





# University of Maryland Physical Sciences Complex College Park, MD

John Melching • Construction Option Focus on Façade Systems

Building CM: Gilbane Co.

Faculty Advisor: Dr. Chimay Anumba



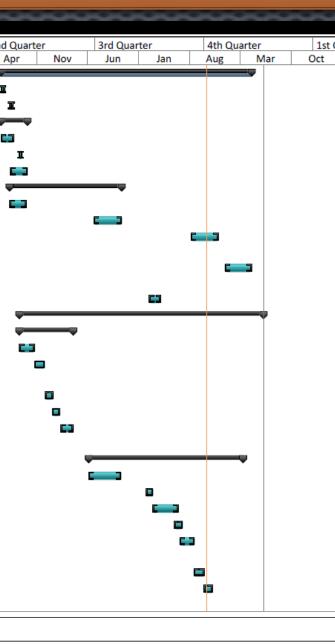
#### Overview

Building Information & Familiarization Analysis Topics

#1: Elliptical Curtain Wall Redesign Architectural Breadth #2: HCPV Façade #3: Multi-shift Work Schedule Compression Conclusion Acknowledgements & Credits

Task Name	Duration	Start	Finish
Sitework	751 days	Thu 6/3/10	Thu 4/18/13
Sediment and Erosion Control	12 days	Thu 6/3/10	Fri 6/18/10
Demo Existing Improvements	10 days	Fri 7/9/10	Thu 7/22/10
North	79 days	Thu 6/3/10	Tue 9/21/10
Install Duct Banks	38 days	Thu 6/3/10	Sun 7/25/10
Temporary Steam	10 days	Tue 8/17/10	Mon 8/30/10
New Utility Lines	51 days	Tue 7/13/10	Tue 9/21/10
South	336 days	Fri 7/9/10	Fri 10/21/11
Install Duct Banks	50 days	Fri 7/9/10	Thu 9/16/10
Excavate & Install New Steam	85 days	Mon 6/27/11	Fri 10/21/11
Plaza East - Retaining wall, Paving, and finishings	82 days	Wed 8/8/12	Thu 11/29/1
Plaza West - Seat wall, paving, drains, furnishings	80 days	Fri 12/28/12	Thu 4/18/13
Permanent site lighting	35 days	Tue 2/14/12	Mon 4/2/12
PSC Main Building	732 days	Thu 8/19/10	Fri 6/7/13
Excavation	162 days	Thu 8/19/10	Fri 4/1/11
Equip. set-up & Delivery	46 days	Thu 8/19/10	Thu 10/21/1
Exc. For Piles, caissons, steam lines	30 days	Fri 10/22/10	Thu 12/2/10
Install Dewatering wells	24 days	Mon 12/6/10	Thu 1/6/11
Install Lagging & guardrail	23 days	Tue 1/4/11	Thu 2/3/11
Drill for Caissons/remove spoils	38 days	Wed 2/9/11	Fri 4/1/11
Sub Basement	463 days	Mon 6/6/11	Wed 3/13/1
Structure	97 days	Mon 6/6/11	Tue 10/18/1
Wall Framing	20 days	Thu 2/2/12	Wed 2/29/12
Duct and Pipe	78 days	Wed 2/29/12	Fri 6/15/12
Insulation and set Equip.	24 days	Wed 5/30/12	Mon 7/2/12
Electrical (Panel Boxes, conduit, in wall)	44 days	Thu 6/21/12	Tue 8/21/12
Finish Walls & Paint	31 days	Mon 8/20/12	Mon 10/1/12
Pull Wire and Set lighting Fixtures	26 days	Mon 10/1/12	Mon 11/5/12

#### **Presentation Overview**





Overview **Building Information & Familiarization** Analysis Topics #1: Elliptical Curtain Wall Redesign Architectural Breadth #2: HCPV Façade #3: Multi-shift Work Schedule Compression Conclusion Acknowledgements & Credits

158,000 SQ FT Green roof Space (CSS) Building

- 5 Above ground levels, 2 basement levels State-of-the-art Science Labs 27 Laser labs, 18 prep labs, 9 biophysics labs
- Connects to existing Computer Science and
- 20% funding from government ARRA program Project costs approximately \$99 million

