

University Medical Center of Princeton  
David Bodnar  
Construction Management



2010 Senior Thesis

University Medical Center of Princeton  
David Bodnar  
Construction Management

**Introduction & Outline**

Project Background  
Efficient Curtain Wall  
Greywater System  
Pre – Cast Foundation Wall  
Green Roof  
Remarks & Acknowledgements  
Questions

## Outline

- Introduction & Outline
- Project Background
- Efficient Curtain Wall
- Greywater System
- Pre – Cast Foundation Wall
- Green Roof
- Remarks & Acknowledgements
- Questions



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## Project Background

Project : University Medical Center of Princeton

Location : Plainsboro NJ

Owner : Princeton HealthCare System

Construction Manager : Turner Construction

Cost : \$321 Million

Size : 209,525 square feet / 7 stories



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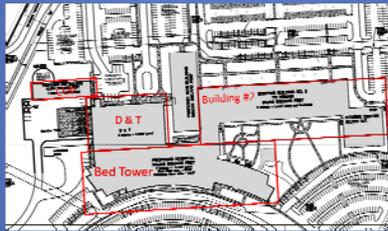
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## Project Background

### Construction Phases & Buildings



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## Project Background

### Thesis Theme

*"To look at sustainable ideas that could  
possible be incorporated into the design and  
constructing of the University Medical Center  
of Princeton"*



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# Analysis I

Efficient Curtain Wall



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## Efficient Curtain Wall

### Original Windows in Place

Common 1" double pane window

U - Value  
Summer - 0.3  
Winter - 0.27



SHG - 0.28

UV Transmittance - 16%



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## Efficient Curtain Wall

### Proposed Windows

Common 1" double pane window

U – Value  
Summer – 0.15  
Winter – 0.16

SHG – 0.49

UV Transmittance – 1%



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## Efficient Curtain Wall

### Benefits of Serious Materials Windows

- Better window insulation with lower U-value
- Better for heat gain in the winter
- Better protection from harmful UV rays
- No change in schedule and constructability
- Savings on mechanical equipment and electrical usage to run mechanical system



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## Analysis II

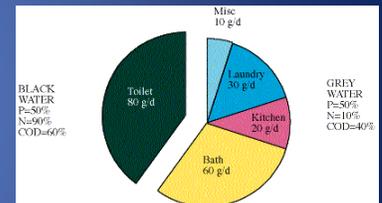
Greywater System



## Greywater System

### What is Greywater?

- Greywater comes from laundry, kitchen, bath, etc.
- Blackwater comes from toilet
- Blackwater harder to purify than greywater due to more nitrogen



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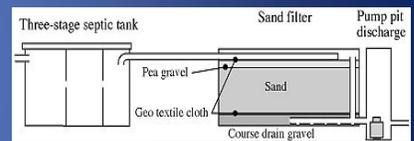
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## Greywater System

Anaerobic to Aerobic Pre - Treatment System

- Works best for breaking down cooking grease and food residue
- Septic tank breaks down grease and sludge
- Sand filter treats water with oxygen
- Pumped to planter bed for near potable treatment



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## Greywater System

### Cost Analysis

Water and sewage cost for typical hospital  
kitchen=\$10.60 per day

Cost of greywater system = \$4,232.00

Total time for system to pay it self  
off  $\approx$ 13.5 month



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## Greywater System

### Benefits and Uses of Greywater

Usage:  
Use recycled greywater for plant irrigation and HVAC cooling

Positive:  
Cost savings on water and sewage bill

Negative:  
Upfront cost of system



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## Analysis III

Pre – Cast Foundation Wall



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## Pre - Cast Foundation Wall

### Cost Analysis

Cost of Cast in Place = \$1,894,713.20

Cost of Pre – Cast = \$2,540,538.00

General Conditions Savings = \$292,100.00 and  
 57 days / 8 month

Overall added cost = \$353,715.80

Cast in Place Wall									
	Quantity	Units	Materials Cost	Materials Total	Labor Cost	Labor Total	Equipment Cost	Equipment Total	Total
3000 psi Concrete	2,600	C.Y.	\$1011.00	\$262,600.00	\$8.00	\$68,000.00	\$0.00	\$0.00	\$330,600.00
Placement Direct Charge	2,600	C.Y.	\$15.85	\$41,210.00	\$0.35	\$912.00	\$0.00	\$42,562.00	\$42,562.00
Formwork	41,200	S.F.	\$2.49	\$102,000.00	\$6.00	\$127,200.00	\$7.99	\$958,211.00	\$1,187,411.00
Rebar	356,040	Lb.	\$1.42	\$505,556.80	\$0.25	\$89,010.00	\$0.00	\$0.00	\$594,566.80
<b>Total</b>				<b>\$1,894,713.20</b>		<b>\$625,982.00</b>		<b>\$958,211.00</b>	<b>\$3,478,906.20</b>

Pre - Cast Wall									
	Quantity	Units	Materials Cost	Materials Total	Labor Cost	Labor Total	Equipment Cost	Equipment Total	Total
Pre - Cast Wall	70,200	S.F.	\$32.40	\$2,274,000.00	\$2.36	\$165,672.00	\$1.43	\$100,388.00	\$2,540,060.00

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## Pre - Cast Foundation Wall

### Advantages

- Takes less time to install pre-cast foundation wall systems
- Schedule acceleration
- Better quality due to being manufactured off site
- Less construction waste
- More energy efficient



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## Pre - Cast Foundation Wall

### Disadvantages

- Cost as opposed to cast-in place foundation wall system
- Size of panels limitations due to shipping
- More coordination on site



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## Analysis IV

Green Roof



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## Green Roof

### Components and Cost

Cost per square foot for green roof = \$14.00

Approximately 18,500 square feet of roof area

Overall cost of  $\approx$  \$259,000.00



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## Green Roof

### Structural Analysis

4" systems weights  $\approx$  21 pounds per square foot

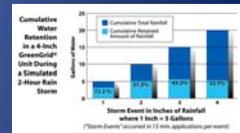
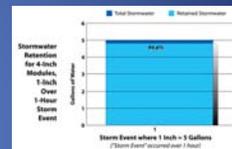
*Passed!!!*



## Green Roof

### Stormwater Collection

- Green roofs are very good in collecting Stormwater
- Average rain fall in New Jersey is 3.84 inch per month
- Average of 44,280 gallons of water run off the roof per month



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## Green Roof

### Additional Benefits

- Urban Heat-Island Effect
- Reduce heating and cooling loads by ~25%
- Use of recycled materials



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## Remarks & Acknowledgements



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## Remarks

### Good

- Change in windows
- Greywater system
- Green roof

### Bad (Maybe!!!!!!!!!!!!)

- Pre – Cast Foundation Wall



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## Acknowledgements

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Chris Auer, Project Manager

### Princeton HealthCare Systems

And most of all my family, friends, and fellow AE students



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# Questions

