Best Practices In Quality Control and Quality Assurance in Design

NCHRP 20-68A, Scan 09-01
U.S. Domestic Scan Program

Federal Highway Administration
American Association of State Highway and Transportation Officials
National Cooperative Highway Research Program
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
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
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
Good QC/QA processes in highway and bridge designs result in:

- Better constructed product
- Improved durability and 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

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Scan Team Members
Scan Hosts

Eastern US:
- New York
- Pennsylvania
- Georgia

Western U.S.:
- California
- Oregon
- Washington

Midwest US:
- Kentucky
- Minnesota

Web Conferences:
- Ohio
- Illinois
Common Practices Among Successful States

- Experienced Staff and Well Developed Communications Channels
  
  - Quality Requires:
    - Adequate tools
    - Core competency
    - Good standards
  
  - 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
  - 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
  - Consultant Rating
Innovative and Successful Solutions

- Organizational structure, resources, political constraints and funding availability vary widely among states.
- QC/QA Programs need to be tailored to each state to truly be successful – one size does NOT fit all.
Innovative and Successful Solutions

- Successful States have:
  - Support of Upper Management
  - Quality People with Experience and Expertise
  - Performance Measures to show that time spent on quality programs result in cost savings and longer life
  - Recognized that High Quality Plans do not always equal High Quality DESIGN
    - Quality design should include considerations such as constructability, maintainability, sustainability, opportunity for stakeholder input, etc.
Innovative and Successful Solutions

- Checklists, Manuals and Standards
  - Common to all States – BUT
    - Successful 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 Units
  - Centralized quality point of contact
  - Maintain all manuals/checklists, etc.
- Title block sign-offs
Innovative and Successful Solutions

- Project 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 value of quality control and assurance?
- What performance measures should be used to track quality?
- What is the marginal value of incremental increases in quality control
  - “If you spend one more hour on quality review on plans, how much quality does that add to the project?”
Dissemination of Findings & Recommendations

- Letter of findings to FHWA – for use in meeting NTSB recommendation
- Presentations to AASHTO and TRB
- Local implementation in team members’ states
- Post links to final report on appropriate websites
- Submit journal articles to trade publications
Dissemination of Findings & Recommendations

- Website – more information and clearinghouse
- Webinars– large audience outreach
- Identify future research – draft proposals
Thank You