

**Charlottesville Community Hospital**  
Charlottesville, Virginia



**Joe Bonacci – Construction**  
Advisor: Dr. Robert Leicht



## I. Project Overview

### II. Analysis #1 – Prefabricated Bricks

- Mechanical Breadth

### III. Analysis #2 – Rooftop Wind Turbines

- Electrical Breadth

### IV. Analysis #3 – Material Storage Hub

### V. Conclusions

- Acknowledgements



## Project Information

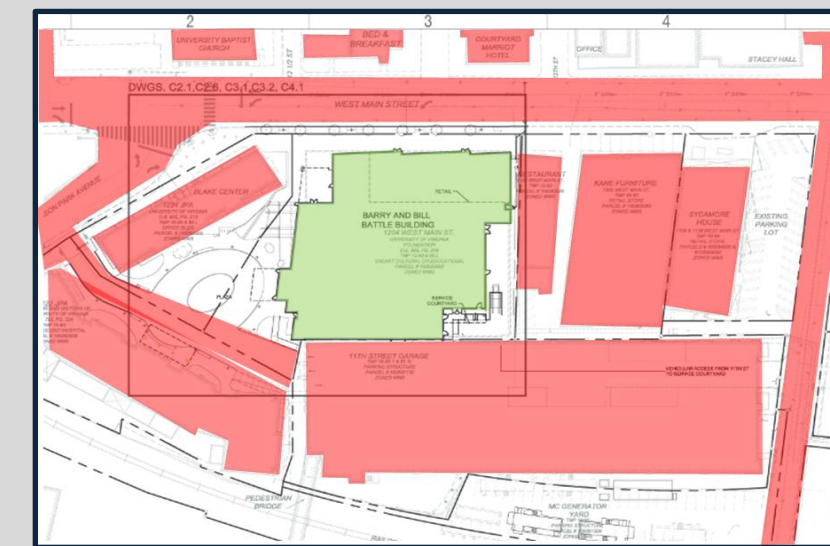
- Project Cost: \$141.6 million
- Duration: 04/01/11 – 06/01/14
- Location: Charlottesville, VA

## Building Structure

- 7 Above Grade Floors
- 200,000 Gross SF
- Cast-In-Place Concrete
- Structural Steel Penthouse

## Building Function

This children's hospital is meant to centralize pediatric care into one building so that parents and visitors do not need to travel to multiple sites.



## Site Logistics

- Congested Job Site
- Neighboring buildings to protect
- Pedestrian Sidewalk protection needed





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## Problem Identification

- Site scaffolding and mortar mixing supplies create safety hazards and building entry obstructions for workers
- The limited site laydown space is taken up by masons for 22% of the project's duration.

## Proposed Solution

- Substitute traditional brick assembly with prefabricated brick panels.
- Eliminate need for scaffolding and hydraulic lift
- Decrease safety risks associated with brick construction

## Panel Information

- 6" thick (5 3/8" concrete, 5/8" thin brick)
- Additional insulation required on interior
- Maximum width: 12'
- Maximum Length: 15'
- Panels will be installed vertically to span from floor to floor
- Joints are sealed with specified caulking





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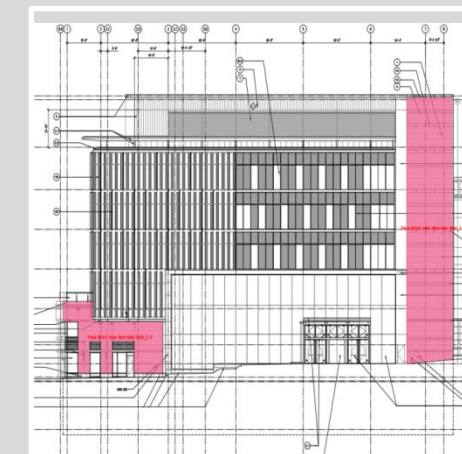
## IV. Analysis #3 – Material Storage Hub

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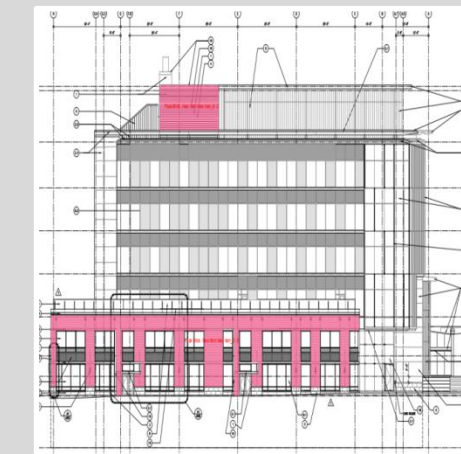
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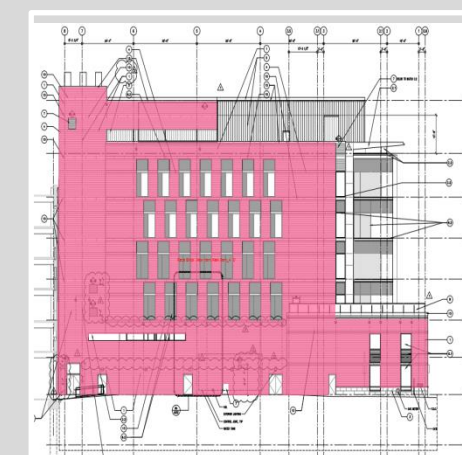
West Facade



