

# AIRPORT EXPANSION AND MODERNIZATION PROJECT



Gilbane

MM  
McKESSACK



Project Overview

Research One – Interdisciplinary Document Coordination

Research Two – Panelized Construction

Analysis One – Pedestrian Rerouting

Analysis Two – Alternative Glazing

Conclusion





## Project Overview

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Analysis One – Pedestrian Rerouting

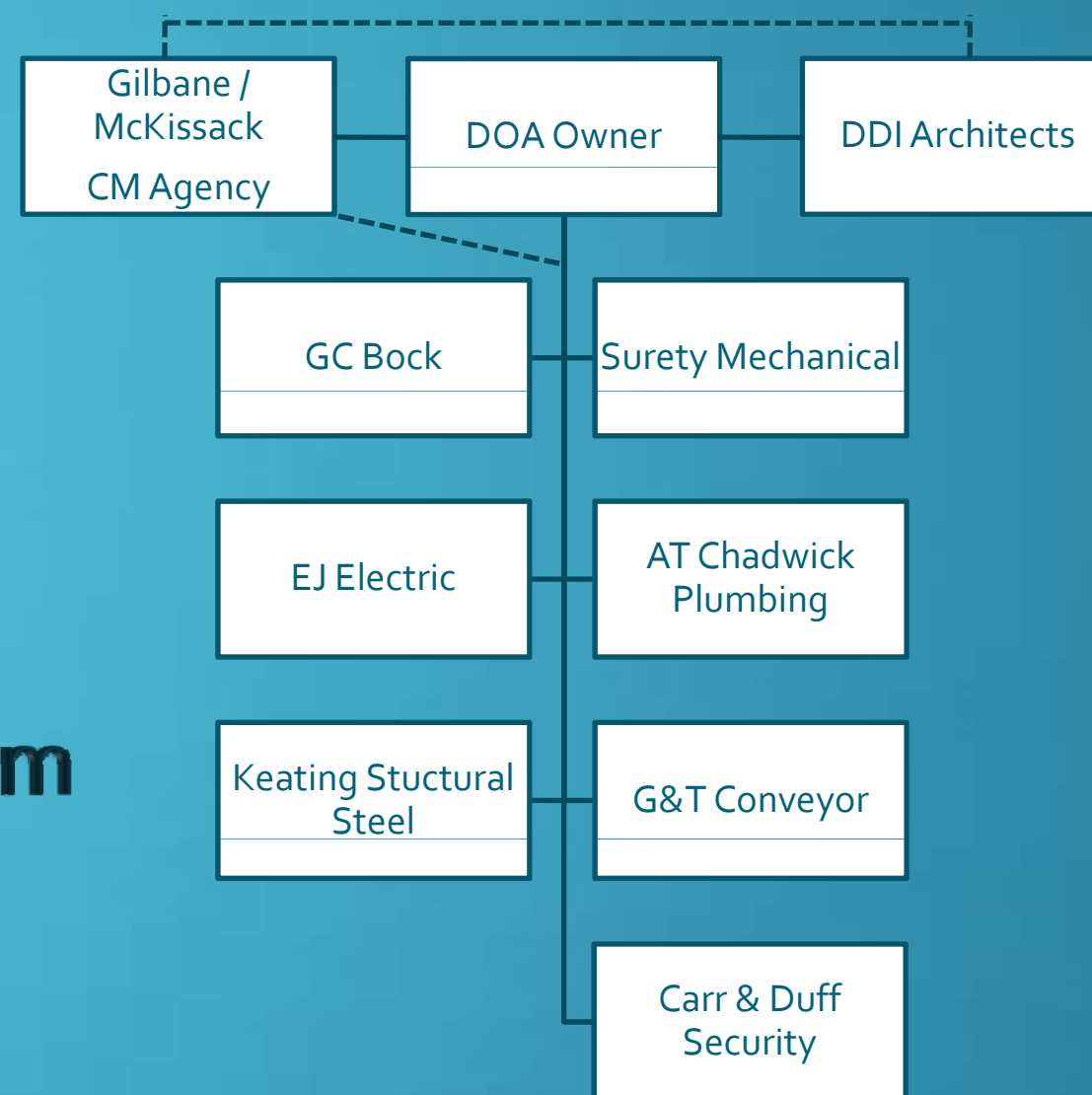
Analysis Two – Alternative Glazing

Conclusion



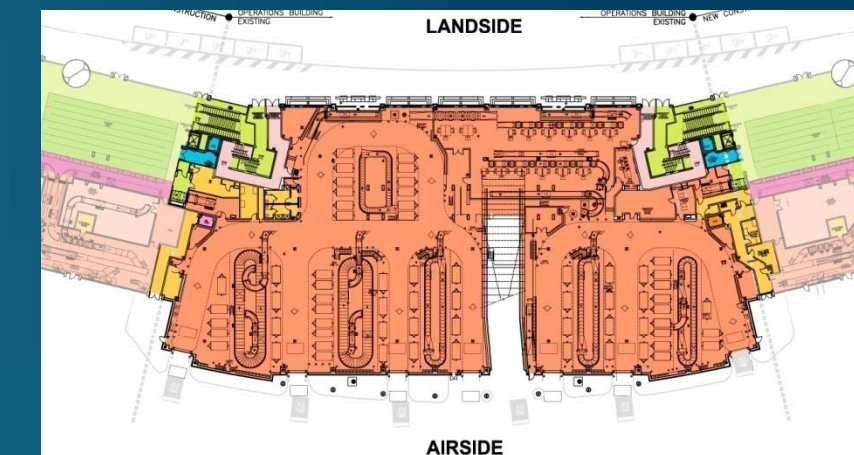
**PAUL YINGLING**  
**SENIOR THESIS**  
**DR MESSNER**

## Project Team

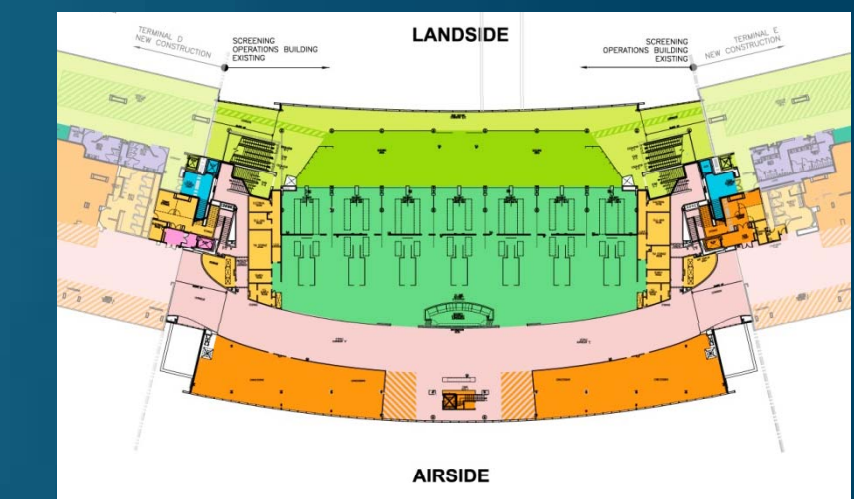


D/E Connector Building:

- 210,000 sq. ft., 4 level, Terminal Building
- 14 lane Passenger Security Checkpoint
- DOA Offices and Airline Club on Level 3
- Mechanical Penthouse
- Access to Secure Side from "A-West to E"
- Improve Passenger and Bag Processing
- In-Line Baggage Screening
- (8) CTX screening units / (2) Future Spots
- Oversize Baggage from both D & E
- Central Trace Detection Area ( 26 Tables )
- (6) Make-Up Carousels ( 4 Flat / 2 Sloped )
- (2) New Curbside Check-In Feed Belts
- Existing Curbside Belts ( 1 @ D / 2 @ E )
- Creates 250 - 300 Construction Jobs



Level One – Baggage Screening



Level Two – Security Checkpoint



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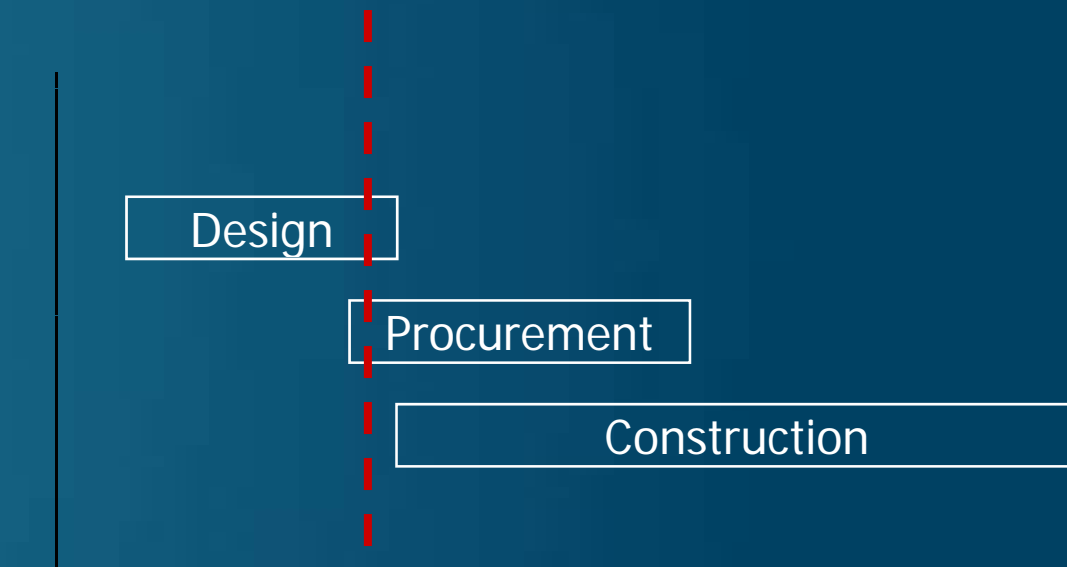
# What are the Goals of IDC?

## Goals of IDC

- Minimize Budget and Schedule by reducing the number of Unwanted Changes
- Issue the “Best Biddable Documents” to contractors for bid
- Reduce the number of construction phase RFIs

# When does it happen?

90% CD's or greater





# What is the Process?

# What are the deliverables?

## Project Overview

## Detailed Summary Report

## Compliance Check Report

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- Receive the Documents
- Verify Documents are +/- 90% CD's
- Review the documents (400+ step Procedures manual)
- Issue Drawings Comments to Owner and AE
- Receive revised documents
- Compliance Check

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Interdisciplinary Document Coordination (IDC) Review Interim Report #2, 7-9-05 thru 7-22-05  
Stony Brook University Hospital-Major Mod.

Issue Number	Int.	Date	Action By	Sheet Spec. Number	Location	Description	Conflicting Sheet Spec. Number	Conflicting Location	Conflicting Description	Comment/Question	Response	Confirmed	Revised Date	Compliance Check #
314	CB	07/14/05	CANNON	1514E	PANORAPH SUPPORTS & 12 B.F	THERE IS A REFERENCE TO SECTION 1520 "MECHANICAL INSULATION"				MECHANICAL INSULATION IS SPECIFIED IN SECTION 1520		NO		
342	CB	07/22/05	CANNON	1612A	PANEL SLOD ANCHORS	SCHEDULE LISTS PANEL AS 48027V.3 PHASE 4 WIRE.				COMMENT: CANNOT FIND MOUNTING, MAIN BREAKER REQUIREMENT, MAIN SIZE, A/C RATING, OR ANY OTHER PERTINENT NOTES.		NO		
188	CK	07/11/05	CANNON	A109	GL V10M1 COLUMN A52A	NEAR COLUMN A52A ENLARGED OUTLINE 11KX8 IS SHOWN @ AN EXTERIOR MULLION PLASTER	A635	11KX8S	11KX8S SHOWS 03 DOORS & A INTERIOR WALL PARTITION	COMMENT: APPEAR SNAKS IS MORE APPLICABLE TO THE PLAN AREA THE ENLARGED DETAIL OUTLINE IS SHOWS		NO		
198	CK	07/11/05	CANNON	A119	GL V501 COLUMN B38	SHOWS IN THE PLAN THE EXTERIOR WALL PROTRUDING OUT WITH AN ENLARGED DETAIL OUTLINE REFERENCEING 14A09	A639	V1A09	NO SUCH SHEET EXIST IN THE SET OR IS NOTED ON THE COVER SHEET IN THE INDEX OF DWG.	QUESTION: WHERE IS THE DETAIL DRAWN THAT THIS OUTLINE SHOWS?		NO		
324	CK	07/21/05	CANNON	A311	6A311 ELEVATION	SECTION 4A46S DOES NOT EXIST BUT SEQUENTIALLY SNAKS DOES EXIST THRU THE ENTRY LOCATION	A635	5A46S	SECTION 4A46S DOES NOT EXIST BUT SEQUENTIALLY SNAKS DOES EXIST AND APPEARS TO SHOW THE ENTRY SECTION	QUESTION: SHOULD SNAKS ACTUALLY BE 4A46S?		NO		
191	CK	07/11/05	CANNON	A415	G1 SECTION @ ATRIUM LOBBY	SECTION SHOWS AN EXPANSION CURB @ LEVEL 6. 4A411 BASE DETAIL @ EXPANSION JOINT SHOWS A 2" COMPRESSIBLE FILLER	GL 1907		SECTION 115/170 WHICH JOINT BETWEEN THE EXIST. & NEW BUILDING.	COMMENT: DISCREPANCY ON THE LOCATION OF THE EXPANSION JOINT BETWEEN ARCH & STRUCTURAL. QUESTION: IS THERE TO BE AN EXPANSION JOINT @ THE 6TH LEVEL IN THIS LOCATION? SHOULD THERE ALSO BE ONE A THE 5TH LEVEL SECTION 55-70P		NO		
303	CK	07/22/05	CANNON	ENM	GL 16EE	ALONG GL 16 IS A DASHED LINE & A THICK DARK LINE (BM) BUT ONLY AN				QUESTION: IS THERE TO BE A NEW BEAM BETWEEN GL FF & DO ALONG		NO		

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## Is IDC the same as Constructability?

