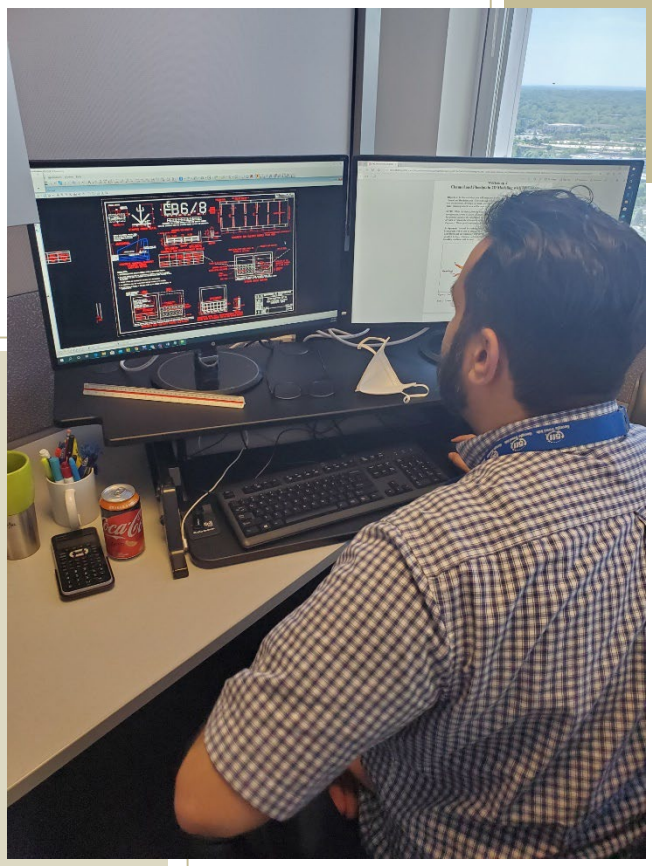
Georgia Department of Transportation

ORD Design Guidelines

OpenRoads Designer



OpenRoads Designer Design Guidelines

08/05/2022

Revision 1.1

This document was developed as part of the continuing effort to provide guidance within the Georgia Department of Transportation in fulfilling its mission to provide a safe, efficient, and sustainable transportation system through dedicated teamwork and responsible leadership supporting economic development, environmental sensitivity and improved quality of life. This document is not intended to establish policy within the Department, but to provide guidance in adhering to the policies of the Department.

Your comments, suggestions, and ideas for improvements are welcomed.

Please send comments to:

State Design Policy Engineer

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DISCLAIMER

The Georgia Department of Transportation maintains this printable document and is solely responsible for ensuring that it is equivalent to the approved Department guidelines.

Revision Summary

Date	Revision #	Section(s)	Description
01/04/22	1.0	1.4	Updated workflow on creating new working files.
01/04/22	1.0	1.5	Removed GDOT Menu, added GDOT Bridge and GDOT PDF Plotting workflows
01/04/22	1.0	2.1.2	Revised Table 2.2 to reference correct file names
01/04/22	1.0	2.3	Added Linear/Draft category to Table 2.6
01/04/22	1.0	2.4	Added .XML type to Table 2.8
01/04/22	1.0	2.5-2.6	Updated hyperlinks to Photogrammetry and Survey documents
01/04/22	1.0	3.1	Added note about avoiding special characters on alignment names
01/04/22	1.0	5.7	Added hyperlink to civil cell videos and updated file naming conventions and general guidance
01/04/22	1.0	7.1	Clarified that cross sections are placed in PI#_23.dgn file
01/04/22	1.0	8.1, 8.3	Removed mention of GDOT End Area Earthwork Volumes Report_ORD, instead referencing Bentley report: endareavolumes.xsl
01/04/22	1.0	9.1	Added mention of 2 separate R/W models in PI#REQD.DGN file needed to generate R/W Tables as well as typical plotting of alignments.
01/04/22	1.0	11.3	Corrected hyperlink and path to Style Sheet Help Files
01/04/22	1.0	11.4	Removed GDOT End Area Earthwork Volumes Report_ORD, GDOT GPS Cross Section Grading Report_ORD, and GDOT Cross Section Report_ORD Reports
01/04/22	1.0	5.2	In Table 5.2, corrected name of component Shoulders/Combined/*Paving Under Guardrail* to be *Asphalt Shldr Extension to Guardrail Face*
01/04/22	1.0	5.4	Updated Table 5.3 to add some End Condition template points that were missing; added Sidewalk category
01/04/22	1.0	6.1	Corrected AASHTO standards from 2011 to 2018 Imperial
01/04/22	1.0	12.1, 12.3	Removed mentions of eliminated style sheets, GDOT End-Area Report-Standard_ORD and GDOT GPS Grading Report_ORD
01/04/22	1.0	6.2	Added note about a known defect with parametric constraint labels; added step for adding control/target alignments for point controls; added info on PI#SUPR.dgn file
08/05/22	1.1	1.3.2, 2.1, 5.1	Changed preferred naming of ITL file to GDOT_Design.itl

Date	Revision Number	Section	Description

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Preface

Design Processing consists of the generation of Design Data for Construction Plan and Right of Way Plan Deliverables and coordination/oversight of other Plan Deliverables. Designers utilize the OpenRoads Designer (ORD) platform for the generation of the Design database(s) used in the development of highway project plans. Previously, GDOT utilized InRoads v8i, which opened inside of MicroStation v8i. ORD, however, is both the Design and CADD platform in a single software.

These Design Guidelines have been developed as part of the statewide GDOT implementation of ORD. The intent of this document is to provide guidelines and standards for generating Design Data in ORD. These guidelines must be followed in detail in order to conform to the current GDOT standards for producing the required design data for plan deliverables. Updates to this document will be made periodically when minor revisions, additional information, and/or enhancements are added.

If there is any approved deviation from the standard file and data naming/feature style conventions as prescribed by this document - a detailed description of the deviation(s) and approved reasons for the deviation(s) shall be documented and included with the project files in electronic format.

Contact Information

To submit any comments or questions regarding the information contained in this document, please contact the **Office of Design Policy & Support** by email at the following address:

SolutionsCenter@dot.ga.gov

In the Email Subject Header, please reference the **ORD Design Guidelines**

Table of Contents

Overview

These Guidelines cover the GDOT standards for generating Design Data by utilizing the OpenRoads Designer software. The procedures below depict the Project Initialization Standards and Conventions to create an ORD Design Project to GDOT format and the processes to create/generate the files which are to be submitted as deliverables to the Construction and Right of Way Offices.

All users are strongly encouraged to subscribe to the ROADS Notifications so they are informed of all updates to the GDOT ORD-CE Workspace. To subscribe, visit the ROADS web page and click the Subscribe button.

Document Content

Below is a list of topics covered in this document:

- Project Initialization Standards
- Standard Conventions
- Horizontal Alignments
- Vertical Alignments
- Component and Template Creation
- Corridor Creation
- Cross Section Sheets/Annotation Generation
- Construction Limits
- Earthwork
- Required Right of Way
- Survey Enhancements
- ORD Style Sheets
- Additional File Deliverables
- Deliverables

Chapter 1: Project Initialization Standards - Contents

Project Initialization Standards

Project Initialization Standards have been established in order to promote consistency and assist in the organization of project data. These standard project schemes help to ensure uniformity for all users who may work on the project.

1.1 GDOT Standard Files

In order to conform to current policy for plan deliverables – GDOT provides the requisite files needed to standardize OpenRoads Designer to GDOT requirements. The first step in the development of an ORD Project is to ensure that these standard files are being utilized. Instructions for downloading/installing the executables are included on the GDOT web page (see the links below). These files are required for any Survey/Design Data Projects generated for GDOT.

- ***ORD Standard Files Location For Internal GDOT Users*** – all users shall work in ProjectWise in order to access the latest ORD Standard Files in the GDOT Workspace. Users will not have access to the GDOT Workspace outside of ProjectWise as they did in MicroStation v8i/InRoads. Users internal to GDOT will not need to download any files in order to have the latest GDOT Standard Files.
- ***ORD Standard Files Location For External Users*** – an ORD (GDOT_Org_Civil_Standards_CaddAll.exe) executable file is available for download, accessible from the GDOT web page. This executable contains all of the GDOT OpenRoads Designer standard files. This file can be downloaded by navigating to the OpenRoads Designer links from the following location:

http://www.dot.ga.gov/PS/DesignSoftware/OpenRoads

The **GDOT_Org_Civil_Standards_CaddAll.exe** file contains all of the standard GDOT files which are required to generate projects to GDOT standards. This file is only needed for the administration of the workspace; individual users do not need to download this file unless they are responsible for administering the workspace independently. Consultants have 3 options to administer the GDOT workspace:

1. Set up an administrative workspace on a shared network drive and have individual users map to this network drive, similar to how it was done in MicroStation v8i.
2. Copy these files directly onto individual users' machines, similar to how it was done in MicroStation v8i.
3. Administer the workspace in ProjectWise.