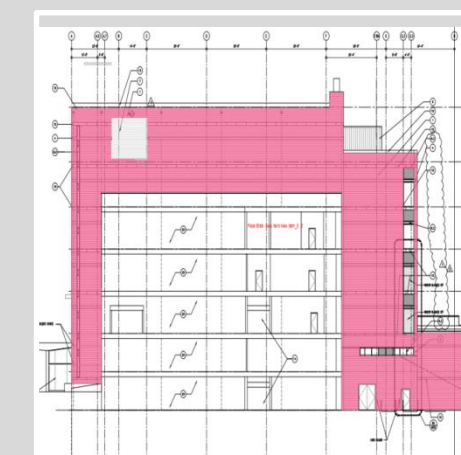
North Facade



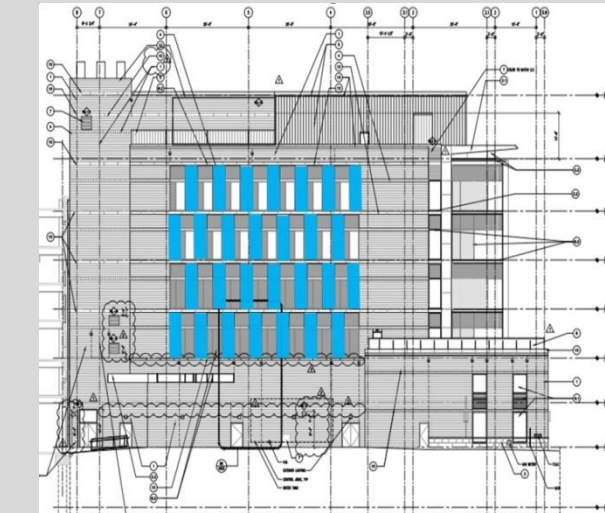
East Facade



South Facade

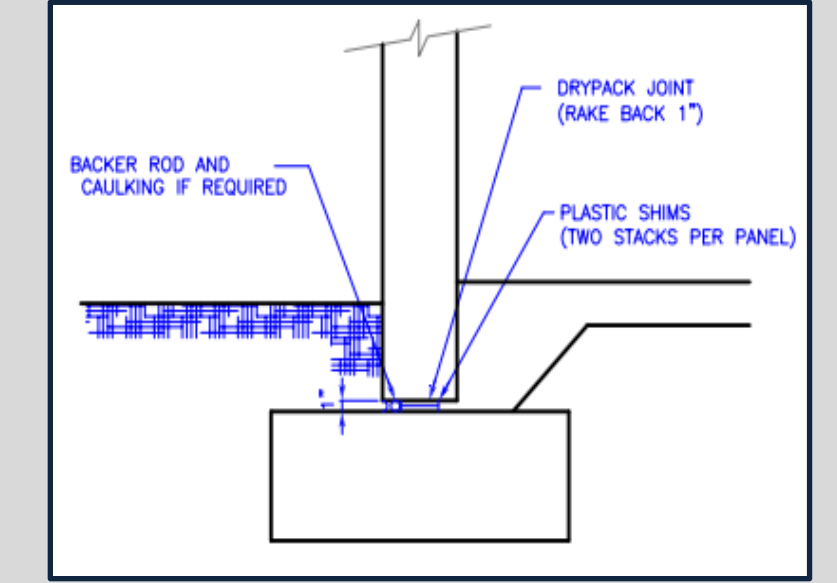
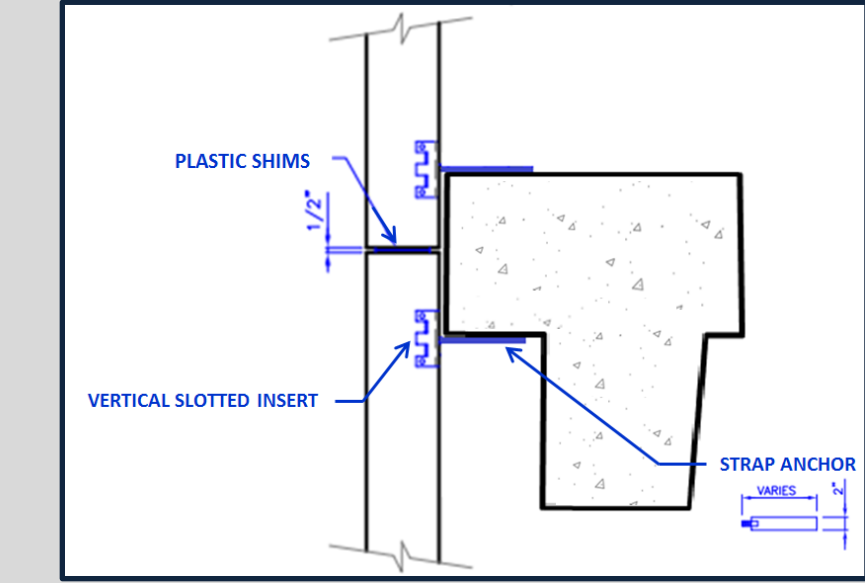


