Delivering Projects In A Digital World

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Speaker Background

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25 Years of Experience in Transportation Design and Construction
Licensed in Texas, Arkansas, Florida, and Utah
Has introduced advanced digital practices on over $5B of design-build projects across America in the past ten years
ASCE Digital Project Delivery Committee
TRB Application of Emerging Technologies for Design and Construction
TRB Information Systems in Construction Management Subcommittee
TRB Virtual Design and Construction Subcommittee
2012 MAP-21 Law

The US Secretary of Transportation shall encourage the use of advanced modeling technologies during environmental, planning, financial management, design, simulation, and construction processes of the projects.
Advanced modeling technology means an available or developing technology, including 3-dimensional digital modeling, that can:

(A) accelerate and improve the environmental review process;
(B) increase effective public participation;
(C) enhance the detail and accuracy of project designs;
(D) increase safety;
(E) accelerate construction, and reduce construction costs; or
(F) otherwise expedite project delivery with respect to transportation projects that receive Federal funding.
Basic Vocabulary

Model - A simplified representation of a system at some particular point in time or space intended to promote understanding of the real system.

System – A system exists and operates in time and space.

(Definitions obtained from Society for Modeling and Simulation International)
Does “Model” Mean 3D?

A model is anything that represents the system. A system can be 1D, 2D, 2D+time, 3D, stress, flow, finite element, finite boundary, etc.

Most transportation design information is in a 2D digital model. The static 3D digital model is developed by adding vertical elements such as profiles, superelevations, and templates.
Model Centric Design

- **Model Centric Design** – All significant design processes extract information from and update changes to a digital model that represents the real system
Traditional Design Technology

The “model” is represented by *analog* lines and numbers on rectangular sheets

- Each sheet only shows small section of the design
- Visualizing the proposed design requires significant practical experience
- Changes to the design are difficult
- Large labor forces are required for drafting
- Requires extensive training to interpret during construction
Enabling Technology

Computer software with design in the same **digital coordinate system** that will be used for construction.

Computer networks allowing multiple users to see the **latest version of any design component** in its actual location.

Positioning technology and automated machine guidance that allow us to construct the project **exactly the same way that its designed in the computer**.
BUT, IT’S NOT ABOUT SOFTWARE!

Software packages are just tools that help us work with the data

We use software to retrieve the data, analyze it, manipulate it, put it back in, and present it

Model-centric design is about improving the way we use the data to make design decisions
Software By Itself Won’t Improve Anything

Design firms continue to invest in the latest software with little improvement in real productivity. Managers eventually turn deaf ears to production staff requests for each new “killer” application. “Old School” project managers still cling to the old analog ways creating a half-breed process even more inefficient than the old ink and mylar system.
We Need Model-Centric Processes

Firms can separate **digital** design from **analog** construction document drafting.

Managers can make choices about technology investments based on **actual productivity needs**.

Senior designers can base their decisions on the actual design, not limited sheet views of it.
Evolution of Model-Centric

Plans Only

“What’s a model?”

Plans Visualization

The plans build the model

Plans and model coexist

Roundtrip Engineering

The model builds the plans

Model-Centric

Model Only

Pure design (no more plan sheets)
What does Engineering Need?

People trained to communicate in the “language” of design models and real-time design changes

Development of guidelines to transition from *analog* thinking to *digital* thinking

Establishment of new skills in how to control and assure the quality of the model
Model-Centric Quality Assurance occurs when the evaluation of adequacy of a design is based on the integrated review of the actual digital design model rather than a fragmented inspection of individual analog views (plans).
Traditional Design Quality Management

Document Based (Analog)
Multiple Iterations of Construction Plans
Heavy Focus on Appearance
Is This What We Want?

Frustrating Amount of “Drafting” Comments

Reviewer Reward based on Volume of Comments Generated

Have fonts and line weights ever caused a single error or omission?
Have We Had Enough Of The Current State of Practice?

Are we ready for a change?
Engineering Process Waste

2004 NIST report estimates 40% - 60% of time and money in engineering wasted creating, locating, and verifying non-interoperable analog information
That’s 15.8 Billion Dollars Per Year!
That’s A Lot Of Cheddar!
If We Want Our Engineered Works To Be Sustainable, Shouldn’t We Start With Our Engineering Process?

...they had to cut down all the trees to print all the bailout money needed to create green jobs to save the environment...
Let’s Remove Waste From Engineering

Our traditional practices are based on analog information.
Muda - Uselessness
Mura - Inconsistency
Muri - Overload
We Need To Change Our Ways
We Can’t Be Afraid Of Evolving

Go Back!!
That Digital Crap Freaks Me Out!
We have met the enemy, and he is us!
Thank You For Your Attendance

Is everything clear now?
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