Presentation Outline

- Project Background
- Analysis #1: Bringing BIM into the Field
  - Vico Software and Trimble
  - Vela Systems
  - Impacts of Implementing New Technology
- Analysis #2: Alternative Curtain Wall Systems
  - System Design
  - Architectural Impacts
  - Schedule/Cost Impacts
- Analysis #3: Feasibility of PV Curtain Wall
  - Electrical Breadth Design
  - Energy/Electrical Impacts
  - Feasibility Analysis
- Lesson Learned
- Acknowledgments
## PROJECT BACKGROUND

### Project Data

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<th>Occupant</th>
<th>University</th>
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<td>Total Height</td>
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<td>Function</td>
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PROJECT BACKGROUND

Project Data
- Occupant: University
- Size: 265,000 SF
- Total Height: 4 Floors
- Function: Research Labs and Offices

Project Team
- CM Agency: Turner Construction
- Design Architect: Hopkins Architects
- Executive Architect: Payette Associates
- Engineer: ARUP

Michael Gallagher
AE Senior Thesis 2011

Construction Management Advisor: Dr. Riley
Project Background
- Analysis #1: Bringing BIM Into the Field
- Analysis #2: Alternative Curtain Wall Systems
- Analysis #3: Feasibility of PV Curtain Wall System
- Lessons Learned
- Acknowledgments & Questions

Building Design / Layout
## Project Background

### Analysis #1: Bringing BIM Into the Field
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### Analysis #2: Alternative Curtain Wall Systems

### Analysis #3: Feasibility of PV Curtain Wall System

### Lessons Learned

### Acknowledgments & Questions

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### Bringing BIM Into the Field

**Problem Identification**
- BIM model only used for 3D MEP Coordination

**Research Goal**
- Show the benefits of BIM and how it can be utilized more on a project
Bringing BIM Into the Field

Problem Identification
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- Show the benefits of BIM and how it can be utilized more on a project

Potential Areas to Implement
- Steel, Concrete and MEP Layout
- Commissioning
- Punchlist
- Tracking Progress
- Tracking Materials
- Safety
- QA/QC
- Turnover / Maintenance / Warranty
Project Background

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New Technology

Bringing BIM Into the Field

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Research Goal
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Potential Areas to Implement
- Commissioning
- Punchlist
- Tracking Progress
- Tracking Materials
- Safety
- OA/QC
- Turnover / Maintenance / Warranty
- Steel, Concrete, Wall, and MEP Layout
Vico Software and Trimble

- Vico and Trimble have a Partnership
- Allows you to export information from Vico Software and 3D model to Trimble Field Layout Solution
- Can use GPS, Laser, and a Total Station to layout steel, concrete, MEP, and walls all based on coordinates from the 3D Model
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- Allows you to export information from Vico Software and 3D model to Trimble Field Layout Solution
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Benefits
- Reduces errors during construction
- Improves QA/QC
- Improved Coordination
- Insures MEP is placed in correct locations
Vela Systems

- Vela’s goal is to help better manage construction projects
- Program that contains all the documents pertaining to project such as drawings, ASI’s, RFI’s, Specs, etc.
- Everyone has access and anyone can upload information to it
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Vela Systems

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Benefits
- Helps track progress
- Two week look aheads
- Reduces time to complete punchlist, closeout, and commission
- Safety checks
- Improves QA/QC
- Improves Coordination
Project Background

Analysis #1: Bringing BIM Into the Field
- Vico Software and Trimble

Analysis #2: Vela Systems

Analysis #3: Impacts of Implementing New Technology

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Lessons Learned

Acknowledgments & Questions

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Impacts of Implementing New Technology

Vela Systems - Case Studies
- Skanska – New Meadowlands Stadium
- Turner Construction – 10 Rittenhouse Square Philadelphia, PA and Hampton Roads Naval Housing Norfolk, VA
- Barton Malow – Maryland General Hospital in Baltimore
- Cianbro – Destiny USA, Syracuse, New York

