

# Design Quality Assessment Using Process Review

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# Speaker Background

Danny Kahler, P.E.

22 Years of Experience in Transportation Design and Construction

Professional Engineer in Texas, Arkansas, and Florida

Independent Design Quality Assurance for State Highway 130 in Austin TX, a \$1.3B Design-Build Tollroad

Design and Construction Risk Engineering Program for the Intercounty Connector in Rockville, MD, a \$2.4 B Design-Build Tollroad and The New I-64 in St. Louis, MO, a \$450 M Design-Build Freeway

ASQ Certified CMQ/OE, CQA, CQE, CSQE, CSSGB

Coordinator for Development of a Body of Knowledge in Design Quality Management



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# Session Goals

- Summarize the benefits of design process review relative to traditional approach of plans review
- Share lessons learned from projects where design process review has been done
- Discuss how owners, contractor, and design firms can benefit by adding design process review to their quality toolbox



# Traditional Design Quality Assessment Approach

- Multiple copies of interim plan sets are prepared at 30%, 60%, and 90%.
- Copies of the plans are widely distributed for review.
- Reviewers mark up plans with comments. Comments could be actual design issues, questions, commentary, or preferences for drafting and plans quality.
- Design organization must respond to every comment made by every reviewer. Often comments from different reviewers conflict with each other.



# Are We Really Happy With The Current Approach?



Are we ready for a change?



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# Plans Review is *PRODUCT* Review

- The product is a set of construction documents that communicates the design to the contractor. The reviewer only controls whether or not the product is accepted or sent back for rework
- Requires significant amounts of time from the designer, the plans producer, and the reviewer
- Does not address **process flaws** that created the defects in the design and the plans
- Will only catch a portion of plans defects and and even smaller amount of design defects



# Plans Review Is Traditional Approach for Design-Bid-Build

- Design schedule is measured in terms of years
- Plans must adhere strictly to owner style and format for uniformity and biddability
- Design firm process is usually modeled after owner design process for compatibility



# Innovative Project Delivery Changes the Game

- Design schedule is measured in months instead of years
- Design teams are quickly assembled – team members often have to “unlearn” practices of other clients or projects to learn practices of current client or project within few weeks
- Traditional plans review can't keep up with high-tempo operations - but it's the only thing we've been trained in over the years.
- Innovative project delivery requires innovative quality assurance

