

HPR INTEGRATED DESIGN



Jeremy Heilman
CONSTRUCTION



Nico Pugliese
LIGHTING/ELECTRICAL



Josh Progar
STRUCTURAL



James Rodgers
MECHANICAL

Presentation #5:
Go/No Go
February 20, 2012

Penn State Ice Hockey Arena
The Pennsylvania State University

Mission Statement:

HPR Integrated Design combines innovative, cutting edge concepts with a collaborative multi-disciplinary approach through the utilization of state-of-the-art BIM technologies to exceed owner expectations both in system efficiencies and the enrichment of the human experience within its aesthetic.



BIM Thesis Proposal
December 9th, 2011



PENN STATE ICE HOCKEY ARENA
UNIVERSITY PARK, PA



Jeremy Heilman | Josh Progar | Nico Pugliese | James Rodgers
Dr. John Measner | Dr. Andres Lepages | Dr. Richard Miatrick | Dr. Moses Ling



Courtesy of Crawford Architects

BIM Thesis Proposal
December 9th, 2011

PENN STATE ICE HOCKEY ARENA
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BIM Thesis Proposal
December 9th, 2011

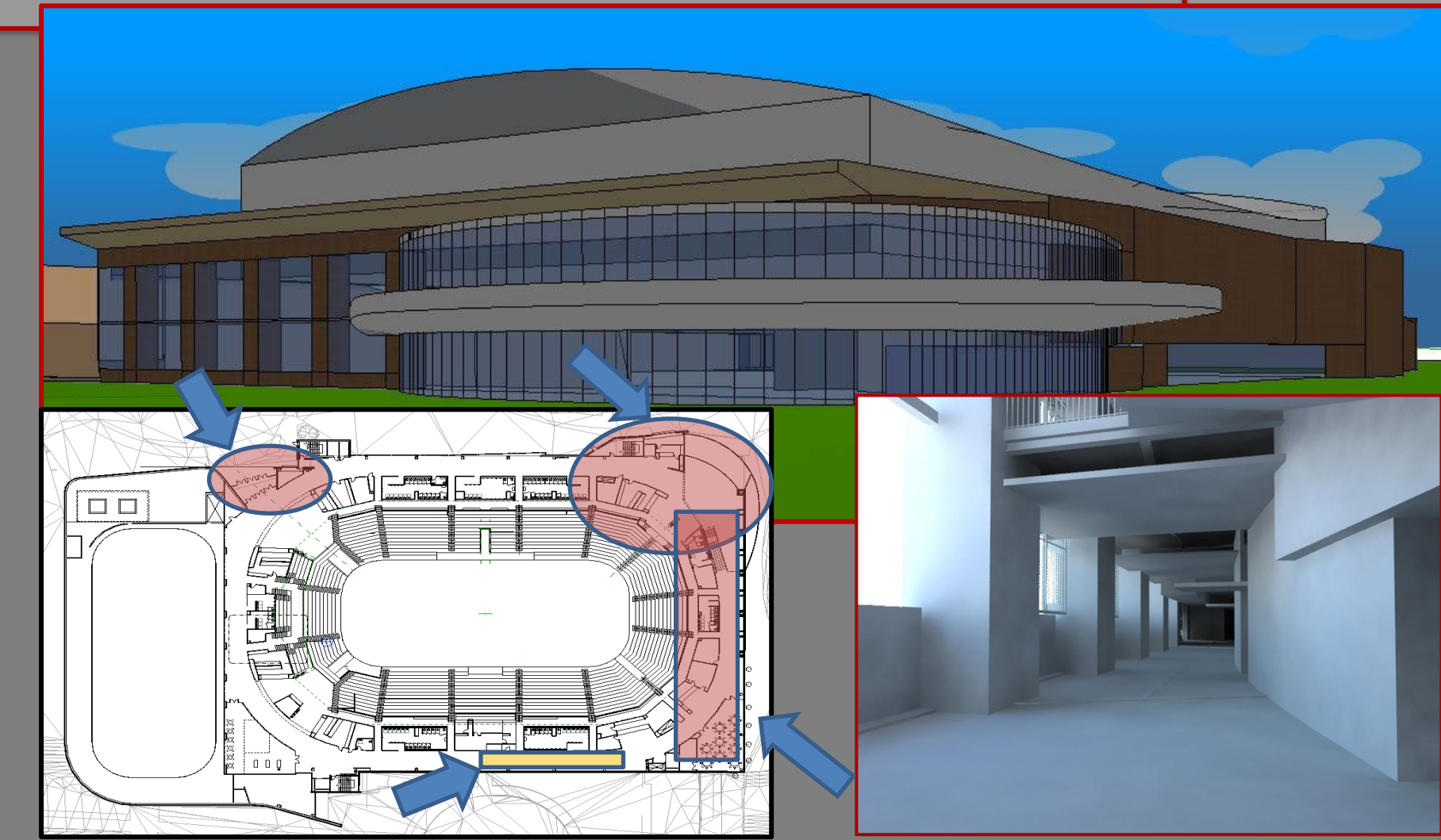
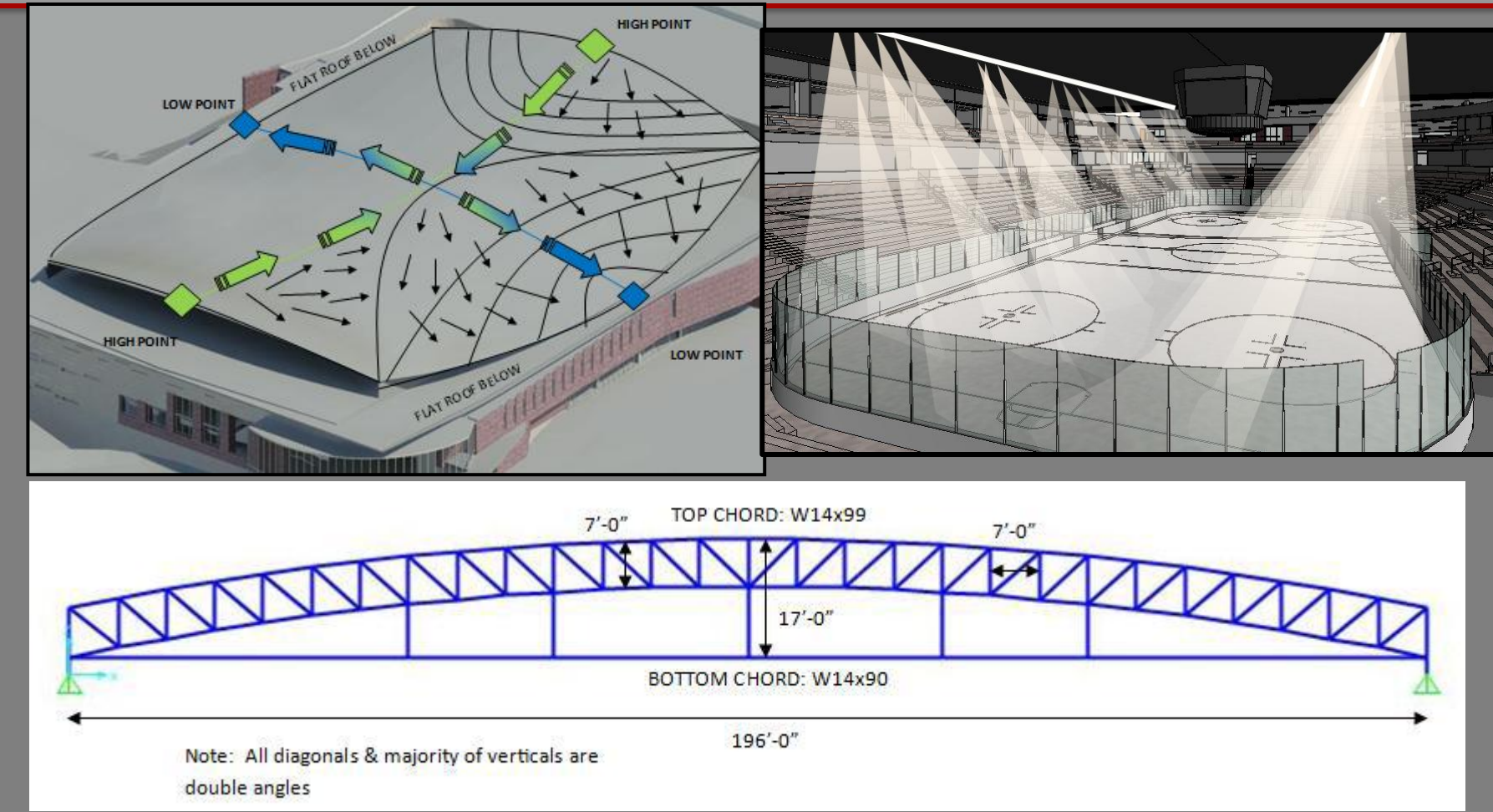
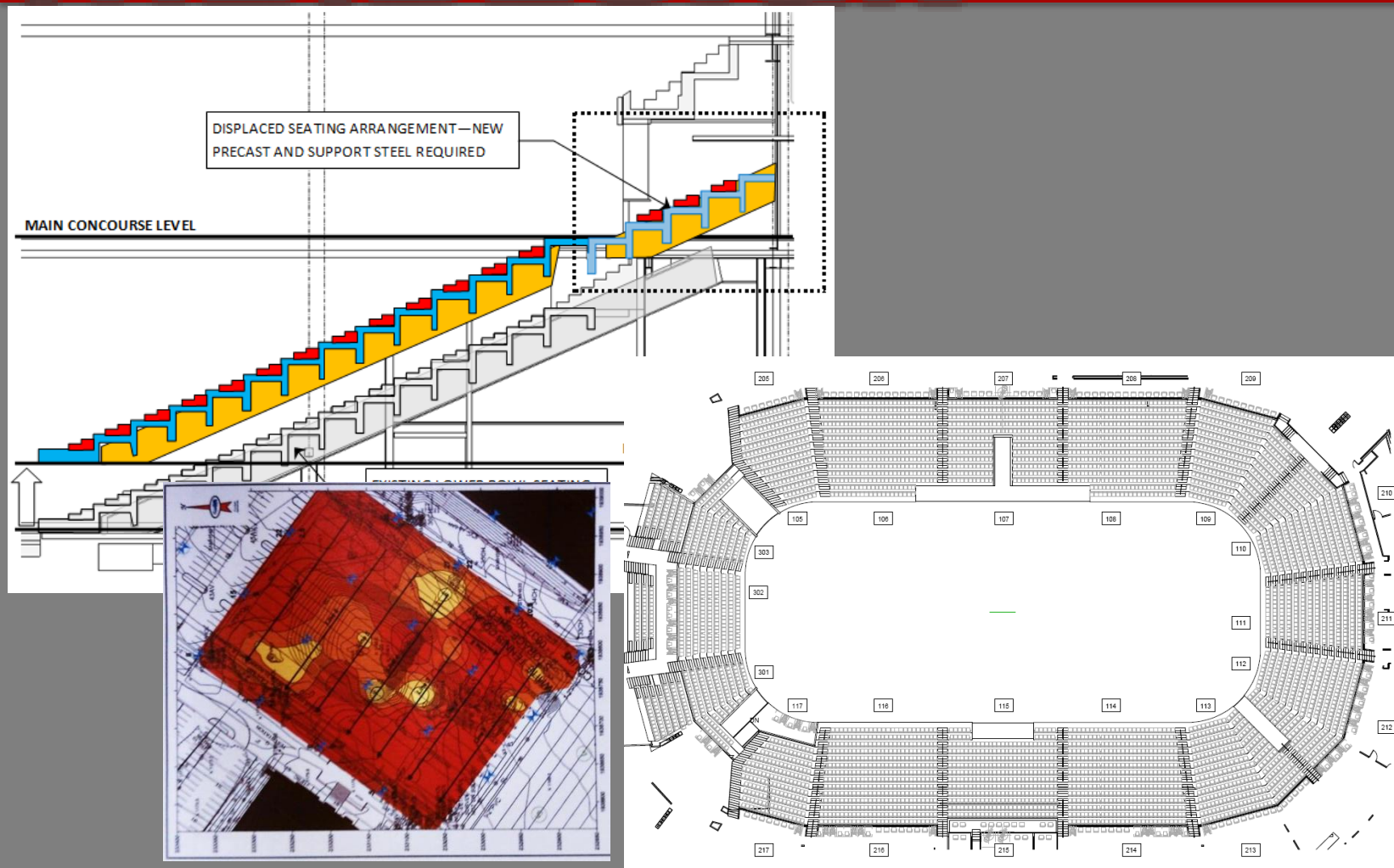
PENN STATE ICE HOCKEY ARENA
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Revised Proposal

TREID DESIGN :



Event Level Raising

Main Arena Roof Systems

Façade Redesign

Communication:

- 4 Different Models
- 4 Different Schedules
 - Team Time Is Limited & Valuable
 - General Meeting Each Week
- Alternative Communication Methods
 - Autodesk Project Blue Streak
 - Text List-Serv
 - Email
 - Documentation (Meeting Minutes)

Autodesk® Project Bluestreak

Joshua Progar in BIM Thesis Discussion Forum: Due to the relocation of the event level, the Structural engineer needs to check the bottom of steel elevation for the community rink to make sure that it conforms to the NCAA ice hockey rules and regulations. - 7:21 am Jan 24, 2012 Comment

Project Bluestreak – Facebook for Revit/IPD

Email

Texting

Group Meetings

Meeting Minutes

BIM Thesis Design Team Meeting
 Meeting #15
 Date: 2.15.12
 Meeting Location: Thesis Lab

Attendance:

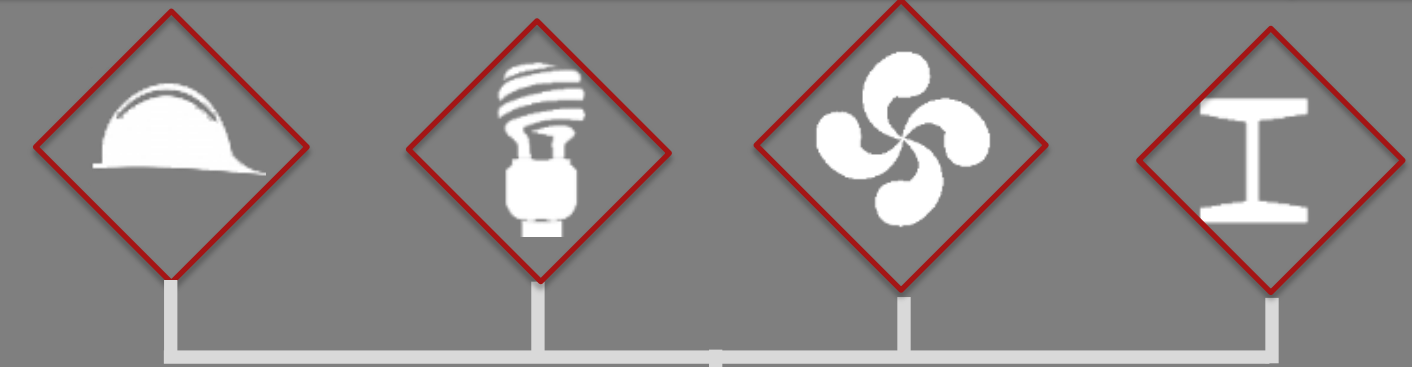
Josh Progar	Structural Engineer	jpp5085@psu.edu
Nico Pugliese	Electrical Engineer	nap5076@psu.edu
Jeremy Heilman	Construction Manager	jdh5081@psu.edu
Jim Rodgers	Mechanical Engineer	jr5085@psu.edu

Absent:
None

Distribution: All members in attendance, Dr. Lepage, Dr. Ling, Dr. Mistrick, Dr. Messner, Dr. Parfitt, Bob Holland, Ryan Solnosky

General Business:

Item	Description	Action Item
1.0	Design team discussed that website needs to be up and running by Friday, February 22, by 5:00pm.	All



4 Team Members
4 Different Schedules



KEY MILESTONES:

