Quality Matters
Vol. III, Issue 4 – Winter 2013
from the Quality Assurance Branch (QAB) of Highway Design

Design-Build: *Another tool in the tool box for Project Delivery in Kentucky*

Design-Build (DB) is not a new concept for Kentucky. In 2006, the General Assembly passed a law that the Kentucky Transportation Cabinet (KYTC) could have a maximum of 10 pilot projects designated as DB for 2007-2008 Biennium. Since that time, we have learned several poignant lessons.

House Bill 445 passed this past spring. Effective June 25, 2013, KYTC, under KRS 176.431, can procure up to five DB projects per fiscal year. Each project is limited to a construction phase no greater than $30 million.

The work completed on a DB project doesn't change, but the roles and responsibilities of the Project Management staff do. Many state agencies across the country are using DB as a way to improve the way they deliver their annual programs. There are full reports and books pertaining to the details that can focus on DB directly.

Major differences between DB and traditional project delivery DBB (design-bid-build):

- The owner enters into one contract with a designer and builder (Design-Build-Team or DBT). The DBT can be a Joint Venture entity comprised of a design consultant and a contractor or a lead contractor that directly hires a design consultant.
- Selection of the DBT relies on entities with qualifications-based engineering factors that provide "Best Value" and not just low price. This is similar to how the Cabinet advertises and selects for professional services for project development stages.
- A fixed budget defined early because the project is considered bid before it is actually designed.
- Pace at which projects are completed. See diagram below. (Dr. Keith Molenaar, 2001)

Not all projects are right for DB. Some significant positives that can result when DB delivery is used:

- Schedule savings (as seen below)
- Innovation
- Cost Savings
- Minimization of Change Orders
- Partnering between the owner, designer and contractor to achieve project success
- Transfer of specific Risk elements to the entity that can best manage it

Alternatively, some points of possible failure, from experience:

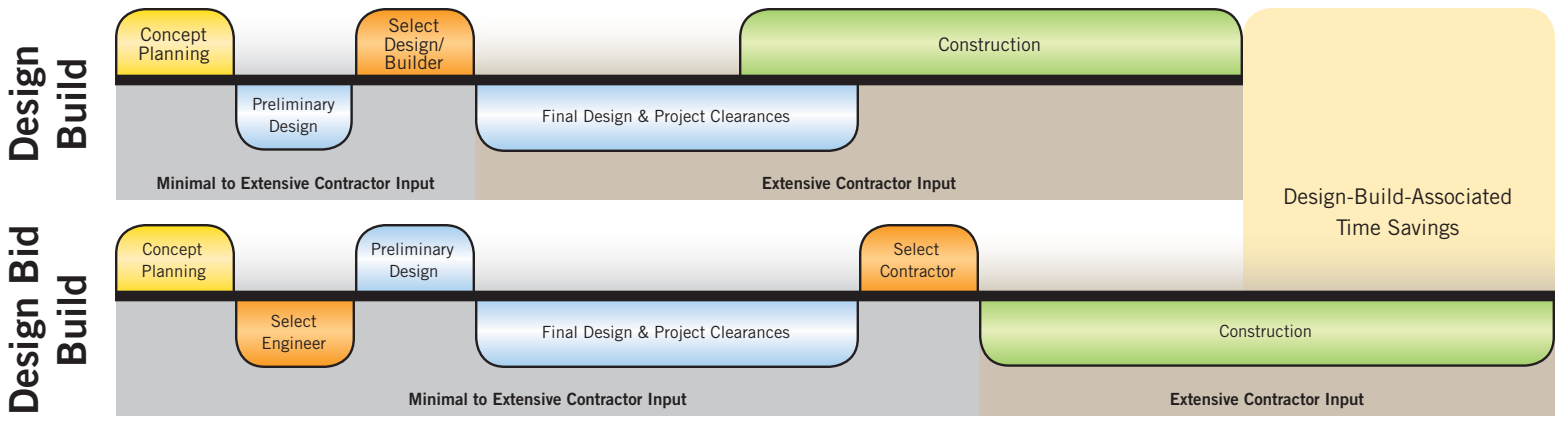
- Misunderstood changed responsibilities within the project delivery team
- Projects that could not acquire Right-of-Way in a timely fashion
- Utilities not on the same time-line which constricts workflow

Four DB projects are underway with the Cabinet including Somerset Southeast Bypass (KY 914) in Pulaski County, Cadiz Bypass Road (U.S. 68, KY 80) in Trigg County, John Rowan Boulevard (KY 245) in Nelson County, and Interstate 69 at Western Kentucky/Pennyrile Parkway in Hopkins County.