The Consultant workspace administrators may find instructions on how to install the GDOT ORD Workspace here: http://www.dot.ga.gov/PartnerSmart/DesignSoftware/OpenRoads/Install%20Instructions.pdf

1.2 Standard Project Structure

Internal ORD users shall utilize ProjectWise to store all ORD Project Files. DGN files for Design shall be saved in the **DGN-CE** folder.

1.3 Starting a Design Project in ORD

Use the **starting_point.dgn** file to create new Design .DGN Files for your project, by copying and renaming this file in ProjectWise.

1.3.1 Copy and Rename the SDE DGN Files

The Designer will receive from the SDE (Survey Data Engineer) some or all of the following electronic files. These files will be copied in ProjectWise from the **Location Database** folder, over to the project folder **Roadway Design\DGN-CE** in ProjectWise for Internal GDOT Users. Designers will not utilize any files directly residing in the **Location Database** folder.

- PI#TOPO.dgn (Existing Topo and Property features, plus Terrain Model)
- PI#UTLE.dgn (Existing Utility features)
- PI#PSR.xls (Property Statistics Report)
- PI#Hydraulics.docx (Hydraulics report)
- PI#Misc.txt (Miscellaneous information SDE deems important. This file may not be included.)

1.3.2 Template Library

The Standard GDOT Template Library is **GDOT_Standards_CE.itl**. For internal GDOT users, this is what opens initially by default in ORD. Internal users should save and rename this file to **GDOT_Design.itl** in the ProjectWise project folder **Roadway Design\DGN-CE**. Renaming in this manner will allow the **GDOT_Design.itl** file to become the default ITL file that opens for that specific project in ORD. It is recommended that external users follow this same file naming, even if not using a ProjectWise-managed workspace for ORD. As long as the ITL file is located in a project's folder, there should be no confusion on which project the ITL is for. As an alternative naming solution, designers may also use **PI#.itl** as the file name, but doing so may require you to manually navigate and open the desired ITL for a project with each new session of ORD.

Any future updates made by the Engineering Software Standards Group to the **GDOT_Standards_CE.itl** will need to be manually updated on each individual project using the *Template Library Organizer* and then applied to each project template, as needed. External users can obtain this file by downloading the **GDOT_Org_Civil_Standards_CaddAll.exe** file from the ROADS web page.

1.4 Starting OpenRoads Designer

Internal designers should have a *Starting_Point.dgn* file located in their Project's *DGN-CE* folder on ProjectWise. To create a new working file, it is recommended to first open this *Starting_Point.dgn* file and then select File>New. Name the new file appropriately and perform the work only in this new file. No work should be done in the *Starting_Point.dgn* file. Using this workflow will automatically use the PW workspace and most recent **GDOT_ORD_2D.dgn** seed file. External users will need to ensure they are selecting the **GDOT_Standards** *Workspace*, appropriate WorkSet, and **GDOT_ORD_2D.dgn** seed file.

Note: 3D seed files are only to be used for the creation of terrain and/or survey data (i.e. the delivered PI#TOPO.dgn file); 2D seed files should be what all designers are using for geometry, corridors, superelevation, etc.

1.5 Overview of ORD Ribbon Interface

To become familiarized with the general OpenRoads Designer Ribbon Interface, all users should go through the *QuickStart – Navigating the Interface* training in the **00 – OpenRoads Designer – Roadway Design & Modeling – Fundamentals** *Learning Path*: https://learn.bentley.com/app/Public/ViewLearningPathWithMasterCourseExpanded?lpId=113539&mcId=102986.

GDOT has the following custom Workflows on the Ribbon Interface:

- GDOT Bridge
- GDOT Interface Tools
- GDOT PDF Plotting
- GDOT Survey

Chapter 2: Standard Conventions - Contents

Standard Conventions

This section provides an overview of the GDOT standard Project, File and Geometry Object naming conventions utilized for Design. A Design Feature Definitions Table is provided which lists the applicable Feature Definitions available for use in Design. The Photogrammetry/Survey Feature Code Tables are also provided as Reference Information so that the Designer can refer to these Feature Codes/Definitions when working with Existing Survey/Mapping Data.

2.1 Project and File Naming Conventions

As mentioned previously in **Section One**, in order to ensure Project and File Naming consistency and uniformity, standard Project and File Naming conventions have been established. The Designer must follow these naming procedures in order to conform to GDOT standards and policies.

This section details the following Standard Naming Conventions:

- Standard Project Naming Conventions
- Standard File Naming Conventions

2.1.1 Standard Project Naming Conventions

The standard ProjectWise File Structure for ORD is a Project Folder named DGN-CE residing within the main folder named for the PI Number of the project. All ORD DGN files placed in this folder will open automatically in ORD with the GDOT Workspace. This is the folder location where the core Design File data is located. Other subfolders within the DGN-CE folder may be used to help further organize files, as needed. (See *Table 2.1*)

Table 2.1

Standard Project Naming Conventions	
ProjectWise Project Structure	PI# - (description)\PE (Preconstruction)\Roadway Design\DGN-CE\
ProjectWise Project Structure (Example)	0013379 – Butts – Op Improvements – SR 36 Conn\PE (Preconstruction)\Roadway Design\DGN-CE\

2.1.2 Standard File Naming Conventions

OpenRoads Designer, unlike InRoads, contains all information inside of the .DGN file itself. It does, however, still utilize the .ITL (Template File) as InRoads did, as well as the associated .DGN file deliverables. It is not recommended to bring forward InRoads .ITL files, as many point names have changed, Feature Definitions would need to be assigned, and many of the components have been further modified. Following are the applicable file naming conventions (See *Table 2.2*)

Table 2.2

Standard File Naming Conventions

File Type	File Name	Example Name(s)
2D "Working" DGN file used as the standard DGN file for producing graphics and/or design data in ORD. Use this file to create all other Design DGN files (see Section 1.4 above)	**starting_point.dgn**	1234567GEOM-SR92.dgn 1234567CORD-SR92.dgn 1234567SUPR-SR92.dgn
ITL – Template Library File A standard GDOT ITL File named GDOT_Standards_CE.itl is provided. The Designer will copy this file to the Project Directory and rename it to GDOT_Design.itl or PI#.itl [see Section 1.3.2 for more details]	**GDOT_Design.itl** **PI#.itl**	GDOT_Design.itl 1234567.itl

2.2 Standard Geometry Object Names and Feature Definitions

The following section details the Standard Design and Survey Geometry Object Naming Conventions.

The SDE provides copies of the existing survey data in the PI#TOPO.DGN file, as well as the Utility data in the PI#UTLE.DGN file. This survey data consists of Property, Existing Right of Way, Alignments, Field Survey data, etc. The original files will be maintained by SLB. (See ORD SDE Guidelines for more detail).

The Designer will store all proposed Geometry Data (Geometry Points, Horizontal Alignments and Vertical Alignments) in a separate .DGN file.

NOTE: The term Horizontal Alignments represents not only Baseline Alignments but also Right of Way Alignments, Easement Alignments, Edge of Pavement Alignments, Ditch Alignments, etc.

NOTE: When generating a curve table for plan sheets, the Designer will manually name the Curve Table Curve Number. This is described in more detail in Section 3.5.

2.2.1 Standard Design and Survey Object Naming Conventions

ORD contains several different object types such as Points, Horizontal Alignments and Vertical Alignments. Following are the applicable object naming conventions (See Tables 2.3 – 2.5). The Designer shall follow the guidelines below when storing design geometry objects in ORD. These guidelines must be followed in order to conform to current GDOT standards and policies. Use only one prefix (DE) for Design points in ORD and begin point numbering at 1 (i.e. DE1).

A. Design Object Names

The Design Geometry Objects consist of Geometry Points, Horizontal Alignments and Vertical Alignments. The Designer will store Proposed Construction Baselines, Required R/W Alignments, Easement Alignments, Edge of Pavement Alignments, etc. The following Naming Conventions shall be used.