January 27th, 2012:
Initial Architectural Modeling Completed

February 13th, 2012:
Baseline Schedule & Estimate Completed

March 2nd, 2012:
Event Level Raising Redesign Completed

DISCIPLINE	TASK	ACTIVITY	Milestone 1 1/27/2012			Milestone 2 2/13/2012			Milestone 3 3/2/2012			Milestone 4 3/26/2012			Proj Due 4/4/2011	Present. 4/9/2011
			1/9/2012	1/16/2012	1/23/2012	1/30/2012	2/6/2012	2/13/2012	2/20/2012	2/27/2012	3/5/2012	3/12/2012	3/19/2012	3/26/2012	4/2/2012	4/9/2012
Architectural	Event Level Raising	Relocate Event Level, Address Egress, Seat Relocate	█													
		Site Considerations	█													
	Main Arena Roof System	Finalize Main Arena Roof Design			█											
		Façade Redesign	Redesign Façade - address East façade views			█										
Structural	Event Level Raising	Design Two Way Flat Plate System w/ & w/o Post-Tensioning			█											
		Column Design/Redesign, Misc. Steel Framing & Precast Tub Design			█											
	Main Arena Roof System	Coordination & Finalize Model					█									
		Long Span Truss Alt. Research & Opt.	█													
Façade Redesign	Long Span Truss Design; Misc Steel Members for Roof				█											
	Exterior Columns, Exterior Glazing Panels										█					
Mechanical	Event Level Raising	Event Level Duct Layout, Calcs, Diffuser Locate	█													
		Finalize Design, Size/Locate Low Press duct/diff, Reflect Ceil				█										
	Main Arena Roof System	Volumn Calcs, Size Ducts, Locate Diffusers						█								
		Life Safety Systems (Sprinkler & Smoke Exhaust)							█							
Façade Redesign	Trace-Load & Energy Analysis							█								
Electrical	Event Level Raising	Plug Load Research, Load Calcs	█													
		Locate Panels, Load Calcs, Conduit & Wire Sizing & Routing														
		Finalize Design														
	Main Arena Roof System	Pigging Load Research, Load Calcs, Size Conduit/Wire														
		Finalize Design														
	Façade Redesign	Plug Load Research, Load Calcs														
Locate Panels, Size Conduit & Wiring, Conduit Route																
Finalize Design																
Lighting	Event Level Raising	Light Study of Event Level, Luminaire Select & Locate	█													
		Load Calcs, Controls Design														
		Finalize Design, Lighting Layout, Reflect Ceil														
	Main Arena Roof System	Arena Lighting Research	█													
		Calculations, Controls, Aiming Diagrams, Lighting Layout														
	Façade Redesign	Atrium, Concourse, Mt. Nittany Rm, Club Dining Light Research	█													
		3DS Modeling for best shading analysis														
		Space Daylight Utilization Analysis, Daylight Harvest Controls														
Integrate Daylight Controls with Lighting	Luminaire Select, Calcs, Energy Analysis, Code Comp. Check															
	Aiming Diagram, Lighting Layout, Finalize Cut Sheets															
CM	Baseline for Existing Conditions	Existing Condition Estimate	█													
		Schedule Analysis, Create Schedule														
		Analysis of LEED Score Card														
	Event Level Raising	Update Estimate, Schedule, & LEED Score Card														
		Perform 3D Coordination, Clash Detection, 4D Modeling														
		Perform Crane Analysis														

SPRING BREAK

March 26th, 2012:
All Redesign Focuses Completed

April 4th, 2012:
Final Report Submission

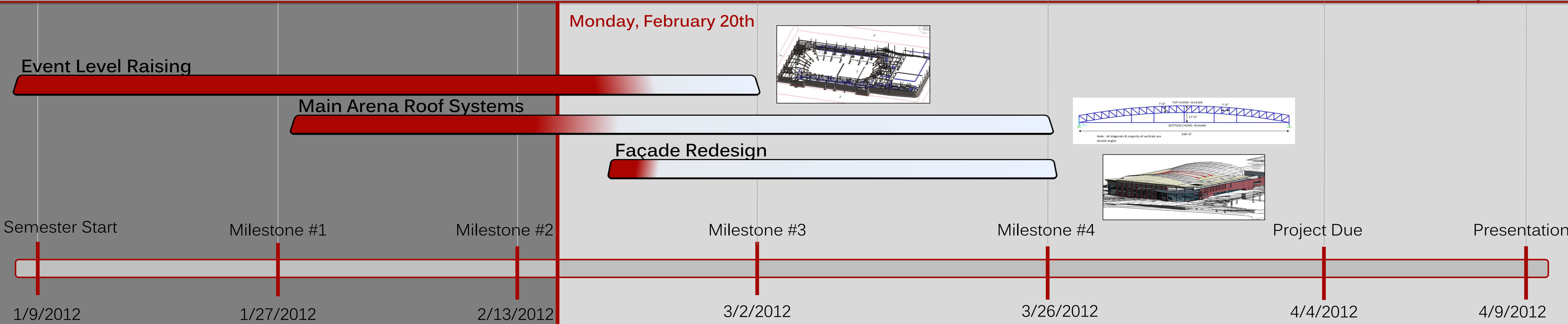
April 9th, 2012:
Final Presentation

Team Schedule

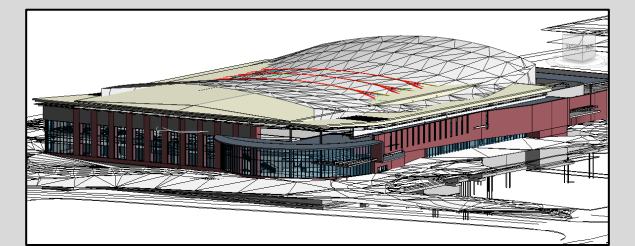
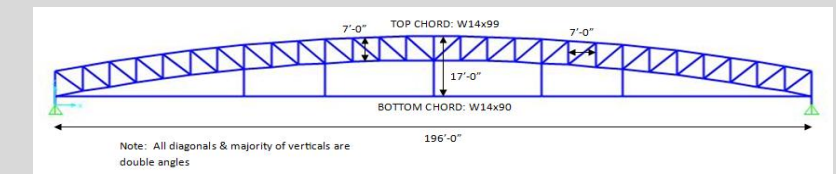
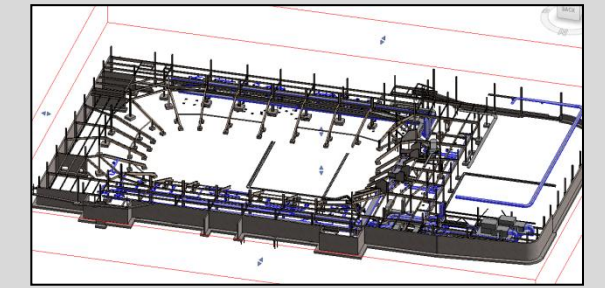


Proposed Scheduled Timeline

Simplified Scheduled Approach:



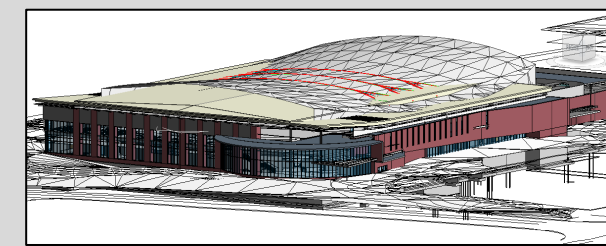
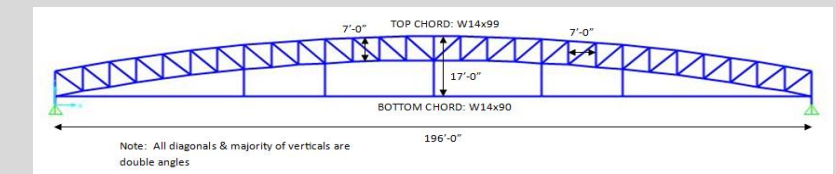
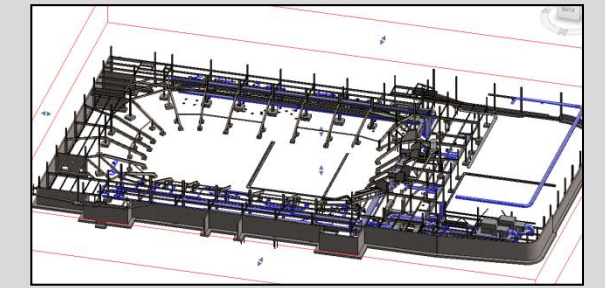
Monday, February 20th



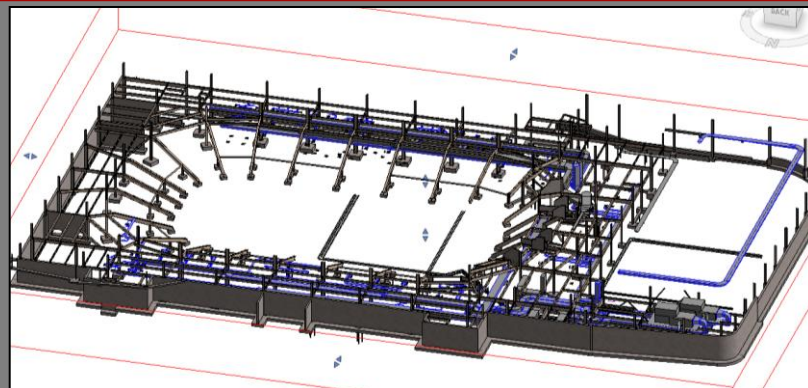
◆ MILESTONE #1 FOCUS: Event Level Raising



Monday, February 20th



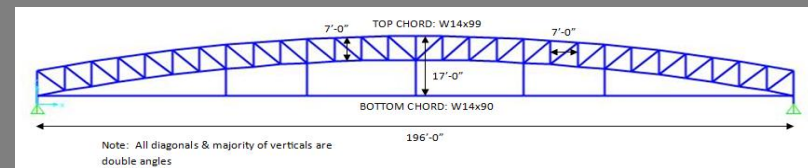
MILESTONE#1: Initial Architectural Modeling Completed



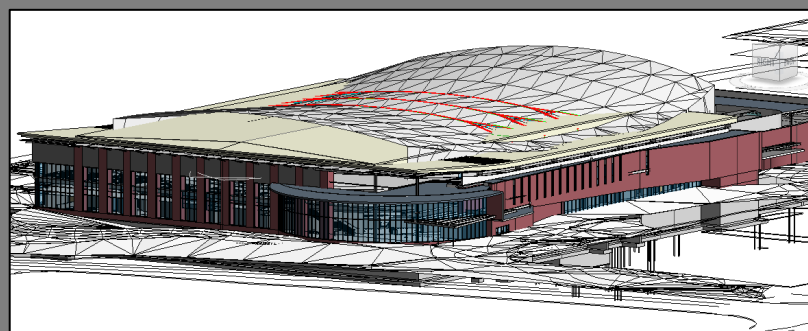
Progress



Event Level Raising



Arena Roof Systems



Façade Redesign

DISCIPLINE	TASK	ACTIVITY	Milestone 1 1/27/2012			Milestone 2 2/13/2012		Milestone 3 3/12/2012			
			1/9/2012	1/16/2012	1/23/2012	1/30/2012	2/6/2012	2/13/2012	2/20/2012	2/27/2012	3/5/2012
Architectural	Air Handler Relocation & Event Level Redesign	Relocate Air Handlers	█								
		Site Considerations	█								
Structural	Design Development	Design Two Way Flat Plate System w/o Post-Tensioning		█	█						
		Design Two Way Flat Plate System w Post-Tensioning			█	█					
		Redesign Concrete Gravity Columns			█	█	█				
		Design Concrete Gravity Columns for Mech. Loft				█	█				
		Design New Foundations for Columns					█	█			
Mechanical	Design Development	Re-Evaluate Existing Columns					█				
		Re-calculate Loads on the Event Level	█	█							
		Concept Design for ERV system serving training facility		█	█						
		Select Air Handlers & Determine Structural Load			█	█					
		Locate/Size high & medium pressure duct				█					
Mechanical	Modeling	Revit - Coordination w/ other disciplines				█	█				
		Finalize Design					█	█			
		Size and Locate Low Pressure Duct & Diffusers						█	█		
		Reflected Ceiling Plan							█		
		Design Documentation								█	
Electrical	Design Development	Plug Load Research	█								
		Load Calculation		█							
		Early Foreseeable Coord. Issues	█								
		Location of Panels throughout Level			█	█					
		Sizing of Conduit & Wiring				█	█				
Electrical	Design Development	Conduit Routing throughout Building				█	█				
		Revit - Coordination w/ other disciplines					█	█			
		Finalize System						█	█		
		Design Documentation								█	
		Reflected Ceiling Plan									█
Daylighting	Design Development	Space Daylight Utilization Analysis			█	█					
		Integration with Lighting System				█	█				
		Finalize Design					█	█			
Lighting	Design Development	Office Spaces			█	█					
		Locker Rooms			█	█					
		Training Facilities			█	█					
		Ice Support					█	█			
		Luminaire Selection						█	█		
Lighting	Design Development	Calculations				█	█				
		Control Design					█	█			
		Revit - Coordination w/ other disciplines						█	█		
		Finalize Design							█	█	
		Lighting Layout								█	█
CM	Design Development	Existing Conditions Baseline Estimate	█								
		Update Cost Based on Event Level Relocation						█	█		
		Perform Schedule Analysis & Create Baseline Schedule				█	█	█	█		
		Update Schedule Based on Event Level Relocation							█	█	
		Baseline LEED Score Card								█	█

Proposed Objectives:

- Two-Way PT Flat Plate Design
Capacity Checks
Misc. Steel Framing Design
- Electrical – Main Distribution System
Day lighting Analysis
Lighting Layouts
- Duct Layouts/Plenum Study
Model Analysis/Refinement
Diffuser Locations – Event Level
- 3D Coordination
Constructability Review
Cost & Schedule Comparisons

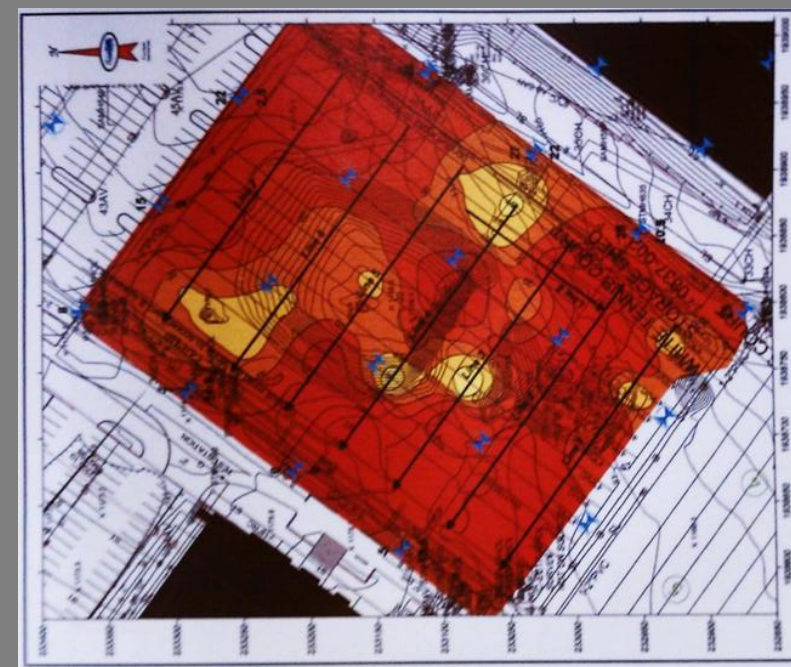
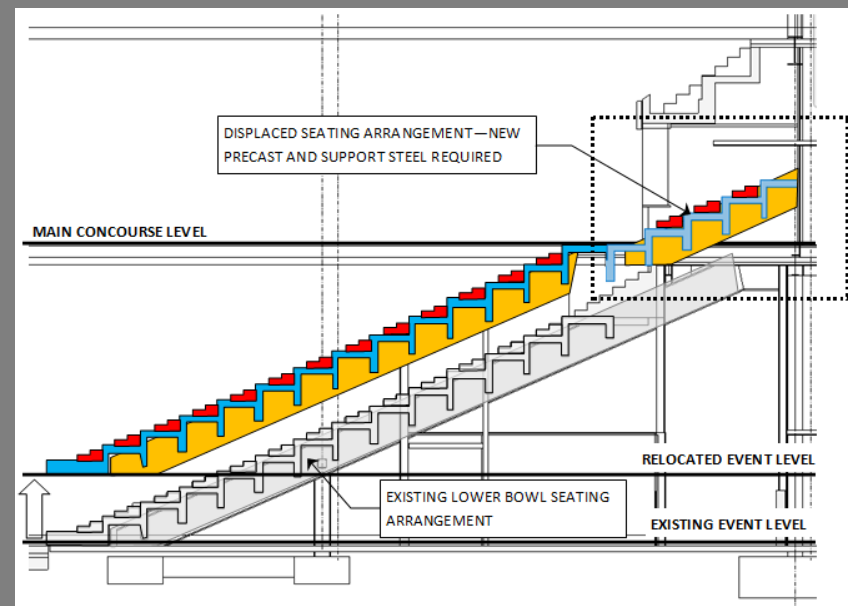
Friday, January 27th, 2012

