AIRPORT
EXPANSION AND MODERNIZATION PROJECT

Gilbane | MMM McKIBBACK

Project Overview

Research One – Interdisciplinary Document Coordination

Research Two – Panelized Construction

Analysis One – Pedestrian Rerouting

Analysis Two – Alternative Glazing

Conclusion

Paul Yingling
Senior Thesis
Dr Messner

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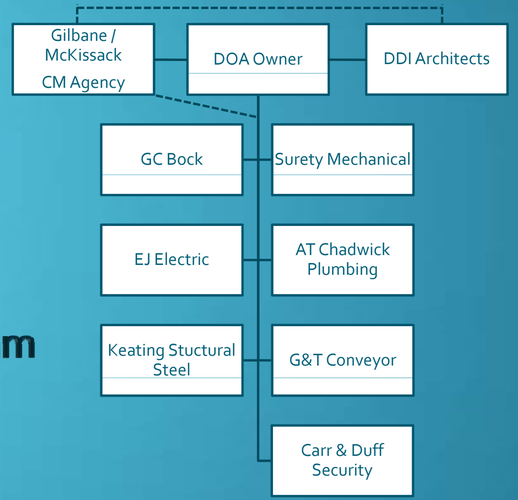
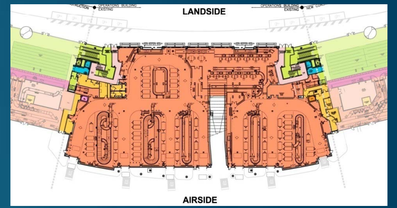
Project Team

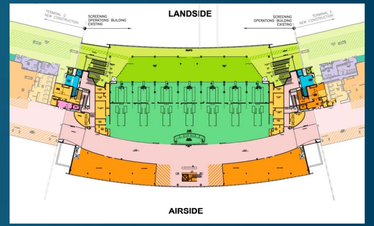


D/E Connector Building:

- 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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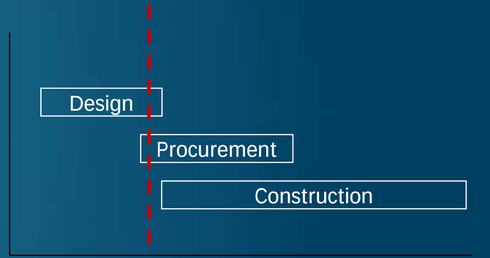
What are the Goals of IDC?

