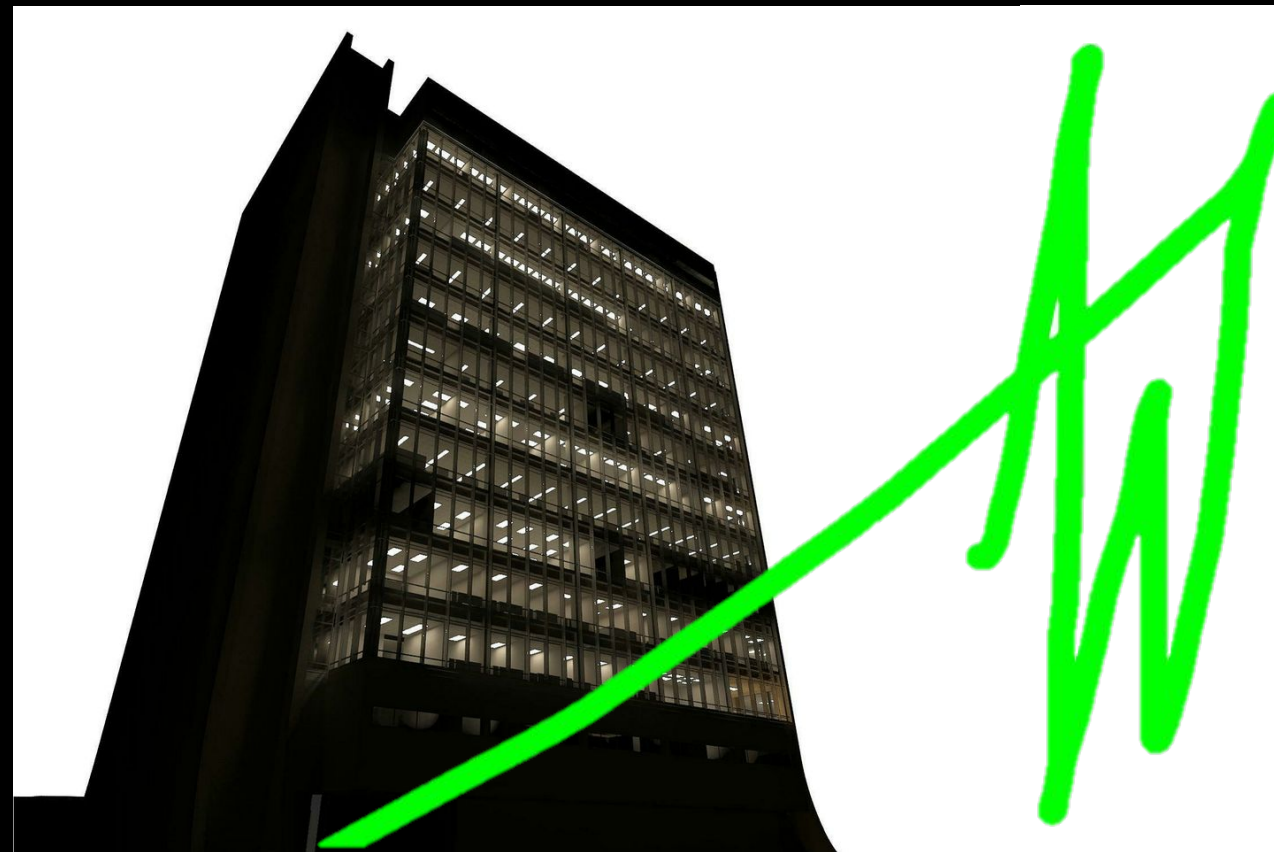


Government Office Center

Mid-Atlantic U.S.



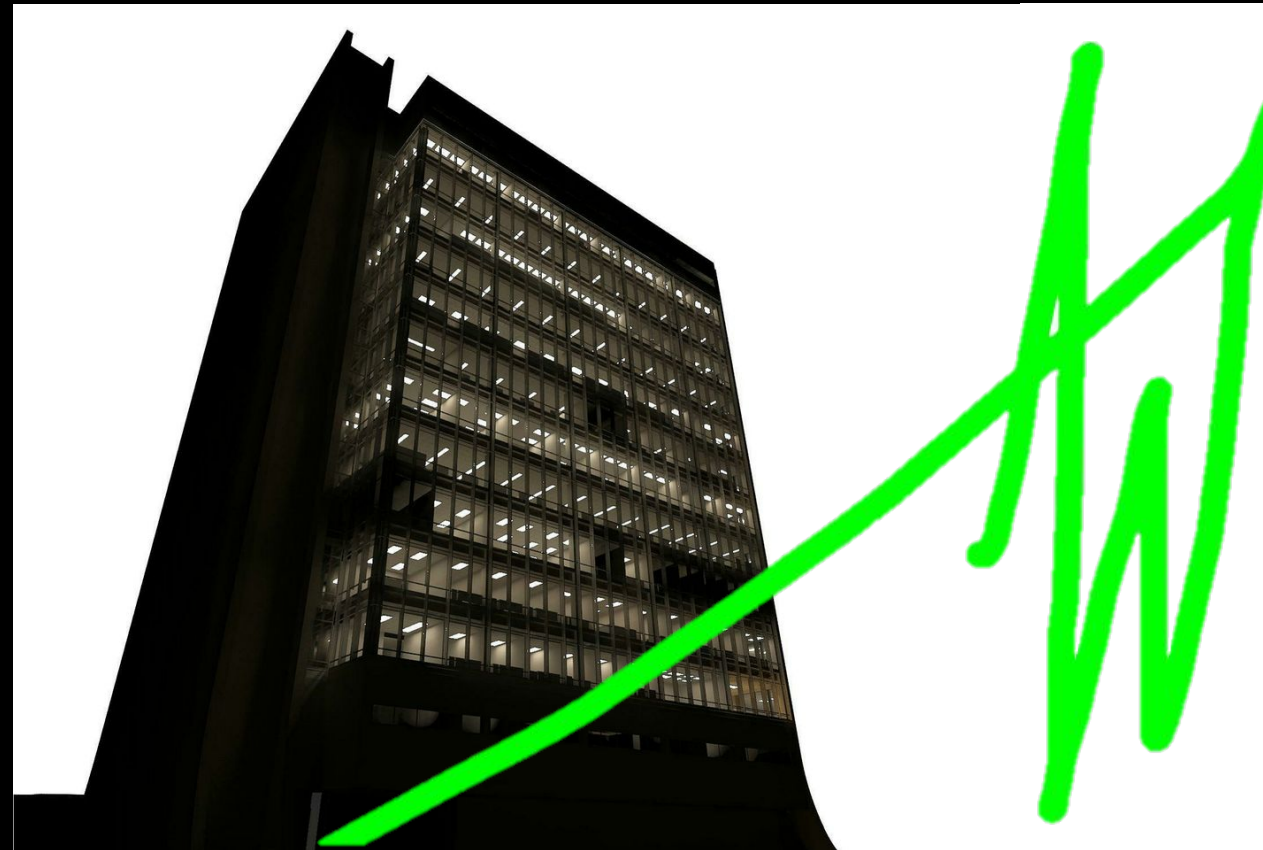
Penn State AE Senior Thesis Project
Alexander Ward | Construction Management
James Faust | CM Advisor

Government Office Center

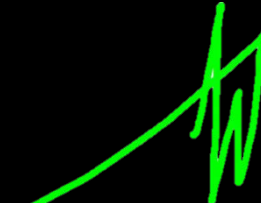
Mid-Atlantic U.S.

Presentation Outline:

- I. Project Background
- II. Analysis #3: Integrated Processes
 - A. Engaged Owner
- III. Analysis #2: SIPS Study for Curtain Wall Activities
 - A. Renewable Energy/Electrical Breadth
- IV. Analysis #1: Implementation of Building Information Modeling
 - A. Facilities Management
- V. Analysis #4: Progressive Collapse
 - A. Structural Breadth
- VI. Summary of Conclusions & Acknowledgements



Penn State AE Senior Thesis Project
Alexander Ward | Construction Management
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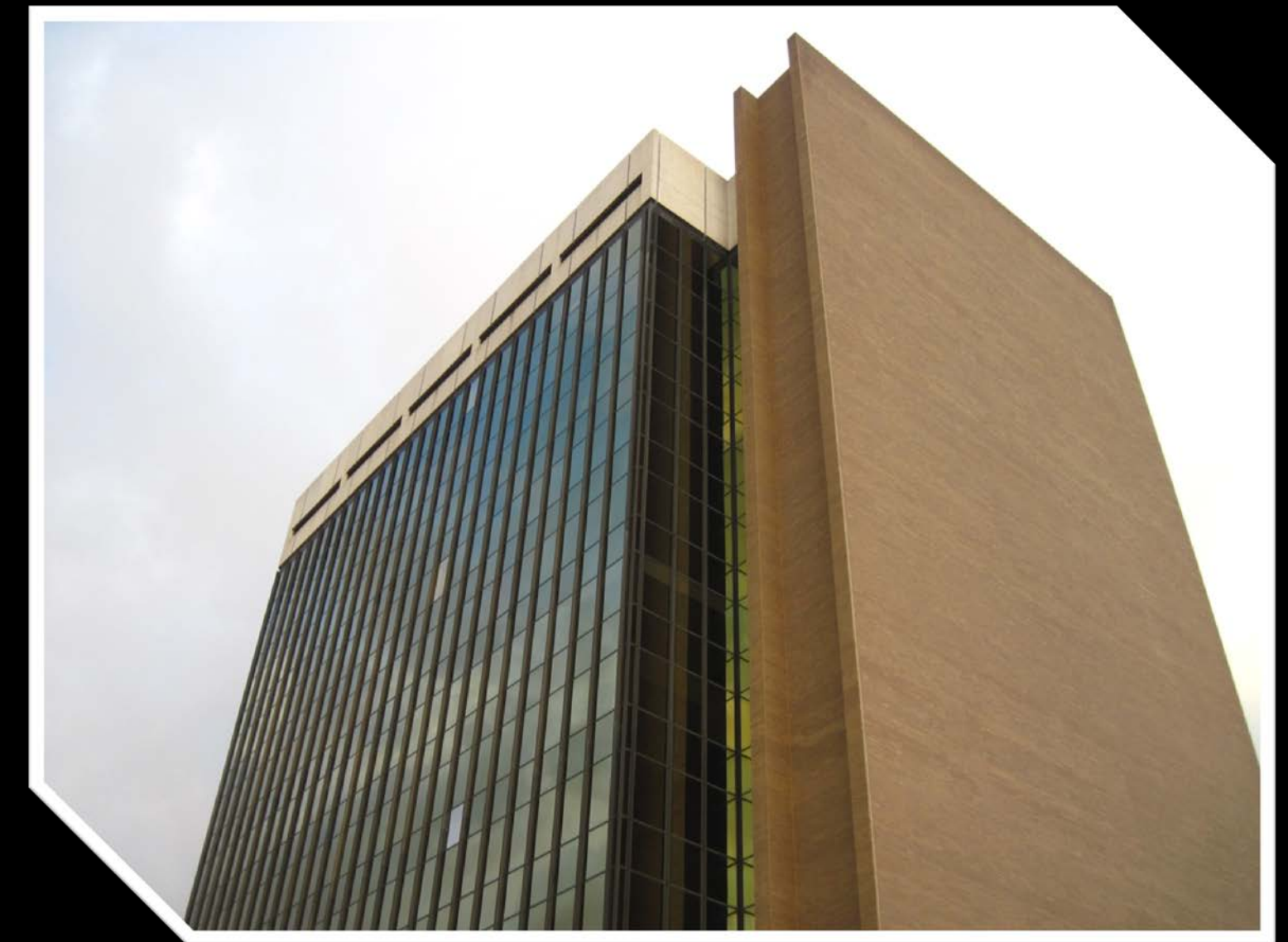


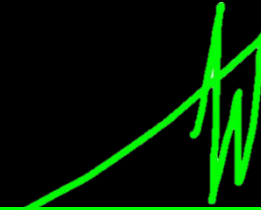
Presentation Outline:

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- II. Integrated Processes
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- \$42 Million Renovation
- 14 Story Federal Office & Courthouse
- 316,000 SF
- August 1, 2011 – January 31, 2014
- Major upgrades to Envelope and HVAC systems
- LEED Gold (LEED 2009 EBO&M)
- Occupied throughout construction