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Impacts of Implementing New Technology

Potential Benefits
- Cost Savings
- Schedule Reduction
- Improved Communication
- Everyone has the newest drawings / information

Vela Systems - Case Studies
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Construction Management
Advisor: Dr. Riley
Alternative Curtain Wall Systems

Problem Identification
• $40+ million dollar curtain wall system
• Size of the glass did not allow to be manufactured in the U.S.
• Egress stair tower glass breaking
• Scope was so large – almost no bidders

Research Goal
• Find another system that costs less and/or is able to incorporate PV into it
System Design

Scenario #1
- Maintain large glass size and implement PV glass where fritted glass is currently located on exterior façade

Scenario #2
- Reduce glass size and implement PV where fritted glass is currently located on exterior façade

Scenario #3
- Reduce glass size and maintain fritted glass where currently located – no PV
Schuco E² Façade – Scenario #1
- Maintain large glass size and implement PV glass where fritted glass is currently located on exterior façade
Project Background

Analysis #1: Bringing BIM Into the Field

Analysis #2: Alternative Curtain Wall Systems
  - System Design
  - Architectural Impacts
  - Schedule/Cost Impacts

Analysis #3: Feasibility of PV Curtain Wall System

Lessons Learned

Acknowledgments & Questions

System Design

Schuco E² Façade – Scenario #2
  - Reduce glass size and implement PV glass where fritted glass is currently located on exterior façade

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Advisor: Dr. Riley
Architectural Impacts

Minimal Changes
- Largest PV glass size is 8' x 7'
- Sizes of glass being replaced
  - 5.5' x 5.5'
  - 3' x 10.5'
  - 5.5' x 10.5'
- Proposed New Sizes
  - 5.5' x 5.5'
  - 3' x 5.25'
  - 5.5' x 5.25'
- Non-Stair tower Glass – Interior Mullion is behind Aluminum Panel on the inside
Schedule / Cost Impacts

- Current System for the purpose of this analysis is roughly $20 million dollars
- This price only includes the following
  - Price of the glass
  - Aluminum Extrusions
  - Steel Structure supports
  - Gaskets and Silicone
  - Hoisting
  - Installation
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  - Hoisting
  - Installation

- Scenario #1 is approximately $3,713,480 more expensive than the current system
- Scenario #1 is Proposed system because it has the least amount of Architectural Impacts
- Smaller glass size should be considered though
  - Reduce Current $2.65 million dollar cost for packaging and shipping
  - Reduce lead time by about 2 weeks
Feasibility of PV Curtain Wall
Feasibility of PV Curtain Wall

- Requires
  - (3) – 68.4 kW Inverters
  - (1) – 49.6 kW Inverter
  - 900’ of DC wire
  - 345’ of AC wire

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AE Senior Thesis 2011
Advisor: Dr. Riley
### Feasibility of PV Curtain Wall

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### Justification for Cost
- Current PV Trays above atrium skylight cost about $2 million dollars
- Produce 85 kV or 68 kWh
- Schuco Esp system produces just over 3.6 times as much energy
- Schuco system only costs 13.8% more money

### Feasibility of PV Curtain Wall

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<th>Year Energy Cost</th>
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Lesson Learned

Analysis #1:
- Implementing new software and technology can save time, reduce costs, improve communication, and improve the overall construction process.

Analysis #2:
- There is a substantial premium for large glass sizes.
- Curtain wall systems are becoming more efficient and more feasible to implement components like PV into them.

Analysis #3:
- Tax rebates and incentives make PV glass affordable.

Lessons Learned

Analysis #1: Bringing BIM into the Field
- Alternative Curtain Wall Systems
- Feasibility of PV Curtain Wall System

Acknowledgments & Questions

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AE Senior Thesis 2011

Construction Management
Advisor: Dr. Riley
Acknowledgements

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PACE Industry Members
The Owner