

# Quality Matters

Vol. III, Issue 2 – Summer 2013

from the Quality Assurance Branch (QAB) of Highway Design

## 3D Modeling and Automated Machine Guidance

by Jonathan West, PE

### What's new?

Certainly not 3D modeling... For many years now, 3D modeling has been an integral part of highway plan production at the Kentucky Transportation Cabinet (KYTC). Most designers develop a project from concept through final design in a 3D CADD-based environment with the goal of producing a 2D record plan set. The paper version is one of the key elements of communication to the Division of Construction and Project Delivery detailing the design.

In the past, the contractor would construct the project based on the 2D record set using standard construction staking methodology. New technology, such as GPS, has greatly affected how that staking is performed.

The construction industry is becoming increasingly engaged in utilizing GPS or Automated Machine Guidance (AMG). Heavy equipment

such as dozers, graders, excavators, pavers and rollers equipped with such technology are used to deliver the project more efficiently requiring less construction staking.

These processes are leading to a much faster, safer, cost effective and predictable project delivery. As part of the current Federal Transportation Bill "Moving Ahead for Progress in the 21st Century" (MAP21) and Phase 2 of the Every Day Counts initiative, 3D Engineered Models for Construction have become a major point of emphasis to connect design and construction in the "modern-day digital jobsite."

KYTC, for some time now, has required projects to be submitted with a supplemental data directory that includes all necessary InRoads files produced during the Design Phase and the LandXML counterparts. Digital versions of the geometry, templates, as well as the existing and proposed Digital Terrain Models

(DTMs) are included in the required deliverables. At this point, however, the quality control of the data has been essentially non-existent from a KYTC standpoint.

During a recent forum, Kentucky Association of Highway Contractors (KAHC) membership expressed frustration to KYTC Highway Design representatives with the quality of the digital files in the plan deliverables. Many simply choose to scrap the files delivered and develop their own models based on the 2D paper plans. Essentially, the contractor is "reverse-engineering" the plans into a usable digital form that can be uploaded to his AMG and GPS systems.

In an effort to respond to these concerns, KY 7 in Elliott County was selected by the Division of Highway Design's Developmental Branch as a pilot project with the goal of providing a 3D model that is 100 percent reflective of the record set. Special notes were developed in order to



# 3D Modeling and Automated Machine Guidance

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deliver this project through the letting process requiring the contractor to use AMG and the supplied 3D model. A major provision in the notes detail that if a discrepancy is discovered in the contract documents, the 3D surface model shall supercede the contract plan set. Once the project progresses to construction, the contractor will be required to schedule mandatory progress meetings with KYTC staff. This will provide a forum in which 3D modeling issues can be resolved in a timely fashion.

After construction, the pilot project will hopefully provide many valuable

lessons that will shape the future of electronic deliverables required by KYTC during project development. In the meantime, designers producing KYTC plan documents are

encouraged to continue refining their modeling skills. The next phase in project deliverables is on the horizon.



## Check out the Current Supplemental Specs...

When considering the letting date of upcoming projects, it's a good idea to double check the supplemental specifications. Since the last Quality Matters issue, two additional publications of the supplemental specs have been released. The most recent publication is effective for projects let on or after June 14, 2013. To view all publications of the supplemental specs, visit: <http://transportation.ky.gov/Construction/Pages/Kentucky-Standard-Specifications.aspx>

## Upcoming Training:

### Kentucky Engineering Center:

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

- June 11 - InRoads II (three days)
- June 18 - Paducah - Spring One Day Seminar
- June 25 - InRoads Survey V8i (two days)
- June 27 - InRoads Survey V8i (two days)
- July 9 - Applying InRoads III V8i (four days)
- July 16 - Advanced Concepts of Open Channel Flow HEC-RAS (two days)
- Aug. 6 - Modeling in 3D Microstation / InRoads (four days)
- Aug. 15 - Architect-Engineer (A-E) Selection and Contracting
- Aug. 16 - A-E Contract Negotiation, Awards and Contract Administration

### KYTC/FHWA/ACEC-KY Partnering Conference

- Sept. 9 - 11 Galt House Hotel, Louisville, Kentucky

## Before U Dig (BUD) KY 811

Effective July 12, 2013 - Don't forget to make your Design Locate Requests



see Design Memo 02-13

Visit their website at

<http://kentucky811.org/>

To submit a request:

Call 811 or 800-752-6007

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# Value Engineering (VE) Policy Changes

by Brent Sweger, PE, AVS

In February, the Division of Highway Design released a new design memo addressing a KYTC policy change that reflects new federal regulations. The criteria calls for an increase in the threshold of the total project cost for which projects shall have a VE study conducted. Total project cost includes the estimated costs of all project phases. The new threshold is \$50 million for a roadway project or \$40

million for a bridge project. The limits of a project are the termini defined in the environmental document and therefore may constitute several item numbers. The Quality Assurance Branch keeps a list on the website that includes all applicable item numbers of projects that will require a VE study. Please contact [Body.Borres@ky.gov](mailto:Body.Borres@ky.gov) if your project warrants a VE study.

