



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

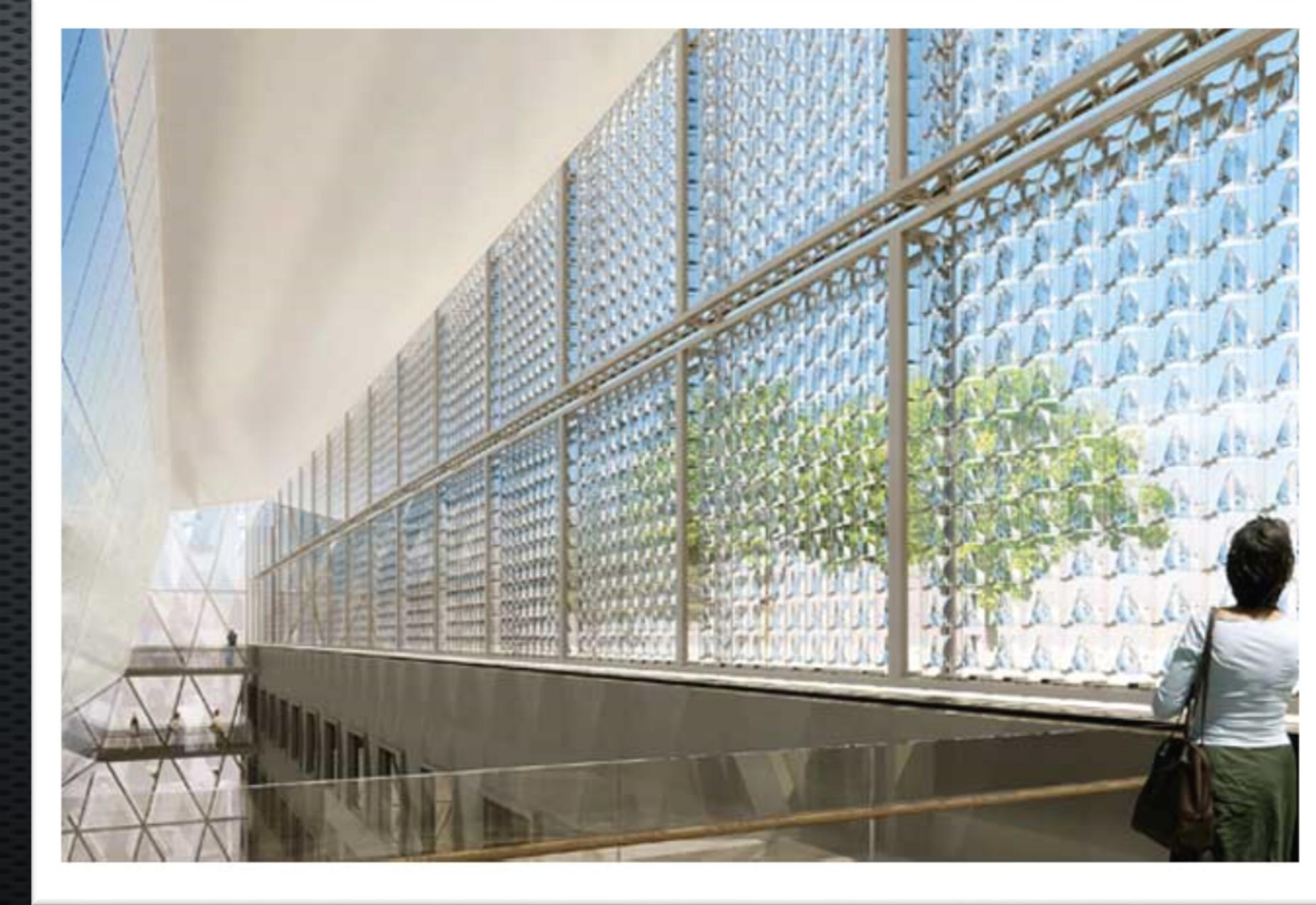
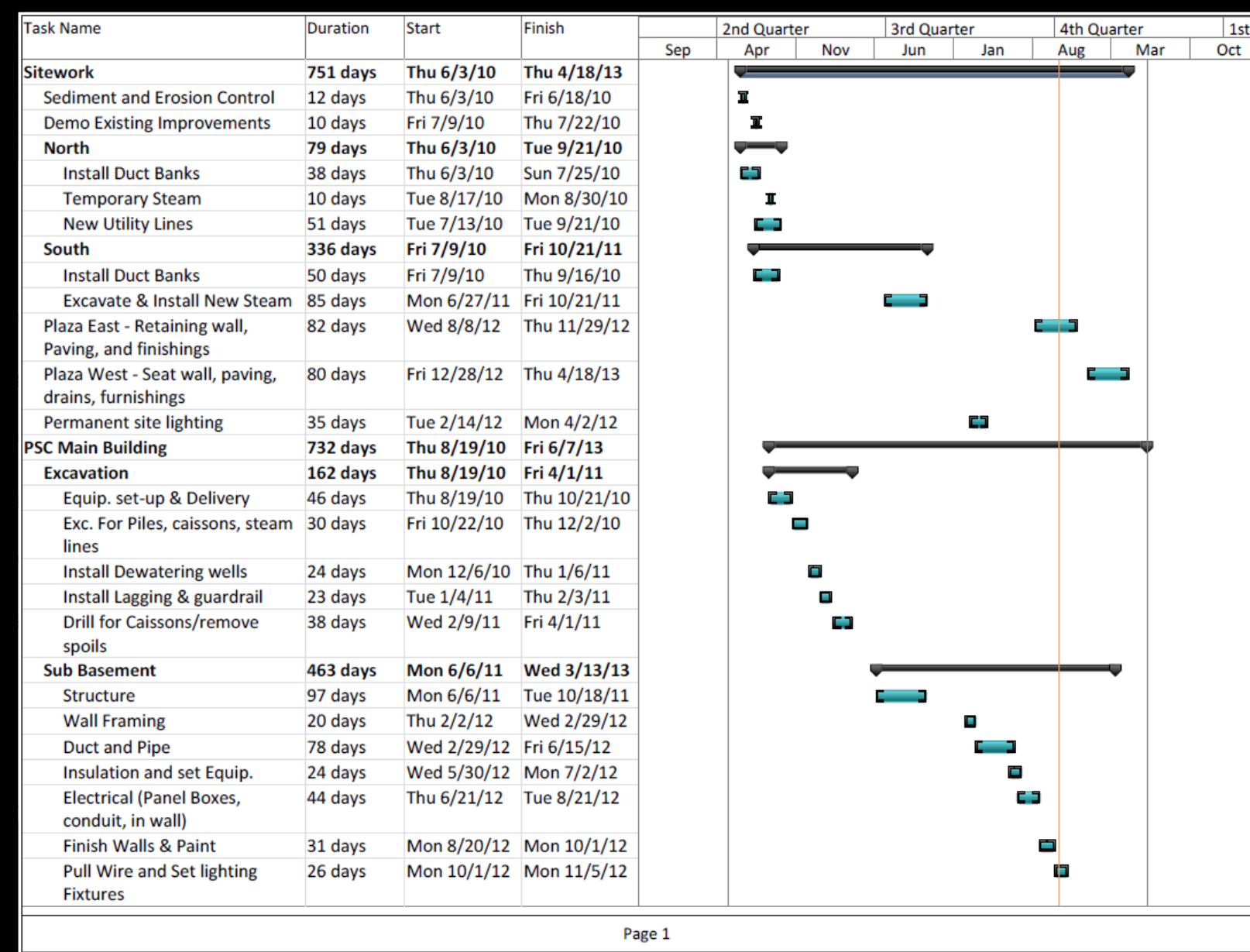
#2: HCPV Façade

