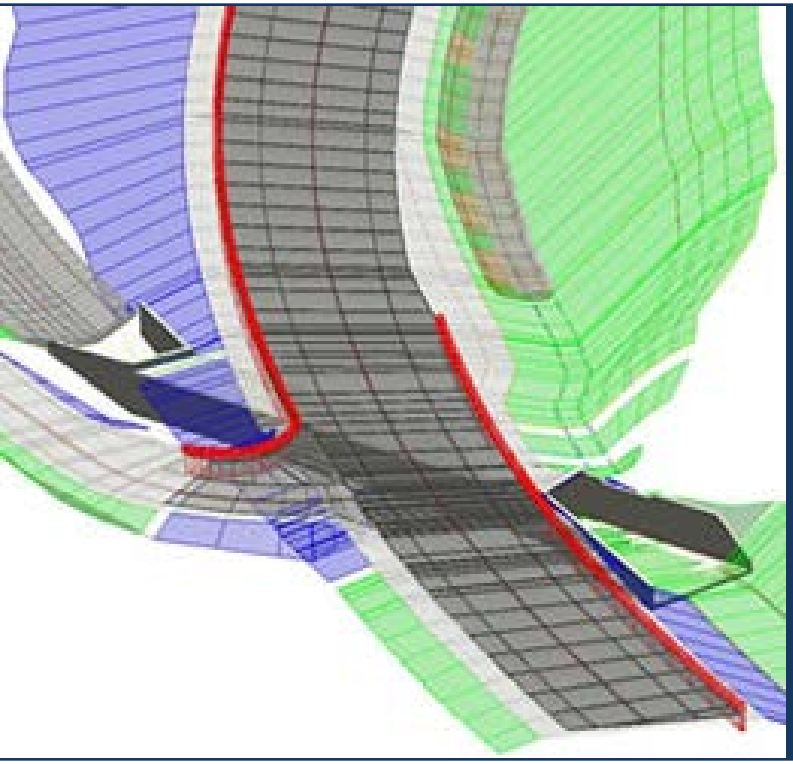


The (Virtual) Oregon Trail

2015 Initiative Update: 3D Roadway Digital Design Data

2015 ODOT Transportation Engineering Conference

Presented by:
Della Mosier, P.E., Roadway/Hydro Manager
ODOT Region 4, Bend, Oregon

April 29, 2015

3D Roadway Design TechBulletin
(Est. Jan 2014)

Purpose:
“To provide clarification concerning the required content, process/workflows, delivery timelines, and quality control of digital 3D Roadway Design data for Oregon’s Statewide Transportation Improvement Program (STIP) projects.”

Timelines

Projects Let in 2014: Voluntary (10 Pilot Projects)

Projects Letting in 2015: Required for all projects let through the Office of Project Letting (OPL)

- State System – Governed by Tech Bulletin
- Local System – Governed by LAG Manual

Exceptions

Exceptions to the 3D Roadway Design Requirement are Granted by the Region Roadway Manager

- Projects without an existing ground survey
- Projects without a significant earthwork component
- Projects with compressed design delivery schedules

Why Do We Design to 3D?