\*24,417 SF of Brick



\*24 window panels

## Connection Details







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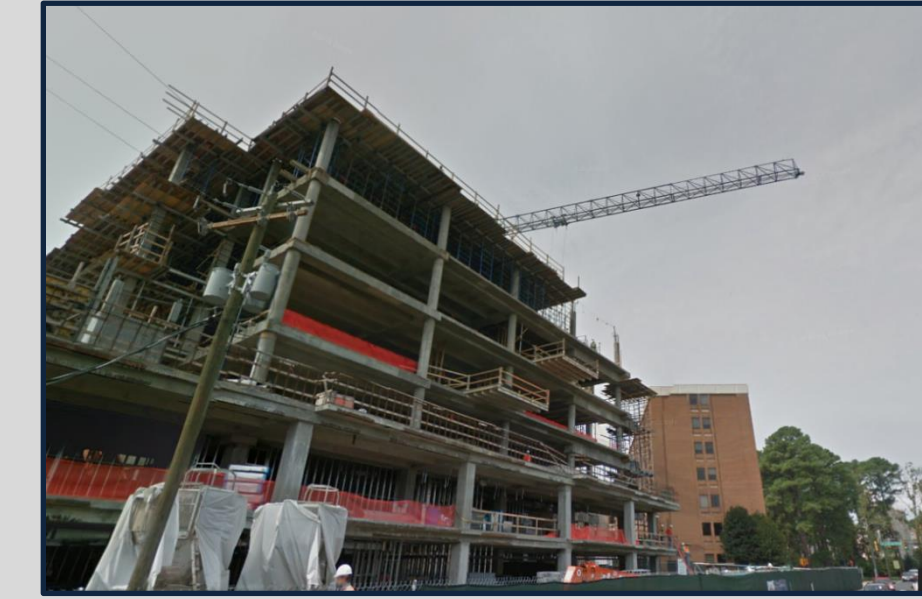
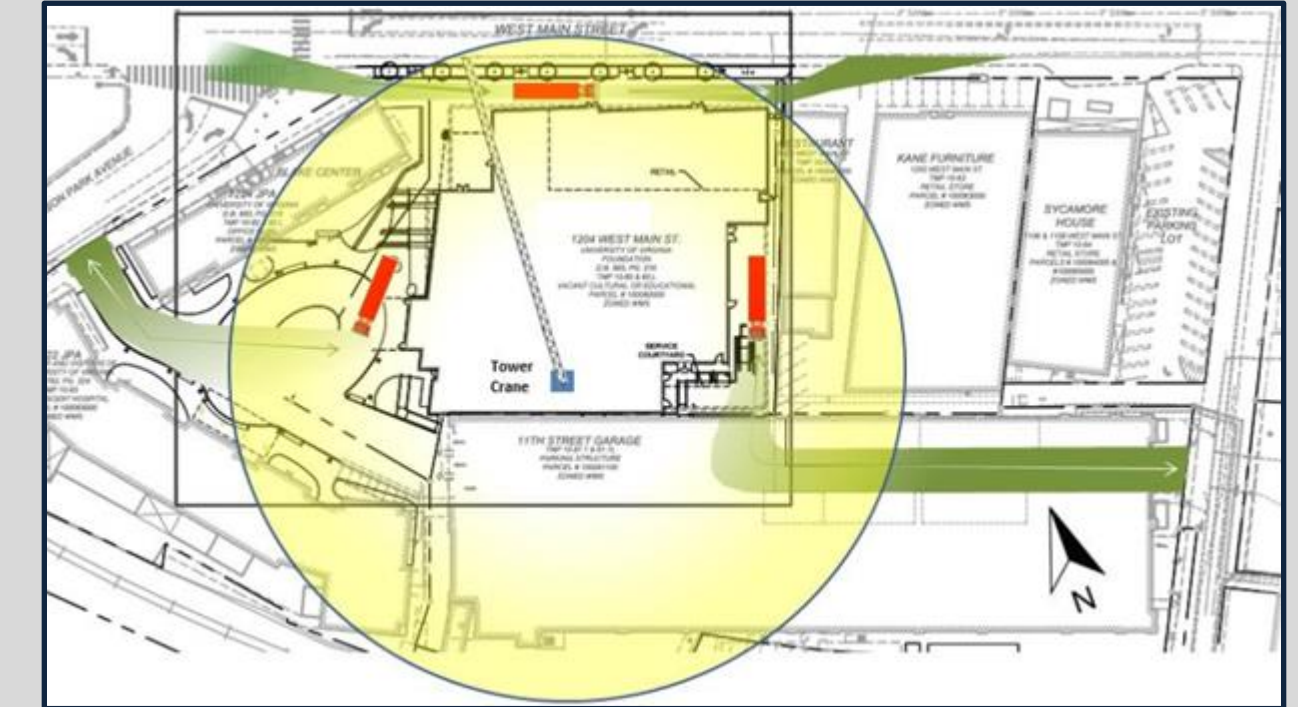
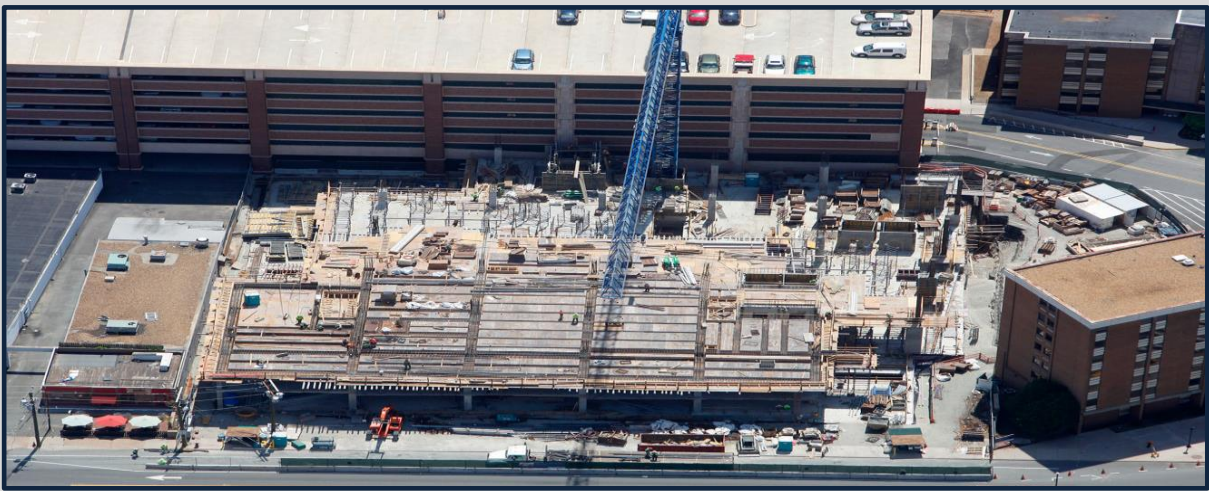
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**Heaviest Panel:** 13,500 lbs.  
**Crane Capacity:** 39,680 lbs.