#3: Multi-shift Work

Schedule Compression

Conclusion

Acknowledgements & Credits



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158,000 SQ FT

5 Above ground levels, 2 basement levels

State-of-the-art Science Labs

27 Laser labs, 18 prep labs, 9 biophysics labs

Green roof

Connects to existing Computer Science and Space (CSS) Building

20% funding from government ARRA program

Project costs approximately \$99 million



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Elliptical Façade



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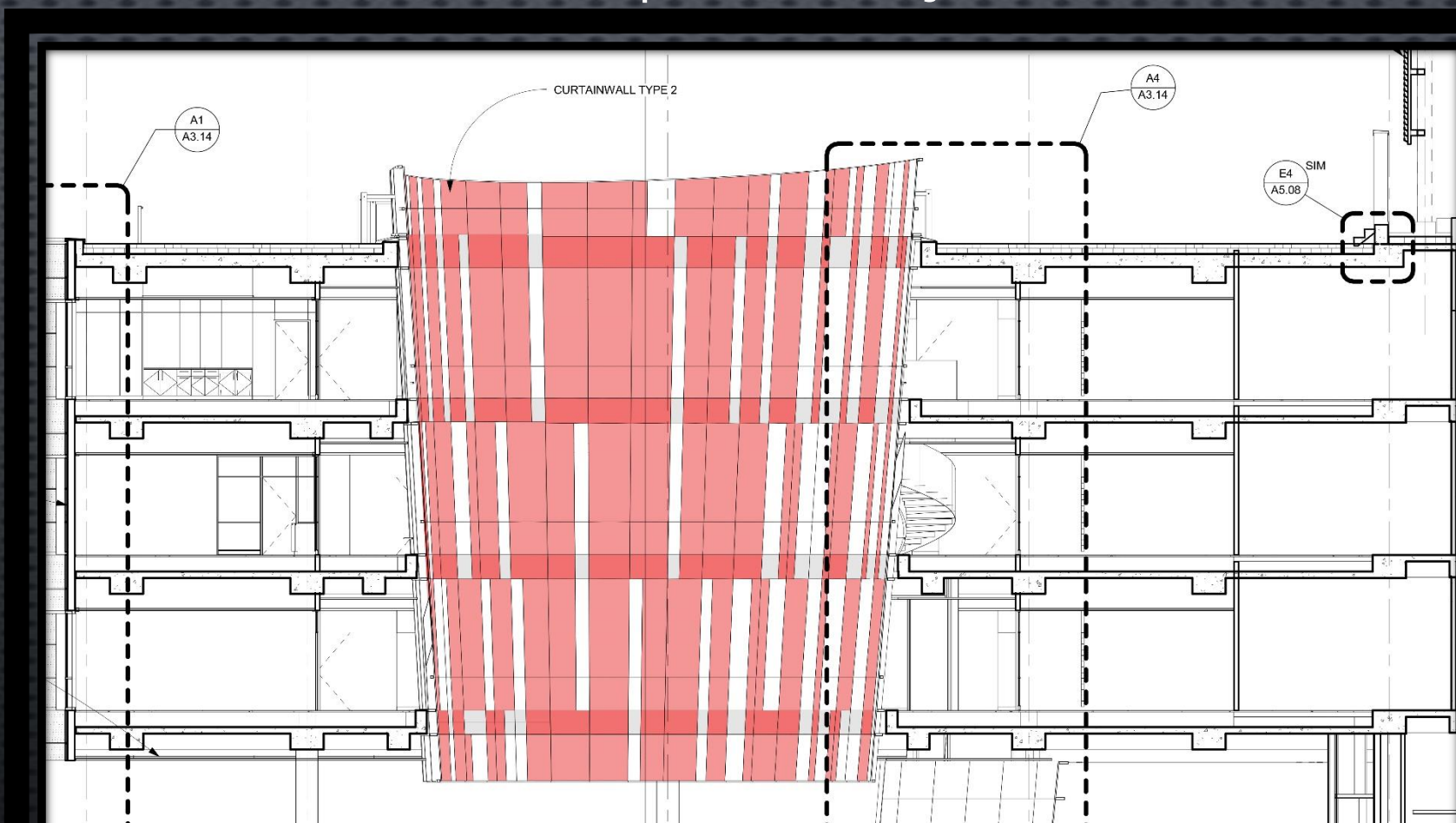
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Problem Identification