TIME

MONEY

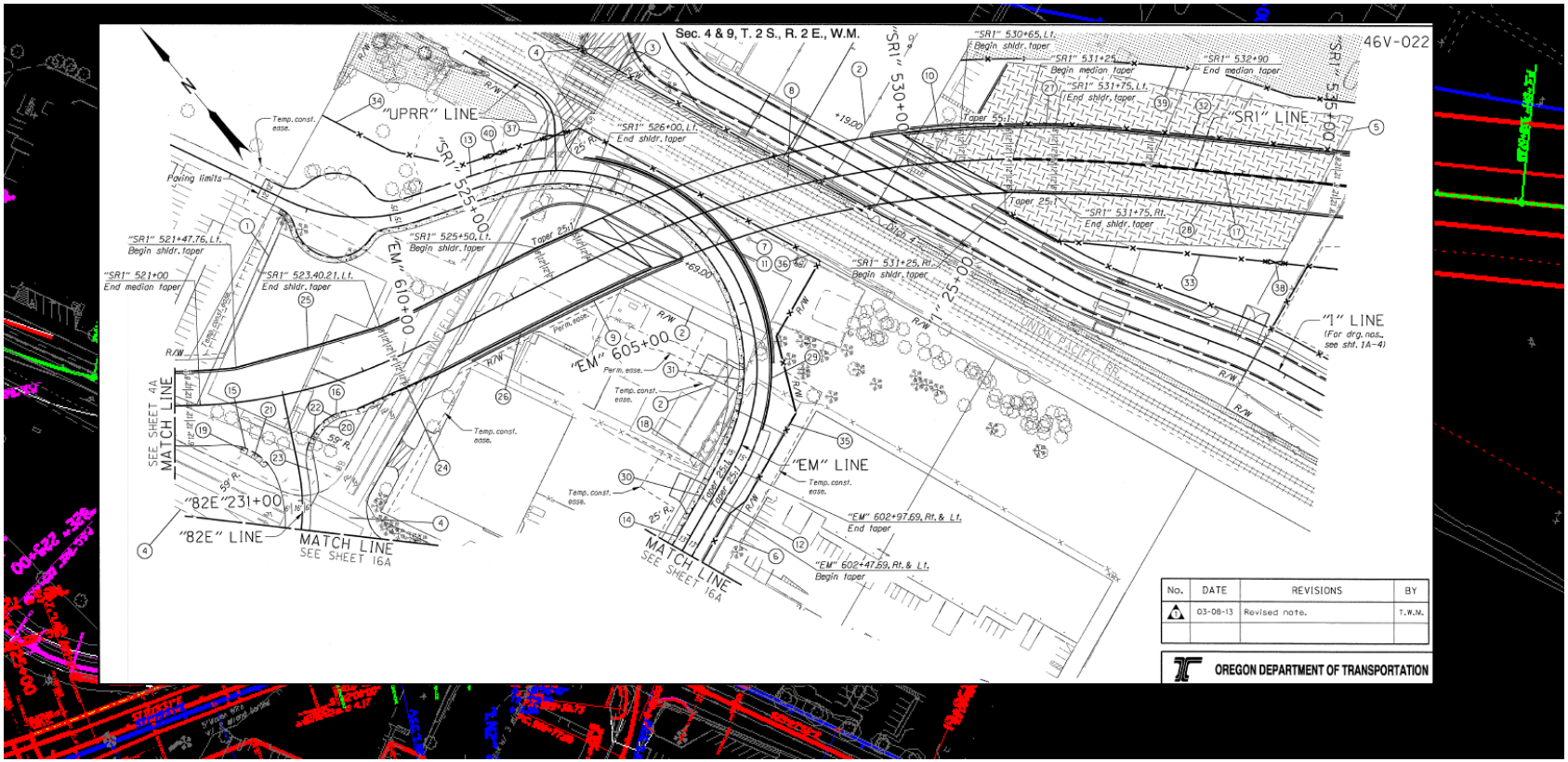
How MUCH time and money?

Time savings of 30-40%

Construction savings of about 4-6%

3D vs. 2D roadway design

2D Design (contract plans) attempt to convey the 3D engineered model in a scaled paper format.



How much Does 2D Cost?

