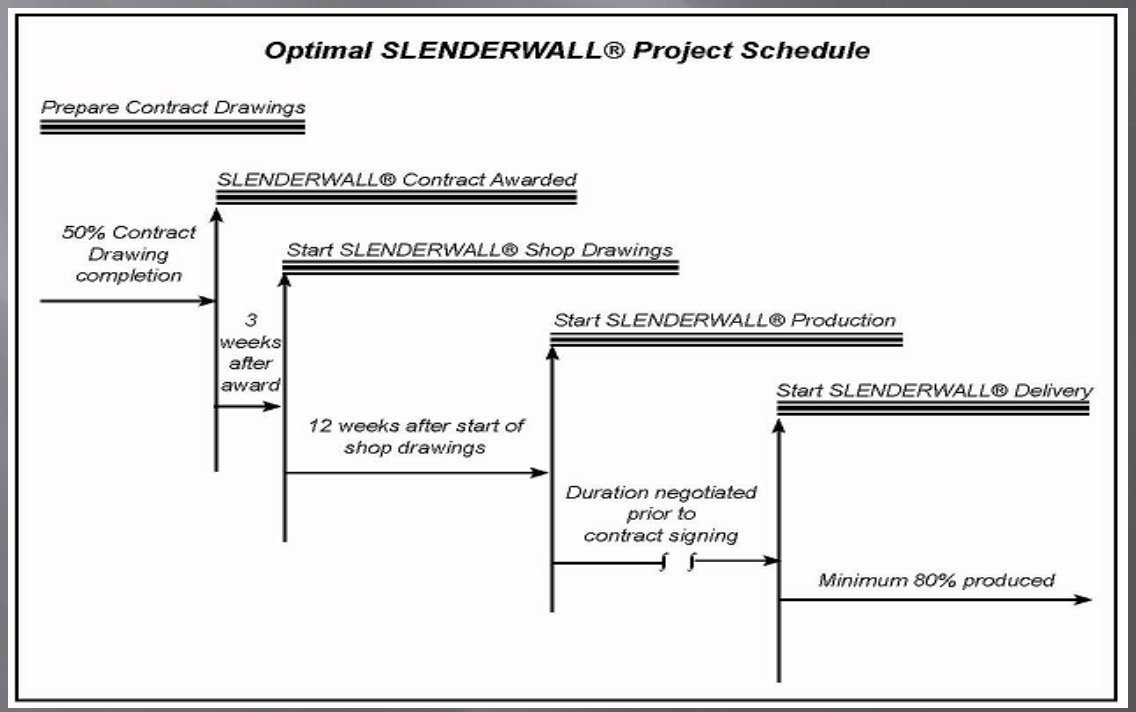
COST COMPARISON

Item	SF	Cost/SF	Total Cost
Slenderwall Panels	64,000	$36	$2,304,000

Item	Cost
Slenderwall Panels	2,304,000
Crane Usage	29,904
General Condition savings	-184,241
Cost of Previous system	-1,878,050
Additional cost of new System	**$271,613**

SCHEDULE COMPARISON

Item	Quantity	Total Days
Brick/EIFS/CMU	64,000 SF	166 days
SlenderWall Panels	324 Panels	21 days