Object Type	Example Name
***Design Geometry Points**	DE1
****Design Non-Baseline Horizontal Alignments**	DE1
****Design Baseline Horizontal Alignments**	Roadway Name
*****Design Non-Baseline Vertical Alignments**	DE1
*****Design Baseline Vertical Alignments**	Roadway Name

- All Design Geometry Points must be named with a prefix of DE and be assigned a unique number, beginning with the number 1 (e.g., first design point = DE1, 2nd, DE2, etc.). ***Geometry Points are only necessary for Horizontal Alignments used to create Right of Way and/or Easements**.
- **All names must be unique.
- ***The Design Vertical Alignment (which corresponds with the Horizontal Alignment) shall be named the same as the associated Horizontal Alignment. Only baseline alignments should be named after the Roadway Name.

B. Survey Object Names and Point/Alignment Ranges:

The SDE stores any computed and/or existing survey points with No prefixes. Any computed Alignments will be stored with an SV prefix to represent a Survey-stored Alignment, with the exception of baseline alignments, which shall be named after the Roadway Name (see SDE ORD Guidelines for details). The reason that Survey (field collected and computed points) do not contain pre-pended prefixes is simply to make it easier to distinguish between Survey and Design Points.

Table 2.3

Standard Survey Geometry Object Names

Object Type	Prefix	Starting Number
Survey Points	Survey (SDE) = No Prefix	1
Survey Non-Baseline Horizontal Alignments	SV	1
Survey Baseline Horizontal Alignments	No Prefix. Named after Roadway Name	N/A

2.2.2 Standard Geometry Survey and Design Feature Definition Conventions

The following Section details the Feature Definitions used for Survey and Design Objects. When storing Survey and Design Geometry Objects, the applicable Feature Definitions must be utilized in order to view the correct Feature Symbology, cells, etc. for each of the elements. This ensures that the data conforms to the correct Level and Symbology as depicted by the Electronic Data Guidelines and for use in Plans Production utilities.

2.2.2.1 Survey Feature Definitions for Points and Alignments

The Standard Feature Definitions the SDE uses when storing Points and Alignments for the Existing Baseline Alignments, Existing R/W, Property, etc. are named according to the type of Point or Alignment which is to be stored. The following Table lists the applicable Feature Definition(s) the SDE (Survey Data Engineer) utilizes when storing the Existing Point and Alignment data: (See *Table 2.4*)

Table 2.4
Feature Definitions for Geometry Survey Points and Alignments

Existing/Computed Points	PROP_E_APC PROP_E_API PROP_E_APOC PROP_E_APOT PROP_E_APT PROP_E_PCF PROP_E_RWE-LTD-ACCESS PROP_E_LTD-ACCESS	PROP_E_POEL PROP_E_PPC PROP_E_PPOL PROP_E_RWC PROP_E_RWE PROP_E_RWM PROP_E_RWRR PROP_E_RWU
Existing Baseline Alignment **Existing R/W Alignment** **Existing Property (Parcel) Alignment** **Existing Easement Alignment** **Existing R/W & Limited Access** **Existing Limited Access**	PROP_E_ACL PROP_E_RWE PROP_E_PAR PROP_E_POEL PROP_E_RWE-LTD-ACCESS PROP_E_LTD-ACCESS	

2.2.2.2 Design Feature Definitions for Points and Alignments

The Standard Feature Definitions to use when storing Design Points and Alignments for the Proposed Baseline Alignments, Proposed R/W and Easements, etc. will be named according to the type of Point or Alignment which is to be stored. The following Table lists the applicable Feature Definition(s) the Designer utilizes when storing Design Points and Alignment data: (See *Table 2.5*)

Table 2.5

Feature Definitions For Geometry Design Points and Alignments

Proposed Design Point Feature Definitions	DRNG_P_Cross Drain and Culvert	MAIN_P_SIDECL 100/500
	DRNG_P_Ditch	REQD_P_DWESMT
	DRNG_P_Storm Drain Pipe	REQD_P_PESMT
	MAIN_P_CONSTCL 100/500	REQD_P_REQD
	MAIN_P_Driveway	REQD_P_RWRM
	MAIN_P_EOP	REQD_P_TESMT
	MAIN_P_EPSHLDR	STE_P_DETCL 100/500
	MAIN_P_SHLDR	

Proposed Baseline Alignments

Descriptions	Feature Definition	Feature Name Example
Mainline Baseline – 100’ tick spacing	MAIN_P_CONSTCL 100	HWY 100
Mainline Baseline – 500’ tick spacing	MAIN_P_CONSTCL 500	HWY 100
Sideroad Baseline – 100’ tick spacing	MAIN_P_SIDECL 100	PEQUANOC DR.
Sideroad Baseline – 500’ tick spacing	MAIN_P_SIDECL 500	PEQUANOC DR.
Detour Baseline – 100’ tick spacing	STE_P_DETCL 100	US 78
Detour Baseline – 500’ tick spacing	STE_P_DETCL 500	US 78

Proposed Right of Way

Descriptions	Feature Definition	Feature Name Example
R/W Marker	REQD_P_RWRM	N/A
Reqd. R/W	REQD_P_REQD	DE52
Perm. Const. Esmt.	REQD_P_PESMT	DE65
Temp. Const. Esmt.	REQD_P_TESMT	DE75
Driveway Esmt.	REQD_P_DWESMT**	DE100

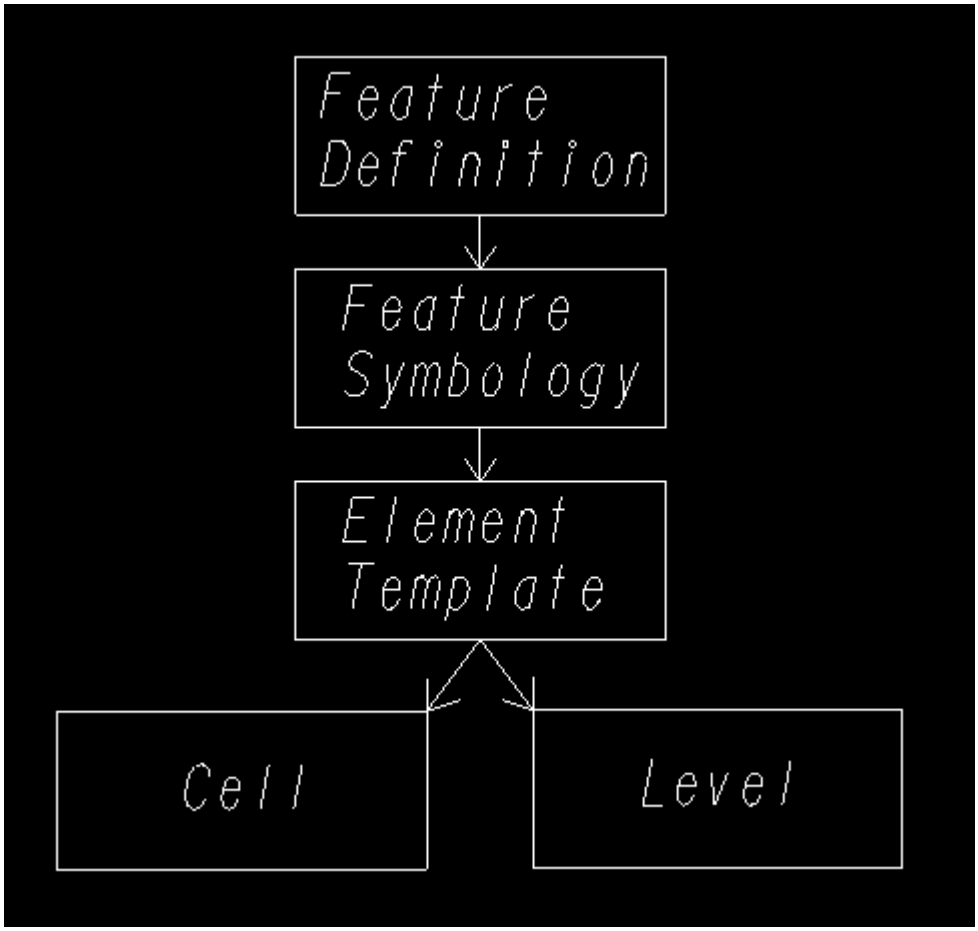
Miscellaneous

Descriptions	Feature Definition	Feature Name Example
Edge of Pavement	MAIN_P_EOP	DE40
Edge of Paved Shoulder	MAIN_P_EPSHLDR	DE41
Edge of Shoulder	MAIN_P_SHLDR	DE42
Ditch Baseline	DRNG_P_Ditch	DE45
Other	(User-Defined)	DE50

**** The Feature Definition REQD_P_DWESMT will be used for all other types of easements (that are not listed above) and be noted as such on plans by the Engineer.**

2.3 Standard Design Feature Definitions

ORD Feature Definitions are similar to what Feature Styles were in InRoads. Feature Definitions describe the engineering properties of the feature and define how it will display in various contexts (plan, profile, 3D, cross section), by pointing to one or more Feature Symbologies. Feature Symbologies may define Annotation Groups and also point to one or more Element Templates. These Element Templates, in turn, point to a specific Cell and/or Level, and therefore define *how* a feature is displayed. See the diagram below, which summarizes the relationships described above.



