





HPR INTEGRATED DESIGN

 Jeremy Heilman CONSTRUCTION	 Nico Pugliese LIGHTING/ELECTRICAL
 Josh Progar STRUCTURAL	 James Rodgers MECHANICAL

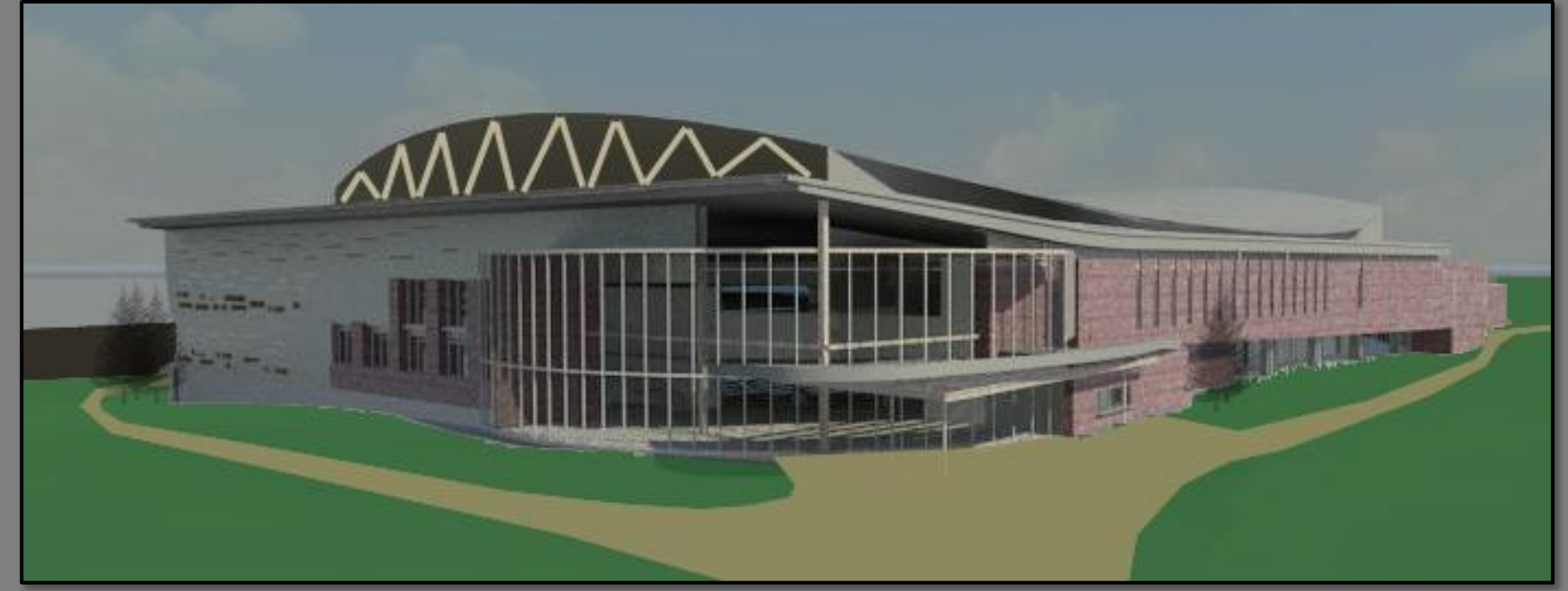
Presentation #3: Design Presentation

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.



Project Goals

- ✓ Create a loud and exciting environment for NCAA Division 1 Men's & Women's Hockey
- ✓ 6000 seat facility
- ✓ 2 sheets of ice (competition and community)
- ✓ Championship Ice
- ✓ Ice Hockey only training facility (weight room)
- ✓ Mt. Nittany Room and Club Level Restaurant
- ✓ Create a facility that ultimately generates revenue

Team Goals

- ✓ Seamless work flow integration of all disciplines
- ✓ Increased Sustainability
- ✓ LEED Gold
- ✓ Improve System Design Efficiency
- ✓ Efficient Constructability
- ✓ Reduced Budget and Schedule



<http://www.facebook.com/photo.php?fbid=10150384121867952&set=pu.194501567951&type=1&theater>



HPR Integrated Design's Project Touchstones for the Penn State Ice

- ✓ Improve the Game Day experience for both the fans and players
- ✓ Create an environment that fosters hockey excellence
- ✓ Minimize the amount of energy the facility consumes
- ✓ Create an architecturally recognizable facility
- ✓ Maximize value with minimizing cost
- ✓ Earn a LEED Gold rating



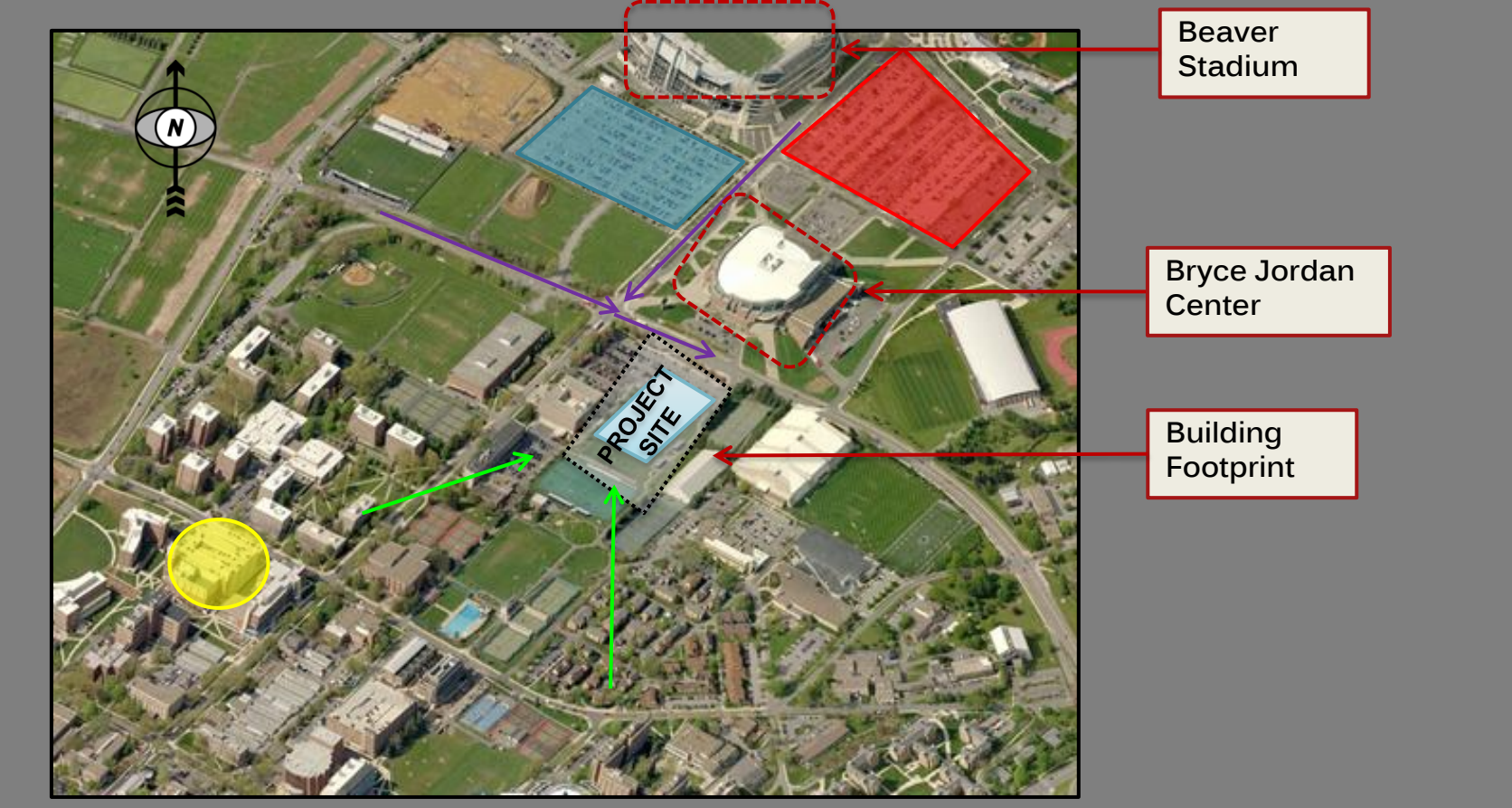
Cost Efficiency



Design Aesthetics



Sustainability



East Parking Deck BJC Parking Beaver Stadium Parking

Vehicular travel ← Student Travel ←

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
6-10p	6-10p	5:30-7:30p	6-10p	5:30-7:30p	By appt.	By appt.
Design & Coord.	As needed	Weekly General	As needed	Design & Coord.	As needed	As needed

OLD



Needed Improvement

- Group needed to improve of the collaborative nature of our design process
- Simple coordination meetings were not enough to effectively share information and ideas

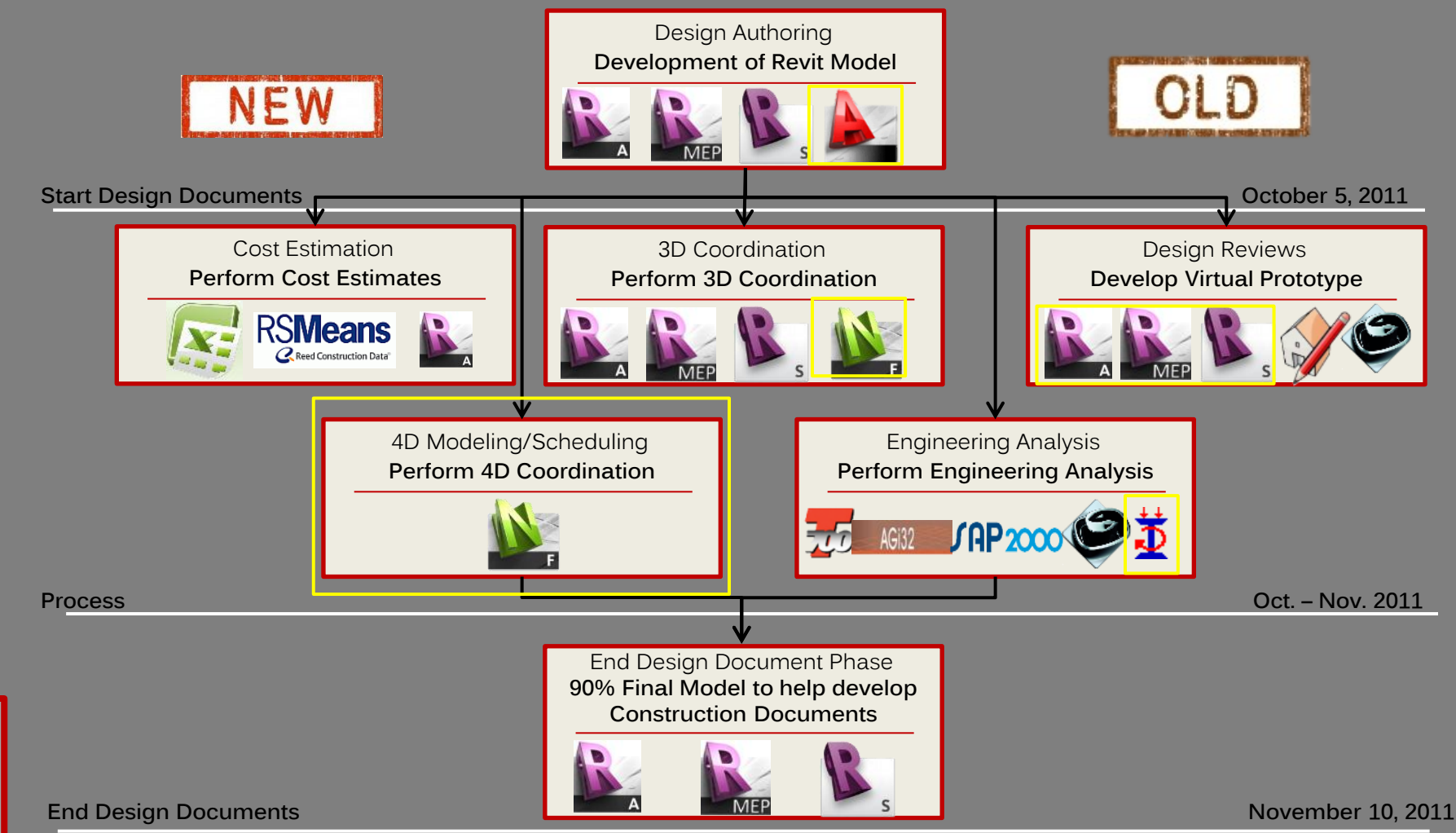
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
6-10p	6-8p	5:30-7:30p	6-10p	5:30-7:30p	By appt.	By appt.
Work Session	Coordination Meeting	Work Session & Weekly General	As needed	Coordination Meeting	As needed	As needed