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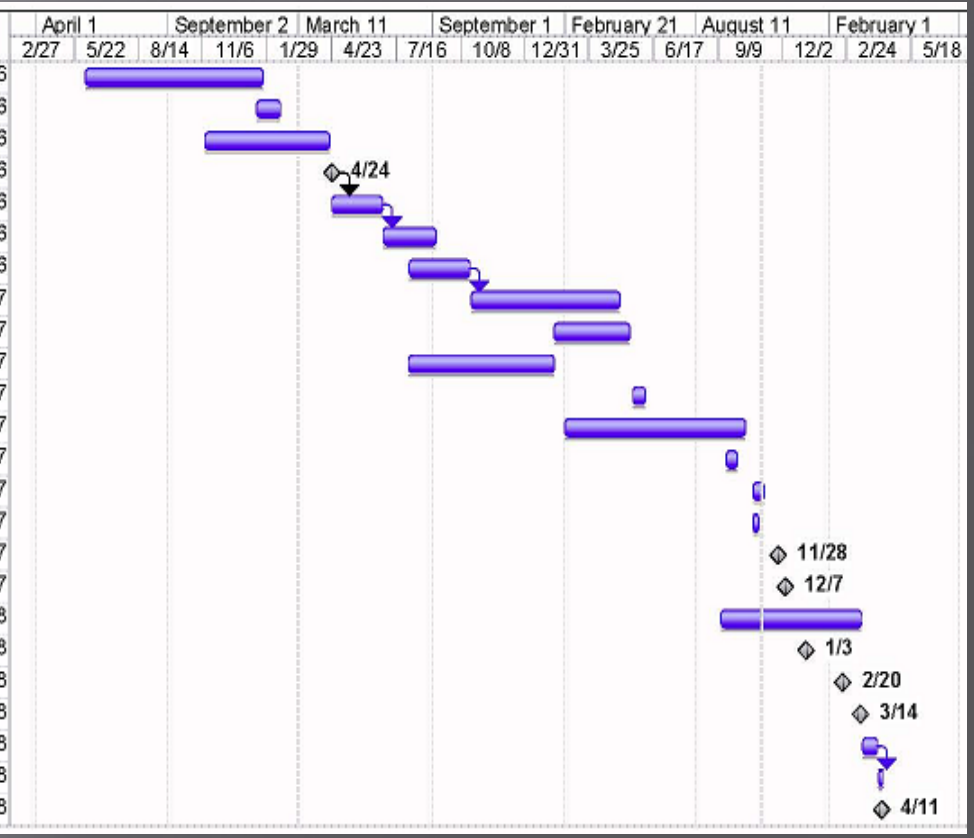
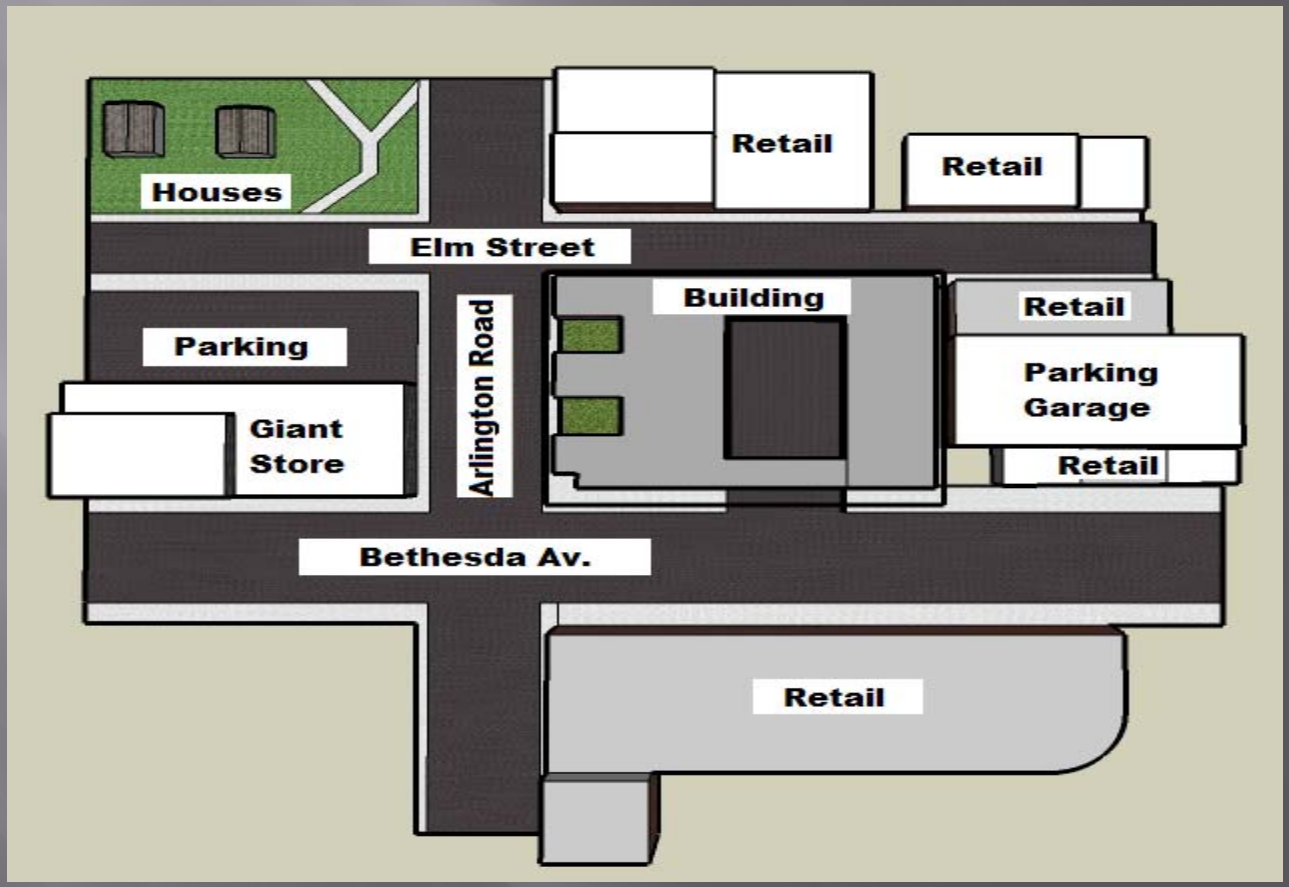


SITE PLANNING IMPLICATIONS





ADVANTAGES VS DISADVANTAGES OF PROPOSED SYSTEM

Disadvantages:

- Increases Cost.
- Additional Planning and Coordination.