Time+$$

Time+$$

<u>Designer</u>
Creates a 3D Engineered Model

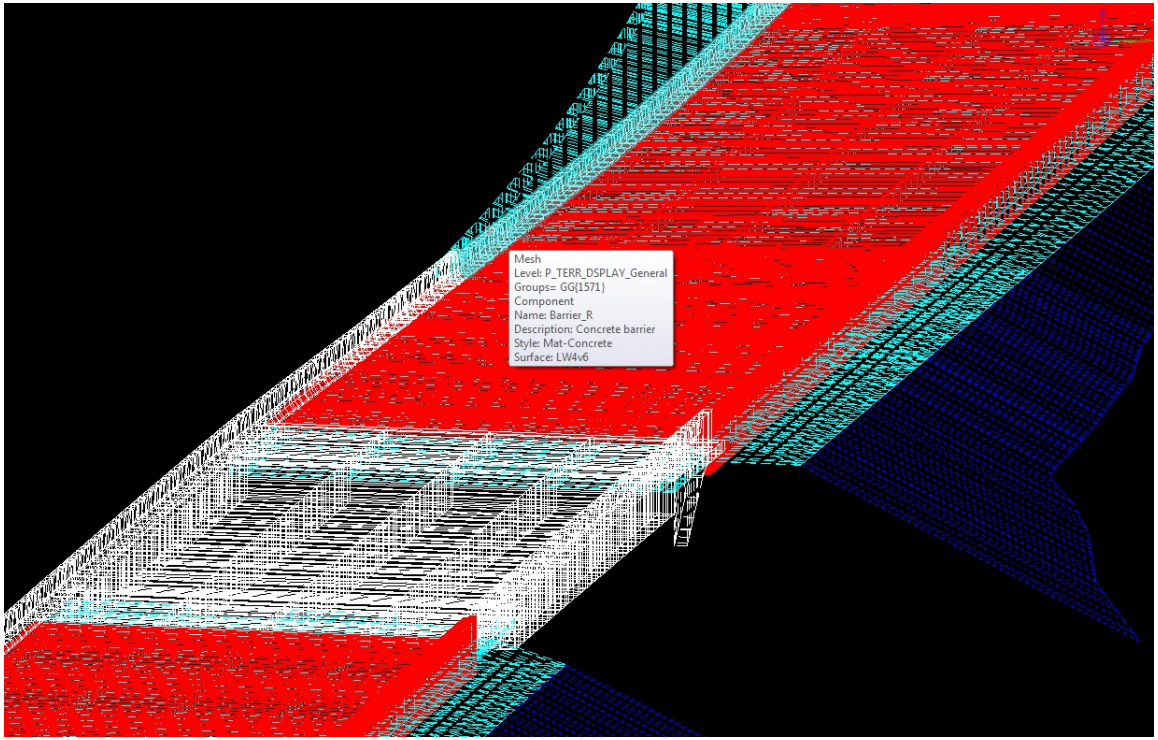
<u>Drafter</u>
Creates a 2D Contract Plan

<u>Bidder/Contractor</u>
~~Translate &~~ interpret 2D Design into a 3D design for bid and construction use

<u>Construction Admin</u>
Inspect, Administer, QC of the constructed product

Constructible 3D Engineered Models

- To 2-1/2D or not to 2-1/2D?



eBIDS Roadway Digital Design Package

IF: Accurate 3D Model

Then: Accurate Design Plans

- Submit the digital data your designers *already developed* as part of their regular work for bidders to use.

- *If* the quantities on your *paper plans are correct*, this data is readily available from your designer.

How Will I Know What to Post?

(see Appendix M of the HDM)

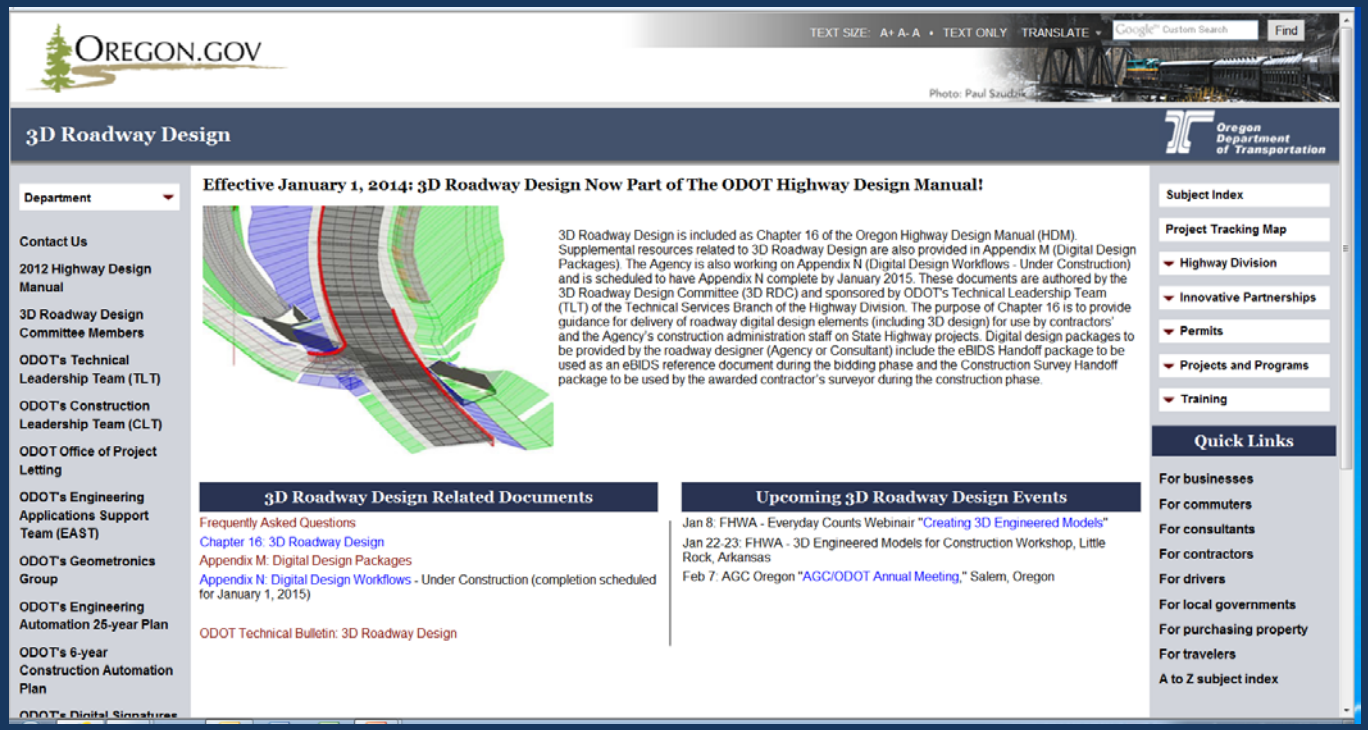
ODOT Roadway Digital Design - eBIDS Handoff Checklist*