NEW

Solution

8 hour minimum on the amount of time the whole group must spend together each week. This made sharing ideas much easier and effective.

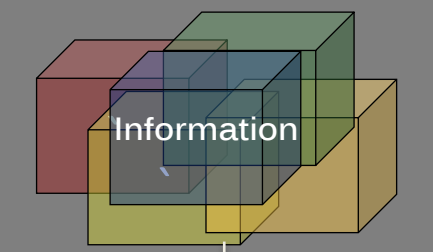
Level 1 Process Map – Design Documents



X	PLAN	X	DESIGN	X	CONSTRUCT	X	OPERATE
	PROGRAMMING	X	DESIGN AUTHORIZING		SITE UTILIZATION PLANNING		BUILDING MAINTENANCE SCHEDULING
	SITE ANALYSIS	X	DESIGN REVIEWS		CONSTRUCTION SYSTEM DESIGN		BUILDING SYSTEM ANALYSIS
		X	3D COORDINATION		3D COORDINATION		ASSET MANAGEMENT
		X	STRUCTURAL ANALYSIS		DIGITAL FABRICATION		SPACE MANAGEMENT / TRACKING
		X	LIGHTING ANALYSIS		3D CONTROL AND PLANNING		DISASTER PLANNING
		X	ENERGY ANALYSIS		RECORD MODELING		RECORD MODELING
		X	MECHANICAL ANALYSIS		OUT OF SCOPE OF THIS PROJECT		RECORD MODELING
			OTHER ENG. ANALYSIS				
		X	SUSTAINABILITY (LEED) EVALUATION				
			CODE VALIDATION				
X	PHASE PLANNING (4D MODELING)	X	PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)
	COST ESTIMATION	X	COST ESTIMATION		COST ESTIMATION		COST ESTIMATION
X	EXISTING CONDITIONS MODELING	X	EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING

Required by Contract
 Used for this Stage of design

Information Exchange



Y: Drive-BIM Folder (HPR Integrated Design) + S: Drive – BIM Folder



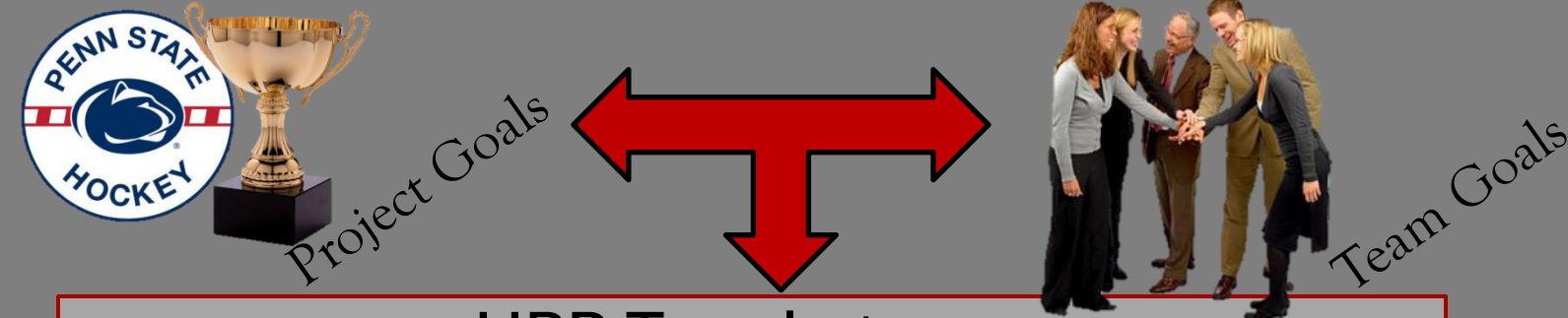
Worksets
New Central Files

Meeting Minutes



BIM Thesis Design Team Meeting
Meeting #5
Date: 9.28.11
Meeting Location: Thesis Lab

Overview of Team Investigation & Redesign



HPR Touchstones

- Improve the Game Day experience for both the fans and players
- Create an environment that fosters hockey excellence
- Minimize the amount of energy the facility consumes
- Create an architecturally recognizable facility
- Maximize value with minimizing cost
- Earn a LEED Gold rating



Cost Efficiency



Design Aesthetics



Sustainability

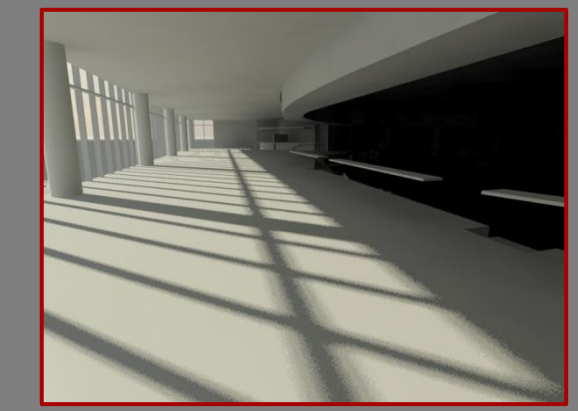
Leader	What we looked at	Why we looked at it	Decision Factors	Who was involved
	Daylighting in the Concourse	By utilizing daylighting strategies in the concourse we would be able to reduce the energy use of the lighting systems of the building and improve the fans experience.	\$	
	Daylighting in the Practice Arena	By utilizing daylighting strategies in the practice area we would be able to reduce the energy use of the lighting systems of the building	\$	
	Façade Redesign	A façade redesign could have a positive architectural impact and cause a reduction in envelope load on the building	\$	
	Long Span Truss Redesign	Architectural considerations for a new, more pronounced roof profile created the need for a new long span truss system with the possibility of increased structural efficiency	\$	
	Alternative flooring systems	An investigation in to alternate flooring systems could reveal options that either save on cost or decrease the depth of the floor, therefore increasing plenum space	\$	
	Roof Profile	By redesigning the roof profile we believe we can create a more architecturally recognizable arena as well as improve on storm water drainage and acoustical properties within the building	\$	
	Excavation Techniques	With the addition of the new Millennium Science Complex it became important to reduce the vibrations caused by excavation.	\$	
	Campus Utilities vs. Isolated System	Determining which plant option is most economical for this ice arena is important in reducing both the first cost and lifecycle cost of the arena as well as energy consumption.	\$	

[RE]DESIGN:

East Façade Redesign

REASON: To improve the architecture and reduce load on the east façade

- Touchstones**
- Minimize the amount of energy the facility consumes
 - Create an architecturally recognizable facility
 - Maximize value with minimizing cost
 - Earn a LEED Gold rating



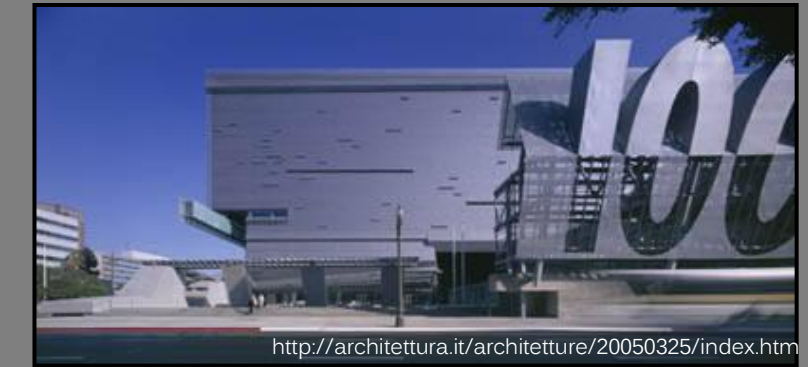
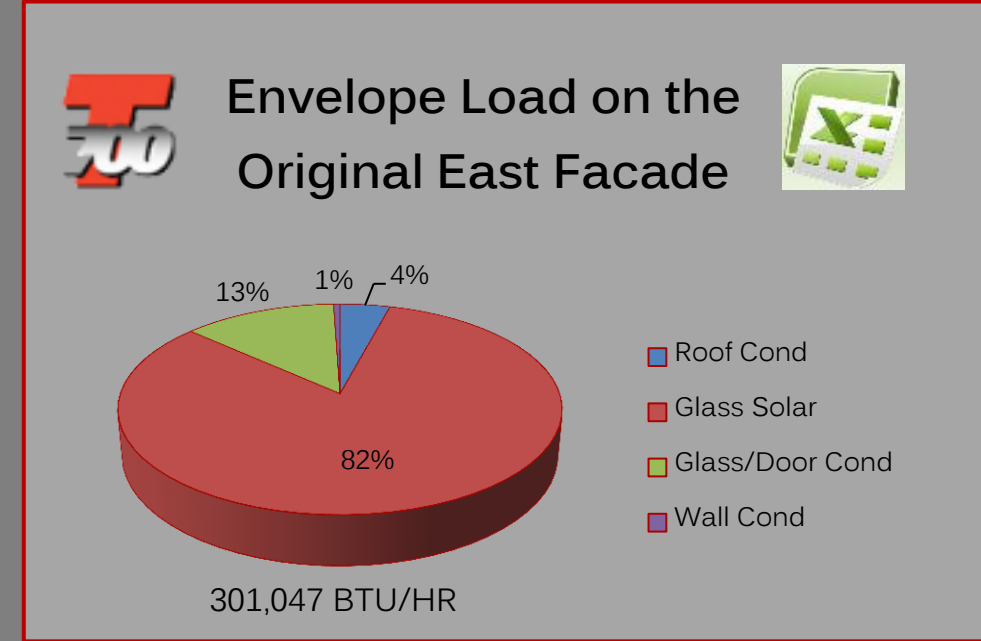
July 7am