Advantages:

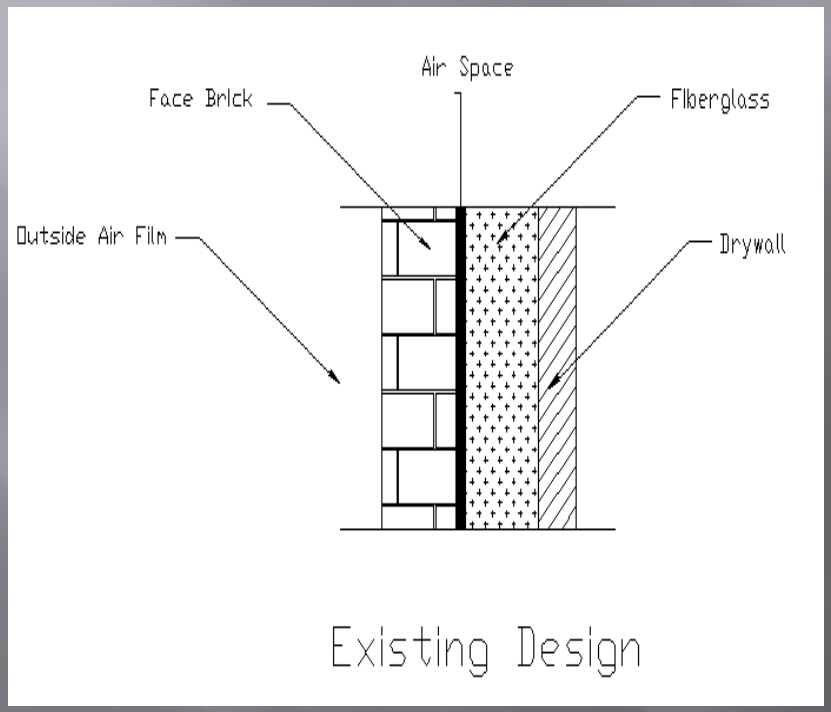
- Reduces Schedule Duration.
- Better Performance.

ANALYSIS 2: REDUCTION OF THE HVAC SYSTEM

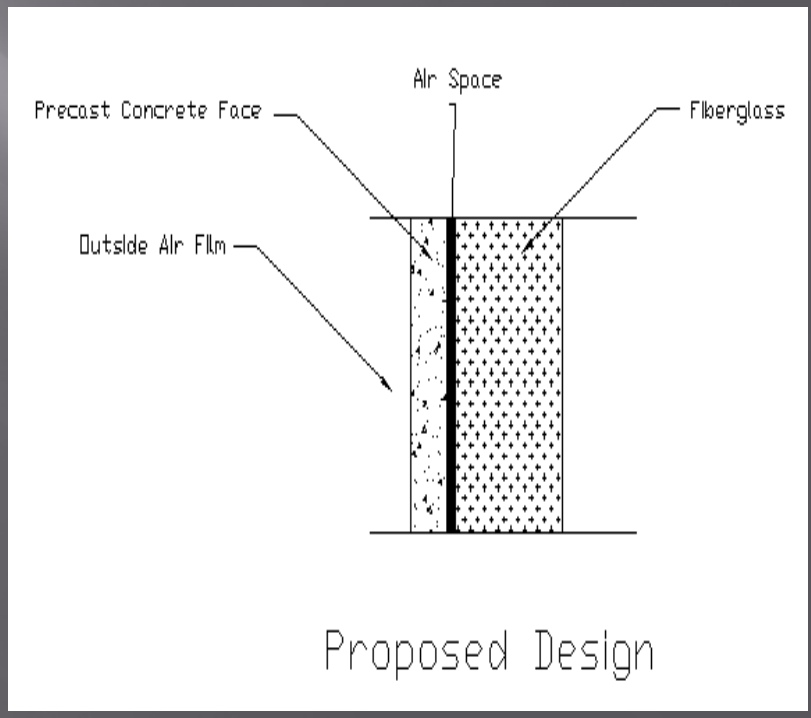
PROPOSED IDEAS

- Centralized system
- Elimination of some units
- Downsizing the current units

TYPES OF WALLS



Existing Design



Proposed Design

R AND U VALUE CALCULATIONS

Current System Layer	Thickness (in)	R-Value/inch	Total R-Value (hr-SF-F/BTU)
Outside Air Film	∞	0.17	0.17
Brick	4	.8/thickness	0.8
Drywall	2	0.9	1.8
Air Space	0.5	1	0.5
Fiberglass	4	3.2	12.8
			16.07