Presentation Outline:

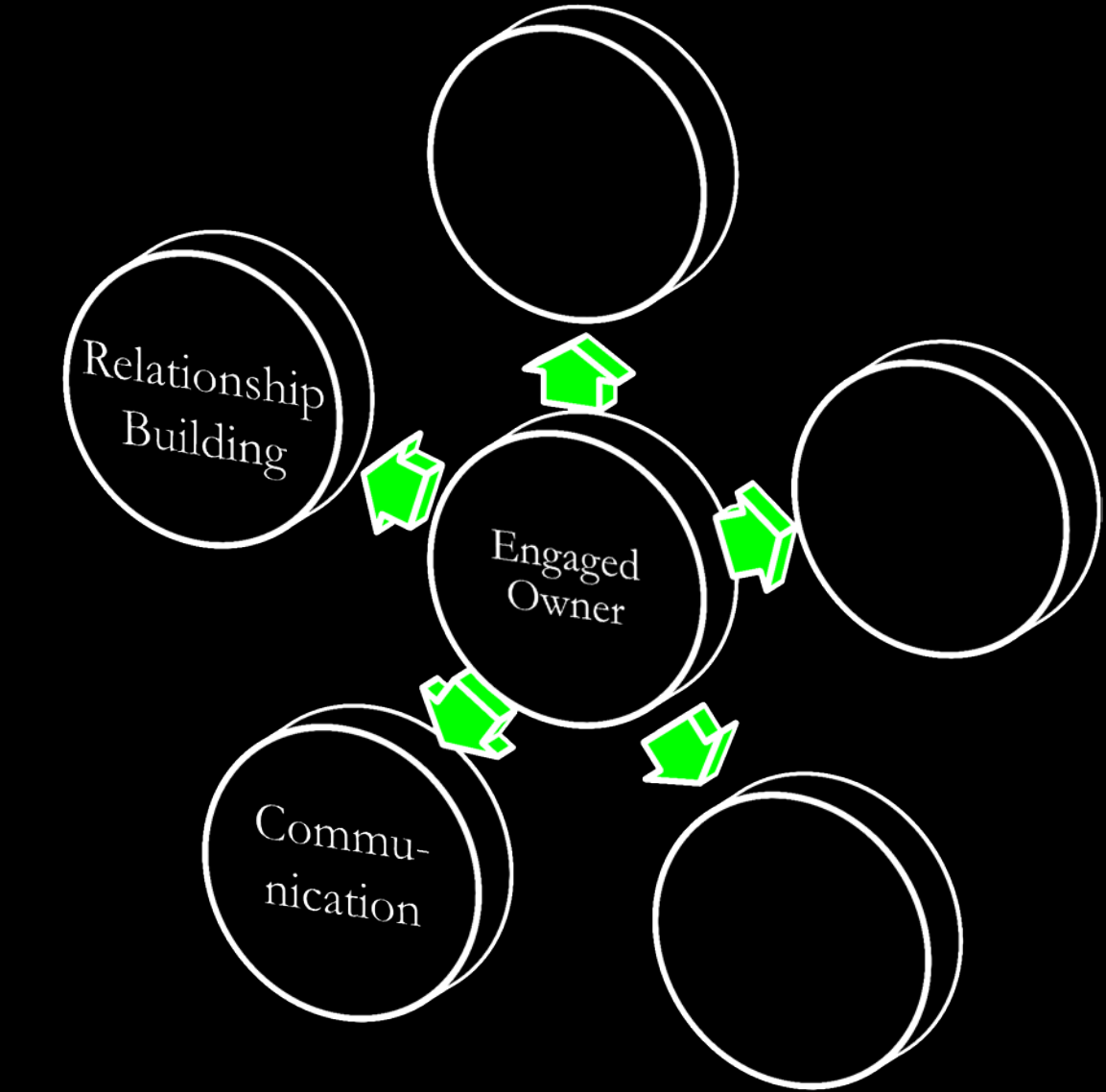
- I. Project Background
- II. **Integrated Processes**
- III. SIPS Study for Curtain Wall Activities
- IV. Implementation of BIM
- V. Progressive Collapse
- VI. Summary of Conclusions & Acknowledgements

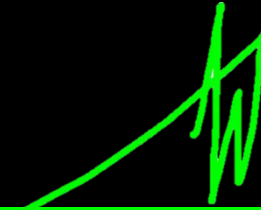
Problem Identification:

- Industry trending toward integrated solutions
- Engaged owners extremely important in process
- Need to educate owners on importance of role

Research Goal:

- Evaluate key benefits of engaged owner





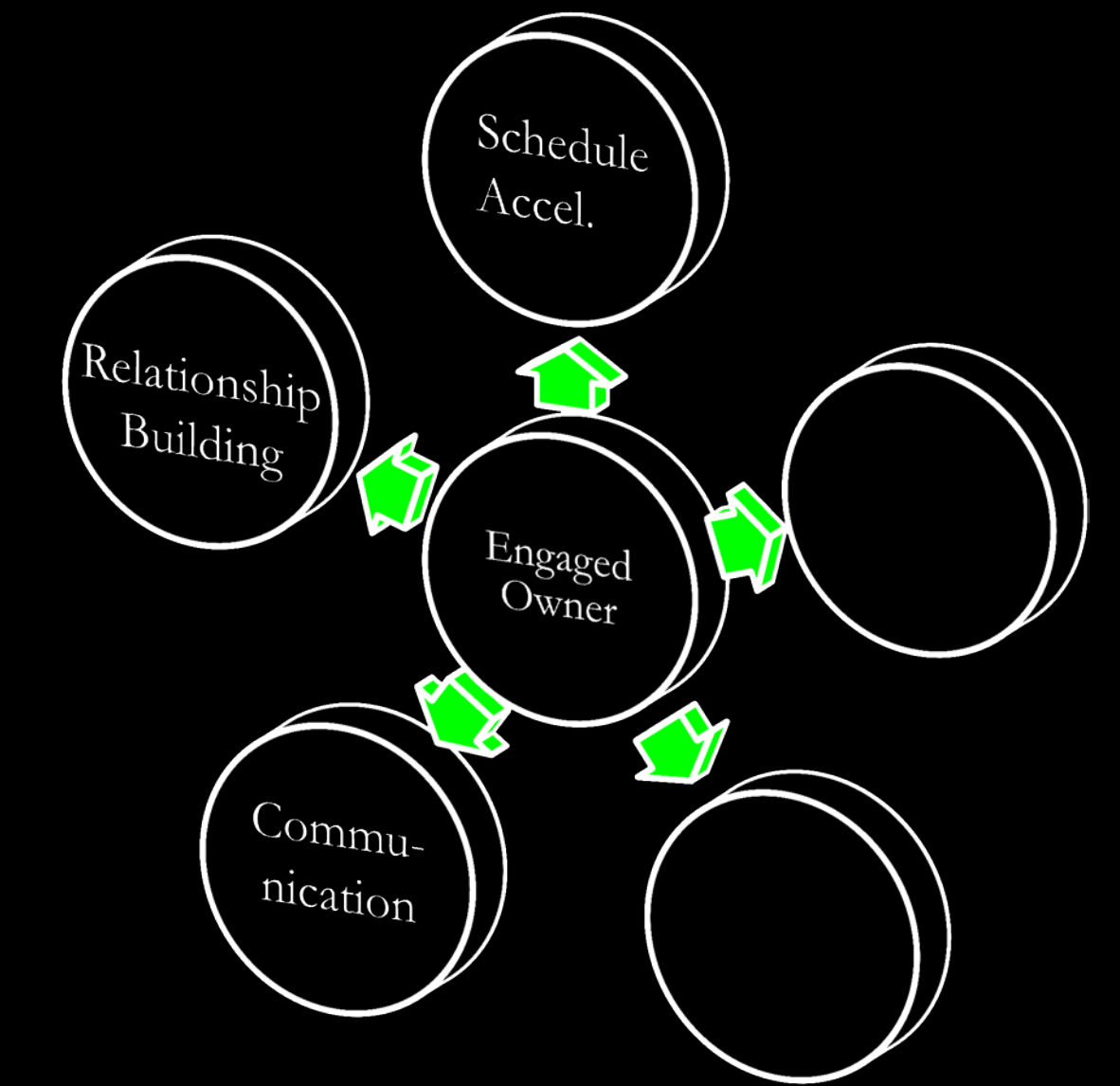
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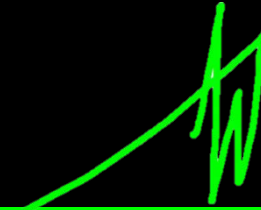
- I. Project Background
- II. **Integrated Processes**
- III. SIPS Study for Curtain Wall Activities
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...improved delivery through **schedule acceleration**...

An Engaged Owner is:

- Actively involved in the design and design review process
- Aware of the unique challenges of the project
- Willing to use uncommon project delivery and construction strategies when feasible





Presentation Outline:

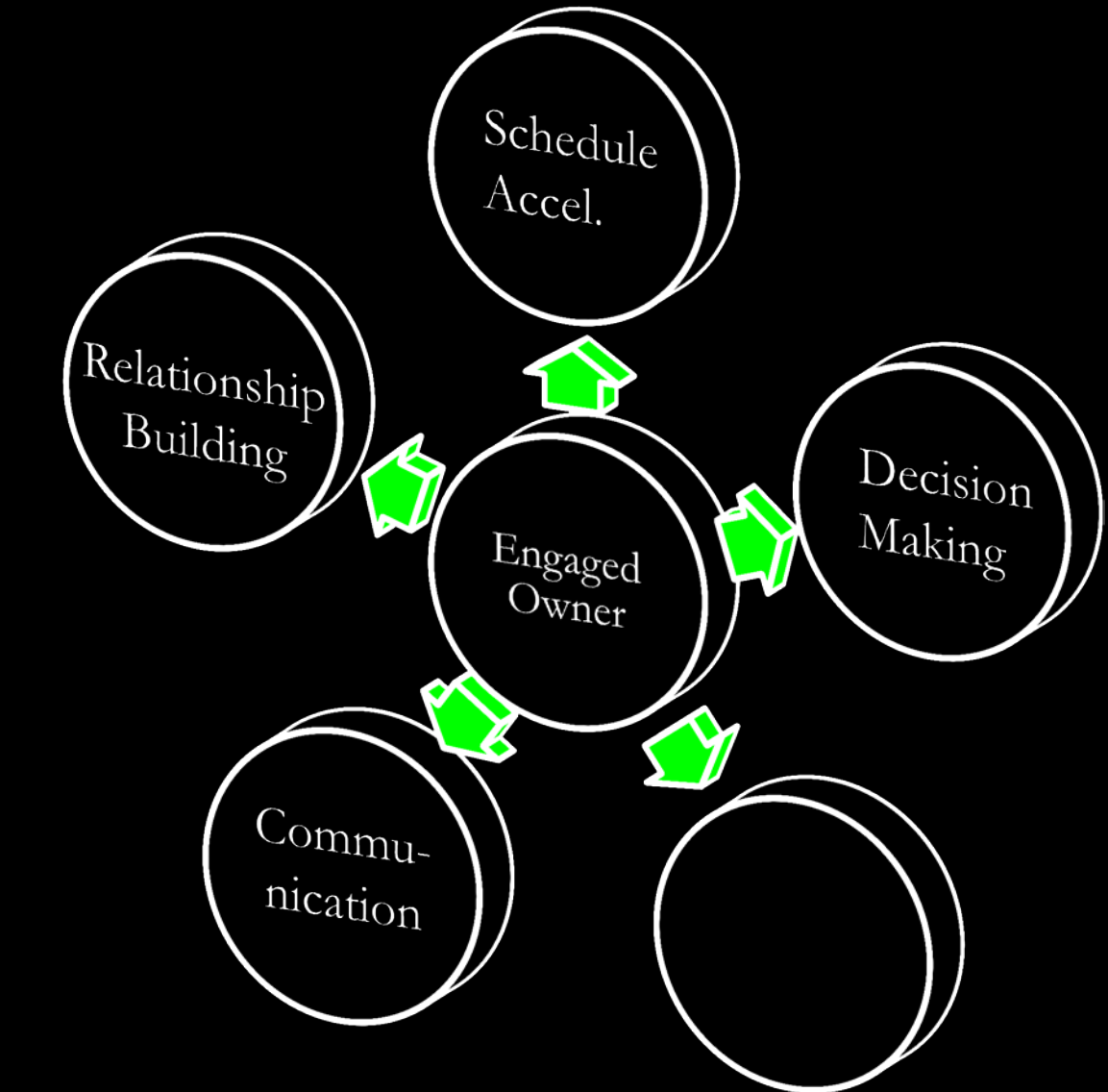
- I. Project Background
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- III. SIPS Study for Curtain Wall Activities
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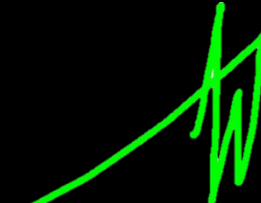
...improved delivery through schedule acceleration...