Arch. DWGs Elliptical Façade Section



\$2,000,000 Estimated Cost

Manufacturing DWGs Elliptical Façade Section



\$4,875,000 Actual Cost

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Solution

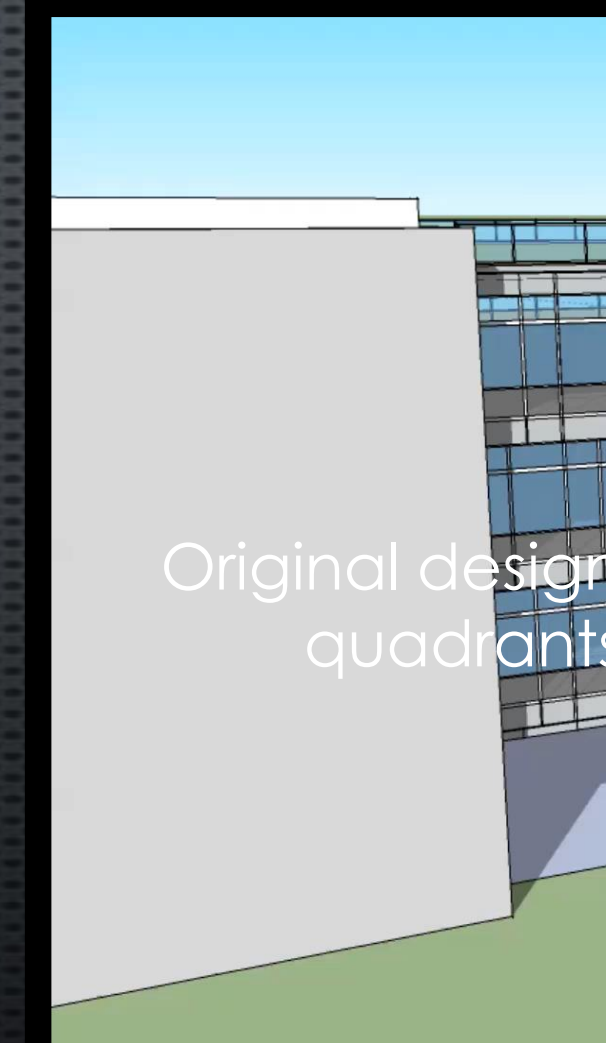
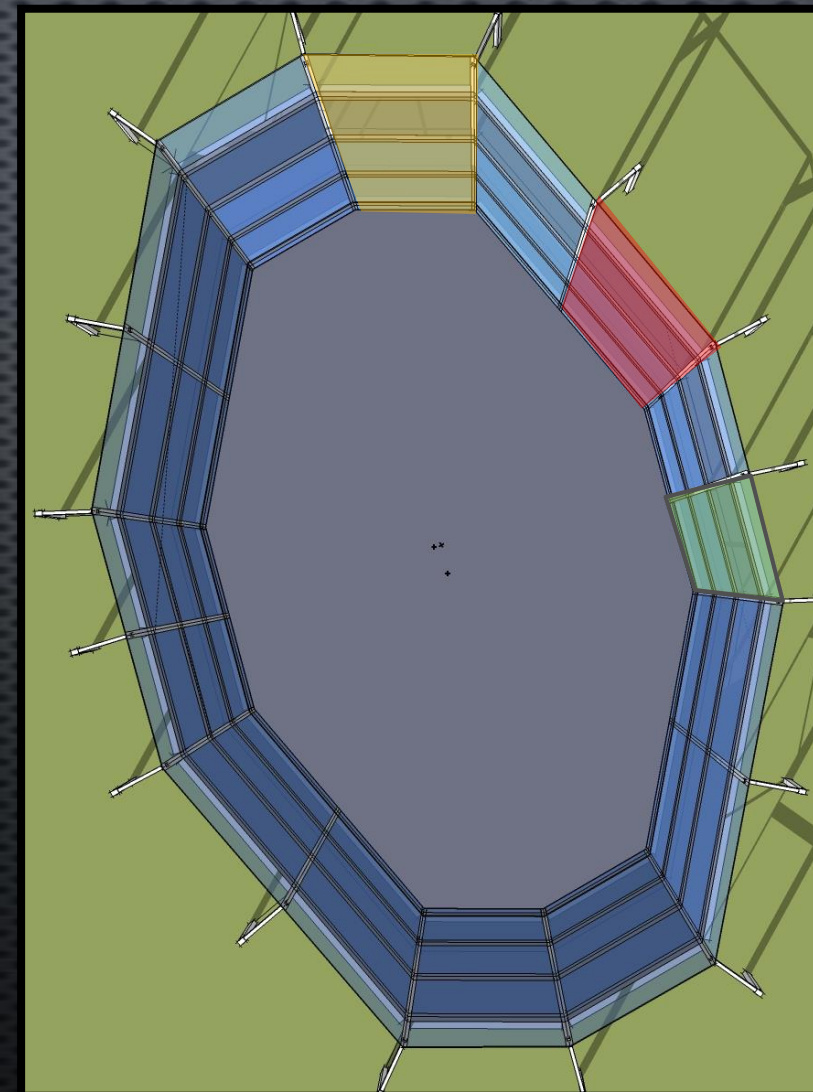
Plan View elliptical façade