SlenderWall System Layer	Thickness (in)	R-Value/inch	Total R-Value (hr-SF-F/BTU)
Outside Air Film	∞	0.17	0.17
Precast Concrete face	2	0.8	1.6
Air Space	0.5	1	0.5
Fiberglass Batt insulation	6	3.14	18.84
			21.1

System	R-Value	U-Value
Unit	hr-SF-F/BTU	BTU/hr-SF-F
Current Brick system	16.07	.0622
SlenderWall System	21.1	.0474

MECHANICAL SYSTEM CALCULATIONS

	Area (SF)
Perimeter Wall	65,000

Winter Temperature In Washington DC	
To	15°F
Ti	70°F
Change in Temperature	55°F

Summer Temperature In Washington DC	
To	95°F
Ti	70°F
Change in Temperature	25°F

MECHANICAL SYSTEM CALCULATIONS

Heat Loss During Winter				
System	U-Value (BTU/hr-sf-F)	Area (SF)	Δ T (F)	Heat Loss (BTU/hr)
Current Brick Façade	.0622	65,000	55°F	222,365
SlenderWall System	.0474	65,000	55°F	169,455
			Difference	**52,910**

Heat Gain During Summer				
System	U-Value (BTU/hr-sf-F)	Area (SF)	Δ T (F)	Heat Loss (BTU/hr)
Current Brick Façade	.0622	65,000	25°F	101,075
SlenderWall System	.0474	65,000	25°F	77,025
			Difference	**24,050**

HVAC SYSTEM INFORMATION

WY13B33A

Cooling Capacity: 12,500/12,100 BTU/h

Heating Capacity: 10,400/10,000 BTU/h

EER: 9.0/9.0

Moisture Removal: 3.2 Pints/Hr.

Room Side Air Circulation: 280 CFM

Volts Rated: 230/208

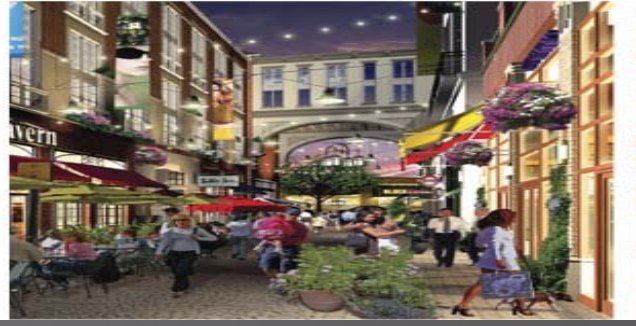
Cooling Amps: 6.4/6.8

Cooling Watts: 1,389/1,352

Heating Amps: 5.4/5.7

Heating Watts: 1,182/1,136





MECHANICAL SYSTEM IMPACTS

- Centralized system
- Elimination of some units
- Downsizing the current units

MECHANICAL SYSTEM IMPACTS

Each apartment would need 294 BTU/Hr less in the winter and 134 BTU/Hr less in the summer

Model	Cooling BTU/h	Heating BTU/h	Volts	Amps**	EER	Height in.	Width in.	Depth in.	Circuit Breaker	Weight lbs.
WS08B10A	8000		115	6.8	10.5	16-3/4	27	16-3/4	125V-15A	93
WS10B10A	10000		115	8.7	10.5	16-3/4	27	16-3/4	125V-15A	103
WS14B10A	13500		115	12.0	9.5	16-3/4	27	16-3/4	125V-15A	112
WS10B30A	10000		230/208	4.6/5.0	10.0	16-3/4	27	16-3/4	250V-15A	101
WS13B30B	12500		230/208	6.3/6.7	8.9	16-3/4	27	16-3/4	250V-15A	109
WS16B30A	15800		230/208	7.8/8.5	9.0	16-3/4	27	16-3/4	250V-15A	119
WE10B33A	10000	11000	230/208	16.0/14.7	10.0	16-3/4	27	16-3/4	250V-20A	103
WE13B33B	12500	11000	230/208	16.0/14.7	8.9	16-3/4	27	16-3/4	250V-20A	111
WE16B33A	15800	11000	230/208	16.0/14.7	9.0	16-3/4	27	16-3/4	250V-20A	121
WY10B33A	10100	8100*	230/208	3.9/6.0	10.0	16-3/4	27	16-3/4	250V-20A	107
WY13B33A	12500	10400*	230/208	5.4/5.7	9.0	16-3/4	27	16-3/4	250V-20A	116

ADVANTAGES VS DISADVANTAGES OF PROPOSED SYSTEM

Disadvantages:

- Increases Cost (increases cost of projects by only 0.6%).
- Additional Planning and Coordination.