These Feature Definitions conform to the Electronic Data Guidelines (still under development) and must be utilized to conform to GDOT Standard Conventions for use in Plan Production.

Table 2.6 below shows all of the major categories (and subcategories, if applicable) of Feature Definitions.

Table 2.6

Feature Definition Type	Feature Definition Subcategory	Description
Alignment		For baseline alignments only
Terrain	Bogus Surface	For creating temporary surfaces in obscured areas or outside of existing survey limits
	Existing	Existing Terrain
	Finish	Proposed Terrain
Corridor		For setting Corridor parameters (Concept, Design, Final, etc.)
Superelevation		Superelevation
Linear Template		Templates applied along linear feature only; often used in Civil Cells
Surface Template		Templates applied to a Terrain; often used in Civil Cells
Linear	Bridge	For Linear features (broken up by subcategory)
	Draft	For non-plotting Linear features
	Drainage	For Linear features (broken up by subcategory)
	Limits	For Linear features (broken up by subcategory)
	Main	For Linear features (broken up by subcategory)
	Modeling	For Linear features (broken up by subcategory)
	Pavement Marking	For Linear features (broken up by subcategory)
	Profiles	For Linear features (broken up by subcategory)
	Property	For Linear features (broken up by subcategory)
	Required	For Linear features (broken up by subcategory)
	Template Points	For Linear features (broken up by subcategory)
	Topo	For Linear features (broken up by subcategory)
	Utilities	For Linear features (broken up by subcategory)
Point	Detour	For Point features (broken up by subcategory)
	Drainage	For Point features (broken up by subcategory)
	Limits	For Point features (broken up by subcategory)
	Main	For Point features (broken up by subcategory)
	Property	For Point features (broken up by subcategory)
	Required	For Point features (broken up by subcategory)
	Signage	For Point features (broken up by subcategory)
	Topo	For Point features (broken up by subcategory)
	Utilities	For Point features (broken up by subcategory)

Feature Definition Type	Feature Definition Subcategory	Description
Mesh	Aggregate	For Mesh features (broken up by subcategory)
	Asphalt	For Mesh features (broken up by subcategory)
	Barriers	For Mesh features (broken up by subcategory)
	Bridge	For Mesh features (broken up by subcategory)
	Concrete	For Mesh features (broken up by subcategory)
	Detour	For Mesh features (broken up by subcategory)
	Drainage	For Mesh features (broken up by subcategory)
	Grading	For Mesh features (broken up by subcategory)
	Limits	For Mesh features (broken up by subcategory)
	Main	For Mesh features (broken up by subcategory)
	Modeling	For Mesh features (broken up by subcategory)
	Property	For Mesh features (broken up by subcategory)
	Required	For Mesh features (broken up by subcategory)
	Topo	For Mesh features (broken up by subcategory)
	Utilities	For Mesh features (broken up by subcategory)
	Volumes	For Mesh features (broken up by subcategory)
Trace Slope		Trace Slope
Aquaplaning		Aquaplaning
Survey	Linear	Survey Linear features (Alpha Codes)
	Point	Survey Point features (Alpha Codes)
Node	CommunicationsNode	Communications points on conduits
	ConflictNode	Conflict points on conduits
	ElectricalNode	Electrical points on conduits
	GasNode	Gas points on conduits
	StormWaterNode	Storm Water points on conduits
	WasteWaterNode	Waste Water points on conduits
	WaterNode	Water line points on conduits

Feature Definition Type	Feature Definition Subcategory	Description
Conduit	CommunicationsSegment	Communications conduits
	ElectricalSegment	Electrical conduits
	GasSegment	Gas conduits
	StormWater	Storm Water conduits (Channels, Circular, Gutters)
	WasteWaterSegment	Waste Water conduits
	WaterSegment	Water line conduits
Drainage Area	Catchment	Catchment drainage areas
	Pond	Pond drainage areas

These Feature Definitions are used in Design Features, Components and Component Points. **Table 2.7** contains the applicable Design Feature Definitions to use for Design.

Table 2.7
Feature Definitions -- GDOT Geometry Design Points and Alignments

Feature Definition	Description
BRDG_E_Hydraulics	Bridge Hydraulics
DRNG_P_Ditch	Ditch-Drainage
DRNG_P_Cross Drain and Culvert	Cross Drain and Culvert
DRNG_P_Storm Drain Pipe	Storm Drain Pipe
LIMT_P_CUT	Cut Limits (**Assign to End Condition Components**)
LIMT_P_CUT_Const-Limit	Cut Limits (**Assign to LAST Point in the End Condition**)
LIMT_P_FILL	Fill Limits (**Assign to End Condition Components**)
LIMT_P_FILL_Const-Limit	Fill Limits (**Assign to LAST Point in the End Condition**)
MAIN_P_Barrier-Median-Side	Proposed median or side barrier
MAIN_P_Barrier-Retain-Wall	Proposed retaining wall
MAIN_P_Barrier-Sound-Wall	Propose sound wall
MAIN_P_CableBarrier	Proposed cable barrier
MAIN_P_CONSTCL 100	Proposed Construction baseline 100’ tick spacing
MAIN_P_CONSTCL 500	Proposed Construction baseline 500’ tick spacing
MAIN_P_CROWN	Crown Point
MAIN_P_Curb	Proposed Curb
MAIN_P_Driveway	Driveway
MAIN_P_EOP	Proposed Road Edge of Pavement
MAIN_P_EPSHLDR	Proposed edge of paved shoulder
MAIN_P_Guardrail	Proposed guardrail
MAIN_P_MILLING	Milling
MAIN_P_Misc-Const-Feat	Proposed misc. construction feature
MAIN_P_OVERLAY	Overlay
MAIN_P_SHLDR	Proposed Shoulder lines
MAIN_P_SIDECL 100	Proposed Side or Cross road baseline 100’ tick spacing
MAIN_P_SIDECL 500	Proposed Side or Cross road baseline 500’ tick spacing
MAIN_P_Sidewalk	Proposed Sidewalk
MAIN_P_Slope-break	Proposed Slope Break Location

Table 2.7 Feature Definitions -- GDOT Geometry Design Points and Alignments	
Feature Definition	**Description**
MAIN_P_Transverse Features	Transverse Features
MAIN_P_WALL-PROF-Bottom-of-Wall	Wall Profile Bottom of Wall
MAIN_P_WALL-PROF-Exist-Grd-TP6	Wall Profile Type 6 Existing Ground line or Backfill Slope Tie-in
MAIN_P_WALL-PROF-Existing-Grd	Wall Profile Existing Ground line or Backfill Slope Tie-in
MAIN_P_WALL-PROF-Finish-Grd-BoW	Wall Profile Finished Ground line at Back Face of Wall
MAIN_P_WALL-PROF-Finish-Grd-FoW	Wall Profile Finished Ground line at Front Face of Wall
MAIN_P_WALL-PROF-Top-of-Footing	Wall Profile Top of Footing
MAIN_P_WALL-PROF-Top-of-Wall	Wall Profile Top of Wall
REQD_P_DWESMT	Required Driveway Easement
REQD_P_PESMT	Required Permanent Easement
REQD_P_REQD	Required R/W
REQD_P_RWRM	Required Right of Way Marker
REQD_P_TESMT	Required Temporary Easement
Special Ditch LT	Special Ditch Profile LT
Special Ditch RT	Special Ditch Profile RT
STE_P_DETCL 100	Proposed Detour baseline 100’ tick spacing
STE_P_DETCL 500	Proposed Detour baseline 500’ tick spacing

2.4 Standard File Information

Following is a brief overview of the most common ORD file types the Designer will utilize:

Table 2.8

Standard File Information Overview

.DGN
DGN files are the main file types Designers will use in ORD. All DGN files used by a Designer should be created as 2D files, with the exception of the delivered 3D PI#TOPO.dgn. DGN files contain all Design, Survey and Photogrammetric information, including Superelevation, Corridor Modeling, Drafting, Field Book/Survey Data, Terrain Models (Existing Ground & Proposed Design Surfaces), Photogrammetry feature graphics, Property, Existing R/W, Existing Baseline Alignments, Proposed Horizontal/Vertical Alignments and R/W and Easement Alignments, etc.