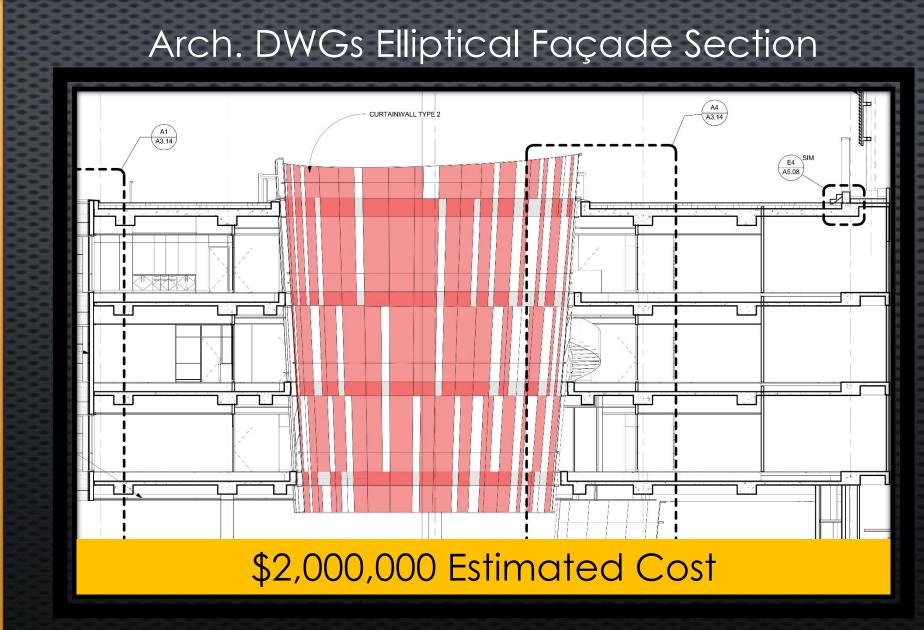


Overview **Building Information & Familiarization** Analysis Topics #1: Elliptical Curtain Wall Redesign Architectural Breadth #2: HCPV Façade #3: Multi-shift Work Schedule Compression Conclusion Acknowledgements & Credits





Overview Building Information & Familiarization Analysis Topics #1: Elliptical Curtain Wall Redesign Architectural Breadth #2: HCPV Façade #3: Multi-shift Work Schedule Compression Conclusion Acknowledgements & Credits



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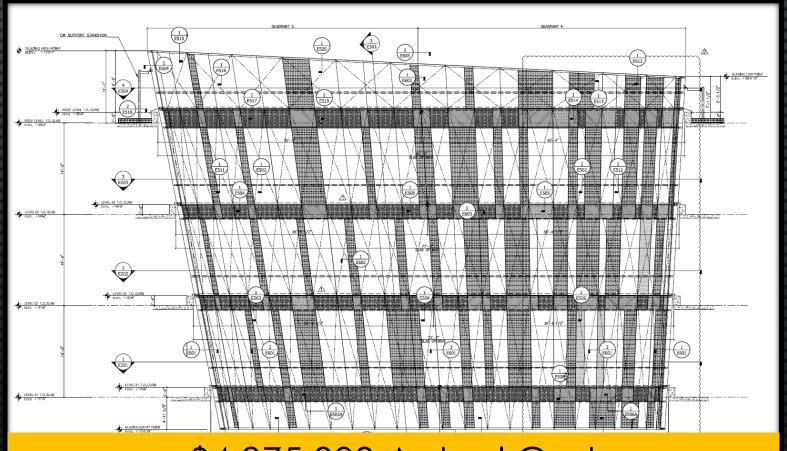
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# Analysis #1: Elliptical Curtain Wall Redesign

