



Delivering Projects In A Digital World

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Speaker Background

Danny Kahler, PE

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

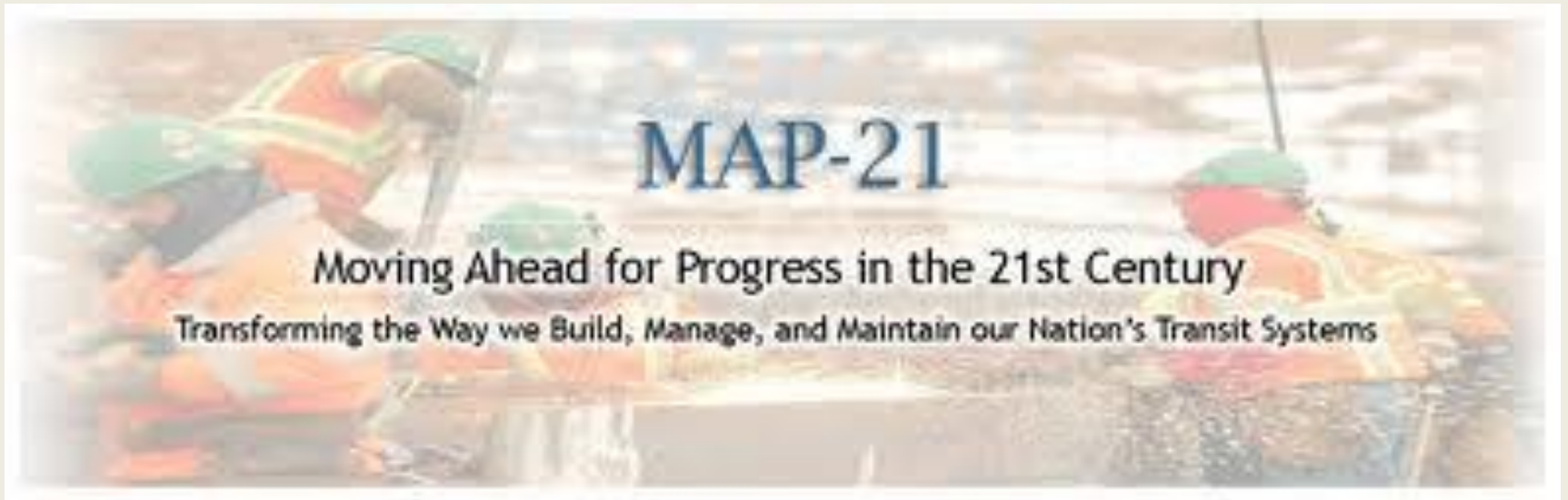
TRB Application of Emerging Technologies for Design and Construction

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

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

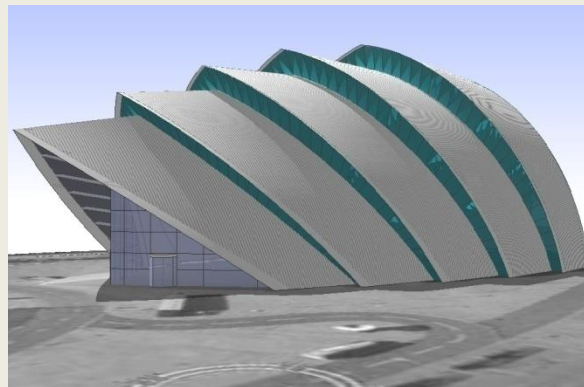
System – A system exists and operates in time and space

(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

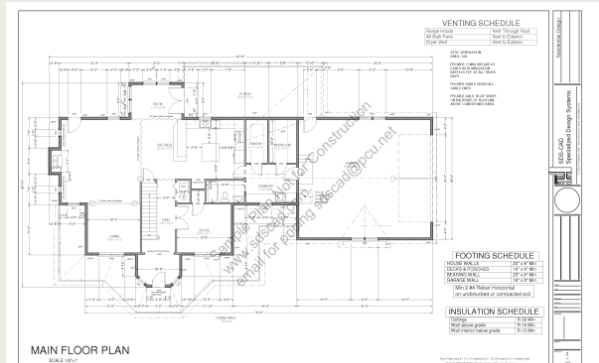
- **Model Centric Design** – All significant design processes extract information from and update changes to a digital model that represents the real system



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

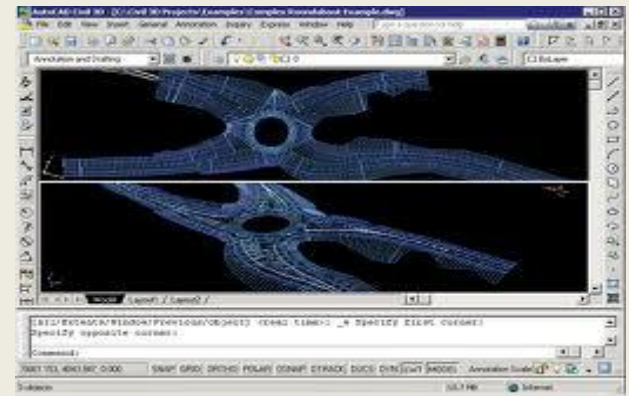


Enabling Technology

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 it's 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