.ITL
The .ITL is the Template File which contains all of the Templates and Components required to produce cross sections. This file is specific to each individual ORD Project.

.XML
These files perform several different functions in ORD, including exporting/importing terrains and/or alignments, housing superelevation rules, Civil Labeler options and more.

2.5 GDOT Standard ORD Photogrammetric Feature Codes

To see the most current GDOT ORD Photogrammetric Features and the Levels used for them, please see the ORD Photogrammetric Features document, found on the GDOT ROADS webpage.

2.6 GDOT Standard ORD Field Survey Feature Codes

To see the most current GDOT ORD Survey Feature Codes/Definitions, please see the ORD Field Survey Feature Codes document, found on the GDOT ROADS webpage.

Chapter 3: Horizontal Alignments - Contents

Horizontal Alignments

This section provides a brief overview of the requirements for Horizontal Alignments, Points and Curve Tables. For generic training on how to place Horizontal Alignments, go through the Bentley Learning Path: 00 – OpenRoads Designer – Roadway Design & Modeling – Fundamentals Learning: Quickstart for OpenRoads Designer Geometry: https://learn.bentley.com/app/Public/ViewLearningPathWithMasterCourseExpanded?lpId=113539&mcId=102577.

3.1 Horizontal Alignment Overview

In ORD, the term Horizontal Alignment refers to all linear elements, open or closed, such as baselines, right of way parcels, edge of pavements, etc. Horizontal Alignments may consist of design points, linear elements and curves. In order to generate Horizontal Alignments to GDOT standard conventions, the following information shall be adhered to:

a) All Baseline Horizontal Alignments must have a Feature Definition assigned of either **MAIN_P_CONSTCL 100**, **MAIN_P_CONSTCL 500**, **MAIN_P_SIDECL 100, MAIN_P_SIDECL 500, STE_P_DETCL 100** or **STE_P_DETCL 500** for the correct Feature Symbology and Stationing to view correctly.

b) All Right of Way and Easement Alignments must have a Feature Definition assigned of either **REQD_P_DWESMT**, **REQD_P_PESMT, REQD_P_REQD** or **REQD_P_TESMT** for the Right of Way Tables to generate correctly.

c) Any additional Horizontal Alignments such as Ditch Baselines, Edge of Pavements, etc. must be assigned the appropriate Feature Definition for the Feature Symbology and Levels to view correctly.

d) All Design Horizontal Alignment Names for *Baseline* Alignments shall be named for the roadway itself (e.g. Roswell Rd-SR 9). **Important**: these names are used by default during the Named Boundary command; therefore, you may want to avoid using the following characters in your names because they are not allowed in model names: **“*/?<>|&=’,.**

e) All other Design Horizontal Alignment/Point Names must begin with a **DE** Prefix and a unique number (i.e. DE5).

f) Designers should not use the Existing Baseline Alignment provided by Survey as the Design Alignment but should instead create a new Design Alignment either by copying and renaming the Existing Baseline Alignment and assigning an appropriate Feature Definition or by creating a new Design Baseline Alignment from scratch.

g) When working on a Horizontal Alignment – ensure that it is set as the Active Alignment.

3.2 Horizontal Alignment and Point Names/Feature Definitions

Horizontal Alignments and Points must be stored with the appropriate Feature Definition. See the **Tables 3.1** and **3.2** for a list of the required naming conventions.

Table 3.1	
Object Type	**Name (example)**
***Design Points**	DE1
****Design Horizontal Alignments (baseline)**	Roswell Rd-SR 9
****Design Horizontal Alignments (non-baseline)**	DE1
*****Design Vertical Alignments**	***As Horizontal Alignment

* All Design Points **must** be named with a prefix of DE and begin with the number 1 (e.g., first design point = DE1).

**All Design Horizontal Alignments for Baselines shall be named for the roadway itself. Other, non-baseline types of Design Horizontal Alignments, shall be named with a prefix of DE and begin with the number 1, (e.g., DE1).

***The Design Vertical Alignments (which corresponds with the Horizontal Alignments) shall have the same name as the associated Horizontal Alignments, although more descriptors can be added (i.e. Roswell Rd-SR 9 – Alternative1).

Table 3.2 Feature Definitions for Geometry Design Points and Alignments		
Proposed Design Feature Definition	DRNG_P_Ditch MAIN_P_CONSTCL MAIN_P_EOP MAIN_P_EPSHLDR MAIN_P_SHLDR MAIN_P_SIDECL	REQD_P_DWESMT REQD_P_PESMT REQD_P_REQD REQD_P_RWRM REQD_P_TESMT STE_P_DETCL
Proposed Baseline Alignments	**Feature Definition**	**Feature Name Example**
Mainline Baseline	MAIN_P_CONSTCL 100 MAIN_P_CONSTCL 500	SR 100
Sideroad Baseline	MAIN_P_SIDECL 100 MAIN_P_SIDECL 500	CR69
Detour Baseline	STE_P_DETCL 100 STE_P_DETCL 500	SR100D
Proposed Right of Way	**Feature Definition**	**Feature Name Example**
R/W Marker	REQD_P_RWRM	DE2
Reqd. R/W	REQD_P_REQD	DE2
Perm. Const. Esmt.	REQD_P_PESMT	DE2
Temp. Const. Esmt.	REQD_P_TESMT	DE2
Driveway Esmt.	REQD_P_DWESMT**	DE2
Miscellaneous	**Feature Definition**	**Feature Name Example**
Edge of Pavement	MAIN_P_EOP	DE2
Edge of Paved Shoulder	MAIN_P_EPSHLDR	DE2
Edge of Shoulder	MAIN_P_SHLDR	DE2
Ditch Baseline	DRNG_P_Ditch	DE2
Other	(User-Defined)	DE2

** **Note:** All other Types of Miscellaneous Easements should use the REQD_P_DWESMT Feature Definition.

3.3 Design/Alignment Points

ORD has the capability to store COGO Points (which are northing and easting coordinates). It is a required GDOT standard that all Points used to define Required Right of Way or Required Easements must be stored as COGO Points.

3.4 Reviewing Horizontal Alignments

The Horizontal Alignments description can be reviewed and printed by using the OpenRoads Modeling workflow, with the Geometry►Reports►Horizontal Geometry Report command.

Ensure you have entered the following items in order to have the desired results using this command:

- Ensure that the desired Interval is entered (i.e. 50').
- Ensure the desired Start and End Stations have been entered. For the entire alignment, simply check both the Lock to Start and Lock to End boxes.

Once the Bentley Civil Report Browser appears, simply select the **GDOT Alignment Report** Style Sheet (see example below). This can be saved out as a .PDF file by using the File>Print command and choosing an available PDF printer driver such as Bluebeam, Adobe, or Microsoft Print to PDF.