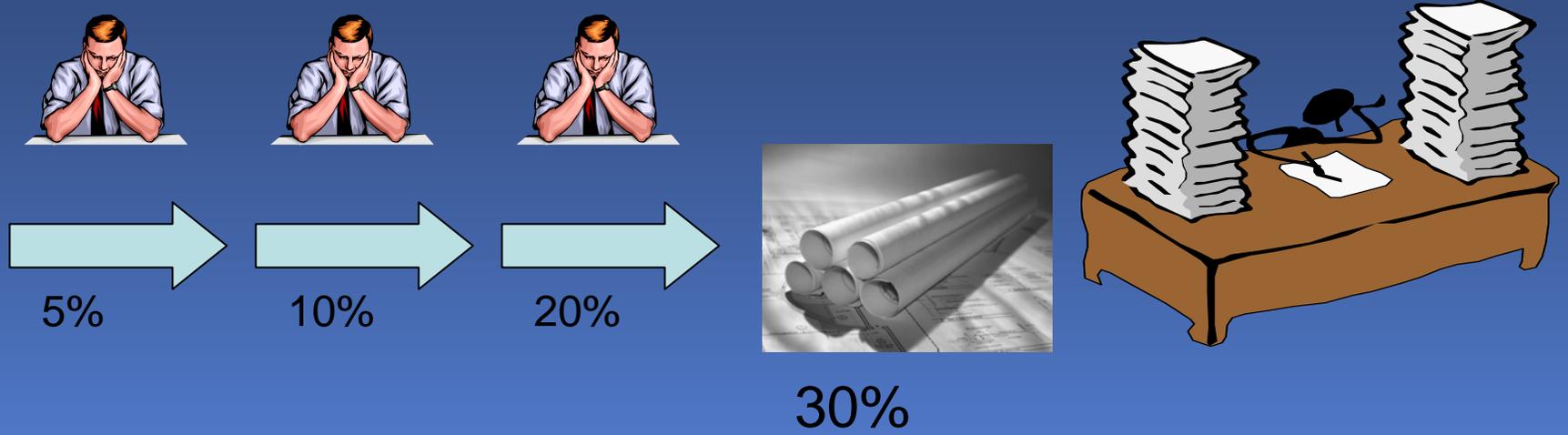


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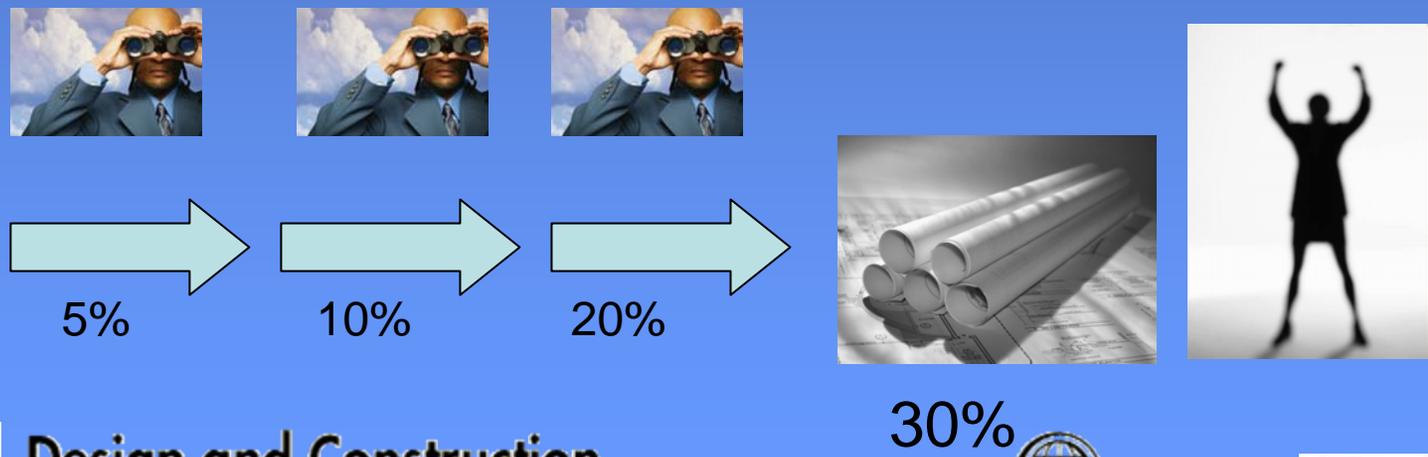
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In plans review, you have to wait for the package to come in



Process review let's you identify the design issues early



# Process Review Is A Prediction of Ultimate Design Quality

- A rain gauge lets you know for certain whether or not it rained, just as the severity and frequency of construction problems give you a general idea about the quality of the design and plans.
- A barometer helps you predict whether or not it will rain, so you can take action. Design process review helps you predict whether or not the design organization will produce a good design and set of plans.



# How Do We Review the Actual Design *PROCESS*?

- Follow the information:
  - Who created it?
  - Who uses it?
  - How is it controlled?



- See the whole project: *The real world is not cut up by plans sheets*
- Assess the capability of the people actually doing the design
- Assess the reliability of the tools the people are using

# Design Process Review Is *NOT* About Software



- Software vendors often “sales pitch” to design organizations that installing their product will solve their quality control problems
- Design managers spend more IT money but don’t see improved results
- Software vendors market “design process review” to design firms, but it’s really just training on how to use their software
- The defects are in the *system* imposed on the people, not the software



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Slide 12

# Focus Areas To Assist In Process Review

- **FIT** – Most design issues are about how the project fits together, i.e. the “model”
- **FLOW** – Just because something is constructable doesn't mean it will perform
- **FUNCTION** – Highways are getting more “high-tech”; systems engineering approach may be required



# Example Design Process Issues

- **Variability** – The aerial survey is only accurate to +/-0.5 feet but design engineer uses the data as if its all exact
- **Over analysis** – Hydrologic data is +/- 10% but design engineer attempts to get hydraulic runs to agree to the hundredth of a CFS
- **Coordinate Systems** – State highway ties to county project, but county files are in different system. Design engineer let's the computer overlay the files by coordinate but doesn't check the real world.



