Best Practices In Quality Control and Quality Assurance in Design

NCHRP 20-68A, Scan 09-01

U.S. Domestic Scan Program

NCHRP

National Cooperative
Highway Research Program

American Association of State
Highway and Transportation Officials

Federal Highway Administration

Disclosure

This scan is being conducted as a part of NCHRP Project 20-68A, the U.S. Domestic Scan program. The program was requested by the American Association of State Highway and Transportation Officials (AASHTO), with funding provided through the National Cooperative Highway Research Program (NCHRP). The NCHRP is supported by annual voluntary contributions from the state Departments of Transportation. Partial support for selected scans is provided by the U.S. Federal Highway Administration or other agencies. Each scan is selected by AASHTO and the NCHRP 20-68A Project Panel to address a single technical topic of broad interest to many state departments of transportation and other agencies. The purpose of each scan and of Project 20-68A as a whole is to accelerate beneficial innovation by (a) facilitating information sharing and technology exchange among the states and other transportation agencies and (b) identifying actionable items of common interest.

Further information on the NCHRP 20-68A U.S. Domestic Scan program is available at http://144.171.11.40/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=1570

Background

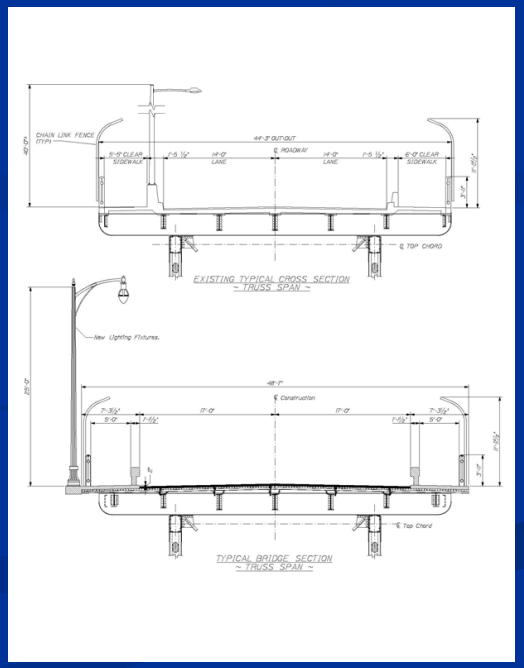
- Recent events have highlighted the need for Quality Control and Assurance in Highway and Bridge Design:
  - August 1, 2007 collapse of I-35W Bridge
  - NTSB Findings
    - Failure of the gusset plates at U10
    - Design error
  - NTSB Recommendation to AASHTO and FHWA
    - Work together to develop guidance on QC/QA in bridge design for the States

Domestic Scan Development

- Scan proposal approved December 2008
- Planning meeting held August 2010
- Scan conducted October-December 2010
- Final Scan Report Expected Summer 2011

Scan Focus

- Examine the policies and procedures used by various states to ensure high quality highway and bridge designs
  - Preliminary highway design
  - Final highway design
  - Environmental clearance/compliance
  - Bridge details
  - Design calculations
  - Final plans
  - Innovative project delivery methods



Scan Focus

- The Scan looked at States that:
  - Had documented standard operating procedures to ensure quality
  - Used performance measures to monitor effectiveness
  - Had identified the key components of quality control plans

Scan Focus

- Good QC/QA processes in highway and bridge designs result in:
  - Improved service life
  - Improved safety
  - Reduction in construction and maintenance costs

Amplifying Questions – Key Topics

- Detailed Amplifying Questions fell into the following Categories:
  - Definitions of successful QC/QA
  - How to measure the successfulness of the program?
  - How was the process developed?
  - How are the processes documented?
  - What types of reviews are done across disciplines?
  - What qualifications should be in place for designers and reviewers?
  - What QC/QA should be done differently for specialized processes such as Design-Build or Value Engineering?
  - How do Standards, Drawings and Software contribute to the QC/QA processes?
  - How do the QC/QA design processes extend into construction?

Scan Team Members

Scan Team Members

State DOTs:

- Hossein Ghara, LA – Chair
- Nancy Boyd, WA
- Tim Swanson, MN
- Carmen Swanwick. UT
- Robert Healy, MD
- Richard Dunne, NJ

Report Facilitator:

- Kelley Rehm, TN

NCHRP Contract:

- Harry Capers, Principal Investigator
  Arora and Associates, PC
- Michael Wright
  Arora and Associates, PC

Scan Hosts

Eastern US:

- New York
- Pennsylvania
- Georgia

Midwest US:

- Kentucky
- Minnesota

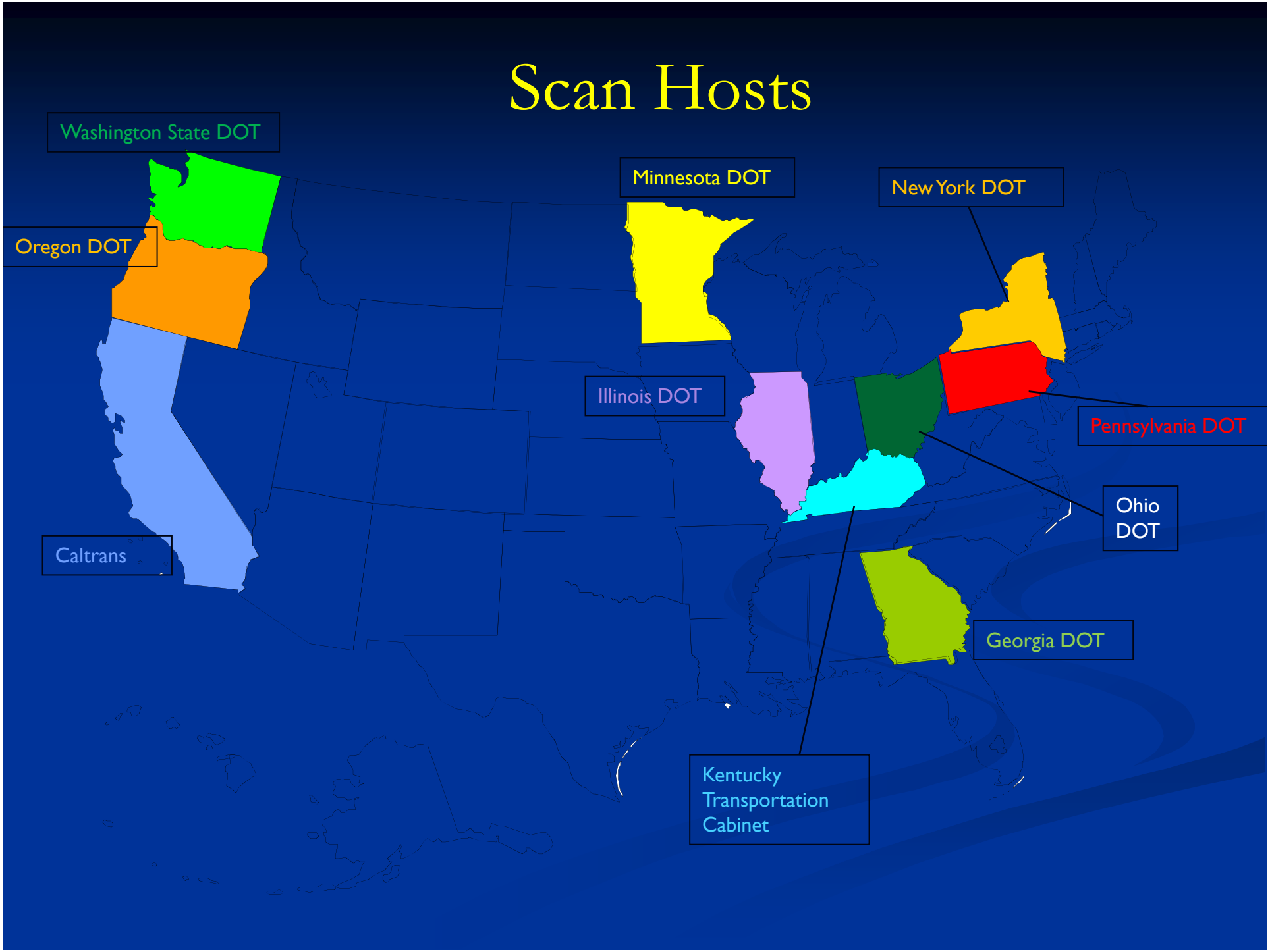
Western U.S.:

- Caltrans
- Oregon
- Washington State DOT

Web Conferences:

- Ohio
- Illinois

Scan Hosts


Washington State DOT
Oregon DOT
Minnesota DOT
New York DOT
Illinois DOT
Pennsylvania DOT
Ohio DOT
Caltrans
Georgia DOT
Kentucky Transportation Cabinet

Common Practices Among Successful States

- Experienced Staff and Well Developed Communications Channels
  - Quality Requires:
    - Adequate tools
    - Core competency
    - Good standards

Common Practices Among Successful States

- Experienced Staff and Well Developed Communications Channels
  - Training rotations for new staff
  - Regularly scheduled review meetings for all disciplines involved
  - Good communication channels between consultants and in-house designers

Common Practices Among Successful States

- Documentation of QC/QA Practices
  - Drivers to Document Practices
    - Higher percentage of designs done by consultants
    - High retirement and staff turnover
    - Decentralized organizations
    - Use of specialty contracting such as Design-Build