PROJECT	US730: POWERLINE RD INTERSECTION IMPROVEMENTS SEC.
HIGHWAY	COLUMBIA RIVER HIGHWAY
COUNTY	UMATILLA
KEY #	16009
CONTRACT #	14769
MILEPOINTS	182.58 TO 182.37
DATE	1/7/2015

ITEM	DESCRIPTION**	REQUIRED	COMPLETE?
Notice of eBIDS Roadway Digital Design Data Letter	Include Notice of eBIDS Roadway Digital Design Data Letter using template provided.	Yes	☑
Computer File Index***	List of computer file names with a brief description for all provided files	Yes	☑
Alignment Data	Primary Alignments in LandXML Format	Yes	☑
	Secondary Alignments in LandXML Format	Not Currently Required	☐
Surface Data	Design Finish Surface in LandXML Format	Yes	☑
	Design Subgrade Surface in LandXML Format	Not Currently Required	☐
	Design Top of Rock in LandXML Format	Not Currently Required	☐
	Existing Ground Surface in LandXML Format (to be supplied by Project Surveyor)	Yes	☑
Cross Sections	Cross Sections every 25 feet and at critical points (i.e. taper points, guardrail flare transitions, impact panels, super elevation breaks, etc.) that contain Finish Grade, Existing Ground, Subgrade, and relevant components (guardrail, curb, sidewalk, etc.) in pdf format.	Yes	☑
Corridor Map Index	Exhibits showing finish grade triangles for Design Finish Grade surfaces provided as part of Surface Data, described above. Exhibits to be provided in pdf format.	Not Currently Required	☐

3D Roadway Design Outreach Site

http://www.oregon.gov/ODOT/HWY/3DRDM/Pages/index.aspx



FAQ’s Website – Check it OUT!

3D Roadway Design FAQs

Why Do We Need 3D Roadway Design?

What Projects are Subject to the Requirement to Provide Roadway Digital Design Data?

Why Do We Provide an eBIDS Handoff Package to Bidders?

What is LandXML?

Why are there Two Handoff Packages?

What are the Deliverables for an eBIDS Handoff Digital Design Package?

When is the eBIDS Handoff Package Due?

What are the Deliverables for the Construction Survey Handoff Digital Design Package?

When is the Construction Survey Handoff Package Due?

What if I Don't Use InRoads Software to Design Roadway Projects?

What if the Project is on a Local Street (not a State Highway)?

How Do I Modify an A&E Consultant Contract Statement of Work (SOW) to Include Roadway Digital Data Deliverables for Bid and Construction?

How Will I Be Notified at Bid?

- eBIDS Notice

Oregon
John A. Kitzhaber, Governor

Department of Transportation
Technical Services
Office of Project Letting
4040 Fairview Industrial Drive SE
Salem, OR 97302
Telephone 503-986-4040

Date: January 6, 2014

To: **PLAN HOLDERS**

Notice of eBIDS Roadway Digital Design Data

Subject: Contract Number 14653
OR39: Merrill N. City Limits – California State Line Sec.
Klamath Falls – Malin & Hatfield Highways
Klamath County
Grading, drainage, paving, signs & signals
(Bids to be opened and read January 30, 2014)

ODOT design staff have prepared an "eBIDS Handoff Package" that contains roadway digital design data. The digital data includes alignment data and three-dimensional surfaces provided in LandXML format, as described in the attached eBIDS Handoff Checklist and Computer File Index.