### Constructability Review

- Occurs During SD / DD
- Results in Change of Design
  - Example:  
given: Floor to Floor height 12', Desired Ceiling Height 8'  
conflict: Steel 18", Ductwork 24", Sprinkler 10", ACT 2"  
solution: Raise floor to floor height – "Altered Design"

### IDC

- Occurs at CD
- Results in Coordination of Design
  - Example:  
given: Floor to Floor height 12', Desired Ceiling Height 8'  
conflict: Steel 18", Ductwork 24", Sprinkler 10", ACT 2"  
solution: Change duct size, lower ceiling - "Coordinated Design"

## Who benefits from IDC?

### Architects

- Allows more time for Shop Drawing review
- Increases Quality of the Design
- Reduces E&O Claims and Premiums
- Makes deadlines on other design projects easier

### Owners

- Maintain and Improve Schedule by Reducing RFI's
- Reduce Potential Change Orders Due to Coordination Issues **7-10 times the cost of review**
- Enhances Quality in Construction
- Direct \$ Savings to their project



# How is the IDC Priced?

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Estimated IDC review man-days based on project type and cost range  
Avg. rate = \$40/hour Billing Rate = \$704 per day (burdened with no profit)

Cost Range (million)	Daily Rate	Project Type			
		New Man-d		Reno Man-d	
0-5	757	10	\$7,568	12	\$9,082
5-10	757	16	\$12,109	21	\$15,893
10-15	757	23	\$17,406	29	\$21,947
15-20	757	31	\$23,461	38	\$28,758
20-25	757	38	\$28,758	46	\$34,813
25-30	757	45	\$34,056	55	\$41,624
30-35	757	53	\$40,110	65	\$49,192
35-40	757	61	\$46,165	76	\$57,517
40-45	757	69	\$52,219	86	\$65,085
45-50	757	77	\$58,274	95	\$71,896
50-60	757	85	\$64,328	105	\$79,464
60-70	757	94	\$71,139	116	\$87,789
70-80	757	102	\$77,194	125	\$94,600
80-90	757	110	\$83,248	133	\$100,654

**10% OF TOTAL BUILDING COST**



# Project Specific Example:

Project Overview

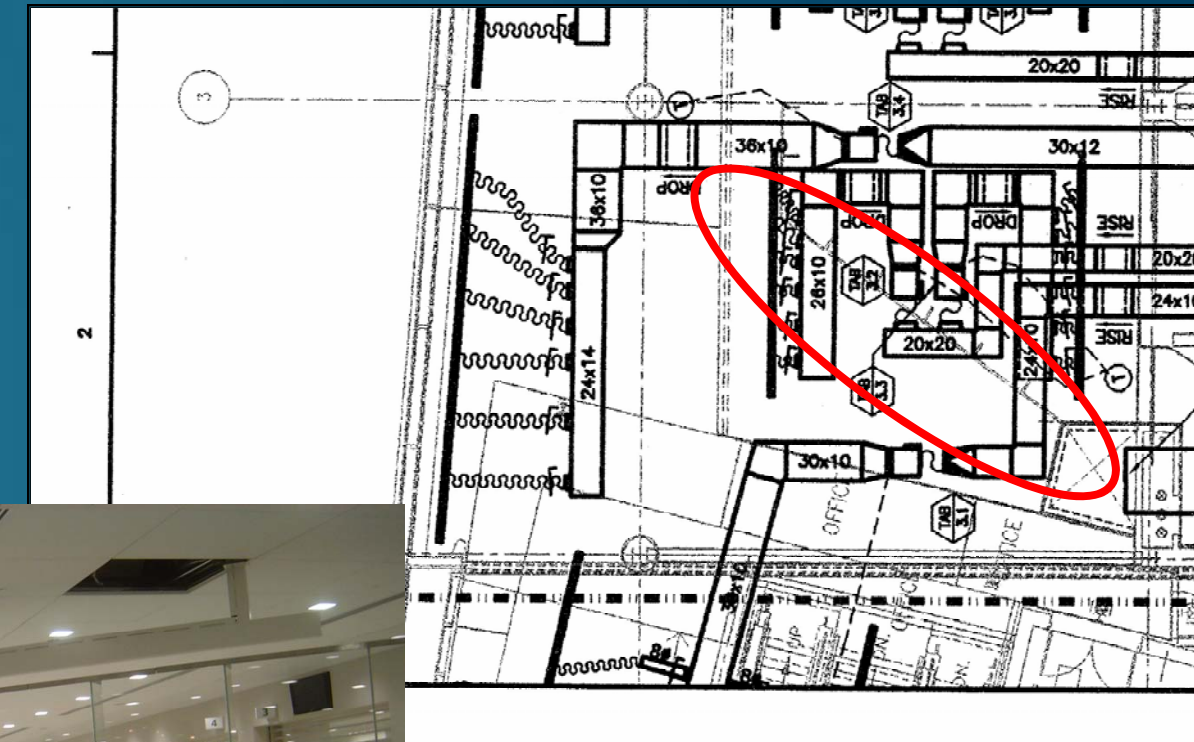
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Duct Size (L+W+1")	Weight (plf) 22 gauge	Length	Total Weight
37	9.36 lbs	20'	187.2 lbs

Total Incl. O&P	Weight	Total Cost
\$7.75 per pound	187.5 pounds	\$1,453



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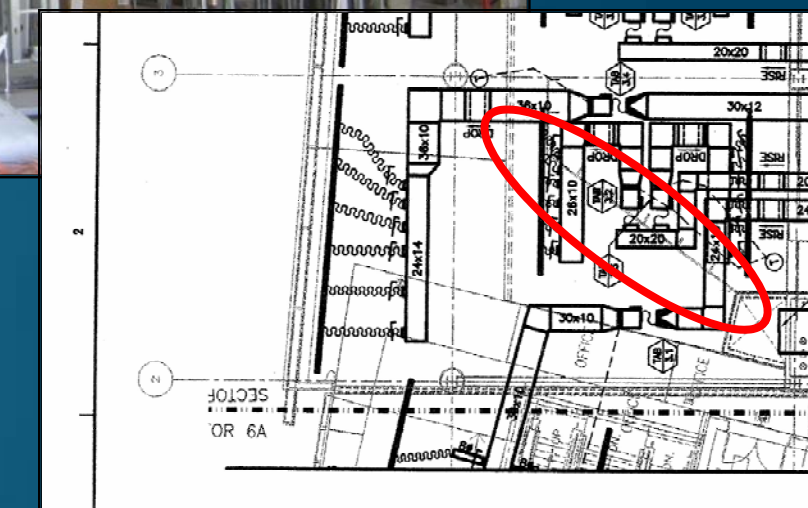
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## Problem:

- Cast stone veneer color consistency
- Potentially hazardous site
- Grout color approval
- Building enclosure

## Goal:

- Implement a precast system in place of cast stone
- A less congested site may improve safety
- Explore the Approval process

## Expected Outcomes:

- Cheaper cost and faster installation
- Safer site
- Quicker architect approval
- Achieve weatherproof enclosure quicker