Event Level Raising

SPRING BREAK

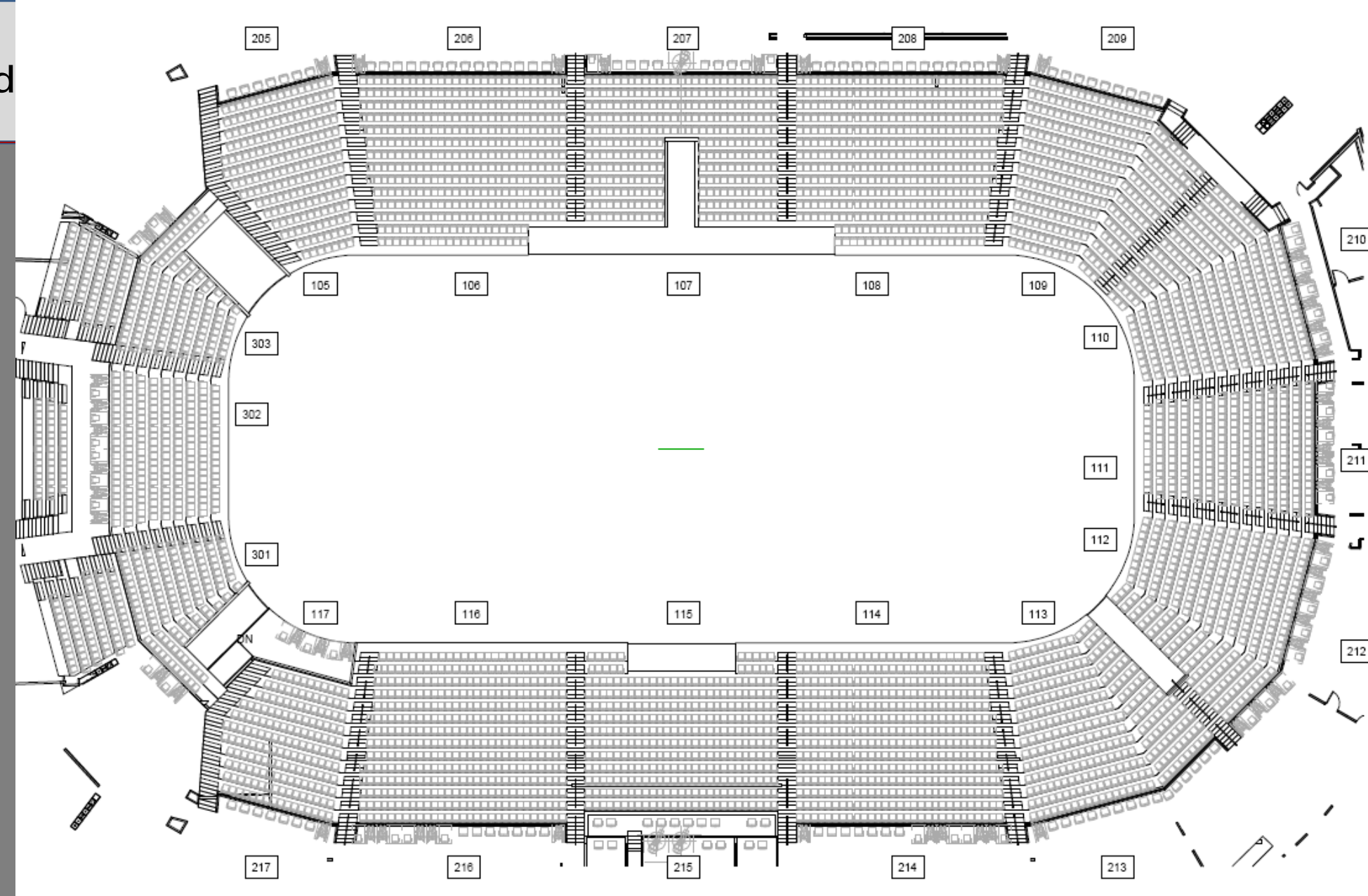
MILESTONE#1: Initial Architectural Modeling Completed

[RE]DESIGN: Event Level Raising

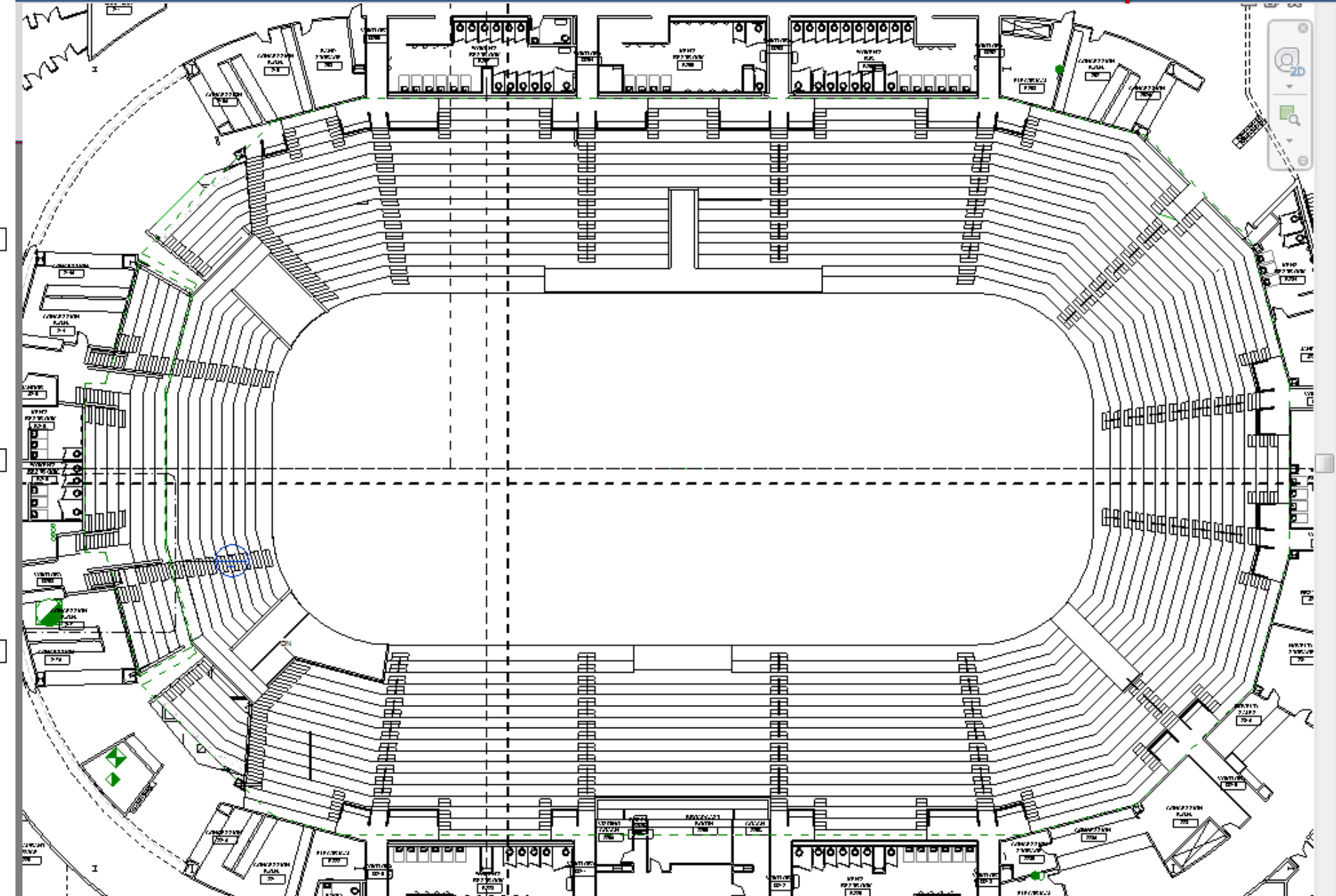


Preliminary Results:

- Raised 38" (3'-2") in Elevation
- Added 1.0% More Seats
- ADA/IBC 2009 Compliance
- \$400,000 (~16%) Savings In Rock Excavation



ORIGINAL DESIGN: 6,031 Seats



REDESIGN: 6,094 Seats



Architecture

BIM THESIS PROPOSAL
HPR Integrated Design | Jeremy Heilman | Josh Progar | Nico Pugliese | James Rodgers

- Major design considerations are listed below:
- Egress logistics of the main arena bowl
 - ADA seating
 - Sight lines
 - The number of seats at different price points
 - Constructability
 - Plenum space
 - Grading on the southern side of the facility
 - Loading dock logistics
 - Other site restrictions such as building width

Major design considerations are listed below:

- Egress logistics of the main arena bowl
- ADA seating
- Sight lines
- The number of seats at different price points
- Constructability
- Plenum space
- Grading on the southern side of the facility
- Loading dock logistics
- Other site restrictions such as building width

Alternative solution to meeting the venue level elevation would be to raise the entire ice arena facility as a whole. This solution would also reduce the excavation scope and help to decrease costs, but would greatly impact the architectural intent of the main entrance to the facility. The architectural design for the main entrance to the ice hockey arena maintains a clean entry which allows customers to enter the arena on grade with the main concourse level. By raising the entire facility, the main concourse level would not be on grade and would require entrance steps and ADA compliant ramps at the main entrance. This would eliminate the clean entry that has been designed by the architect.

Additionally, site design by the civil engineer has been coordinated with the architectural intent through the use of "skate lines" in the concrete entrance plaza design. Control joints in the exterior concrete are mimicked in the main lobby with an architectural intent to connect the exterior and interior of the facility while also touching on the hockey architectural theme. Overall, without major site re-grading, HPR Integrated Design has decided to abandon this alternative as a viable option.

Figure 14 shows a sectional view of the proposed changes to the event level. The green lines represent the existing conditions while the yellow lines represent the proposed changes. Notice that the plenum below the concourse level is reduced and the slope of the arena seating stays the same. This reduction in plenum space will require a more closely coordinated plenum space. In these areas, BIM software like Navisworks will be vital in performing clash detection to avoid any issues that could arise on the jobsite.

ADA Seating

ADA Seating Lower Level Seating:	
Total Number of Seats:	3688 seats
IBC Table 1108.2.2.1: 501 to 5,000 seats = 6+1/150 between 501 - 5,000 seats	
Total ADA Seating - Lower Level:	27 Total ADA Seats

ADA Seating Upper Level Seating:	
Total Number of Seats:	961 seats
IBC Table 1108.2.2.1: 501 to 5,000 seats = 6+1/150 between 501 - 5,000 seats	
Total ADA Seating - Lower Level:	9 Total ADA Seats

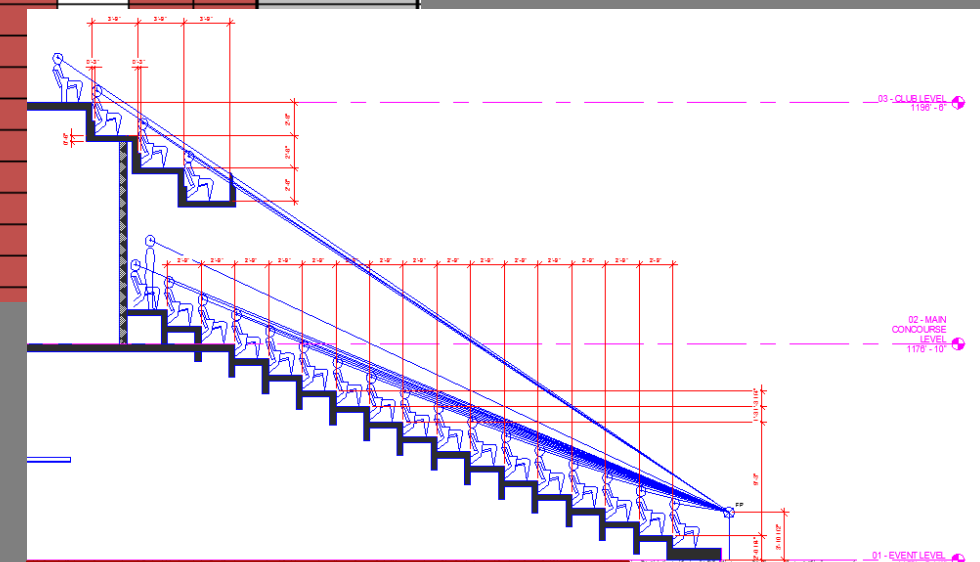
ADA Seating Student Section (Section E) Seating:	
Total Number of Seats:	995 seats
IBC Table 1108.2.2.1: 501 to 5,000 seats = 6+1/150 between 501 - 5,000 seats	
Total ADA Seating - Lower Level:	9 Total ADA Seats

PENN STATE ICE ARENA															
Seating Counts per Seating Section															
Seating Section	Seating Type Count										High Top Seats	Coaches Seating	Wheelchair Seat	Companion Seat	Total
	18" Bench	19" Seat	20" Front Row Seat	19" Club Seat	21" Club Seat	24" Suite Seat	36" Loge Seat	21" Press Seat	19" Seat on Removable Platform	20" Seat on Removable Platform					
105		183	7												190
106		359	20												379
107		289													289
108		359	20												379
109		262	10												272
110		262	12												274
111		212	12												224
112		245	10						16	2					273
113		245	10						16	2					273
114		365	25												
115		307	10					16							
116		365	25												
117		165													
205														8	
206														14	
207														7	
208														14	
209														9	

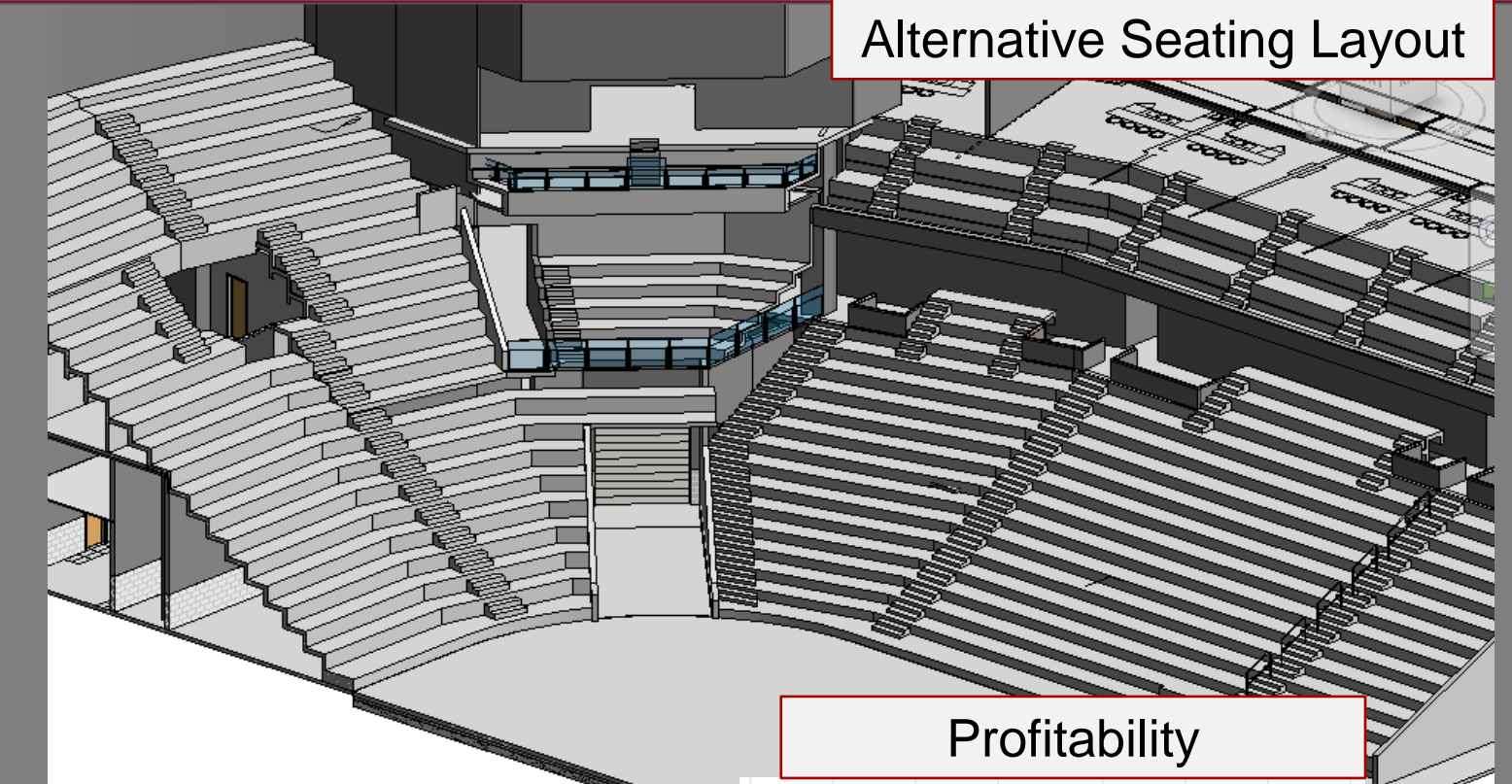
Seating Capacity

PROPOSED PRICE POINTS:		
■	General Admission	3716 seats
■	General Admission - Students	1015 seats
■	Club Level	977 seats
■	Suite	352 seats

Price Points



Sight Lines



Alternative Seating Layout

Profitability

Penn State Ice Arena - Single Game Ticket Sales Profits:	
Glass Seats:	161 seats
	\$ 3,220.00 per game
Lower Bowl:	3555 seats
	\$37,327.50 per game
Club Seats:	977 seats
	\$19,540.00 per game
Suite Level Seats:	352 seats
	\$14,080.00 per game
*Student Section:	1,015 seats
	\$ 5,075.00 per game
*Assumed \$5 dollar student tickets	
GRAND TOTAL	\$ 79,242.50 per game

Penn State Ice Arena - Single Game Ticket Sales Profits:	
Glass Seats:	161 seats
	\$ 3,220.00 per game
Lower Bowl:	3816 seats
	\$40,068.00 per game
Club Seats:	695 seats
	\$13,900.00 per game
Suite Level Seats:	279 seats
	\$11,160.00 per game
*Student Section:	1,046 seats
	\$ 5,230.00 per game
*Assumed \$5 dollar student tickets	
GRAND TOTAL	\$ 73,578.00 per game

PROPOSED

EXISTING

◆ MILESTONE#1: Initial Architectural Modeling Completed

◆ Structural

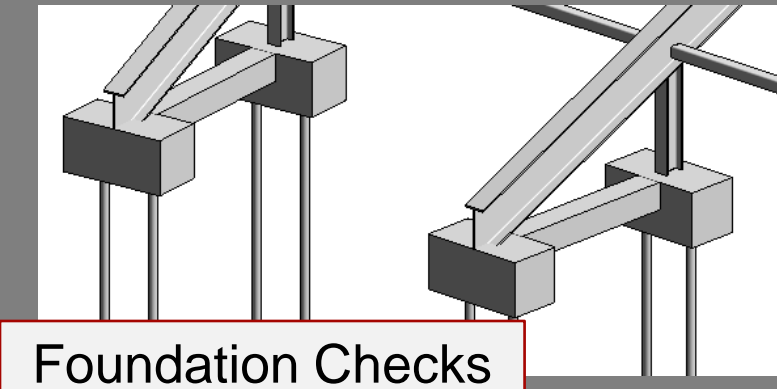
Two Way Post Tensioned Slab System
Designer: Josh Progar