Common Practices Among Successful States

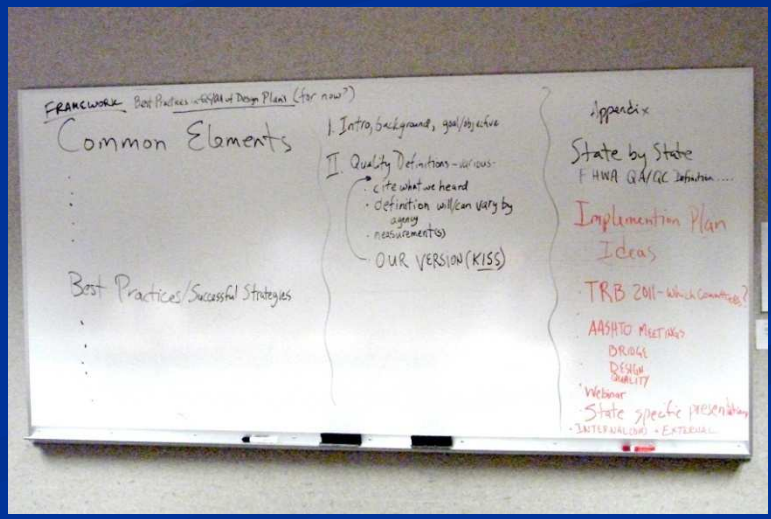
- Review and Approval Practices
  - Checklists
  - Consultant Grading/Rating
  - Risk-based scale to determine how much review is needed
  - Feedback loops for Value Engineering
  - Third party consultant reviews
  - Plan sign-offs or PE stamping for design, review and construction changes
  - Single point data systems

Innovative and Successful Solutions

- Successful States have:
  - Support of Upper Management
  - Quality People and Expertise
  - Performance Measures to show that time spent on quality programs result in cost savings and longer life
  - Recognize that Quality Plans do not always equal Quality DESIGN
    - Quality design should include considerations such as sustainability, constructability, public participations, etc.

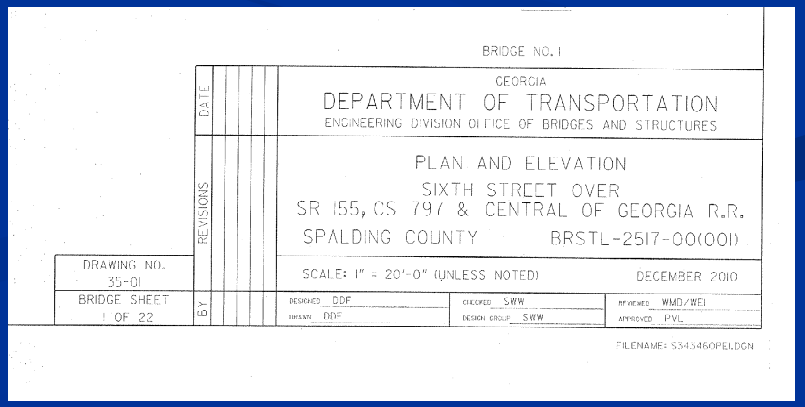
Innovative and Successful Solutions

- NOTE – Organizational structure, political constraints and funding availability vary widely
  - QC/QA Programs need to be tailored to each state to truly be successful



Innovative and Successful Solutions

- Checklists, Manuals and Standards
  - Common to all States – BUT
    - Successful Practice States use these tools for communication, training and re-evaluate the processes on a regular basis.
  - "Review Training" – specific training on how to review plans
  - Separate Quality Divisions or Bureaus
    - Centralized quality point of contact
    - Maintain all manuals/checklists, etc.
  - Title block sign-offs

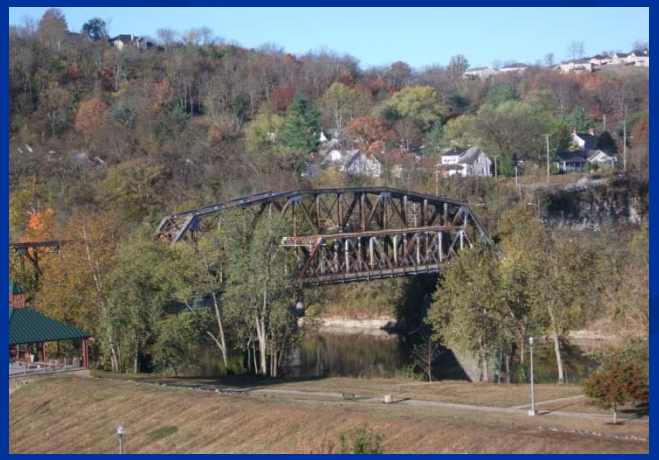


Innovative and Successful Solutions

- Scoping and Environmental
  - Include all parties involved in design and construction early in the process
    - Scheduled meetings at key points in the design, during construction and for post-construction feedback
  - State funded positions located at regulatory agencies
    - Expedites projects by taking away bottlenecks
  - Using "Green Sheets" or Environmental Tables within plan sets