The "eBIDS Handoff Package" roadway digital design data provided on the eBIDS reference documents site is for bidding purposes only. As with all documents on the eBIDS reference documents site, use of this data for any other purpose is at the Bidder's own risk.

In addition to the "eBIDS Handoff Package", a "Construction Survey Handoff Package" will be provided to the awarded Contractor at the pre-survey meeting. Additional information regarding the content of the Construction Survey Handoff Package is provided in Appendix M of ODOT's Highway Design Manual. The roadway digital design data provided to the awarded Contractor may be used to aid in the use of automated machine control equipment, such as GPS grade control, for earthwork construction. Three dimensional representations of physical project component "solids" (pipes, footings, structures, poles, etc.) will not be provided.

Attachments: eBIDS Handoff Checklist and Computer File Index

Data available for bid: Bid Reference Documents

PROJECT DETAILS

Project Detail | Item Detail | Bid Documents | Bid Reference Documents

Bid Reference Documents obtained from ODOT eBIDS will not become part of the contract as stated in the ODOT eBIDS Terms Of Use.

Title	Type	ContentSize
Xsect_21120_Fill.pdf	LandXML	1.1 MB
LandXMLTriangles_dtmL22350_MB.xml	LandXML	0.0 MB
LandXMLTriangles_dtmL18834_MB_SG.xml	LandXML	0.0 MB
LandXMLTriangles_dtmL33690GRail.xml	LandXML	0.0 MB
CorridorIndex.pdf	LandXML	0.1 MB
Xsect_34100_GR.pdf	LandXML	2.1 MB
LandXMLTriangles_dtmL34100GRail_SG_L.xml	LandXML	0.0 MB

Download

View Holders of Plans

3D Construction

US26: Mill Creek Passing Lanes Project

ODOT's Digital Construction Admin.

- Construction Survey Handoff Package
  - ODOT Designer Provides at Pre-Survey Mtg
  - Includes Detailed LandXML and InRoads Files

- Examples provided in Appendix M of ODOT's Highway Design Manual

When is an Accurate 3D Roadway Design Model Needed?

A. For Automated Machine Guidance (AMG) Construction

B. For Manual Survey Methods

Both A and B

Engineering Construction Support

- Alignments and Finish Grade Surface
- Temporary Alignments and Temporary Surfaces
- Alternate Surfaces as required
  - (Subgrade, Top of Rock, Leveling, Bottom of Grind, etc.)
- Verification of Contractor Model
- Cross Section & Grade Reports
- Potential Needs Based on Construction Manager's Requests
  - Random Point Elevations, Confidence Point Analysis, Miscellaneous Layout Info (Pipes, Guardrail, Signs, etc.)

Manual Survey vs. Automated Machine Guidance

Example – how do we provide Finish Grade Surfaces and Alignments?

A. For Manual Survey Methods
(.dgn, .html, .pdf, .dgn, .dwg, etc.)

B. For Automated Machine Guidance (AMG) Construction
(all of A, but add LandXML format)

Same Diff!

Same Data, Different Formats

SAMPLE ROADWAY CONSTRUCTION SURVEY HANDOFF DELIVERABLE CHECKLIST*

Final list of handoff package contents will be negotiated between the roadway designer and the construction office staff. Some items on this list may not be needed; additional items may be needed.

