Role of Design in Advancing 3D Engineered Models & Beyond

Key Issues/Gaps for 2016

EDC-3 3D Engineered Models: Schedule, Cost and Post-Construction
Where are we headed?
Civil Integrated Management (CIM) Supporting Lifecycle Asset Management

Decision Making

- Planning
- Conceptual Design
- Detailed Design
- Construction
- As-built
- Procurement
- Operation & Maintenance

Source: Domestic Scan: Scan 13-02 or NCHRP 20-68A
MAP-21 - 23 USC 106 (j)
Use of Advanced Modeling Technologies

(2) Program — ... the Secretary shall encourage the use of advanced modeling technologies during environmental, planning, financial management, design, simulation, and construction processes of the projects.

(3) Activities — ... the Secretary shall ... compile information/best practices ... disseminate ... and promote use

(4) Comprehensive plan — ... the Secretary shall develop and publish on the public website ... a detailed and comprehensive plan for the implementation of paragraph (2).
Why should we work harder on implementation?
Proven Benefits ... and those we're discovering.
Pre-construction Uses of 3D Models

Which capabilities are you pursuing to implement 3D Engineered Models for Construction?

Expanded use of 3D modeling to create plans and estimates

Use of 3D visualization for public outreach

Use of 3D digital data for quantity take-off (e.g. earthworks)

More detailed 3D modeling to review the design concept

EDC-2 Webinar 9/10/14 Multi-answer, 83 unique respondents
Practical Design Support?
Planning Complex Activities
Benefits of 4D Modeling and 5D Modeling
Using the Model in the Field: Layout

Source: Iowa State University
Using the Model in the Field: AMG

Source: FHWA
Using the Model in the Field: Quality Assurance

Source: North Carolina DOT
Creating Digital As-Built Records

Construction is the most cost-effective time to capture position information

Image Source: FHWA
Subsurface Utility Engineering

Image Source: Cardno
Asset Inventory and Condition Assessment
... and Simplified Design

Image credits: Utah Department of Transportation
Design Leads 3D Engineered Models implementation in many states ...
Issues/Gaps & the (Suggested) Role for Design Leadership in Advancing 3D Engineered Models Applications
Source of Issue/Gap Information
3D Workshops & Webinars

Workshop Host States to date

CA  AZ  CO  NM  TX  OK  AR  LA  MO  KY  AL  GA  FL  VA  OH  MI  VT  AK  MT  NV  ME  WA  OR  UT  KS  ID  WY  ND  SD  MN  NE  WI  IA  IL  IN  MS  TN  SC  NC  WV  PA  NY  CT  NJ  DE  MD  DC  MA  NH  RI

Other States Attending Workshops
Issues/ Gaps

1. Implementation planning/ change management
2. Survey policies and standards
3. CADD and Design standards
4. Model Review/ QA
5. 4D/ 5D modeling/ enhanced constructability
6. Data governance/ management and exchange
7. Model for public communication
8. Model for Construction & As-builts
   - Model handoff to construction/ contractors
   - Model as contract
   - Model of record
Implementation Planning/Change Management - WI, OR, UT, IA (structures)

one bite at a time...
Survey Policies & Standards - CA, OR, MO
CADD and Design Standards

• Clarify modeling level of detail
• Consistency for DOT/consultant designers
• Facilitate handoffs to DOT construction and to contractors pre-bid

• Examples:
  – Iowa, Oregon, Pennsylvania, Illinois (via STIC grant), Maryland (via current consultant effort)
3D Model Reviews - Is it correct? How accurate is it? What can it be used for?

Examples - Michigan, Oregon
4D and 5D Modeling - NY, CA

Image Sources: Iowa DOT, Wikimedia Commons, Caltrans
Data Governance and Data Exchange Schemas

- Durability and accessibility of data
- Facilitate exchange between software
- LandXML is current solution, but not enough for future data exchanges
- BrIM/Structures considering IFC
- Examples:
  - Iowa, Utah, Florida
Public Communications & Enhanced Constructability Reviews

Video credit: Sundt Construction and Multnomah County, Oregon
Legal Research Digest 58

LEGAL ISSUES SURROUNDING THE USE OF DIGITAL INTELLECTUAL PROPERTY ON DESIGN AND CONSTRUCTION PROJECTS

- Ownership of models, including joint ownership
- Creation of derivative models
- Freedom of Information Act implications
- Usage agreements
- Challenge of signing & sealing models

http://www.trb.org/Publications/Blurbs/168710.aspx
Model of Record - Agree with Contractor

Example – Utah, Connecticut

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Lead states

- IA – design handoff, AMG construction spec, asset inventory, data governance/integrating data, structures
- OR – design handoff, survey, LIDAR
- WI – design handoff, structures, clash detection
- CA – Survey/LIDAR, structures, 4D (on large projects)
- NY – 4D/5D, construction QA, structures, as-built, data governance/integrating data
- CT – design handoff, construction QA
- OH – as-built spec
- FL – data governance ROADS
- UT – model as contract, asset inventory/LIDAR
- MI – model review, design handoff
- MO – Survey, AMG
- FLH – CADD/design standard, construction spec
National Website

- Specs, Standards, Details, Tech Briefs, Case Studies, etc.

New web page viewable at www.fhwa.dot.gov/3d (search “fhwa 3D”)
Electronic Technology Sharing conferences

Electronic Technology Sharing Conferences can be customized to meet an agencies needs. Examples of topics that can be discussed include:

- Implementation planning
- Creating surveying and construction specifications
- How to prepare DOT field staff for quality assurance on AMG projects
- 3D models and structures
- Adding 4D/5D modeling
- Post-construction surveying to create 3D as-built records
- Programmatic as-found survey to develop asset inventories and assess conditions

For More Information
To discuss your state’s needs, or to schedule an eTS Conference, contact:
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EDG-3 Information
Visit the EDG-3 Website for additional information and resources:

3D Webinar Series
Visit the EDG-3 webinar series site for a list of upcoming and pre-recorded webinars:
www.fhwa.dot.gov/construction/3d/webinar.cfm
# EDC-3 Deployment Team

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