Advantages:

- Reduces Schedule Duration (Project can be completed 3 month earlier).
- Better Performance (the additional insulation saves energy and reduces electricity cost).

ANALYSIS 3:

REDESIGN OF THE INTERIOR STRUCTURE

REDESIGN OF THE INTERIOR STRUCTURE

COST ANALYSIS

- Total Cost of interior wood structure is $330,905
- Total Cost of new proposed structure is $411,000
- Increases the overall cost of the building by 0.2%.
- Maintenance cost of wood is much greater.

REDESIGN OF THE INTERIOR STRUCTURE

SCHEDULE ANALYSIS

- The erection duration of new system is the same
- Schedule remains the same

REDESIGN OF THE INTERIOR STRUCTURE

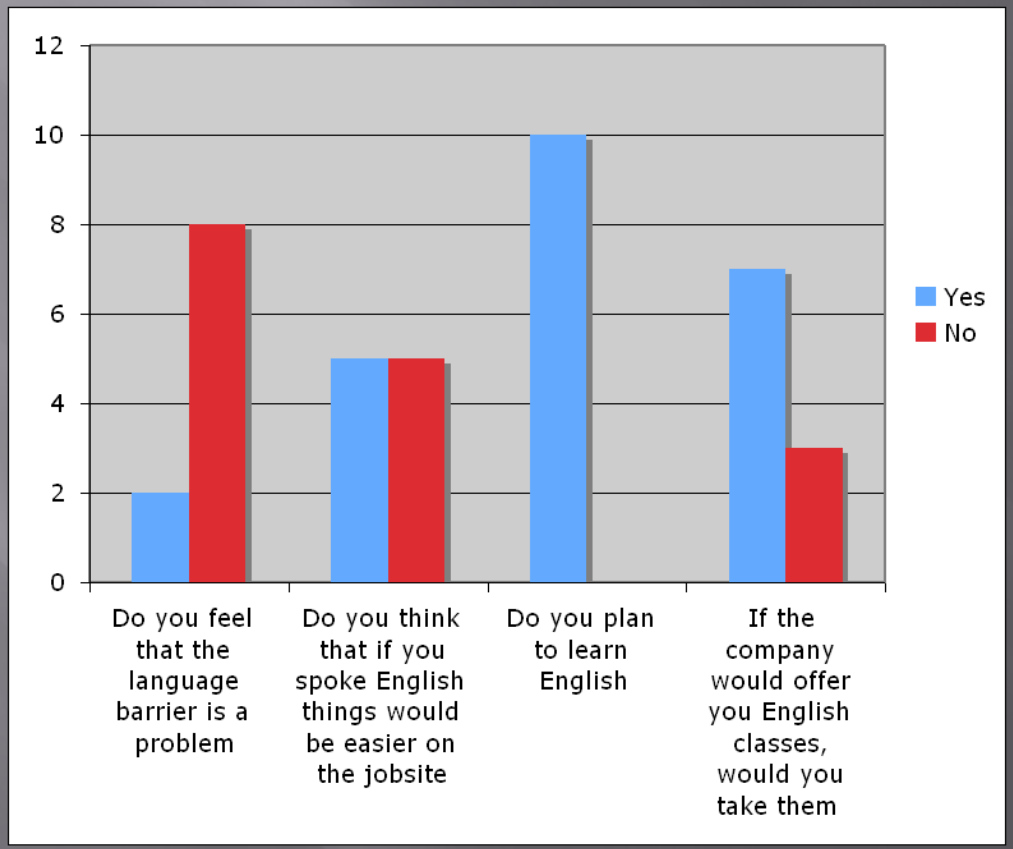
CONCLUSION

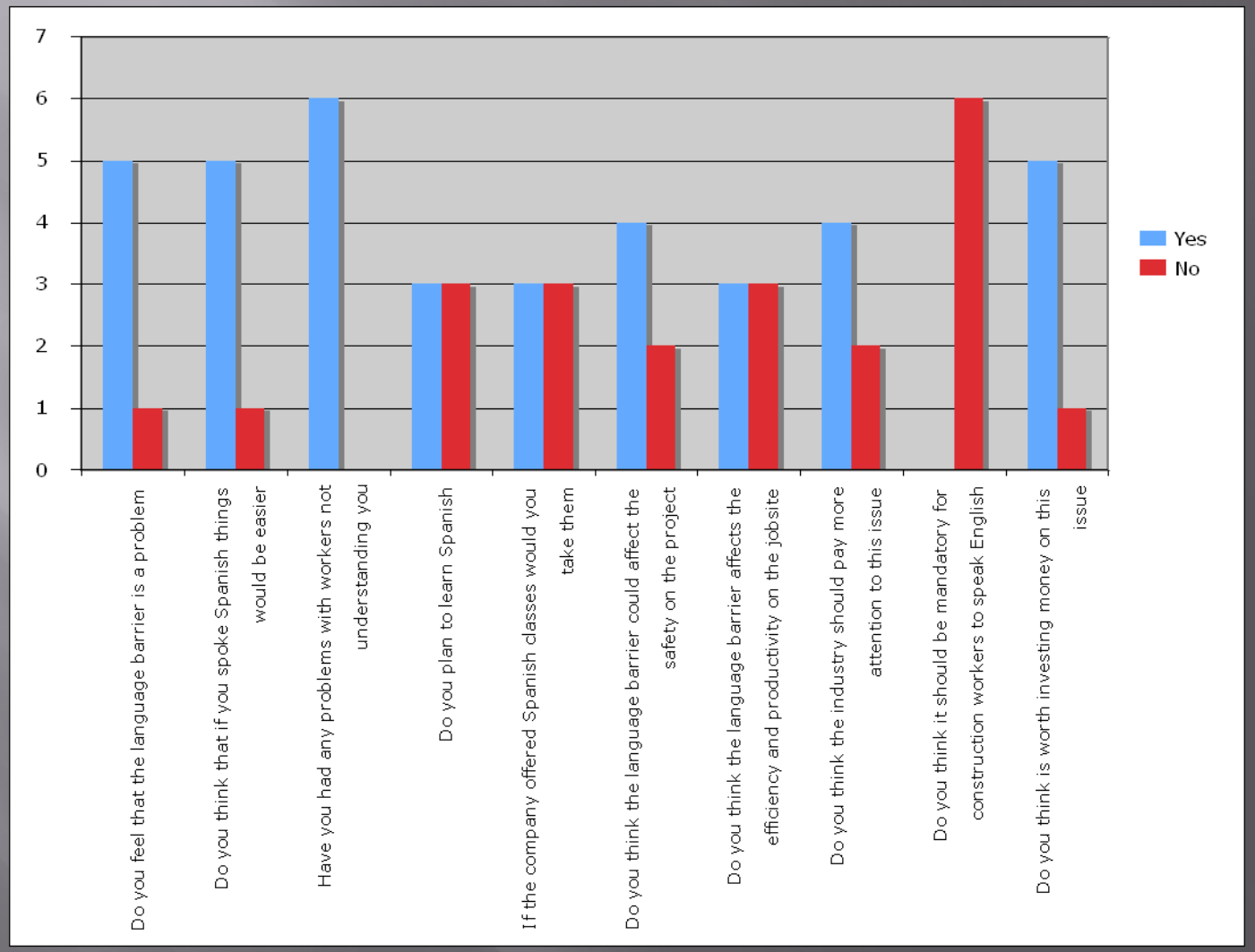
- Increases cost (only by 0.2%)
- Schedule remains the same