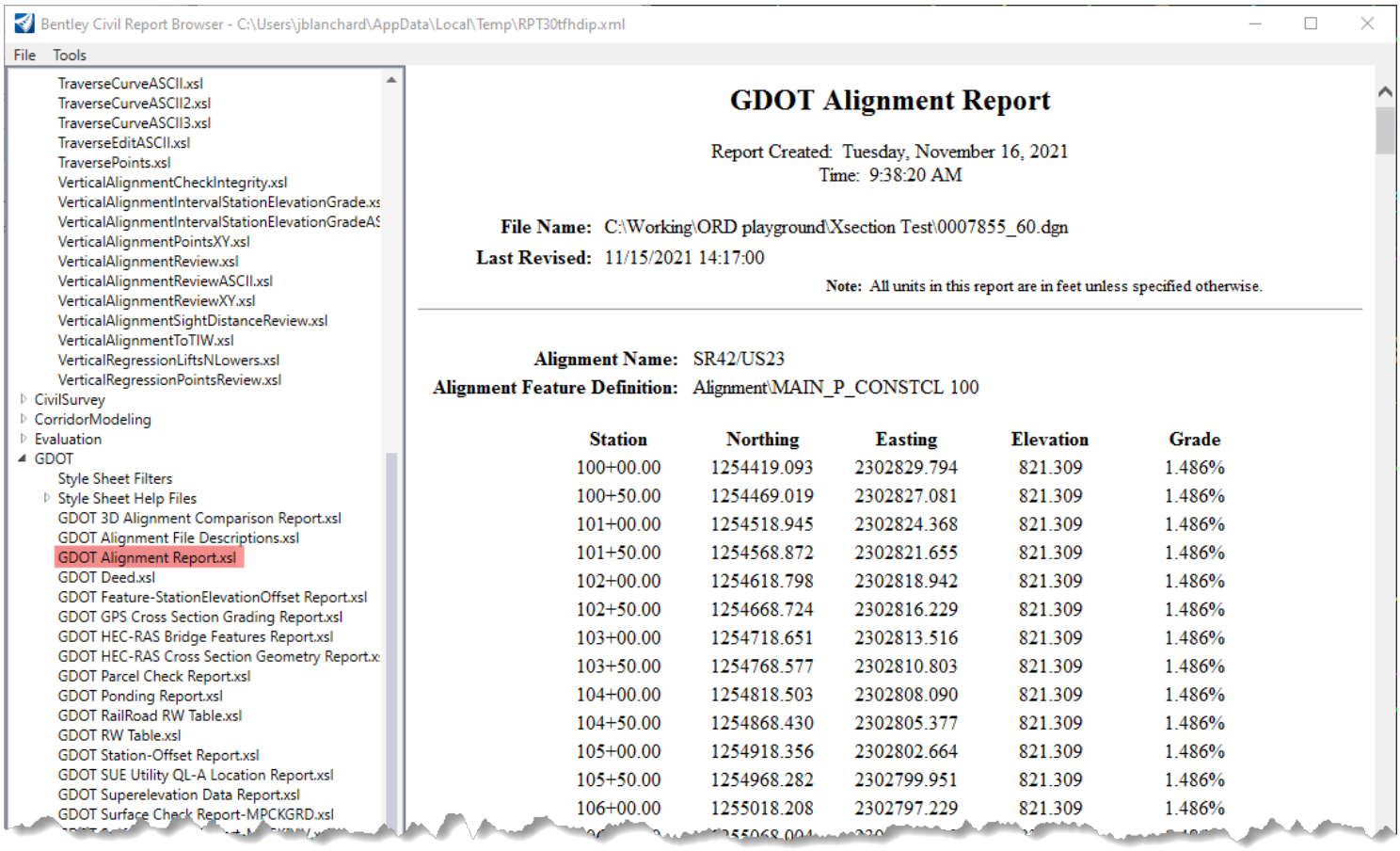


Figure 3-1 Review Horizontal Alignment

3.5 Curve Table Overview

In accordance with the GDOT Plan Presentation Guide, Curve Tables are required for each Horizontal Alignment. The Curve Tables depict the Curve Data for each curve of the Alignment(s). To view the annotation, simply select the alignment element desired to annotate, and use the command Element Annotation>Annotate Element.

Following is the Curve information which is required in all Curve Data Tables:

a) Curve Data Table Required Information
   - **CURVE Number**
   - **P.I. Station**
   - **P.I. Coordinates**
   - **△ or "DELTA" (Deflection angle)**
   - **D (Degree of Curve)**
   - **T (Tangent Length)**
   - **L(Length of Curve)**
   - **R (Radius)**
   - **E (External distance)**
   - **e (Superelevation in percent)**
   - **D.S. (Design Speed)**

b) The Level of the Curve Table (MAIN_P_CONSTCL-Curve-Data-Text or MAIN_P_SIDECL-Curve-Data-Text) are based on the Feature Definition of the Horizontal Alignment and is set up automatically in a corresponding Annotation Group.

c) It is the Designer's responsibility to manually modify each curve table to assign the Curve a unique Number for that Alignment. Generally, the first curve on an alignment would be Curve #1, the second Curve #2, etc. In addition, the Design Speed must also be entered manually.

Chapter 4: Vertical Alignments - Contents

Vertical Alignments

This section provides a brief overview of the requirements for generating Existing Ground Profiles (Terrain Profiles) and Design Vertical Alignments. For generic training on how to create a Vertical Alignment, please go through the Fundamentals and Intermediate free training on the Bentley LEARNserver on creating/editing Vertical Alignments:

00 - OpenRoads Designer - Roadway Design & Modeling - Fundamentals Learning Path
01 - OpenRoads Designer - Roadway Design & Modeling - Intermediate Learning Path

4.1 Vertical Alignment Overview

In ORD the term Vertical Alignment refers to the Proposed Design Profile. A Vertical Alignment is created for each associated Horizontal Alignment. A proposed Horizontal Alignment and an Existing Terrain must be available (and active) before creating an Existing Profile and a Proposed Vertical Alignment. In order to generate Vertical Alignments to GDOT standard conventions, the following information shall be adhered to:

a) All Vertical Alignments should be named the same as the associated Horizontal Alignment. Example: Horizontal Alignment = DE7 then the Vertical Alignment should be named DE7. For Baselines with multiple vertical alignments, other appropriate suffix descriptors should be added to distinguish them.

b) A parent/child relationship exists in ORD between the Horizontal and Vertical Alignments. A Vertical Alignment is a child of the Horizontal Alignment. Multiple Vertical Alignments may exist for a single Horizontal Alignment -- therefore it is important to have the correct Vertical Alignment active along with the active Horizontal Alignment before doing anywork.

c) There are 8 GDOT Drawing Seed options available. See Section 4.4 for a list.

d) Use Named Boundary command to generate Profile Sheets. See Section 15 workflow in ORD Workflows for Roadway Design Sheet Creation for instructions.

4.2 Vertical Alignment Names and Feature Definitions

Vertical Alignments for baseline alignments should match the roadway name of the Horizontal Alignments, although for multiple alternates, more suffix descriptors may be added, as needed (e.g. SR9Alt2). All other non-baseline Vertical Alignments shall be stored with a DE Prefix + unique number (i.e. DE1) and should be named the same as the associated Horizontal Alignment. Example: Horizontal Alignment = DE7 then the Vertical Alignment should be named DE7. The appropriate Feature Definition should be used which corresponds with the Horizontal Alignment Feature Definition. (See *Table 4.1*).

Object Type	Name
Vertical Alignment	Should match the Horizontal Alignment name as closely as possible

Table 4.1
Feature Definitions for Geometry Vertical Alignments

Proposed Vertical Alignment	**Feature Definition**	**Feature Name Example**
Mainline Baseline	MAIN_P_CONSTCL 100 MAIN_P_CONSTCL 500	SR100
Sideroad Baseline	MAIN_P_SIDECL 100 MAIN_P_SIDECL 500	SR100
Detour Baseline	STE_P_DETCL 100 STE_P_DETCL 500	SR100D
Miscellaneous	**Feature Definition**	**Feature Name Example**
Edge of Pavement	MAIN_P_EOP	DE20
Edge of Paved Shoulder	MAIN_P_EPSHLDR	DE20
Edge of Shoulder	MAIN_P_SHLDR	DE20
Ditch	Special Ditch LT or Special Ditch RT	DE20
Other	(User-Defined)	DE20

4.3 Reviewing Vertical Alignments

The Vertical Alignments description can be reviewed and printed by using the OpenRoads Modeling workflow, with the Geometry►Reports►Profile Report command. You can also hover over the desired Profile and select the Profile Report button from the context menu.

This will open directly in the Bentley Style Sheet VerticalAlignmentReview (an example is shown below). This can be saved out as a .PDF file by using the File>Print command and choosing an available PDF printer driver such as Bluebeam, Adobe, or Microsoft Print to PDF. If the Stations are in feet instead of the familiar SS+SS.SS format, simply go to Tools► Format Options and choose ***ss+ss.ss*** as the preferred Station format.

