



# UDOT Intelligent Design & Construction

**UDOT is moving to an intelligent design and construction environment which includes a 3-D project workflow.**

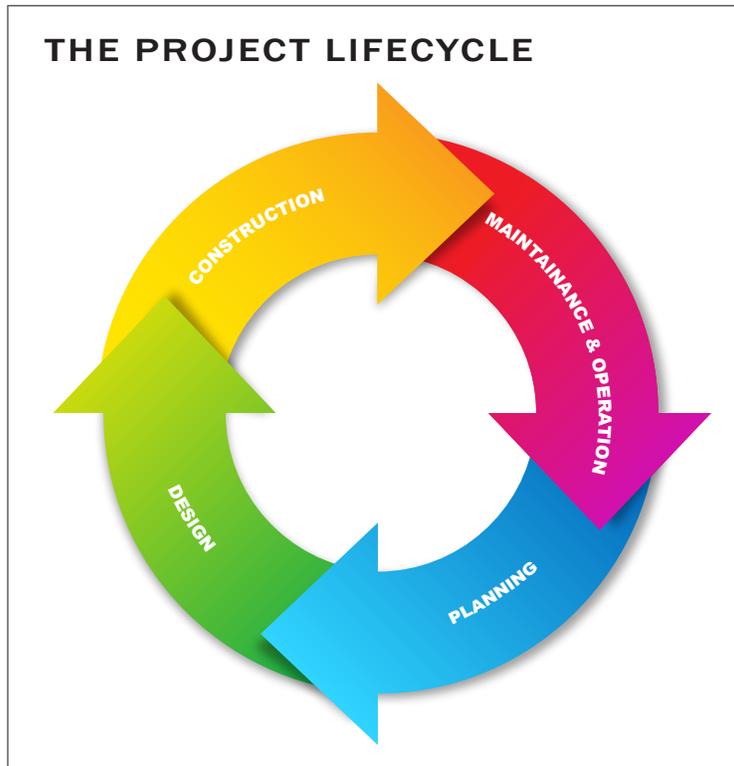
Ultimately, 3-D electronic project files will be provided to construction contractors as the legal construction plan at advertising. 2-D or paper plan sets will eventually be phased out, and construction crews will work with the electronic 3-D construction plan. At project completion, contractors will deliver a 3-D as-built model.

**By fully embracing 3-D capabilities, UDOT will increase efficiencies, save time, conserve time and reduce mistakes.**

A full 3-D workflow will streamline work for UDOT designers and contractors. Providing a 3D Electronic Plan at advertising will have tremendous time and efficiency savings. UDOT and consultant designers spend tens of thousands of hours producing plan sets. Eliminating plan sets will save millions of dollars.

In addition, the 3D plan will convey UDOT's requirements to the contractor more effectively. TRB has found that 3-D design and visualization can have a 15 to one return on investment based on reduced change orders and construction cost savings (NHRCP Synthesis 361, Visualization for Project Development)

UDOT will eventually have a condition model of the entire system. While 3-D implementation activities are taking place in design and construction phases now, full implementation will have a positive impact on the entire project life cycle.



**Implementation will have a positive impact on the entire project lifecycle.**

## TIMELINE

### Short-term plan, April - December 2014:

- Hosted a FHWA 3-D Models for Construction workshop
- Implemented on-site Bentley Training and Workshops to increase depth of region design squads
- Selected 10 projects to provide 3-D engineered models “for information only” at project advertising
- Obtained lessons learned from the 10 projects, including contractor’s data needs
- Formed a contractor, surveyor and UDOT Committee for Construction Implementation
- Held a risk workshop with UDOT, academia, consultants, contractors and vendors from in-state and out-of-state and identified over 20 risks to making the 3-D files the legal construction plan
- Followed up on the risk workshop participants with a brainstorm workshop aimed at solving potential issues. Inform mid term plan activities
- Feedback from construction teams was used to inform mid term plan activities

### Mid term plan, January - December, 2015:

- Developed special provisions for file availability and modified the AMG special provision
- Advertise some projects with electronic files as legal copy and paper copy “For Information Only” copy
- Continue Bentley training to more fully utilize tools
- Investigated software and hardware for use on the construction side
- Used CMGC on SR-20 to collaborate with the contractor to create a DBB template for simple projects

### Long term plan and moving forward, Spring 2016

An official long term plan will be published this summer. Components will include:

- Using CMGC on SR-20 lessons learned to work on the SR-10 project to continue the work of creating a DBB template for simple projects
- Continued investigation of tools used in construction
- Addressing electronic signature for models
- Addressing file transfer and model ownership challenges

## Implementation

UDOT has defined a short term, mid term plan for implementation, with those plan segments informing the subsequent plan. The short term plan was completed in 2014. The goals of the mid term plan have been reached. UDOT is evaluating lessons-learned to shape the long term plan which will be officially published this summer.