Continuous Span - Main Concourses

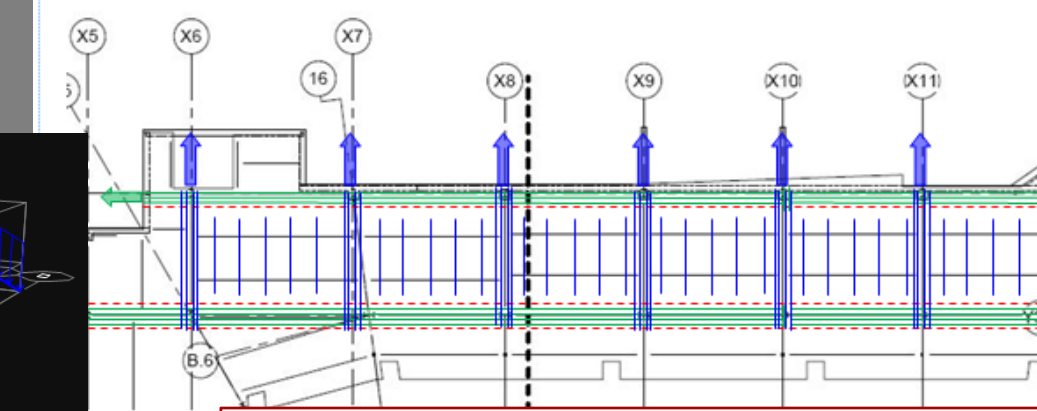
Exterior Spans:		Long Direction		Exterior Spans:		Short Direction	
L=	23.792 ft	X5-X6	L=	28 ft	X5-X6		
	29.625 ft	X14.3-X15		28 ft	X14.3-X15		
Interior Spans:		Long Direction		Interior Spans:		Short Direction	
L=	37.17 ft	X6-X7	L=	28 ft	X6-X7		
	35 ft	X7-X8		28 ft	X7-X8		
	32 ft	X8-X9		28 ft	X8-X9		
	32 ft	X9-X10		28 ft	X9-X10		
	32 ft	X10-X11		28 ft	X10-X11		
	35 ft	X11-X12		28 ft	X11-X12		

DESIGN CRITERIA:	
Superimposed DL:	15 psf
Assumed Live Load:	100 psf
f'c:	5000 psi (NWC)
R:	0.85
f'ci:	4250 psi
fp _u :	270,000 psi
fp _y :	240,000 psi
fp _e :	159,000 psi
E _{ps} :	29,000 psi
f _y :	60,000 psi
E _s :	29,000 ksi

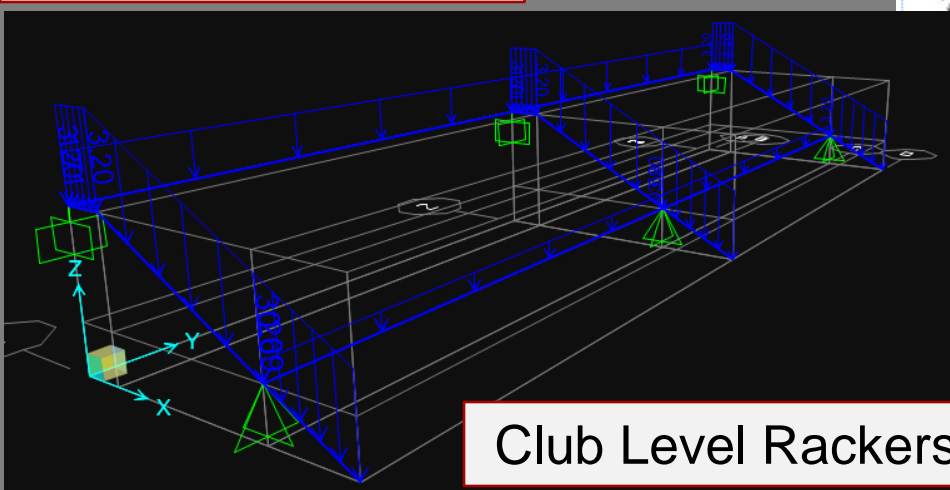
Two-Way PT Slab Design



Foundation Checks



Two-Way PT Slab Layout



Club Level Rackers

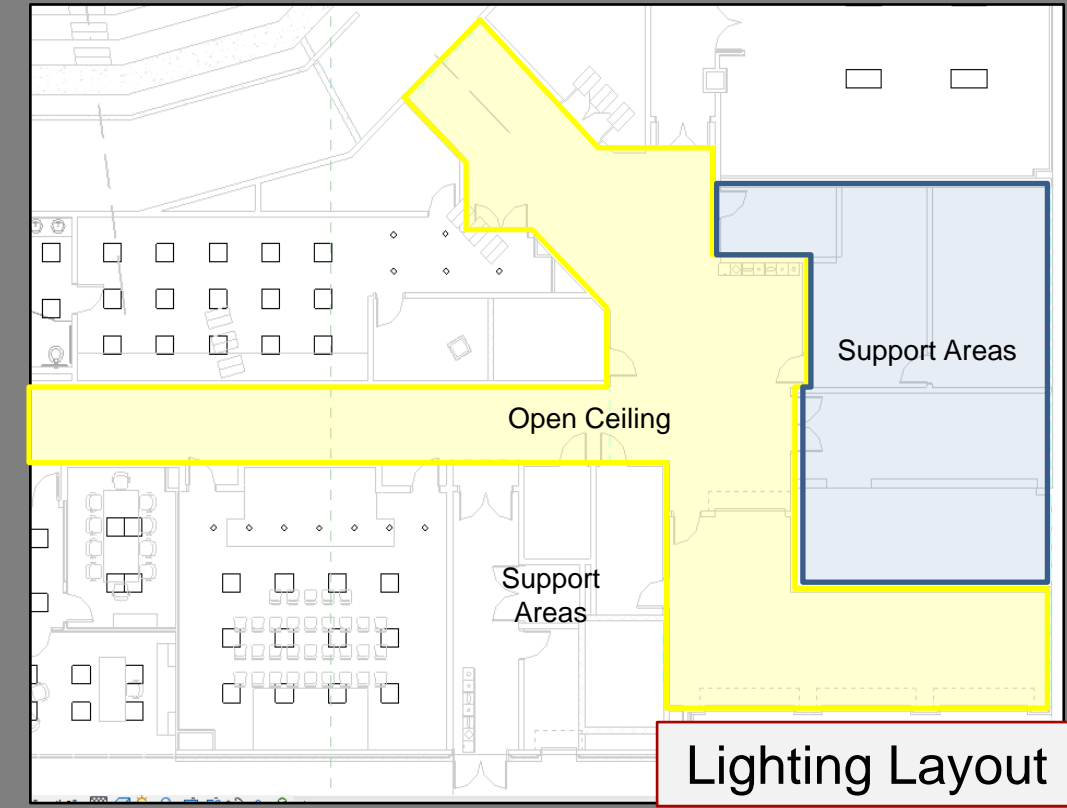
◆ Lighting/Electrical



Plenum Return Luminaire



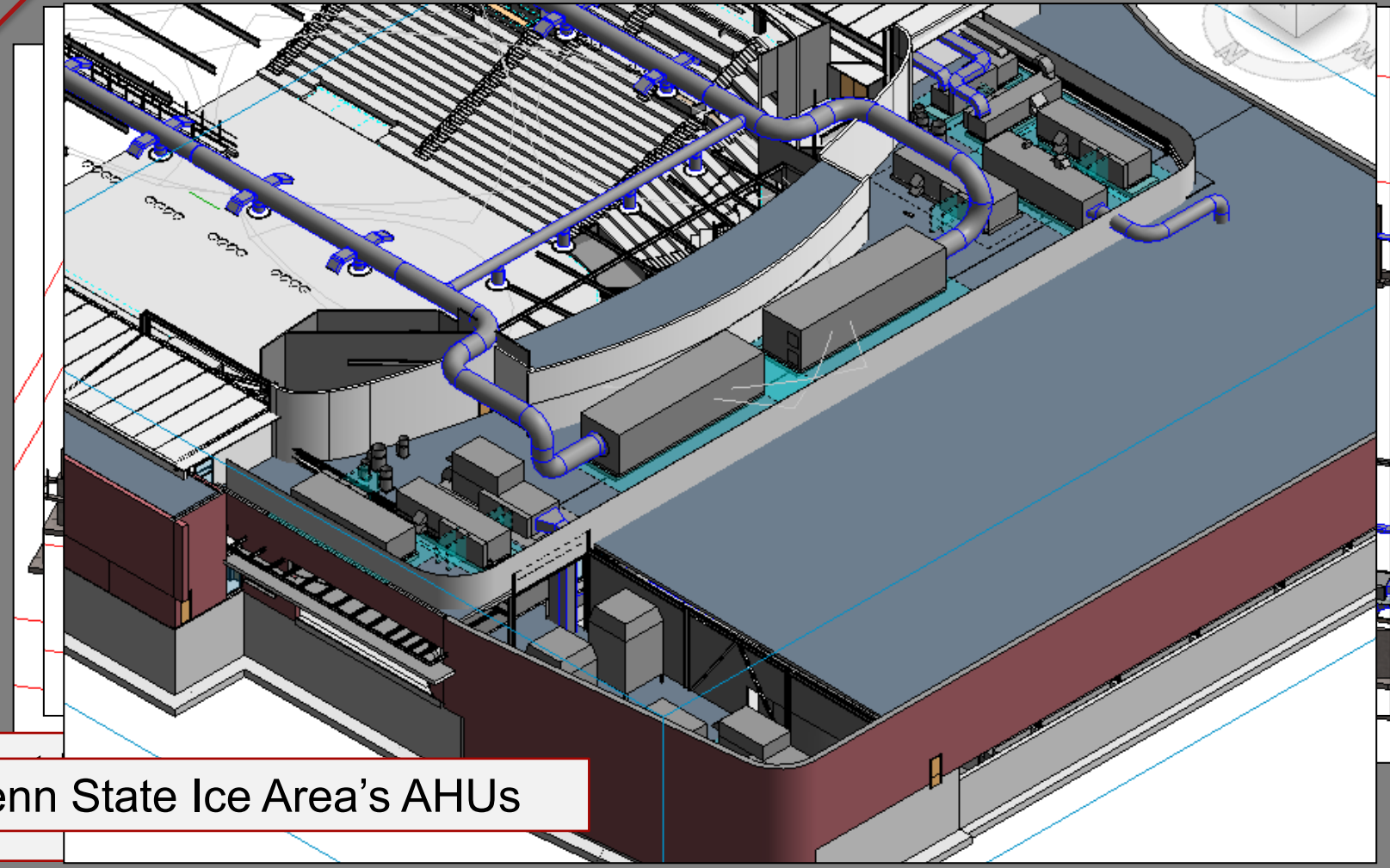
Recessed Downlight



Lighting Layout

◆ Mechanical

Loads from Trace



Penn State Ice Area's AHUs



Structural

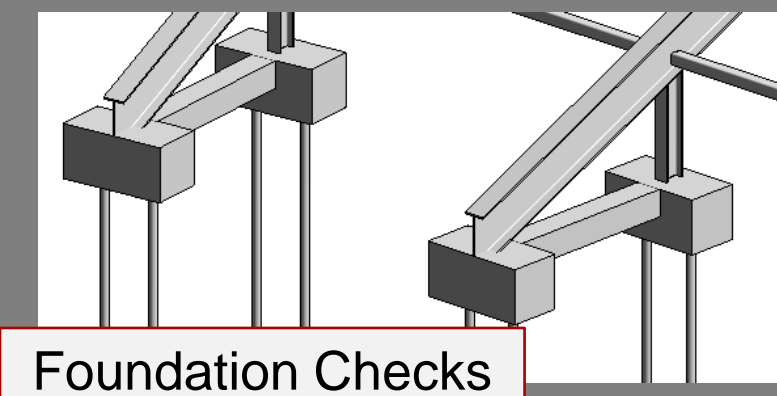
Two Way Post Tensioned Slab System
Designer: Josh Progar

Continuous Span - Main Concourses

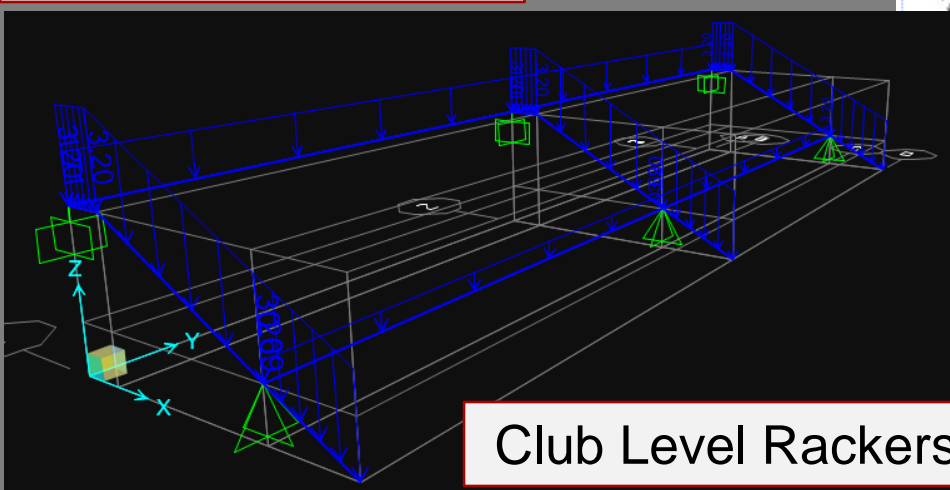
Exterior Spans:		Long Direction		Exterior Spans:		Short Direction	
L=	23.792 ft	X5-X6	L=	28 ft	X5-X6		
	29.625 ft	X14.3-X15	L=	28 ft	X14.3-X15		
Interior Spans:				Interior Spans:			
L=	37.17 ft	X6-X7	L=	28 ft	X6-X7		
	35 ft	X7-X8	L=	28 ft	X7-X8		
	32 ft	X8-X9	L=	28 ft	X8-X9		
	32 ft	X9-X10	L=	28 ft	X9-X10		
	32 ft	X10-X11	L=	28 ft	X10-X11		
	35 ft	X11-X12	L=	28 ft	X11-X12		

DESIGN CRITERIA:	
Superimposed DL:	15 psf
Assumed Live Load:	100 psf
f'c:	5000 psi (NWC)
R:	0.85
f'ci:	4250 psi
fp _u :	270,000 psi
fp _y :	240,000 psi
fp _e :	159,000 psi
E _{ps} :	29,000 psi
f _y :	60,000 psi
E _s :	29,000 ksi