...faster and more refined **decision making**...

An Engaged Owner is:

- More informed of design options being considered by the project team
- More educated on the consequences of these design options
- Actively involved in design reviews
- Supportive and responsive during construction phase





Presentation Outline:

- I. Project Background
- II. **Integrated Processes**
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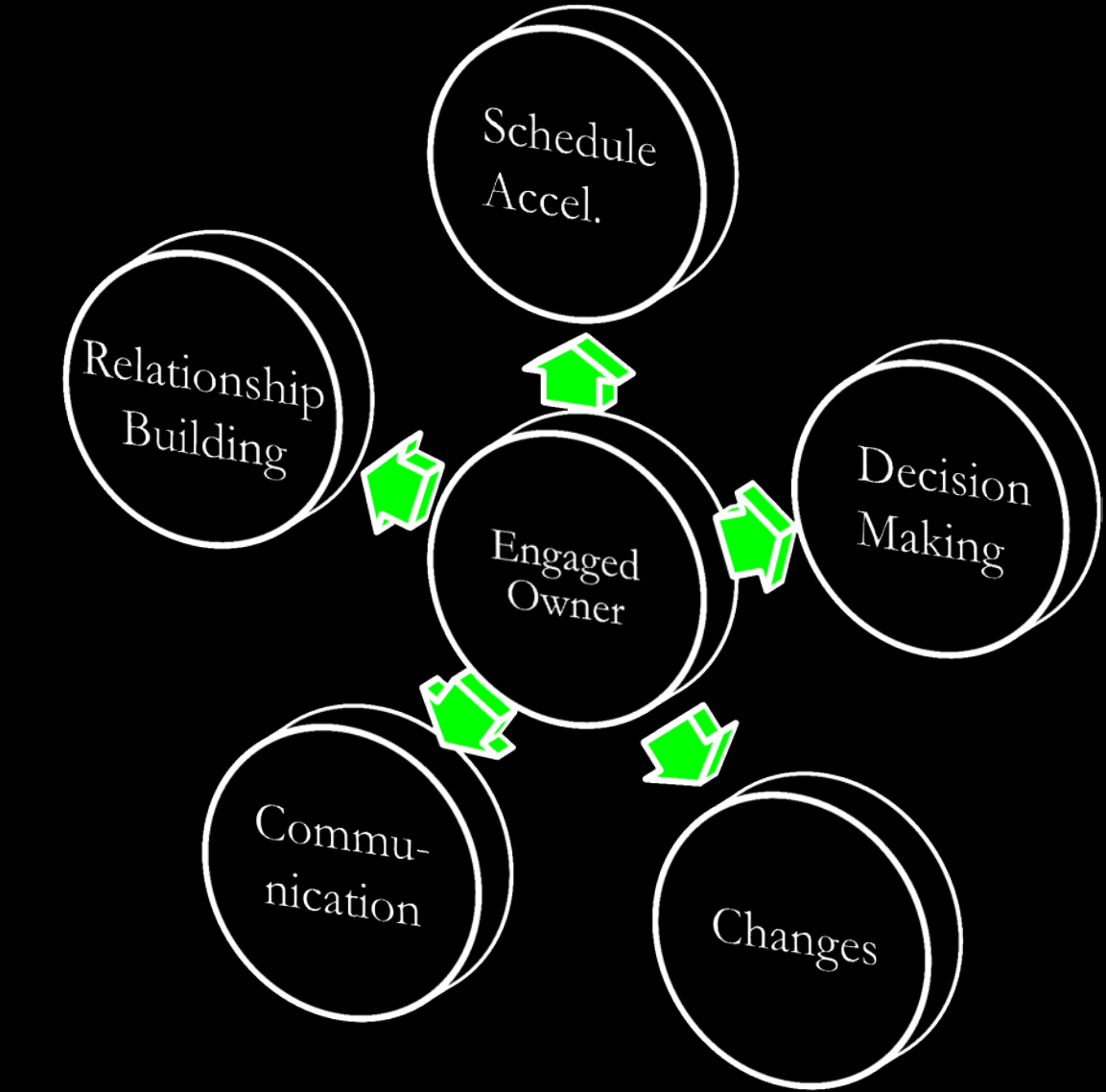
...improved delivery through schedule acceleration...

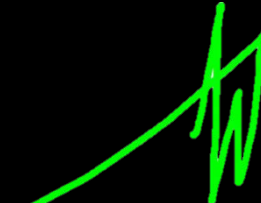
...faster and more refined decision making...

...reduced frequency and degree of **changes**...

An Engaged Owner is:

- Helpful in defining project needs early in the development process
- Educated and understands how design teams meet the previously defined program requirements
- Clear in explaining why a design change is needed and what it will accomplish





Presentation Outline:

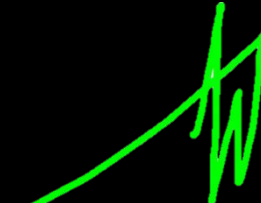
- I. Project Background
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Problem Identification:

- Highly repetitive curtain wall replacement activities
- Opportunity to implement BIPV system

Research Goal:

- Evaluate the benefits of SIPS and BIPV



Presentation Outline:

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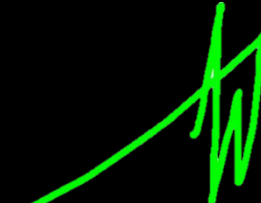


North Area in Red – South Area in Blue

Activities:

- Installation of weather wall
- Demolition of existing curtain wall
- Installation of new structural steel
- Installation of new curtain wall
- Demolition of weather wall
- Frame and rough-in
- Restoration of finishes



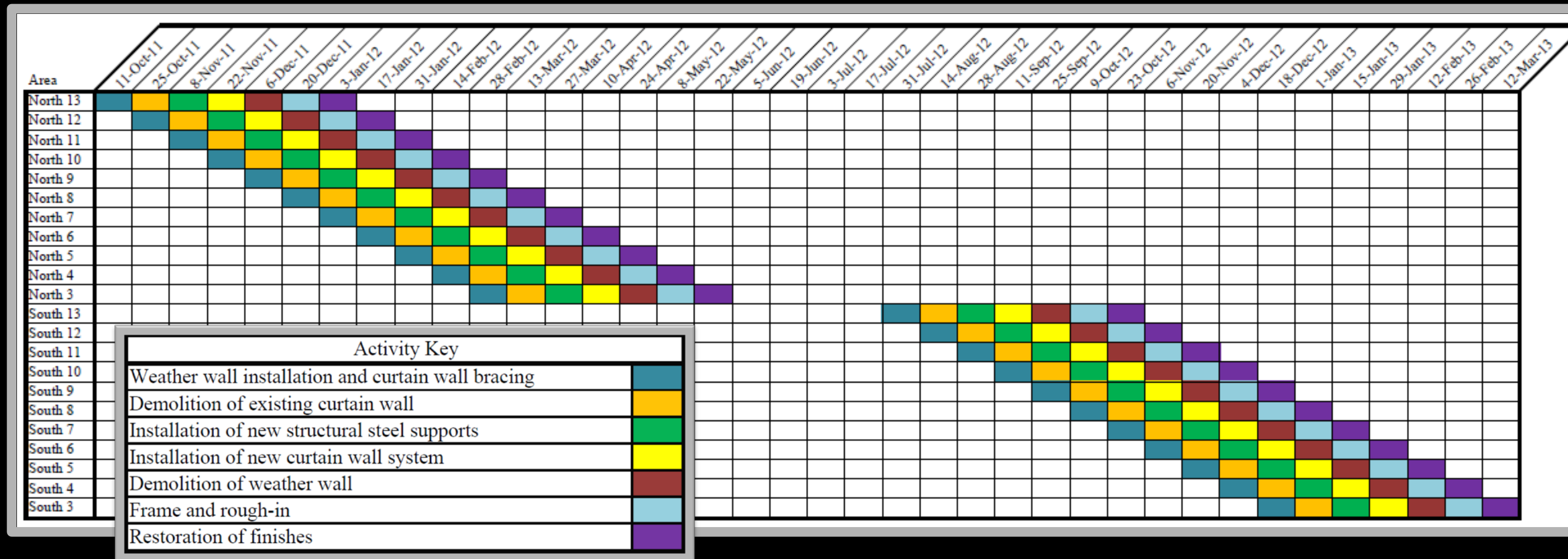


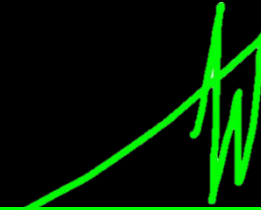
Presentation Outline:

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Existing Schedule:

- Oct. 11, 2011 – Sept. 16, 2013 (101 weeks)
- 8 week schedule gap between North and South
- Longest activity requires 100 days (North finishes)

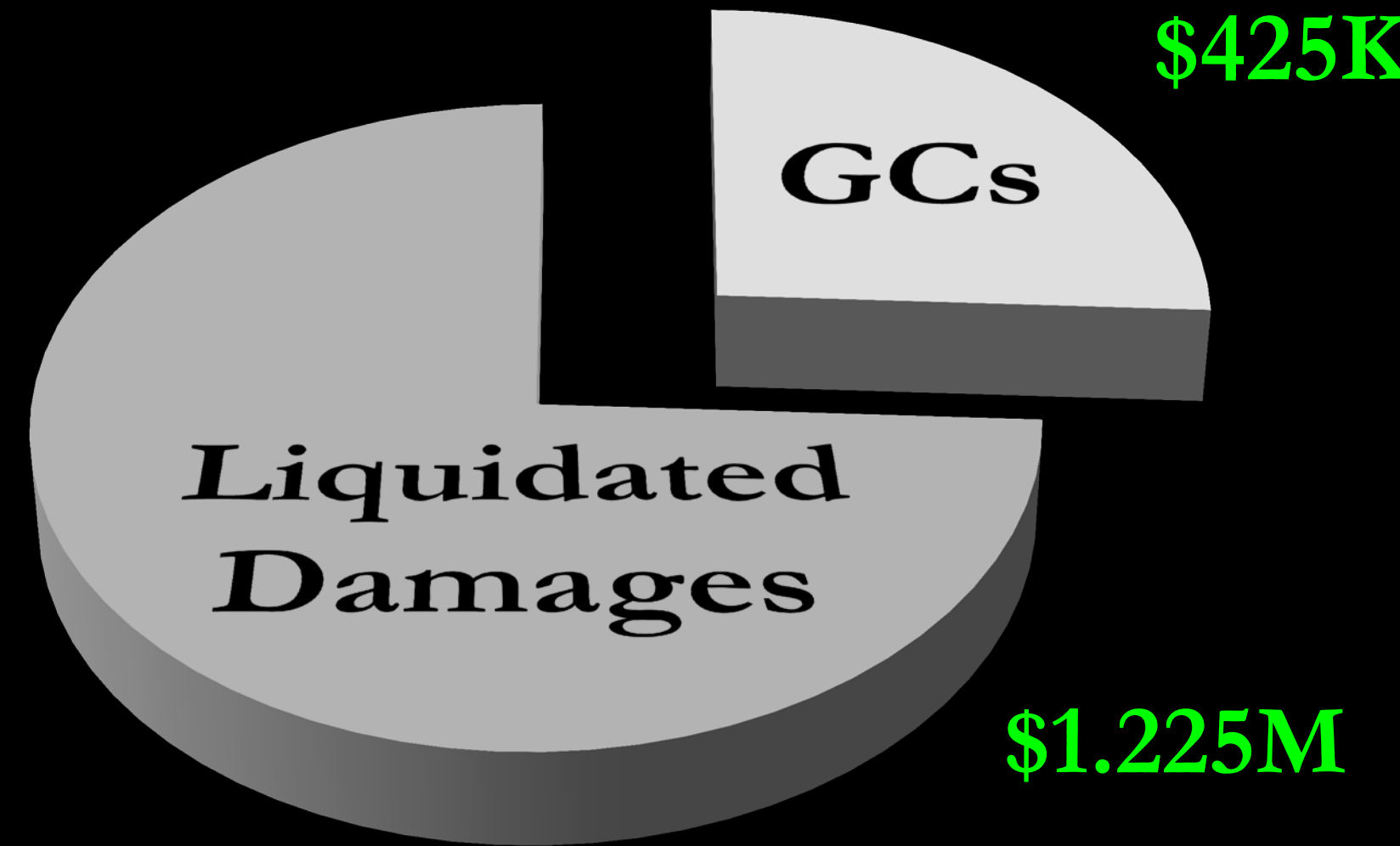




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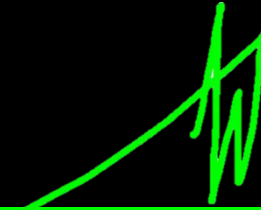
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\$1.65M Total Value