ITEM	DESCRIPTION**	REQUIRED?	COMPLETE?
Computer File Index	List of computer file names with a brief description for all provided files		
Bid Item Quantity Calculations	Spreadsheets containing computations		
	Scanned pdf's of hand calculated quantities		
	InRoads Volume Reports		
Alignment Reports	Construction CL Reports (*.txt or *.html)		
	Detour CL Reports (*.txt or *.html)		
	Misc. Alignments (Curbs, EP radius, etc.)		
Grade Reports	Cross Section Report at intervals agreed upon with construction and also containing critical points		
	Report Contains Transition Control Name, Finish Grade Elevation, Offset, Original Ground Elevation, Slope		
	List and descriptions of feature names		
	Reports in XML format to accommodate different report styles		
Cross Sections	Cross Sections every 25 feet and at critical points (i.e. taper points, guardrail flare transitions, impact panels, super elevation breaks, etc.) that contain Finish Grade, Existing Ground, and Subgrade		
Design Files***	Existing Ground MicroStation File (to be provided by Surveyor)		
	MicroStation Design File containing final drafting		
	MicroStation Design Files displaying features and triangles of each roadway layer - e.g., subgrade, base, finish grade		
	MicroStation Design File containing only construction alignments displayed & labeled (Horizontal & Vertical)		
	MicroStation Cross Section File		
	MicroStation Plan Sheet Files		
	Existing Ground Surfaces (*.dtm) - to be provided by Surveyor		
	Subgrade Surfaces (*.dtm)		
	Top of Rock Surfaces (*.dtm)		
	Finish Grade Surfaces (*.dtm)		
	Geometry File (*.alg)		
	Template Library (*.itl)		
	Roadway Design (*.ird)		

eBIDS Roadway Digital Design Package

- ***If*** **the quantities on your *paper plans are correct*, this data is readily available from your designer.**

IF: Accurate 3D Model
Then: Accurate Design Plans

Review of Construction Practices

Grade Sheet Construction

<u>Designer</u>
Creates a 3D Surface

<u>Project Coordinator</u>
Creates grade sheets derived from Surface, fills in areas at intersection and radii

<u>Contractor</u>
Uses Grade Sheets to install stakes and hubs to construct to. Produces confidence points to verify grade is built correctly.

<u>Construction Admin</u>
Verify stakes/hubs are installed correctly,
Review and approve confidence points.

Review of Construction Practices

Grade Sheet Construction

Manual Survey Method

981+00.00								
SSF_L	SGSh_L	ERk_L	EP_L	CL	EP_R	ERk_R	SGSh_R	SSF_R
2610.96	2613.53	2613.8	2614.02	2614.49	2614.41	2614.37	2614.03	2612.04
		2613.3	2613.69		2614.08	2614.04		
33.61	23.33	22	16.47	0	14.73	22	23.33	31.3
25%	25%	2.9%	2.9%		0.5%	0.6%	25%	25%

981+50.00								
SSF_L	SGSh_L	ERk_L	EP_L	CL	EP_R	ERk_R	SGSh_R	SSF_R
2612.03	2614.97	2615.3	2615.45	2615.92	2615.84	2615.8	2615.47	2613
		2614.97	2615.12		2615	2615.47		
35.11	23.33	22	16.61	0	14.63	22	23.33	33.21
25%	25%	2.8%	2.8%		0.5	0.5%	25%	25%

982+00.00								
SSF_L	SGSh_L	ERk_L	EP_L	CL	EP_R	ERk_R	SGSh_R	SSF_R
2613.16	2616.43	2616.76	2616.91	2617.38	2617.3	2617.27	2616.93	2614.09
		2616.43	2616.58		2616.97	2616.94		
36.38	23.33	22	16.75	0	14.61	22	23.33	34.7
25%	25%	2.9%	2.8%		0.5%	0.4%	25%	25%

Review of Construction Practices

AMG Construction

<u>Designer</u>
Creates a 3D Surface

<u>Contractor</u>
Utilized 3D Surface Model to generate construction model. Uploads model to equipment and constructs grade to match model. Produces confidence points to verify grade is built correctly.

<u>Construction Admin</u>
Verify model, Review and approve confidence points.

Changing the Inspection Paradigm

Biggs Jct Interchange – US97Slope Cut

Automated Machine Guidance (AMG)

Reduced Construction Costs

- Improved production equates to less fuel and operating costs

Reduced Schedules

- Increased productivity, less on-site surveying

Increased Quality

- Accuracy levels are more precise, increased control of elevations & slope control

Increased Safety

- Fewer field personnel exposed to equipment

How Do I get 3D Design in My Work Order Contract?

A&E contract language (eBIDS and Construction Survey Handoff SOW), including tasks describing this work, can be found on the ODOT Procurement Office (OPO) website under Standardized SOW Tasks.