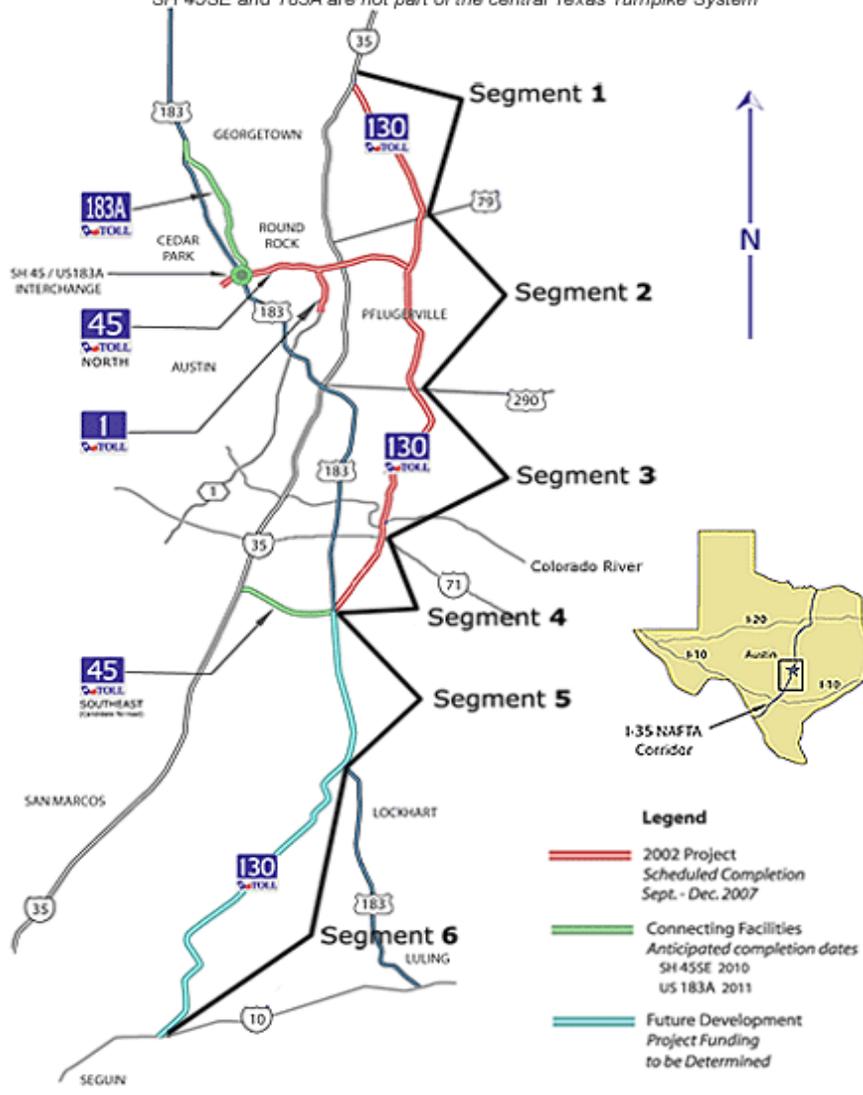
# Has Design Process Review Been Used On A Project?

- State Highway 130, Central Texas
- \$1.3 Billion Design-Build Toll Road
- Required Independent Design Quality Assurance Firm with dual reporting to both TxDOT and Developer
- Design process review consisted of both design process audits and real-time design-model review



# Central Texas Turnpike System\*

\*SH 45SE and 183A are not part of the central Texas Turnpike System



# SH 130

- DQAF had 10 people to review over 50 miles of highway (Segments 1-4) during an 18-month design period.
- Two people, trained in design process review, accounted for nearly 80% of significant design issues discovered. (Pareto Principle for Risk?)
- The other 8 people produced large amounts of comments as well, but mostly on drafting quality and plans appearance.

# What Professional Skills Did Design Process Review Require On SH 130?

- Direct experience with design and plans production
- Training in Quality Auditing
- Intermediate knowledge of the technology used for design and plans production
- Understanding of various design team organizations



# How Can Design Process Review Help An Owner, Design Firm, Or Constructor?

- Improved confidence about the quality of fast-track design
- Improved sense of effectiveness by design reviewers (and improved morale)
- General improvement of the state of the art in design processes in organizations producing plans
- Reduced cost of plans review = more profit!



# Why Consider Design Process Review As An Alternative To Plans Review?

- Improving the design process is in everyone's interest; improves “return on investment”
- Responding to thousands of plans review comments is costly to both engineering firms and State Highway Agencies
- Private industry already has accepted the concept of supplier process review (the private sector calls it quality auditing)



# How Could An Organization Implement Design Process Review ?

- Self-train your staff using educational resources of ASQ, PMI, INCOSE, or other technical associations
- Hire experienced quality assurance consultant to train your staff to perform design process review
- Hire experienced quality assurance consultant to perform design process reviews for you



# How many people should be involved in Design Process Review?

- My recommendation is to start with an effort equivalent to 10% to 20% of your current plans review staff. This level can usually identify at least half of the significant design issues in a project.
- Design Process Review should be conducted in parallel with traditional plans review
- As an organization becomes more familiar with Design Process Review, it can increase the percentage of process review to plans review



# Design Process Review Is A Part Of Quality Management Oversight

- Quality Management Oversight includes:
  - Management Review and Auditing
  - Process Review and Auditing
  - Product Inspection and Acceptance/Rejection
  - Followup Surveillance
  - Relational Database Management of Project Requirements



# *Delcan* Corporation

- Established 1954
  - DeLew Cather Canada sells Canadian operations to employees. Name changed to Delcan
- US, Canadian, and International practice groups for:
  - Transportation planning
  - Transportation engineering
  - Quality Management
  - Intelligent Transportation Systems
  - Water and Wastewater



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# Thank You For Attending

## How To Contact The Speaker:

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