# Dimensional Limitations

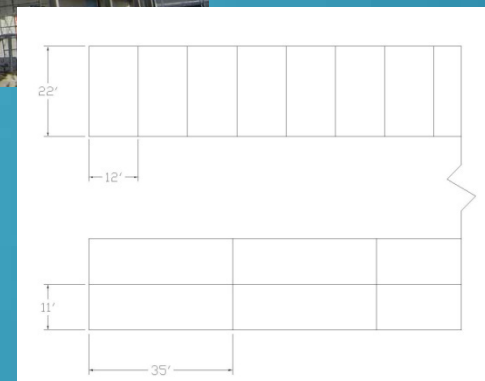
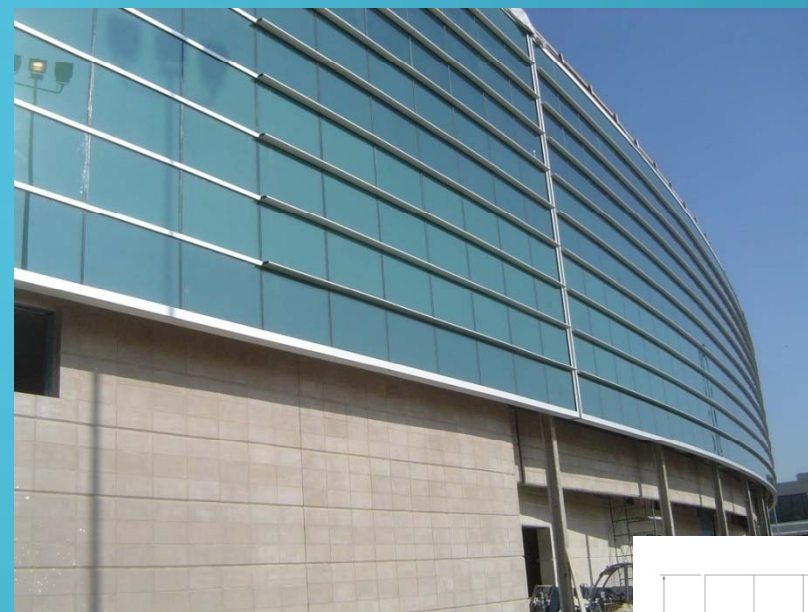
## Design Consideration

- Transportation
- Installation Time

**354' x 22'**

Vertical: 30 panels 12' x 22'

Horizontal: 22 panels 35' x 11'



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## Cost & Schedule Impact

Original Cast Stone: \$57 per sqft  
Total: \$801,306

Precast Stone: \$35 per sqft  
Total: \$492,030

Savings: \$309,276

## Safety



Cast Stone: 40 days  
Precast: 3 days



# Aesthetics

*Project Overview*

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A 179,800 sq. ft., three-story steel frame office building with architectural precast façade

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# Structural Redesign

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Conclusion



**Problem:**

- Concrete integrated into a steel building
- Potentially hazardous site
  - Public
  - Steel Erectors

**Goal:**

- Create a entirely steel structure
- Relocate pedestrians from job site
- Cost Evaluation

**Expected Outcomes:**

- More predictable structure
- Safer site
- Reduction of RFI's

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Project Overview

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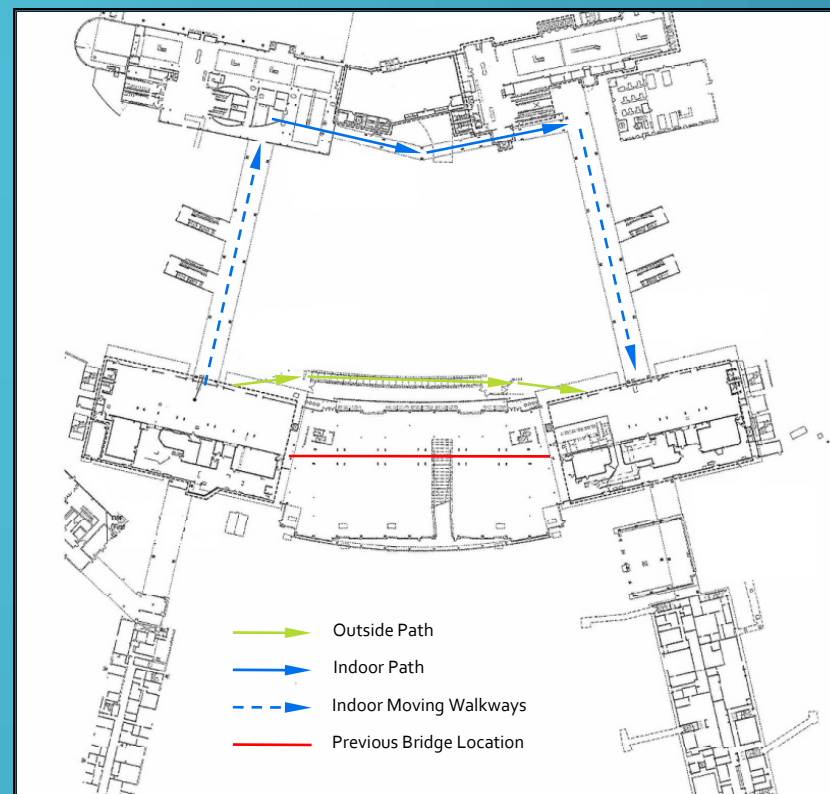
Analysis Two – Alternative Glazing

Conclusion



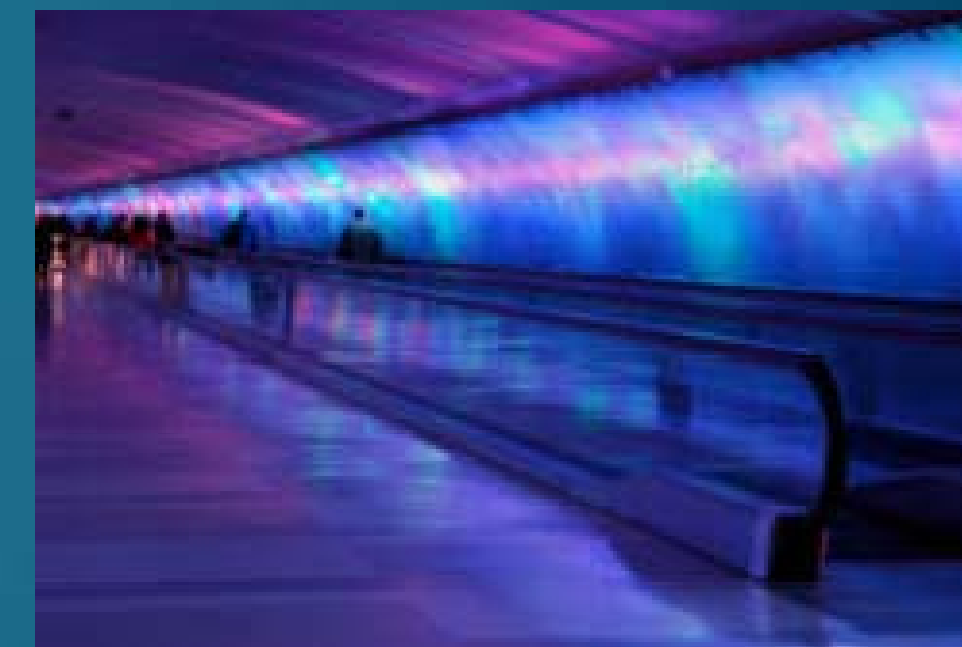
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# Rerouting



$$(600 \text{ ft}) \times (0.3048 \frac{\text{m}}{\text{ft}}) \times (1.4 \frac{\text{m}}{\text{s}}) / (60 \frac{\text{s}}{\text{min}}) =$$