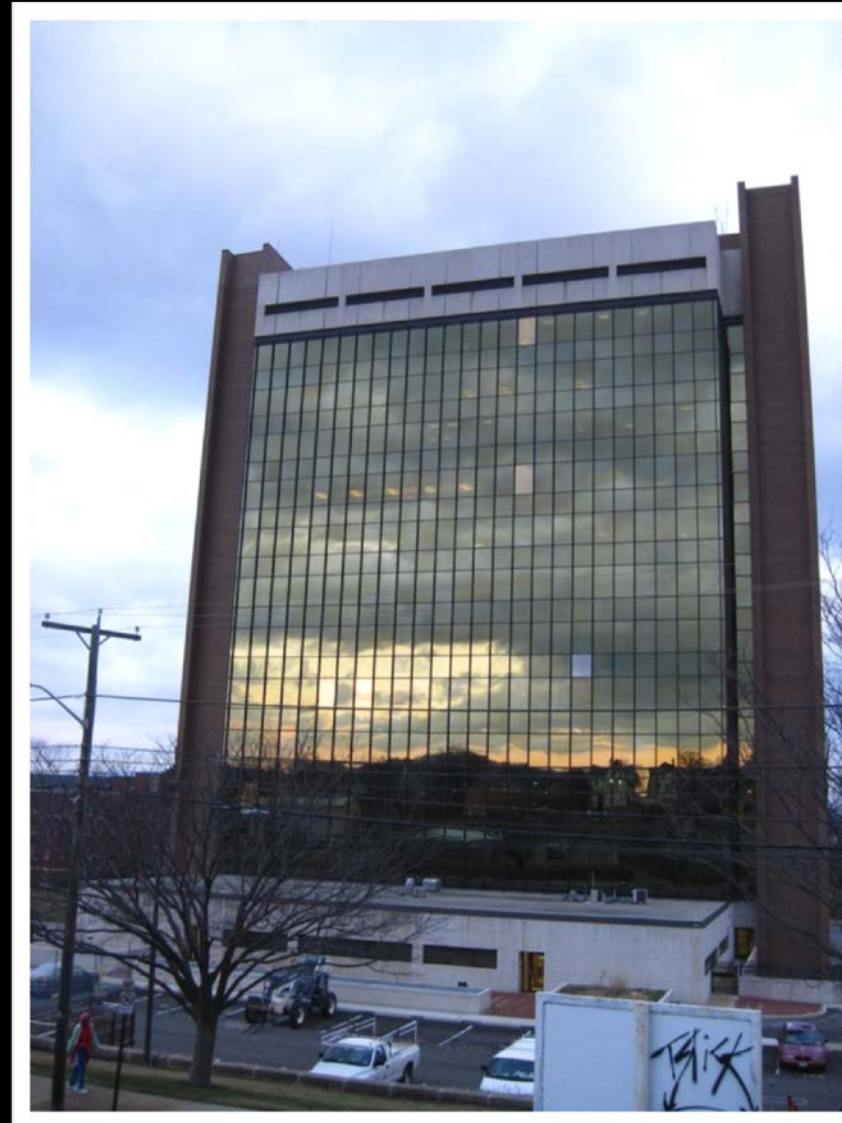
25 Weeks Saved

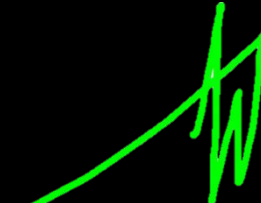




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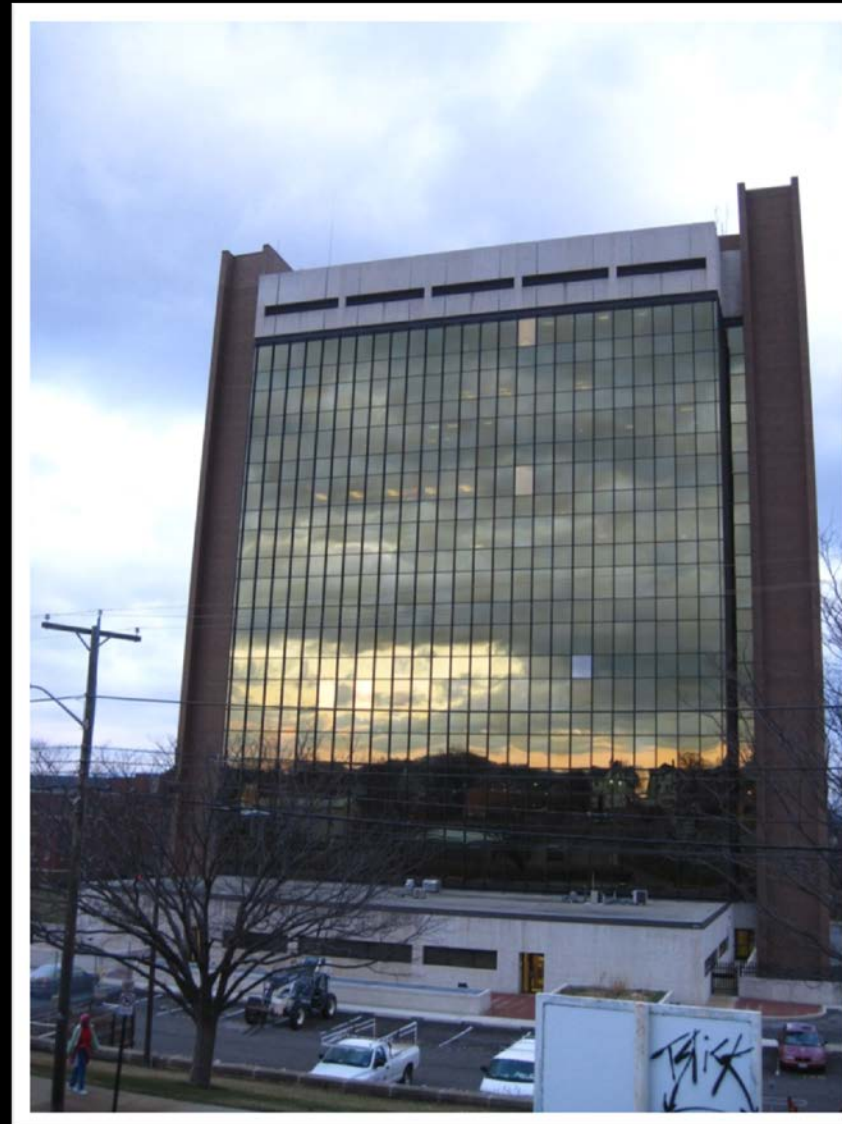
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Station Identification	
City:	Richmond
State:	Virginia
Latitude:	37.50° N
Longitude:	77.33° W
Elevation:	50 m
PV System Specifications	
DC Rating:	202.1 kW
DC to AC Derate Factor:	0.770
AC Rating:	155.6 kW
Array Type:	Fixed Tilt
Array Tilt:	90.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	8.0 ¢/kWh

Results			
Month	Solar Radiation (kWh/m ² /day)	AC Energy (kWh)	Energy Value (\$)
1	3.92	19014	1521.12
2	3.72	16063	1285.04
3	3.53	16039	1283.12
4	3.00	11904	952.32
5	2.55	9729	778.32
6	2.33	7991	639.28
7	2.44	8685	694.80
8	2.77	10614	849.12
9	3.47	13977	1118.16
10	3.76	16716	1337.28
11	3.68	16705	1336.40
12	3.45	16491	1319.28
Year	3.21	163928	13114.24

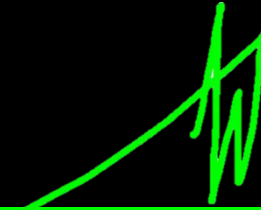
Feasibility:

+\$404,200 for PV marginal cost
 -\$382,500 for sunshades deduction
 =\$21,700 net marginal cost
 ~\$13,000 per year in energy savings

Payback < 2 years

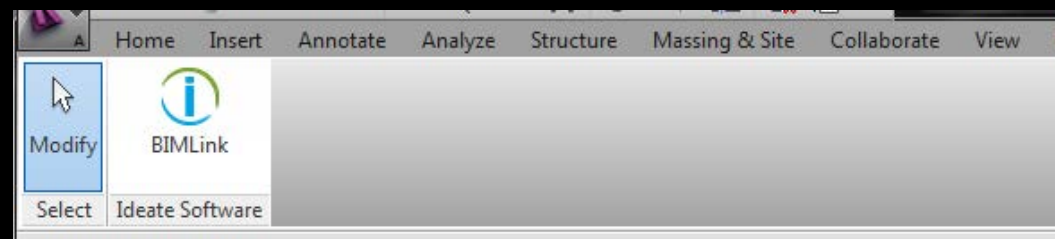
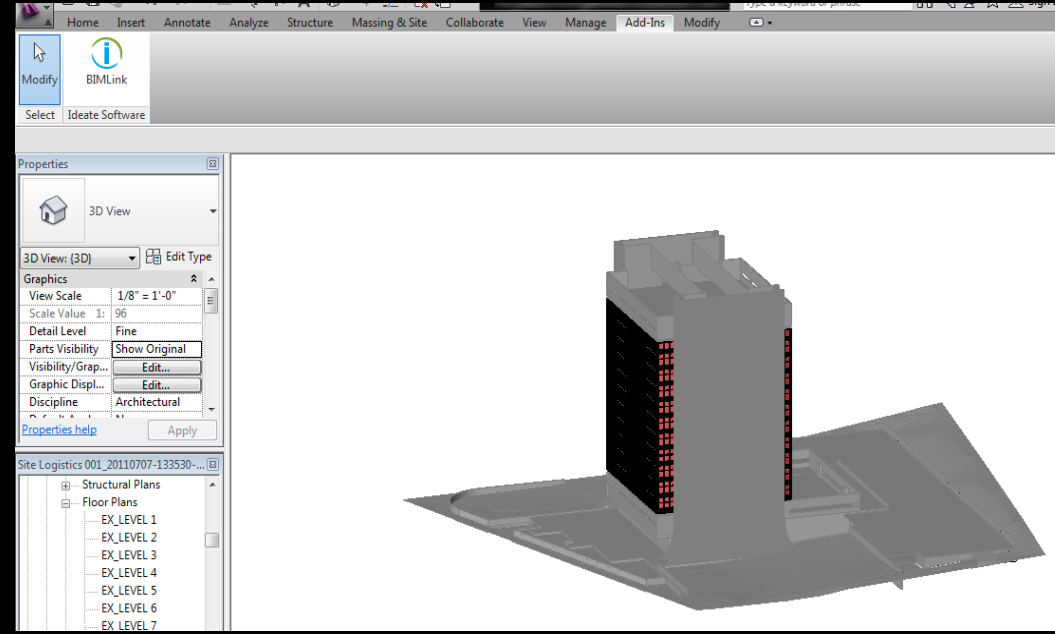
Need to consider heat gain, constructability, etc.