July 8am

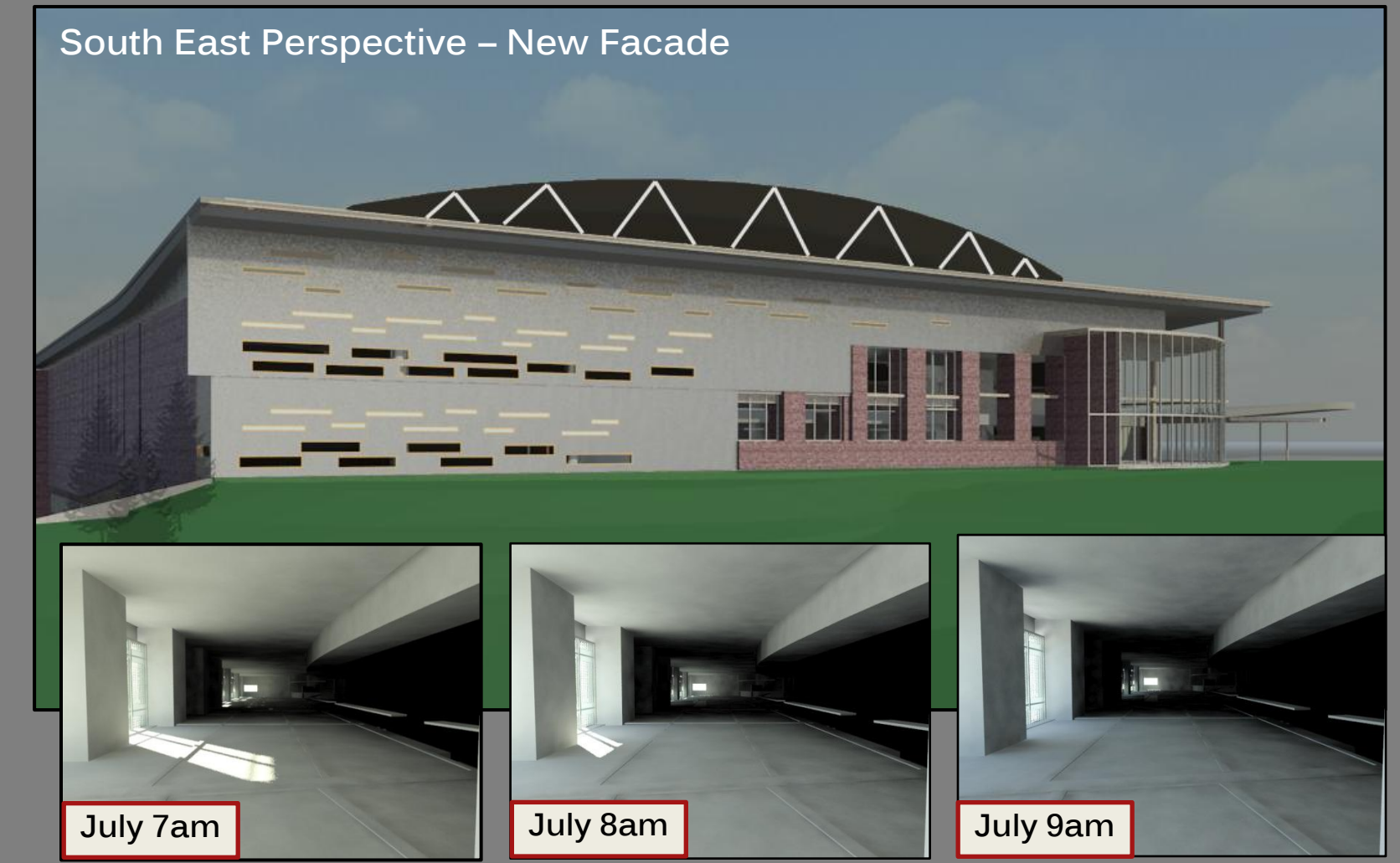
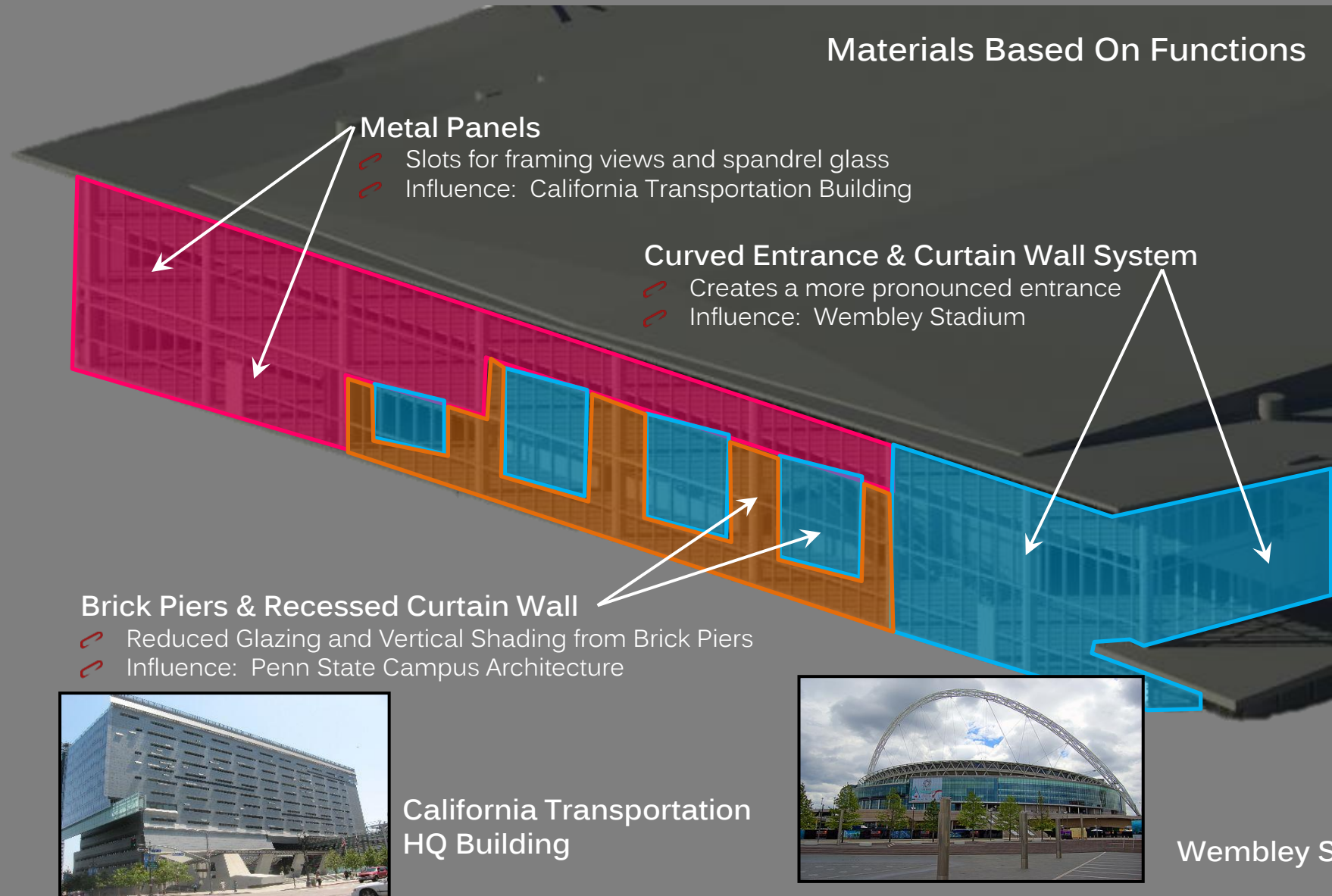
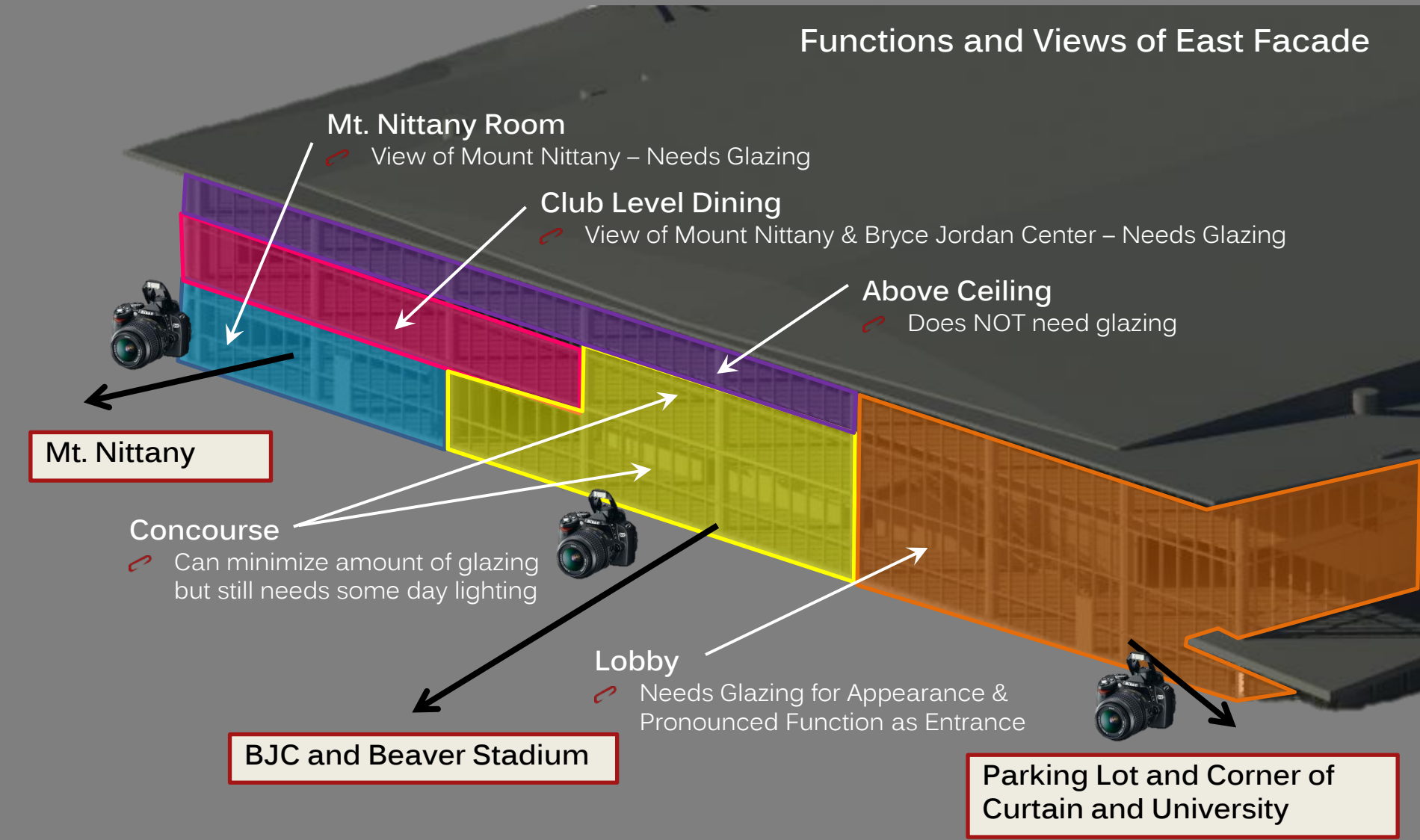