4.26 minutes







# Redesign

Project Overview

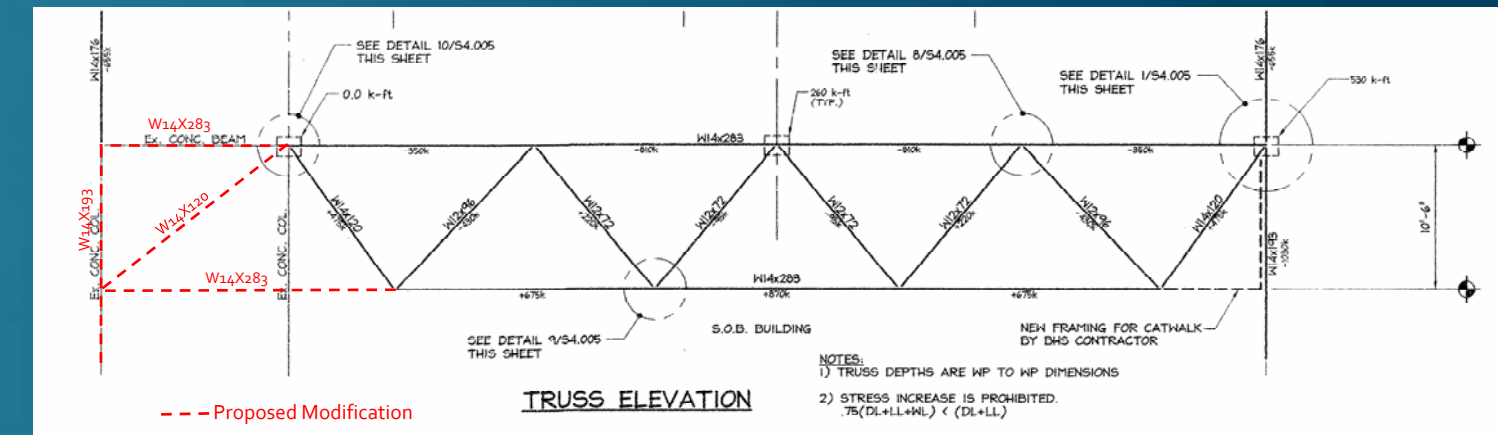
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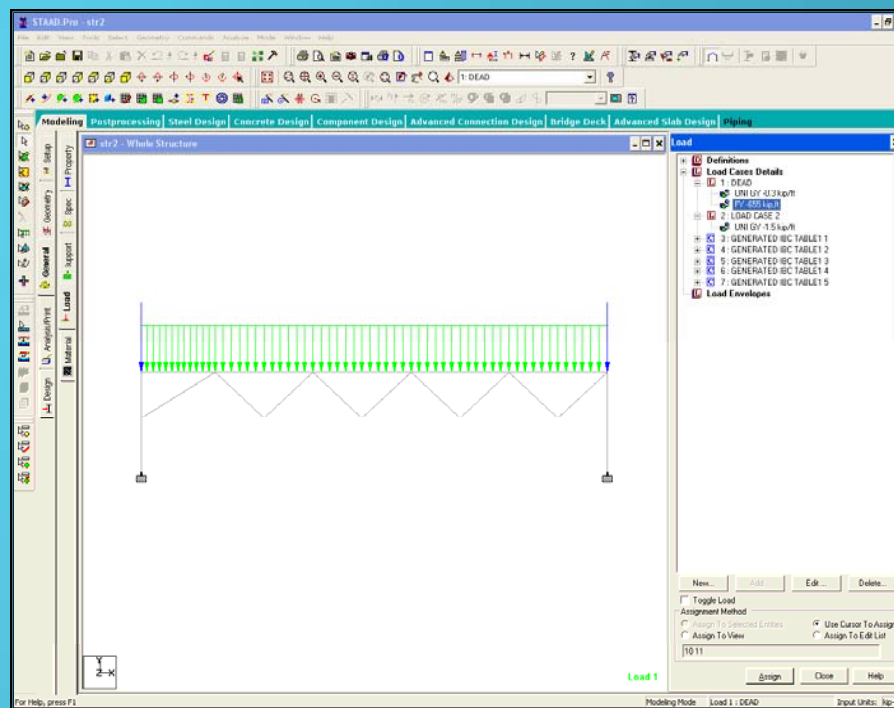