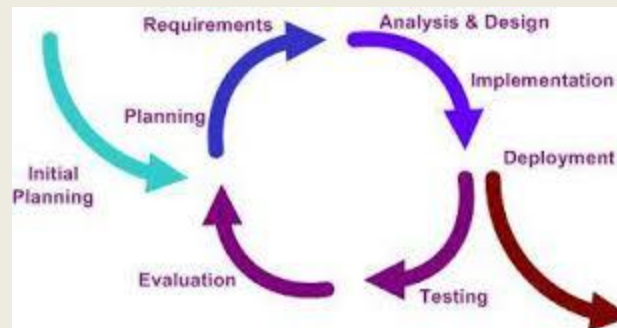


We Need Model-Centric Processes

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

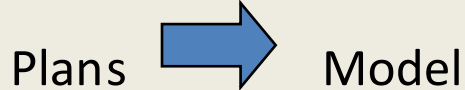


Evolution of Model-Centric

Plans Only

“What’s a model?”

Plans Visualization



The plans build the model

Roundtrip Engineering



Plans and model coexist

Model-Centric



The model builds the plans

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

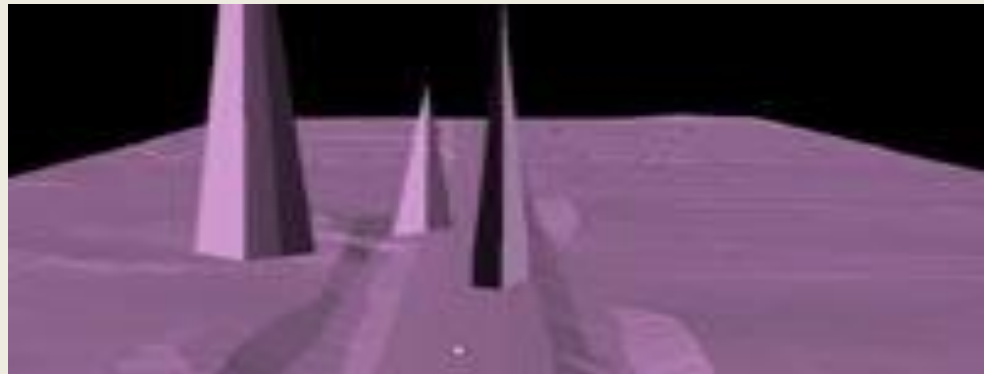
Development of guidelines to transition from *analog* thinking to *digital* thinking

Establishment of new skills in how to control and assure the quality of the model



Model-Centric Quality Assurance

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?



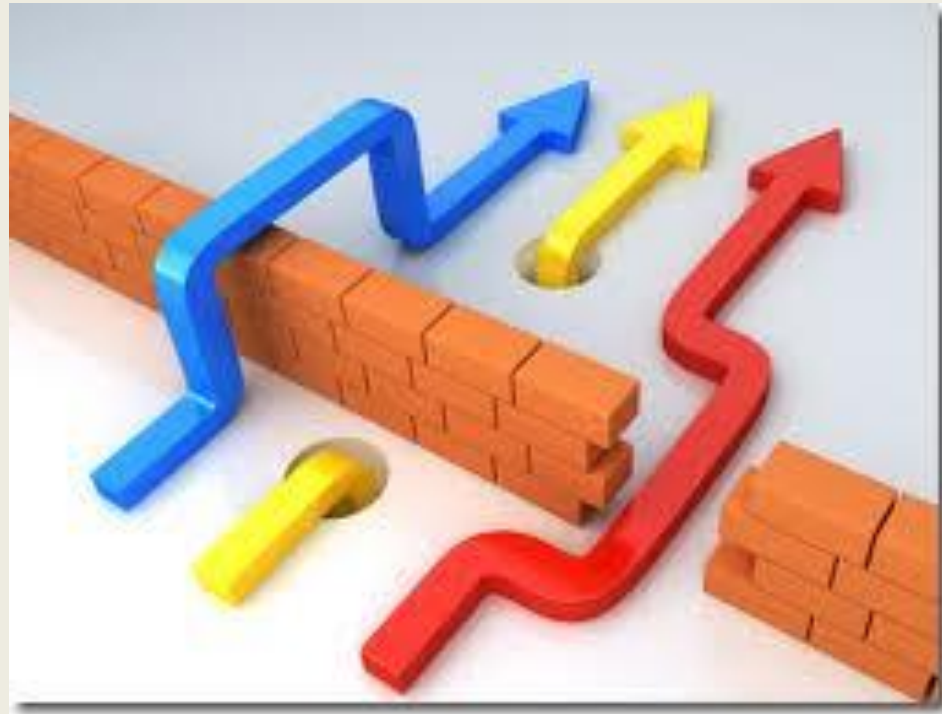
Have We Had Enough Of The Current State of Practice?



