

Student Health Center



Jacob Brambley - AE (structural option)



Student Health Center (Current Building)

Location : University Park, PA

Size: 64,000 SF – 5 stories

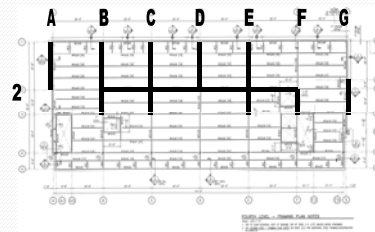
Use: Offices, pharmacy, exam rooms

Architecture: Brick facade accented with stone bands; large curtain wall

Structure: Steel w/ slab on deck floor

Student Health Center (Current Building)

Lateral Force Resisting System



Goals

- Examine the design effects of changing overall building structure including cost and schedule analysis
- Use computer programs to aid in design of building components
- Design shading system to remedy current problems

Redesign of Student Health Center

- Post-tensioned floor system
- Concrete columns
- Shear walls
- Foundations

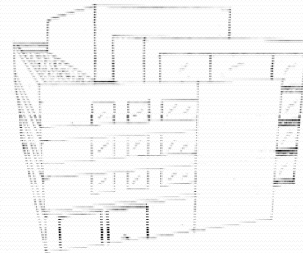
Cost/Schedule impacts

Shading Systems

Questions

Redesign of the SHC

Add extra floor w/o increasing building height by decreasing floor thickness



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PT Floor System:

8" Slab

Typical design strip in x-direction:

(11) - ½" tendons

Typical design strip in y-direction:

(14) - ½" tendons

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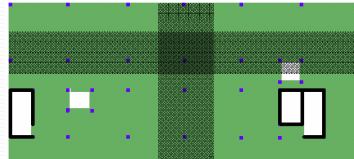
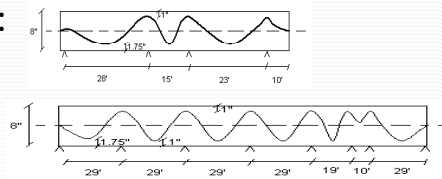
Cost/Schedule impacts

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PT Floor System:



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Cost/Schedule impacts

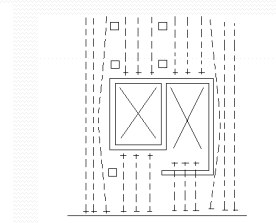
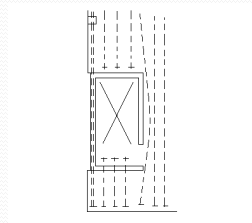
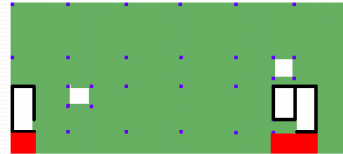
Shading Systems

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Problem Areas

- Openings > 4 ft
- Along cantilever



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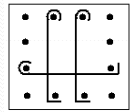
Shading Systems

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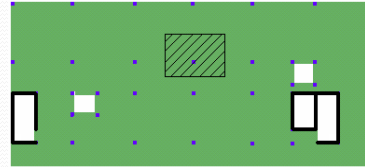
Redesign of the SHC

Columns:

- Sizes based off first level, worst case (1065 k)
- 18" x 18" throughout



(12) #11 bars ($A_s = 18.72 \text{ in}^2$)
(3) #4 ties @ 24"
Clear cover = 1.5"



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Shear Walls:

- Placement (Open Plan)
- Strength and Drift Considerations



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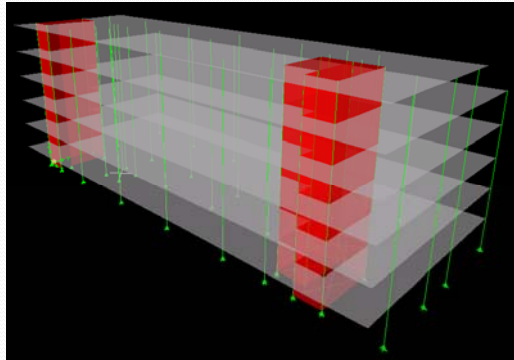
Cost/Schedule impacts

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Shear Walls:



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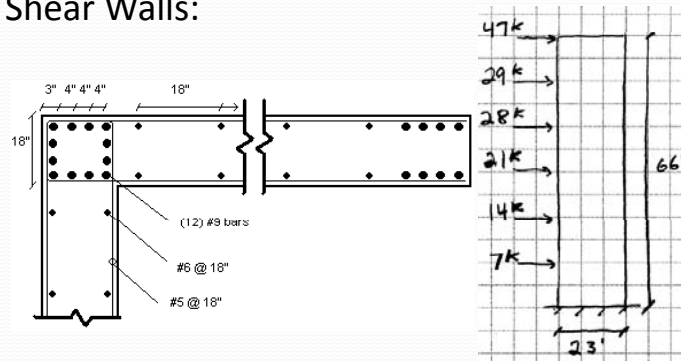
Cost/Schedule impacts

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Redesign of the SHC

Shear Walls:



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Redesign of the SHC

Foundation:

Building weight from 8,222 kips to 11,392 kips

	Pile Caps													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Calculated Load (k)	343	629	629	629	629	629	343	483	934	934	934	934	934	483
Allowable Load (k)	743	991	991	991	991	991	743	991	1233	991	991	991	991	991

	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Calculated Load (k)	444	833	833	833	833	833	444	547	958	958	958	958	958	547
Allowable Load (k)	743	743	743	743	743	991	743	743	991	991	991	991	1233	743

