Atrium Medical Corporation
[Headquarters Facility]

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ATRIUM
MAQUET GETINGE GROUP

Pennsylvania State University
Architectural Engineering
Senior Thesis Final Presentation

Ref: Atrium Medical Project Documents

Jeffrey Martin
Advisor: Dr. Leicht

April 16th, 2014

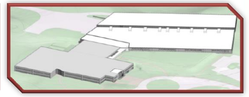
Atrium Medical Corporation

Headquarters Facility

Ref: Atrium Medical Project Documents

40 Continental Boulevard
Merrimack NH, 03054

Atrium Medical Corporation
[Headquarters Facility]



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Project Information:

Location:	40 Continental Boulevard, Merrimack, NH 03054
Site Size:	2,367,100 SF
Existing Structure:	2 Story building 114,000 SF
Previous Owner:	Fidelity Investments
New Owner:	Atrium Medical Corporation/ Maquet Getinge Group
Project Scope:	Existing Renovation 101,200 SF New Addition

Existing Conditions

Proposed 101,200 SF New Addition (Footprint)

Ref: www.google.com/maps

Existing 100,000SF Building to be Renovated

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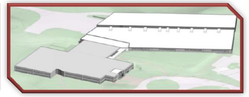

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Project Information:

Project Owner:	Atrium Medical Corporation/ MAQUET/GETINGE Group
Previous Owner:	Fidelity Investments
Reason for Purchase:	Company Expansion Bring all 450 + Employees Into One Facility.
Divisions of Work:	Manufacturing, Storage, Business Offices, R&D, Engineering Shops

Ref: www.classiccapital.net

Owner Information

Ref: www.theiddoctor.info

- Specializes in R&D and Manufacturing
  - Cardiology
  - Radiology
  - Chest Trauma
  - Thoracic Drainage
- Business unit of MAQUET Cardiovascular (Structured Alliance)
- Member of GETINGE Group of companies

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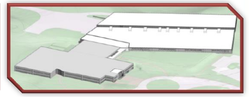

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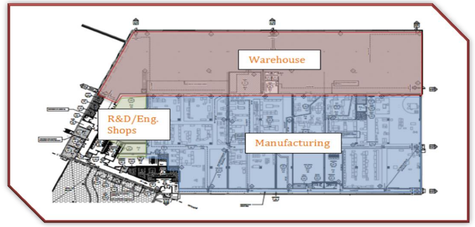
Project Information:



Ref: Atrium Medical Project Documents

- Project Location: 40 Continental Boulevard, Merrimack, NH 03054
- Building Size: 101,200 SF
- Zoning: I-3 Industrial
- Description: Single Story Building Interior Mezzanine

Building Information

- CM Firm: Hutter Construction
- Architect: Lavallee Brensinger
- Structural Engineer: Foley Buhl Roberts
- Civil Engineer: Hayner Swanson Inc.
- Mechanical Engineer: Johnson & Jordan Inc.
- Electrical Engineer: Gate City Electric

HUTTER
LAVALLEE BRENSINGER ARCHITECTS
GATE CITY ELECTRIC — Your Commercial/Industrial Design/Build Contractor
HSI
structural engineers — Foley Buhl Roberts & ASSOCIATES INC
JOHNSON & JORDAN — MECHANICAL CONTRACTORS

Ref: All Images found on www.google.com/images

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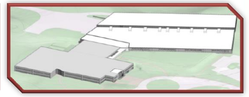

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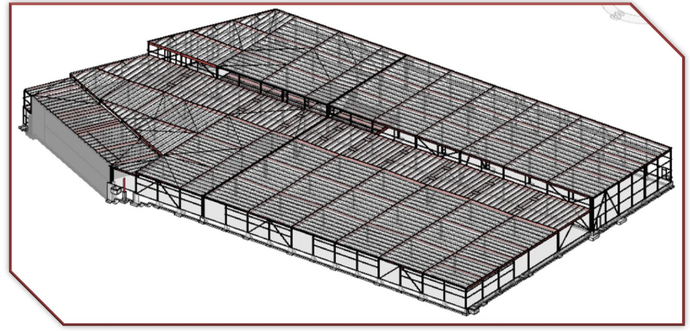
Depth Analysis 1: *Problem Statement*

Description of Structure:

- Structure: Steel Superstructure
- Beams: Wide Flange Steel Beams
- Columns: Wide Flange Steel Columns
- Roof Joists: K-Series Joists
- Lateral Bracing: HSS Steel Sections
- Foundations: Concrete spread & strip footings and piers

Problem: Owner not utilizing the opportunity to develop a more efficient structure, in regards to either cost or scheduling.

Steel Structure: Atrium Medical Corporation



Ref: Atrium Medical Revit Structural Model

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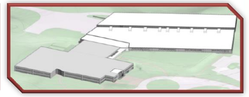

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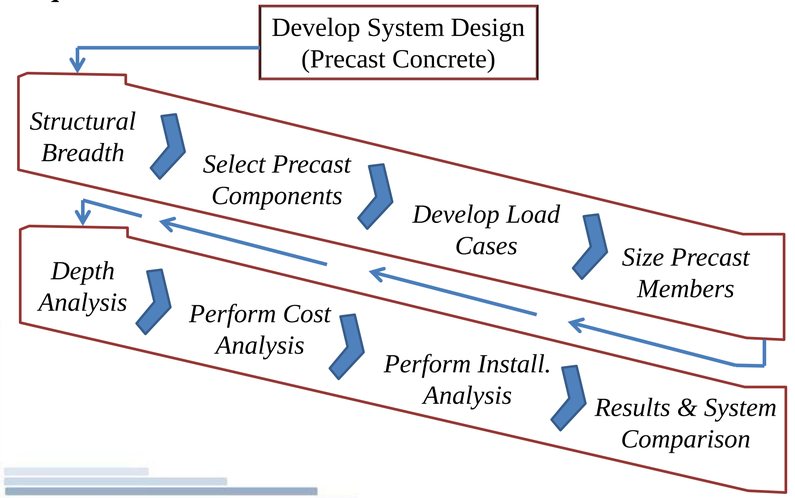
Depth Analysis 1:

Sequence of Events:



Proposed Solution

Advantages of Precast Structures:
- Decrease in Project Schedule
- Saves Space on-site
- Saves Money (labor)

Disadvantages of Precast Structures:
- Availability
- Timing
- Small Margin of Error
- High Material Cost

Ref: All Images found on www.google.com/images

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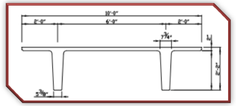
Depth Analysis 1:

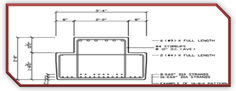
Double Tee Beam



Ref: www.nitterhouse.com/technical-info

Ref: www.concretetech.com

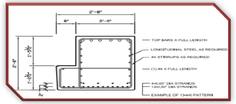
Inverted Tee Beam



Ref: www.nitterhouse.com/technical-info

Ref: www.dynaspan.com

Ledger Beam

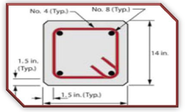


Ref: www.nitterhouse.com/technical-info

Ref: www.cpm-group.com

Structural Breadth: Developing a Design

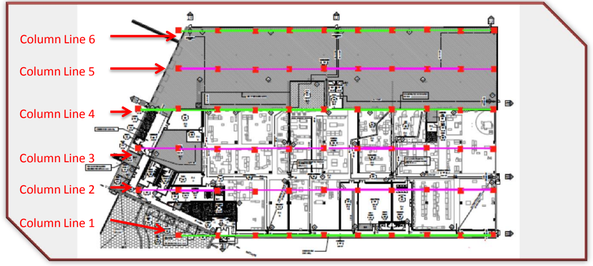
Square Concrete Columns



Ref: www.condor-rebar.com

Ref: www.timesunion.com

Proposed System Layout



Ref: Atrium Medical Project Documents

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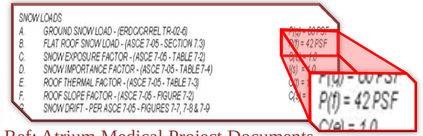
Depth Analysis 1:

Structural Breadth:

Determining Loads

Snow Loads | Snow Drift Loads | Mechanical Loads | Superimposed Loads | Member Self Weights

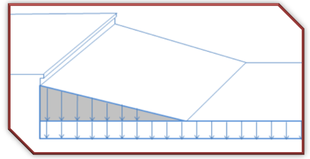
Snow Loads:



Ref: Atrium Medical Project Documents

- Snow loads from structural drawings
- Flat Roof Snow Load = 42 PSF

Snow Drift Loads:



- Two main roof levels
- Lower Roof Height = 17’ 0”
- Higher Roof Height = 27’ 8”
- Max Surcharge = 92.31 PSF
- Surcharge Length = 16.94

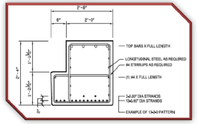
Mechanical Loads

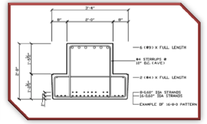
- Loads due to (8) AHU’s and (4) RTU’s
- Act as point load(s) throughout roof
- Maximum AHU load = 9000 lbs.

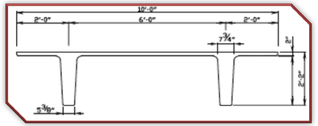
Ref: www.trane.com

Member Self Weights & Superimposed Loads

- Loads from:
  - Double Tees
  - Ledger & Inverted Tee Beams
  - Superimposed Dead = 15 PSF







Ref: www.nitterhouse.com/technical-info

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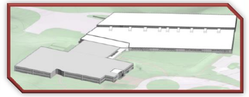

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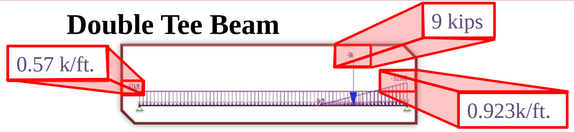
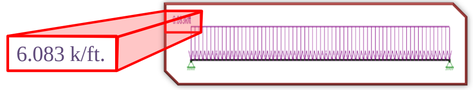
Depth Analysis 1: *Structural Breadth:* Sizing Members

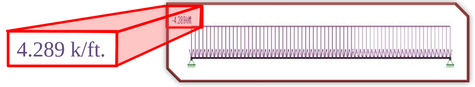
Double Tee Beam



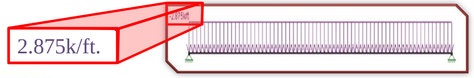
Inverted Tee Beam



Interior Ledger Beam



Exterior Ledger Beam



Beam Designs

26"x10' D.T (No Topping), 26-6.6P
Inverted Tee Beam 40IT36-A
32LB28 (SP 13-6-0) (TB 6 - #9)
18LB32 (SP 6-4-0) (TB 4 - #9)

Concrete Column Loads

Column Line #	Total Axial Loads
Column Line 1	178.4 kips
Column Line 2	409.6 kips
Column Line 3	426.8 kips
Column Line 4	463.1 kips
Column Line 5	409.6 kips
Column Line 6	178.4 kips

Concrete Column Designs

Designs Selected For Columns by Column Line	
Column Line 1	10" x 10" w/ 4 - #5 bars at 17 ft height
Column Line 2	10" x 10" w/ 4 - #10 bars at 17 ft height
Column Line 3	10" x 10" w/ 4 - #11 bars at 17 ft height
Column Line 4	12" x 12" w/ 4 - #8 bars at 27.5 ft height
Column Line 5	10" x 10" w/ 4 - #10 bars at 27.5 ft height
Column Line 6	10" x 10" w/ 4 - #5 bars at 27.5 ft height