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# Guess and Check

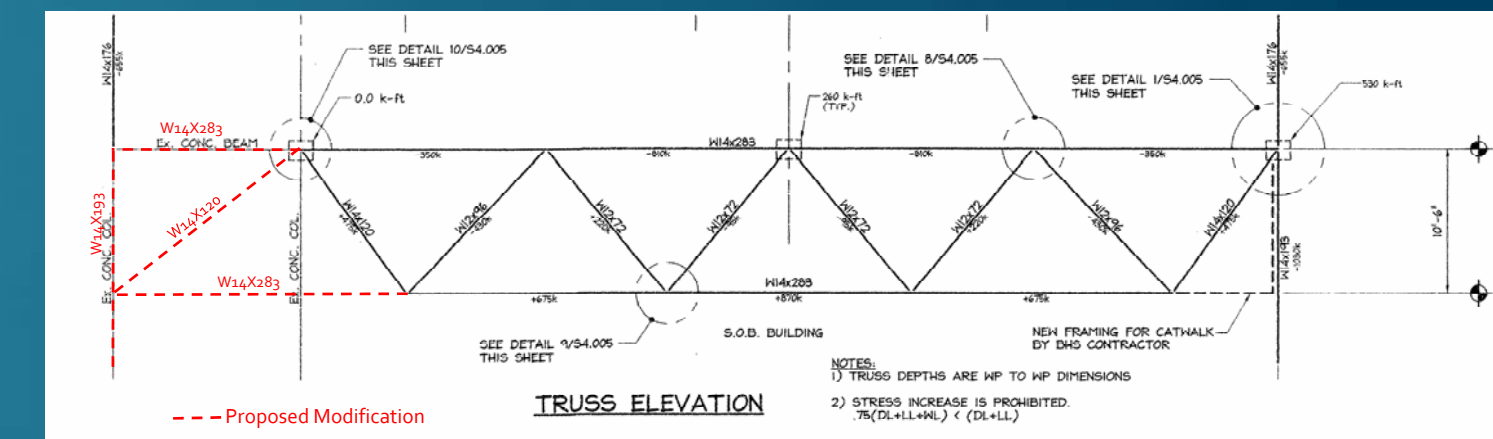
$$\delta = 0.707''$$

3.56" Allowable



Node Displacement Summary										
	Node	L/C	X (in)	Y (in)	Z (in)	Resultant (in)	rX (rad)	rY (rad)	rZ (rad)	
Max X	9	2:LOAD CASE	0.004	-0.112	0.000	0.112	0.000	0.000	0.000	
Min X	1	4-GENERATE	-0.134	-0.085	0.000	0.159	0.000	0.000	0.000	
Max Y	12	1:DEAD	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Min Y	6	4-GENERATE	-0.071	-0.707	0.000	0.711	0.000	0.000	0.000	
Max Z	1	1:DEAD	-0.019	-0.061	0.000	0.064	0.000	0.000	0.000	
Min Z	1	1:DEAD	-0.019	-0.061	0.000	0.064	0.000	0.000	0.000	
Max rX	1	1:DEAD	-0.019	-0.061	0.000	0.064	0.000	0.000	0.000	
Min rX	1	1:DEAD	-0.019	-0.061	0.000	0.064	0.000	0.000	0.000	
Max rY	1	1:DEAD	-0.019	-0.061	0.000	0.064	0.000	0.000	0.000	
Min rY	1	1:DEAD	-0.019	-0.061	0.000	0.064	0.000	0.000	0.000	
Max rZ	1	1:DEAD	-0.019	-0.061	0.000	0.064	0.000	0.000	0.000	
Min rZ	1	1:DEAD	-0.019	-0.061	0.000	0.064	0.000	0.000	0.000	
Max Rst	6	4-GENERATE	-0.071	-0.707	0.000	0.711	0.000	0.000	0.000	

DEFLECTION DOES NOT CREATE INSTABILITY





# Predictable Structure

Project Overview

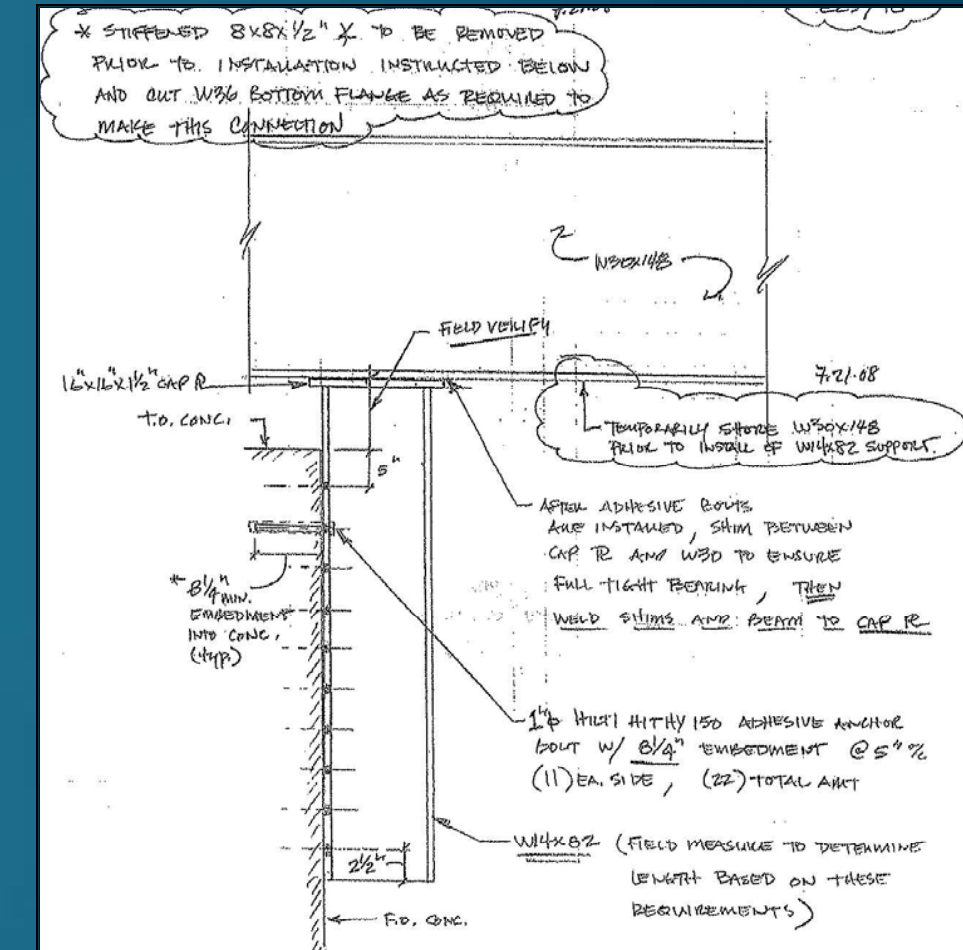
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# Cost & Schedule Impact

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Member Type	Member Length		Weight
W14X120	19.96'		2395.20 lbs
W14X193	22.50'		4342.50 lbs
W14X283	17.00'		4811.00 lbs
		Total weight	5.77 tons

46 tons at \$2,338 per = \$108,003

**Savings = \$391,997**

# Safety





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## Problem:

- Aesthetics and Energy Efficiency

## Goal:

- Create a more efficient facade
- Maintain architectural aesthetics
- Cost Evaluation

## Expected Outcomes:

- More energy efficient facade
- Does not compromise aesthetics
- Cost effective



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# Dual Façade Advantages

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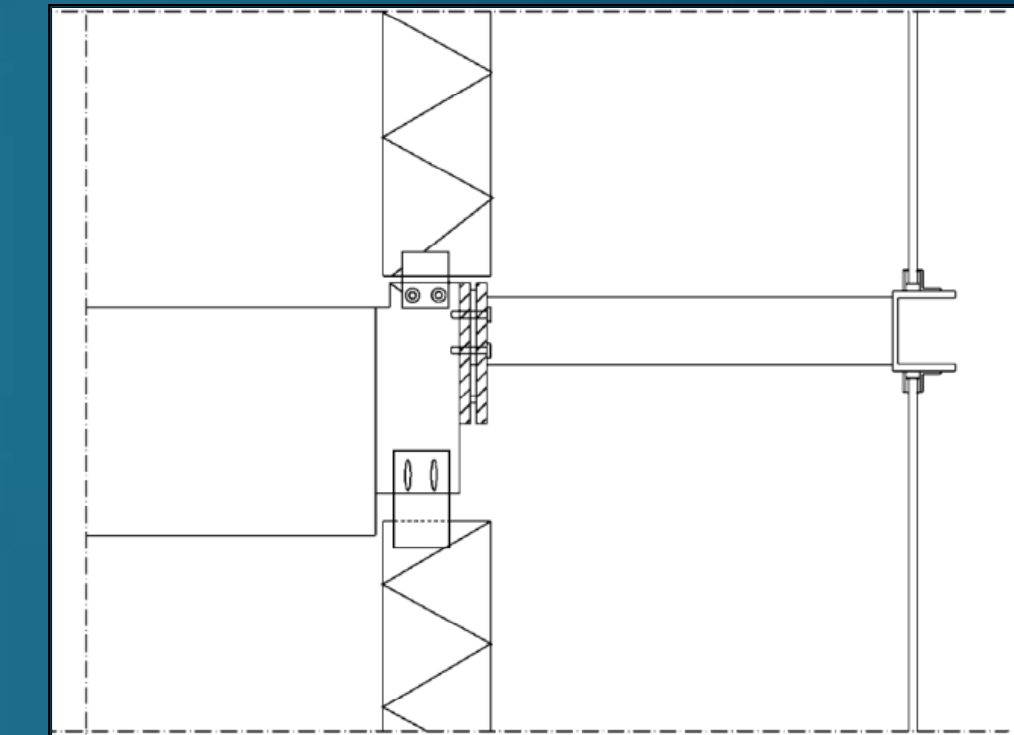
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Conclusion

