Integrating Design Through 3D Technology
Why do Contractor’s have all the fun?

Oregon APWA
Fall 2017 Conference

Presented by: Tony Roos & Fred Wismer
SESSION OBJECTIVE

Current Buzz Words - Construction Focused

- BIM
- E-Construction
- 3D Construction Models

Design Process and Team Communications can also capitalize on the value provided by advancing technologies
SESSION OBJECTIVE

E-Construction

• The e-Construction system has the potential to increase the quality, efficiency, environmental sustainability and productivity of the construction industry at large...the highway industry is ready to reap the benefits of program-level implementation.

— FHWA Every-day-Counts
SESSION OBJECTIVE

GOAL: Spark Ideas and Discussion

– Improve efficiency and value in design process by implementing innovative technologies

Technology in survey, design and construction can change how we deliver projects by integrating teams and workflows.
DISCUSSION TOPICS

6 TOPICS TO GUIDE THE CONVERSATION:

1. Observations of the current design process
2. Integrated design process using 3D Technology
3. Examples and Benefits of 3D Technology in Design
4. Challenges, Constraints & Benefits to Integrating 3D Technology
5. Risk Management
6. Public Involvement
DISCUSSION TOPICS

TOPIC 1: OBSERVATIONS OF THE CURRENT DESIGN PROCESS

Linear Approach to Design Elements:
• Horizontal Alignment
• Vertical Profile
• Cross Section
• Drainage
• Details
• Utilities
• Estimate
• Documentation
DISCUSSION TOPICS

TOPIC 1: OBSERVATIONS OF THE CURRENT DESIGN PROCESS

- Linear Workflows
- Increased Complexity
- Increased Design Detail Needs
- Funding and Budgets
- Plan Sheet Focus
- Plan Sheet Clarity/Ease of Understanding
- Unused Modeling Detail
- Misunderstanding of Design Intent
- Stakeholder Engagement
- Review and Approval Process
- Accuracy and Efficiency
- Team Coordination
DISCUSSION TOPICS

TOPIC 2: INTEGRATED DESIGN PROCESS USING 3D TECHNOLOGY

• Collect and Use Data as needed
• Connect Workflows
• Focus on Design First
• Model / Surface Based Design
• Identify Key Value/Cost Elements
• Higher Level of Detail Earlier

• Increased Estimate Confidence
• Real Time / Active Review and Decisions
• Earlier Stakeholder Engagement
• Plan Documentation Follows Design Completion
Traditional vs 3D Technology Delivery

- **Ability to impact cost and functional capabilities**
- **Cost of design changes**
- **Traditional design process**
- **Preferred design process**

**Project Progress**

Original Concept by Patrick MacLeamy, FAIA, CEO, HOK
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Integrated Design Elements
Sharing Data

Design Life Cycle

- We create 3D model
- Share with Contractor
- Used for construction

Design (3D Model)

Survey

Construction & As-Built

Plan

Maintenance
DISCUSSION TOPICS

TOPIC 3: EXAMPLES AND BENEFITS OF 3D TECHNOLOGY IN DESIGN

- Quality of Data Collection
- Integrated Element Workflows
- Increased Detail on Specific Elements
- 3D details vs 2D details
- Conflict Identification
- Earthwork Calculations

- Dynamic Plan Production
- Review Process
- Reduced Contract Modifications
- Increase Bidding/Estimates Accuracy
- Utilize Design Detail in Construction
- Better Understanding of Design Intent
Survey Data
Survey Data
Final Product
Detailed Model Development
Detailed Model Development
Detailed Model Development
Detailed Model Development
Detailed Model Development
Detailed Model Development
Detailed Model Development
Detailed Model Development
Detailed Model Development
Detailed Utility Conflict Analysis
Detailed Utility Conflict Analysis
Detailed Utility Conflict Analysis
DISCUSSION TOPICS

TOPIC 4: CHALLENGES, CONSTRAINTS, & BENEFITS TO INTEGRATING 3D TECHNOLOGY

- Challenges
- Constraints
- Benefits

QA/QC Review Process
DISCUSSION TOPICS

QA/QC Review Process: CHALLENGES & CONSTRAINTS

- Resistance to change
- Time and effort to develop skills
- Time and effort to develop detail
- Checking “3D Modeling” and “Plans”
DISCUSSION TOPICS

QA/QC Review Process: CHALLENGES & CONSTRAINTS

- Team buy-in and communication
- Effectively conveying information in unfamiliar methods
- Constraints of standard formats and file types
- Lack of documented Standards and Processes
Discussion Topics

QA/QC Review Process: BENEFITS

• QA/QC is a continuous process

• Check input to model
  – Model is the driver and plans the output
  – Plan comments to be updated in models

• QA/QC integrated and measuring performance continuously
  – Not just at key submittals, but throughout!

• Better understanding of project constraints and funding needs early in process
DISCUSSION TOPICS

TOPIC 5: Risk Management

• Digital Delivery vs OSBEELS
• Specifications
• Construction Survey Specifications
• Inspection without Hub & Lathe
• Document Ownership/Control and Relationships
OAR 820-025-015 (1) All final Documents...must bear the seal and signature of the registrant...
DISCUSSION TOPICS

Specifications:

• Bid Specifications: 00120.10
  – Are contractors given the CAD/MicroStation files to aid their bid preparation?

• Construction Specifications: 00305
  – Limited Liability of Agency and Engineer for Contractors use of CAD/MicroStation files?
  – Update to Section 00305 in 2018 special provisions references the ODOT “Construction Surveying Manual for Contractors”.

2.1 General - The Engineer will not be responsible for any data translations. Compressed data provided by the Engineer or the Contractor will be in a "self-expanding executable" format. The method of exchange of electronic data will be mutually agreed upon at the pre-survey conference.
**Eugene’s Solution:**
Please be aware that pursuant to your contract with the City, your construction of XYZ must be based upon survey grades and lines provided in the Specifications, and any Supplemental Specifications and Special Provisions for the Project. The finished grade surface information being provided to you at your request in no way modifies, amends or supplements the terms of the contract entered into by you and the City regarding construction of XYZ....Project XYZ must be constructed in accordance with the contract between you and the City, any use of the City’s finished grade surface information by you during the construction of Project XYZ is done solely at your own risk.”
DISCUSSION TOPICS

Construction Survey / Inspection
DISCUSSION TOPICS

Contractual Relationships

* Image courtesy of BIMtoFIELD.com
DISCUSSION TOPICS

TOPIC 6: Public Involvement

• 3D Renderings
• Fly-Through videos
Public Involvement

Cornelius Pass Road at Rock Creek

* Images courtesy of Cardno, Inc.
Public Involvement

Cornelius Pass Road at Rock Creek

* Images courtesy of Fred Wismer
Public Involvement

Butler Road Roundabout, Hillsboro OR

* Images courtesy of Cardno, Inc.
Public Involvement

10th Avenue & OR8, Cornelius, OR
Public Involvement

Baseline Road, Hillsboro OR

* Images courtesy of Cardno, Inc.
Public Involvement

* Images courtesy of Cardno, Inc.
Questions?

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