- Increases the value of the building

ANALYSIS 4:

RESEARCH: THE LANGUAGE BARRIER PROBLEM

THE LANGUAGE BARRIER PROBLEM

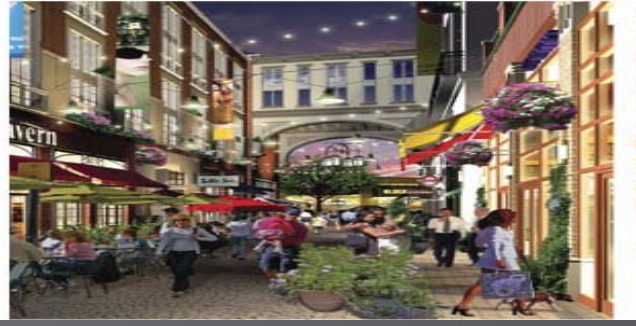



7
6
5
4
3
2
1
0
Yes
No
Do you feel that the language barrier is a problem
Do you think that if you spoke Spanish things would be easier
Have you had any problems with workers not understanding you
Do you plan to learn Spanish
If the company offered Spanish classes would you take them
Do you think the language barrier could affect the safety on the project
Do you think the language barrier affects the efficiency and productivity on the jobsite
Do you think the industry should pay more attention to this issue
Do you think it should be mandatory for construction workers to speak English
Do you think is worth investing money on this issue