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?



Let's Remove Waste From Engineering

Our traditional practices are based on analog information



Muda - Uselessness



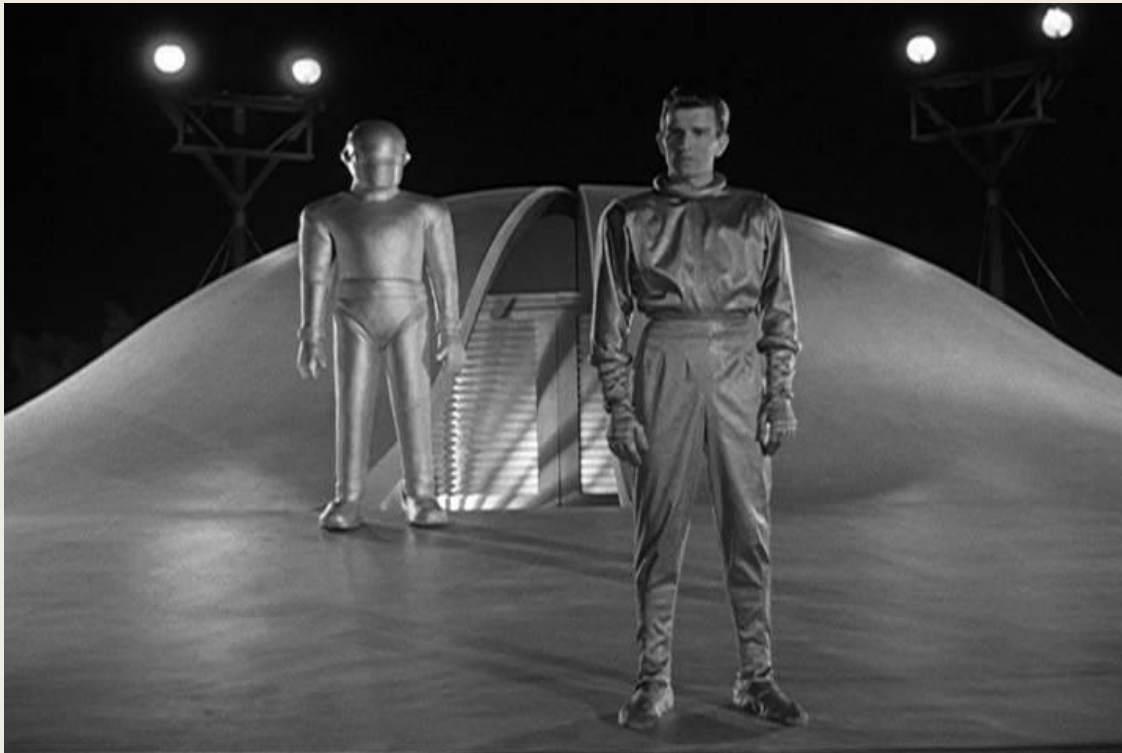
Mura - Inconsistency



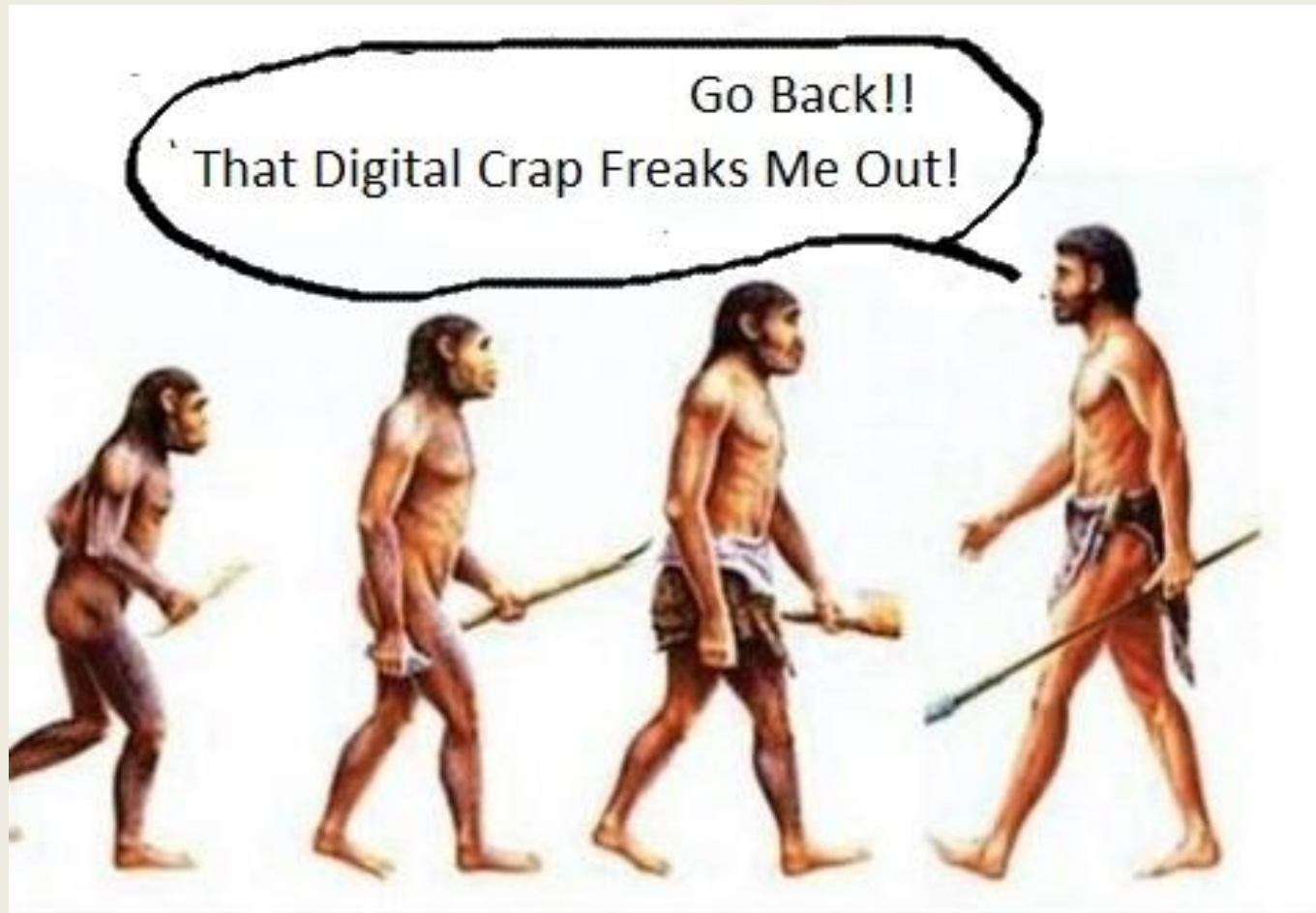
Muri - Overload