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Cost/Schedule impacts

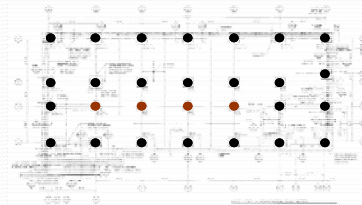
Shading Systems

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Foundation:

Changed to 4-pile pile caps instead of 3



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Cost / Schedule Impacts

Cost Comparison:

Material	Concrete Structure			
	Material	Labor	Equipment	Total
Concrete	159788	0	0	158788
Formwork	162572	288787	0	451359
Reinforcing	173950	61080	0	235030
Placing	0	21907	7995	29902
Finishing	0	9798	0	9798
Post-tensioning	10359	3917	0	14276
Total	505669	385489	7995	899153

Material	Steel Structure			
	Material	Labor	Equipment	Total
Framing	924150	118170	0	1042320
Concrete	57876	0	0	57876
Placing	0	13104	4805	17909
Metal Deck	179626	21773	2177	203576
WWF	14424	12519	0	26944
Finish	0	9798	0	9798
Total	1176076	175364	6982	1358422

Redesign of Student Health Center

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Cost/Schedule impacts

Shading Systems

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Cost / Schedule Impacts

Cost Comparison:

Didn't take into account:

- Contractors Available
- Additional Floor Work
- Additional Piles
- Mechanical/Electrical Usage

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Cost/Schedule impacts

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Cost / Schedule Impacts

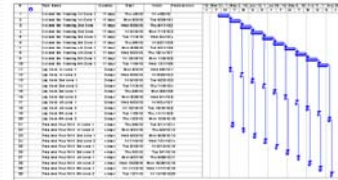
Schedule Comparison:

Steel Structure: 177 days

Conc. Structure: 234 days

Didn't take into account:

- Lead Time
- Additional Floor Work
- Additional Piles
- Connections



Redesign of Student Health Center

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Cost/Schedule impacts

Shading Systems

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Cost / Schedule Impacts

CM Conclusion:

- Concrete structure costs less
- Steel structure is a quicker build
- More analysis is needed

	Concrete supported structure	Steel supported structure
Schedule	234 days	177 days
Cost	\$899,153	\$1,358,422

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Cost/Schedule impacts

Shading Systems

Questions

Shading Systems

Problems with current fabric shades

Architectural Impacts

Possible energy savings

Two systems studied:

- Louvers
- Light Shelves



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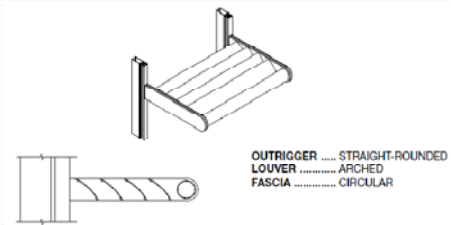
Shading Systems

Louvers:

Fit in with nearby architecture

Economical

Easily Installed



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Shading Systems

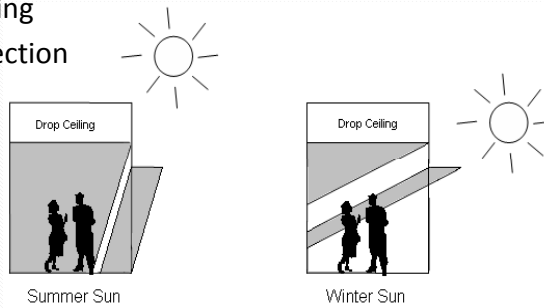
Questions

Shading Systems

Louvers:

10 ft ceiling

30" projection



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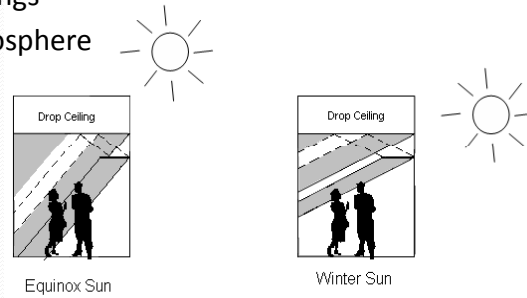
Questions

Shading Systems

Light Shelves:

Energy Savings

Better atmosphere



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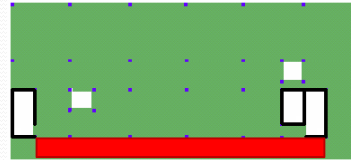
Shading Systems

Questions

Shading Systems

Light Shelves:

Energy Savings :



of light bulbs in corridor = 100

KWh used per year = 9,344

Electricity Cost (@ \$0.10 per KWh) = \$934.40

Savings with light shelves = \$150

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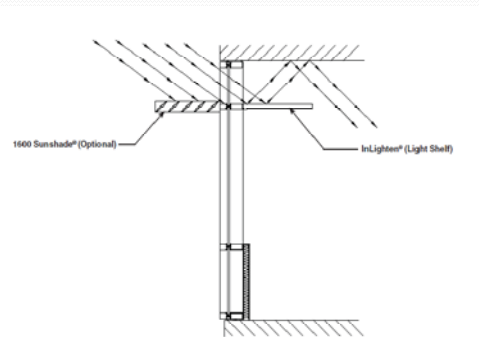
Shading Systems

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Shading Systems

Conclusion:

Dual System



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Cost/Schedule impacts

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Questions

Thesis Conclusions

- New concrete building appears to work well and be more cost effective than steel
- Downside in schedule
- Have to look into program that needs space
- Learned the ins and outs of two computer programs
- Shading systems viable to reduce need for fabric shading

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Cost/Schedule impacts

Shading Systems

Questions

Questions?

I would like to thank the following people for their assistance with this thesis project:

- My family and friends for their encouragement;
- OPP for answering my many questions;
- AE faculty for continued help throughout;
- Outside consultants for clarification;
- Fellow AE students