- Noise reduction with the close proximity to the tarmac
- Improved insulation and reduced heating loads / costs
- Architectural intent is modified, rather than eliminated, for higher energy performance





# Modification

## Project Overview

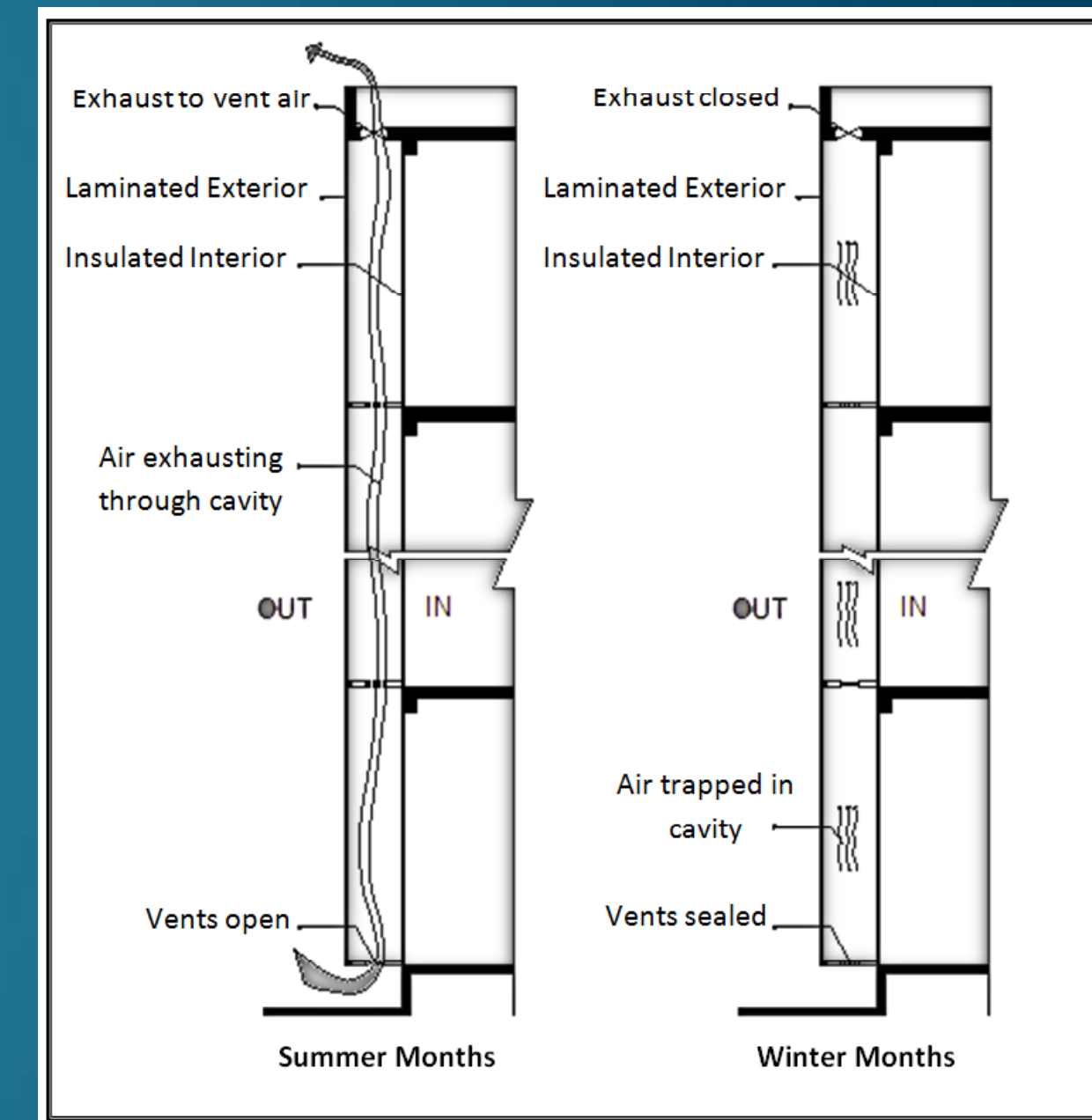
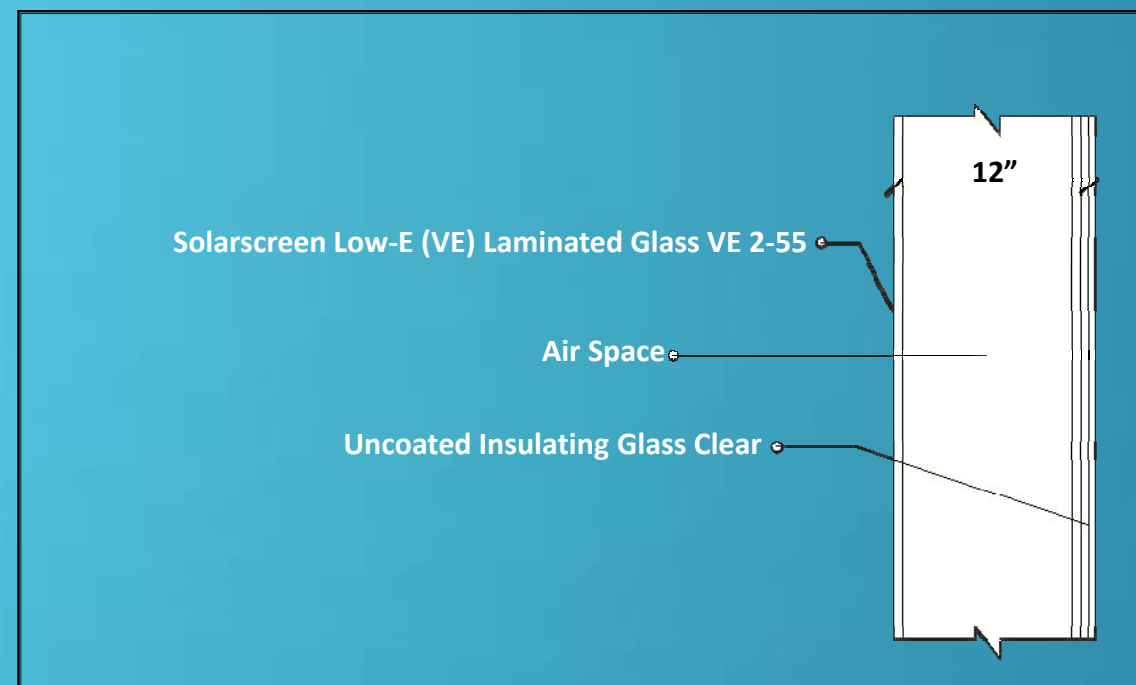
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# Replacement Glass