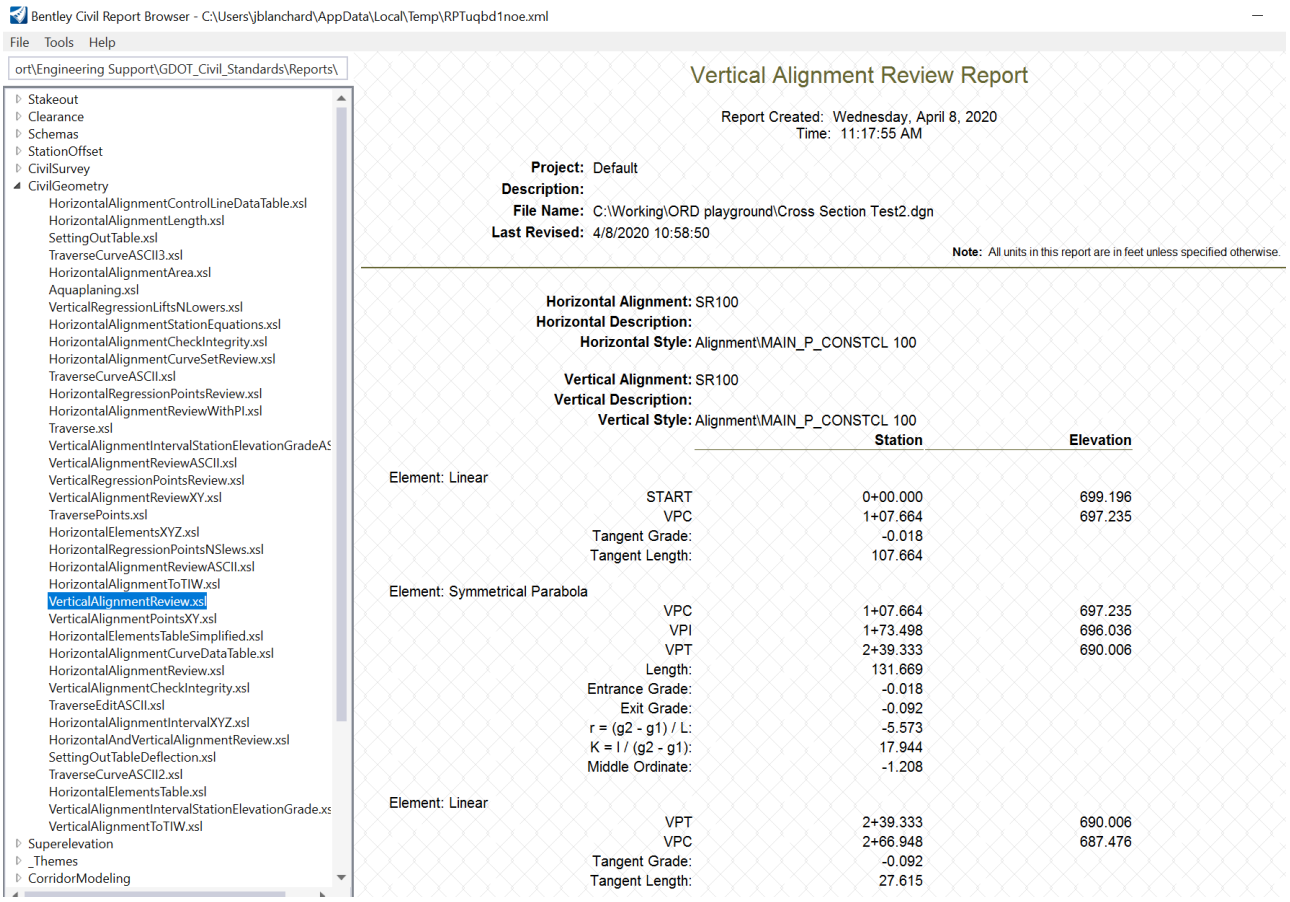


Figure 4-1 Review Vertical Alignment

4.4 Vertical Alignment Drawing Seed Preferences

In order to generate Vertical Alignment/Profile Sheets to GDOT Standards, the appropriate Drawing Seed must be set. The Drawing Seed is set in the Named Boundary workflow. (See *Table 4.2* below for descriptions of each Drawing Seed). The Profile Sheets will be created as Models inside of the DGN file. The PDF deliverables will be created from these Models.

Table 4.2 Drawing Seeds

Drawing Seed	Description
Profile Double Sheet 40h 10v	Used for Vertical Alignment Sheet generation for a Double Profile with 40 Scale Horizontal and 10 Scale Vertical Sheet.
Profile Double Sheet 100h 20v	Used for Vertical Alignment Sheet generation for a Double Profile with 100 Scale Horizontal and 20 Scale Vertical Sheet.
Profile Double Sheet USACoE 100h 10v	Used for Vertical Alignment Sheet generation for a Double Profile of Streams at Culvert locations with 100 Scale Horizontal and 10 Scale Vertical Sheet.
Profile Driveway 20 Scale	Used for Vertical Alignment Sheet generation for a Driveway Profile with 20 Scale Vertical Sheet.
Profile Sheet 40h 10v	Used for Vertical Alignment Sheet generation for a Single Profile with 40 Scale Horizontal and 10 Scale Vertical Sheet.
Profile Sheet 100h 20v	Used for Vertical Alignment Sheet generation for a Single Profile with 100 Scale Horizontal and 20 Scale Vertical Sheet.
Profile Sheet 200h 20v	Used for Vertical Alignment Sheet generation for a Single Profile with 200 Scale Horizontal and 20 Scale Vertical Sheet.
Profile Sheet USACoE 100h 10v	Used for Vertical Alignment Sheet generation for a Single Profile of Streams at Culvert locations with 100 Scale Horizontal and 10 Scale Vertical Sheet.

Chapter 5: Component and Template Creation - Contents

Component and Template Creation

This section provides a brief overview of the requirements for creating Components and Templates.

5.1 Component and Template Creation Overview

The following section depicts an overview of the components and templates used to generate cross sections in ORD. In order to create and utilize GDOT Components and Templates to GDOT standard conventions, the following information should be adhered to:

a) The ORD Template Library (.ITL) is where the Designer creates all the Components necessary to generate a complete Template such as shoulders, travel lanes, barriers, medians and end conditions.

b) The ORD Template Library is included in the GDOT_ORD_Civil_Standards_CaddAll.exe file download, as well as the internal ProjectWise Workspace. Internally, the Designer will need to copy the latest Template Library (GDOT_Standard_CE.itl) from Documents\Standards\Civil_Standards\ to their Project Directory in the DGN-CE folder and rename the file to GDOT_Design.itl or PI#.itl (Ex. 123456-.itl). External users shall use this same file-naming scheme. Please refer to section 1.3.2 for more details on the file naming.

c) Once the Designer modifies the ITL file and creates the components and templates, this file is always submitted as a deliverable with the project so that anyone who works on the project will have the Template Library that contains the associated project components and templates.

d) There are seven types of Components which can be created: Simple, Constrained, Unconstrained, Null Point, End Condition, Overlay/Stripping, and Circle.

e) The GDOT Standard ITL file contains the following Component Categories: Barriers, Curbs and Gutters, End Conditions, Medians, Shoulders, Sidewalks and Travel Lanes. In addition, Linear/Surface Templates are provided for use on Civil Cells. Finally, several full Templates are also provided as a starting point for Designers.

f) The Designer is provided a Point Name List and Feature Definitions to utilize in the development and/or modifications to the Components. It is important to use the standard GDOT Feature Definitions so that Cross Section Annotation will generate correctly. Using already-established Point Names from the GDOT_Standard_CE.itl will automatically pick up the correct Feature Definition. Therefore, if new Point Names are necessary, it is recommended to use a similar Point Name (if one exists) from the standard ITL to get the correct Feature Definition and then change the name. Doing so could avoid issues later on.

5.2 ITL Template Library and Naming Conventions

The ORD Template Library is included in the GDOT_ORD_Civil_Standards_CaddAll.exe file download and also in the internal ProjectWise workspace. The Designer will copy the Template Library to the Project Directory and rename the file to the following: (See *Table 5.1*).

Table 5.1
ITL Naming Convention

GDOT Standard ITL	Rename To	Example
GDOT_Standard_CE.itl	GDOT_Design.itl or PI#.itl [see 1.3.2]	GDOT_Design.itl 1234567.itl

The project-specific ITL file shall be submitted along with DGN deliverables. It is very important for anyone who works on (or inherits) the project to receive the associated ITL file so that they will have access to the same Components and Point Names used to create the original Templates.

The Designer may need to add additional Components, Templates and Point Names to the ITL file during the course of Project design to cover design situations that are not represented in the Standard GDOT Template Library. It is very important that the Designer use the same Feature Definitions as those provided in the ITL. Component and Point Names may need to be added but always use one of the provided Feature Definitions contained in the Workspace.

