



Value Adding Utilities to the 3D Model
GEOPAK 2004 – OpenRoads SS-4

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What is “Value” ?

1.3.2.1 General Requirements

The utilization of three dimensional (3-D) design is an integral part of the performance of the Project prior to, during construction, and throughout the Project’s service life. Additionally, the implementation of 3-D design techniques is intended to improve quality, reduce risk, improve collaboration with Project stakeholders, provide an early focus toward technical review, and increase opportunity for innovation.

Typical 3D Model Specs

The DB Contractor shall include existing and proposed 3-D Design features for the following elements of the Work in accordance with the Technical Provisions:

- a. Roadway;
- b. Drainage;
- c. Structures (including, at a minimum: sufficient detail to show top of deck surface, structure type, bottom of beam surface, bent cap, piers, foundations (size and length), abutment, and retaining wall locations);
- d. Utilities (including, at a minimum: xyz data for relocated and existing utilities to remain in place . Existing utilities to be abandoned in place do not need to be included);
- e. Signing (including, at a minimum: overhead span or cantilever sign structure locations and structure type);
- f. Lighting (including, at a minimum: pole and foundation locations);
- g. Signals (including, at a minimum: controller, pole, and foundation locations); and
- h. Toll Infrastructure (including, at a minimum: structure type (overhead span and cantilever); not to include detailed elements related to toll gantries or elements inside buildings).

Typical 3D Model Specs

1.3.2.4 Immersive 3-D Over the Shoulder Milestone Review Meetings

The DB Contractor shall present the Project 3-D design model to TxDOT and stakeholders at review meetings. The DB Contractor shall utilize software that allows for **interactive visualization** of the 3-D design model key features. The 3-D design model shall be completed to a sufficient level of detail that existing terrain, proposed design features, and existing infrastructure to remain in place can be **viewed, analyzed, and discussed among participants**. Review meetings shall occur prior to any design submittals to TxDOT.

The DB Contractor's 3-D design model shall be capable of providing the **following minimum functionality** during the immersive 3-D milestone review meetings:

- View the model and manipulate view settings to interactively change data display on the screen (e.g. pan, rotate, walk, fly, zoom, etc.);
- Measure distances and areas throughout all areas of the model;
- Reference baseline geometry, stationing, and existing and proposed right of way;
- Dynamically visualize key existing and proposed design features and detect conflicts/clashes amongst the disciplines.

What “Values” do we need to know ?

1. Name
2. Shape
3. Diameter
4. Slope
5. Material
6. Corrugation
7. Length
8. Coefficient of friction
9. Discharge
10. Capacity
11. Depth
12. Velocity: actual, critical, uniform, full
13. Shear Stress
14. HGL
15. EGL
16. Wetted Perimeter
17. % Full
18. Cost
19. Trenching material, cost
20. Etc. etc. etc. (Fun fact – GEOPAK Drainage outputs more than **360** ‘values’)

Drainage Requirements

- Drainage file must be a 3D DGN file
- Cell Library Nodes must have the GEOPAK adhoc attribute: “structure” attached to extrusion plane

All Other Utilities Requirements

- Store ALL other utilities in GEOPAK Water/Sewer
- GWS DGN file must be 3D
- Cell Library Nodes must have the GEOPAK adhoc attribute: “structure” attached to extrusion plane
- Utilities with curved vertical pipe can be extruded in 3D with GPK and MicroStation (and duplicated/approximated in GWS)

GPK Requirements

- Export ALL utilities (plan & profile) to a single GPK file.
- Standard precautions on GPK database naming limitations
- Use Active Chain Control for locating any and all utilities

DGN Requirements

- Export ALL utilities to their own 3D file (separate from their 'design' files)
- Use Master 3D DGN file that references all other 3D files
- Use Active Chain Control for locating any and all utilities
- Use 2D “track files” (for plan, profile and cross-section) referenced to the 3D DGN

