Integrated MEP Design and Construction: The BIM Revolution

Presenter Names
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Speakers Info

Barry Brunet
BIM/VDC Director
Corporate BIM/VDC Manager for 15 years with Bernard Energy Solutions. Manages BIM teams across offices in 7 different states. Responsible for strategic implementation and solutions within $400M company of over 1,100 employees. Works with teams from pre-design and pre-construction planning throughout successful modelling and coordination of complex projects.

Chip Branscum, PE
Director of Engineering
Director of Engineering at Pinnacle Infotech with 34 years of experience in the HVAC industry, licensed to practice engineering in 25 states. 14 years of design-build experience including Engineer of Record for Ohio’s first LEED Platinum Certified project. Active member of local building appeals board, past president of local ASHRAE chapter and Assistant Scout Master/Eagle Coordinator for local Boy Scouts of America Troop 850.
Key Learning Objectives

- **Integrated Design – What does this really mean?**
  - Building Information Modelling software can improve design efficiencies, save time, reduce errors, and construction costs.

- **Central Model Collaboration**
  - Using an integrated central model to optimize design and coordination between disciplines.

- **Integrating Software**
  - Using software solutions for design, analysis, and collaboration.

- **Lesson Learned Case Studies**
Global Offices

Durgapur Campus (India)  
Kolkata Campus (India)  
Jaipur Campus (India)  
Houston Office, U.S.A.

London (U.K.)  
Calolziocorte (Italy)  
Dubai (U.A.E.)  
Zurich (Switzerland)
Sample Projects

UC Berkeley Memorial Stadium, USA

Well Pharma Medical Plant, UAE

Marlins Park Stadium, USA

New Orleans International Airport

Central Baptist Hospital, USA

Dubai International Airport, UAE
The Bernhard Companies came together to offer a holistic “Energy-as-a Service” solution.

**MISSION:** Bernhard delivers innovative engineering, construction, and energy solutions that empower our clients and promote a sustainable future.
Bernhard MCC

- 100+ YEARS
  - FOUNDED IN 1919
- $800+ MILLION
  - ANNUAL REVENUE
- 3,000 EMPLOYEES
- 900 ACTIVE PROJECTS
- $38.5 Million
  - ANNUAL ENERGY SAVINGS

ENERGY-AS-A-SERVICE

We have the in-house expertise to deliver the right solution for your needs. As an integrated team, we have the unique ability to self-perform every facet of a project as a turnkey solution. Together, we deliver better ideas.
Bernhard MCC – BIM/VDC

- **50+** In-house BIM/VDC Staff Members
- **12** Experienced in Leading BIM Coordination efforts:
  - Clash detection with viewpoint organization
  - Recommending coordination changes
  - Working with GC and trade partners to develop RFIs
- All BIM/VDC Staff have Navisworks Manage with the Glue Plug-in
- All BIM/VDC Staff have Autodesk Fabrication, Bluebeam & Revit with Fabrication Parts
- **7** Full Time In-house Fabrication Detailers
- **10** Trimble Robotic Stations with 10+ operators in the Carolina Region
Integrated Design
Integrated BIM Design

Concurrent Process

System Integration
Dodge Analytics Survey

**Top Values of BIM (by Level of BIM Engagement)**

Percentage of high and low engagement BIM users who agree or strongly agree with each value statement

- **BIM tools improve collaboration**: 74%
- **BIM helps eliminate unnecessary rework**: 59%
- **BIM helps reduce costs and material waste**: 51%
- **Use of cloud-based technologies allowing teams to connect to project data in the field results in faster and more accurate onsite information**: 61%
- **BIM tools engage the supply chain earlier and help mitigate risk**: 47%

Users with high BIM engagement (more than 50% of projects involve BIM)

Users with low BIM engagement (50% or fewer projects involve BIM)
Dodge Analytics Survey

Top Values of BIM (by Discipline)

Percentage of each discipline that agrees or strongly agrees with all value statements

- Architects: 58%
- Structural Engineers: 73%
- MEP Engineers: 52%
- GC/CMs: 80%
- Structural Trades: 69%
- MEP Trades: 78%

Average: 67%
Central Model Collaboration
Collaboration

- One central model
- Real-time communication
- Up-to-date information
Connectivity

Design Development and Optimization

Value Engineering and 3D Revit BIM Model

2D detailed Shop Drawings and BOM

Consultant Approval and Issued to site for Construction
Energy Models
Lighting Simulation

Lighting renderings using **DIALux**

Lighting rendering using **ElumTools** (an add-in in Revit)

Rendering image in **Navisworks Manage**
Electrical Design

- Classify the load
- Define their demand factor in Revit
- Easily reflect load classification in panel schedule as well as demand load.
Static Pressure Analysis
Integrating Software
MEP Rack Design

Pre Design

Actual Rack System
Coordination Challenges

Did the architect finally answer that RFI on ceiling height?

OH, umm, I didn't see that there the last time...

Can't put that there, it's a no fly zone...

No, you move your light, this sprinkler head can't be moved due to code!

Your duct is in my pipe!

They want to resize the duct now?! Let's meet again tomorrow...
MEP Rack Design

Fittings

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Rack-Assembly Materials

- 2 1/2" HHWS
- 1 1/2" EWH
- 2 3/4" W
- 10" EXH
- 12" PSA
- 8" PSA
- 2" Sprinkler
MEP Rack Design
- Reduce/Eliminate RFI and change orders as constraints of construction
- Deliver clash-free Constructible Model
- Simulation/Optimization & Evaluation of Design stages – integrated design/analysis
- Flexibility to edit & change quickly
- Collaboration with Owners, Architects, Contractors and others using BIM 360
- Quality Output
Sample software
Heat Load Calculations

Tonnage of the Dwelling Unit Saved almost $\frac{1}{4}$th Time of Conventional Method
Pump Head Calculations

Pump Head Calculation through Pipe Flow Expert Saved almost **50% time** of Conventional

| Pipe Id | Pipe Name | Pump Name | Speed rpm | Pref. Op From US gpm | Pref. Op To US gpm | Flow In/Out US gpm | Velocity ft/sec | Suction Pressure psi.g | Discharge Pressure psi.g | Pump Head (ft hd Fluid) | Pump NPSH ft hd (absolute) | Pump NPSHa ft hd (absolute) | Pump Efficiency Percentage | Pump Power Horsepower |
|---------|-----------|-----------|-----------|----------------------|-------------------|-------------------|------------------|-----------------------|------------------------|------------------------|---------------------------|-----------------------------|----------------------------|-----------------------------|---------------------------|
| 2       | P2        | Pump      | 1400      | 1029.95              | 2403.21           | 1165.00           | 7.471            | 48.0920               | 61.0920                | 139.638                | 6.687                      | 34.89                       | 73.37                       | 56.0727                    |
Wire Size Optimization

Automatic Wire Sizing Through BIM Integrated Tool Revit. Saved almost 50% time of Conventional Method.
Amazing Facts

2 Freedom Towers (834 m) + 1 Empire State Building (381 m) ~ Jeddah Tower (1,100 m)

The R&D cost is 33% of the total construction cost ($1.2 Bn)

Featuring 59 elevators with 4 double decker & 3 triple decker

270 piles underneath ~ Approx. 30 floors (105 m) under the ground

All Steel bars used underneath are electrified to keep rust free for more than 100 years
Integrated Electrical
Integrated Plumbing