HPR INTEGRATED DESIGN

Jeremy Heilman
CONSTRUCTION

Nico Pugliese
LIGHTING/ELECTRICAL

Josh Progar
STRUCTURAL

James Rodgers
MECHANICAL

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.

Presentation #3:
Design Presentation
Penn State Ice Hockey Arena
The Pennsylvania State University

INTRODUCTION
BIM-EX
REDESIGN
FACADE
MAIN ARENA
INTRODUCTION

BIM - EX MAIN ARENA REDESIGN FACADE

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

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

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**Introduction**

8 hour minimum  

**Monday**  
6:10p - 6:40p  
Design & Coord.  
6:40p - 8:00p  
Weekly General  
11:40p - 12:00p  
Design Coord.  
3:00p - 5:30p  
Coordination Meeting  
6:00p - 8:00p  
Coordination Meeting  

**Tuesday**  
6:10p - 8:00p  
Coordination Meeting  
3:00p - 5:30p  
Coordination Meeting  

**Wednesday**  
6:10p - 8:00p  
Coordination Meeting  
3:00p - 5:30p  
Coordination Meeting  

**Thursday**  
6:10p - 8:00p  
Coordination Meeting  
3:00p - 5:30p  
Coordination Meeting  

**Friday**  
6:10p - 8:00p  
Coordination Meeting  
3:00p - 5:30p  
Coordination Meeting  

**Saturday**  
By appt. - 6:00p  
Design Coord.  
6:00p - 8:00p  
Coordination Meeting  

**Sunday**  
By appt. - 6:00p  
Design Coord.  
6:00p - 8:00p  
Coordination Meeting  

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**Needed Improvement**

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

**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
INTRODUCTION

BIM EX

MAIN ARENA

INTRODUCTION

BIM EX

MAIN ARENA

Overview of Team Investigation & Redesign

HPR Touchstones

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<table>
<thead>
<tr>
<th>Leader</th>
<th>What we looked at</th>
<th>Why we looked at it</th>
<th>Decision Factors</th>
<th>Who was involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daylighting in the Concourse</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daylighting in the Practice Arena</td>
<td>By utilizing daylighting strategies in the practice arena we would be able to reduce the energy use of the lighting systems of the building.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Façade Redesign</td>
<td>A façade redesign could have a positive architectural impact and cause a reduction in envelope load on the building.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long Span Truss Redesign</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternative flooring systems</td>
<td>An investigation into alternate flooring systems could reveal options that either save on cost or decrease the depth of the floor, therefore increasing plenum space.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roof Profile</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excavation Techniques</td>
<td>With the addition of the new Millennium Science Complex it became important to reduce the vibrations caused by excavation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Campus Utilities vs. Isolated System</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
[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

**EXISTING**

- [http://architettura.it/architetture/20050325/index.htm](http://architettura.it/architetture/20050325/index.htm)

**Courtesy:** Crawford Architects
**INTRODUCTION**

**BIM - EX**

**MAIN ARENA - ROOF PROFILE**

“Engineering Driven, Architecturally Appealing”

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**Mt. Nittany Room**
- View of Mount Nittany – Needs Glazing

**Club Level Dining**
- View of Mount Nittany & Bryce Jordan Center – Needs Glazing

**Above Ceiling**
- Does NOT need glazing

**Lobby**
- Needs Glazing for Appearance & Pronounced Function as Entrance

**Concourse**
- Can minimize amount of glazing but still needs some daylighting

**Parking Lot and Corner of Curtain and University**

**8Jc and Beaver Stadium**

**California Transportation HQ Building**

**Brick Piers & Recessed Curtain Wall**
- Reduced Glazing and Vertical Shading from Brick Piers
- Influence: Penn State Campus Architecture

**Curved Entrance & Curtain Wall System**
- Creates a more pronounced entrance
- Influence: Wembley Stadium

**Concourse**
- Can minimize amount of glazing but still needs some day lighting

**Materials Based On Functions**

**Metal Panels**
- Sheet for framing views and spandrel glass
- Influence: California Transportation Building

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**South East Perspective – New Facade**

**July 7am**

**July 8am**

**July 9am**

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**Functions and Views of East Facade**

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**Materials Based On Functions**

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**Wembley Stadium**

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**California Transportation HQ Building**

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**Wembley Stadium**
**Façade Redesign:** To improve the architecture and reduce load on the east façade.

*Cost Reduction on East Façade = 5.74%*

“Engineering Driven, Architecturally Appealing”
**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
New rendering in the new facade.

"Architecturally Driven, Technically Sound"

N-S Section – New Roof Profile

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 catwalks.

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.

Coppin State FEC

Coordinated Roof Framing and MEP Systems

http://jerichostageinc.com/archives/tag/small-stages
**INTRODUCTION**

**BIM – EX**

**MAIN ARENA – ROOF PROFILE**

**FACADE**

**PROCESS**

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**60" diameter round supply duct with additional diffusers on stands side of duct and shut off dampers**

**1000W Metal Halide Luminaires with "Black Out" shutters**

**Prefabricated trusses that will assembled on site and lifted as one piece.**

**Split long span truss system with moment connections and a vierendeel truss for supply duct coordination.**

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**N-S Section – Lighting Incident Angle Reflection**

"Architecturally Driven, Technically Sound"
**INTRODUCTION**

**BIM**

**MAIN ARENA – ROOF PROFILE**

New Roof Profile – Saddle

*Architecturally Driven, Technically Sound*

Air Distribution Diagram

- High Supply
- 2/3 Low Return
- High Point
- Low Point

Cost Impact of Truss Redesign = +1.5%

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal Illuminance (fc)</td>
<td>130.98</td>
</tr>
<tr>
<td>Emax/Emin</td>
<td>1.35</td>
</tr>
<tr>
<td>Coefficient of Variance</td>
<td>0.06</td>
</tr>
<tr>
<td>Uniformity Ratio</td>
<td>1.29</td>
</tr>
</tbody>
</table>

**PROCESS**
**Roof Profile:** To create a more architectural recognizable facility

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

**Cost Impact of Truss Redesign:** +1.5%

*New rendering in the new facade*

*To create a more architectural recognizable facility*

*Improve the Game Day experience for both the fans and players*

*Create an architecturally recognizable facility*
Thank You For Your Time!

Cost Reduction on East Façade = 5.74%

Load Reduction on East Façade = 26.9%

Cost Increase for Truss Redesign = +1.5%

Please feel free to ask questions.