# **University of Maryland Physical Sciences Complex**

# Manufacturing DWGs Elliptical Façade Section



\$4,875,000 Actual Cost

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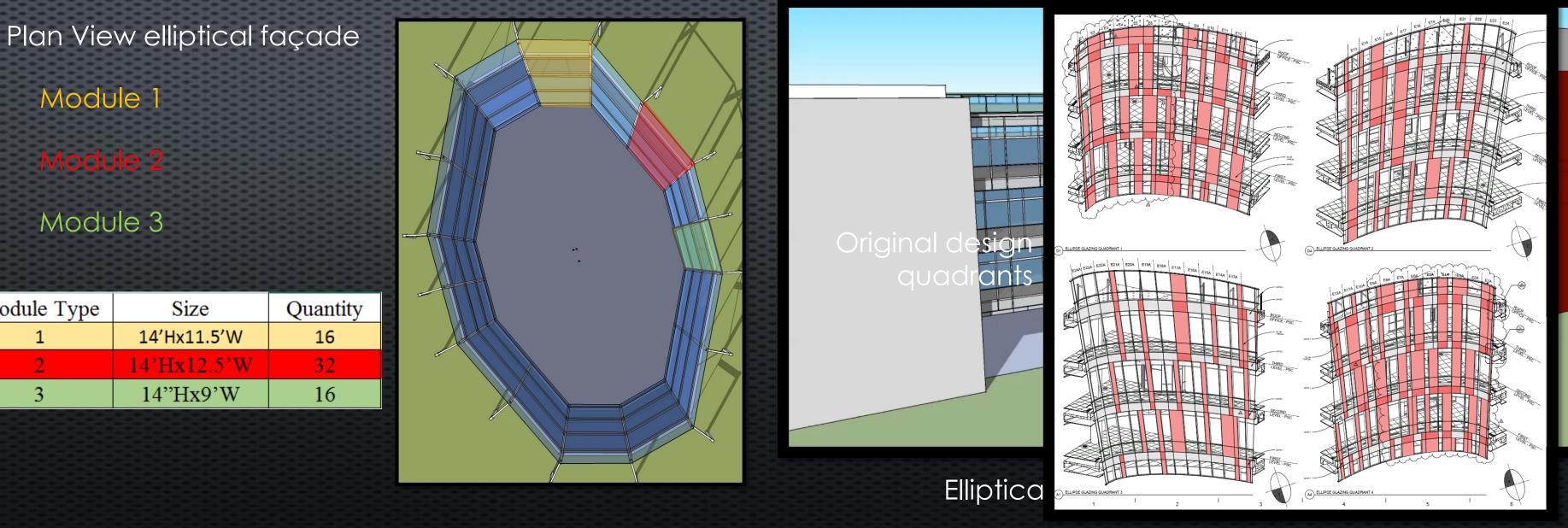


Module 1

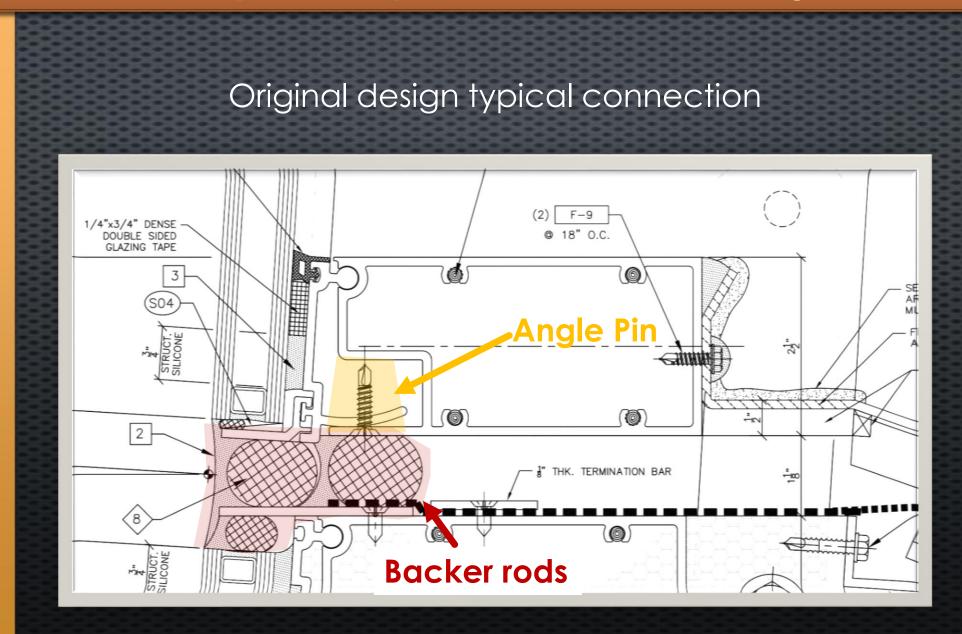
Module 3

Module Type	
1	14
2	14'
3	14

# Analysis #1: Elliptical Curtain Wall Redesign



Overview Building Information & Familiarization Analysis Topics #1: Elliptical Curtain Wall Redesign Architectural Breadth #2: HCPV Façade #3: Multi-shift Work Schedule Compression Conclusion Acknowledgements & Credits