July 9am



EXISTING

“Engineering Driven, Architecturally Appealing”



PROCESS

Façade Redesign: To improve the architecture and reduce load on the east façade



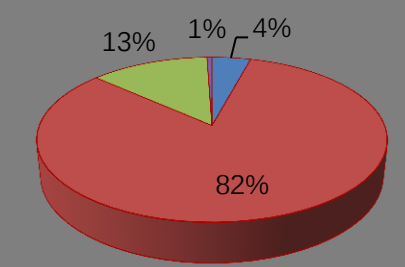
- Minimize the amount of energy the facility consumes
- Create an architecturally recognizable facility
- Maximize value with minimizing cost
- Earn a LEED Gold rating



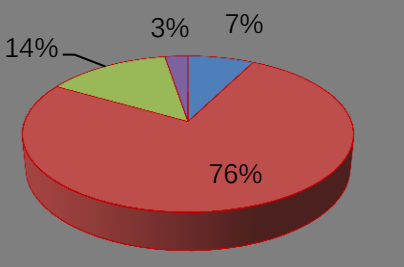
“Engineering Driven, Architecturally Appealing”



Envelope Load on the Original East Façade



Envelope Loads on the New East Façade

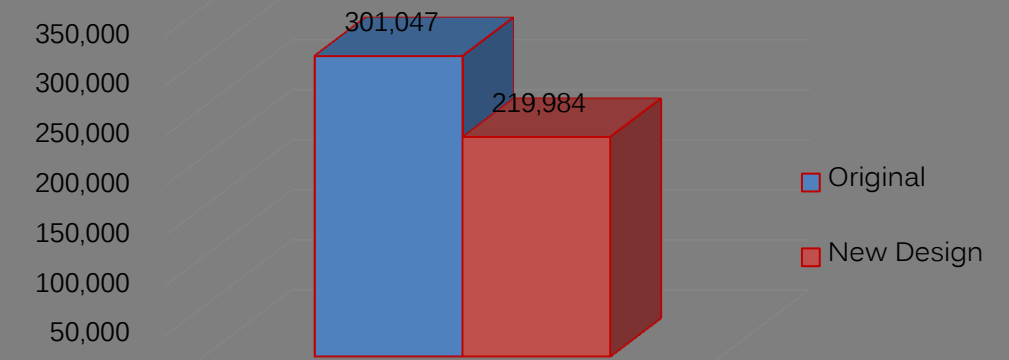


Load Reduction on East Façade = 26.9%
Total Envelope load on the East Façade

EXISTING



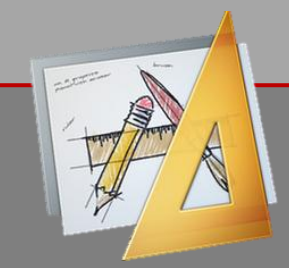
REDESIGN



COMPARISON

[RE]DESIGN: Roof Profile Redesign

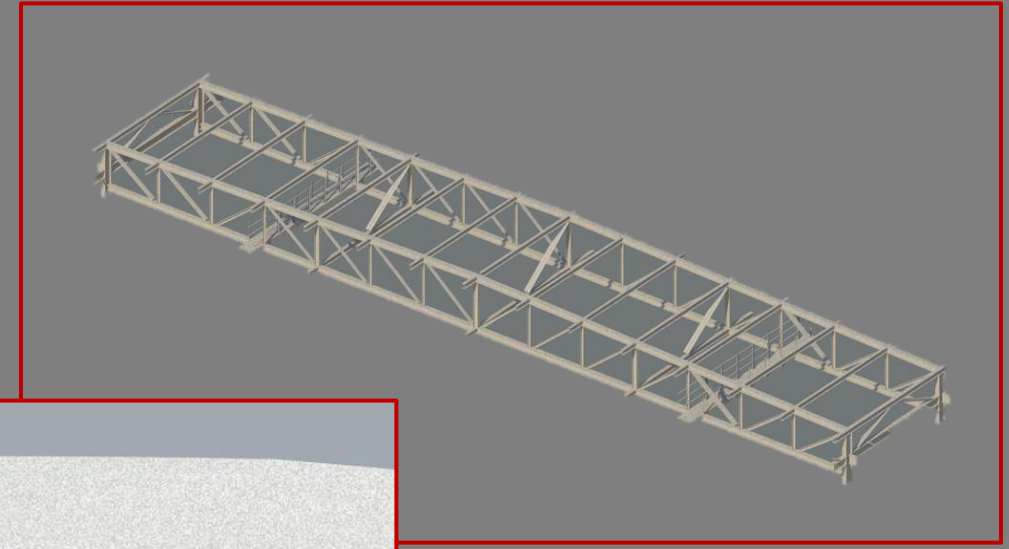
REASON: To create a more architecturally iconic roof profile



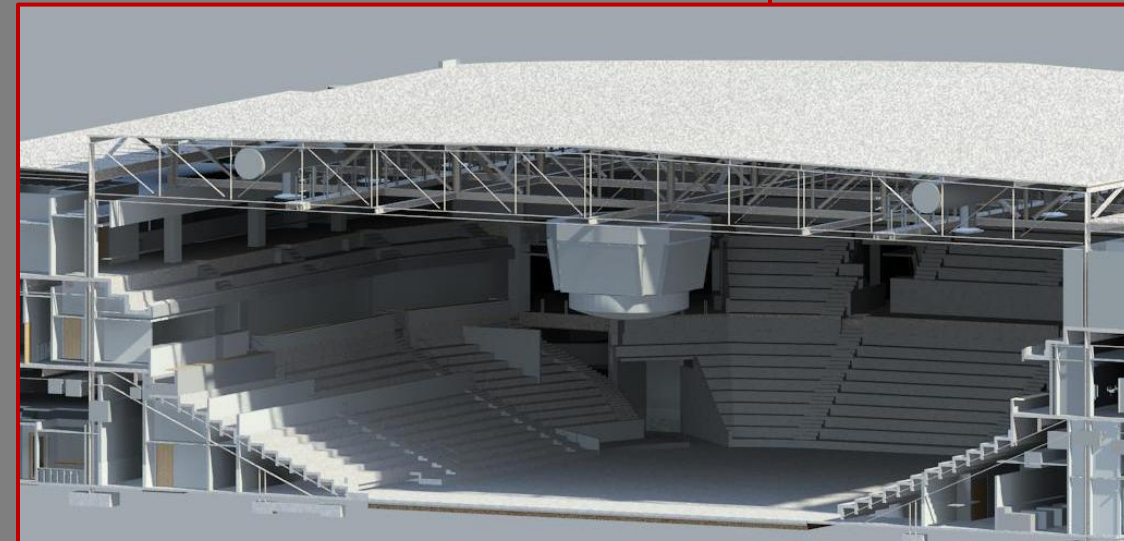
- Touchstones**
- Improve the Game Day experience for both the fans and players
 - Create an architecturally recognizable facility