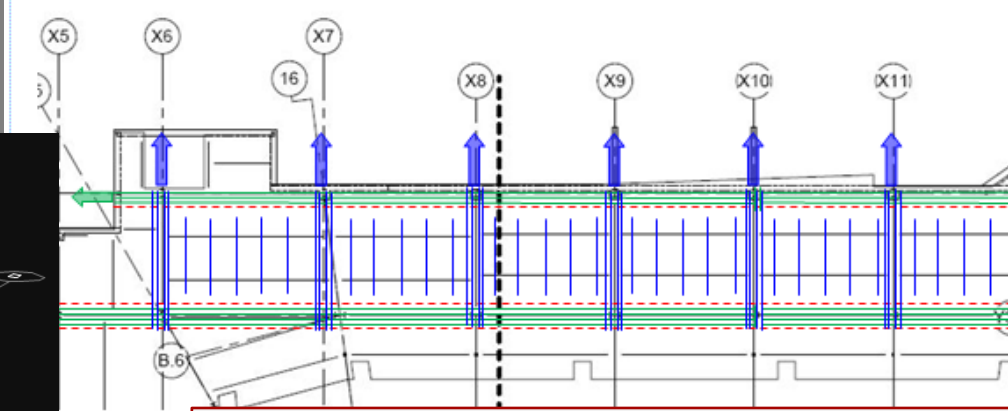
Two-Way PT Slab Design



Foundation Checks



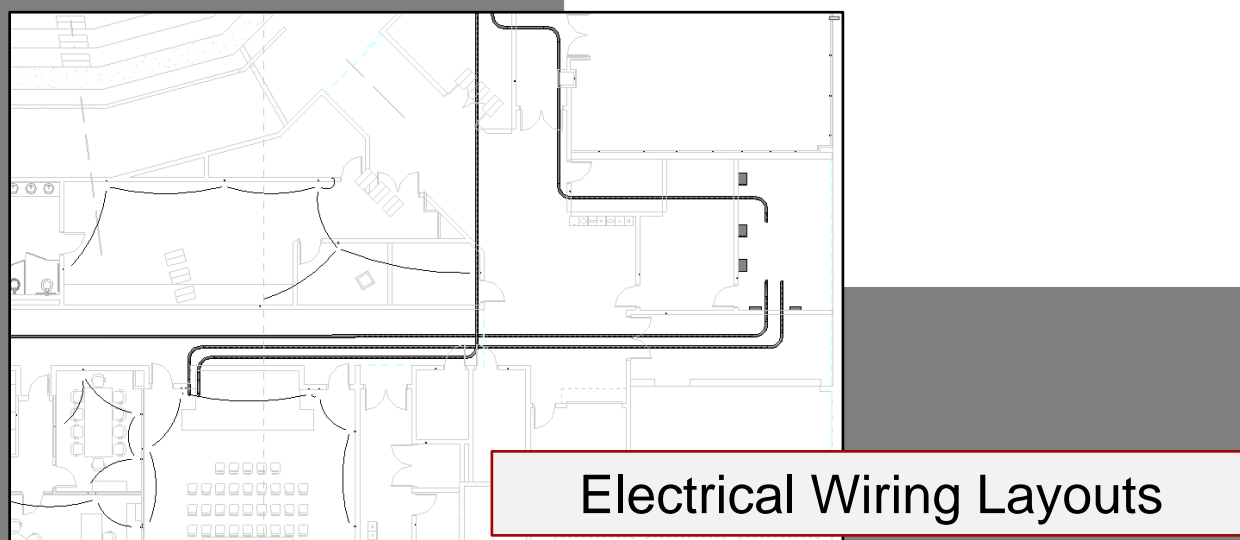
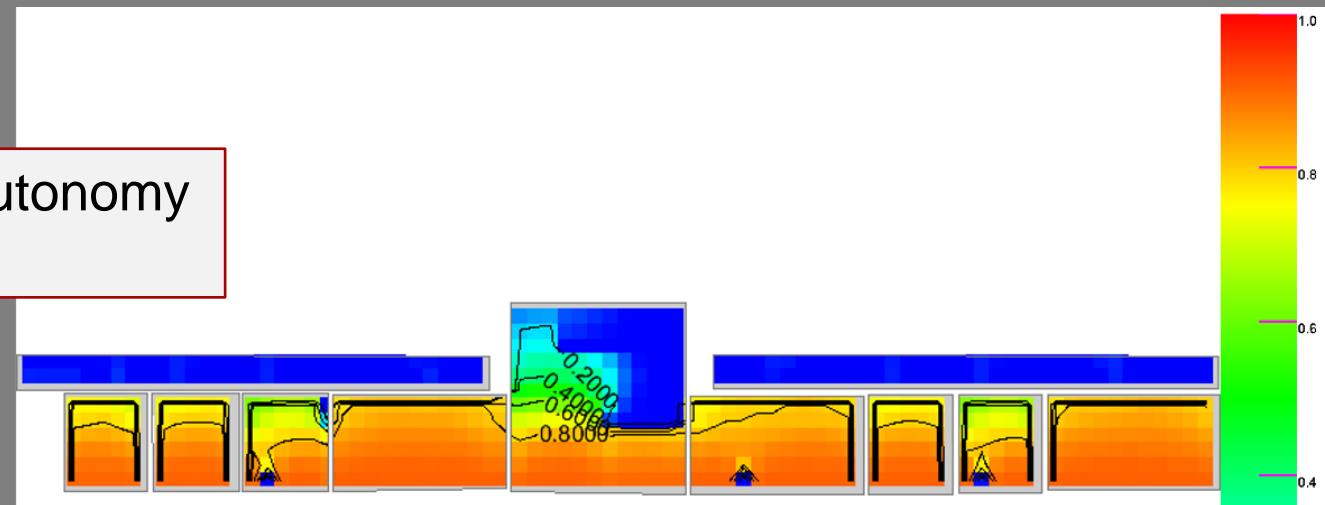
Club Level Rackers



Two-Way PT Slab Layout

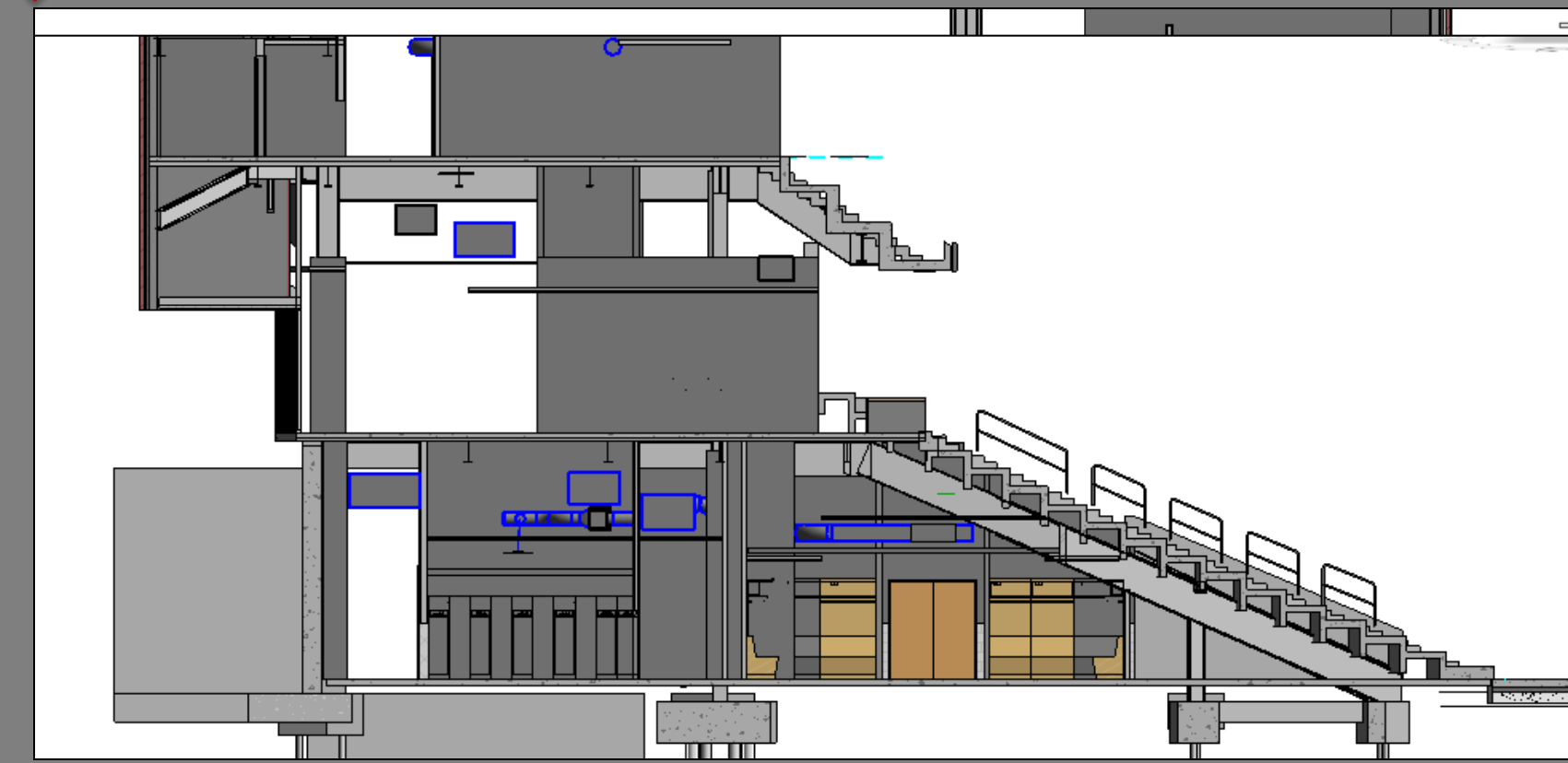
Lighting/Electrical

Daysim – Daylight Autonomy @ 500lx



Electrical Wiring Layouts

Mechanical

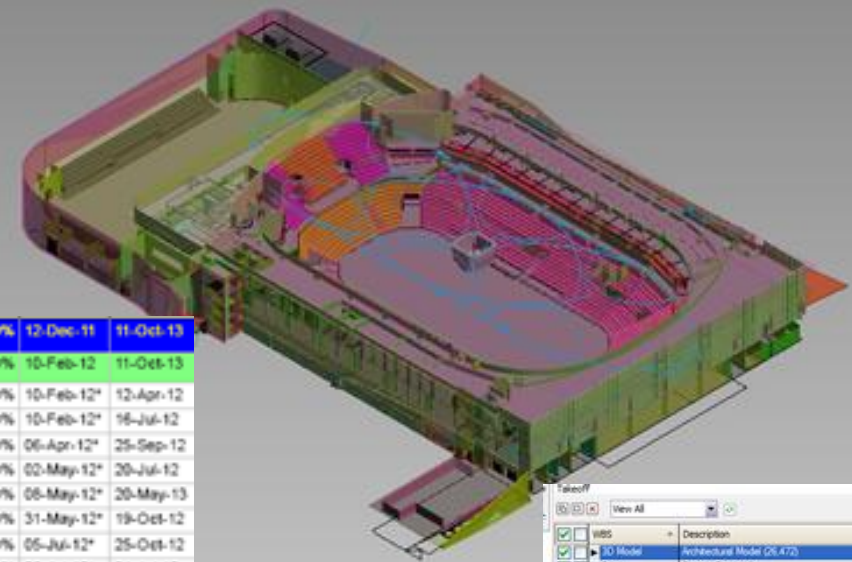


Coordinated Event Level plenum

MILESTONE#1: Initial Architectural Modeling Completed

Construction

Quantity Takeoff



PSIA Penn State Ice Arena	469	469	0%	12-Dec-11	11-Oct-13
PSIA.Milestones Construction Milestones	437	437	0%	10-Feb-12	11-Oct-13
MILESTONE-01	Start Site Prep, Excavation	45	45	0%	10-Feb-12* 12-Apr-12
MILESTONE-02	Site Utilities	110	110	0%	10-Feb-12* 16-Jul-12
MILESTONE-03	Foundations	120	120	0%	06-Apr-12* 25-Sep-12
MILESTONE-04	Underslab MEP	56	56	0%	02-May-12* 20-Jul-12
MILESTONE-05	Slab on Grade	264	264	0%	08-May-12* 20-May-13
MILESTONE-06	Steel Erect	100	100	0%	31-May-12* 19-Oct-12
MILESTONE-07	Slab on Metal Deck	80	80	0%	05-Jul-12* 25-Oct-12
MILESTONE-08	Stairs	18	18	0%	06-Jul-12* 31-Jul-12
MILESTONE-09	Building Enclosure - Exterior Walls	127	127	0%	31-Jul-12* 29-Jan-13
MILESTONE-10	Building Enclosure - Roof	105	105	0%	01-Aug-12* 28-Dec-12
MILESTONE-11	Equipment Installation	187	187	0%	08-Aug-12* 01-May-13
MILESTONE-12	Stud Framing	122	122	0%	15-Aug-12* 06-Feb-13
MILESTONE-13	Interior Finishes	205	205	0%	22-Aug-12* 11-Jun-13
MILESTONE-14	Rough-In	103	103	0%	28-Aug-12* 23-Jan-13
MILESTONE-15	Elevators Installation	99	99	0%	28-Aug-12* 17-Jan-13
MILESTONE-16	Trusses	67	67	0%	07-Sep-12* 11-Dec-12
MILESTONE-17	Drywall	141	141	0%	19-Sep-12* 08-Apr-13
MILESTONE-18	Building Enclosure - Curtain Walls	65	65	0%	27-Sep-12* 28-Dec-12
MILESTONE-19	Sitework and Landscaping	158	158	0%	02-Nov-12* 17-Jan-13
MILESTONE-20	Systems Testing	120	120	0%	19-Mar-13* 05-Sep-13
MILESTONE-21	Arena Station	53	53	0%	22-Mar-13* 05-Jun-13
MILESTONE-22	Comm				
MILESTONE-23	Penn				
MILESTONE-24	1st Pu				

Baseline Schedule

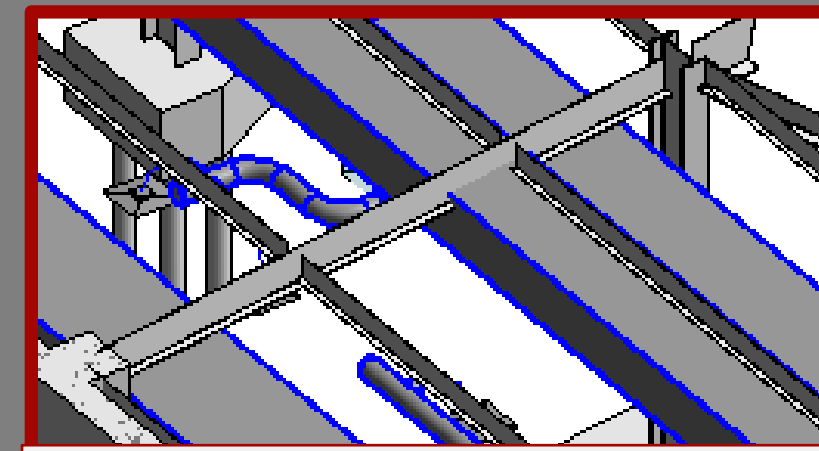
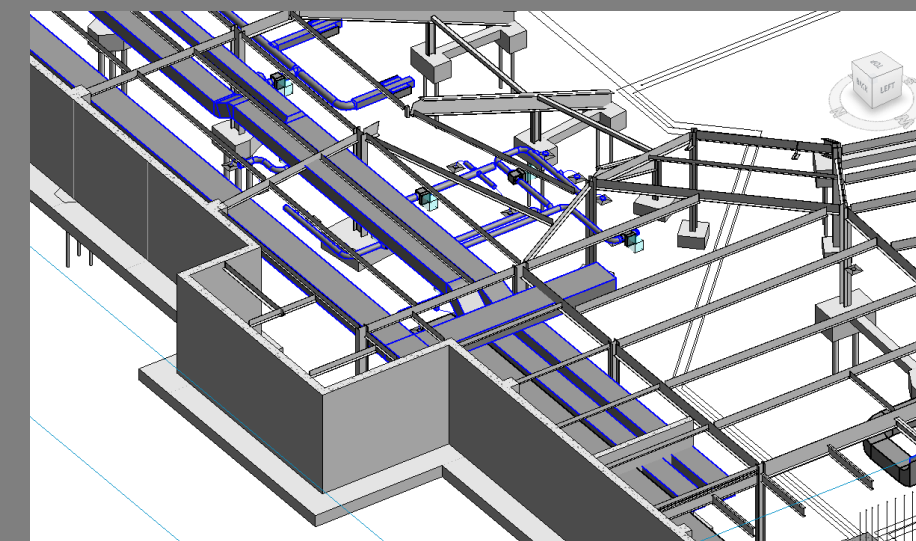
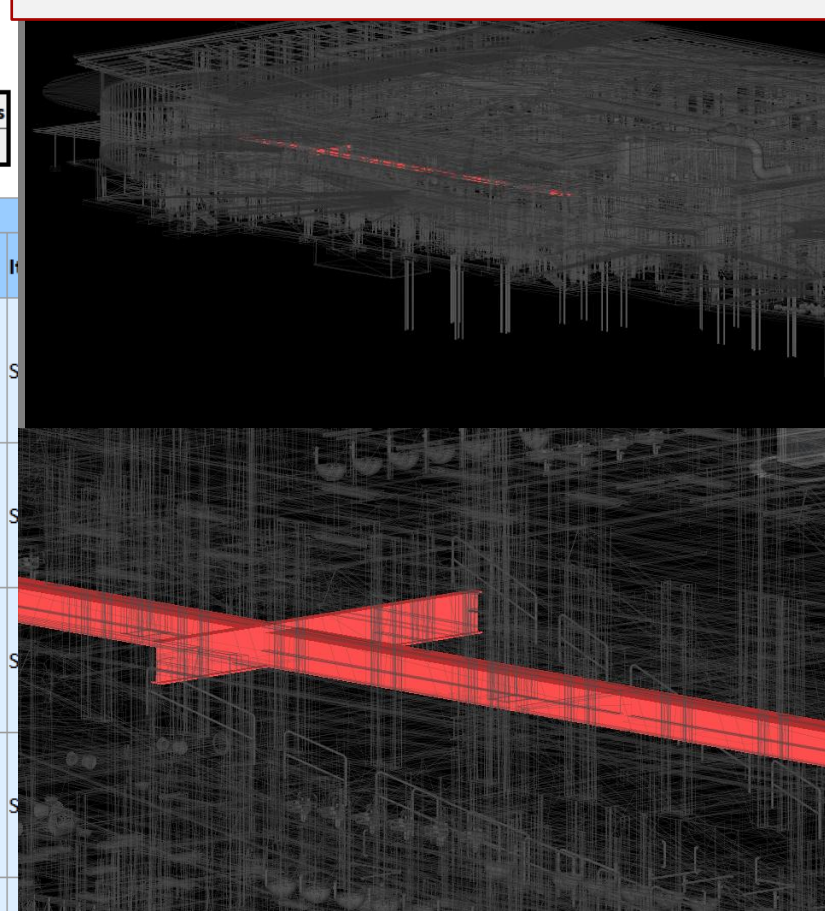
Autodesk Navisworks Clash Report

Evt Plenum - Mech/Struct	Tolerance	Clashes	New	Active	Reviewed	Approved	Resolved	Type	Status
	0.001m	174	174	0	0	0	0	Hard	OK