Module 1

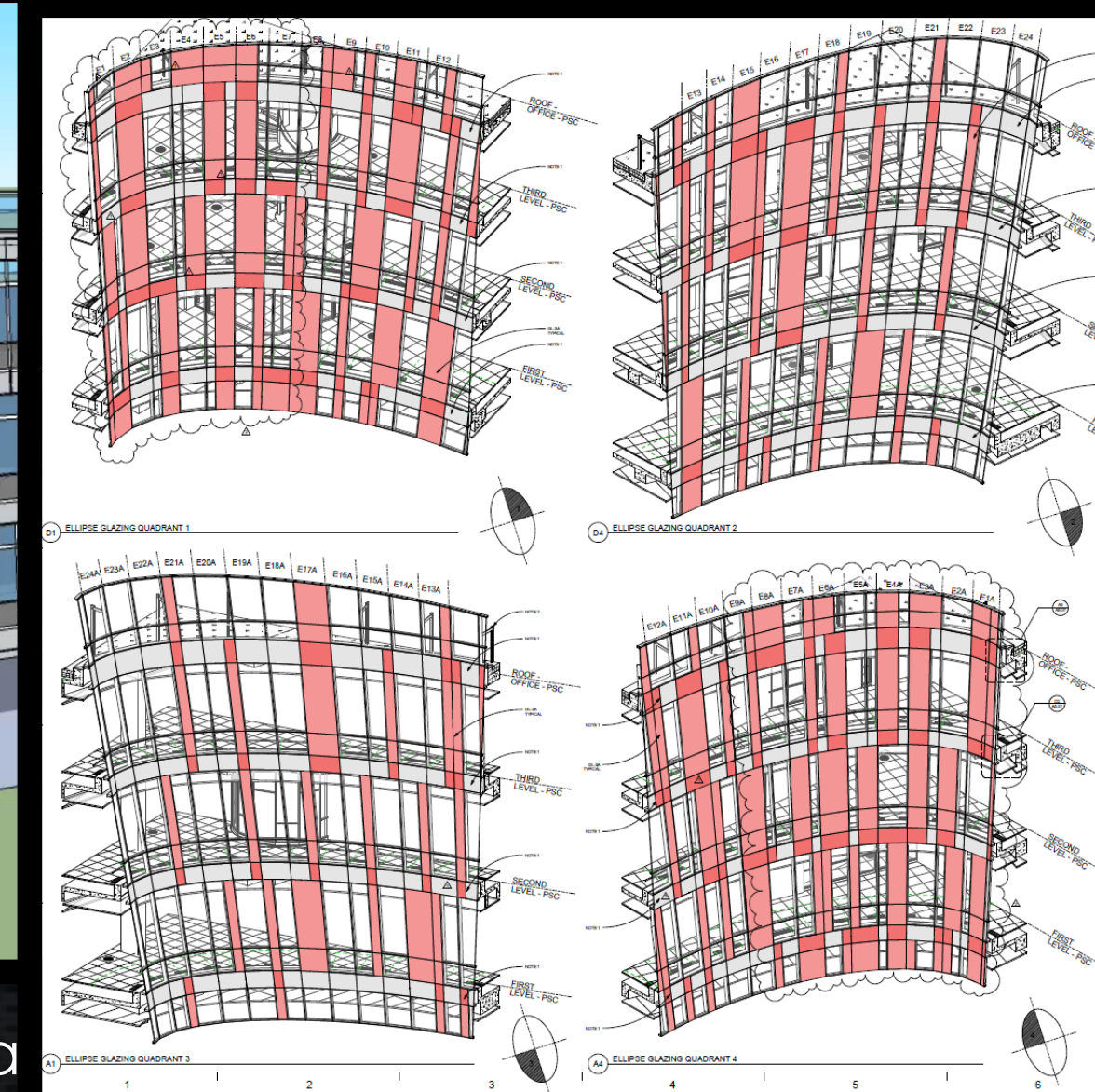
Module 2

Module 3

Module Type	Size	Quantity
1	14'Hx11.5'W	16
2	14'Hx12.5'W	32
3	14'Hx9'W	16



Elliptica



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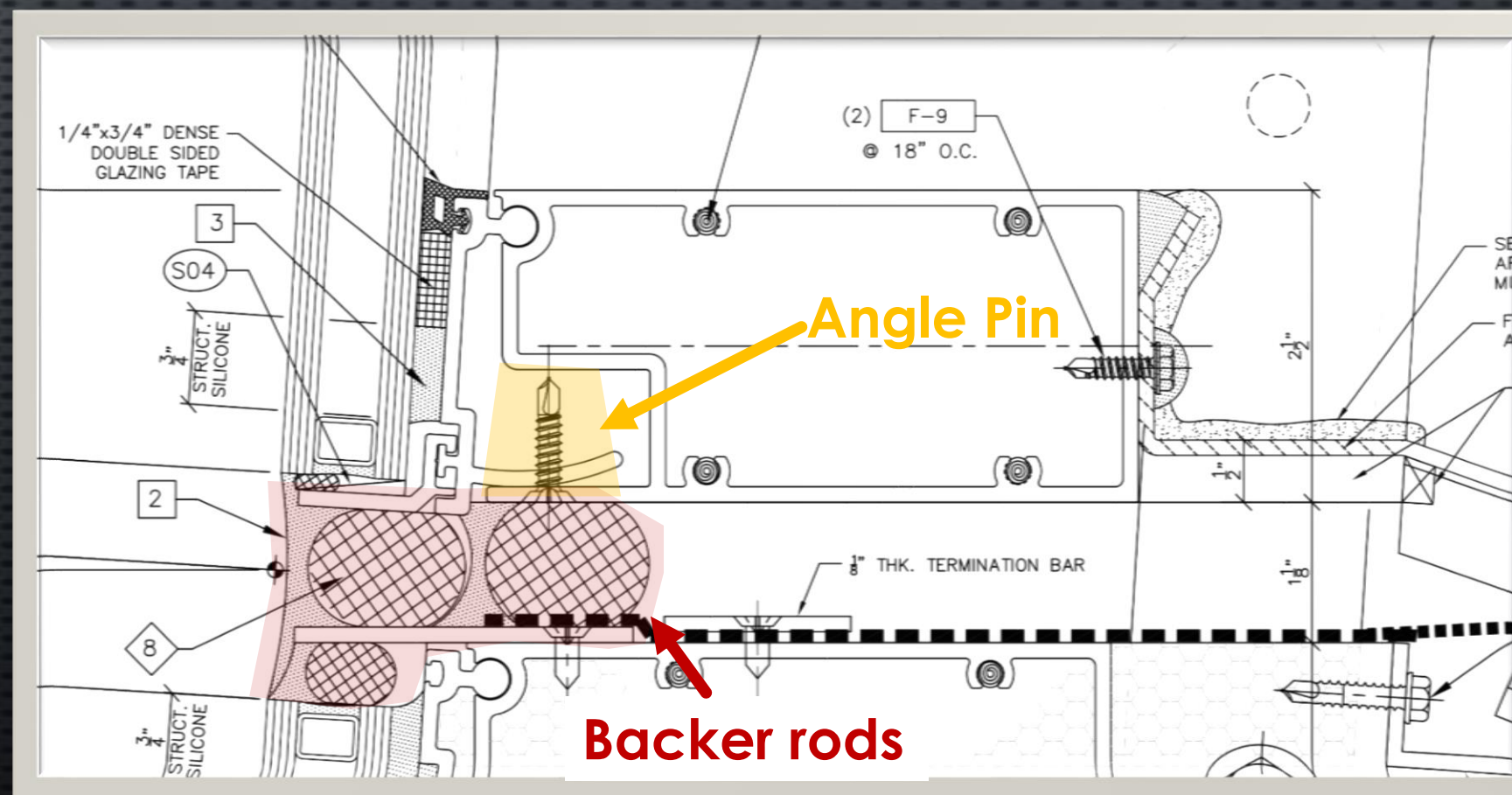
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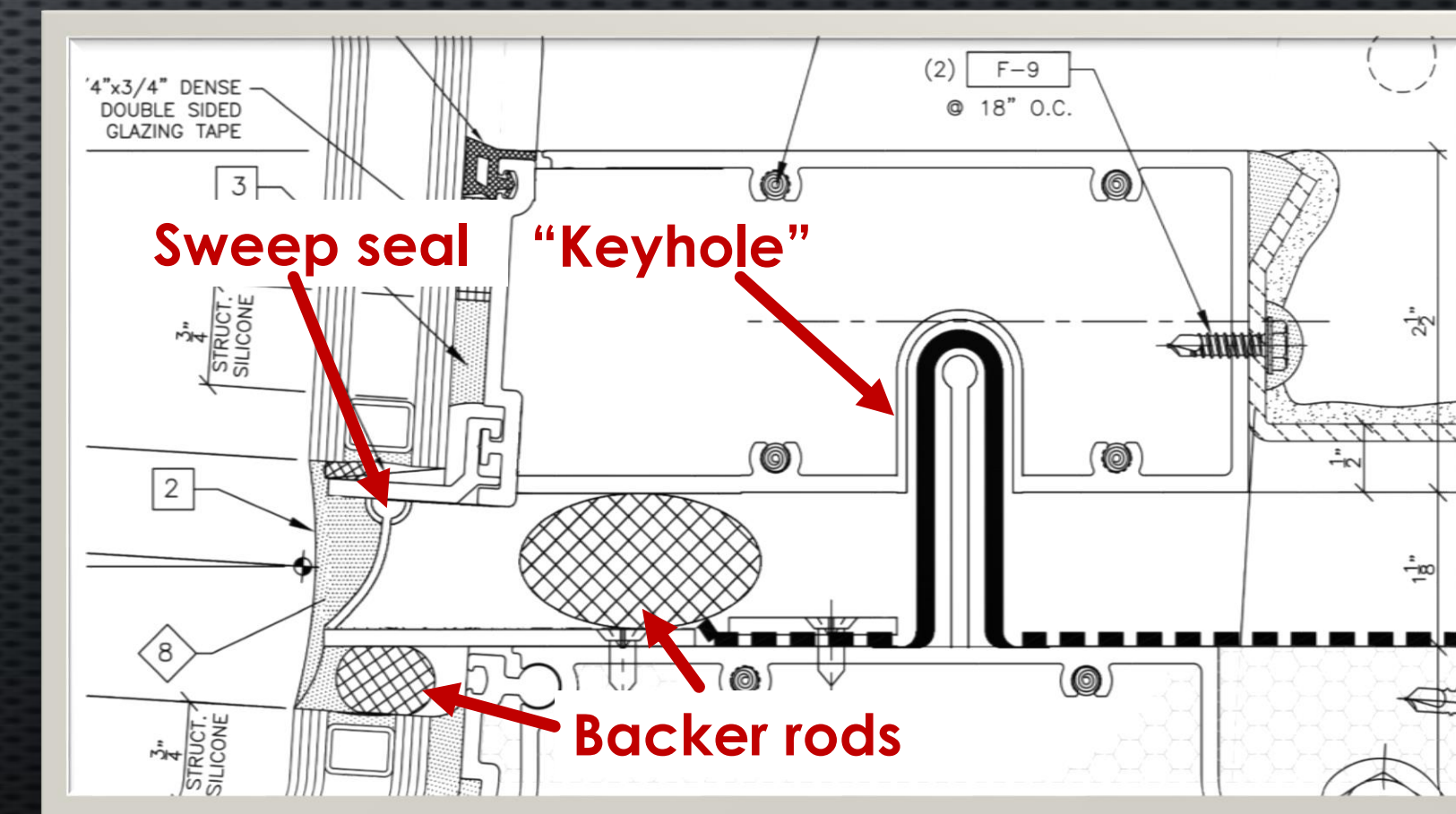
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Solution