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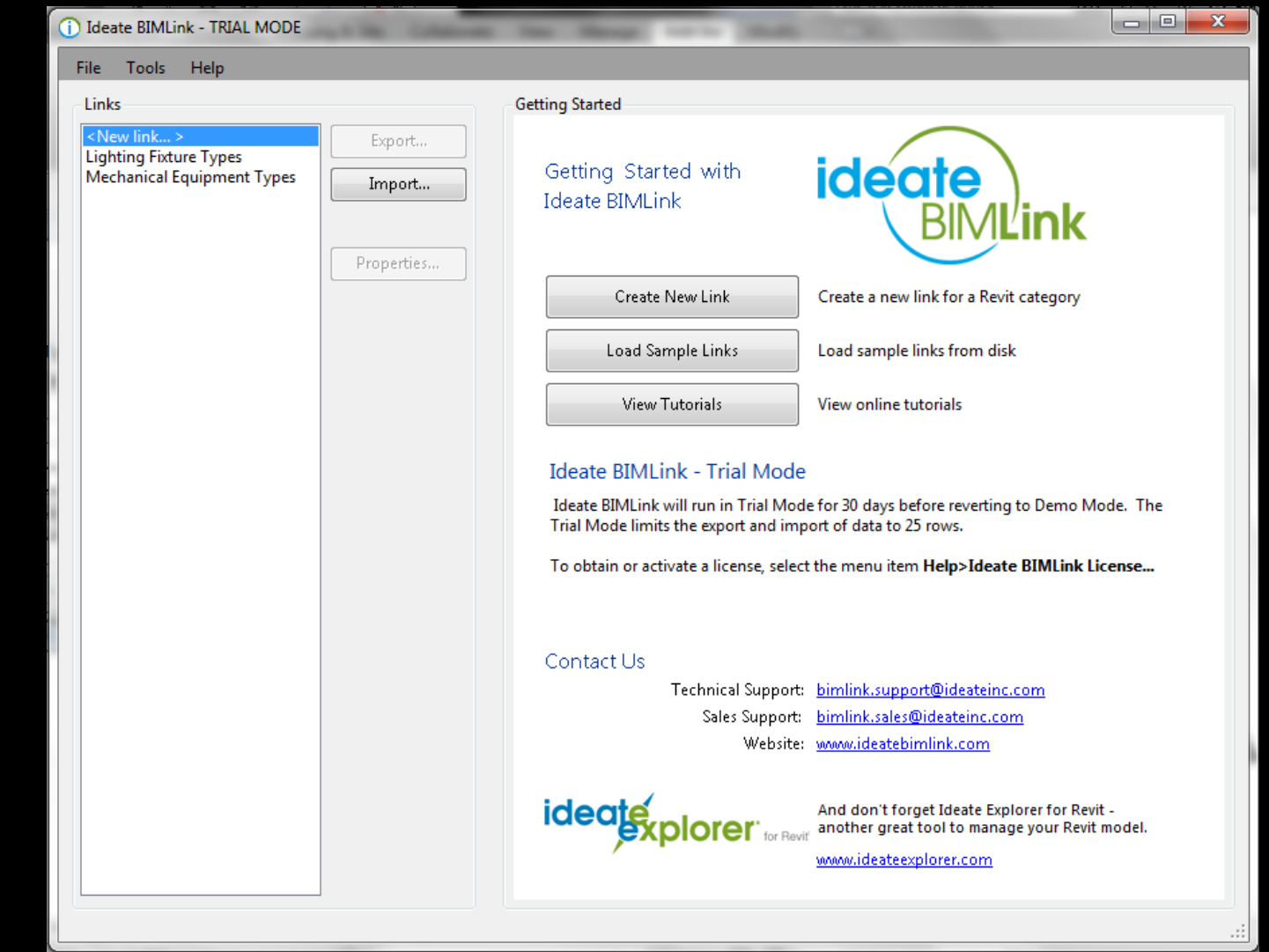


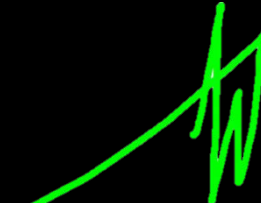
Problem Identification:

- Minimal push of information downstream for future needs

Research Goal:

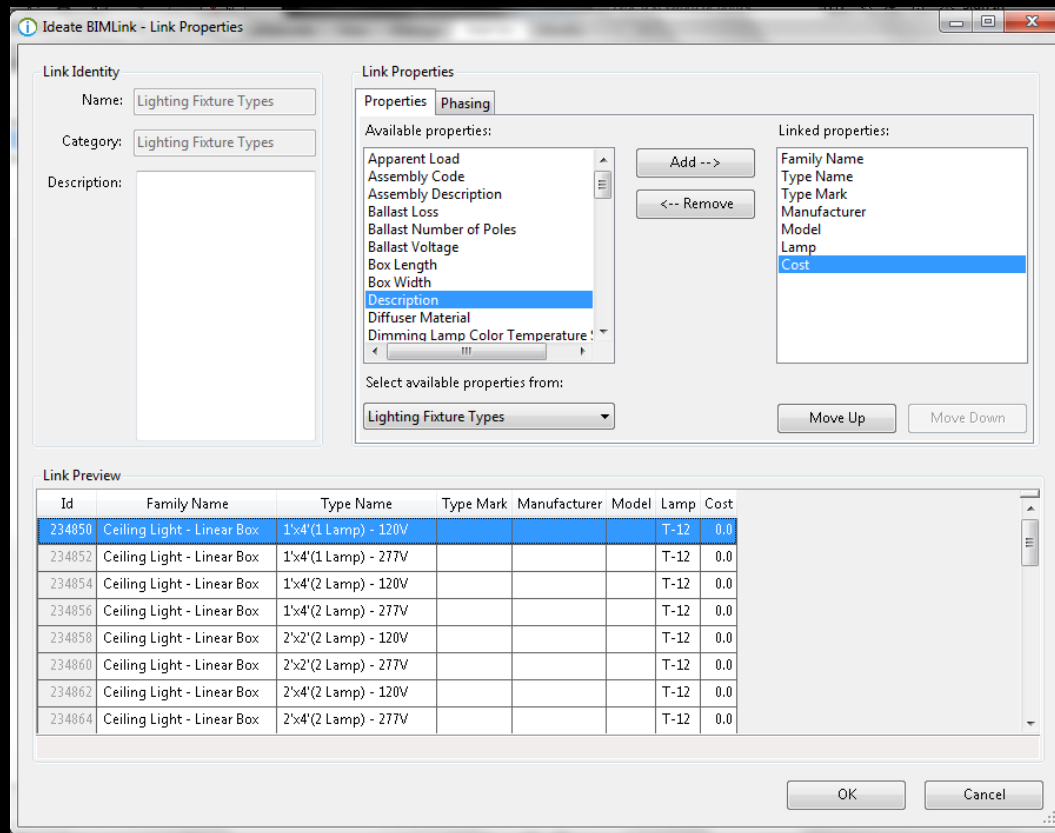
- Evaluate the benefits of implementing BIM for facilities management uses