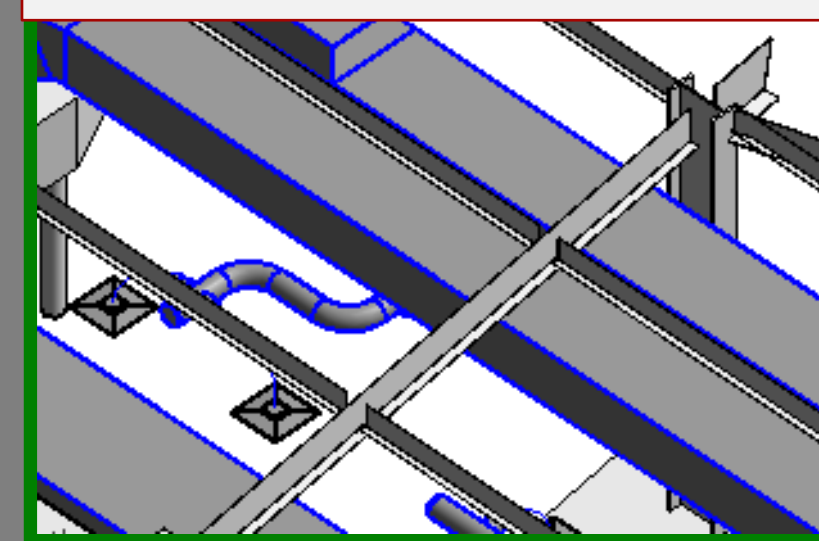
Image	Clash Name	Status	Distance	Description	Date Found	Clash Point	Item ID	Layer	Item Name
	Clash1	New	-1.58	Hard	2012/2/13 14:53.01	x:-50.70, y:34.02, z:356.22		<No level>	Mitered Elbows / Taps
	Clash2	New	-1.20	Hard	2012/2/13 14:53.01	x:-50.70, y:31.57, z:356.18		<No level>	Mitered Elbows / Taps
	Clash3	New	-0.95	Hard	2012/2/13 14:53.01	x:-50.70, y:33.16, z:356.38		<No level>	Mitered Elbows / Taps
	Clash4	New	-0.51	Hard	2012/2/13 14:53.01	x:24.89, y:35.41, z:364.23	Element ID: 1316945	<No level>	Mitered Elbows / Taps
	Clash5	New	-0.51	Hard	2012/2/13 14:53.01	x:-36.65, y:-35.35, z:356.22	Element ID: 1316945	<No level>	Mitered Elbows / Taps

Evt Plenum - Mech/Struct	Tolerance	Clashes	New	Active	Reviewed	Approved	Resolved	Type	Status
	0.001m	174	174	0	0	0	0	Hard	OK

3D Coordination



Beam/Duct Clash

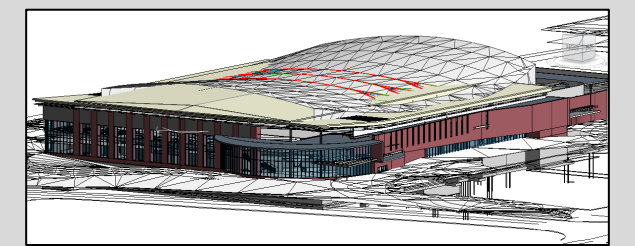
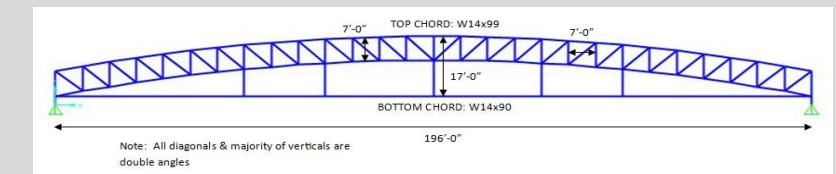
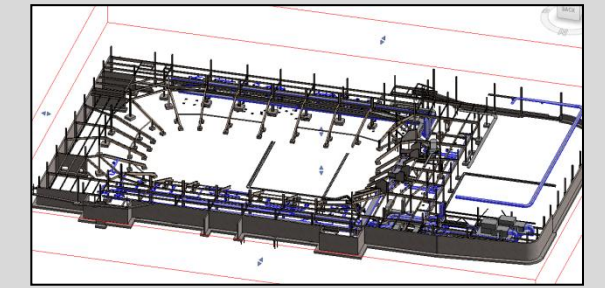
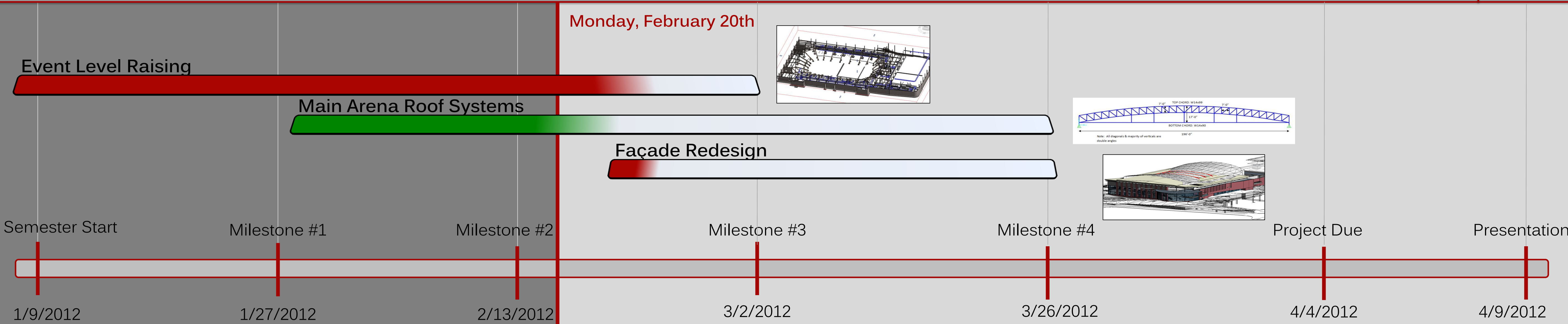


3D Clash Detection Remedy

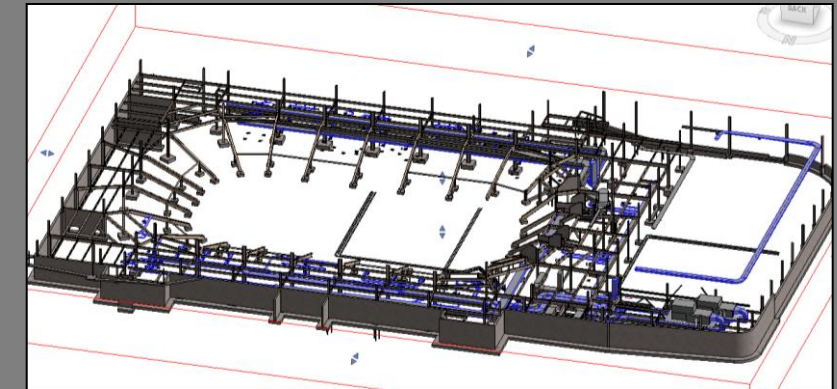
[RE]DESIGN: Event Level Raising



◆ MILESTONE #2 FOCUS: Main Arena Roof Systems



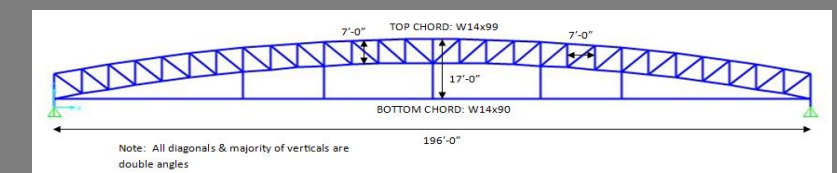
MILESTONE#2: Baseline Schedule & Estimate Completed



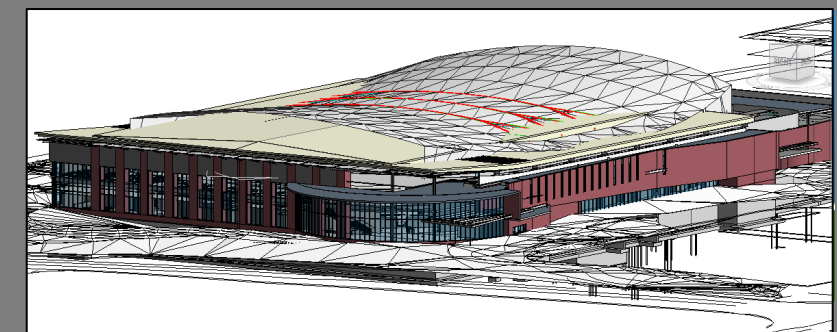
Progress



Event Level Raising



Arena Roof Systems



Façade Redesign

Monday, February 13th, 2012

DISCIPLINE	TASK	ACTIVITY	Milestone 1 1/27/2012			Milestone 2 2/13/2012			Milestone 3 3/12/2012		
			1/9/2012	1/16/2012	1/23/2012	1/30/2012	2/6/2012	2/13/2012	2/20/2012	2/27/2012	3/5/2012
Architectural	Main Arena Roof System	Modeling									
Structural	Concep & Schem Design	Long Span Truss Alternatives Research & Optimization									
	Design Documentation	Long Span Truss Design									
	Modeling	Misc. Steel Members Design to Accommodate Roof									
	Value Engineering	Revit - Coordination w/ other disciplines									
Mechanical	Design Development	New Volume/Load Calculations									
		Size Ducts									
		Locate Diffusers & Coordinate w/ other Disciplines									
	Modeling	Life Safety Systems (Sprinkler & Smoke Exhaust)									
	Value Engineering	Revit - Coordination w/ other disciplines									
Electrical	Design Development	Redesign if necessary based on CM's Estimate									
		Finalize Design									
	Schematic Design & System Analysis	Rigging Load Research									
	Distribution System	Load Calculation (lighting & rigging)									
	Design Development	Sizing of Conduit & Wiring									
	Modeling	Conduit Routing throughout Building									
Lighting	Design Development	Revit - Coordination w/ other disciplines									
		Value Engineering	Redesign if necessary based on CM's Estimate								
		Design Documentation	Finalize System								
	Conceptual & Schematic Design	Ice Lighting									
		Seating Lighting									
CM	Design Development	Life Safety Lighting									
		Versatility of Space									
	Design Development	Luminaire Selection									
	Modeling	Calculations									
	Value Engineering	Control Design									
CM	Design Development	Revit - Coordination w/ other disciplines									
		Value Engineering	Redesign if necessary based on CM's Estimate								
	Design Documentation	Finalize Design									
		Aiming Diagram									
		Lighting Layout									
CM	Design Development	Reflected Ceiling Plan									
		Crane Selection									
	Site Logistics	Perform Crane Analysis									
	Estimate	Site Utilization Analysis									
CM	Scheduling	Update Cost Based on Roof/Light/Elect/Mech Design									
		Update Schedule Based on Roof/Light/Elect/Mech Design									
	LEED	Update LEED Score Card Based on Roof/Light/Elect/Mech Design									
	3D Coordination	Perform Clash Detection									
4D Modeling	Perform 4D Modeling										

Main Arena Roof Systems

Proposed Objectives:



Long Span Truss Design
Complete Steel SAP Modeling
Misc. Steel Framing Design



Electrical Distribution System Layout
Sizing and Modeling of Conduit
Conceptual Lighting Design



Controls Study



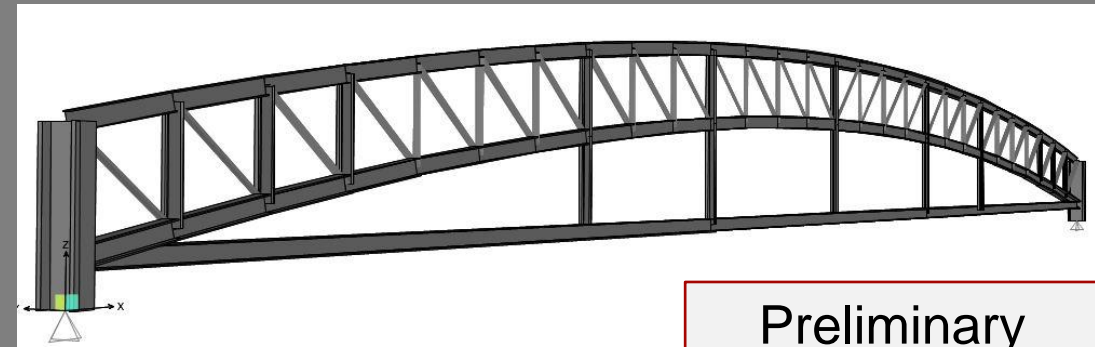
Baseline Schedule
Baseline Cost Estimation

SPRING BREAK

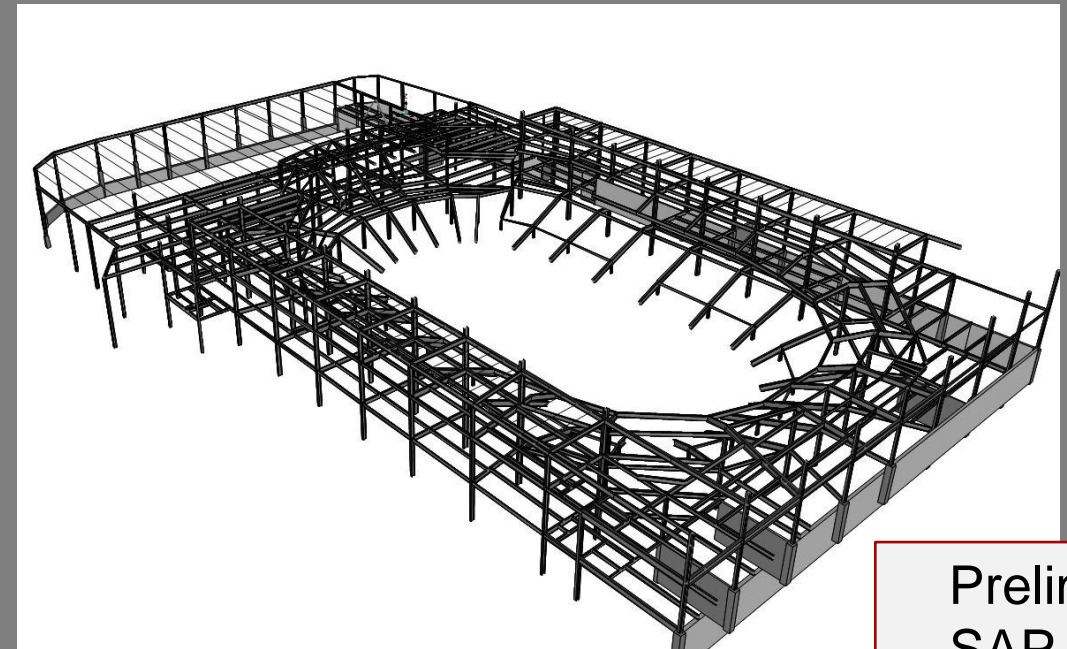
◆ MILESTONE#2: Baseline Schedule & Estimate Completed