Original design typical connection

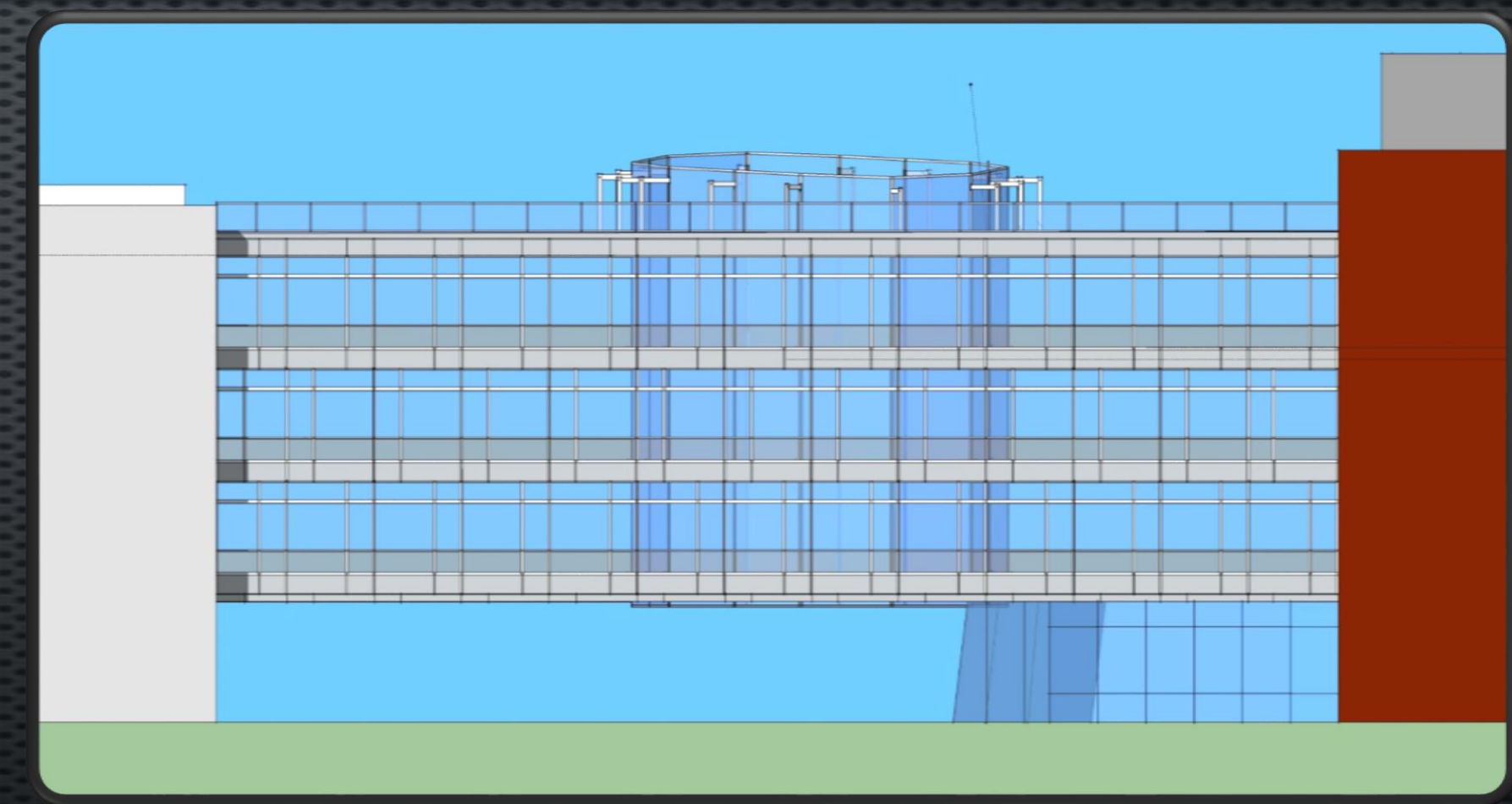
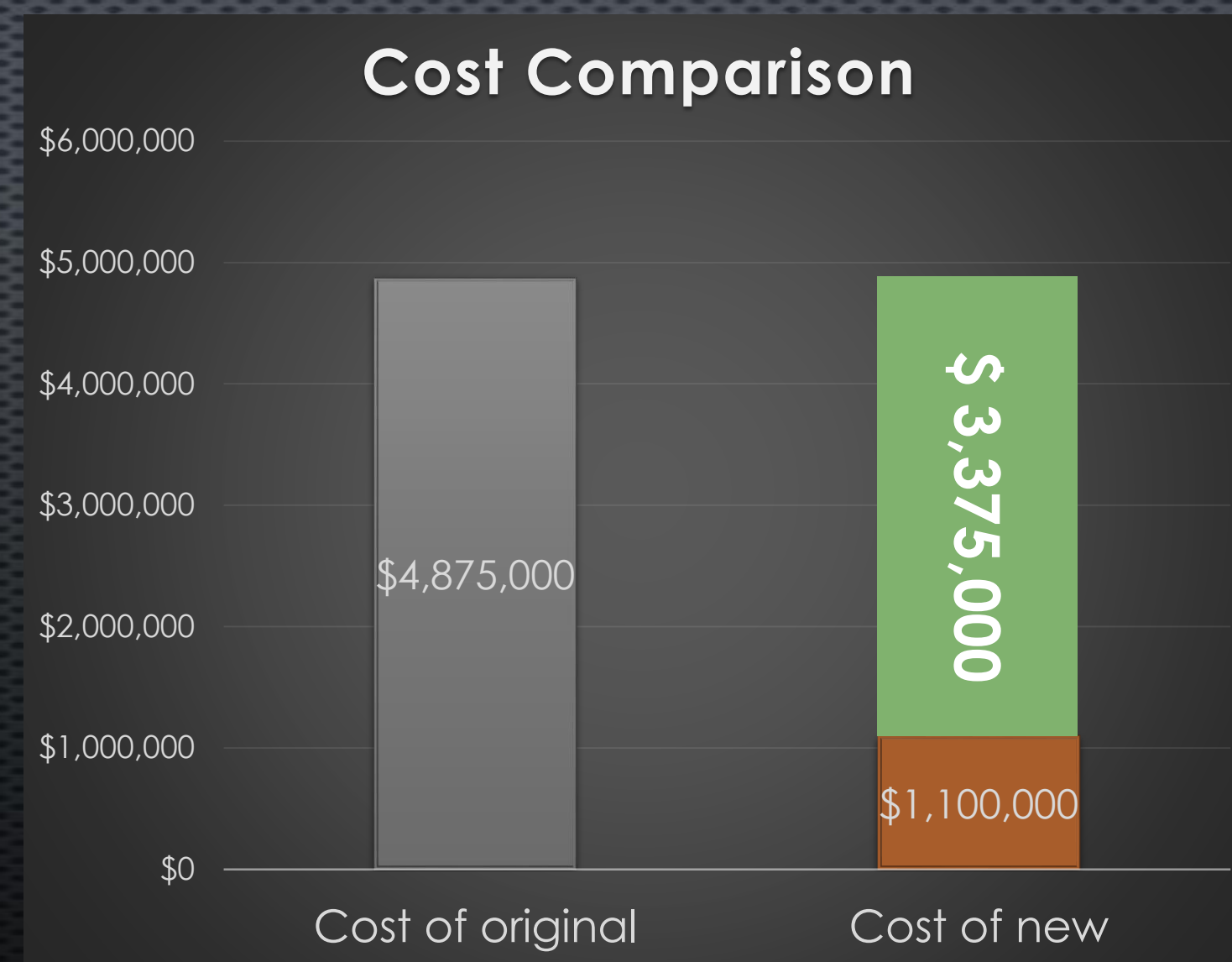