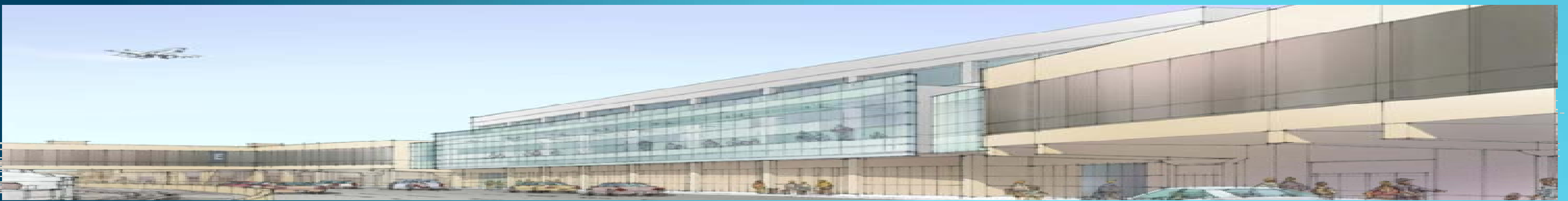
Goals of IDC

- 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





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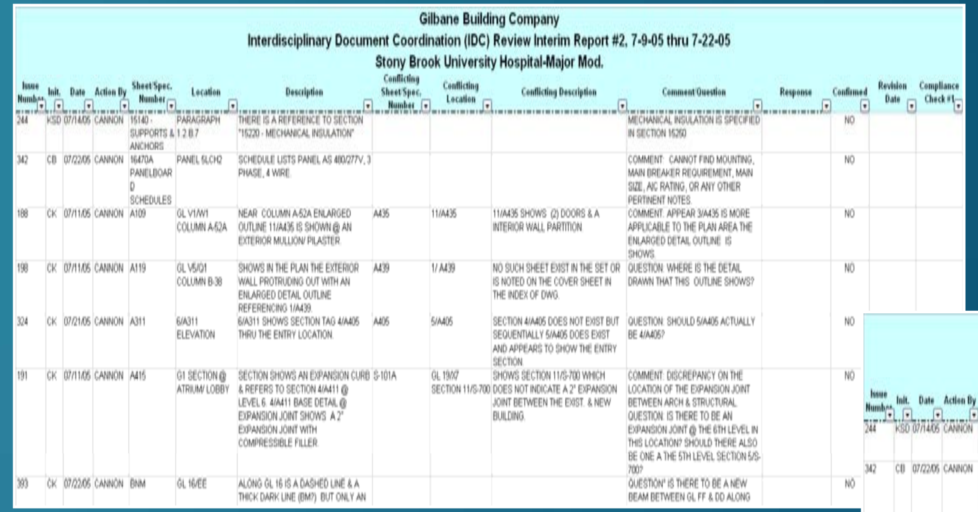
What is the Process?

- 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

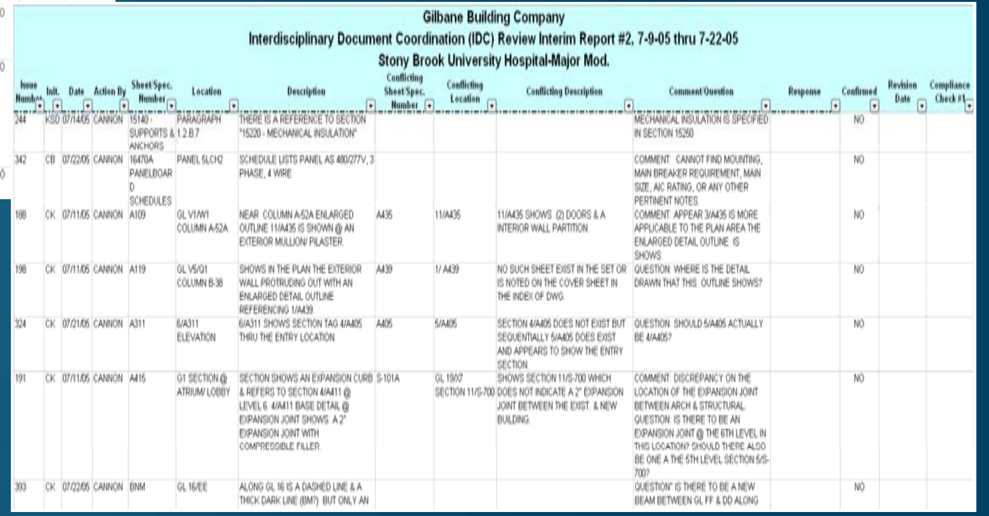
What are the deliverables?

Detailed Summary Report



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

Compliance Check Report



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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

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How is the IDC Priced?

Estimated IDC review man-days based on project type and cost range
Avg. rate = $40hour 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

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Project Specific Example:

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Project Specific Example:

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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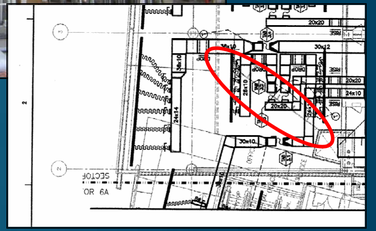
Project Specific Example:



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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

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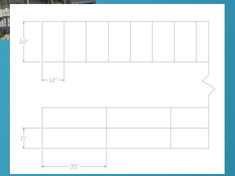
Dimensional Limitations