We Need To Change Our Ways



We Can't Be Afraid Of Evolving

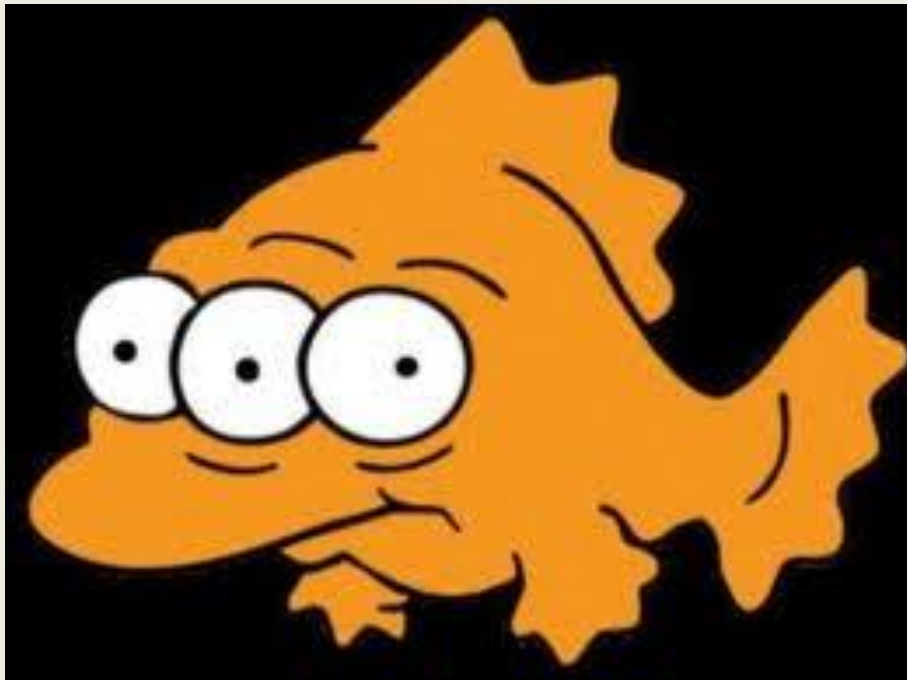


We have met the enemy, and he is us!



Thank You For Your Attendance

Is everything clear now?



How to contact the speaker:

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