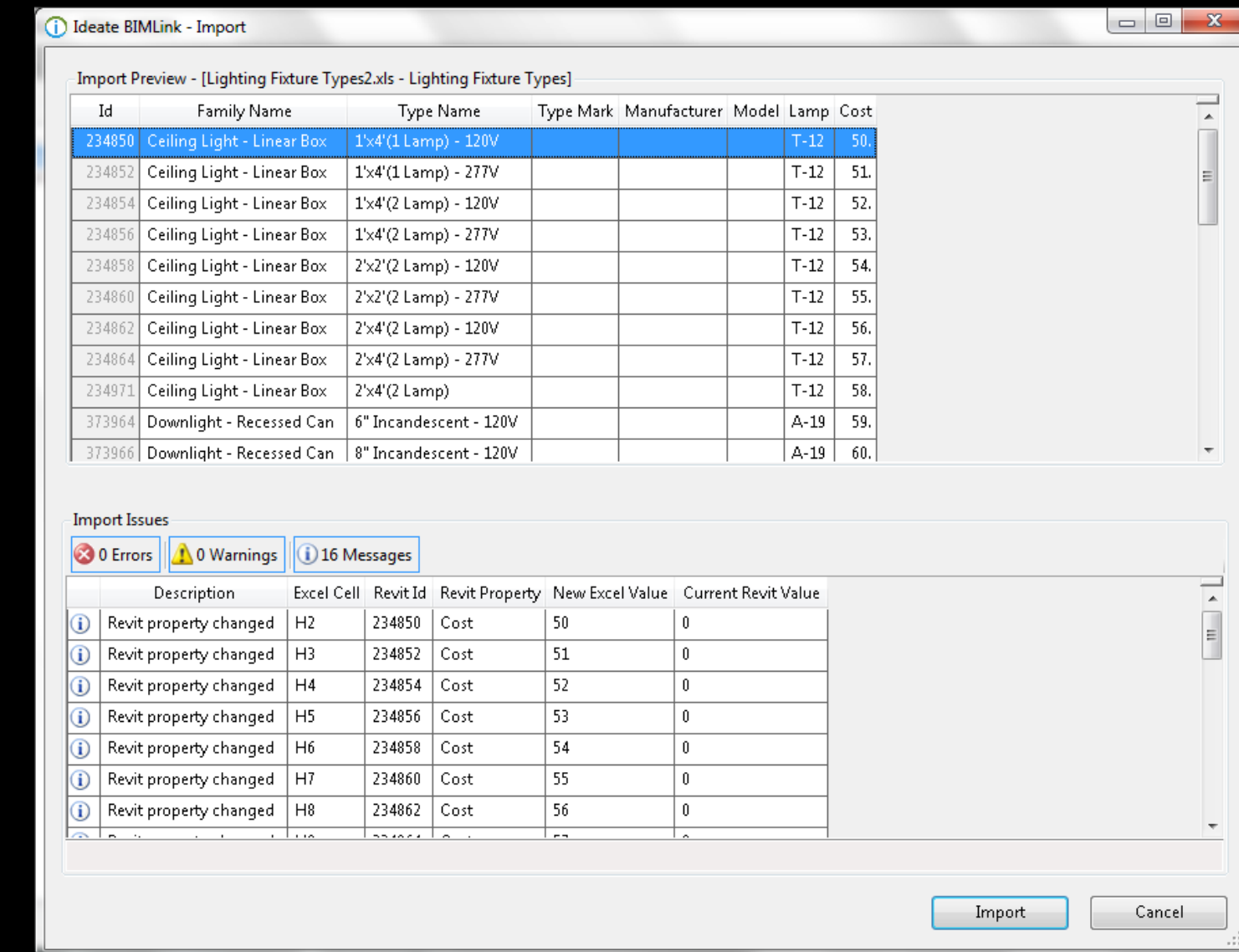


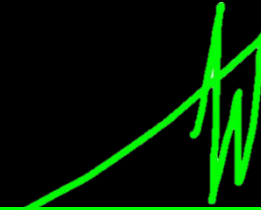
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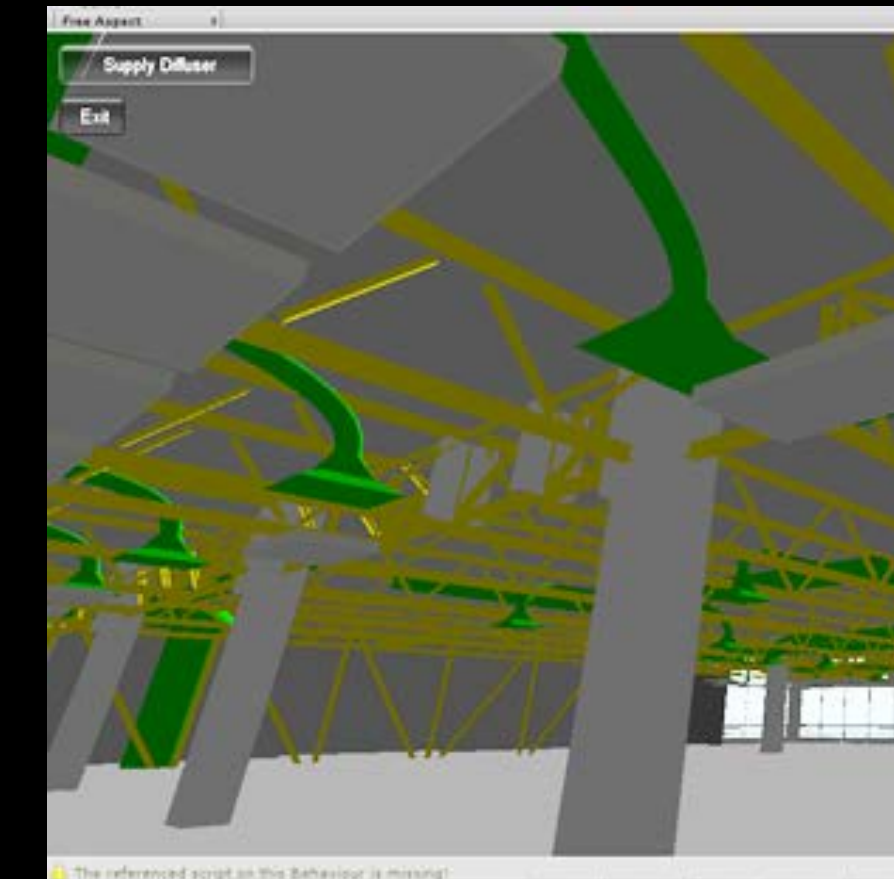
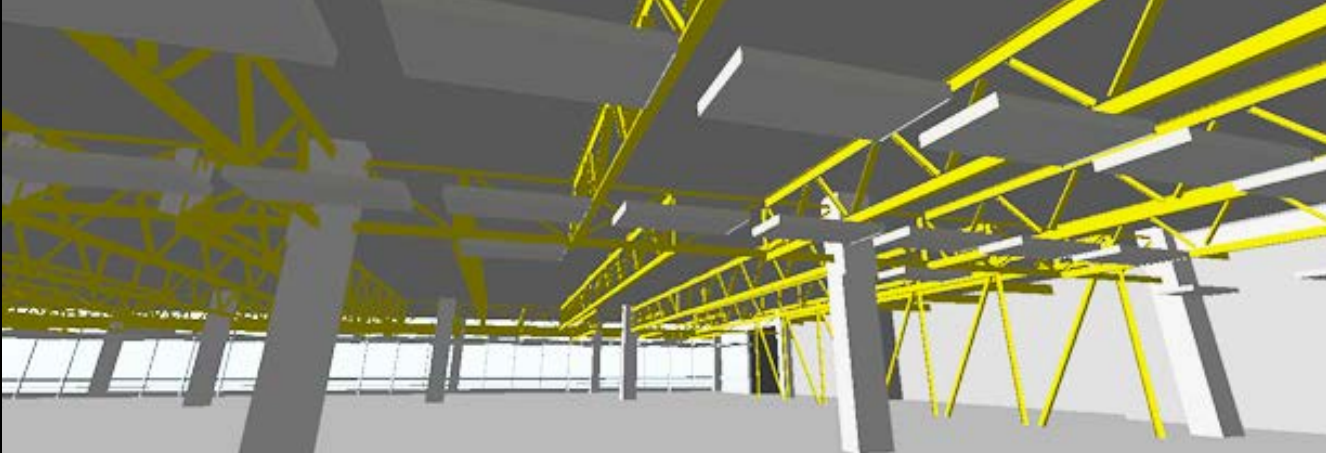
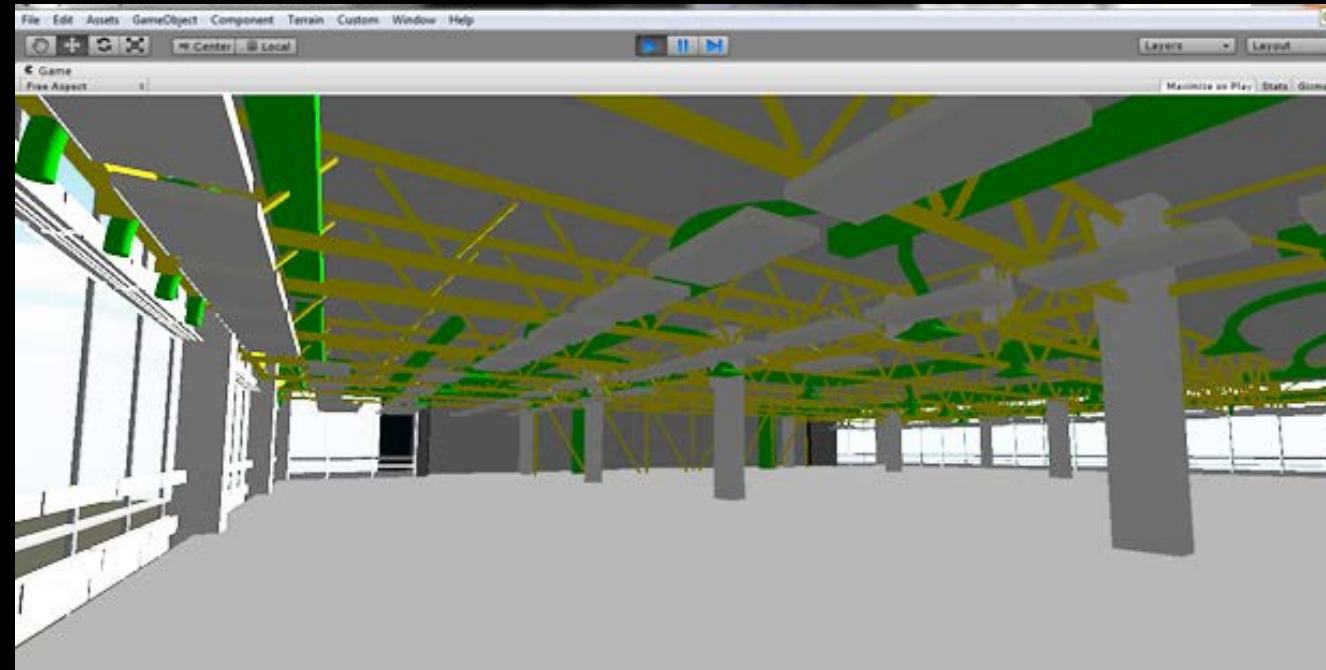
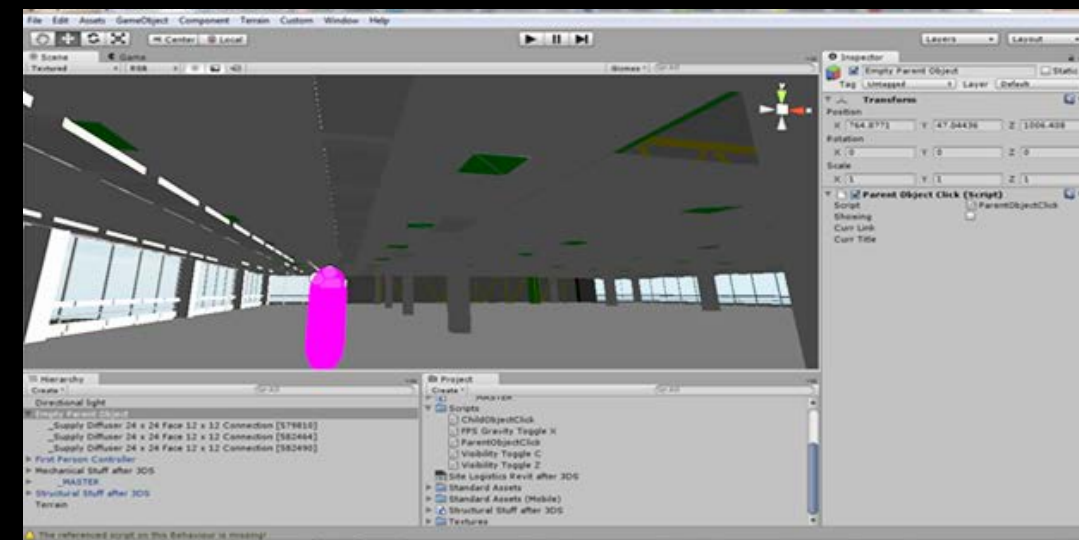
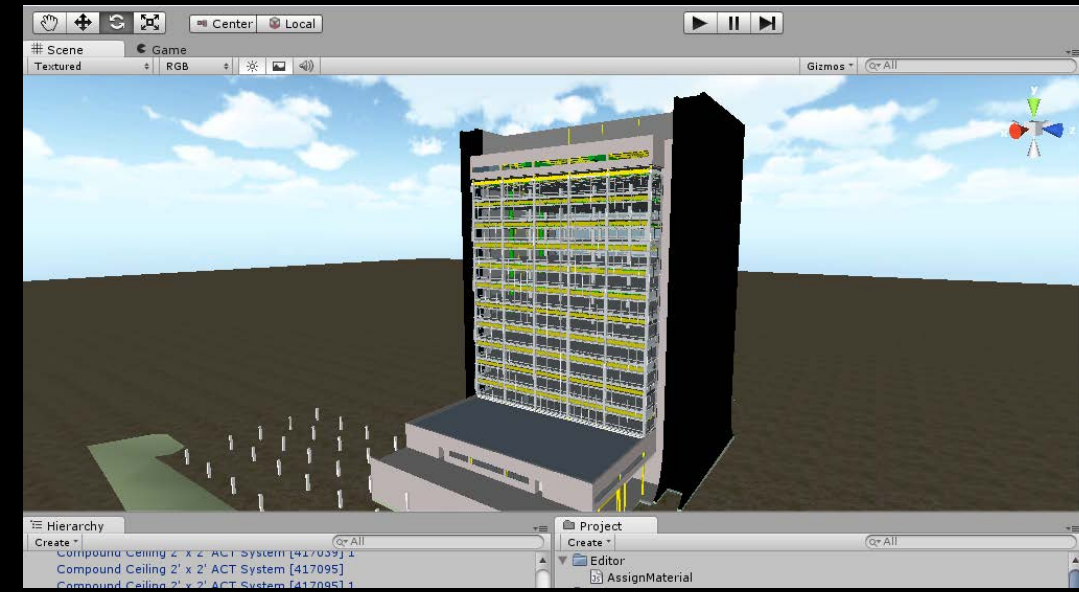
	A	B	C	D	E	F	G	H
1	Id	Family Name	Type Name	Type Mark	Manufacturer	Model	Lamp	Cost
2	234850	Ceiling Light - Linear Box	1'x4'(1 Lamp) - 120V				T-12	50.00
3	234852	Ceiling Light - Linear Box	1'x4'(1 Lamp) - 277V				T-12	51.00
4	234854	Ceiling Light - Linear Box	1'x4'(2 Lamp) - 120V				T-12	52.00
5	234856	Ceiling Light - Linear Box	1'x4'(2 Lamp) - 277V				T-12	53.00
6	234858	Ceiling Light - Linear Box	2'x2'(2 Lamp) - 120V				T-12	54.00
7	234860	Ceiling Light - Linear Box	2'x2'(2 Lamp) - 277V				T-12	55.00
8	234862	Ceiling Light - Linear Box	2'x4'(2 Lamp) - 120V				T-12	56.00
9	234864	Ceiling Light - Linear Box	2'x4'(2 Lamp) - 277V				T-12	57.00
10	234971	Ceiling Light - Linear Box	2'x4'(2 Lamp)				T-12	58.00
11	373964	Downlight - Recessed Can	6" Incandescent - 120V				A-19	59.00
12	373966	Downlight - Recessed Can	8" Incandescent - 120V				A-19	60.00
13	373968	Downlight - Recessed Can	6" Incandescent - 277V				A-19	61.00
14	373970	Downlight - Recessed Can	8" Incandescent - 277V				A-19	62.00
15	373972	Downlight - Recessed Can	Fluorescent - 120V					63.00
16	373974	Downlight - Recessed Can	Fluorescent - 277V					64.00
17	380074	Ceiling Light - Linear Box	1'x8'(2 Lamp) - 277V				T-12	65.00