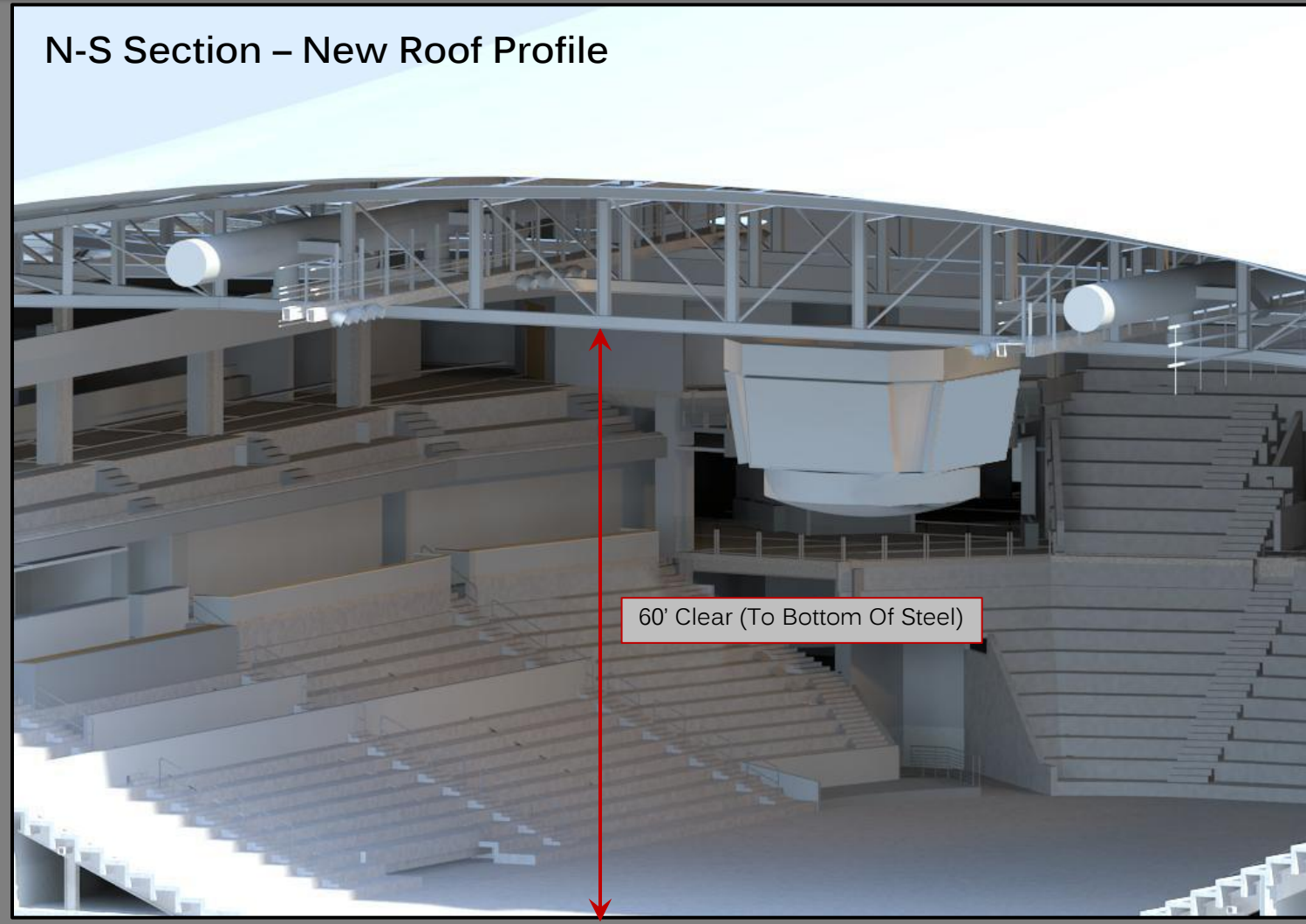
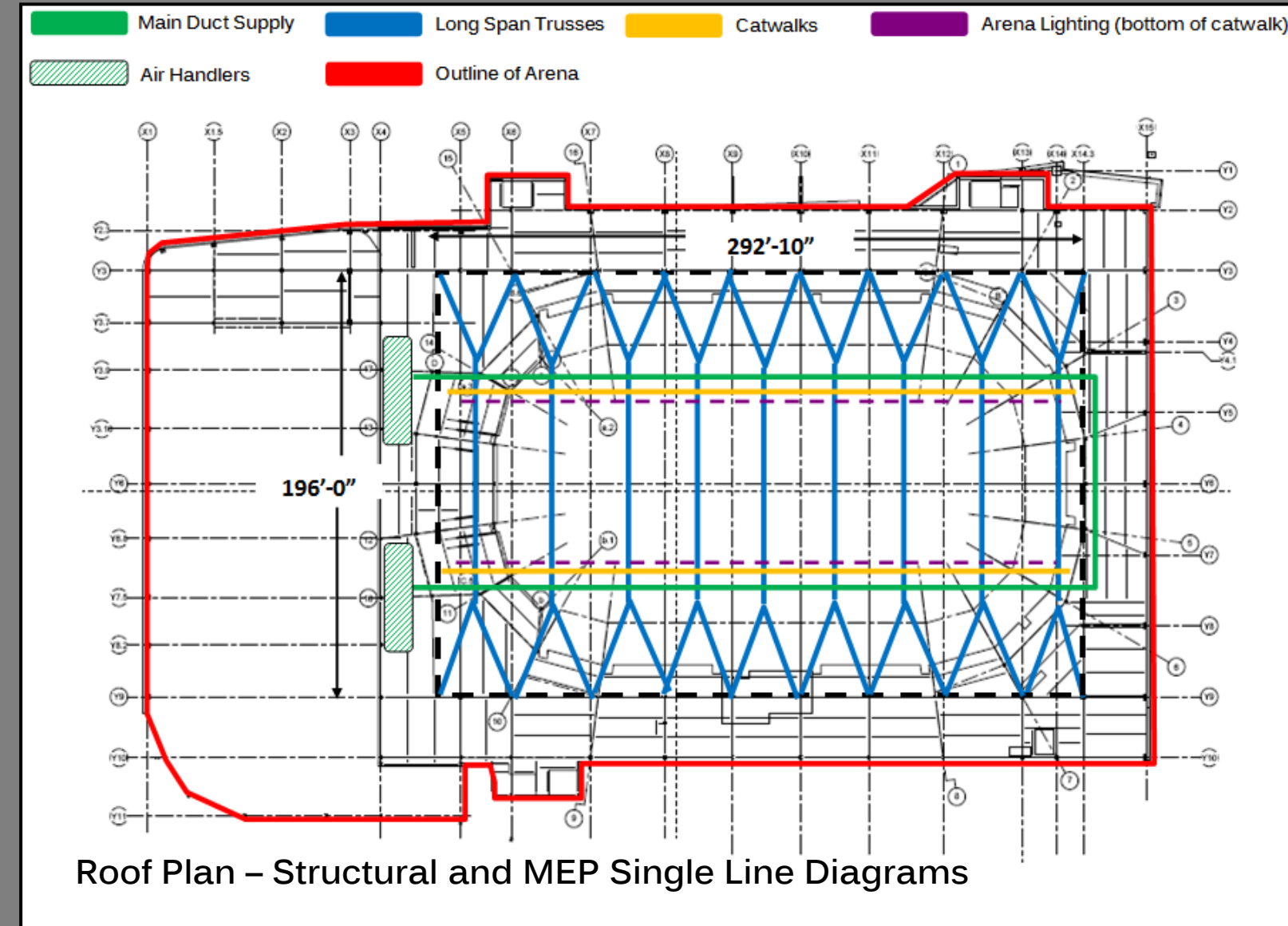
Existing Truss and Section







N-S Section – Main Arena Bowl

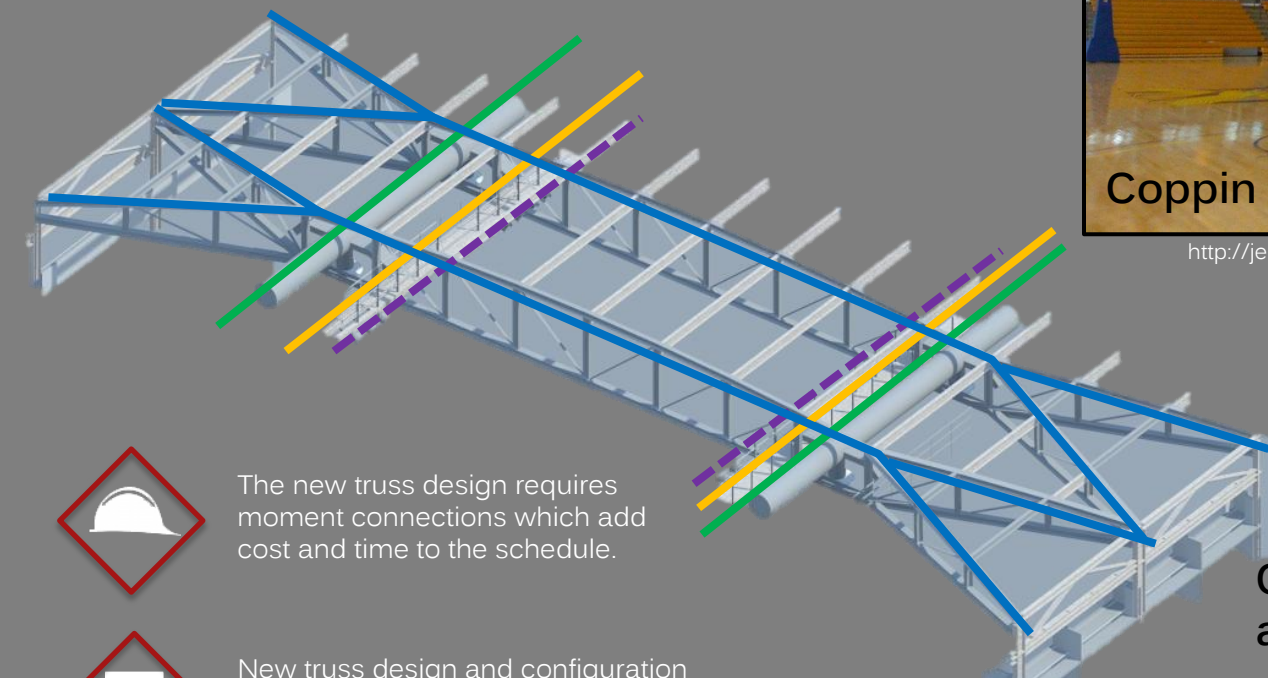


EXISTING

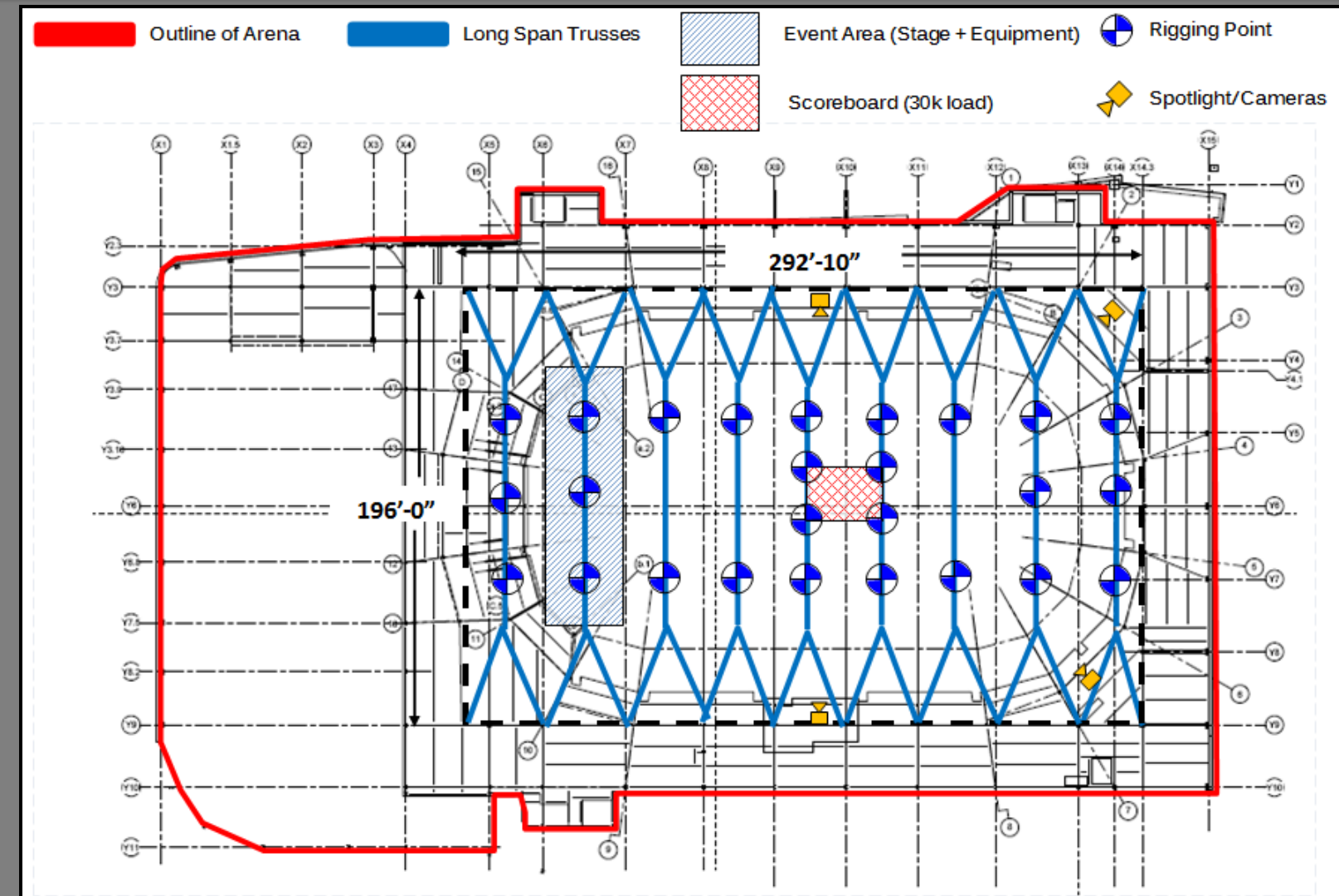


“Architecturally Driven, Technically Sound”