Quality Control of 3D Roadway Design

Who: Construction Coordinators, Roadway Designers

When: Project Delivery Milestones, Project Advertisement for Bid (eBIDS), Construction Survey Handoff

3D Quality Control Discovery
(2014-2015)

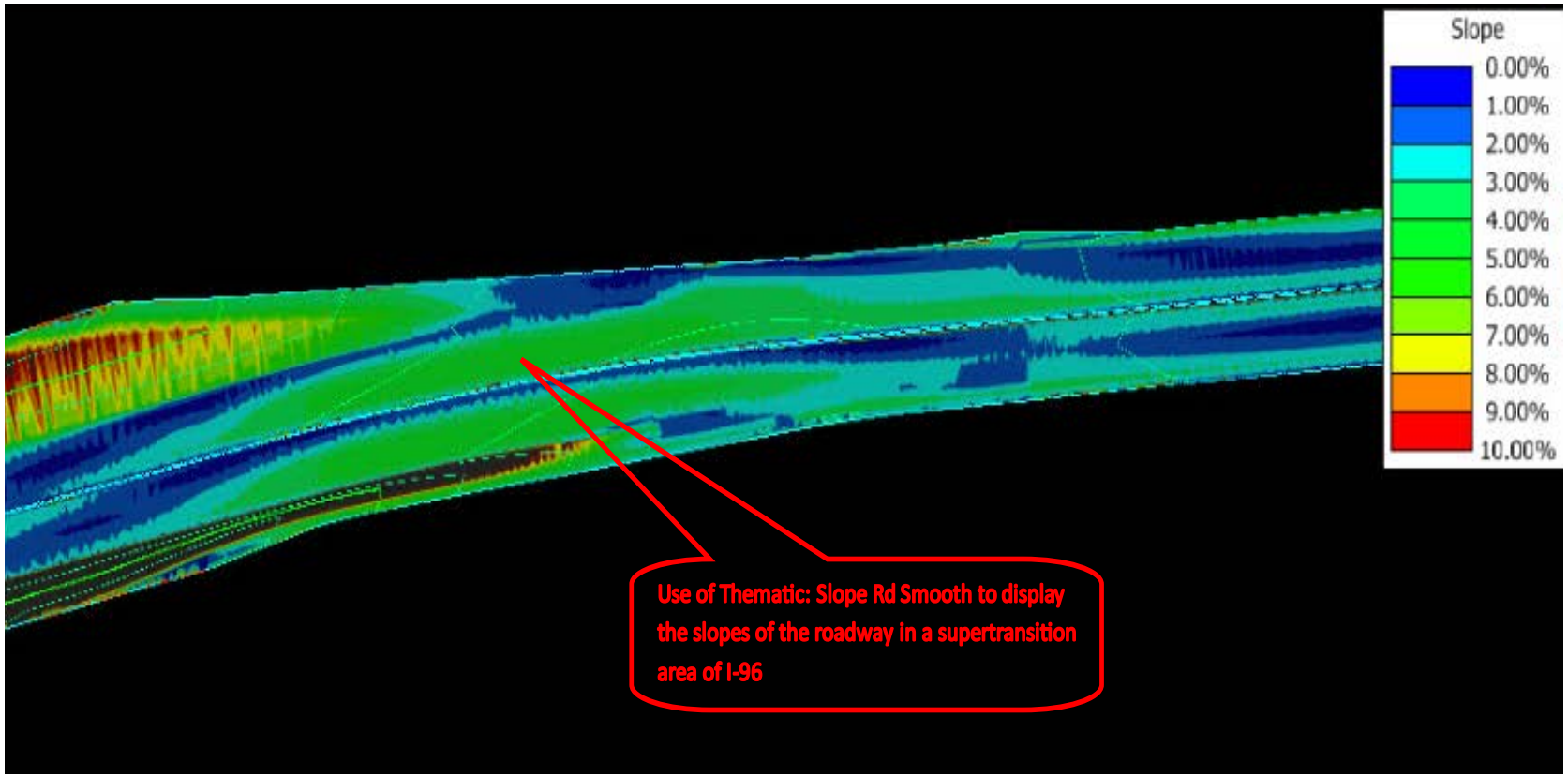
Five Consultant Design Firms reviewing 3D Roadway Design Packages

Numerous ODOT Roadway Designers in 5 Regions reviewing 3D Roadway Design Packages