6 Main Model Operational Modes

1. Navigational Control
2. Asset Spatial Awareness
3. Asset Parametric Awareness
4. Conflict & Clashes: Detection, Analysis & Resolution
5. Animation Capabilities
6. On-the-fly Re-Engineering with Automatic Model Regeneration

1. Navigational Control

- 3D controller access
- Station & Offset coordinates
- XYZ coordinates
- Asset view control
- Tagging capability

2. Asset Spatial Awareness

- Individual asset location – curvilinear & rectangular coordinate system control
- Individual asset geometry – (size, area, slope, volume, etc.)
- Referential asset geometry – (distance, slope, etc)
- Asset view control with interactive synchronized planar deconstruction:
 - Plan View
 - Profile View
 - Cross Section View
 - 3D Model View

3. Asset Parametric Awareness

- Interactive asset tagging, identification
- Asset database
 1. Review asset
 2. Analyze engineering specifications
 3. Import&export engineering data
 4. Redesign asset and/or specifications

4. Conflict detection/analysis/resolution

- Detection: manual, automatic (per asset)
- Analysis: conflict view control with interactive synchronized planar deconstruction:
 - Plan View
 - Profile View
 - Cross Section View
 - 3D Model View
- Resolution: on-the-fly asset redesign

5. Animation Capabilities

- 3D Camera Types:
 1. Automatic Roadway Camera – can be attached to any roadway and driven at any speed
 2. Automatic Asset Camera – can be attached to any geometric asset and driven at any speed
 3. Miscellaneous Camera – customized camera locations can be created
- 3D Camera Control:
 1. Play, Pause (for spatial & parametric asset extraction and asset planar deconstruction) Stop, Record
 2. Camera Type on-the-fly reattachment

6. Reengineering & Automatic Updating

- Current workflow:
 1. Navigate to asset
 2. Ascertain asset's spatial and parametric characteristics
 3. Detect any conflicts and resolve based on asset's relationship to remainder of model
 4. Redesign asset in 2 dimensional space
 5. Automatically update 3D model
- Optional workflow: skip steps 1-3 above
- Future workflow: skip steps 1-4 above

Model Tolerance & Exactness

- 2 Types of computer **aberrations** exist:

ab·er·ra·tion

/,abəˈrɑːʃ(ə)n/

noun

a departure from what is normal, usual, or expected, typically one that is unwelcome.

"they described the outbreak of violence in the area as an aberration"

synonyms: anomaly, deviation, departure from the norm, divergence, abnormality, irregularity, variation, digression, freak, rogue, rarity, oddity, peculiarity, curiosity, quirk; mistake

"a statistical aberration"

- Anomalies (*hardware generated*)
- Artifacts (*software generated*)

Model Tolerance & Exactness

- **Anomalies** result from interpolation between cross sections and are generated by *computer hardware*.

Interpolation


From Wikipedia, the free encyclopedia

For other uses, see [Interpolation \(disambiguation\)](#).

In the [mathematical](#) field of [numerical analysis](#), **interpolation** is a method of **constructing new data points within the range of a discrete set of known data points.**

Model Tolerance & Exactness

- **Artifacts** appear as a result of the lack of available quantity of standardized databases within *computer software*.

artifact 

[ahr-tuh-fakt]

Spell Syllables

noun

1. any feature that is not naturally present but is a product of an extrinsic agent, method, or the like:
"statistical artifacts that make the inflation rate seem greater than it is."

Model Tolerance & Exactness

- Artifacts result from generic database categories:
 - other – supplemental – generic – ad hoc attributes -

ad hoc

From Wikipedia, the free encyclopedia

This article is about the Latin phrase. For other uses, see [Ad hoc \(disambiguation\)](#).

ad hoc is a [Latin phrase](#) meaning "for this". It generally signifies **a solution** designed for a specific problem or task, non-generalizable, **and not intended to be able to be adapted to other purposes.**

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DTM Solutions
5114 Balcones Woods Drive
Suite 307-463
Austin, Texas 78759

Headquarters: 512-331-7211













info@dtm-solutions.com

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