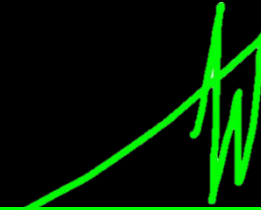




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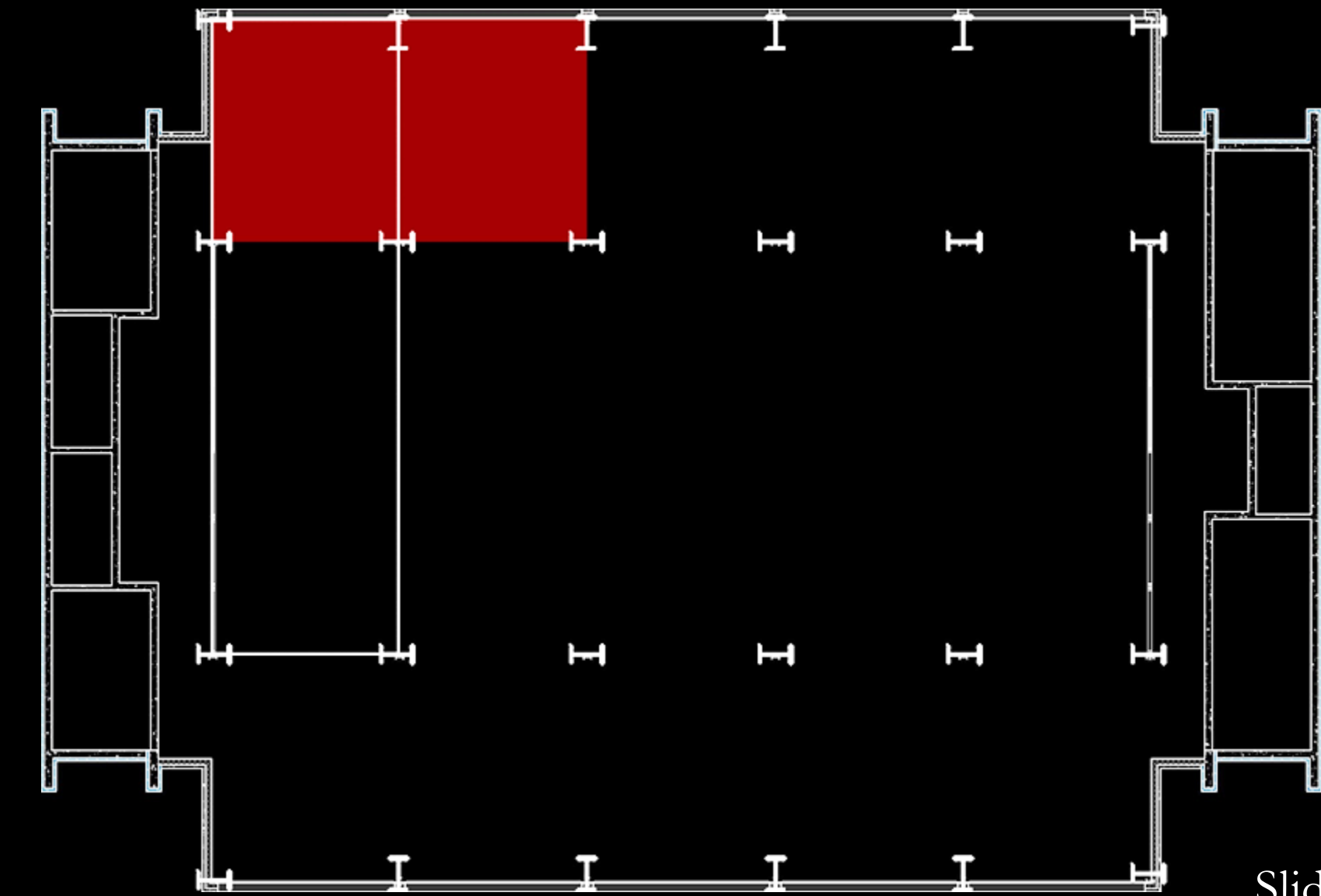
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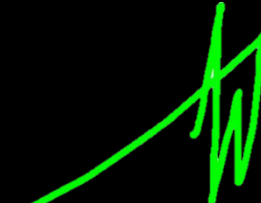
Problem Identification:

- Original construction decades prior to recent federal requirements

Research Goal:

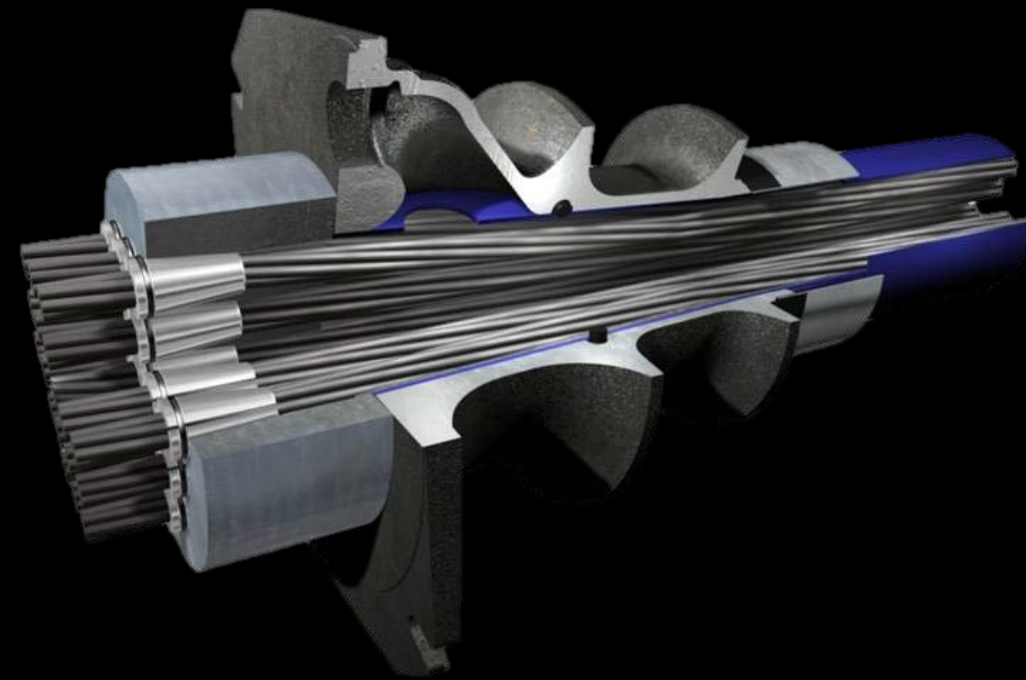
- Compare the cost and schedule impacts of adding this scope of work in three scenarios



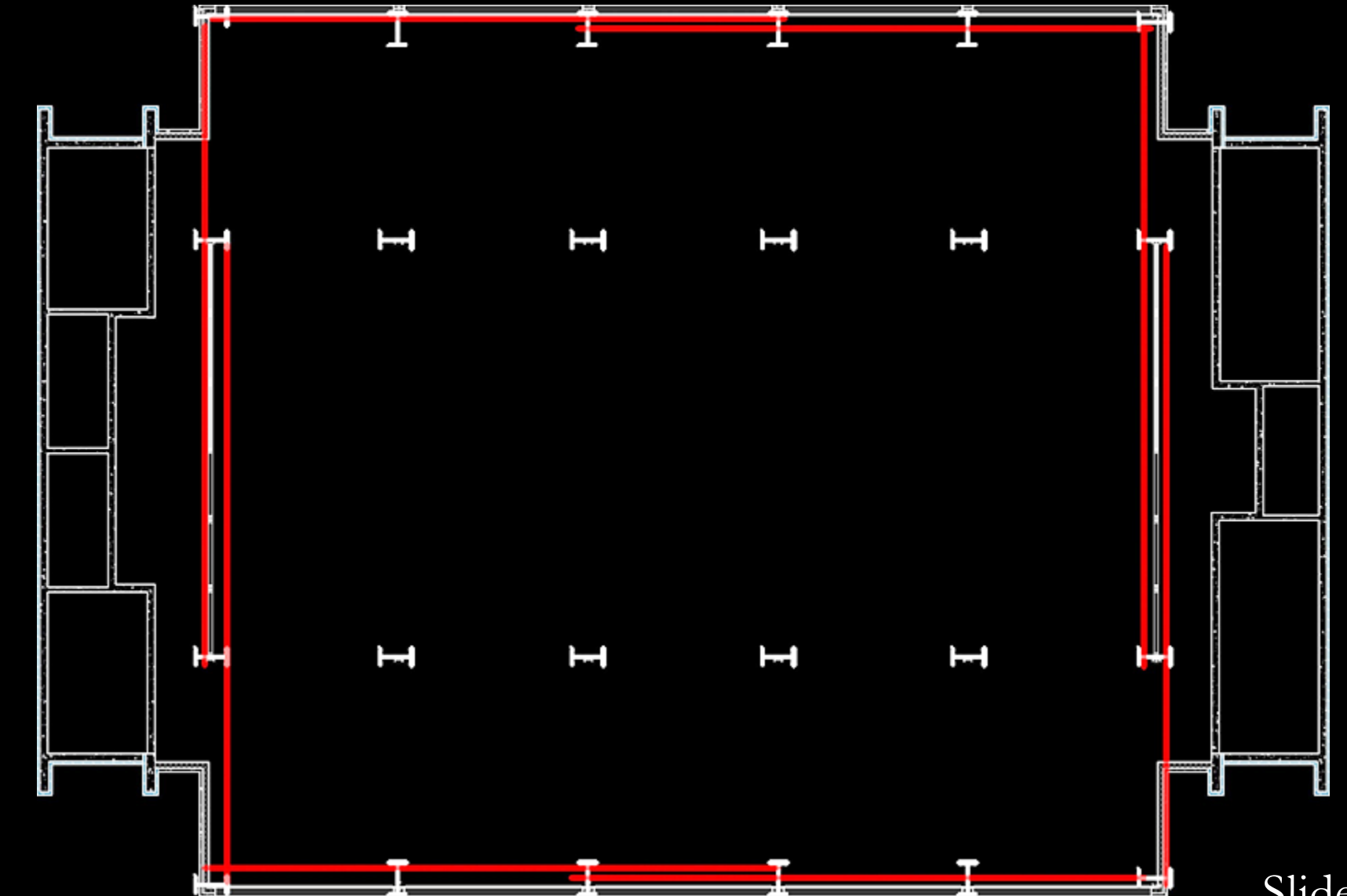
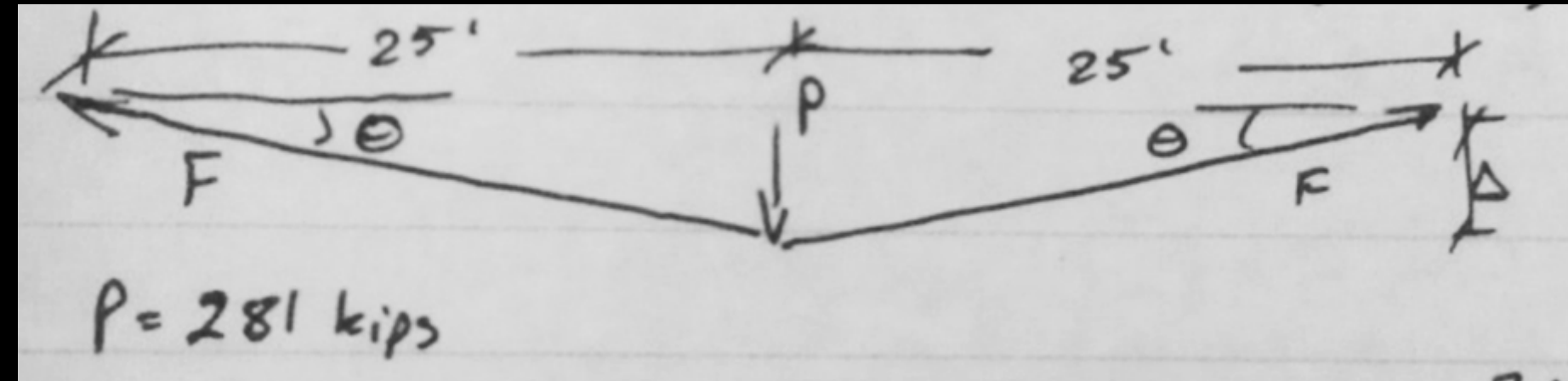


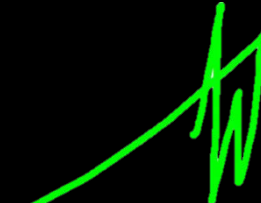
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Freyrom Anchor Section