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## Conclusion

Material	U-Value $\left[\frac{Btu}{ft^2 \cdot F \cdot hr}\right]$		R-Value $\left[\frac{ft^2 \cdot F \cdot hr}{Btu}\right]$	
	Winter Conditions	Summer Conditions	Winter Conditions	Summer Conditions
Existing - Silk-Screened Low-E (VE) Insulating glass (50% Coverage V933) VE 2-55	0.310	0.290	3.23	3.45

Material	U-Value $\left[\frac{Btu}{ft^2 \cdot F \cdot hr}\right]$		R-Value $\left[\frac{ft^2 \cdot F \cdot hr}{Btu}\right]$	
	Winter Conditions	Summer Conditions	Winter Conditions	Summer Conditions
Exterior - Solarscreen Low-E (VE) Laminated Glass VE 2-55	0.970	0.880	1.03	1.13
12" Airspace (sealed in winter and open in summer)	0.017	4.55	60	12
Interior - Uncoated Insulating Glass Clear	0.470	0.490	2.13	2.04
<b>Totals:</b>	<b>0.016</b>	<b>0.066</b>	<b>63.16</b>	<b>15.17</b>



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# Calculations

Winter Conditions	U-Value $\left[\frac{Btu}{ft^2 \cdot F \cdot hr}\right]$	Temperature Difference °F	Area $ft^2$	Total $\frac{Btu}{hr}$
Existing – Silk-Screened Low-E (VE) Insulating glass (50% Coverage V933) VE 2-55	0.310	55	8650	147483.00
Dual Facade	0.016	55	8650	7612.00

Summer Conditions	U-Value $\left[\frac{Btu}{ft^2 \cdot F \cdot hr}\right]$	Temperature Difference °F	Area $ft^2$	Total $\frac{Btu}{hr}$
Existing – Silk-Screened Low-E (VE) Insulating glass (50% Coverage V933) VE 2-55	0.290	19	8650	47661.50
Dual Facade	0.066	19	8650	10847.1

# Cost

	Months	Btu saved with Dual Façade per month	Cost per Million Btu per month*	Total Savings per year
Winter	5	71.87 million	\$365.40	\$131,309
Summer	7	26.51 million	\$936.30	\$173,749
			<b>Total:</b>	<b>\$305,058</b>

\*Prices obtained from the US Department of Energy

Approximately a 2 year payoff



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# Photovoltaic alternative?



Problem:

- Aesthetics and Energy Efficiency

Goal:

- Create a more efficient facade
- Maintain architectural aesthetics
- Cost Evaluation

Expected Outcomes:

- More energy efficient facade
- Does not compromise aesthetics
- Cost effective



## Project Overview

Research One – Interdisciplinary Document Coordination

Research Two – Panelized Construction

Analysis One – Pedestrian Rerouting

**Analysis Two – Alternative Glazing**

Conclusion

# Calculations

Monthly Daylight Averages (hours)

(Data available on NASA's website)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
<b>Average</b>	9.68	10.7	11.9	13.2	14.3	14.9	14.7	13.7	12.5	11.1	10	9.4

Average output for January

$$9.68 \text{ h} \cdot 125 \frac{\text{W}}{\text{m}^2} \cdot 438.95 \text{m}^2 \cdot \frac{1 \text{ Kw}}{1000 \text{ W}} \cdot 31 \text{ days} = 16,465 \text{ kWh}$$

Output per Months (kWh)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
<b>Average</b>	16,465	16,439	20,241	21,728	24,323	24,526	25,004	23,303	21,262	18,880	16,461	15,989

# Cost

Output Comparison to Actual Building Demand

<b>Total Solar Output per year:</b>	244,621 kWh
<b>Average Building Demand per year:</b>	5,125,000 kWh
<b>Supplemented Polycrystalline Impact:</b>	4.8%
	<b>\$26,052.10</b>

**17 year Pay Period**



# Educational Aspect



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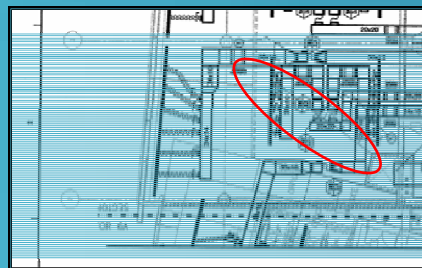
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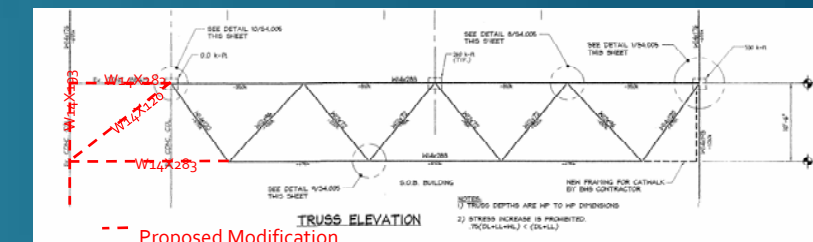
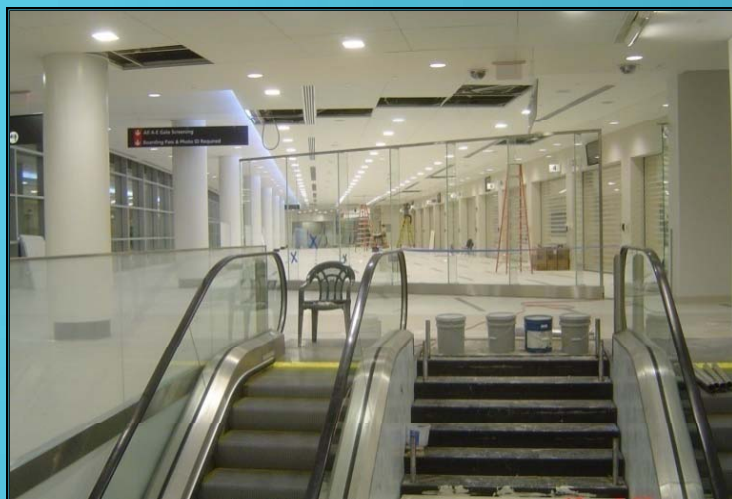


## Project Overview



## Research One – Interdisciplinary Document Coordination

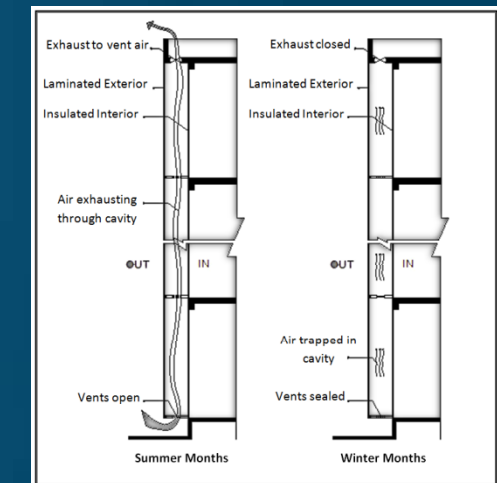
## Research Two – Panelized Construction



## Analysis One – Pedestrian Rerouting

## Analysis Two – Alternative Glazing

## Conclusion



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