MIPSYCON – 2015

3D Coming to a Substation Near You

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Michael Chasser
Electrical Designer
Burns & McDonnell
Michael Chasser
Electrical Designer
10 Years at Burns & McDonnell
7+ Years Doing 3D Substation Design
3+ Years Doing 3D BIM Modeling (Residential Architecture)
Facilitated Numerous Large Scale 2D-3D Design Transitions for Electric Utilities

CADD Platforms
• AutoCAD, MEP, REVIT
• Autodesk Inventor Professional
• MicroStation
• Bentley Substation
• SoildWorks

Document Management Platforms
• Autodesk Vault
• ProjectWise
Agenda

• Where are we?
  • Current CADD Platforms & Design Environments

• Where are we going?
  • Alternate CADD Platforms & Design Environments

• Why go 3D?
  • Benefits & Challenges of 3D

• How do we get there?
  • Migration Guidelines & Procedures

• Questions
Where Are We?

Current CADD Platforms & Design Environments

MicroStation V8, V8i

AutoCAD 2014, 2015, 2016
Where Are We?

Current CADD Platforms & Design Environments (cont’d)

• 2D design environment

• One design change requires modification to multiple drawings

• Manual bill of material creation

• Static or “semi-smart” 2D blocks or cells for commonly used parts

• Custom programming or auto-lisp creation for automation

• Manual inter-disciplinary coordination
Where Are We Going?

Alternate CADD Platforms & Design Environments

Bentley Substation V8i

• MicroStation V8i platform with substation specific design tools

• 3D intelligent models for physical layouts

• Intelligent protection & controls design

• Create accurate reports for construction estimating

• Generate 2D construction drawings from linked 3D model
Where Are We Going?

Alternate CADD Platforms & Design Environments (cont’d)

**Autodesk Inventor Professional & Automation Force Substation Design Suite**

- Autodesk Inventor 3D design platform with SDS toolkit
- 3D intelligent models for physical layouts
- Intelligent protection & controls design
- Create accurate reports for construction estimating
- Generate 2D construction drawings from linked 3D model
Why Go 3D?

Benefits of 3D

• Improved Efficiency
  • Single update to 3D model propagates changes to all linked drawings
  • Build library of intelligent 3D models

• Improved Accuracy
  • Eliminate omissions from bill of materials (BOM)
  • Ability to verify dimensions in all coordinates

• Reduced Design/Engineering Time
  • Utilize automated processes
  • Develop standard “modules” for commonly used designs
Why Go 3D?

Benefits of 3D (cont’d)

• Consistent Design/Application of Standards
  • Easily link to standards & automate consistency

• Inter-Disciplinary Coordination
  • Physical/Electrical vs. Civil/Structural vs. Relay & Control
Why Go 3D?

Benefits of 3D (cont’d)

- **Automated Processes**
  - Bill of Materials (BOM)
  - Cable Lists
  - Conduit Fill Calculations
  - Lightning Protection (Shielding)
  - Conductor sag
  - Ground grid design
  - Clearance checking (phase-to-phase & phase-to-ground)
  - Automatic wire numbering
  - Error checking
  - Self-healing schematics & wiring diagrams

- **Engineering Drawing Output**
  - Plans, Elevations, Isometric Drawings
  - Schematics, Wiring Diagrams, Panel Front Views
Why Go 3D?

Challenges of 3D

• Transition to 3D design is an ORGANIZATIONAL change
  • For transition to be successful, all parties within an organization must be involved
    • Management
    • Engineering
    • Design/Drafting
    • IT
    • Finance
    • Human Resources (HR)

• Large capital investment
  • Software/Hardware
  • Training – shortage of experienced users
  • Development
  • Implementation
How Do We Get There?

Migration Guidelines & Procedures

• Identification of CADD Platform & Document Management System
  • Consider current CADD platform & CADD user experience
  • Consider implications on current document management system
  • Potential change in document management software

• Procurement/Installation/Training of Software (2-4 months)
  • Potential hardware changes to accommodate new software
How Do We Get There?

Migration Guidelines & Procedures (cont’d)

• Standards/Processes/Workflow Development (4-6 months)
  • Develop organizational standards for 3D design
    • Standard filenames
    • Folder structures
  • Develop 3D modeling guidelines/standard practices
    • Organizational 3D modeling preferences & guidelines
    • Create standard documentation for these practices
  • Workflow Development
    • Develop design workflows for internal and/or external engineering
    • Consider all design aspects from start to finish – including review cycles
How Do We Get There?

Migration Guidelines & Procedures (cont’d)

• Pilot Projects (6 months minimum)
  • Execute numerous pilot projects to fully vet standards & practices
  • Start small & simple!
  • Gradually increase size and complexity

• Capitol Investment/Major Development (6 months minimum)
  • Develop standard “content library” of intelligent 3D models
    • Major Equipment
    • Foundation
    • Structures
    • Connectors
    • Line/Bus Work
    • Miscellaneous parts/pieces
  • Reach out to equipment/material vendors for already developed models
How Do We Get There?

Migration Guidelines & Procedures (cont’d)

- Refine Standards/Revise Specifications
  - Make modifications to any necessary standards due to 3D implementation
  - Revise equipment/material specifications to require submission of 3D model (in correct file-type) from equipment/material manufacturer

- Push To Internal Staff/External Consultants
  - Provide 3D modeling guidelines, processes, standards, & workflows
  - Consider how external staff/consultants will access previously developed models
    - VPN access vs. Web-Hosted Server vs. Limited system access
  - Consider how files will be transferred from external staff/consultants
    - VPN access vs. FTP
How Do We Get There?

Typical 2D to 3D Migration Workflow

- Identify CADD Platform
- Software Install/Training
- Standards Development
- Pilot Projects
- Major Development
- Refine Standards/Revise Specifications
- Push Internal/External
Example
Example
Example
Example
Questions