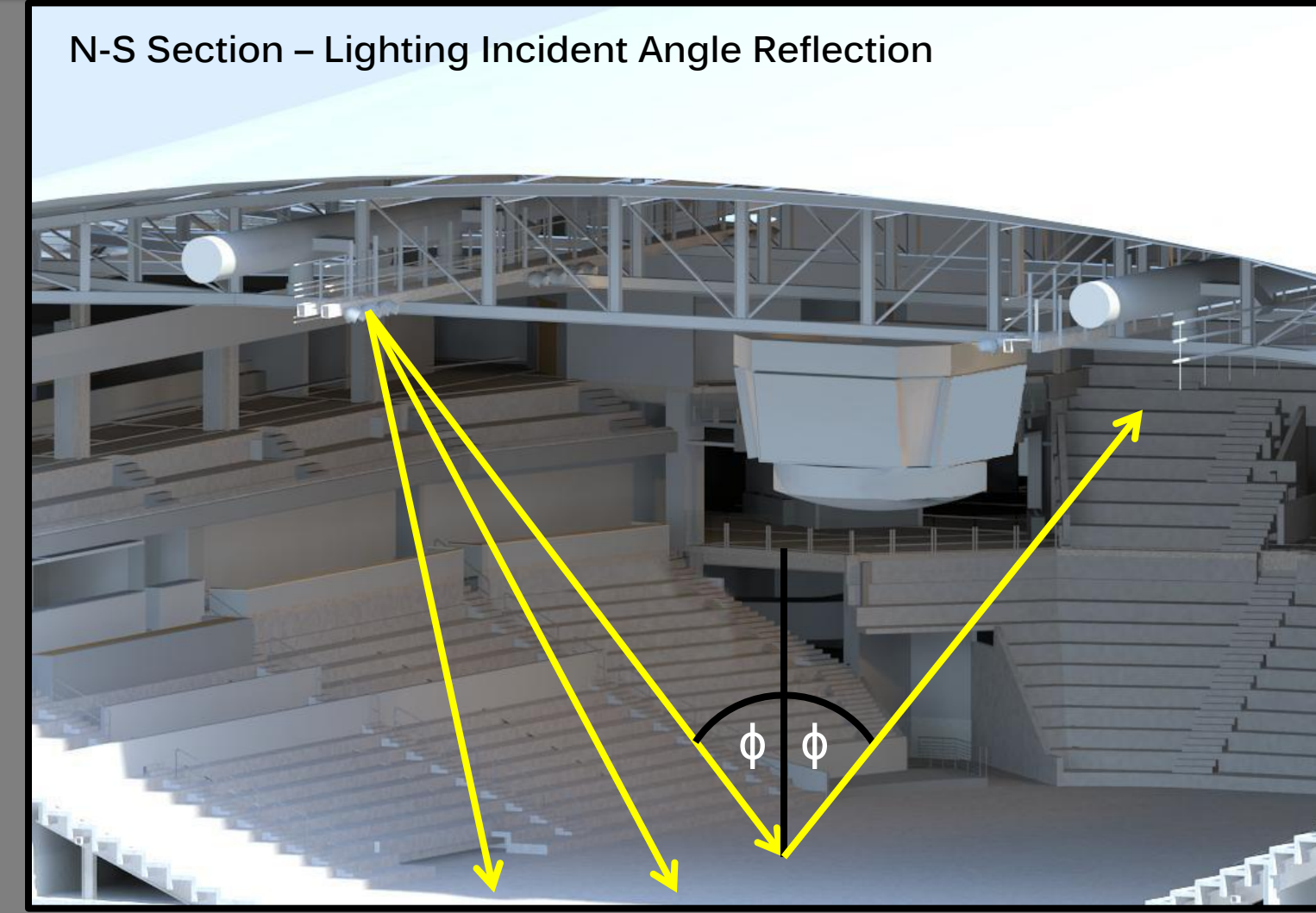
-  Duct relocated due to clash with truss. Changes included duct and extra diffuser locations.
-  Catwalks located outside vierendeel truss configuration with easy access to lights attached to underside of the catwalk.
-  The new truss design requires moment connections which add cost and time to the schedule.
-  New truss design and configuration allows for new roof profile and smaller member sizes.