The project risk profile is typically higher for DBB than DB. For the DBB, KYTC assumes the risk of changes between design and construction, normally in the form of construction change orders. For DB, these risks have been transferred to the DBT. The changes are handled internally to the team resulting in a much lower likelihood of change orders and added cost and schedule.

Lastly, the quality assurance piece for DB is an important factor for all phases of work. Without diligent effort, the "positives" will be distorted and may prove to be costly. Getting the work completed in a timely fashion with proper DBT quality control for inspections are relevant for a "good" product. For that reason alone, everyone in the Kentucky transportation industry needs to be much more aware and knowledgeable about the changes in how DB projects are to be managed for success.

by Boday Borres, PE, AVS



Mitered Headwalls:

What can they do for you?

Mitered headwalls can offer protection for the end of a pipe that is comparable to typical headwalls. KYTC's Drainage Manual identifies the benefits of a headwall as providing stability for the end of a pipe, preventing erosion, retaining soil and providing safety for errant vehicles. The mitered headwall accomplishes all these with distinct advantages of safety, adaptability and cost effectiveness.

When used on cross drains 30 inches and smaller, the mitered headwall is traversable by conforming exactly to the slope angle. Pipes larger than 30 inches may need bar grates to maintain the clear opening width according to the AASHTO Roadside Design Guide and subsequently lose some cost effectiveness. In addition, the ability to modify this headwall to conform to the foreslope with pipe installed on a skew helps to avoid slope discontinuity commonly seen with traditional headwall installations. This greatly improves the safety of the slope by eliminating the bulge around the headwall on the foreslope.

The mitered headwall concept is another tool in the designer's tool belt that may just be the answer for a sticky cross drain issue or even retrofitting existing culvert pipes via a maintenance project or on Highway Safety Improvement Program (HSIP) projects. For more information, see the FDOT 2014 Design Standards for the headwall implemented by Florida DOT. Stay tuned for future detail drawings to be developed by KYTC for designers' use.

by Travis Carrico, PE

Other Uses for Value Engineering Studies Not Only for Transportation Projects: Headwall Standards Process Improvements

In March 2013, a three-day Value Engineering (VE) study evaluated the current Headwall Supplement and looked for improvements to the KYTC headwall standards process. "RDH" drawings used to be part of the Standard Drawings. Then, in 1983, the Headwall Supplement came into its first printing as an independent document, due to the magnitude of information. The latest revision to the current Headwall Supplement was in 2000. Since that time, there have been no updates or revisions made to the charts or drawings in the Headwall Supplement. For this reason, it was determined that a Value Engineering study would be a useful tool to evaluate and potentially update the Headwall Supplement. The primary objectives of the study were to:

1. Look for more efficient ways to design and construct headwalls using current industry materials and construction practices, and
2. Look for ways to realize immediate and long-term cost savings to Kentucky in the manufacturing and installation of these structures.

During the initial phase of the study, the VE team brainstormed 56 ideas to improve the headwall standards process. As the study progressed, 13 ideas were identified for further development into VE recommendations. Of those 13, eight recommendations are now under consideration for implementation. A few examples under consideration are:

- Allowing alternate materials for headwalls, not just reinforced concrete
- Designing and detailing headwalls and wing walls individually
- Developing an interactive worksheet for calculations of steel and concrete to eliminate quantities within the standards
- Re-integrating headwall standards into the Standard Drawings and eliminate the Headwall Supplement.

The next printing for the Standard Drawings and Headwall Supplement is scheduled for January 2016. Therefore, the revision process may start as early as mid-2014. Look for future articles in the Quality Matters newsletter for updates on the potential changes implemented into the Headwall Supplement and the headwall standards process. This VE study may prove to bring value to KYTC and transportation across the state.

The current headwall standard drawings can be found on-line at http://transportation.ky.gov/Highway-Design/Pages/2012-Standard-Drawings.aspx.

by Michael Vaughn, PE

QAB's Personnel - On the Move

New Additions

Michael Vaughn, PE, is the new Value Engineering Coordinator in the Quality Assurance Branch. He graduated from the University of Kentucky with a Bachelor of Science in Civil Engineering where he attended as a KYTC scholarship student. In January 2003, immediately after graduation, he began his career with KYTC. After a brief rotation period, he worked the next 4 1/2 years in the Design Section of District 7. In 2008, he became the District 7 Bridge Engineer where he worked until accepting the Value Engineering Coordinator position starting Oct. 1, 2013. With a background in highway design and bridge maintenance/ construction, Vaughn has a wide foundation of valuable experience that will help him in his new role as the Value Engineering Coordinator. If you would like to contact him, email: *mike.vaughn@ky.gov*.