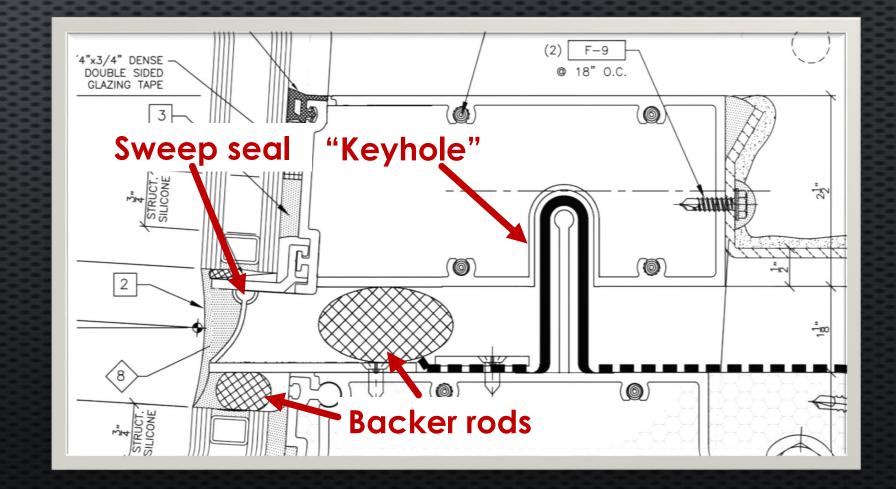


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### Analysis #1: Elliptical Curtain Wall Redesign

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### New design typical connection



Overview Building Information & Familiarization Analysis Topics #1: Elliptical Curtain Wall Redesign Architectural Breadth #2: HCPV Façade #3: Multi-shift Work Schedule Compression Conclusion Acknowledgements & Credits



# Analysis #1: Elliptical Curtain Wall Redesign

Overview Building Information & Familiarization Analysis Topics #1: Elliptical Curtain Wall Redesign Architectural Breadth #2: HCPV Façade #3: Multi-shift Work

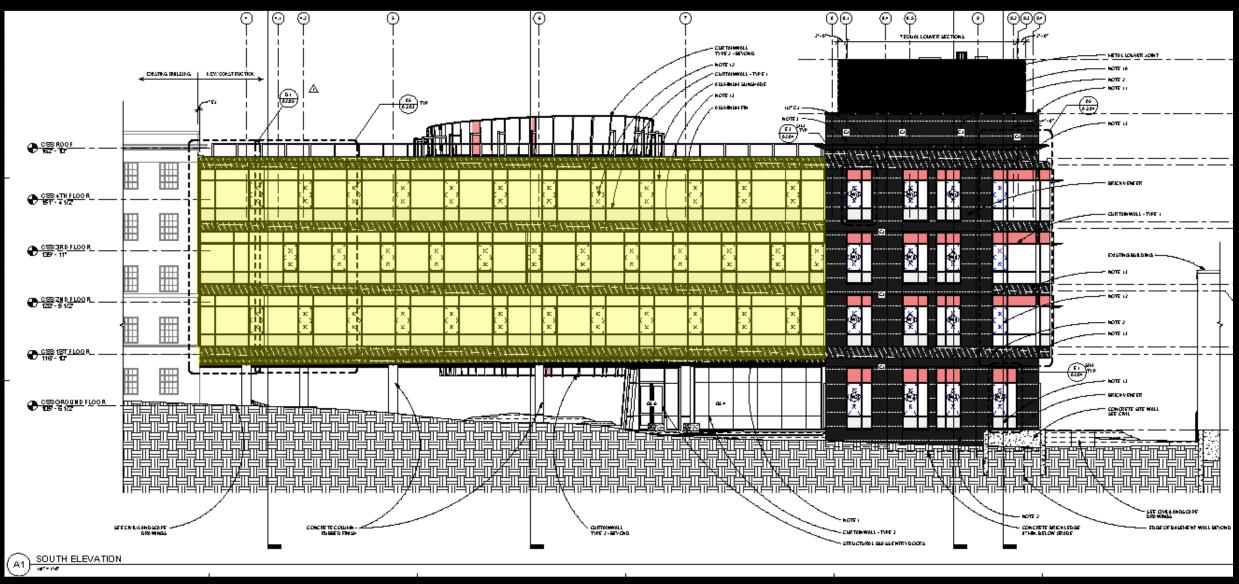
Schedule Compression Conclusion Acknowledgements & Credits 