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

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Aesthetics

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

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Structural Redesign

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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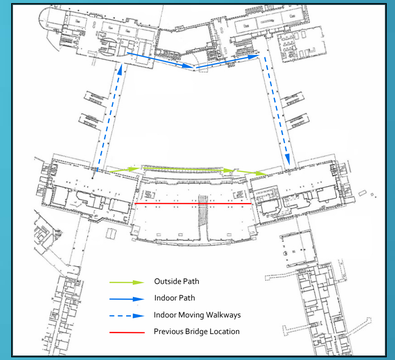
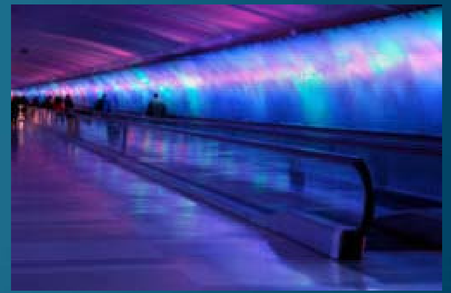
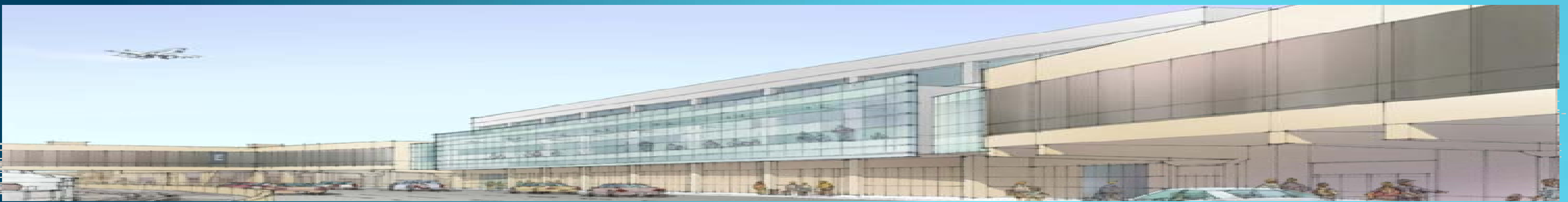
Rerouting



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

4.26 minutes





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- ***Analysis One – Pedestrian Rerouting***
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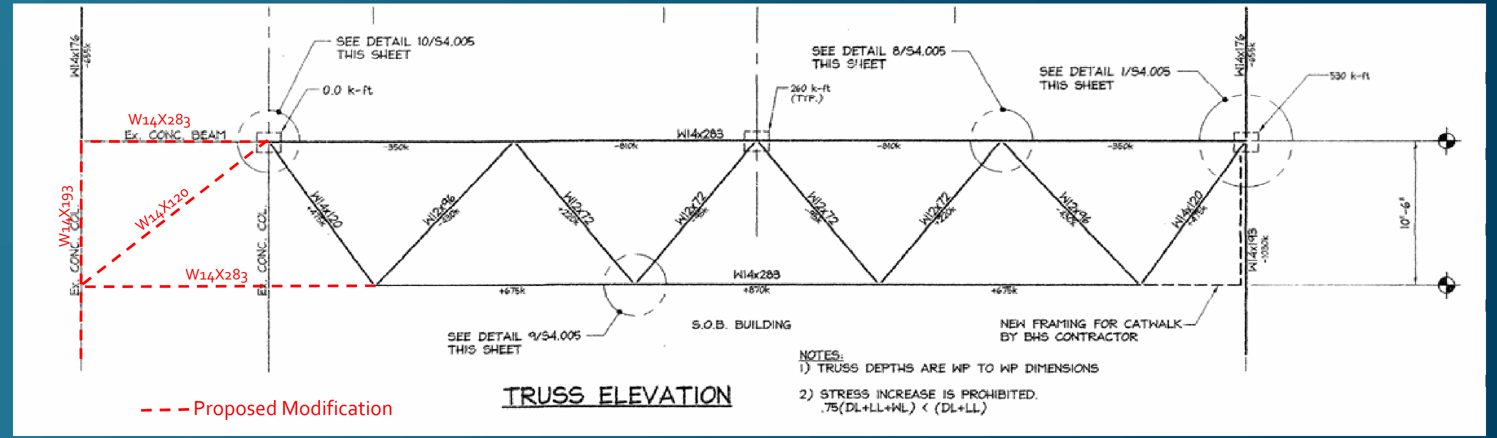
Redesign