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Depth Analysis 1:

Total Design Summary:

Cost Summary

Total Precast Cost Summary:

Type	Quantity	Length	Unit	Mat'l Cost/Unit	Total Mat'l Cost	Labor/Equip. Cost/Unit	Total Labor/Equip. Cost
Double Tee Beam	188	50	LF	$18.00	$169,200.00	$700.00	$131,600.00
Inverted Tee Beam	29	40	LF	$275.00	$319,000.00	$700.00	$20,300.00
Interior Ledger Beam	10	40	LF	$275.00	$110,000.00	$700.00	$7,000.00
Exterior Ledger Beam	28	40	LF	$275.00	$308,000.00	$700.00	$19,600.00
Column Line 1	10	17	LF	$275.00	$46,750.00	$700.00	$7,000.00
Column Line 2	11	17	LF	$275.00	$51,425.00	$700.00	$7,700.00
Column Line 3	11	17	LF	$275.00	$51,425.00	$700.00	$7,700.00
Column Line 4	11	27.5	LF	$275.00	$83,187.00	$700.00	$7,700.00
Column Line 5	10	27.5	LF	$275.00	$75,625.00	$700.00	$7,000.00
Column Line 6	10	27.5	LF	$275.00	$75,625.00	$700.00	$7,000.00
				Total	$1,290,237.00	Total	$222,600.00
				Total Initial System Cost			**$1,512,837.00**

Additional Footing Cost:

Footing Type	Original Cost	Cost Increase (35%)
Spread Footings	$69,225.81	$24,229.03
Strip Footings	$25,675.92	$8,986.57
Additional Concrete Cost		$33,216.00

DAVIS

Initial System Cost: $1,512,837.00
\+
Additional Footing Cost: $33,216.00
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Total System Cost: **$1,546,053.00**

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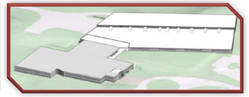

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Depth Analysis 1: *Total Design Summary:* Installation Summary

Total Precast Installation Summary:

Type	Quantity
Double Tee Beam	188
Inverted Tee Beam	29
Interior Ledger Beam	10
Exterior Ledger Beam	28
Column Line 1	10
Column Line 2	11
Column Line 3	11
Column Line 4	11
Column Line 5	10
Column Line 6	10
Total Members	318
# Picks per day	~ 6 to 8
Days for completion	**40 to 53 Days**

Ref: www.timesunion.com

Ref: www.dynaspan.com

Ref: www.concretetech.com

Total System Installation Time: **40 to 53 days**

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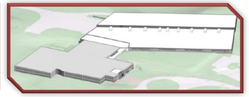

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Depth Analysis 1: *Analysis Results*

Overall Systems Comparison and Analysis Results:

	Total Cost	Installation Time (days)
Precast Structural System (Proposed System)	$1,546,053.00	53 to 40
Steel Structural System (Original System)	$1,273,160.00	45
Difference	(+) $272,893.00	(+) 8 to (-) 5

Issues:
- Cost is too high
- Schedule decrease not significant

Solution:
- Add another crane on-site

Adjusted Costs and Installation Times:

Costs	
100 Ton Crane Rental Cost	$18,000.00
Add'l Cost of Precast System	$272,893.00
Total System Cost	$290,893.00
Installation Times	
Total Steel Member Qty.	318
# Picks per day (one crane)	~6 to 8
# Picks per day (two cranes)	~12 to 16
Total System Installation Time (days)	20 to 26.5

Revised Precast System Cost: **$1,564,053**

Revised Precast System Installation Time: **20 to 26.5 days**

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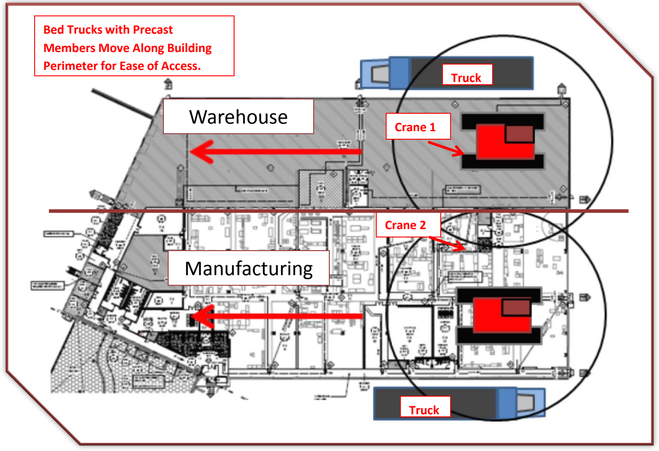
Depth Analysis 1:



Ref: Atrium Medical Project Documents

Analysis Results

- Project will utilize (2) 100 Ton Crawler Cranes
- Cranes will move within building footprint
  - (1) crane in Manufacturing area
  - (1) crane in Warehouse Area
- Movement of work flow from East to West
- Gives Total Installation time = 20 to 26.5 days

Ref: www.bigge.com

BIGGE Established 1916 CRANE and RIGGING CO.

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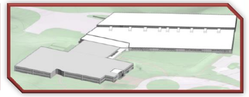

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Depth Analysis 2:

Problem Statement

Description of Envelope:

- Design — Kingspan Micro-Rib Insulated Metal Panels
- Location: — Exterior Warehouse Area
- Area (SF)
  - Southern Face: — 3,106 SF
  - Eastern Face: — 2,788 SF
  - Northern Face: — 10,401 SF
  - Western Face: — 4,016 SF

Problem: Owner not utilizing the opportunity to create a more efficient building envelope surrounding the warehouse area.