#### Analysis #2: HCPV Façade

# **University of Maryland Physical Sciences Complex**

Southern Facing PSC Façade

Estimated \$308,000/year electricity cost



Overview Building Information & Familiarization Analysis Topics #1: Elliptical Curtain Wall Redesign Architectural Breadth **#2: HCPV Façade** 

#3: Multi-shift Work Schedule Compression Conclusion Acknowledgements & Credits nvestigation

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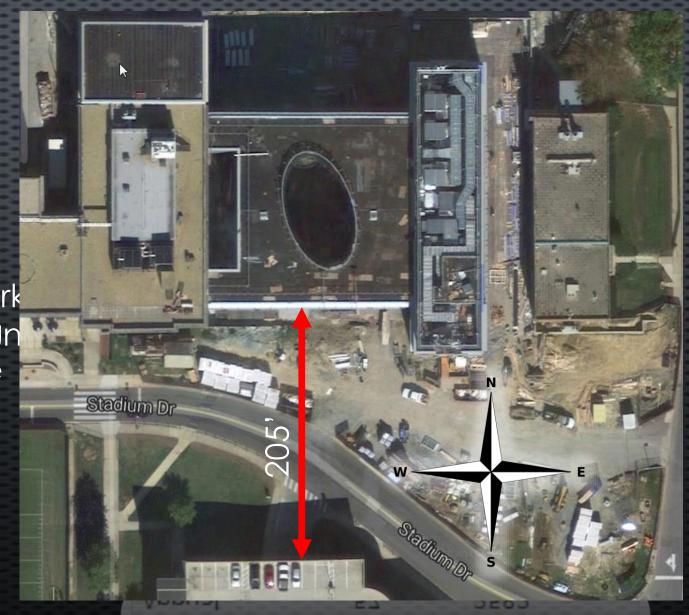
#### Analysis #2: HCPV Façade

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# South Facing?

#### Adequate Sun?

Visible Sky?









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#3: Multi-shift Work Schedule Compression Conclusion Acknowledgements & Credits

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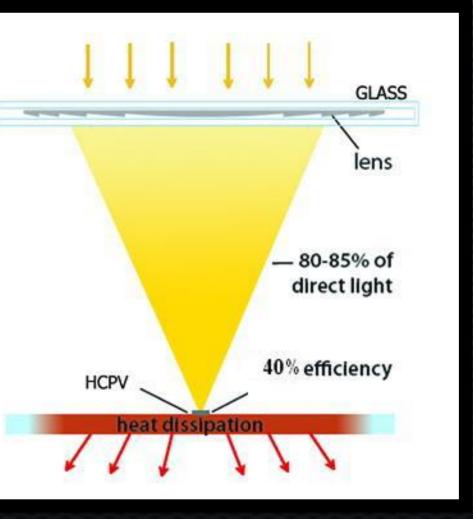
#### Analysis #2: HCPV Façade

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Typical HCPV (High Concentrated Photovoltaic) Array

40% efficiency Ability to "Solar track" Additional heat generation as useful byproduct \$1,500/SQ Meter

# HCPV Cell Diagram



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#3: Multi-shift Work Schedule Compression Conclusion Acknowledgements & Credits