[RE]DESIGN: Main Arena Roof Systems

◆ Structural

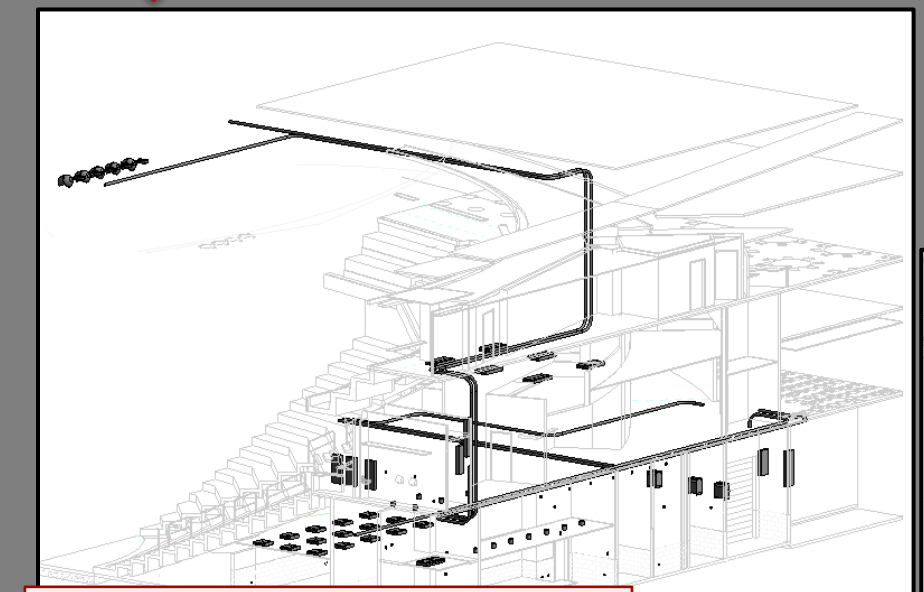


Preliminary Truss Design

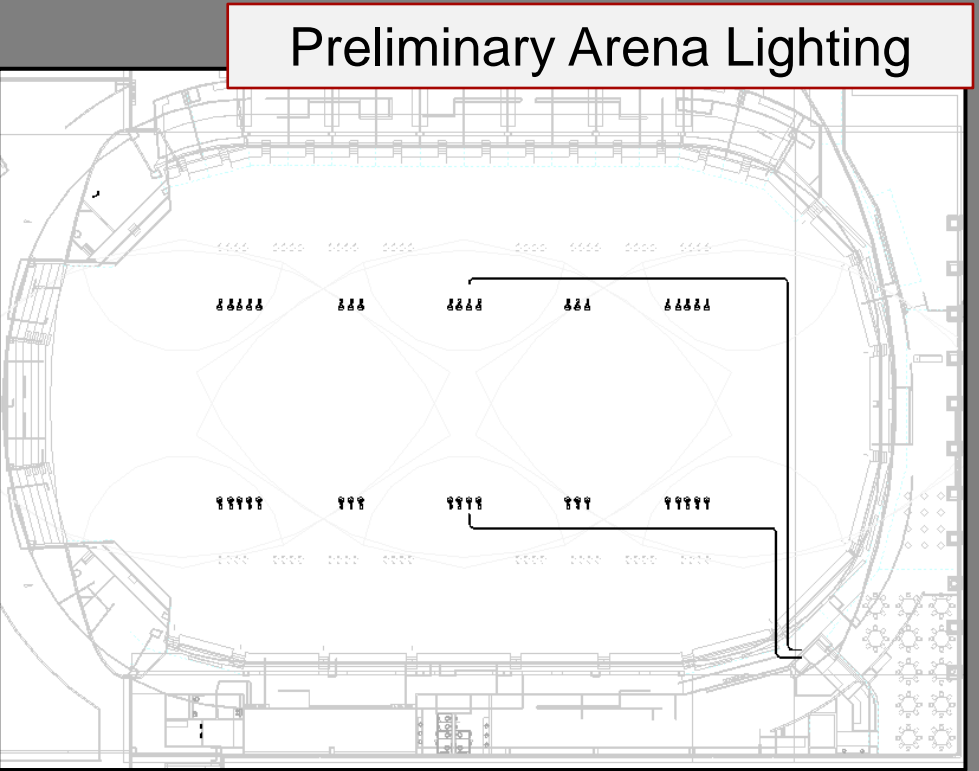


Preliminary SAP Model

◆ Lighting/Electrical



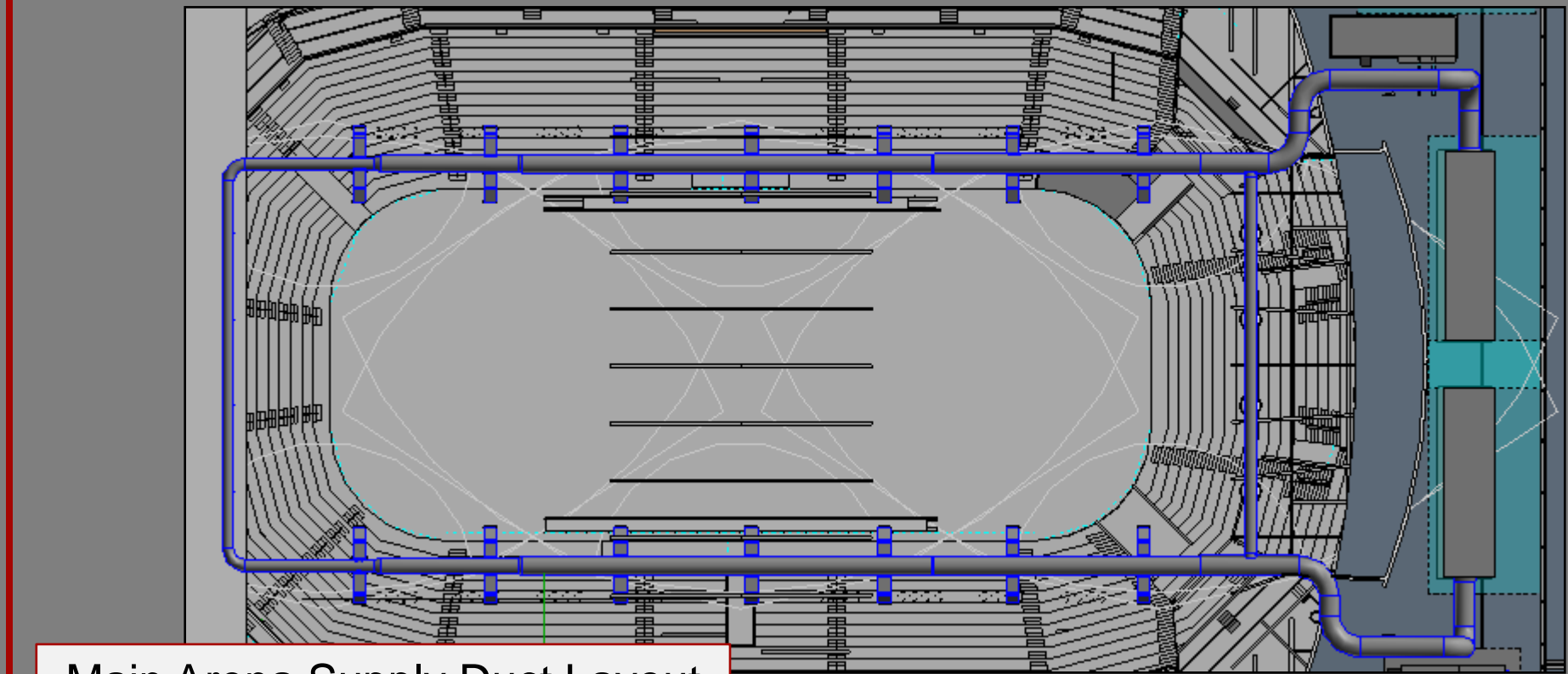
Main Distribution Systems



Preliminary Arena Lighting

[RE]DESIGN: Main Arena Roof Systems

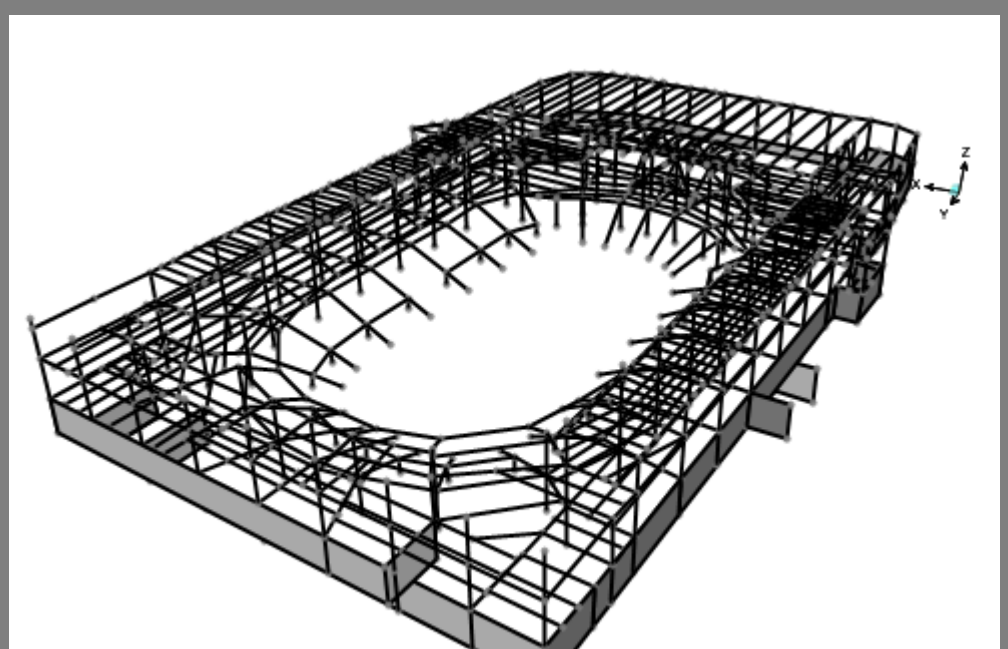
◆ Mechanical



Main Arena Supply Duct Layout

◆ MILESTONE#2: Baseline Schedule & Estimate Completed

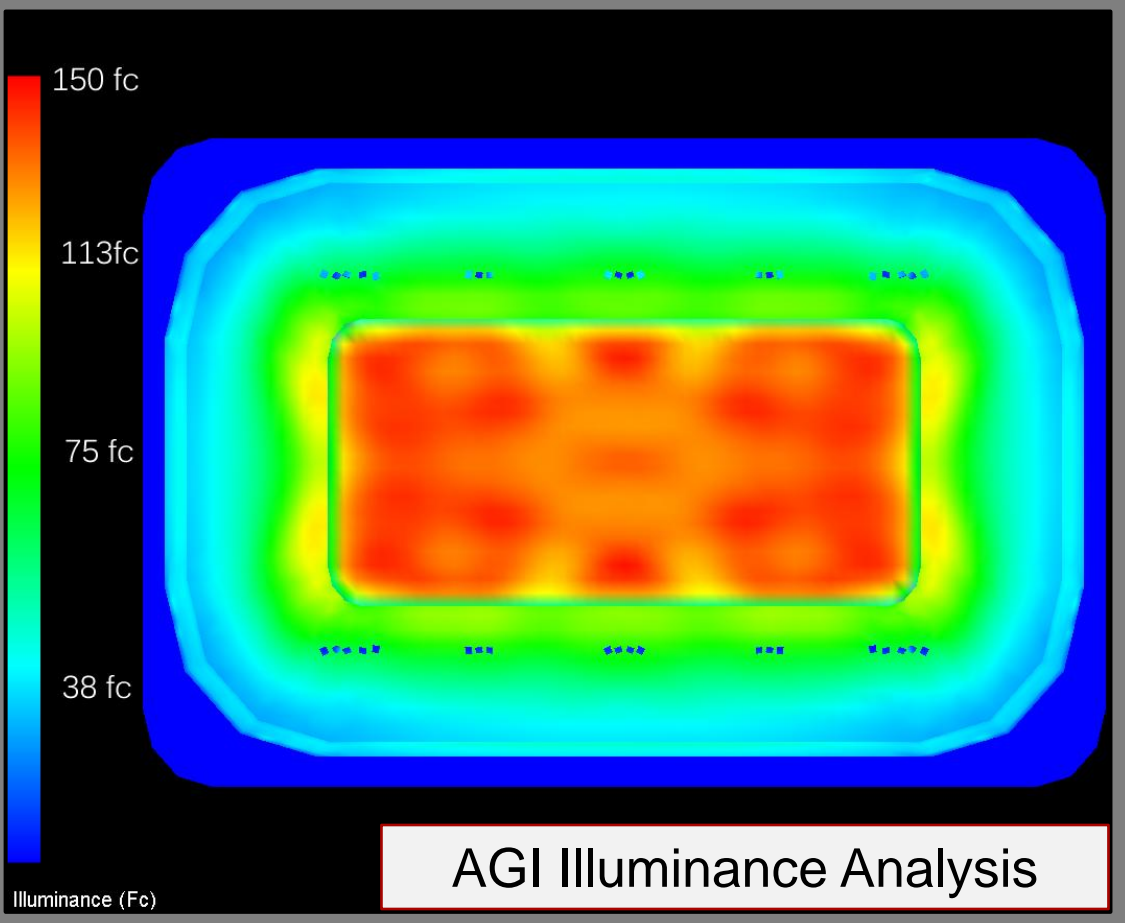
◆ Structural



PRELIMINARY ROOF LOAD WEIGHT & COST PER SQUARE FOOT

Structural Member	Quantity	Weight/ft. (PLF)	Length (ft)
W14x74	4	74	40.25
W14x74	4	74	31.33
W14x74	6	74	32
W14x38	12	38	41
W14x43	6	43	41
W14x30	8	40	41
W14x38	12	38	31.25
W14x43	6	43	31.25
W14x30	8	30	31.25
W14x38	18	38	32
W14x43	9	43	32
W14x30	12	30	32
T-1 W14x132	2	132	60
T-1 W14x132	2	132	37.5
T-1 W14x99	2	99	59
T-1 W14x99	1	99	76
T-1 W14x61	13	61	11.33
T-1 W14x61	14	61	17.6
T-1 W14x61	15	61	17.6
T-1 W14x61	16	61	17.6
T-1 W14x61	17	61	17.6
T-1 W14x61	18	61	17.6
T-1 W14x61	19	61	17.6
T-1 W14x61	20	61	17.6
T-1 W14x61	21	61	17.6
T-1 W14x61	22	61	17.6
T-1 W14x61	23	61	17.6
T-1 W14x61	24	61	17.6
T-1 W14x61	25	61	17.6
T-1 W14x61	26	61	17.6
T-1 W14x61	27	61	17.6
T-1 W14x61	28	61	17.6
T-1 W14x61	29	61	17.6
T-1 W14x61	30	61	17.6
T-1 W14x61	31	61	17.6
T-1 W14x61	32	61	17.6
T-1 W14x61	33	61	17.6
T-1 W14x61	34	61	17.6
T-1 W14x61	35	61	17.6
T-1 W14x61	36	61	17.6
T-1 W14x61	37	61	17.6
T-1 W14x61	38	61	17.6

◆ Lighting/Electrical



[RE]DESIGN: Main Arena Roof Systems

◆ Construction

Preliminary Estimate = \$1.15 million

Existing Long Span Truss Estimate

iBBS	Description	Total Cost
New Gr.	3D View: Truss System	1,150,418.82
New Gr.	Structural Framing	1,150,418.82
New Gr.	W-Wide Flange	22,542.74
New Gr.	LL-Double Angle	254,727.51
New Gr.	TT-HSS-Hollow Structural Section	114,977.91
New Gr.	TT-W-Wide Flange	757,870.65

◆ MILESTONE #3 FOCUS: Façade Redesign



Monday, February 20th

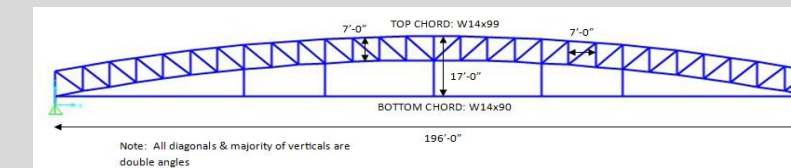
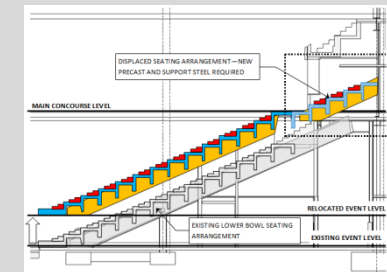
Event Level Raising



Main Arena Roof Systems



Façade Redesign



Semester Start

Milestone #1

Milestone #2

Milestone #3

Milestone #4

Project Due

Presentation

1/9/2012

1/27/2012

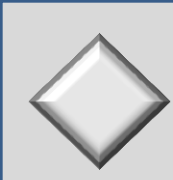
2/13/2012

3/2/2012

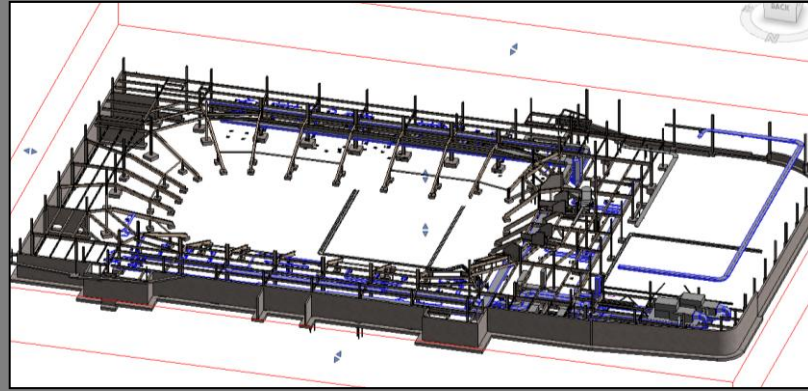
3/26/2012

4/4/2012

4/9/2012



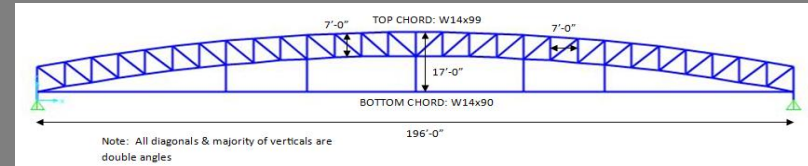
MILESTONE#3: Event Level Raising Completed



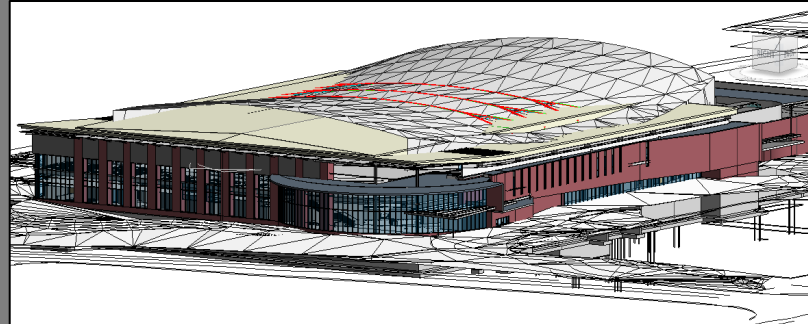
Progress



Event Level Raising



Arena Roof Systems



Façade Redesign

Friday, March 2nd, 2012

DISCIPLINE	TASK	ACTIVITY	Milestone 1		Milestone 2		Milestone 3		Milestone 4		Proj Due	Present.
			1/27/2012	2/13/2012	2/13/2012	2/20/2012	2/27/2012	3/5/2012	3/12/2012	3/19/2012	3/26/2012	4/2/2012
Architectural	Modeling	Check East Views Redesign according to meeting with Prof. Holland										
Electrical	Schematic Design & System Analysis	Plug Load Research Load Calculation										
	Distribution System Design Development	Location of Panels through Building Sizing of Conduit & Wiring Conduit Routing throughout Building										
	Modeling	Revit - Coordination w/ other disciplines										
	Value Engineering	Redesign if necessary based on CM's Estimate										
	Design Documentation	Finalize System										
	Daylighting	Schematic Design	Space Daylight Utilization Analysis Controls for Daylight Harvesting Integration with Lighting System 3DS Modeling for best shading analysis									
Modeling		Revit - Coordination w/ other disciplines Daysim Model for verification										
Value Engineering		Redesign if necessary based on CM's Estimate										
Design Documentation		Finalize Design										
Lighting	Conceptual & Schematic Design	Lobby Atrium Space										
		Concourse										
		Mt. Nitang Room										
		Club Dining										
	Design Development	Other Club Level Spaces										
		Luminaire Selection										
		Calculations										
		Integration of Daylighting Controls										
		Energy Analysis & Code Compliance Check										
		Revit - Coordination w/ other disciplines										
Value Engineering	Redesign if necessary based on CM's Estimate											
	Aiming Diagram											
Design Development	Lighting Layout											
	Finalize Cut Sheets											
Mechanical	Schematic Design	Adjust Trace Model for New Area & Volume										
	Modeling	Trace-Load & Energy Analysis Revit - Coordination w/ other disciplines										
	Value Engineering	Redesign if necessary based on CM's Estimate										
Structural	Schematic Design & System Analysis	Check Exterior Columns for Strength Requirements										
		Design additional Steel Members										
	Modeling	Analyze & Design Exterior Glazing Panels										
		Revit - Coordination w/ other disciplines Model members in Revit										
Value Engineering	Redesign if necessary based on CM's Estimate											
CM	Estimate	Update Cost Based on Façade/Light/Elect/Mech Design										
	Scheduling	Update Schedule Based on Façade/Light/Elect/Mech Design										
	LEED	Update LEED Score Card Based on Façade/Light/Elect/Mech Design										