New design typical connection



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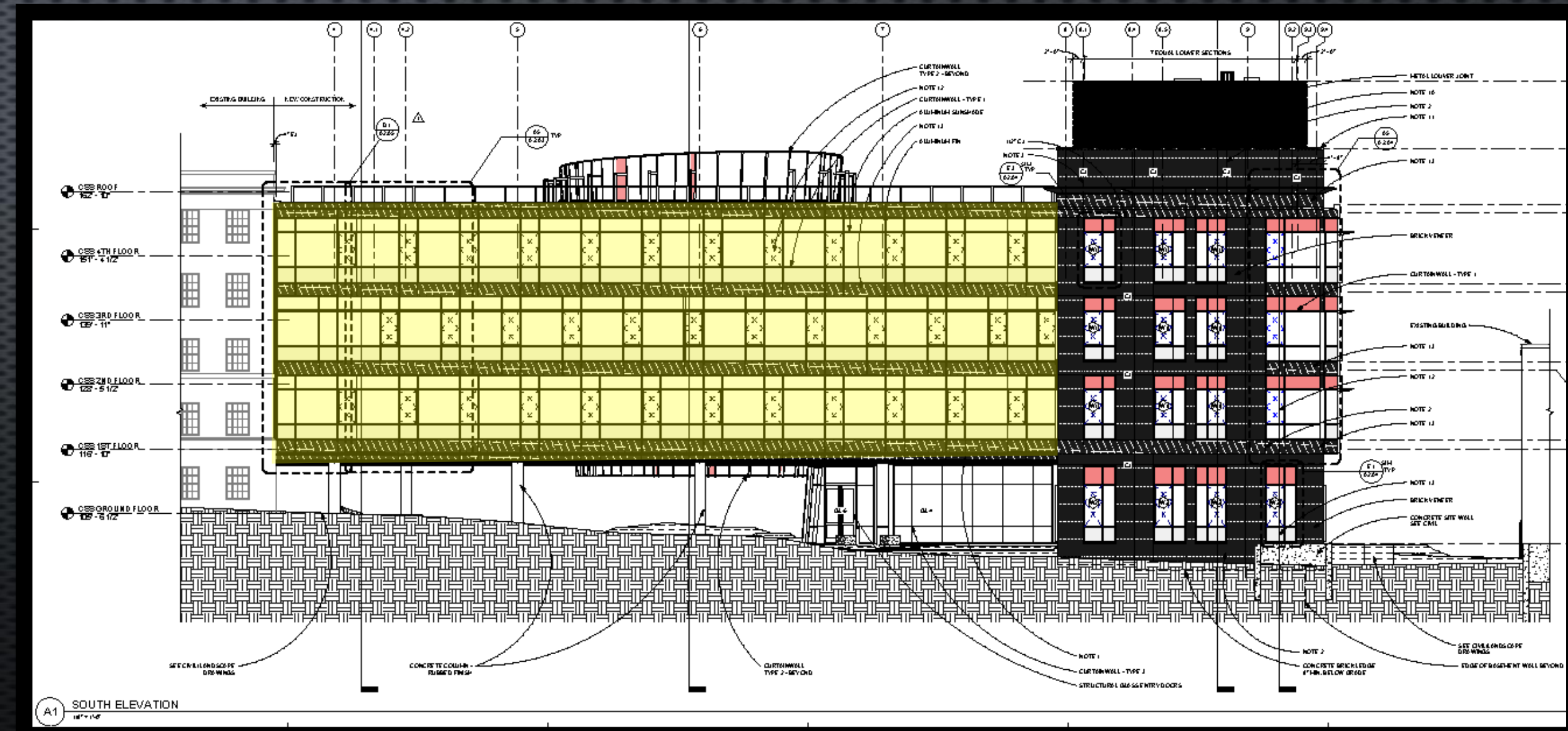


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Southern Facing PSC Façade

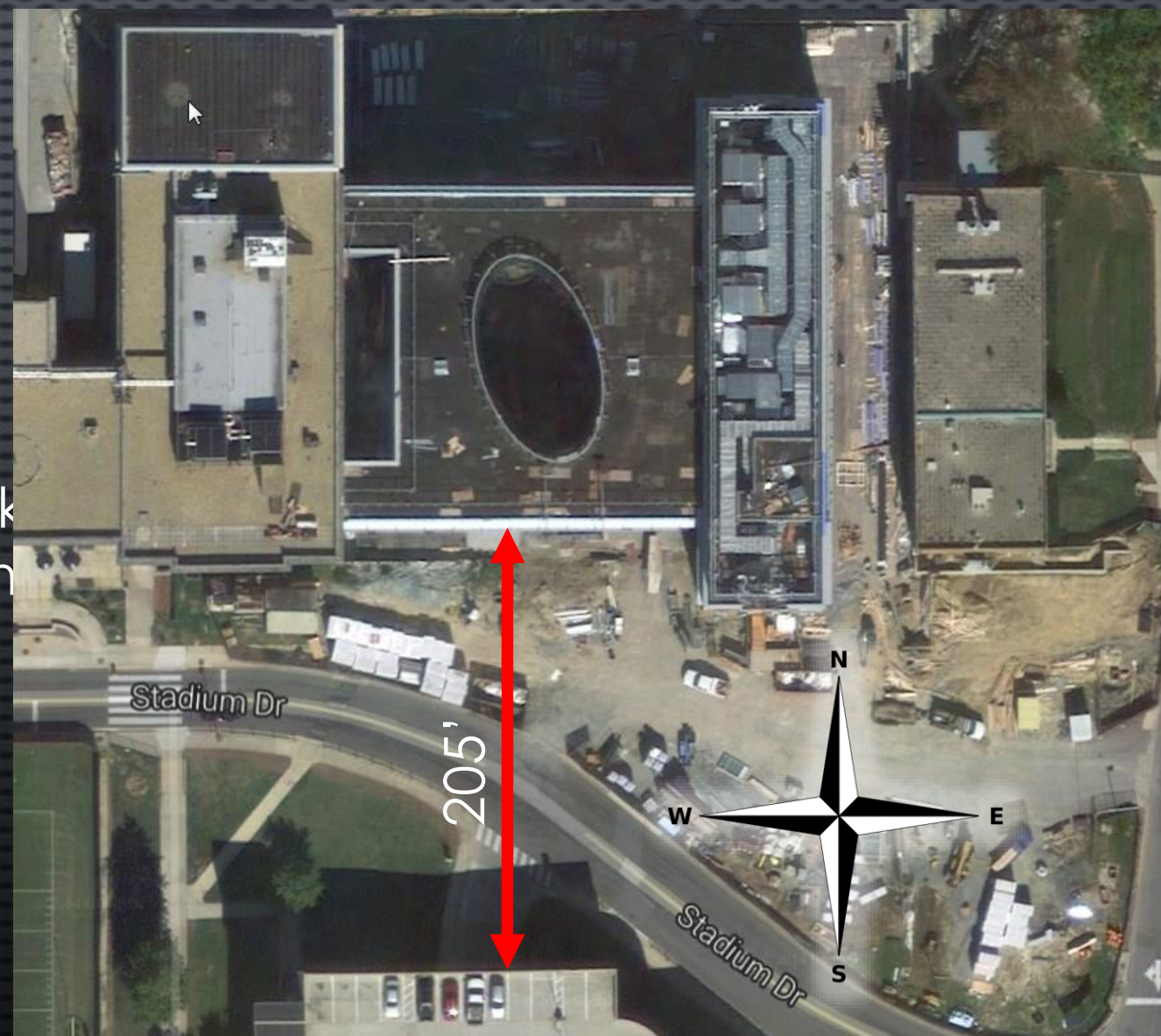
Estimated \$308,000/year electricity cost



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Investigation

College Park
Aerial imagery
by Google



South Facing?