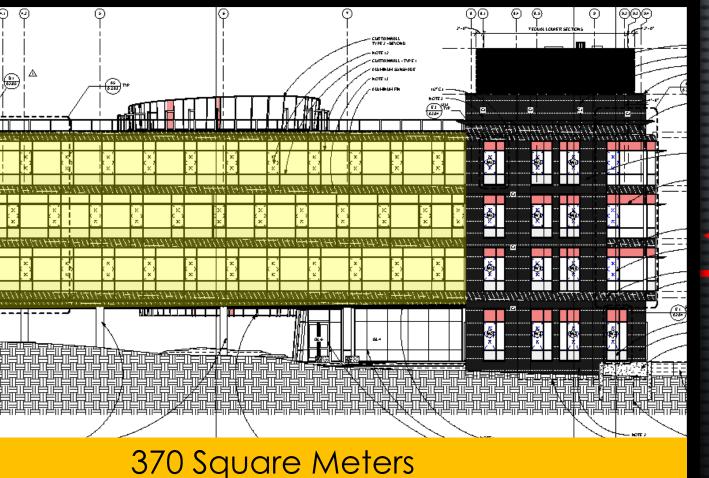
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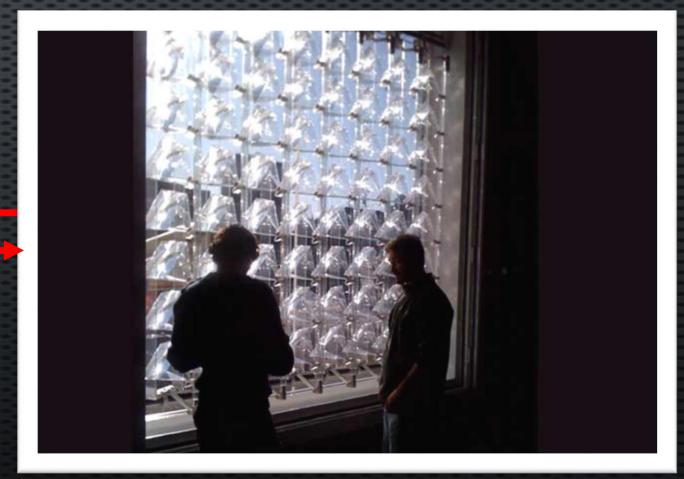
### Analysis #2: HCPV Façade

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# Area to receive HCPV modules Typical HCPV (High Concentrated Photovoltaic)

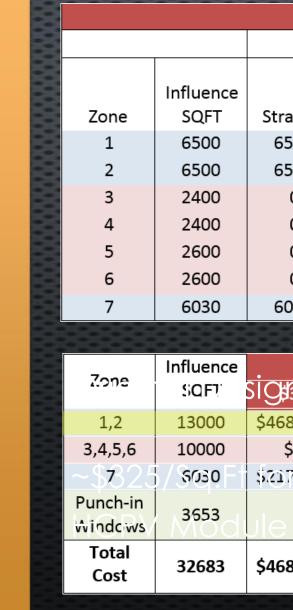
Functional mock-up, Syracuse University Helioptix LLC





Overview Building Information & Familiarization Analysis Topics #1: Elliptical Curtain Wall Redesign Architectural Breadth #2: HCPV Façade

#3: Multi-shift Work Schedule Compression Conclusion Acknowledgements & Credits



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# Analysis #2: HCPV Façade

	SQFT Quantities														
Fra	iming				Instal	lation	Glass (Ins	ulated)							
									Alum.						
							1"		Metal	Alum.	Operable	Final Seal/			
Straight	Segmented	Gasket/Seal	Unitize	Delivery	Interior	Exterior	Clear/Vision	1" Color	Panel	Sunshade	Windows	Inspection			
6500	0	6500	6500	6500	0	6500	3600	1200	1600	630	700	6500			
6500	0	6500	6500 6500		0	6500	3600	1200	1600	0	700	6500			
0	2300	2300	2300	2300	2400	0	1035	1265	0	0	0	2400			
0	2300	2300	2300	2300	2400	0	1080	1320	0	0	0	2400			
0	2600	2600	2600	2600	2600	0	1508	1092	0	0	0	2600			
0	2600	2600	2600	2600	2600	0	1690	910	0	0	0	2600			
6030	0	6030	6030 6030 6030		0	6030	2715	2109	1206	585	120	6030			

