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Research and Economic Development Center

A Building's Life Changing Journey

By Kristen Eash

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The REDC Building

Location: Erie, PA
Building Occupants: School of Business and School of Engineering and Engineering Technology
Owner: The Pennsylvania State University and Department of General Services
Total Cost: $30 million
Structure: Steel
Exterior: Glass, Metal Panel, and Brick Walls Thermoplastic Roofing
Size: 161,500 Sq.Ft.; 2.5 stories

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The Story

During this story I will be taking you on a trip though the building's life.

- Pre-Bid – WBE/MBE Solicitation
- Scope Review – Cladding
- Procurement – Skylight
- Construction – Windmill

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The building had now been out to bid:

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Pre-Bid

WBE/MBE Solicitation

- Funding: Department of General Services (DGS)
- DGS requires: Women and Minority Businesses (WBE/MBE) Solicitation.
- OR ELSE: their bid is Thrown Out.
- The forms:
  - Long
  - Complex
  - Time consuming
- WHAT ARE THE EFFECTS ON THE PRIME CONTRACTORS?

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Pre-Bid

WBE/MBE Solicitation

The Survey asked the following things:

- Does this increase Pre-bid time? All said YES
- Is WBE/MBE Solicitation FAIR?
  71% said NO (many opinions were given as to why this is so)
- Have you hired a sub you normally wouldn't?
  91% Have and of this 58% were unsuccessful Contracts

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WBE/MBE Solicitation

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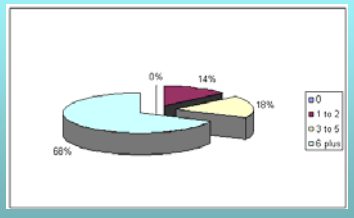
How many DSG Projects have contractors bid on?



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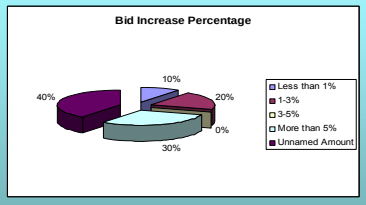
How much do Contractors Increase their Bids by?

45% of the contractors increased their bid. Of those:



This means that in general owners will be paying 1.8% more on DGS project that require WBE/MBE solicitation.

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The low bid contractors have been chosen.
It was now time for…

Scope Review

Cladding

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Scope Review

Cladding

Problem:

- Erie has poor construction practices with Metal Siding
- Other buildings with siding need maintenance every 7 years
- Maintenance is expected to cost REDC $85,000 each time.
- There are 3900 SF of the panel designed onto the building

Proposal:

- Replace with either Glass or Brick Curtain Wall System

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Cladding

Cost:

Name	Cost/ SF	Cost	Maintenance
Glass and aluminum supports	$45	$175,500	$0
Brick	$28.75	$112,125	$0
Metal Siding and aluminum supports	$9.79	$35,244	$229,670 (@4%)

This makes the Brick the Cheapest system event thought the initial cost for metal panel is cheaper.

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Schedule:

Name	Daily Output	Construction Length
Glass and Supports	98 SF/Day	41 days
Brick	230 SF/Day	17 days
Metal Siding	775 SF/Day	6 days
Aluminum supports	1020 SF/Day	1 day added to systems that need this

Metal Panel is the fastest but this work is not on the critical path. This means that adding a few extra days won't matter.

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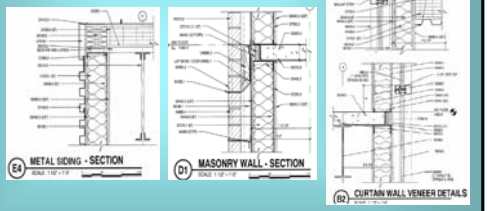
Structural Support:



All three systems are supported by the **same curtain wall** even though the metal panel is 12 psf, the glass is 30 psf, and the brick is 55 psf.

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Conclusion:

Research	Metal Panel	Glass	Brick
Lifetime Cost (@ 4%)	$229,670	$175,500	$112,125
Maintenance	$85,000 every 7 years	$0	$0
System	$35,244	$175,500	$112,125
Schedule	6 days	41 day	17 days
Structure	All same	All same	All same
Constructability	Worst	Middle	Best

As shown Brick ends up being the best system for the building.
This should be changed as a change order immediately.

The contracts have been signed. Now its time for…

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Problem:

•There is a joist that runs through the center the skylight in the main lobby

Proposal:

•Remove the Joist and redesign the roof joist system

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Analysis:

•Joist supports the skylight which weighs 155 plf L.L & 125 plf D.L.

•Below is a picture of the original system

•The joist was removed and new loads were calculated by hand.