Product Specification

Panel Thickness2	2-1/2" 3" 4" 5" 6"
R-Value	7.5 per inch
Panel Width	24" 30" 36" 42" (standard)
Lengths	8'-0" to 52'-0"
Joint Configuration	Double tongue and groove interlocking rainscreen joint
Reveals	Standard 1/8" vertical application, standard 3/8" horizontal application
Exterior Face	24 or 22 Ga. Micro-Rib profiled embossed G-90 galvanized or Galvalume® pre-painted steel
Interior Face	26 Ga. Shadowline profiled embossed G-90 galvanized or Galvalume® pre-painted steel
Orientation	Horizontal or Vertical
Product Code	KS42MR

Ref: www.kingspanpanels.us

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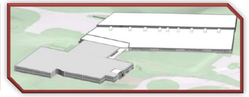

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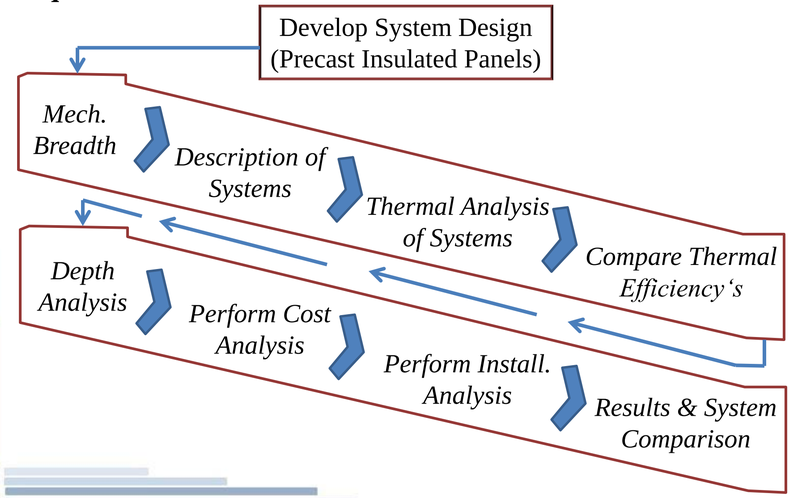
Depth Analysis 2:

Sequence of Events:



Proposed Solution

Advantages of Precast Insulated Panels:
- Decrease Time in Project Schedule
- Versatility
- Energy & Thermal Efficiency
- Fire Resistance

Disadvantages of Precast Insulated Panels:
- High Materials Cost
- Timing

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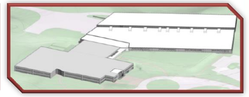

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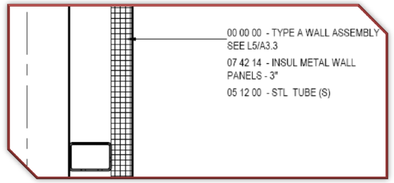
Depth Analysis 2:

Mechanical Breadth:

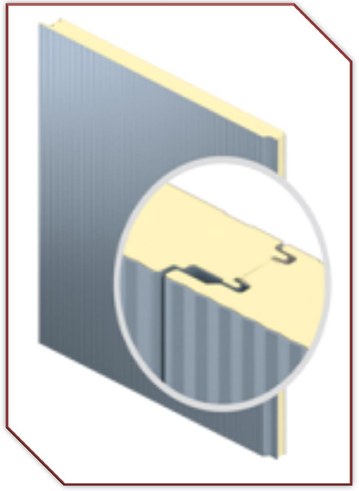
Description of Systems

Original System:
Insulated Metal Panels



Ref: Atrium Medical Project Documents

Kingspan



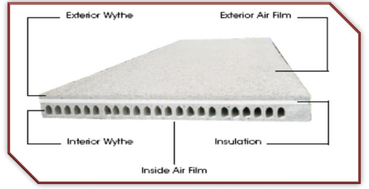
Ref: www.kingspanpanels.us

Proposed System:
Precast Insulated Panels

Ref: www.spancrete.com

SPANCRETE
Building Innovation.™

Ref: www.spancrete.com



Ref: www.spancrete.com

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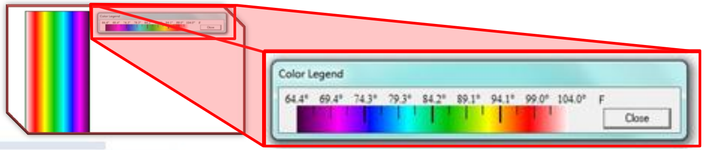
Insulated Metal Panels: *Summer Conditions*

Insulated Metal Panels

Thermal Analysis: Heat Transfer (Extreme Summer Cond. Int = 64.4◦F, Ext = 104◦F)

Outside (Ta)(◦C) =	40	Inside (Td)(◦C) =	18	ΔTi = U * (Ta-Td) * Ri		
	Conductivity (k)	Thickness (m)	Conductance (Ci)	Resistance (Ri)	ΔT	T (◦C)
Interior Temp.						18.00
Int. Film	N.A.	N.A.	8.3	0.120481928	0.6797791	18.68
Metal Panel	18	0.00045466	39,590.02	2.52589E-05	0.0001425	18.68
Insulation	0.02	0.074985	0.27	3.74925	21.153894	39.83
Metal Panel	18	0.00075946	23,701.05	4.21922E-05	0.0002381	39.83
Ext. Film	N.A.	N.A.	34	0.029411765	0.1659461	40.00
				RSI Total =	3.899	
				R-Value =	22.140	
				U-Value =	0.256	

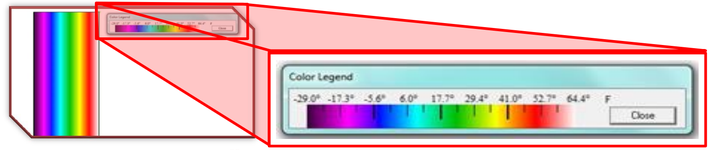


Insulated Metal Panels: *Winter Conditions*

Insulated Metal Panels

Thermal Analysis: Heat Transfer (Extreme Winter Cond. Int = 64.4◦F, Ext = -29◦F)