THE LANGUAGE BARRIER PROBLEM

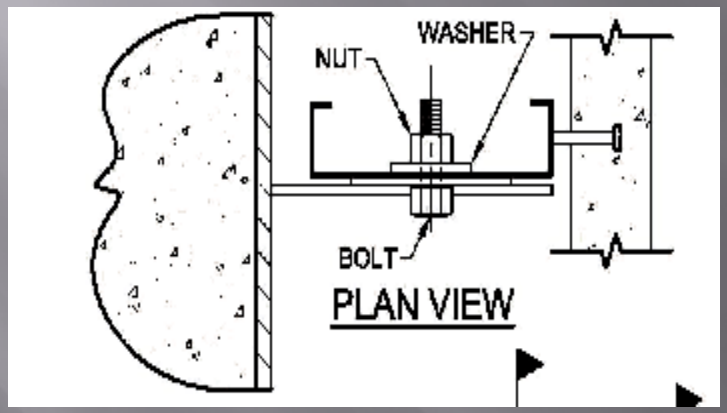
	Yes	No
Would you take Spanish classes if the company offered it?	5	0
Would you spend time studying Spanish at home after work?	1	4

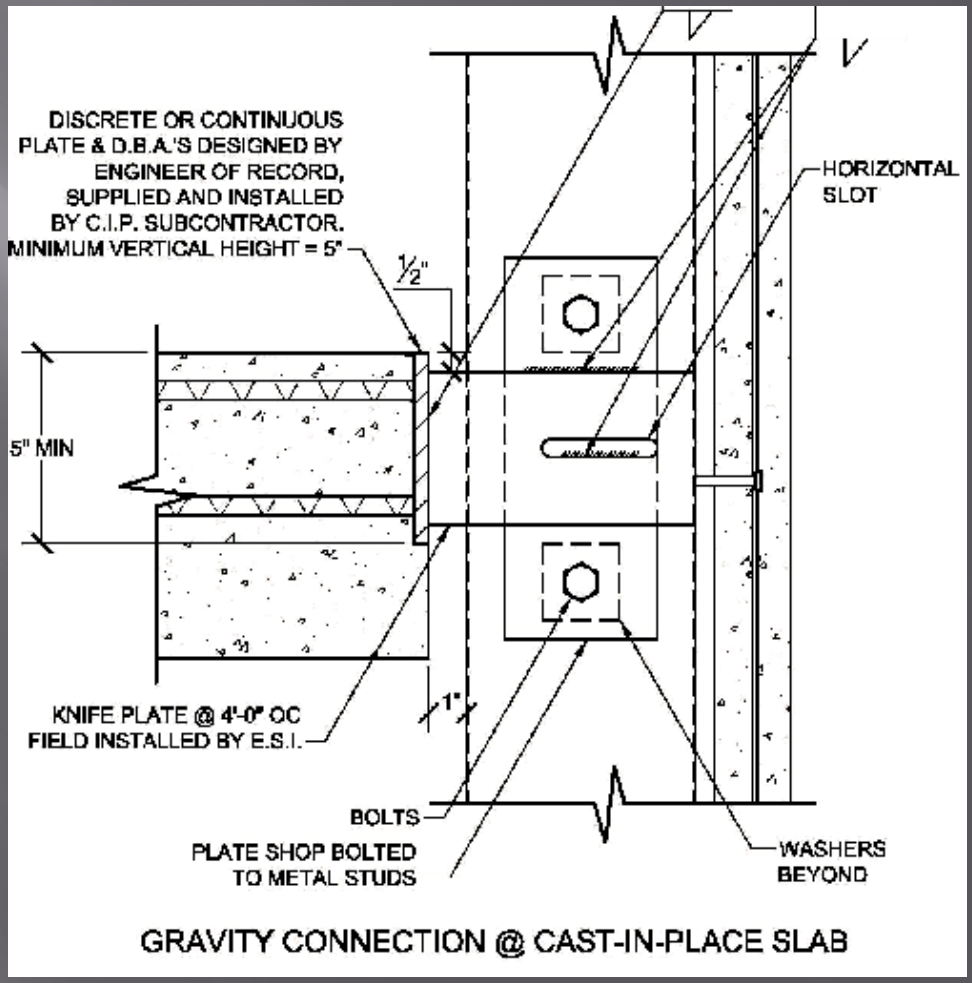



QUESTIONS?