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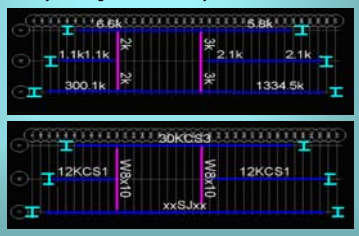
Analysis:

•To check my work a structural program was run. This also helped my redesign the removed joist



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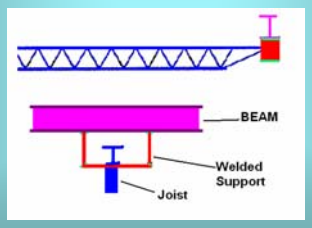
Analysis:

•The support was also redesigned.



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Cost:

Name	Unit	Original Amount	New Amount
30KCS3	13.13 per LF	69 LF ($905.97)	36 LF ($472.68)
12KCS1	9.57 per LF	0	23 LF ($220.11)
Welding	51.60 per LF	0	4 LF ($206.40)
1" Steel Plate	39 per SF	0	2 SF ($78.00)
	Total	$905.97	$977.19

This is a total increase of just over **$71**.

Schedule:

Name	Unit	Original Amount	New Amount
Welding	12 per Day	0	4 LF (+2hr 40 min)
Connect Joist	10 per hour	6	8 (+12 min)

This is a total time increase of **3 hours**.

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Conclusion:

I recommend removing the joist for the additional $71 and 3 hours. This change should be done with a change order and the effect should be shown in the procurement.

Before

After

Materials have shown up on site. Work is beginning.

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Background:

•Building sits in line with Lake Erie and gets lake effect wind

•Penn State is trying to enhance energy conservation.

•REDC is an Engineering and Engineering Technology Building.

Proposal:

•I propose placing windmills on the roof of the building

•Add a display into the lobby of the building to make this an interactive learning process.

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Power Generation:

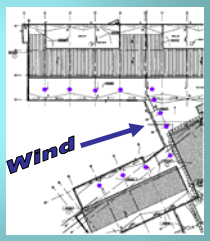
•The average wind speed of the area is 11.1 mph (5 m/s)

•The windmill has an efficiency of 64%

•The windmill is assumed to run 24 hours a day

•Power Generated = **25 Watts/ Windmill**

•Total Power / Windmill = **200,000 kWh/Year**



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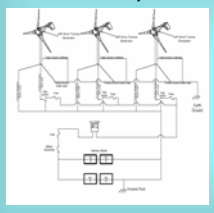
Electrical Hookup:



it passes through a DC breaker and then the inverter box and into the main AC breaker for he building.

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Cost:

- Power savings = 9.6 ¢/kWh → $18,800/windmill saved
- Total Savings in electrical costs in first year = $225,600
- Windmill Costs = $1,500/windmill
- Kiosk = $2,600
- Backup Battery system = $3,000
- Wiring = $6,000
- Total Cost= $30,000

Noise:

- Sits on isolators so no vibrations travel through building
- Blades have anti-flutter system
- Motor has speed control

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Schedule:

- Roof work done early in these sections
- Not on Critical Path
- Wiring not intense, not add much time
- Wiring runs through existing conduit.

Structural:

- Windmills sit on directly on joist or column
- Total Load of new system is 45 lb
- As shown in skylight roof can hold this easily

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Conclusion:

- Will make back its cost in during the fist year
- Does not affect Schedule
- Will not have adverse noise effects
- Roof can easily hold load
- Here is what it will look like.

Because of the above reasons I recommend that the proposed 12 windmills be placed onto the building. They will be able to be used for educational purposes and can help the University reduce power consumption.

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The building was built. Now what?

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	Price	Time	Other
Industry	+ 1.8%	+ Time	
Cladding To glass	- $117,545	+11 days	Same structure & Constructability
Skylight	+ $71	+ 3 hours	New structure and steel schedule
Windmill	- $195,600	+ Time	Same structure and noise new electrical
Total	**- $313,145**	**+15 days**	**No other changes**

Windmill will also save $225,600 every year.

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And the building was built cheaper, was cheaper to run and was better for the environment. So, they all lived happily ever after…

The End

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Questions???

Special Thanks To:

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The REDC Building

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This is a brief look at the floor plan

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WBE/MBE Solicitation

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What Are the biggest problems with WBE/MBE Solicitation?

- The WBE/MBE Subcontractors are not properly qualified.
- The WBE/MBE Subcontractors not responding
- The resulting bids not low enough bids.

What do contractors think of this process?

- Many Contractors feel that this program does not help truly disadvantaged businesses and is therefore corrupt.
- Other contractors feel that there should be no difference between "disadvantaged businesses" and other companies.

Construction

Windmill

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Selection:

Air 403 Industrial Wind Generator
•Weight: 14 lbs
•Start Speed: 2.7 m/s
•Output: 400 watts at 12.5 m/s
•Price: $995.00

Tower Kit
•Height: 27 foot
•Price: $140.00
•Anchors: $55.00

Kiosk
•Price: $2,600.00

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Electrical Hookup:

•Windmills are tied together to a bus bar and connected to a stop switch.

•They pass through an Amp Meter.

–The kiosk will read the amp meter's output

•The power then goes into the battery bank

•Power travels next through the DC Circuit Breaker and into a controller.

•Next it passes through the inverter and into the main AC breaker for the building.