Yes ✓

Adequate Sun?

Yes ✓

Visible Sky?

Yes ✓

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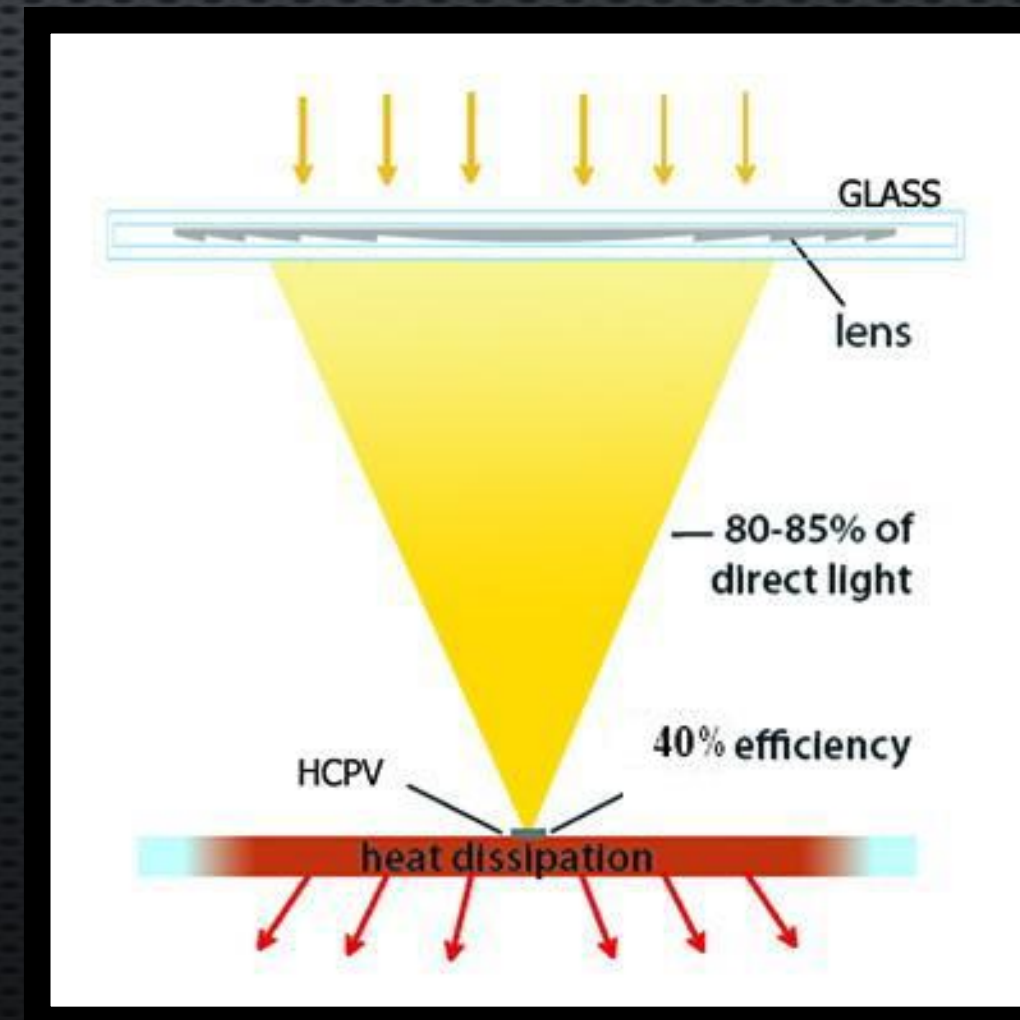
Solution