Request for  
Proposals – Value  
Engineering – June  
11th Bulletin

Be on the lookout  
for the VE Module 1  
training this winter...



## New Addition

### Travis Carrico, PE

Travis Carrico is a new member of QAB. He began his career with KYTC in 2005 after graduating from Western Kentucky University with a Bachelor of Science in Civil Engineering where he attended as a KYTC scholarship student. A veteran of more than eight years in construction, he will charge the Post-Construction Review Program. He comes from District 4 in the Campbellsville Section Office. As always, QAB has embraced his ideas to make future improvements not only in the Cabinet but for his program. He is an impressive individual and will fit in well in his new role. If you would like to contact him, email: [travis.carrico@ky.gov](mailto:travis.carrico@ky.gov)

## New Addition

### Eileen Vaughan, PE

Eileen Vaughan is our latest addition to QAB. Vaughan joins us from the private sector having provided electrical engineering and data analyst services to commercial, industrial and municipal clients. She most recently owned her own engineering company. She will assume the responsibility of managing the Lessons Learned GIS Database and support various projects. She is versed in data mining and will move our Lessons Learned GIS Database to the next level. There are numerous adventures that lie ahead for her with the Cabinet. If you would like to contact her, email: [eileen.vaughan@ky.gov](mailto:eileen.vaughan@ky.gov)

## Farewell

### Brent Sweger, PE, AVS

Brent Sweger has been vital as the VE Coordinator for the past three years. His time with the Quality Assurance Branch has given the VE Program a new face. We are proud of his accomplishments and he has brought innovation to the Cabinet through VE. The articles written by him, in the Quality Matters newsletters, have given cutting edge ideas for designers, construction and maintenance. Sweger has joined the Roadway Design Branch of the Division of Highway Design and is the Location Engineer for District 4. If you would like to contact him, his email remains the same: [brent.sweger@ky.gov](mailto:brent.sweger@ky.gov)

# Lessons Learned by Travis Carrico, PE

*This is the sixth installment of the series titled “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.*

## Designing drainage that works beyond the right of way (ROW) limits

During a recent meeting on a project that incorporated construction within existing right of way (ROW) limits, the topic of discussion quickly

shifted toward drainage issues. It was pointed out by design, construction and maintenance personnel that drainage design on KYTC projects is often adequate up to the ROW line, but often not beyond. When necessary and possible, additional consideration should be given to extending ditch improvements away from the roadway and onto permanent drainage easements. In some cases, without permanent drainage easements, drainage systems may not function as intended and cause ponding to occur on the ROW or even on private property.

When this issue occurs, it negatively impacts maintenance efforts causing an open ended dilemma. On interstate projects, for example, decades old silt covered ditches and silted pipes are frequently encountered. They cannot be properly restored unless clearing past the ROW line, if that is possible. One contributing factor to this issue could be the tendency to design drainage that mimics the existing drainage. This issue must be approached on a case-by-case basis. Overall, designers should keep in mind the global drainage impacts, not just those within our ROW, which ultimately may lead to more drainage work extending beyond the ROW line.

## Dealing with saturated conditions on existing roadbeds

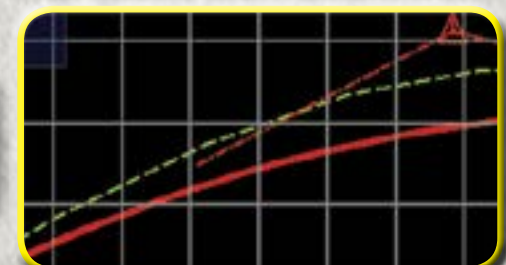
On a recent project, an existing pavement was removed, the grade was cut and saturated subgrade was encountered. The difference in finish and existing grade was approximately 2.5 feet, thus necessitating the existing pavement removal and complete reconstruction.



**Plan View**

A change order was necessary to establish work items for geotextile fabric and crushed aggregate No 2 to mechanically stabilize the subgrade after undercutting was performed.

It's important for designers to investigate subsurface conditions when encountering existing roadbeds as they are commonly saturated due to poor subgrade drainage.



**Profile View**

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## Lessons Learned Database Available Online

<http://transportation.ky.gov/Highway-Design/Pages/Lessons-Learned.aspx>