Outside (Ta)(◦C) =	-34	Inside (Td)(◦C) =	18	ΔTi = U * (Ta-Td) * Ri		
	Conductivity (k)	Thickness (m)	Conductance (Ci)	Resistance (Ri)	ΔT	T (◦C)
Interior Temp.						18.00
Int. Film	N.A.	N.A.	8.3	0.120481928	-1.60675	16.39
Metal Panel	18	0.00045466	39,590.02	2.52589E-05	-0.00034	16.39
Insulation	0.02	0.074985	0.27	3.74925	-50.0001	-33.61
Metal Panel	18	0.00075946	23,701.05	4.21922E-05	-0.00056	-33.61
Ext. Film	N.A.	N.A.	34	0.029411765	-0.39224	-34.00
				RSI Total =	3.899	
				R-Value =	22.140	
				U-Value =	0.256	



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[Headquarters Facility]

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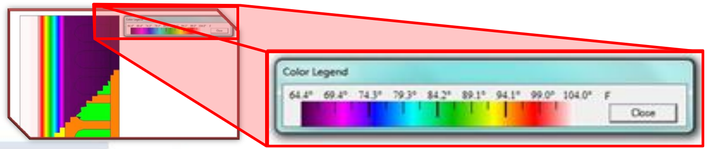
Depth Analysis 2: *Mechanical Breadth:* Thermal Analysis & Results

Precast Insulated Panels: *Summer Conditions*

Precast Insulated Panels

Thermal Analysis: Heat Transfer (Extreme Summer Cond. Int = 64.4°F, Ext = 104°F)

Outside (Ta)(°C) =	40	Inside (Td)(°C) =	18		ΔTi = U * (Ta-Td) * Ri	
	Conductivity (k)	Thickness (m)	Conductance (Ci)	Resistance (Ri)	ΔT	T (°C)
nterior Temp.						18.00
nt. Film	N.A.	N.A.	8.3	0.120481928	0.6326882	18.63
Concrete	0.7	0.1524	4.59	0.217714286	1.1432856	19.78
nsulation	0.02	0.074985	0.27	3.74925	19.688481	39.46
Concrete	0.7	0.0508	13.78	0.072571429	0.3810952	39.85
Ext. Film	N.A.	N.A.	34	0.029411765	0.1544503	40.00
				RSI Total =	4.189	
				R-Value =	23.788	
				U-Value =	0.239	

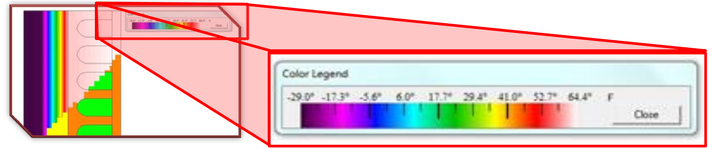


Precast Insulated Panels: *Winter Conditions*

Precast Insulated Panels

Thermal Analysis: Heat Transfer (Extreme Winter Cond. Int = 64.4°F, Ext = -29°F)

Outside (Ta)(°C) =	-34	Inside (Td)(°C) =	18		ΔTi = U * (Ta-Td) * Ri	
	Conductivity (k)	Thickness (m)	Conductance (Ci)	Resistance (Ri)	ΔT	T (°C)
Interior Temp.						18.00
Int. Film	N.A.	N.A.	8.3	0.120481928	-1.49544	16.50
Concrete	0.7	0.1524	4.59	0.217714286	-2.70231	13.80
Insulation	0.02	0.074985	0.27	3.74925	-46.5364	-32.73
Concrete	0.7	0.0508	13.78	0.072571429	-0.90077	-33.63
Ext. Film	N.A.	N.A.	34	0.029411765	-0.36506	-34.00
				RSI Total =	4.189	
				R-Value =	23.788	
				U-Value =	0.239	



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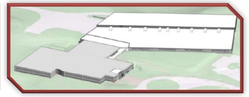

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Depth Analysis 2:

Total Design Summary:

Cost Summary

Precast Insulated Panel Cost:

Location	Area (ft^2)	Unit	Material $/Unit	Material $
Southern Face	3106	SF	18	$ 55,908.00
Eastern Face	2788	SF	18	$ 50,184.00
Northern Face	10401	SF	18	$ 187,218.00
Western Face	4016	SF	18	$ 72,288.00
				$ 365,598.00
Location	**Quantity**	**Unit**	**Labor/Equip $/Unit**	**Labor/Equip $**
Southern Face	14	Ea.	700	$ 9,800.00
Eastern Face	13	Ea.	700	$ 9,100.00
Northern Face	47	Ea.	700	$ 32,900.00
Western Face	18	Ea.	700	$ 12,600.00
				$ 64,400.00
			Total Cost	$ 429,998.00

Additional Footing Cost:

Footing Type	Original Cost	Cost Increase (35%)
Spread Footings	$40,631.00	$14,221.00
Additional Concrete Cost		**$14,221.00**

Initial System Cost:	$429,998.00
	+
Additional Footing Cost:	$14,221.00
	=
Total System Cost:	**$444,219.00**

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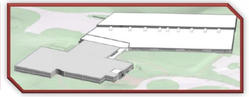

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Depth Analysis 2: *Total Design Summary:* Installation Summary

Precast Insulated Panel Install Time:

Location	Area (ft^2)	Member Area (ft2)	Quantity (Area/Member Area)
Southern Face	3106	221.36	14
Eastern Face	2788	221.36	13
Northern Face	10401	221.36	47
Western Face	4016	221.36	18
	Total Quantity		92
	# Picks per Day		~6 to 8
	Total Installation Time		**12 to 15**

Ref: www.spancrete.com

Ref: www.spancrete.com

Total System Installation Time: **12 to 15 days**

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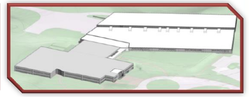

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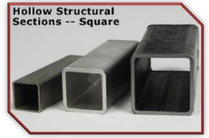
Depth Analysis 2: *Analysis Results*