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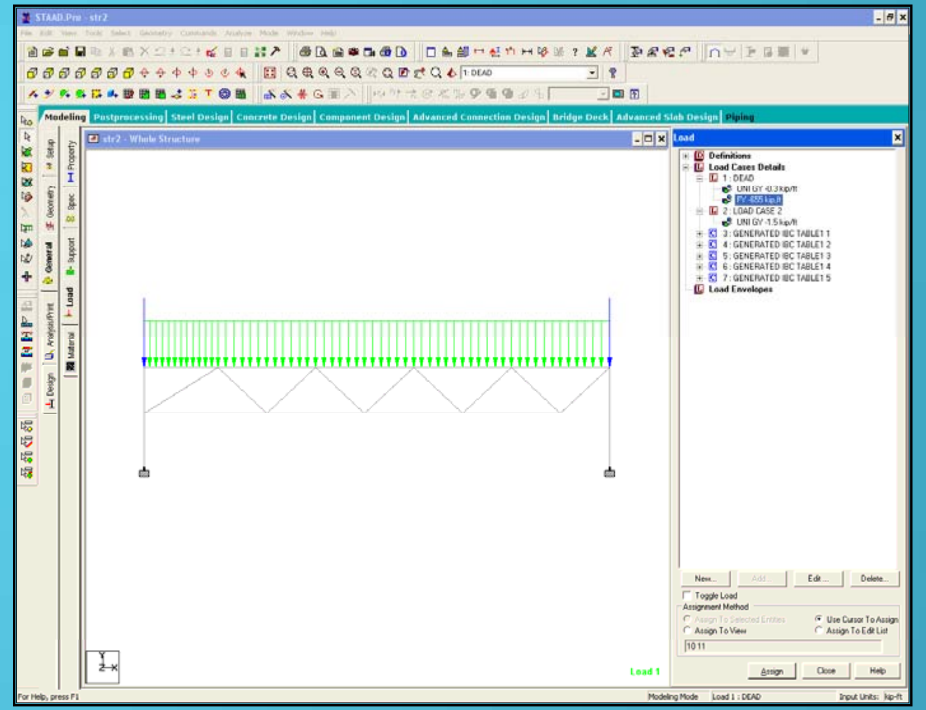
Guess and Check



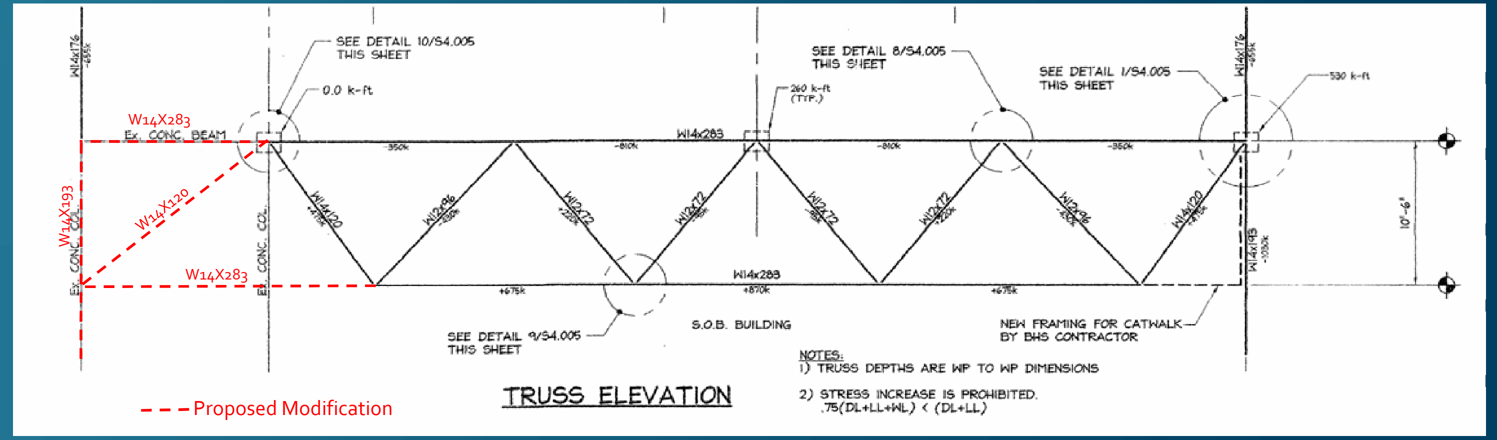
DEFLECTION **DOES NOT** CREATE INSTABILITY