Façade Redesign

Proposed Objectives:



- Analysis/Design of Glazing Panels
- Member Capacity Checks – Alternative Materials
- Building Envelope Analysis



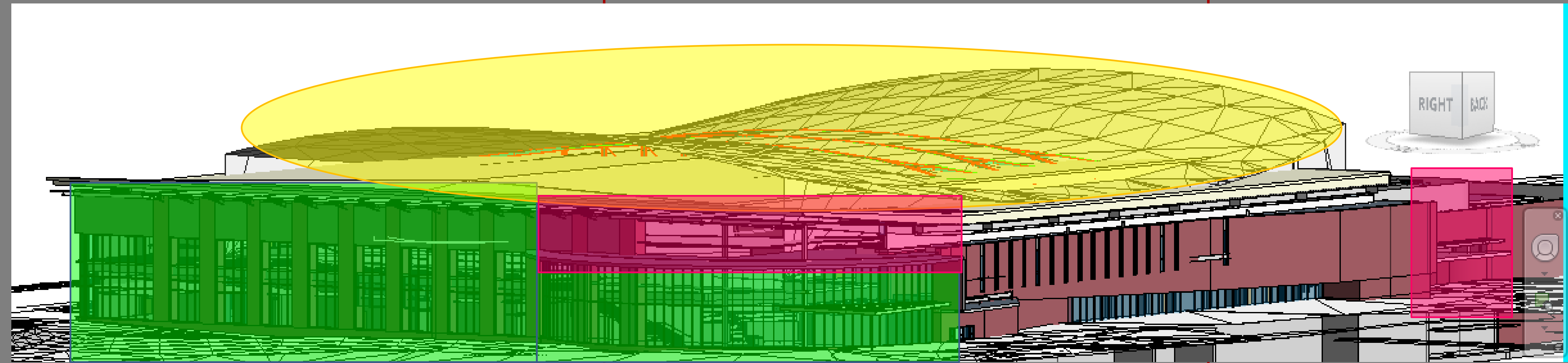
- Day lighting Design – East Façade
- Daylight Utilization, Controls and Lighting
- Energy Analysis and Code Compliance



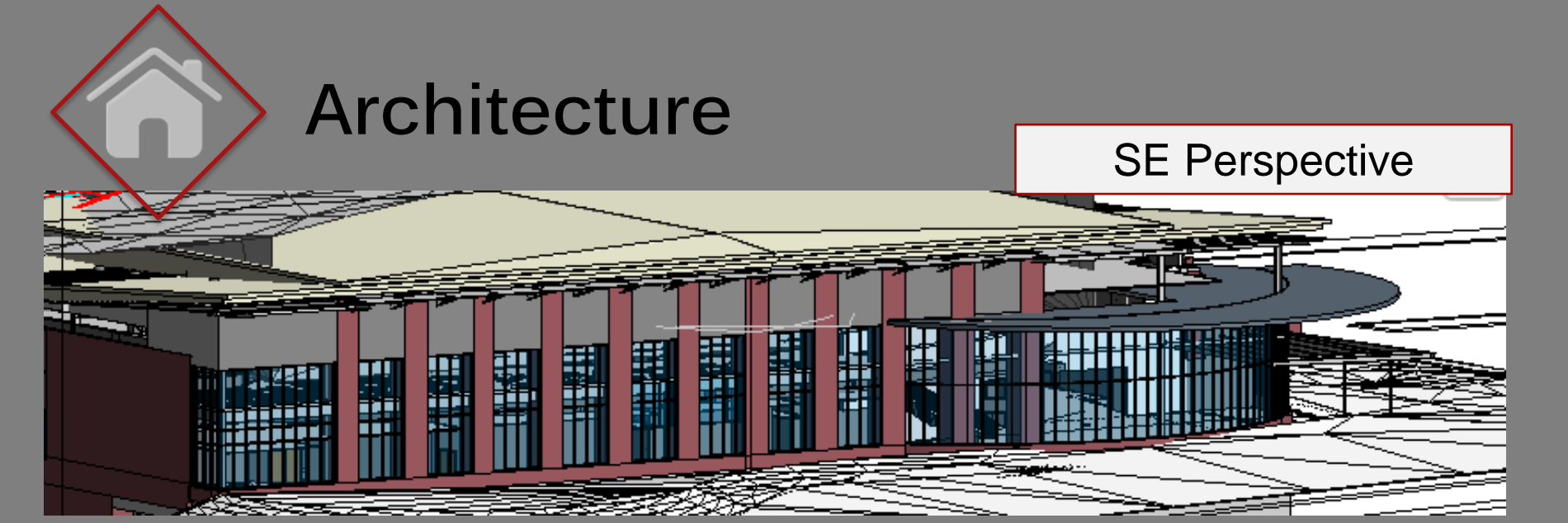
- Load and Energy Analysis
- Façade Design
- Volume and Area Adjustments



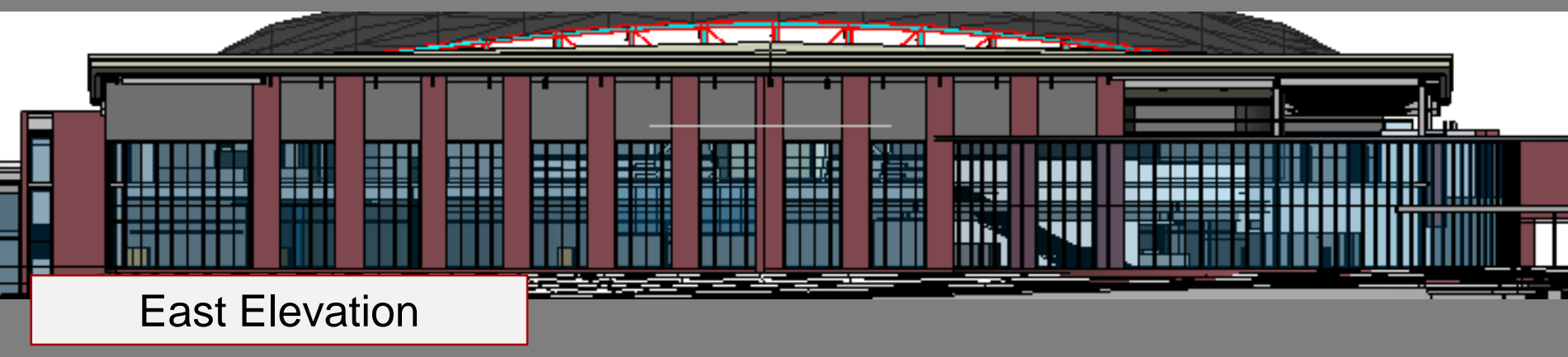
- LEED Analysis
- Cost and Schedule Impacts – Alternative Design



[RE]DESIGN: Façade Redesign



SE Perspective



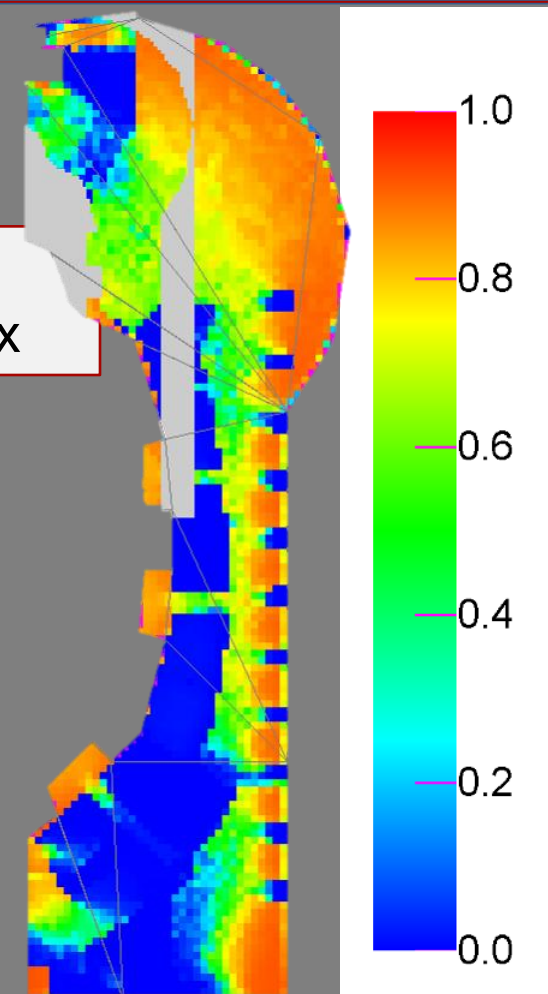
East Elevation

Lighting/Electrical



Daylighting Analysis

Daysim Daylight
Autonomy = 500 lx



Cost Research

Construction



Mechanical



Adjusted Trace
Calculation

System Checksums
By ACADEMIC

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES				
MoHr: 7 / 15				MoHr: 7 / 18				MoHr: Heating Design				Cooling Heating				
Outside Air: OADBWBHR: 91 / 74 / 101				OADB: 87				OADB: 11				SADB: 55.0 95.0				
Space	Plenum	Net	Percent	Space	Percent	Space	Coil Peak	Percent	Space	Coil Peak	Percent	Ra Plenum	Return	Ra Plenum	Return	
Sens. + Lat	Sens. + Lat	Total	Total	Sens. + Lat	Total	Sens. + Lat	Total	Total	Sens. + Lat	Total	Total	75.8	67.5	75.8	67.5	
Btuh	Btuh	(%)	(%)	Btuh	(%)	Btuh	(%)	Btuh	(%)	(%)	(%)	35.6	35.6	35.6	35.6	
Envelope Loads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Skylite Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Skylite Cond	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roof Cond	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glass Solar	3,940	0	3,940	3	6,662	8	6,662	8	6,662	8	6,662	0	0	0	0	0
Glass/Door Cond	1,313	0	-1,313	1	1,313	2	-1,313	2	-1,313	2	-1,313	0	0	0	0	0
Wall Cond	2,090	2,496	4,586	3	2,115	2	2,115	2	2,115	2	2,115	0	0	0	0	0
Partition/Door	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Floor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjacent Floor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Infiltration	8,496	0	8,496	6	2,617	3	2,617	3	2,617	3	2,617	0	0	0	0	0
Sub Total ==>	15,839	2,496	18,335	13	12,707	15	12,707	15	12,707	15	12,707	-25,623	-34,128	37.44		
Internal Loads																
Lights	8,368	1,905	10,273	7	8,368	10	8,368	10	8,368	10	8,368	10,272	-91.27			
People	13,300	0	13,300	10	6,900	8	6,900	8	6,900	8	6,900	6,900	-7.57			
Misc	56,840	0	56,840	41	56,840	68	56,840	68	56,840	68	56,840	56,840	-62.36			
Sub Total ==>	78,508	1,905	80,413	58	72,108	84	72,108	84	72,108	84	72,108	74,013	-81.19			
Ceiling Load	964	-964	0	0	964	1	-3,028	0	0	0	0	0	0	0	0	0
Ventilation Load	0	0	0	0	0	0	0	0	0	0	0	-41,607	-45.64			
Adj Air Trans Heat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dehumid. Ov Sizing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OvUndr Sizing	0	0	0	0	0	0	0	0	0	0	0	-72,372	-79.38			
Exhaust Heat	0	0	0	0	0	0	0	0	0	0	0	2,252	-2.47			
Sup. Fan Heat	0	0	0	0	0	0	0	0	0	0	0	-7,444	-7.40			
RA Preheat Diff.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Additional Reheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underflr Sup Ht Pkwp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Supply Air Leakage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total ==>	95,311	2,497	137,020	100.00	85,769	100.00	85,769	100.00	85,769	100.00	85,769	-28,915	-91,155	100.00		

Structural



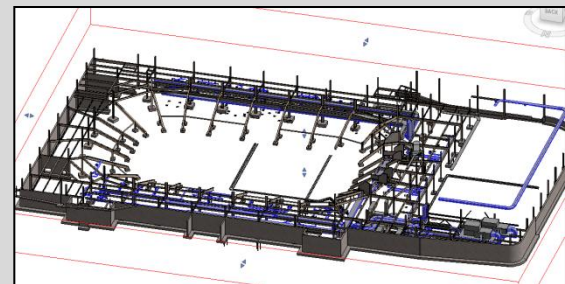
Glazing Analysis
Research

PROJECTED PROGRESS REPORT:

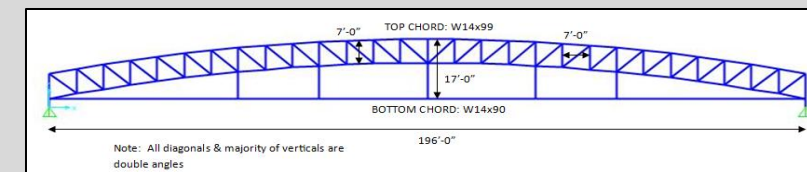


Monday, February 20th

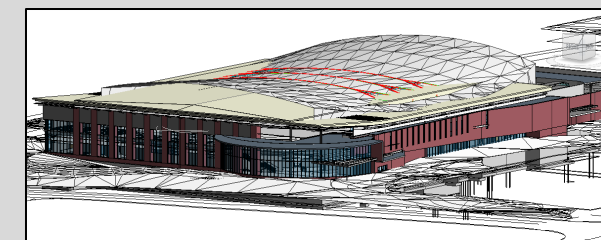
Event Level Raising



Main Arena Roof Systems



Façade Redesign



PROGRESS



Semester Start

Milestone #1

Milestone #2

Milestone #3

Milestone #4

Project Due

Presentation

1/9/2012

1/27/2012

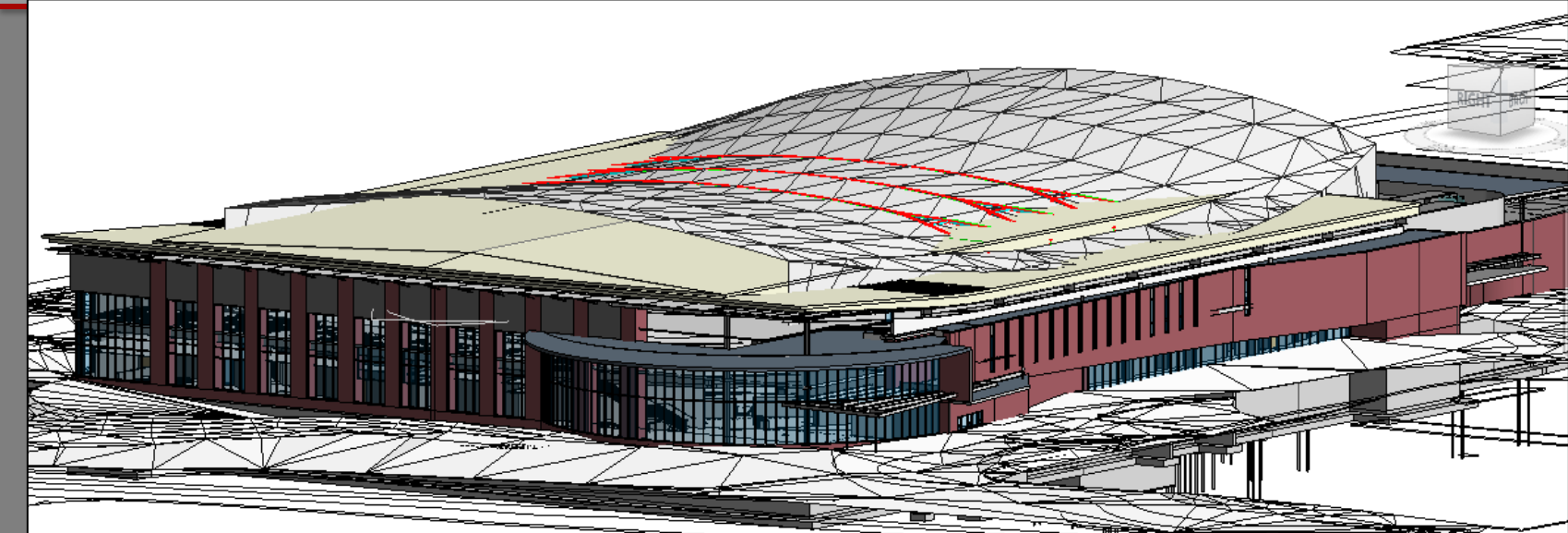
2/13/2012

3/2/2012

3/26/2012

4/4/2012

4/9/2012



Presentation #5:
Thank You
Questions & Comments
Penn State Ice Hockey Arena
The Pennsylvania State University