Insulated Metal Panel Costs:

Insulated Metal Panel System Cost	
Subtotal	$354,400.00
HSS Framing Cost (+)	$46,355.00
Metal Panel Cost (-)	$31,007.00
Total System Cost	**$369,748.00**

Ref: www.bossteel.com



Ref: www.bossteel.com

Insulated Metal Panel Installation Time:

Total Wall Panel System Installation Time =		67 Days	
System Type	Area (ft^2)	% of Install. Time	Total Install. Time (days)
Metal Wall Panels	7,112	26%	17
Insulated Metal Panels	20,311	74%	**50**
Total =	27,423	100%	67

Overall Systems Comparison and Analysis Results:

	Total Cost	Installation Time (days)
Precast Insulated Panels	$444,219.00	12 to 15
Insulated Metal Panels	$369,748.00	50
Difference	(+) $74,471	(-) 38 to (-) 35

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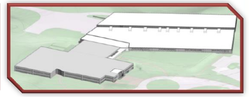

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Depth Analysis 3: *Problem Statement*

Ref: www.hutterconstruction.com

Summary of Safety Plan:
- Formal safety plan for field and office staff *during* construction
- Superintendents have OSHA 30-Hour training
- All other employees have OSHA 10-Hour training.
- Weekly toolbox talks
- Basic construction safety (i.e. PPE, Equip. Safety etc.)

Problem: Owner not utilizing the opportunity to plan and design for safety consideration prior to project's construction.

Hutter Construction on *Safety*:

"Training is an integral part of Hutter's safety commitment. In addition to the traditional weekly toolbox talks, ongoing safety training is regularly provided by outside professionals. Among the topics continually addressed: competent persons, confined space, boom lifts, forklifts, snorkel lifts, CPR and first aid. All of our employees, including project managers have received the OSHA 10-Hour certified training and new employees receive the training within 30 days of hire. All of our superintendents have received OSHA 30-Hour training."

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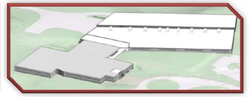

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Depth Analysis 3:

Sequence of Events:

PtD Industry → *System Selection Based on Risk* → *Typical Steel Connections* → *NISD Details* → *Analysis Results*

Proposed Solution

Benefits of Implementing a Design Guide:
- Increase Safety Consideration
- Increase in Quality Control
- Reduce Delays
- Increase in Productivity
- Increase Collaboration between Designer & Constructors

Barriers of Implementing a Design Guide:
- Designer's Liability
- Additional Costs
- Lack of Expertise

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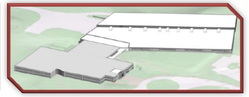

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Depth Analysis 3: *Prevention through Design Industry*

Prevention through Design (PtD):

- Industry developed to prevent hazards from occurring during construction
  - Began in late 90's
  - Construction tasks & processes viewed during conceptual and design phase
  - Ensures safety of workers during construction

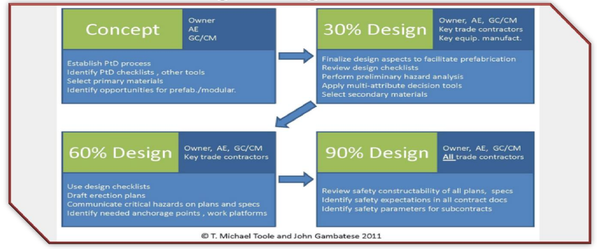
PtD™ Prevention through Design

Ref: www.asse.org

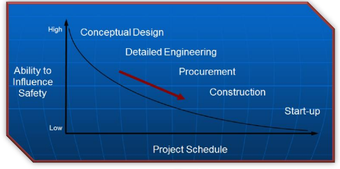
Ref: www.lhsfna.org

Ref: www.asse.org

Prevention through Design Process:



Ref: www.designforconstructionsafety.org



Ref: www.elcosh.org

As the timeline of the project schedule increase, the ability to influence safety on the project decreases.

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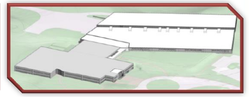

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Depth Analysis 3:

SliDeRulE Information:

- **S**afety in **D**esign **R**isk **E**valuator
- Program designed to interpret the level of construction safety risk for a particular project.
- This program is used primarily for:
  - Determining the level of safety risk for an entire building and each system within that building
  - Comparing designs based on risks
  - Learning about design features that could potentially increase or decrease risk
  - Creating building designs that minimize the risk of injury for construction workers

System Selection

SliDeRulE Results

System Name	Safety Risk	Risk Percentage
Foundation		4%
Structural Frame		28%
Exterior Enclosure		18%
Roof		15%
Interiors		5%
Plumbing		1%
HVAC		17%
Electrical		13%

SliDeRulE

Ref: www.constructionsliderule.org

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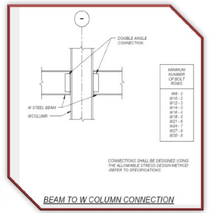
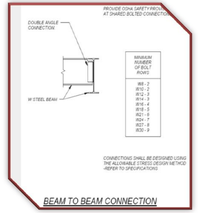
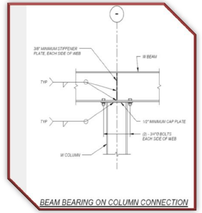
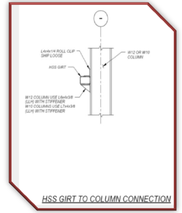
Depth Analysis 3:

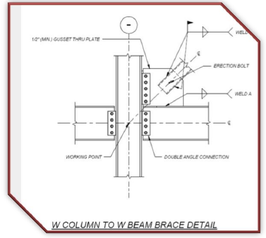
Typical Steel Connections

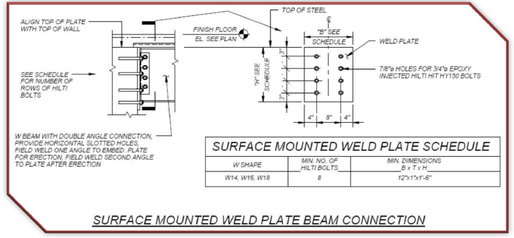












Ref: All Snips from Atrium Medical Project Documents

STRUCTURAL STEEL FRAMING

S1. STRUCTURAL STEEL WORK SHALL CONFORM TO THE AISC "SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS - 360-05" AND AISC "CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES - 2005", AS MODIFIED BY THE SPECIFICATIONS.