$\delta = 0.707''$

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:GENERATEI	**-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:GENERATEI	-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:GENERATEI	-0.071	-0.707	0.000	**0.711**	0.000	0.000	0.000



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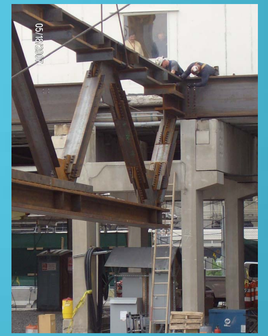
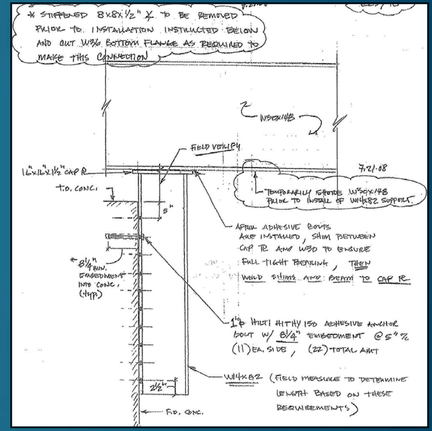
Predictable Structure





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Cost & Schedule Impact

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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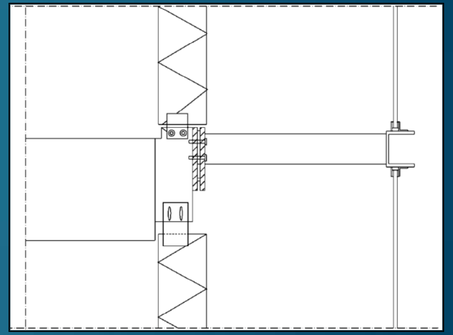
Dual Façade Advantages

- 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



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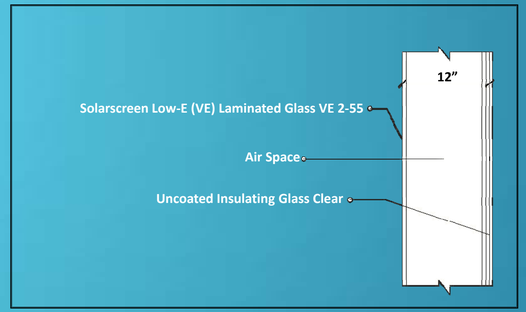
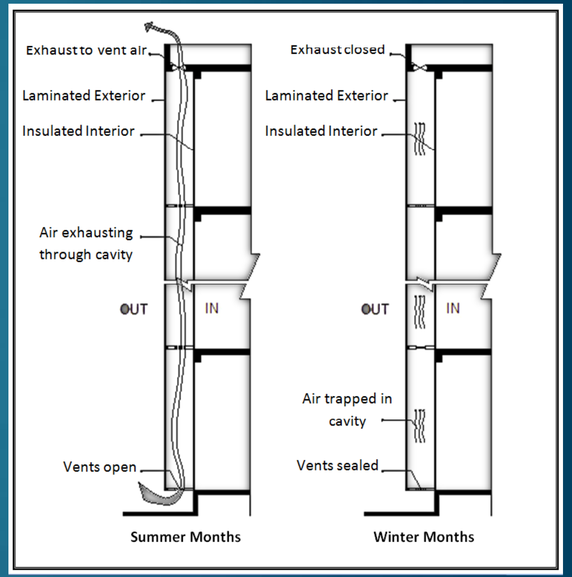
Modification





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Replacement Glass

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
Totals:	**0.016**	**0.066**	**63.16**	**15.17**

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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
			Total:	$305,058

**Prices obtained from the US Department of Energy*

Approximately a 2 year payoff

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Photovoltaic alternative?

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Monthly Daylight Averages (hours)

(Data available on NASA's website)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Average	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

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

Output per Months (kWh)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Average	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	
Total Solar Output per year:	244,621 kWh
Average Building Demand per year:	5,125,000 kWh
Supplemented Polycrystalline Impact:	**4.8%**
	$26,052.10

17 year Pay Period

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Educational Aspect

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