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**Cost Analysis**

**Total Cost of Traditional Method: \$755,773**

**Total Cost of Prefabricated Panels: \$1,001,585**

**General Conditions Savings: \$38,232**

**Schedule Analysis**

Façade	Original Duration of CMU Installation (days)	Original Duration of Brick Installation (days)	Total (Days)	Duration of Prefab Panel Installation (days)	Time Saved (days)
East	75	40	115	5	110
South	0	39	39	4	35
North	10	30	40	2	38
West	31	15	46	2	44
			240		227







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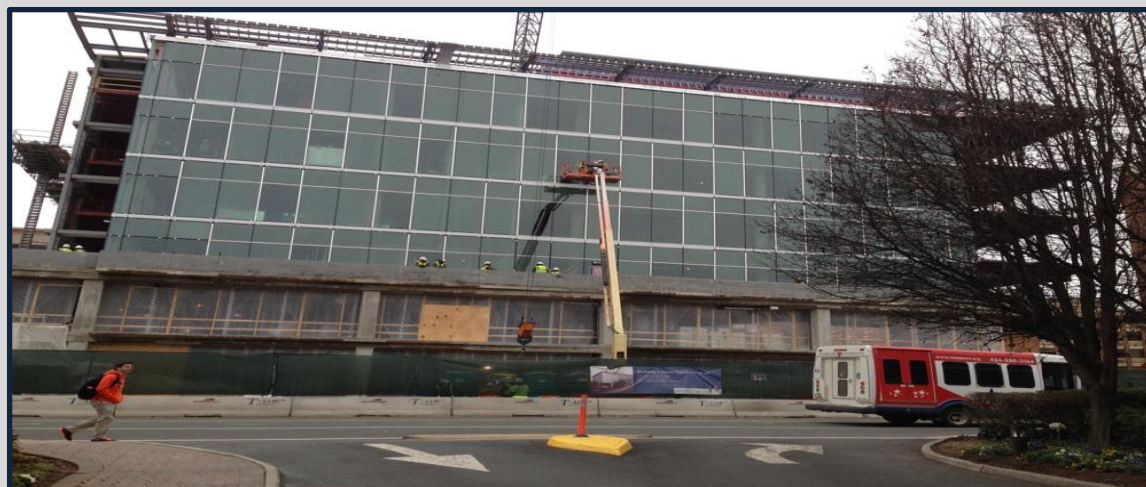
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## Results

- Additional Cost: \$207,600
- All panels can be installed in 13 days
- Eliminate scaffolding and construction debris for 227 days.

Building Energy Consumption							
Project Name: Charlottesville Community Hospital				Date: February 16, 2014			
City: Charlottesville, Virginia				Weather Data: Richmond, Virginia			
Note: The percentage displayed for the "Proposed/ Base %" column of the base case is actually the percentage of the total energy consumption.							
* Denotes the base base alternative for the ECB Study							
		* Alt-1 Traditional Assembly			Alt-2 Prefabricated Panels		
		Energy 10 <sup>6</sup> BTU/yr	Proposed/ Base %	Peak kBtuh	Energy 10 <sup>6</sup> BTU/yr	Proposed/ Base %	Peak kBtuh
Space Heating	Electricity	34.8	1	9	35.5	102	9
	Gas	3006.3	79	1435	2992.6	100	1441
Space Cooling	Electricity	277	7	528	270.4	98	508
Heat Rejection	Electricity	33	1	57	32.4	98	54
Fans - Conditioned	Electricity	430.5	11	49	413.9	96	47
<b>Total Building Consumption</b>		<b>3781.7</b>			<b>3744.8</b>		

		* Alt-1 Traditional Assembly	Alt-2 Prefabricated Panels
<b>Total</b>	Number of hours heating load not met	0	0
	Number of hours cooling load not met	0	0

		* Alt-1 Traditional Assembly	Alt-2 Prefabricated Panels
		Energy 10 <sup>6</sup> BTU/yr	Energy 10 <sup>6</sup> BTU/yr
Electricity		775.3	752.2
Gas		3006.3	2992.6
<b>Total</b>		<b>3782</b>	<b>3745</b>