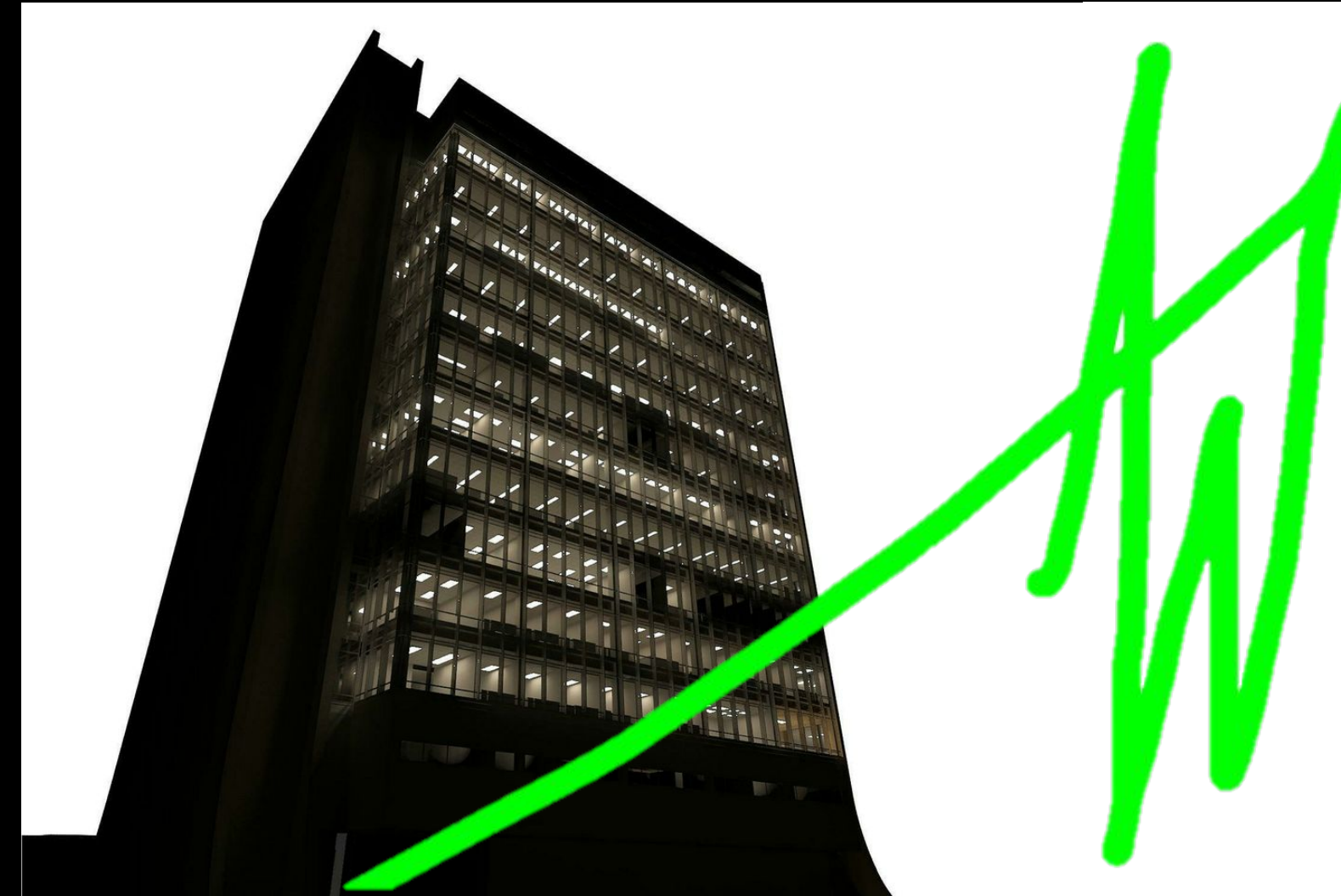




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Questions or Comments?

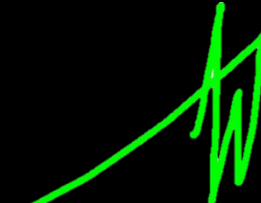


The Balfour Beatty Construction Team

Industry Professionals

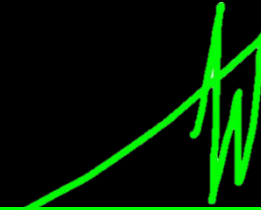
Penn State AE Department

My Family and Friends



Presentation Outline:

- I. Project Background
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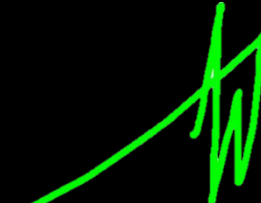
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- Owner | U.S. General Services Administration
- CM | Balfour Beatty Construction
- Architect | TranSystems Corporation
- Structural Engineer | Thornton Tomasetti
- MEP Engineer | Greenman-Pedersen, Inc.
- Sustainability / Design Consultant | William McDonough + Partners



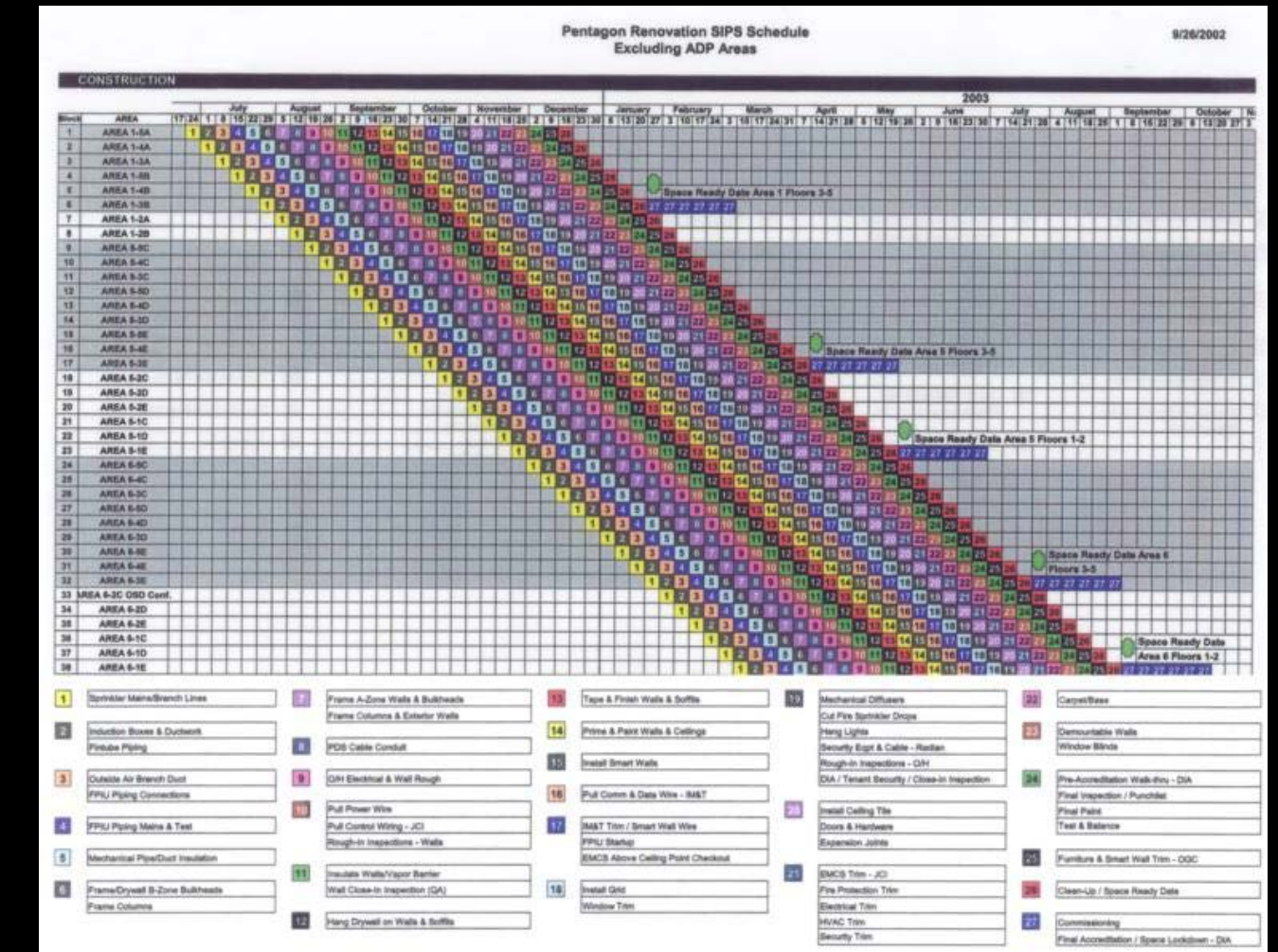
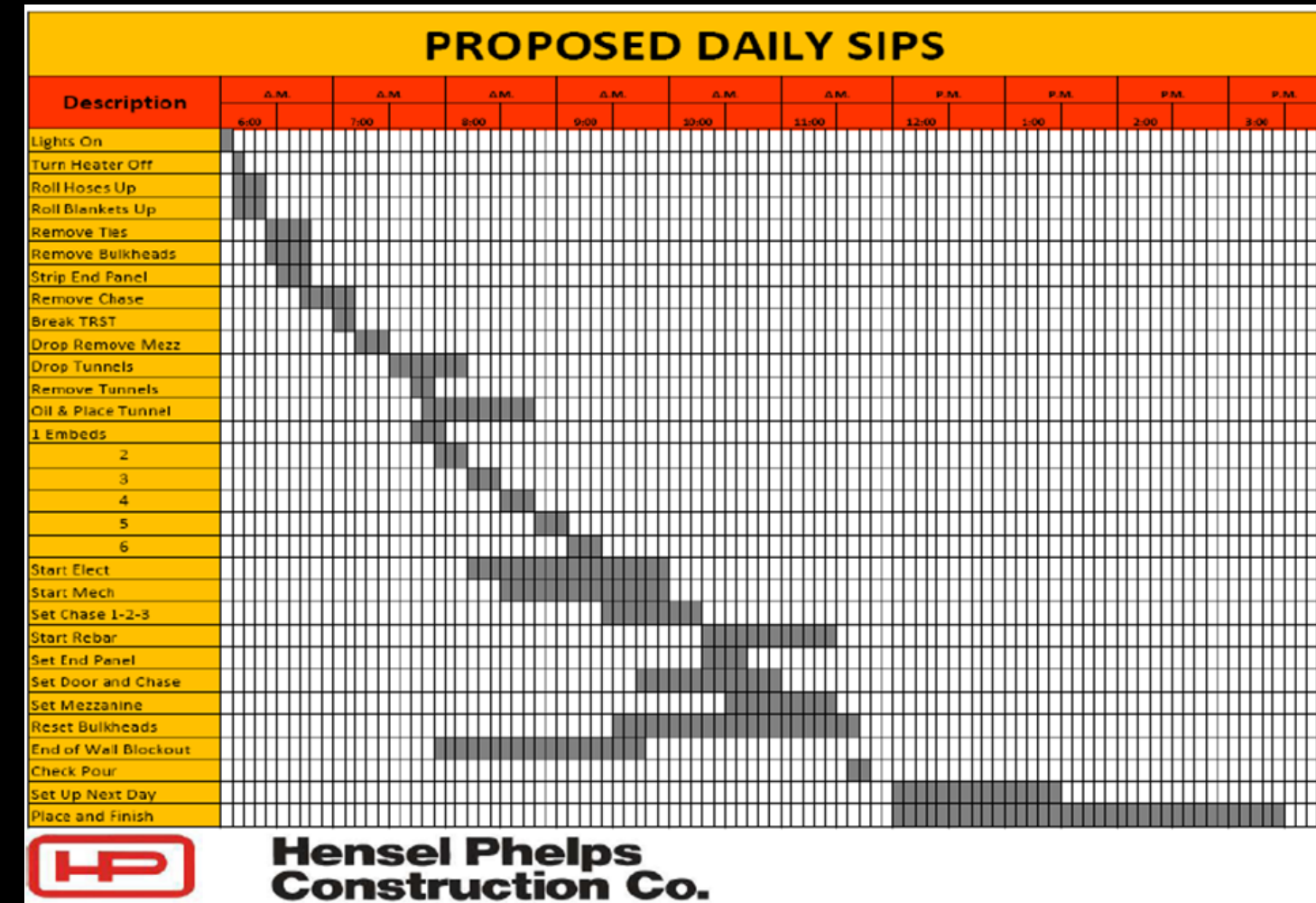


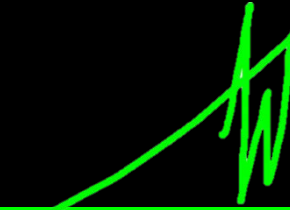
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Traditional SIPS:

Non-Traditional SIPS:





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