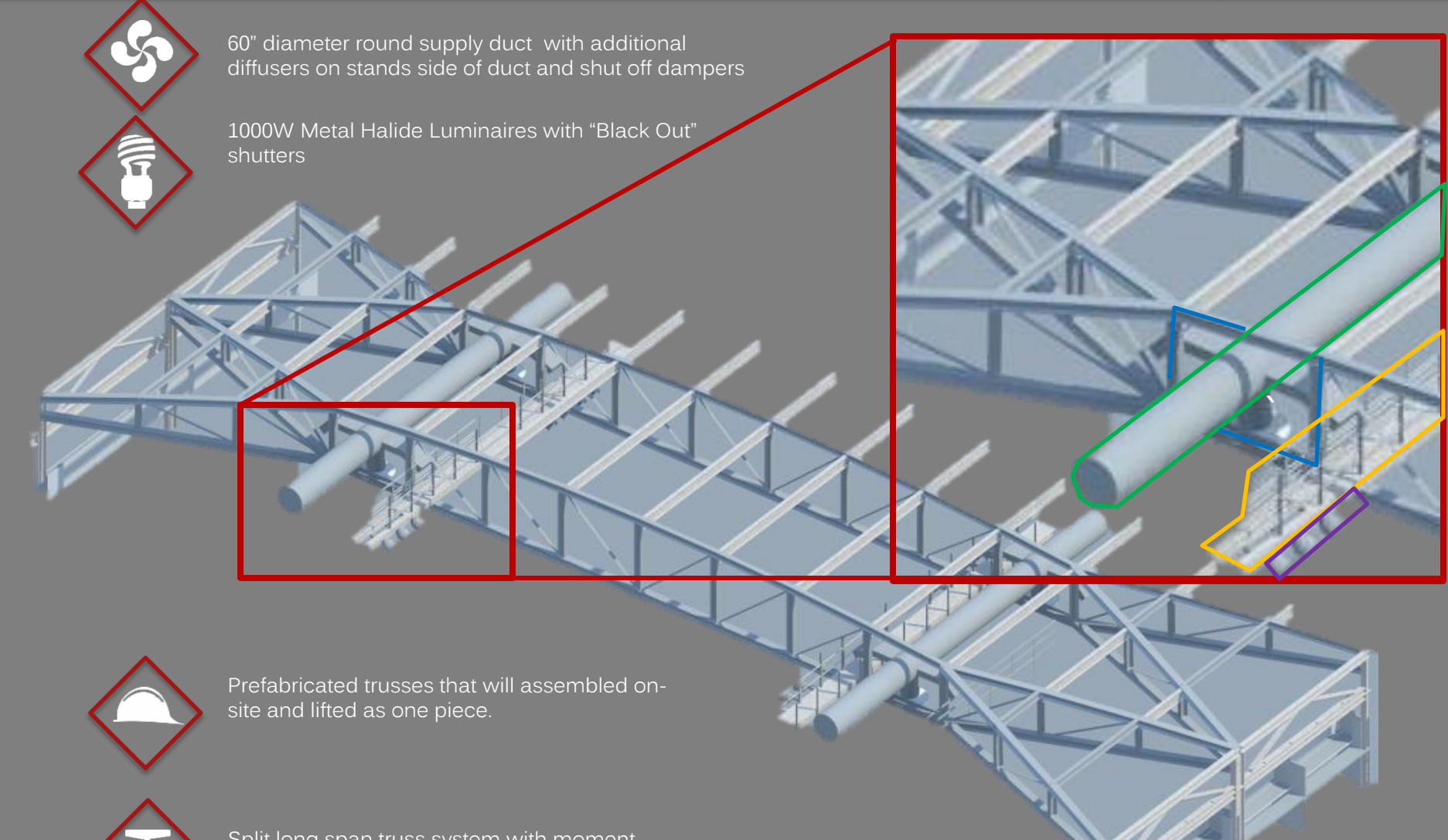
COORDINATION



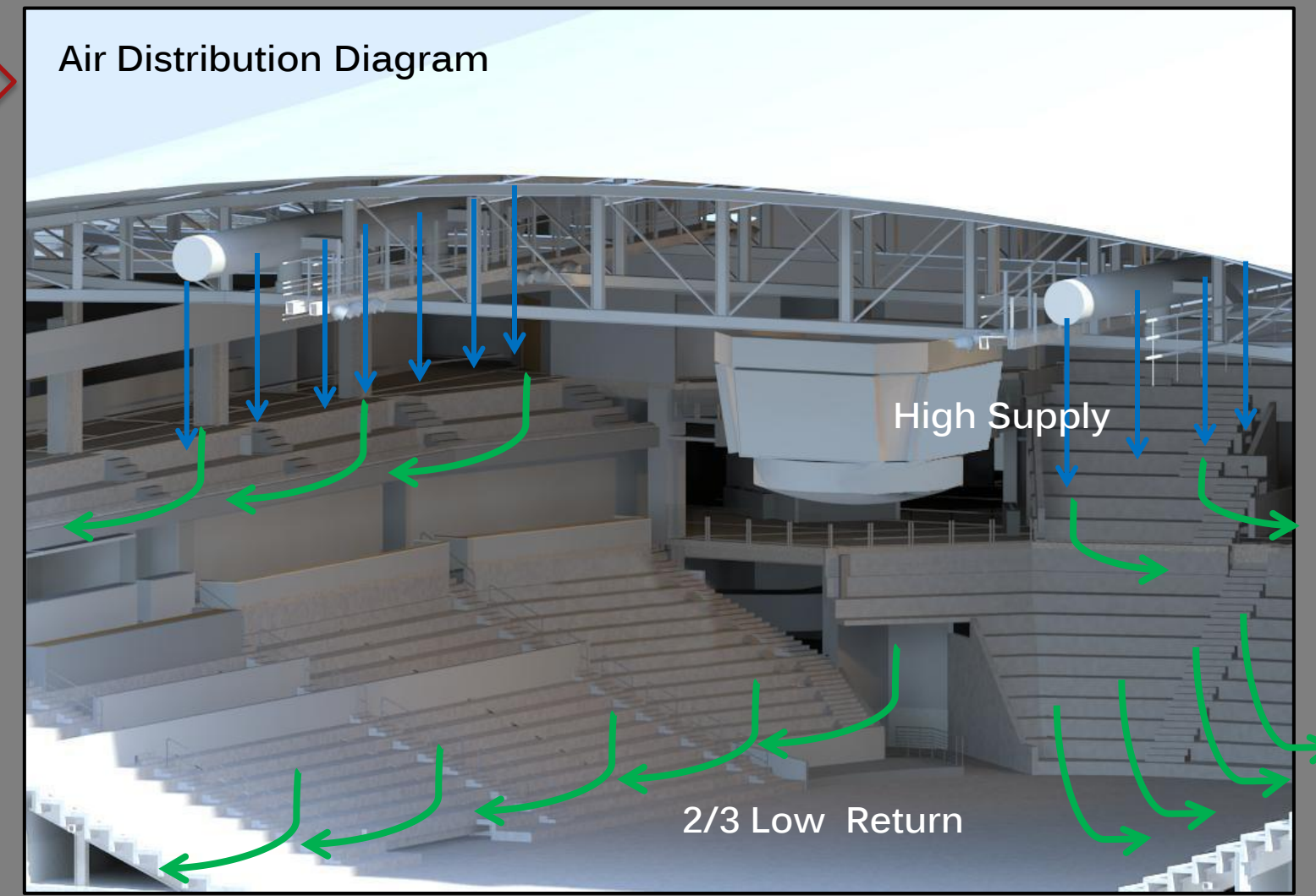
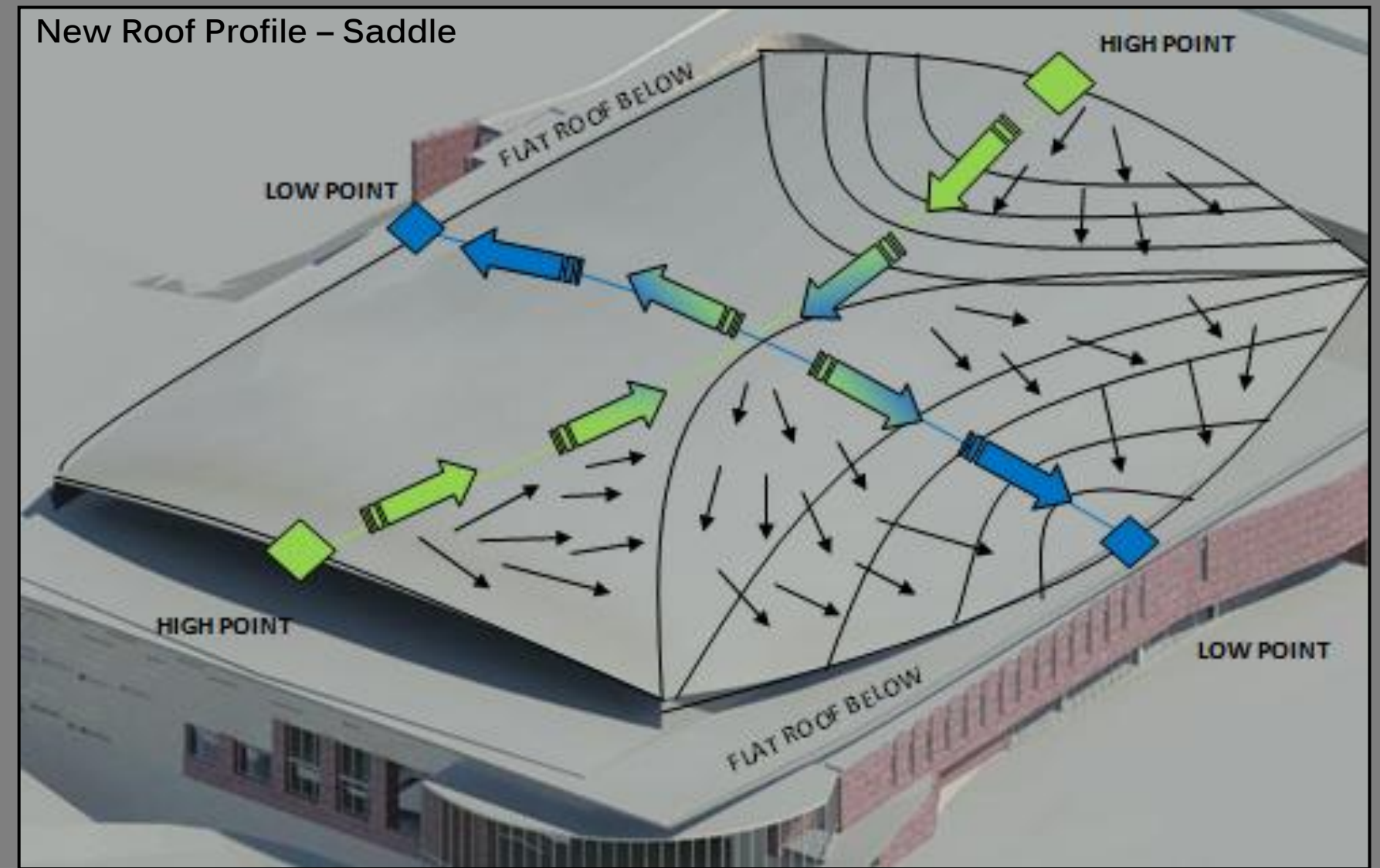
Roof Plan – Event Rigging and Camera Locations



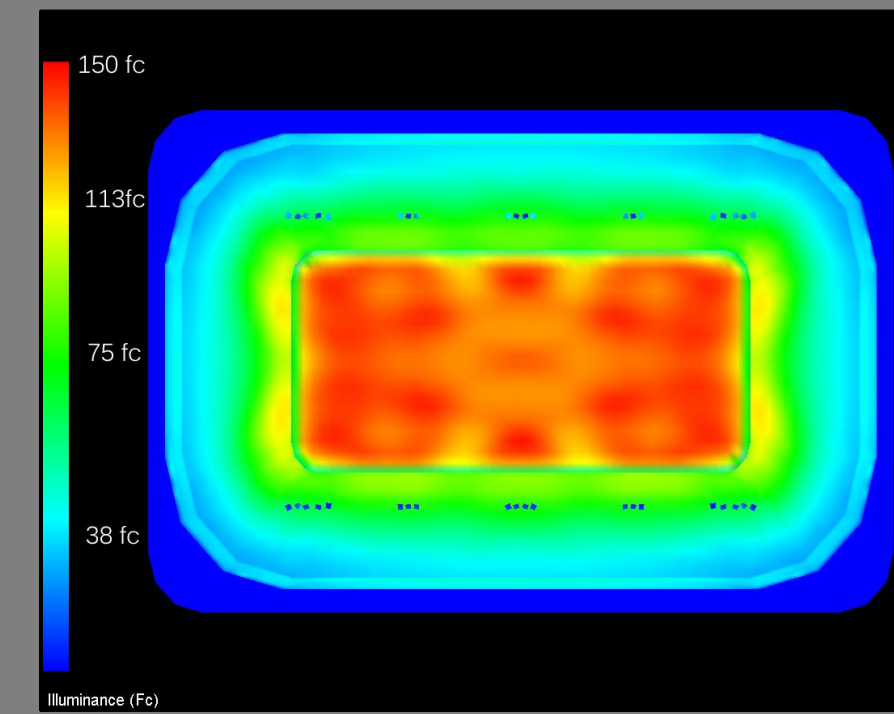
“Architecturally Driven, Technically Sound”



PROCESS



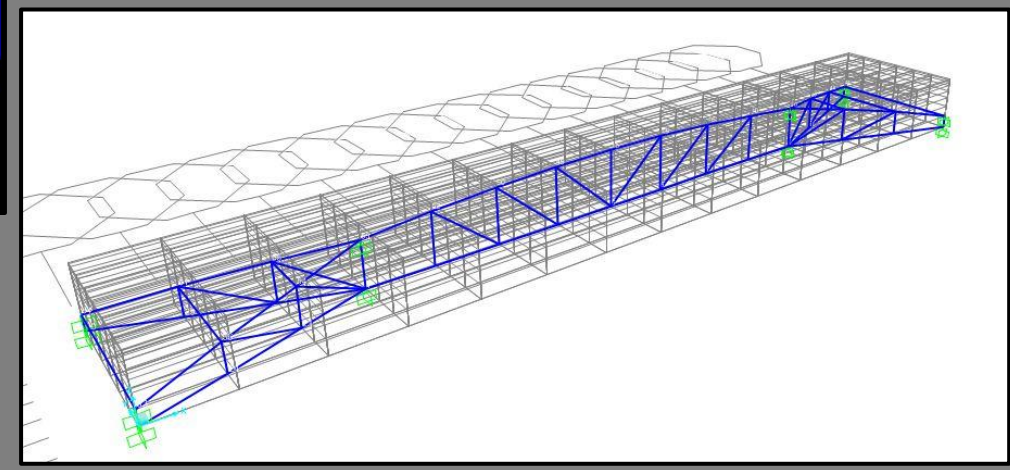
“Architecturally Driven, Technically Sound”



Horizontal Illuminance (fc): 130.98
 Emax/Emin: 1.35
 Coefficient of Variance: 0.06
 Uniformity Ratio: 1.29