S2. WELDING SHALL BE IN ACCORDANCE WITH AWS "D1.1 2006-STRUCTURAL WELDING CODE-STEEL".

S3. STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING, UNLESS NOTED:
A. PLATES — ASTM A36 — Fy = 36KSI
B. STRUCTURAL TUBING — ASTM A500 GRADE B — Fy = 46KSI (SQUARE & RECTANGULAR TUBING), Fy = 42KSI (ROUND TUBING)
C. ALL OTHER SHAPES — ASTM A992 OR A588 GRADE B — Fy = 50KSI

S4. CONNECTIONS MAY BE BOLTED OR WELDED, UNLESS SPECIFICALLY NOTED OTHERWISE. CONNECTIONS SHALL BE DESIGNED AND DETAILED IN ACCORDANCE WITH AISC STANDARDS, USING THE ASD METHOD.

S5. CONNECTIONS SHALL BE WELDED TO CONFORM TO ASTM A233, E70 SERIES, OR BOLTED TO CONFORM TO ASTM A325, TYPE N BOLTS.

S6. PROVIDE 3/4" DIAMETER MINIMUM HEADED TYPE ANCHOR RODS AT COLUMNS AND POSTS, UNLESS NOTED OTHERWISE.

S7. FURNISH AND INSTALL ONE WASHER AND ONE HEAVY HEX NUT WITH ALL ANCHOR RODS, UNLESS NOTED.

S8. SIMPLY SUPPORTED BEAM-TO-BEAM CONNECTIONS SHALL BE DOUBLE ANGLE TYPE IN CONFORMANCE WITH THE AISC "MANUAL OF STEEL CONSTRUCTION", UNLESS SPECIFICALLY NOTED OTHERWISE ON THE STRUCTURAL DRAWINGS.

S9. PROVIDE A 1/4" THICK LEVELING PLATE UNDER EACH COLUMN BASE PLATE FOR USE IN ALIGNING ANCHOR RODS AND BASE PLATES. LEVELING PLATE SHALL BE SET AND GROUTED WITH AN APPROVED NON-SHRINK, NON-METALLIC GROUT. GROUT SHALL HAVE ATTAINED DESIGN STRENGTH BEFORE ERECTION OF COLUMN.

S10. SPLICING STRUCTURAL MEMBERS WHERE NOT DETAILED ON DRAWINGS IS PROHIBITED WITHOUT PRIOR APPROVAL OF ARCHITECT.

S11. STRUCTURAL STEEL EXPOSED TO THE WEATHER IN THE FINISHED PROJECT SHALL BE HOT DIP GALVANIZED TO CONFORM TO ASTM A123. CANOPY STEEL SHALL BE PRIMED AND PAINTED.

S12. STRUCTURAL STEEL EXPOSED TO VIEW IN THE COMPLETED PROJECT SHALL BE ARCHITECTURALLY EXPOSED STRUCTURAL STEEL (A.E.S.S.). ALL COLUMNS AND BRACES ON GRID LINES H AND K SHALL BE AESS STEEL. ALL STEEL IN THE CANOPY SHALL BE AESS STEEL. REFER TO SPECIFICATIONS.

S13. REFER TO THE SPECIFICATION FOR PAINTING AND SURFACE PREPARATION REQUIREMENTS.

S14. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY TEMPORARY GUYING AND BRACING REQUIRED TO ERECT AND HOLD THE NEW STRUCTURE FOR WIND AND CONSTRUCTION LOADS. TEMPORARY SUPPORTS SHALL REMAIN IN PLACE UNTIL ALL ELEMENTS REQUIRED FOR STABILITY OF THE STEEL FRAME ARE COMPLETED.

Ref: Atrium Medical Project Documents

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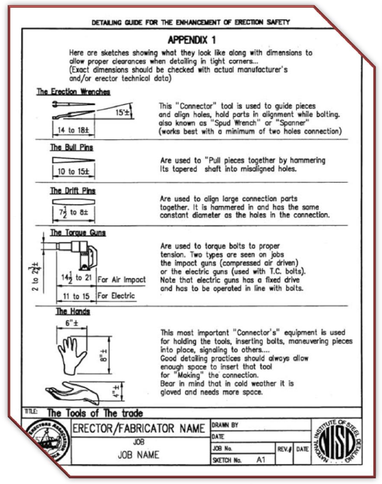
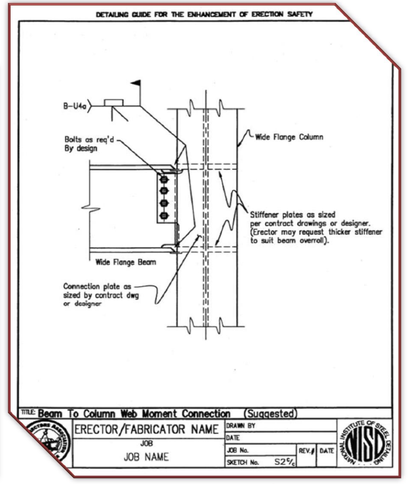
Depth Analysis 3:

NISD Industry Standard Details



Ref: www.NISD.org



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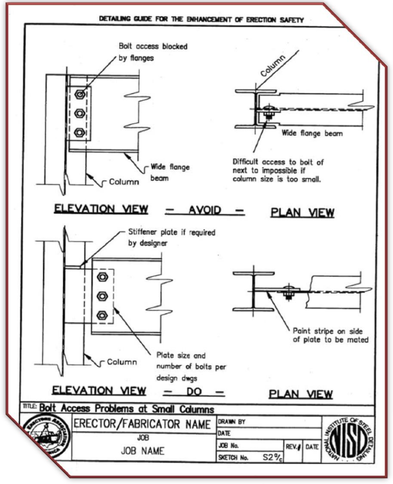

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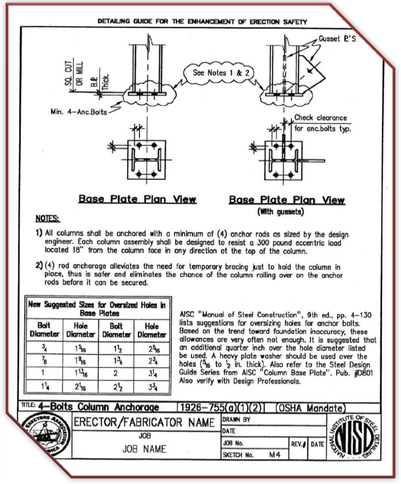

Ref: www.NISD.org

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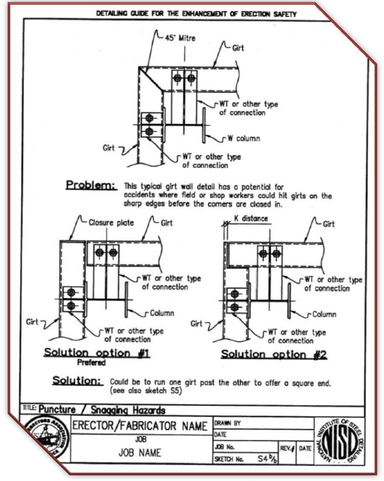
Depth Analysis 3:

NISD Industry Standard Details



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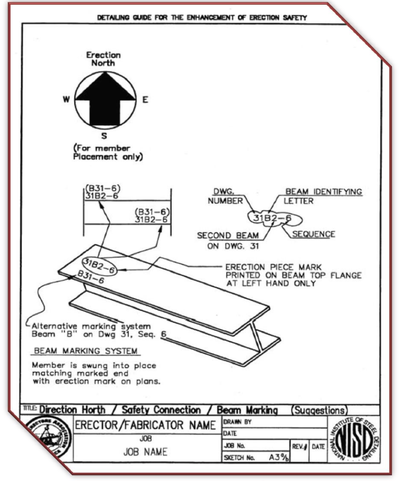

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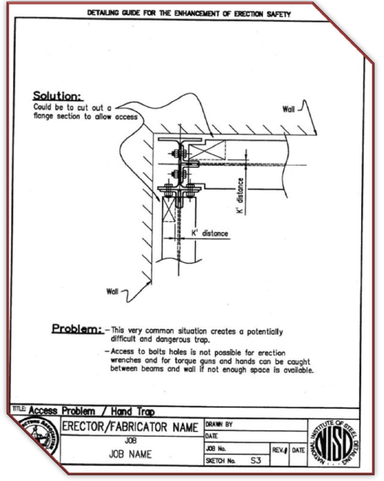

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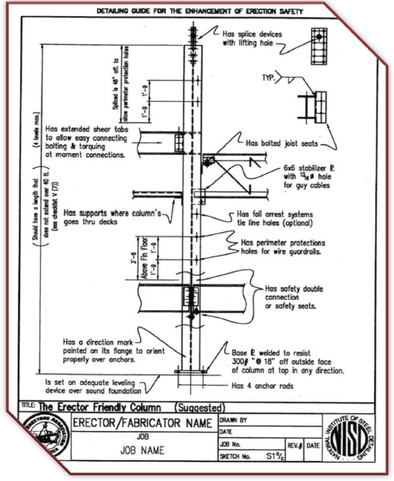

Ref: www.NISD.org

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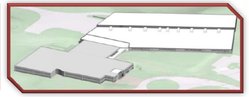

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Depth Analysis 3: *Analysis Results*

Overall Benefits of a Design Guide

- Developed to ensure safety of workers during construction
- If properly implemented, problems can be foreseen and therefore prevented
- Encourages collaboration between designer and constructor
  - Creates a better working relationship, less “lost in translation” incidents
  - Ensures quality control, as issues during design can be managed and adjusted if necessary

NATIONAL INSTITUTE OF STEEL DETAILING
NISD
Founded 1969

Ref: www.NISD.org

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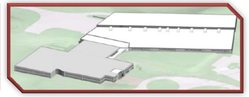

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Conclusions & Recommendations

Depth Analysis 1:

Conclusion

- Precast structural system imposed a $1,564,053.00 cost, with the use of (2) 100 ton crawler cranes and 20 to 26.5 days for installation
  - Cost is $290,893.00 greater than original steel structure
  - 18.5 to 25 days less than structural steel installation

Recommendation

- Install the precast concrete structure, to save time on the critical path of the project schedule

Depth Analysis 2:

Conclusion

- Precast insulated panels cost a total of $444,219.00, and require 12 to 15 days for installation. The panels also have a thermal efficiency (R-Value) of 23.78
  - Cost is $74,471.00 greater than original envelope system
  - Installation time is 35 to 38 days less than original envelope
  - R-Value of this system is 1.64 greater than original envelope

Recommendation

- Install the precast insulated panels to save time during installation

Depth Analysis 3:

Conclusion

- Design guide focused on basic steel installation/connection issues, as well as specific details pertaining to connections typically found within Atrium Medical

Recommendation

- Pay the additional upfront fee to hire design professionals and implement a design guide

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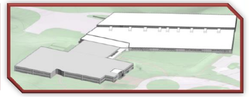

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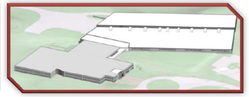

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Questions?