Shawn Russell, PE, is the latest addition to the Quality Assurance Branch and the new Constructability Review Coordinator. He began his career with KYTC in 2001 after graduating from the University of Kentucky with a Bachelor of Science in Civil Engineering. He was a KYTC scholarship student. After a brief rotation period, he began working in the Winchester Construction Crew in 2002. In 2010, he became Section Supervisor of the Richmond Section Office where he worked until accepting the Constructability Review Coordinator position starting Oct. 16, 2013. He has more than 11 years of experience in the construction area that will allow him to excel in his new role as the Constructability Review Coordinator. If you would like to contact him, email: *shawn.russell@ky.gov*

Farewell

Boday Borres, PE, AVS, has been the driving force of the Quality Assurance Branch in the Division of Highway Design since becoming the QAB Branch Manager more than four years ago. She is a veteran of the Cabinet since 1996 and has worked in the Division of Structural Design and the Division of Planning. Borres is a registered civil engineer in Kentucky and Hawaii. She received her Bachelor of Science in Civil Engineering from the University of Kentucky, where she attended as a KYTC scholarship student. She also has a Bachelor of Science in Applied Mathematics with a minor in Physics from Kentucky State University. In 2011, Borres completed her Associate Value Specialist (AVS) status from SAVE International, for Value Engineering. She and her husband, Mark Drury, share seven children (ranging from 20 to 26). Both reside in Frankfort. Borres retired from KYTC at the end of November. She began a new chapter in her life as the Structures Engineer with FHWA effective Dec. 2, 2013. If you would like to contact her, call the FHWA Kentucky Division Office in Frankfort at (502) 223-6763 or email: *Boday.Borres@dot.gov*.

Completed Studies

Evaluation of Mechanically Stabilized Earth Walls for Bridge Ends in Kentucky; What Next? (*http://www.ktc.uky.edu/projects/evaluation-of-mechanically-stabilized-earth-walls-for-bridge-ends-in-kentucky-what-next/*)

Tools for Applying Constructability Concepts to Project Development (Design) (*http://www.ktc.uky.edu/projects/tools-for-applying-constructability-concepts-to-project-development-design/*)

Upcoming Training:

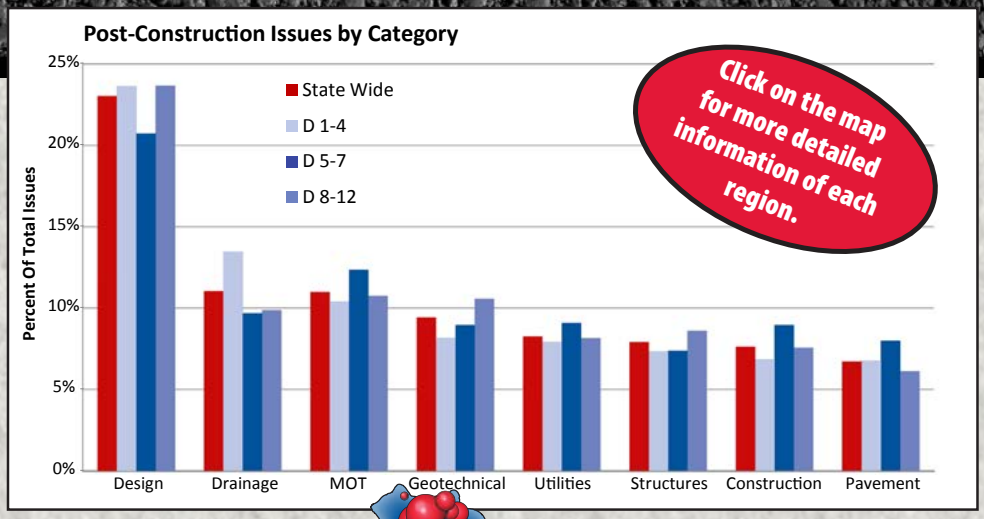
Kentucky Engineering Center:

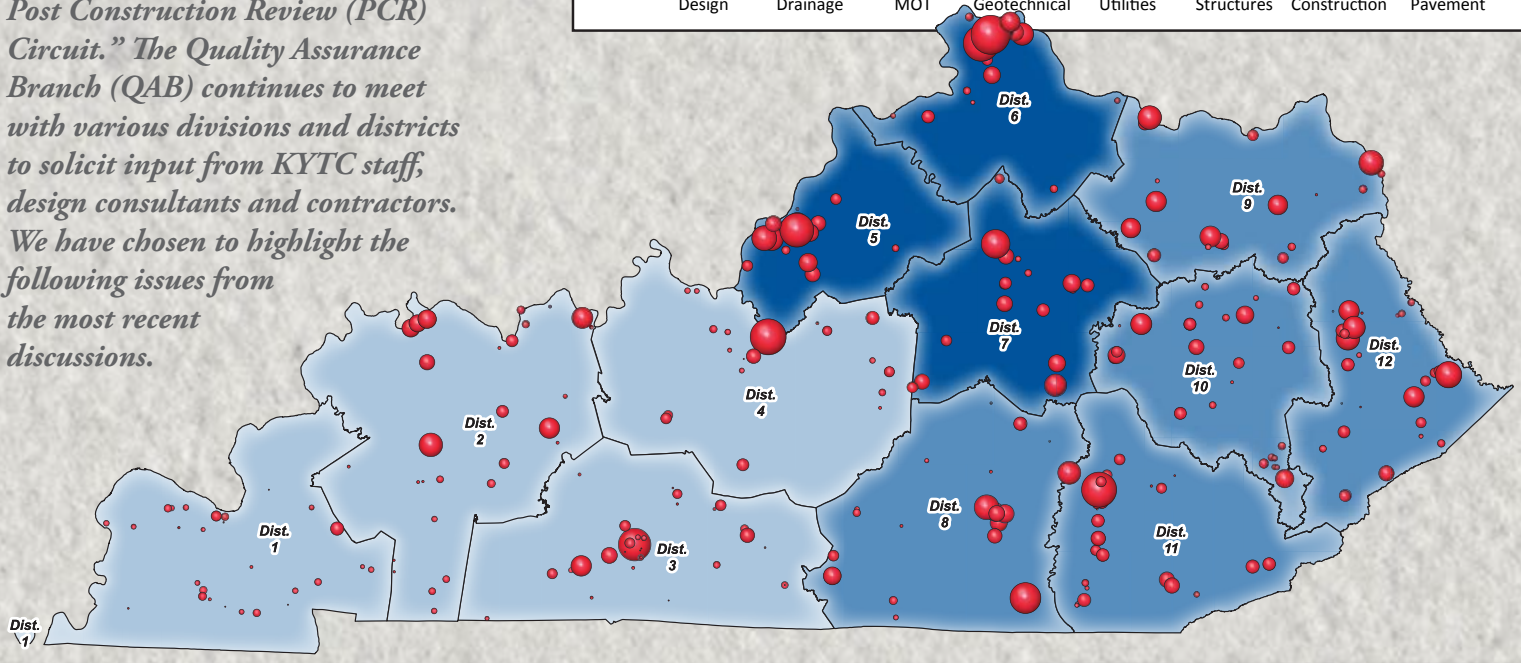
(http://www.kyengcenter.org/)

- Jan. 13-16 – InRoads I (Monday start) at the Kentucky Engineering Center
- Feb. 4 - Third Annual Bridge Seminar Day at the Clarion North Hotel in Lexington
- Feb. 25-26 – InRoads Survey at the Kentucky Engineering Center
- March 25-28 – MicroStation/InRoads TBD (Most likely MicroStation II) at the Kentucky Engineering Center

Lessons Learned

This is the eighth installment of the series, "Lessons Learned from the Post Construction Review (PCR) Circuit." The Quality Assurance Branch (QAB) continues to meet with various divisions and districts to solicit input from KYTC staff, design consultants and contractors. We have chosen to highlight the following issues from the most recent discussions.





Statewide Post-Construction Review Issues

The red circles on the state map show the location of post-construction reviewed projects since 1996. The size of the circle correlates to the number of issues encountered on the project. Issues are identified in Post-Construction Review meetings and categorized into one of 13 categories. Typically, projects in larger cities have more issues.

The corresponding bar graph breaks out the top eight categories of issues by percentage in each area. Design issues are the No. 1 concern for projects across the state. The design issues are further broken into several subtopics for identification and analysis. The rest of the top issues vary by region. The western areas of the state tend to have more drainage issues. The eastern areas of the state tend to proportionally have more geotechnical issues. The northern areas of the state tend to have more issues with MOT.

Quality Assurance conducts approximately four post-construction reviews per district annually. Projects chosen for review typically have several change orders or line item overruns. The Post-Construction Review Coordinator, Travis Carrico, facilitates review meetings with all parties involved in the project. The issues encountered during construction are documented and categorized in a fact sheet. Then the data for each review is entered into the post-construction review database and displayed on the GIS website.

To read all the issues involved in each project, go to the Lessons Learned Database at: *http://maps.kytc.ky.gov/LessonsLearnedDatabase/*

Then press the identify button (ⓘ) and select the road segment desired to find the project and the contents of the review.

by Eileen Vaughan, PE

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