FHWA-DOT Partners sharing ideas on QC of 3D data

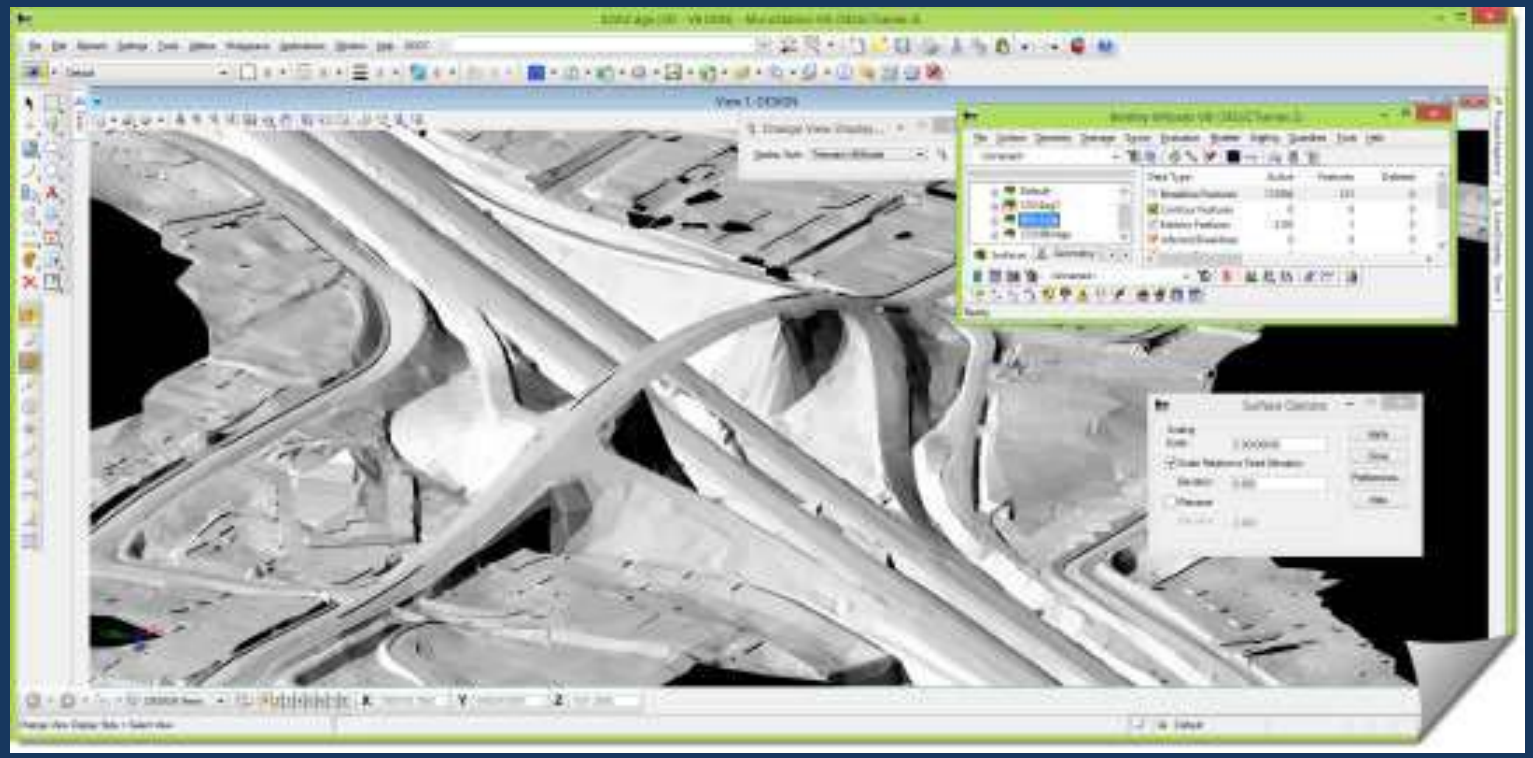
3D Quality Control Process

Detailed in Chapter 16.5 of ODOT's Highway Design Manual (coming Jan 2016)



(Image courtesy of Michigan DOT)

3D Roadway Design Training



(Image courtesy of Zen Engineering, Inc.)

Just-in-Time Training: Content

Intersections
Barrier
Retaining Walls
Abutments
Guardrail
Overlays/Widening
Overburden End Condition
Rock Slope Benching
(and more….)

Just-in-Time Training: Rollout

Available on ODOT's Engineering Support Automation Teams (EAST) website to *everyone*

Available on ODOT's iLearn website for those who want pdh's

Expected Summer 2015

Panel Discussion