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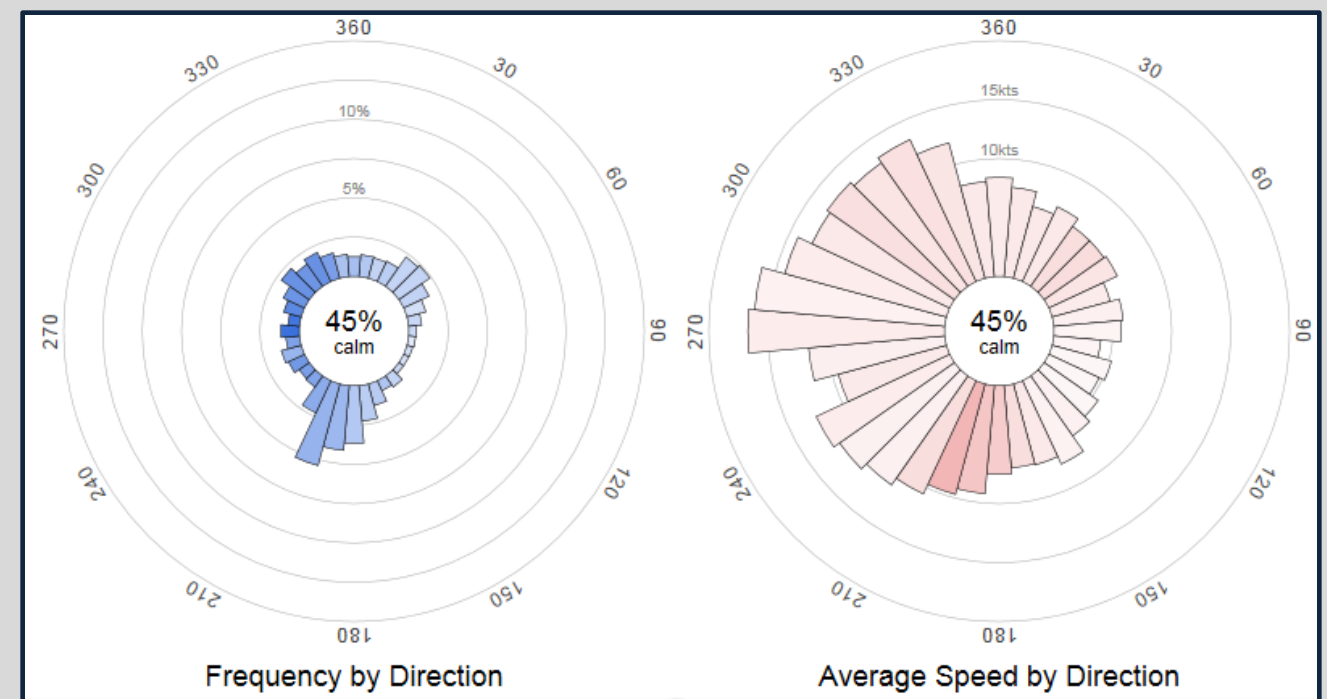


## Problem Identification

- ❑ There is a great deal of electricity needed to power the building
- ❑ A renewable power source may contribute to the project teams goal of a LEED Gold Certification.

## Proposed Solution

- ❑ Wind turbines will be installed on the penthouse roof.
- ❑ Electricity generated will be fed directly into MDP







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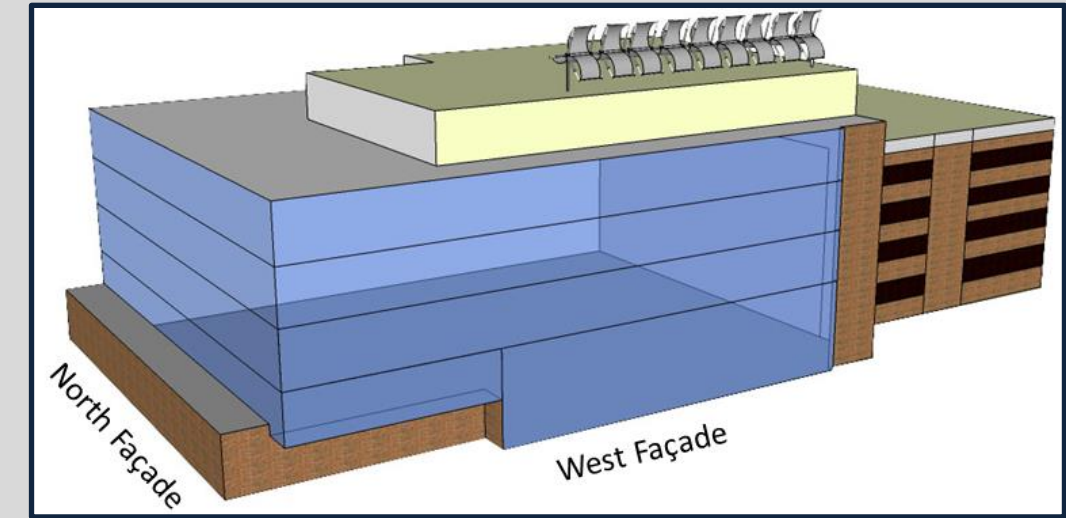
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## Constructability

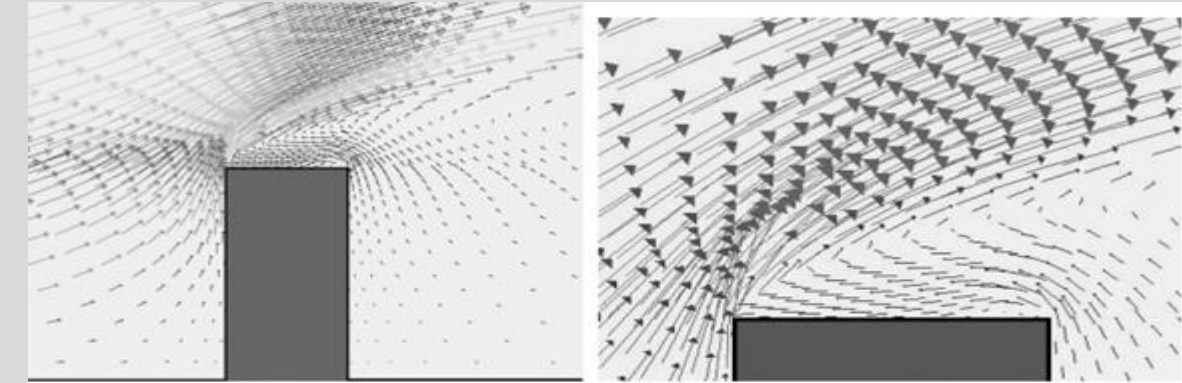
- Crane used to lift material into place
- Roof surface is TPO roof, rigid insulation, 1.5” roof deck