Innovative and Successful Solutions

- Value Engineering Feedback
  - Use Feedback from the VE process to analyze trends and make changes to their design processes.
  - Involve Contractors in the VE process for another point of view



Innovative and Successful Solutions

- Consultant Selection and Communication
  - Submittal of consultant quality plans and project specific quality plans
- Construction Reviews and Feedback
  - Early involvement of construction for constructability
  - Post-construction reviews and feedback
- Quality in Existing Processes
  - Improve quality in EXISTING processes not by ADDING more processes
  - Evaluate processes to instill focus and efficiency

Future Research

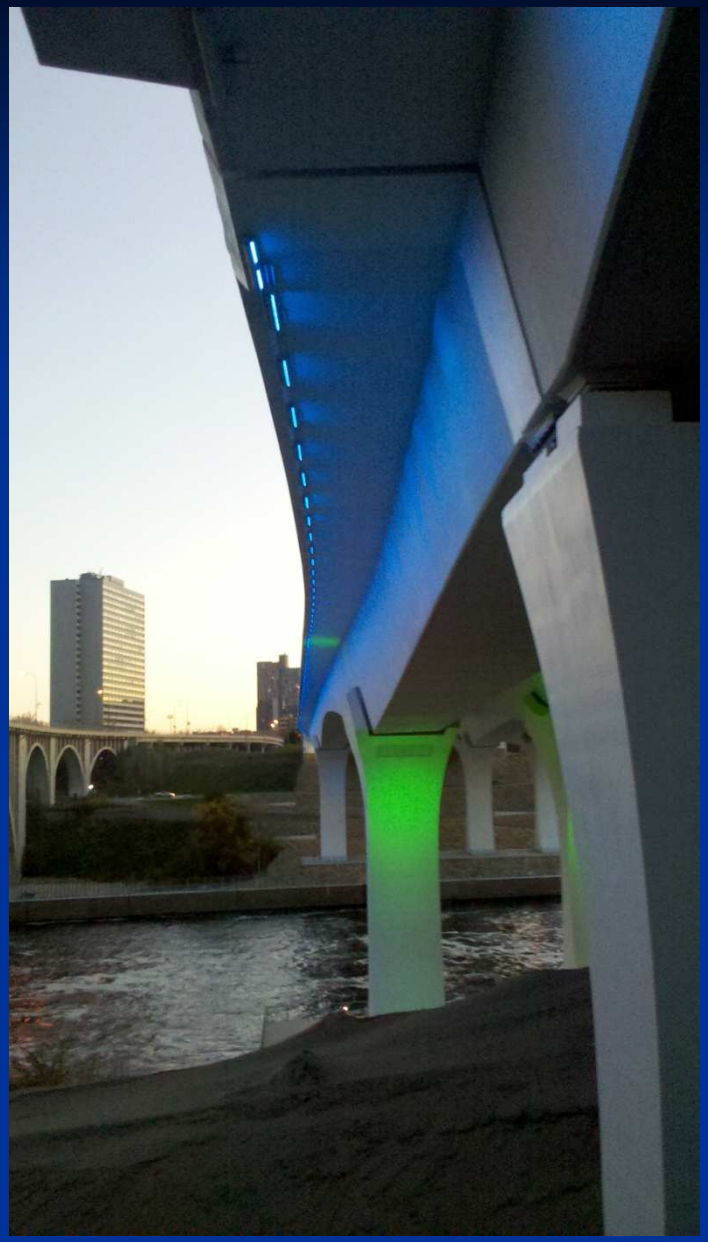
- How do we quantify the benefit of quality control and assurance??
  - Marginal benefit of more quality control
    - "If you spend one more hour on quality review on plans, how much quality does that add to the project?"
- How do we measure the incremental increase in quality and what performance measure should be used?

Implementation of Findings & Recommendations

- WEBINAR – large audience outreach
- PRESENTATIONS TO AASHTO AND TRB
- LOCAL IMPLEMENTATION IN TEAM MEMBERS' STATES
- IDENTIFY FUTURE RESEARCH – Draft Proposals

Implementation of Findings & Recommendations

- LETTER OF FINDINGS TO FHWA – for use in meeting NTSB recommendation
- WEBSITE – more information and clearinghouse
- SUBMIT JOURNAL ARTICLES TO TRADE PUBLICATIONS
- POST LINKS TO FINAL REPORT ON APPROPRIATE WEBSITES



Thank You