	Cost/SQFT of Component														
Offile C	OST\$5\$\$1,	105,000	\$45	\$6	\$59	\$36	<b>S</b> dst	differe	enêe:	\$189,0	<b>))()</b> 32	\$7	Cost	Cost/SQFT	
468,000	\$0	\$117,000	\$585,000	\$78,000	\$0	\$468,000	\$129,600	\$74,400	\$86,400	\$68,040	\$44,800	\$91,000	\$2,210,240	\$170	
\$O	\$568,400	\$88,200	\$441,000	\$58,800	\$590,000	\$0	\$95,634	\$142,197	\$0	\$0	\$0	\$70,000	\$2,054,231	\$205	
217,080	CP\\$ofad	्र\$54,270	\$271,350	\$36,180	\$0	\$217,080	\$48,870	\$65,379	\$32,562	\$63,180	\$3,840	\$42,210	\$1,052,001	\$174	
le Fa	çade (	Cost: \$1,	294,000	)									\$401,830	\$110	
468,000	\$568,400	\$205,200	\$1,026,000	\$136,800	\$590,000	\$468,000	\$225,234	\$216,597	\$86,400	\$68,040	\$44,800	\$161,000	\$5,718,302	\$175	

Overview Building Information & Familiarization Analysis Topics #1: Elliptical Curtain Wall Redesign Architectural Breadth #2: HCPV Façade

#3: Multi-shift Work Schedule Compression Conclusion Acknowledgements & Credits

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College Park, MD cost of electric: \$0.135/kWh

Total estimated energy savings per year: \$84,778/year

631,423kWh per year

Cost difference between façade types: \$189,000

Additional Cost of inverters & heat exchangers:

Subtotal Additional Costs:

Payback period of 3.25 Years

# **University of Maryland Physical Sciences Complex**

\$85,000 \$274,000

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Acknowledgements & Credits

Problem Identification:

Estimate substantial completion in September 2013

Building is not fully operational during Fall semester of 2013

Revenue not received during lack of operations to school

Solution:

clause

Apply two work shifts for trades that can utilize it Push forward the substantial completion into the

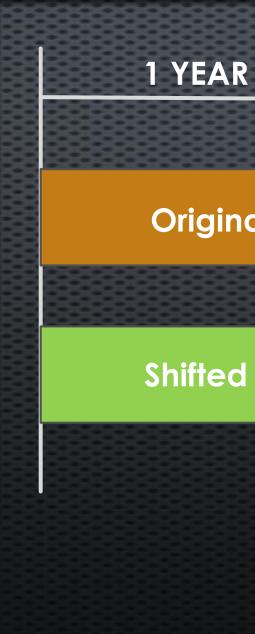
summer of 2013

# **University of Maryland Physical Sciences Complex**

#### Solicit the University for an early finish contractual

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Acknowledgements & Credits



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**Original Schedule** 

Sept 2013

# Shifted Schedule

April 2013

with fully operational PSC

Cost to Gilbane Co. to implement shifted work schedule is approximately \$4.2 million

An early finish clause for an amount over and above \$4.2 million would generate more revenue for both parties and allow students earlier access to the learning facilities

# **University of Maryland Physical Sciences Complex**

### School stands to generate additional \$9 million revenue

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Façade simplification by architectural redesign: \$3,775,000

\$85,000

Additional revenue to Gilbane to range from \$1 to \$4.8 million

Revenue to school between \$4.2 to \$8 million

Yearly energy savings with HCPV technology:

Special Credits and Acknowledgements:

Ms. Rose Abousaid – Gilbane Co. PSC Project Engineer Dr. Chimay Anumba – Penn State AE Mr. Tom Kanuck – Helioptix LLC Mr. Alphonso Lopez – Sentech Architectural Systems Inc. Mr. Bob Mathews – Mathews Architectural Concepts Mr. Bill O'Donnel – Local 401 Iron Workers Union Mr. Patrick Peters – Gilbane Co. PSC Façade Project Manager Mr. John Pierce – Berkowitz Glass Co. Mr. John Shedaker – Shedaker Metal Arts Mr. Robert Specter – University of Maryland