10'

**Weight:** 1400 lbs.  
**Material:** Canvas  
**Structure:** Steel Tubing

27.5'



Wind Velocity Vectors



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**Cost Analysis**

Cost Analysis of Turbines				
Item	Units	Qty	Cost	Total
Turbines	Each	1	\$25,000.00	\$25,000.00
Installation	Hr	8	\$150.00	\$1,200.00
DC to AC Inverter	Each	1	\$3,350.00	\$3,350.00
#9 wire	CLF	0.48	\$110.00	\$52.80
#13 wire	CLF	9.16	\$48.00	\$439.68
1/2" Conduit	CLF	253	\$8.40	\$2,125.20
				\$32,167.68

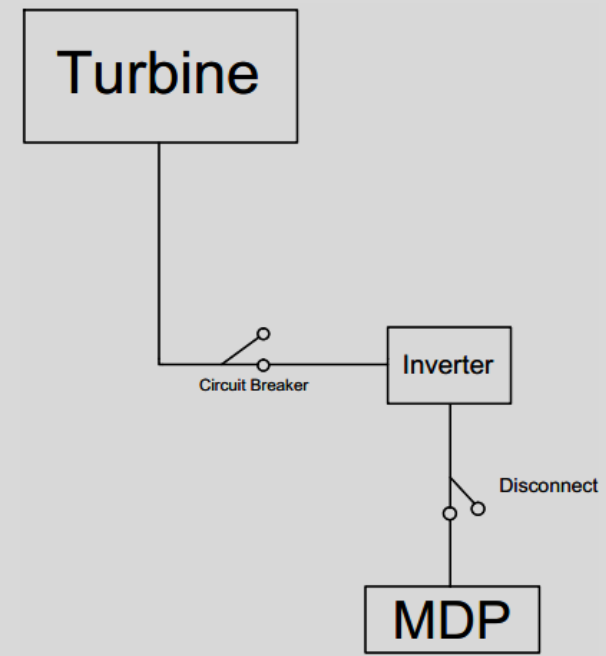
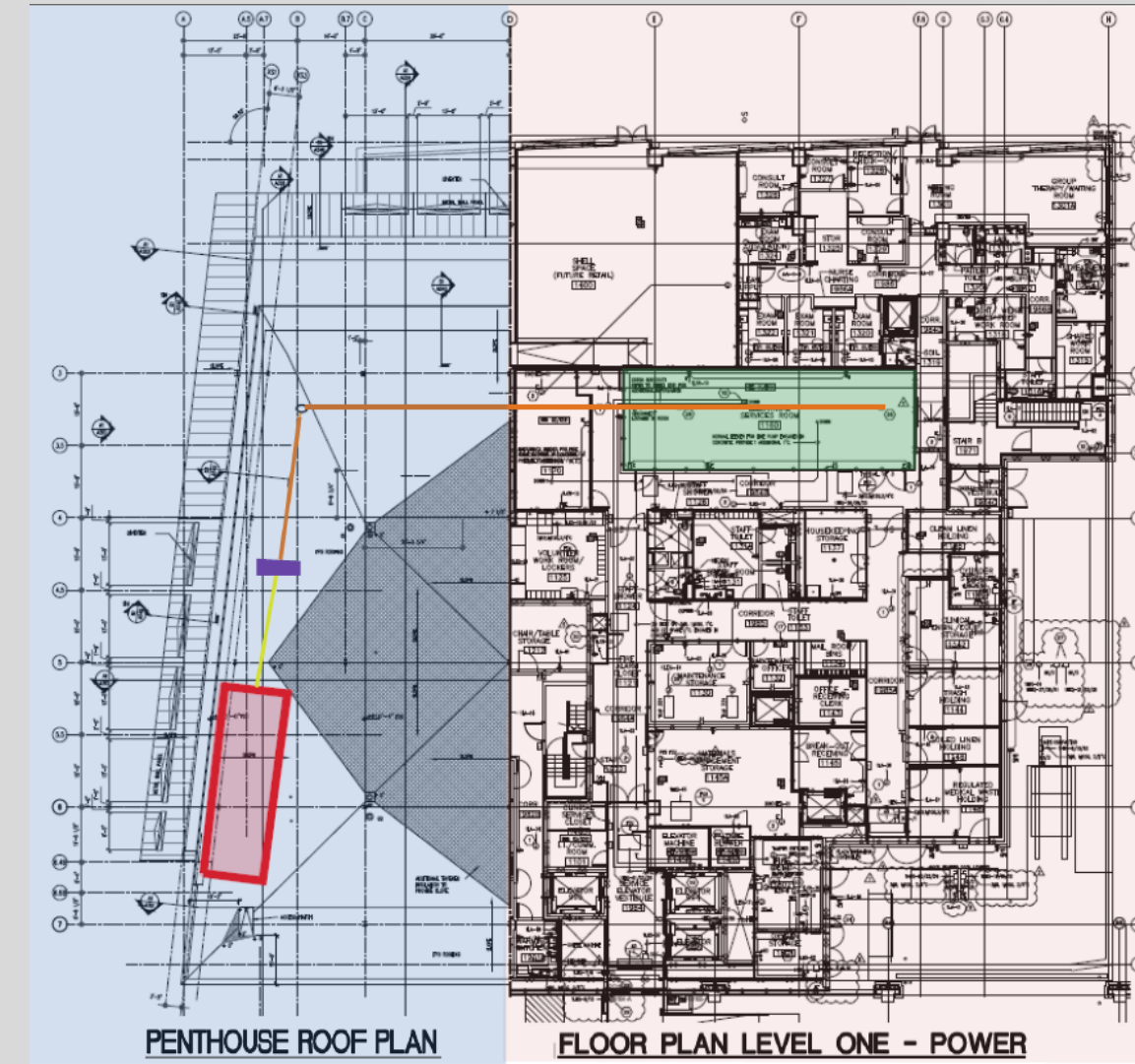
**Scheduling**