## Key Outcomes

**Risk identification:** During the short term plan, two formal risk assessment workshops identified potential risks as UDOT progresses to an all 3-D environment. Participants came from UDOT pre-construction, construction, survey, right of way, utilities, construction and private sector design and construction.

Over 20 potential risks were identified, including the number one risk – software and hardware tools for construction crews are needed. UDOT is identifying available tools and field testing software and devices, but most likely, appropriate tools have yet to be developed.

**3-D engineered models provided:** Ten projects were provided with 3-D “for information only” files. After construction, UDOT met with construction teams, including contractors and UDOT, and got feedback about how to provide information to contractors. UDOT’s GIS based survey was found to be not accurate enough. Contractors needed to manipulate files and reshoot control points for 3-D files to work with AMG.

**Special provisions for file availability and modification of the special provisions for Automated Machine Guidance were developed** – Special provisions are necessary so contractors won’t need to create baseline models from scratch.

**Creation of a Design-Bid-Build template for simple projects:** A CMGC contract was put in place on the Region Four SR-20 passing lane project. The project was designed in-house using Open Roads software. The CMGC process allowed the designer and the contractor to fully collaborate during pre-construction. Feedback from the contractor helped refine and align the Open Roads model to mesh with the contractor’s Trimble model. The project was advertised in March with the model as the legal construction plan. Lessons learned will be put to work on a project on SR-10 during the long term phase. The SR-10 project is slightly more complex. On the outskirts of Price, the project is still rural but closer to an urban center, and includes MSE walls, right-of-way, wetlands, historic properties, structures, and truck ADT.

## Looking Ahead, the Long Term Plan:

UDOT and contractors will investigate hardware and software throughout the long term plan. The CMGC contracting method will continue to be the mechanism to help develop DBB templates for increasingly complex projects.

## WINS

First in the nation to bid the model as the legal construction plan on SR-20

Gained valuable lessons learned on SR-20 CMGC project for moving to DBB model as legal construction plan

Digitally signed SR-20 model as legal plan and provided list of associated iModels; provided plan sheets as For Information Only

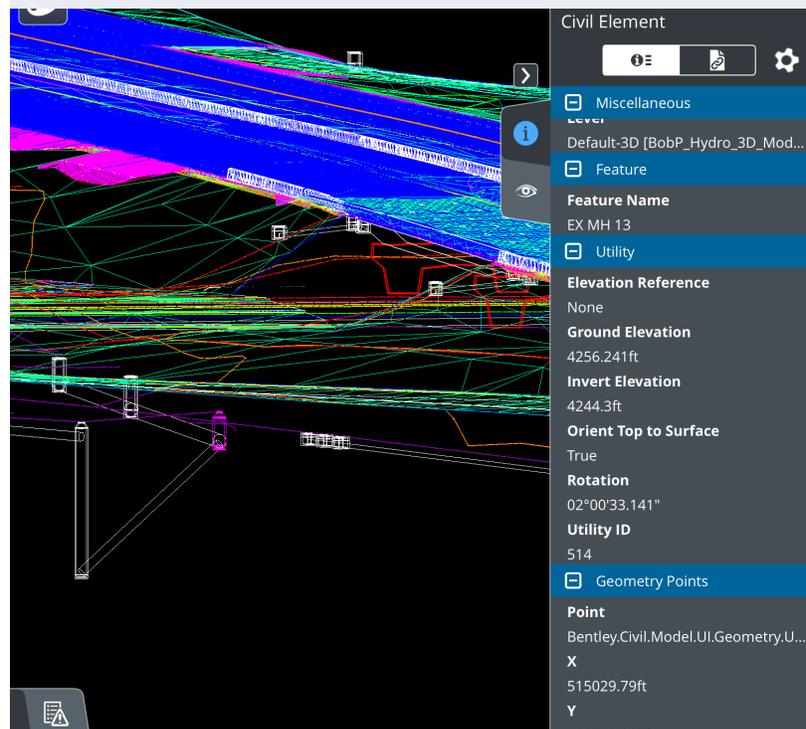
## CHALLENGES

UDOT and contractor model platforms differ e.g. Bentley OpenRoads (UDOT) and Trimble Business Center, TopCon, Leica, AutoDesk (Contractors)

Requiring and enforcing accurate survey provided at design onset

Continued pressure on industry to develop a user friendly tool that inspectors, trans tech and contractor personnel can use to replace 2D plan sets in the field

A consistent and reproducible conversion of UDOT’s model (OpenRoads or possibly Autodesk Civil 3D) to contractor platform (TBC, Topcon, Leica).



*A Bentley Navigator for iPad screen shot — Construction crews are field testing hardware and software for viewing 3-D construction plans.*

**FOR MORE:** [udot.utah.gov/go/3-d](http://udot.utah.gov/go/3-d)