

Creating a Plan to Implement 3D Engineered Models for Construction

The Kentucky Transportation Cabinet Experience

What is Kentucky Doing?

- Contractor must use supplied 3D model
- 3D model takes precedence over plans

"Old School" Thinking

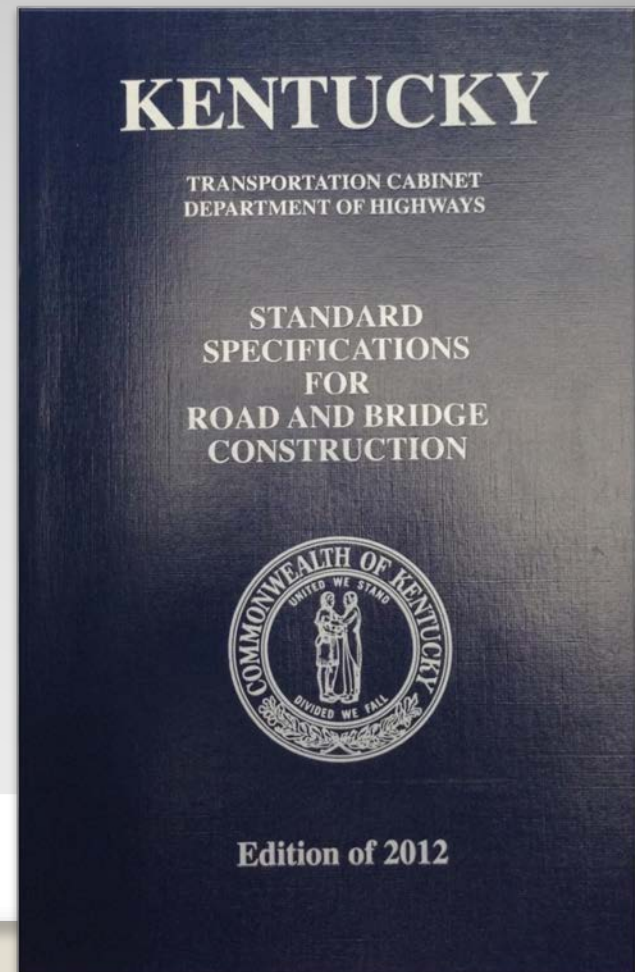
- 2D Plans in a 3D world
- 2005 - KYTC began requiring 3D submittals
- 3D models submitted are not QA/QC'd

Which files are currently submitted?

Supplemental Information	File Format(s)	Notes
Mapping files (3D)	.DGN	Existing Manuscript
Existing Ground Digital Terrain Data	.DTM and .XML	Existing digital terrain data of project area
Coordinate Control Data	ASCII	N,E,Z of control points and PR R/W monuments
Alignment Geometry	.ALG and .XML	All centerline horizontal and vertical alignments
Superelevation Report	.XML	Data file will contain information about superelevation transitions
Proposed Roadway Model	.DTM, .ITL, .IRD, .XML	Proposed 3D model of roadway and approaches
Proposed Manuscript (3D)	.DGN	Includes existing contours and planimetrics as well as proposed features and project control points

What happens to these files?

- Contractor “reverse engineers” plans
- Documents (Sec 105.05)
 1. Questions/Answers
 2. CAP Report
 3. Special notes
 4. Special Provisions
 5. Plans
 6. Standard Drawings
 7. Supplemental Specs
 8. Standard Specs



Contractor Input

- They verify model and recreate if necessary
- LandXML Format
- Finished grade
- Subgrade too!
- Longitudinal features only
 - Continuous where possible
- "Roll" Proposed Manuscript
- Many errors in what is submitted currently

Some Benefits of 3D Models

- KY Assoc. of Highway Contractors members' thoughts
 - Decreased change orders
 - Decreased bids
 - Better product
- Other perceived benefits
 - Catch design errors before construction
 - Better inspection
 - Better communication of intent

Pilot Project

- KY 7 in Elliott Co from KY 885 to Grayson Lake
 - ~5 miles
 - Rural 2-lane relocation
 - Over 3M CY earthwork

What are Kentucky's Goals?

1. Determine "Best Practices" for 3D modeling
2. Determine how to get design models into construction personnel's equipment
3. Determine the role of the designer in assisting the contractor with the design model
4. Have dialog between design, construction and contractor on construction process with AMG
5. Set new policy to require better design models

Meeting with Leadership

- Contractor must use supplied model
- Inspectors check vs. supplied model
- Partnering between KYTC and contractor
- Model available pre-bid
- Mandatory Pre-Bid Meeting
- KYTC 3D model will be record model

Special Notes

- Special notes were included in the plan set to override KYTC's Standard Specifications
 - Use of a 3D Design Model
 - Corrections to the 3D Surface Model
 - Mandatory Progress Meetings
 - Earthwork Quantity Calculation

Project Progress



Construction Inspection

- 12 KY Transportation Cabinet Districts
- 51 Construction Offices across those 12 districts
- To date, 18 of those offices have survey equipment (either GPS or total station)
- Still working to get all 51 equipped

Lessons Learned from Industry

What have we learned from discussions with contractors' software vendors?

- One merged surface with ML, Apprs., Entrs., etc
 - Subgrades on multi-surface submittals
- Horizontal and Vertical alignments
- Bid Quality vs. Build Quality

So Where Does KYTC Go From Here?

- 2nd Pilot Project and beyond
- Develop Best Practices for 3D Modeling
 - 3D Model expectations
- Suggest guidelines for AMG applicability

What about Electronic Submittals?

- Updates to electronic submittals
 - DXF files
 - Coordinate Control file
 - Cross Section Report files (for now)
 - Vectorized PDF plans

Stumbling Blocks to Implementation

- Designer buy-in
- Construction Office buy-in
- Liability issues
- Training/Education
- Model QA/QC
- Enforcement

You've Got To Start Somewhere

- Empower the workers to do their job
 - Give them the tools to do their job efficiently
 - Make sure they know they have your support
- Don't be afraid to fail
 - This pilot may fail, but at least we'll learn what **NOT** to try next time.
- Learn from your mistakes

The Ultimate Goal

- Standardization
 - Designers know what is expected
 - Contractors know what to expect