- Installed in 2 days
- Lead time of 3 weeks
- Should be installed between Feb. 1<sup>st</sup> – April 1<sup>st</sup> 2014





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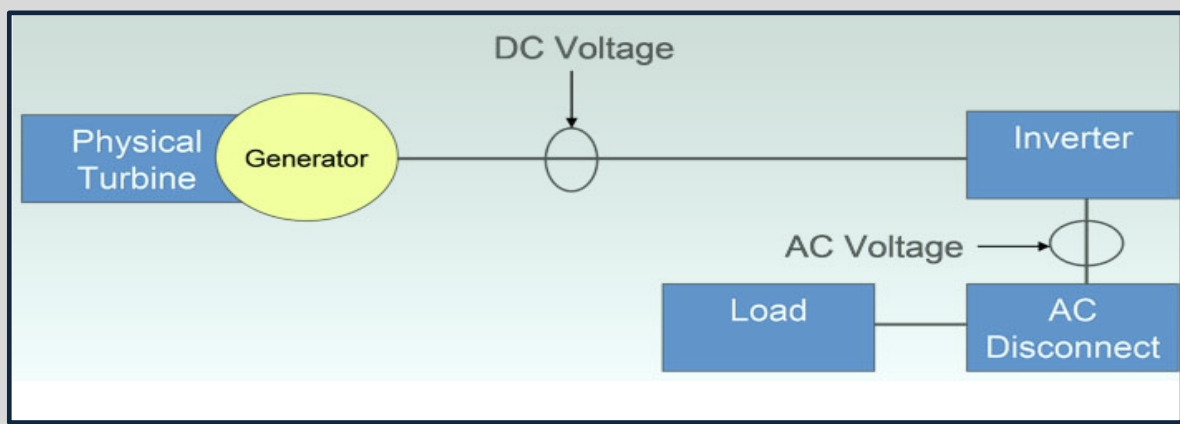


**Results**

$4\text{kw Turbine} * 24\text{hrs/day} * \$0.0804/\text{kWh} = \$7.72/\text{day}$

$\$7.72/\text{day} * 365 \text{ days} = \$2817.8/\text{year}$

**\*11.5 year payback period**





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### Problem Identification

- ❑ Frequent unscheduled deliveries make the loading dock and material hoist congested, which lowers productivity
- ❑ GC is forced to pay for

### Proposed Solution

- ❑ Install temporary storage warehouse across from project entry.
- ❑ Assign a manager who is in charge of accepting deliveries and coordinating with the projects superintendent for site deliveries.

### Site logistics



**Lot Footprint: 140'x70'**  
\*Room to park and swing truck in



**Garage height: 15'**



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## Warehouse Structure



- **Lead time:** 4 weeks
- **Install time:** 5 days

**Building Footprint:** 82'x40'  
\* 34% of lot space  
\* Remaining space for contractor parking



## Building Details

- Thermo-Insulated Modular Building
- Eave height – 13'8"
- Installed with small boom and hand tools
- 2 garage door bays for loading/unloading
- 2 man doors located at each end