Typical HCPV (High Concentrated Photovoltaic) Array



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

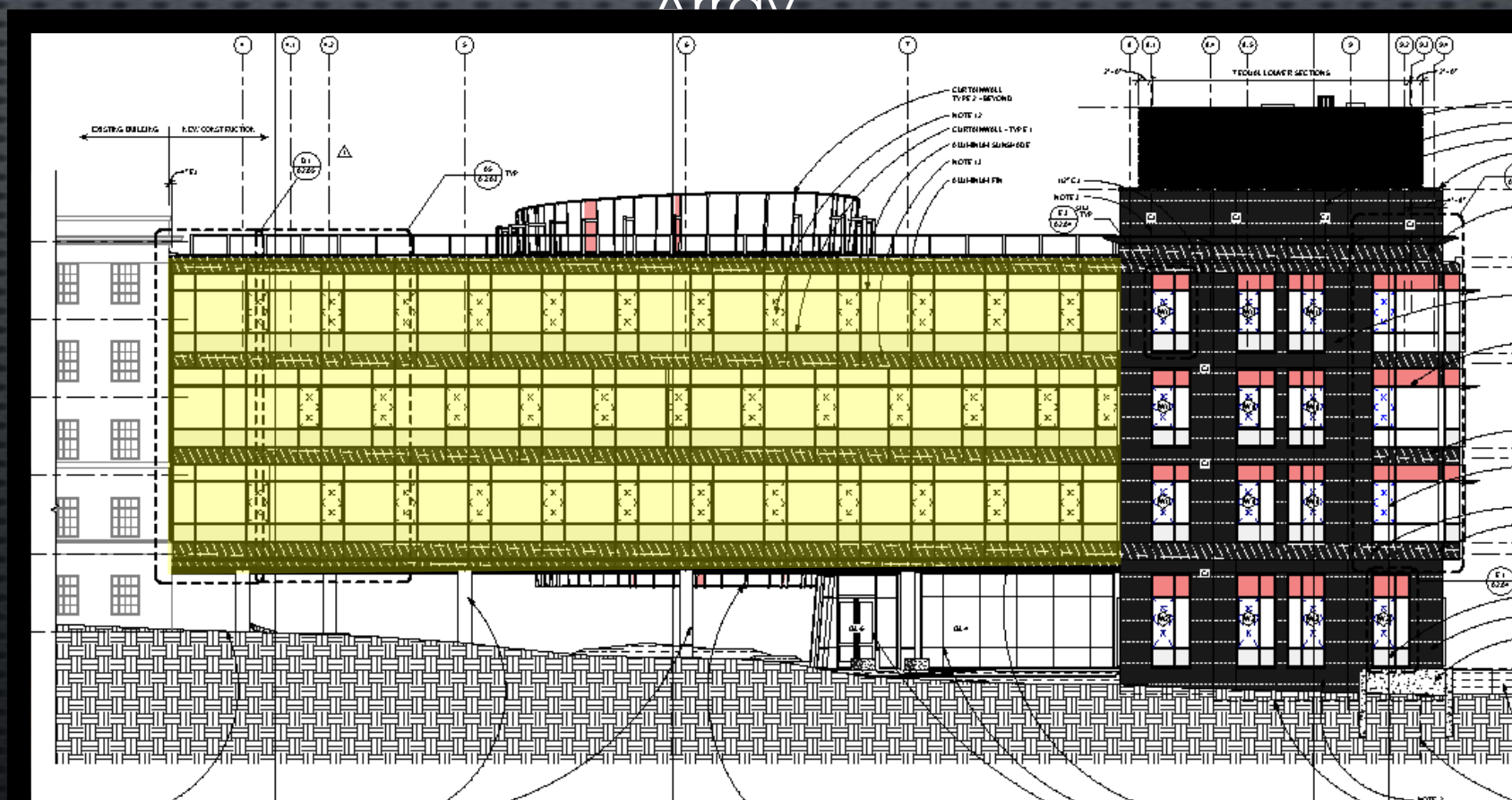
HCPV Cell Diagram



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



370 Square Meters

Functional mock-up, Syracuse University
Helioptix LLC



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SQFT Quantities														
		Framing					Installation		Glass (Insulated)					
Zone	Influence SQFT	Straight	Segmented	Gasket/Seal	Unitize	Delivery	Interior	Exterior	1" Clear/Vision	1" Color	Alum. Metal Panel	Alum. Sunshade	Operable Windows	Final Seal/Inspection
1	6500	6500	0	6500	6500	6500	0	6500	3600	1200	1600	630	700	6500
2	6500	6500	0	6500	6500	6500	0	6500	3600	1200	1600	0	700	6500
3	2400	0	2300	2300	2300	2300	2400	0	1035	1265	0	0	0	2400
4	2400	0	2300	2300	2300	2300	2400	0	1080	1320	0	0	0	2400
5	2600	0	2600	2600	2600	2600	2600	0	1508	1092	0	0	0	2600
6	2600	0	2600	2600	2600	2600	2600	0	1690	910	0	0	0	2600
7	6030	6030	0	6030	6030	6030	0	6030	2715	2109	1206	585	120	6030

Zone	Influence SQFT	Cost/SQFT of Component													Subtotal Cost	Subtotal Cost/SQFT
		Design Cost: \$1,105,000	\$36	\$58	\$9	\$45	\$6	\$59	\$36	Cost difference: \$189,000	\$27	\$199	\$32	\$7		
1,2	13000	\$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
3,4,5,6	10000	\$0	\$568,400	\$88,200	\$441,000	\$58,800	\$590,000	\$0	\$95,634	\$142,197	\$0	\$0	\$0	\$70,000	\$2,054,231	\$205
7	6030	\$217,080	\$0	\$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
Punch-in Windows	3653														\$401,830	\$110
Total Cost	32683	\$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

~\$325/Sq.Ft for HCPV facade
 HCPV Module Façade Cost: \$1,294,000

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Energy Produced, given:
850 w/m² irradiance of the sun
40% HCPV efficiency
57% average sun exposure
370 m² total façade area
631,423kWh per year
College Park, MD cost of electric: \$0.135/kWh
Total estimated energy savings per year: \$84,778/year

Cost difference between façade types: \$189,000
Additional Cost of inverters & heat exchangers: \$85,000
Subtotal Additional Costs: \$274,000
Payback period of 3.25 Years

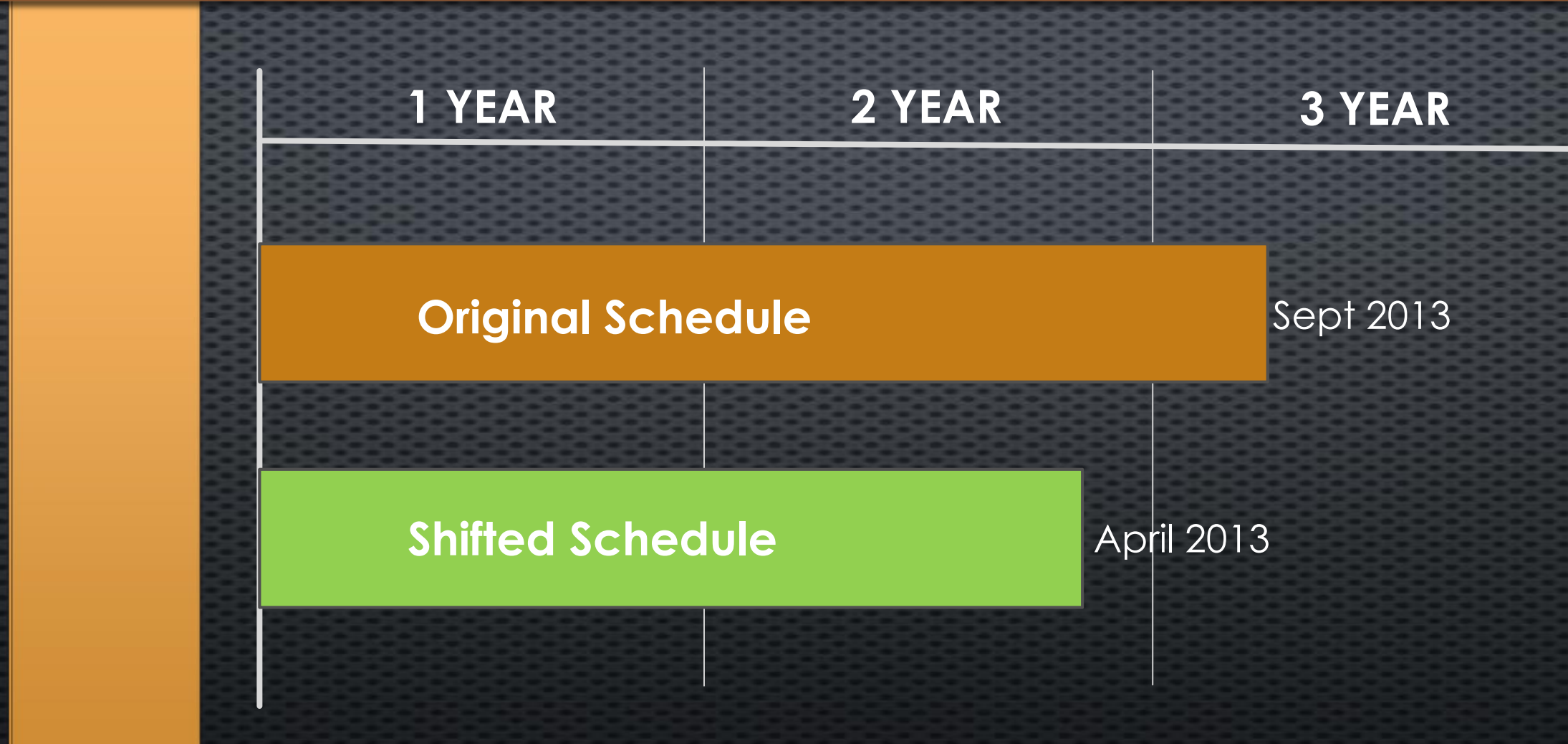
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Problem Identification:
Estimate substantial completion in September 2013
Building is not fully operational during Fall semester of 2013
Revenue not received during lack of operations to school

Solution:
Solicit the University for an early finish contractual clause
Apply two work shifts for trades that can utilize it
Push forward the substantial completion into the summer of 2013

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School stands to generate additional \$9 million revenue 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

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Final Conclusion

Façade simplification by architectural redesign: \$3,775,000
Yearly energy savings with HCPV technology: \$85,000
Additional revenue to Gilbane to range from \$1 to \$4.8 million
Revenue to school between \$4.2 to \$8 million

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