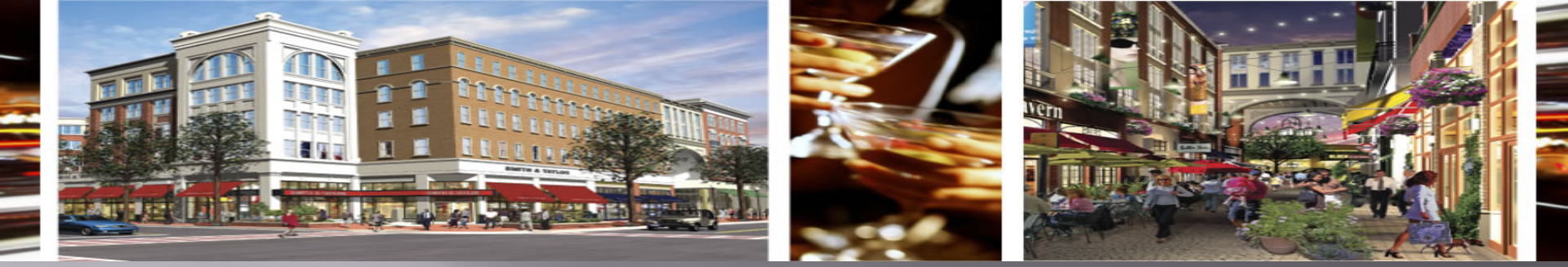
CONNECTION DETAILS





Simple Mils to Gauge Conversion Chart	
Minimum Thickness (mils)	Reference Gauge Number
33	20
43	18
54	16
68	14
97	12
118	10

Load	Metal Stud
4k	400S162-54
8k	400S162-97
12k	(2) 400S162-54
16k	(2) 400S162-68
20k	(2) 400S162-97
24k	(2) 400S162-97
30k	(3) 400S162-54



Unit 1+DAMPDU

S = 4 ft

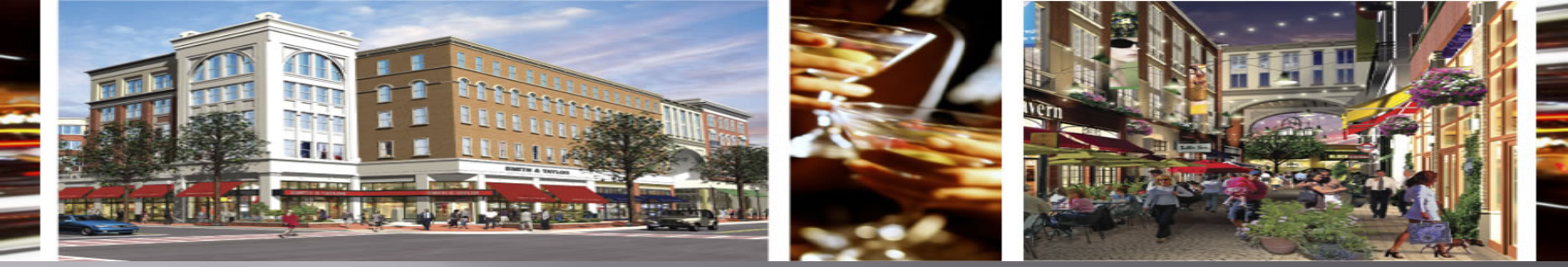
Live load = 40psf x (4 ft) = 160plf

Dead load = 4 ft x [(1.6) x (40psf) + (1.2) x (4in / 12) x (150psf)] = 496plf

Then use an Open Web steel joist k-series 12K5 (dead load = 555plf / live load = 198plf)

P = (496plf) x (21ft) = 10.42Kips Use 12.0 Kips

Then, based on the Joist Girder Design Guide use a 32G8N10.4K (32plf)



- Steel is stronger, lighter and more dimensionally stable than wood.
- Steel stud interior walls provide an uncommonly straight and stable wall. This reduces call backs for sheet rock separation, nail pop-outs, molding separation and warping.
- Pre-punched service holes in studs for electrical wiring, plumbing or other utility lines save time and money.
- Steel framed homes are safer in fires – they will not add fuel to a fire nor collapse as easily as wood.
- Stronger: steel framed homes greatly exceed all wind and seismic codes without adding any additional cost.
- Lightning protection: steel gives electricity a pathway to ground resulting in less secondary fires and explosions.
- No mold, mildew or rotting
- Super Insulated – no air infiltration if insulated with foam.
- Avoid termite problems
- Less repairs and maintenance
- No wasted scrap – all extra material can be recycled.