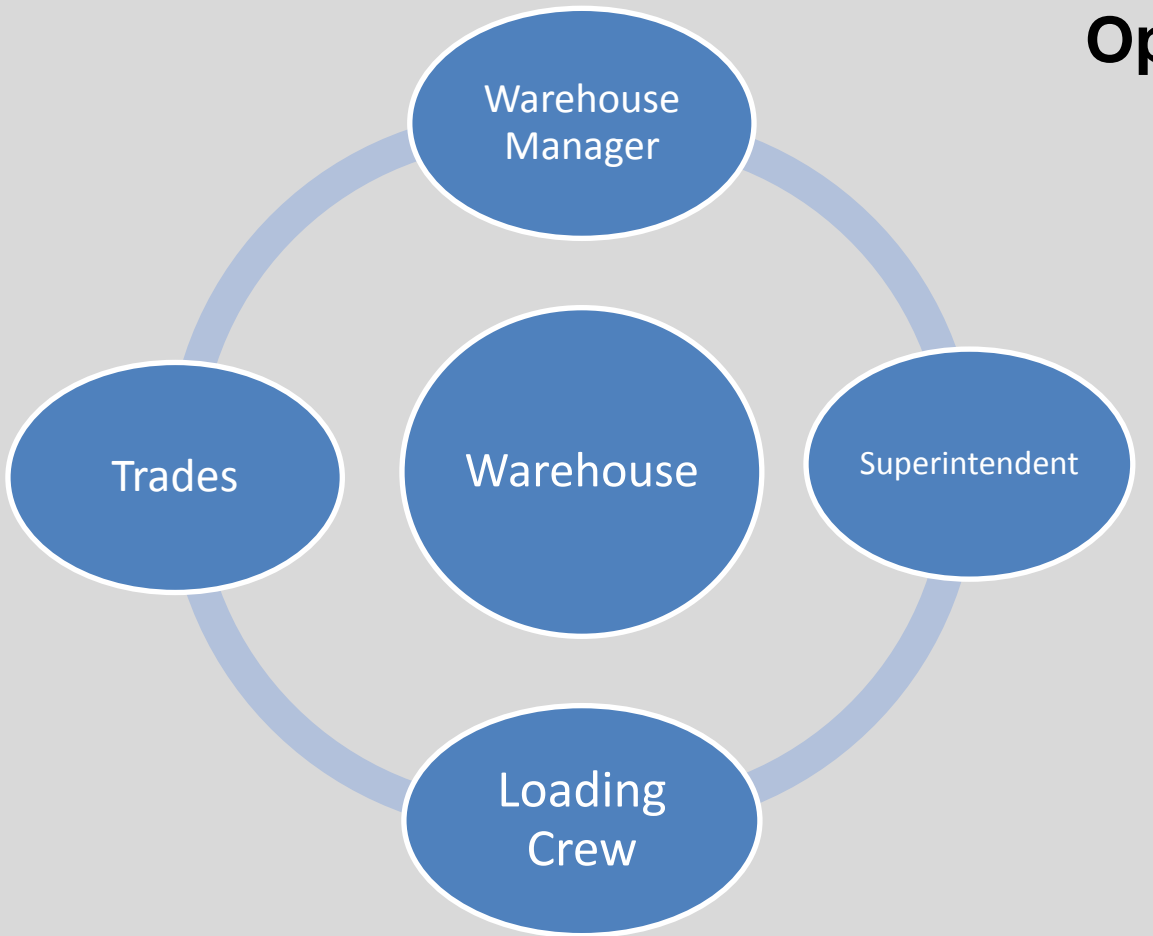




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### Operation



### Advantages

- Contractors can order material earlier since there will always be a place to put them.
  - Less chance of material delays
- Lead times may become insignificant
- Products may be able to be bought in bulk.







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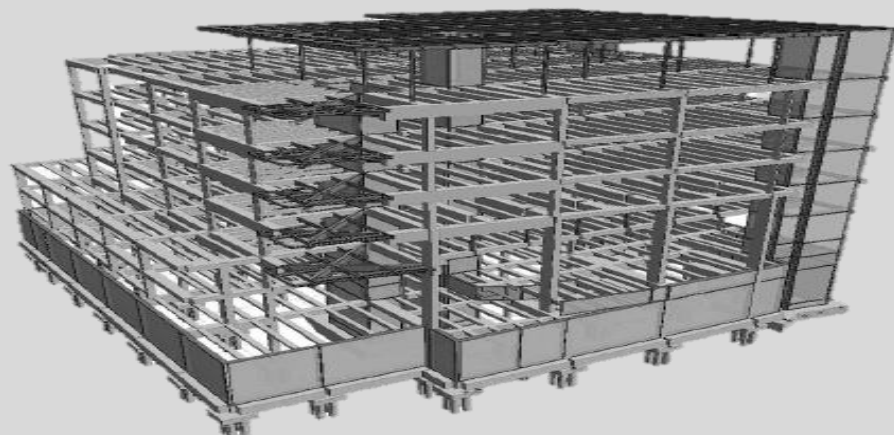
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**Cost Analysis**

Cost Analysis of Temporary Warehouse			
	Item		Cost
<b>Structure</b>	Product		\$52,260.00
	Installation		\$7,380.00
	Freight		\$5,800.00
			<b>\$65,440.00</b>

		C.S.F.	Weeks	Rate	Cost
<b>General Conditions</b>	Temp. Heat	32.8	43	\$36.00	\$50,774.40
	Temp. Lighting	32.8		\$21.50	\$705.20
	Temp. Power	32.8	103	\$0.43	\$1,452.71
	Temp. Cooling		43		\$3,012.40
	Transport Truck		103	\$30.00	\$3,090.00
	Forklift		103	\$30.00	\$3,090.00
	Warehouse Manager		103	\$2,250.00	\$231,750.00
	General Laborer		103	\$2,050.00	\$211,150.00
					<b>\$505,024.71</b>

**Results**

- Added Costs: \$570,000
- Temporary warehouse exists for 24 months
- Installation time: 5 days
- Erection does not affect project schedule



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## Analysis #1 – Prefabricated Bricks

- **Cost:** \$207,600
- **Recommendation:** **Do Not Proceed**

## Analysis #2 – Rooftop Wind Turbines

- **Cost:** \$32,168
- **Recommendation:** **Proceed**

## Analysis #3 – Material Storage Hub

- **Cost:** \$570,000
- **Recommendation:** **Do Not Proceed**







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## Thank You to..

Dr. Robert Leicht  
Dr. Susan Stewart  
Adam Brown  
Bob Stano  
Billy Gamble



Eric Anderson



Mark Taylor



Jim Haller



Darren Kiesler



***Thank You***

Questions?





**DC Feeder**

$A = W/V = 4000/240 = 16.67 \text{ Amps}$  (current through conductor)

(2) # 9's in 1/2" conduit

**AC Feeder**

$A = 5000W / (480V * \sqrt{3}) = 6.01 \text{ Amps}$

(4) # 13's in 1/2" conduit

$4 \text{ kw} * 24 \text{ hrs/day} * \$0.0804/\text{kWh} = \$7.72/\text{day}$

$\$7.72/\text{day} * 365 \text{ days} = \$2817.8/\text{year}$

**Heaviest Prefabricated Panel**

Dimensions: 15' x 12' x 0.5'  
Volume: 90 cu.ft. Concrete

Weight of concrete: 150 lb/cu.ft.

Panel Weight: **13,500 lbs**