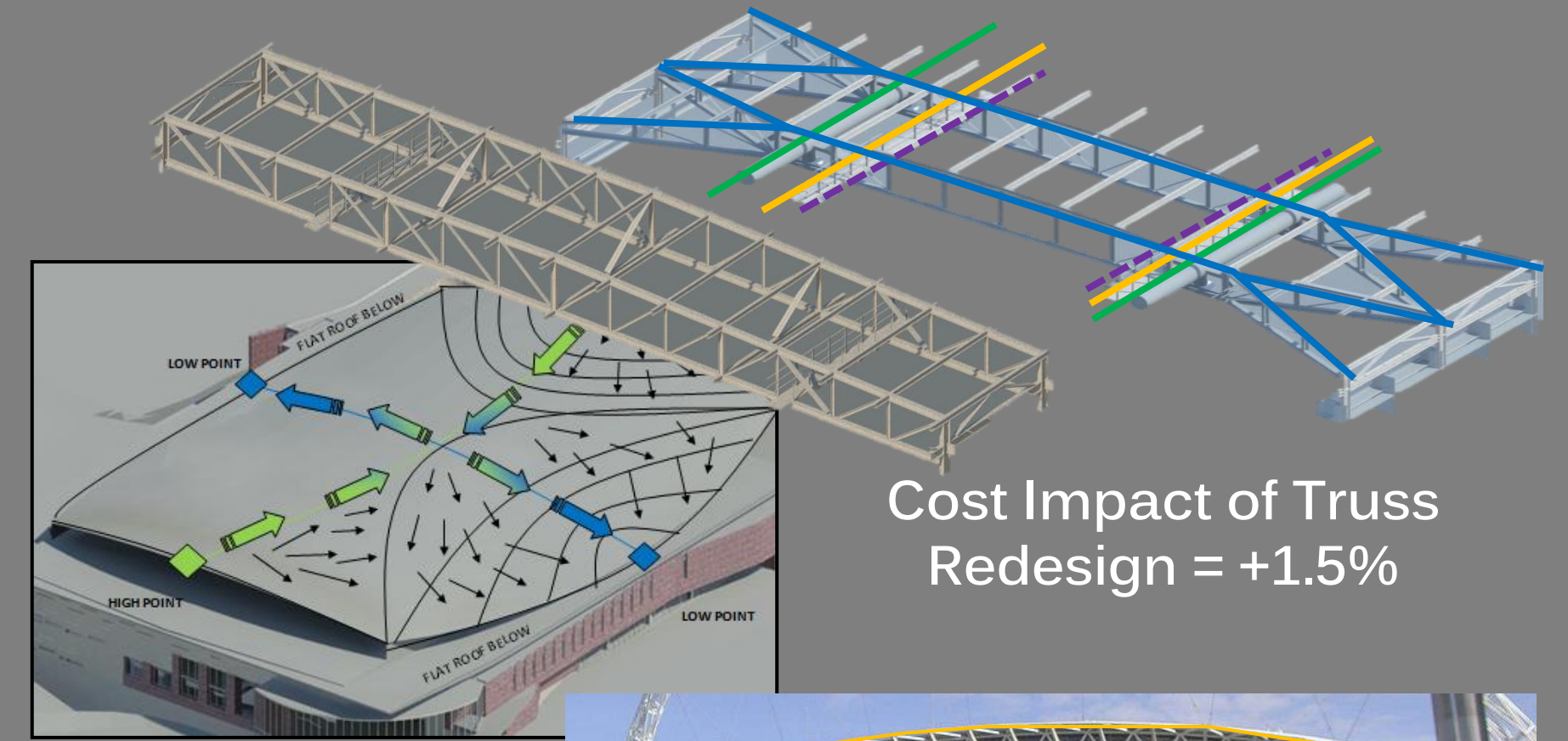
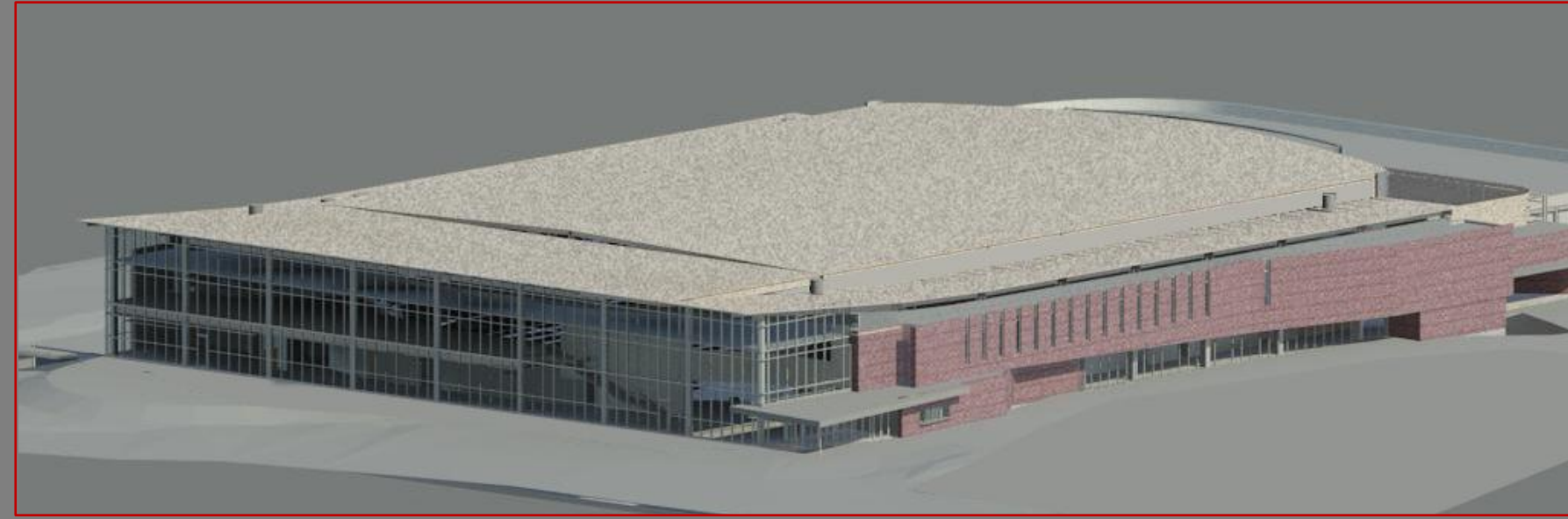
Cost Impact of Truss Redesign = +1.5%

Top Chord (Curved): W14x90
 Bottom Chord: W14x109
 Verticals: W14x61
 Diagonals: Angles LLB



PROCESS

Roof Profile: To create a more architectural recognizable



Cost Impact of Truss Redesign = +1.5%

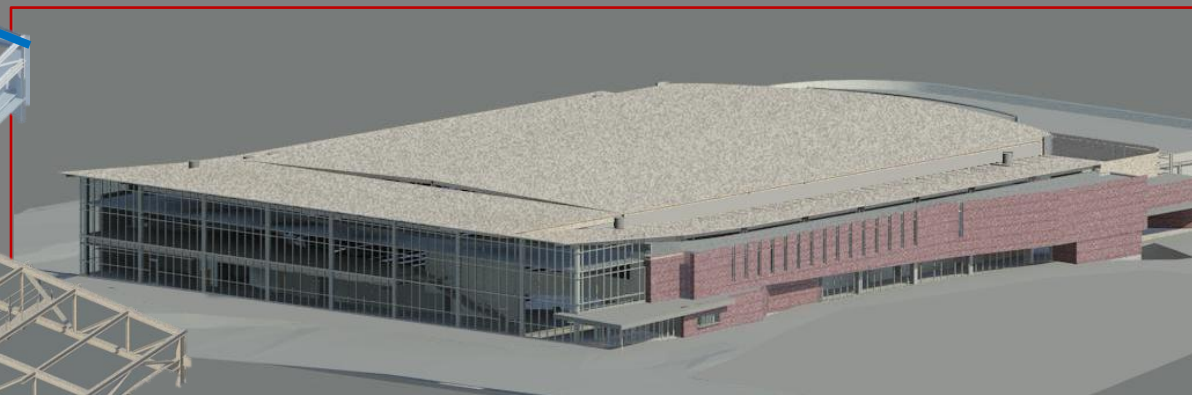
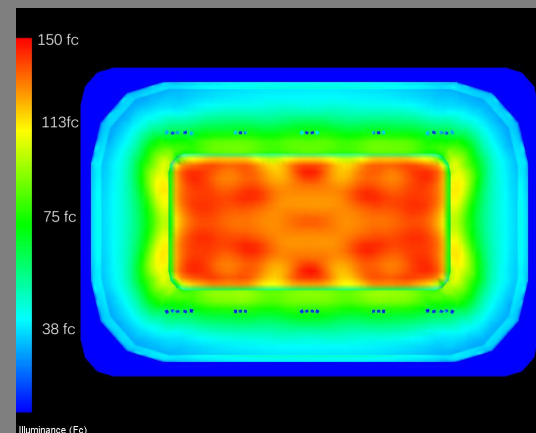


- Improve the Game Day experience for both the fans and players
- Create an architecturally recognizable facility



<http://lovingapartments.com/London-Sport-Wembley-Stadium-poi-682-en.html>

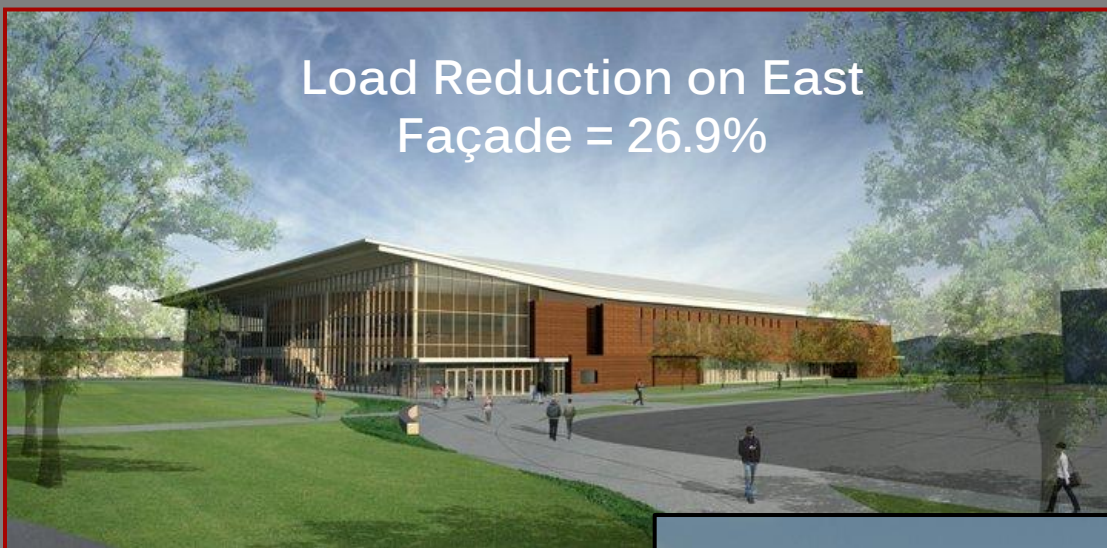
COMPARISON



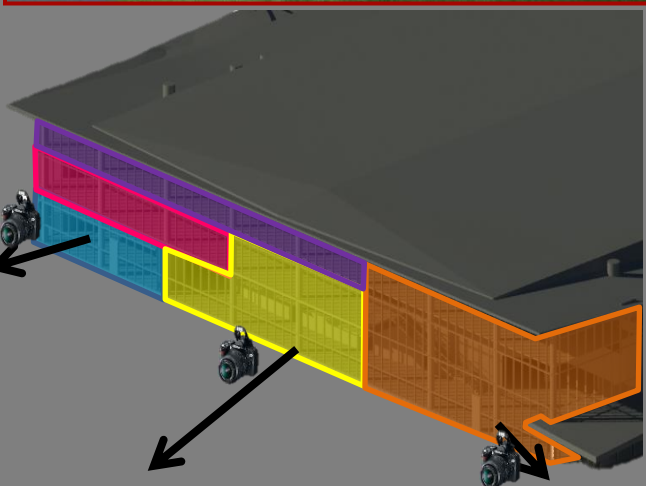
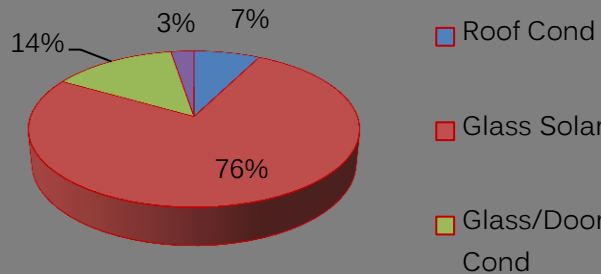
Thank You For Your Time!



Please feel free to ask questions.



Envelope Loads on the New East Façade



Cost Increase for Truss Redesign = +1.5%