Following is a list of the seven types of components that are provided in ORD:

1. **Simple:** A Simple Component is a simple prefabricated closed rectangular shape. This is useful for the quick setup of rectangular shapes like a travel lane.
2. **Constrained:** A Constrained Component is placed one point at a time and can be either a closed or open shape. It is useful for making objects of differing shapes such as curb and gutter. The points in Constrained Components can be set to behave in a particular manner by selection of the differing constraint options. The default constraint is set to be Horizontal and Vertical to the previous point placed.
3. **Unconstrained:** An Unconstrained Component is placed one point at a time, the same as a Constrained Component, but is placed with no constraint defaults applied. The constraints of points composing both Constrained and Unconstrained Components can be edited after placement to apply whatever constraints the user desires.
4. **Null Point:** Null Point Components are placed unconstrained to other components and are typically edited to control the behavior of other points. Null Points can be edited to behave as '**Display Switches'** in order to display different components under differing conditions such as Type S Barrier switching between the S1, S2 or S3 variations.
5. **End Condition:** End Condition Components are used to tie to a surface - typically the existing surface. Cut/Fill slopes are the typical type components created with End Condition Components. End Condition Components can be designed with ditches incorporated and that widen for guardrail when certain conditions are met.
6. **Overlay/Stripping:** Components used for milling/stripping and overlay operations.
7. **Circle:** Used to create a circular, or elliptical, Component.

5.3 GDOT Standard Components

GDOT supplies a standard Template Library (ITL) named GDOT_Standard_CE.itl. This Library contains the Component Categories: Barriers, Curbs and Gutters, End Conditions, Medians, Shoulders, Sidewalks and Travel Lanes. In addition, there are several full Templates provided as starting points for design. Finally, Linear and Surface Templates are included as well, for use on Civil Cells. The following Table lists the Categories and individual components provided in the GDOT_Standard_CE.itl file. (See *Table 5.2*).

Table 5.2
GDOT Standard Components & Templates

Category	Component/Template
Barriers	• Bridge Barrier • Gravity Wall Type A Insertion Back Face • Gravity Wall Type A Insertion Front Face • Gravity Wall Type C Insertion Back Face • Gravity Wall Type C Insertion Front Face • TP 7 CS Barrier_MASH/LRFD Compliant • TP 7 WS Barrier_MASH/LRFD Compliant • TP P1, P2 & P3 Parapet Retaining Wall_ MASH/LRFD Compliant • TP S1, S2 & S3 Median Barrier_ MASH/LRFD Compliant • TP T Guardrail w/Plastic block_LT • TP T Guardrail w/Plastic block_RT • TP T Guardrail w/Steel block_LT • TP T Guardrail w/Steel block_RT • TP W Guardrail_LT • TP W Guardrail_RT • TP W Guardrail at Shoulder Edge_LT • TP W Guardrail at Shoulder Edge_RT • Type 2S_ MASH/LRFD Compliant • Type 6S_ MASH/LRFD Compliant
Curb and Gutter	• 9032B TP 2 CURB & GUTTER • 9032B TP 2 DOWELED INTEGRAL CURB • 9032B TP 2 HEADER CURB • 9032B TP 7 CURB & GUTTER • 9032B TP 7 DOWELED INTEGRAL CURB • 9032B TP 7 HEADER CURB

End Conditions	• Combined
	  ○ GA Cut Fill_LT
	  ○ GA Cut Fill_RT
	• Cut
	  ○ Cut_Flat
	  ○ Cut_Flat w/Ditch
	  ○ Cut_Steep
	• Fill
	  ○ Fill_Flat
	  ○ Fill_Steep w/Guardrail_LT
	  ○ Fill_Steep w/Guardrail_RT
	  ○ Fill_Steep w/Guardrail at Shoulder Edge_LT
	  ○ Fill_Steep w/Guardrail at Shoulder Edge_RT
	  ○ Fill_Steep w/Shoulder

Table 5.2 GDOT Standard Components & Templates	
Category	**Component/Template**
Medians	• 9032B Concrete Median 4" Thk MBCL • MedianFBD-Low
Shoulders	• Asphalt ○ Asphalt Inside Shldr Drainage Course Overlap Rural ○ Asphalt Inside Shldr Drainage Course Overlap Urban ○ Asphalt Outside Shldr Drainage Course Overlap ○ Asphalt Safety Edge ○ Asphalt Shldr Aggregate Base Course ○ Asphalt Shldr Base Course ○ Asphalt Shldr Extension Base ○ Asphalt Shldr Extension Surface ○ Asphalt Shldr Intermediate Course ○ Asphalt Shldr Surface Course • Combined ○ Asphalt ▪ Asphalt Shldr Extension to Guardrail Face ▪ Asphalt Shoulder – Full Depth ▪ Asphalt Shoulder – Partial Depth ○ Concrete ▪ Concrete Shoulder - Full Depth • Concrete ○ Concrete Safety Edge ○ Concrete Shldr Aggregate Base Course ○ Concrete Shldr Aggregate Base Course Extension ○ Concrete Shldr Intermediate Course ○ Concrete Shldr Intermediate Course Extension ○ Concrete Shldr Surface Course • Finish Graded Shoulder
Sidewalks	• 5' Grass Strip • 5' Sidewalk
Travel Lanes	• Asphalt ○ Asphalt Aggregate Base Course ○ Asphalt Base Course ○ Asphalt Drainage Course ○ Asphalt Intermediate Course ○ Asphalt Surface Course • Combined ○ Asphalt ▪ Asphalt Travel Lanes Full Depth ▪ Asphalt Travel Lanes Full Depth w/Drainage Course ▪ Asphalt Travel Lanes Full Depth w/Shoulders ○ Concrete ▪ Concrete Full Depth ▪ Concrete Full Depth w/Shoulders • Concrete ○ Concrete Aggregate Base Course ○ Concrete Intermediate Course ○ Concrete Surface Course

Table 5.2
GDOT Standard Components & Templates

Category	Component/Template	

Linear Templates	• Basins
	  ○ Berm
	• Bridge-Items
	  ○ Bridge End
	  ○ Fill_Steep
	• Connector
	  ○ CG Type2 w/Buffer w/EC
	  ○ Open Shld (Pvd) w/EC
	• Curb Ramps
	  ○ Curb Type 2 (Header)
	  ○ Curb Type 2 (Header) w CBT
	  ○ Curb Type 2 (SW)
	  ○ Curb Type 2 (SW)1
	  ○ Fill_Flat
	  ○ Shld
	• Drives
	  ○ Curb Type 2 (Header)
	  ○ Curb Type 2 (Transition)
	  ○ EC-CutFill
	  ○ Grass Buffer w-EC
	  ○ Gutter
	• Interchange
	  ○ Asphalt Ramp (Fill Only LT)
	  ○ Asphalt Ramp (Fill Only RT)
	  ○ Fill_Flat
	  ○ Ramp Shld w/EC
	  ○ Shld Only- Shld Drop
	  ○ Shld w-Fill_Flat
	  ○ Turn Lane - Open Shld (PVD) w/EC
		• Medians
		  ○ Asphalt Shoulder with EC
		  ○ CG Type 2
		  ○ CG Type 7
		  ○ Curb Type 2 (Header)
		  ○ Curb Type 7 (Header)
		  ○ Turn Lane - C&G Type 2_Median
		  ○ Turn Lane - C&G Type 7_Median
		  ○ Turn Lane - Open Shld (Flat Bottom DCH)
		  ○ Turn Lane - Open Shld (for U-Turn Widening)
		  ○ Turn Lane - Open Shld (V DCH)
		• Roundabouts
		  ○ CG Type2 w/Buffer w/EC
		  ○ CG Type2 w/Buffer w/SW w/EC
		  ○ Curb Type7 (Header)
		  ○ Rotary w/Truck Apron /No EC
		• T-Intersections
		  ○ CG Type2 w/Buffer w/EC
		  ○ CG Type2 w/Buffer w/SW w/EC
		  ○ Curb Type 2 (Header)
		  ○ Curb Type 7 (Header)
		  ○ Open Shld (Pvd) w/EC
		  ○ Open Shld w/EC
		  ○ Overlay & Mill
		  ○ Turn Lane - CG Type 2 w/Buffer w/SW
		  ○ Turn Lane - CG Type 2 w/SW
		  ○ Turn Lane - Open Shld (PVD) w/EC

Surface Templates	• 9032B Concrete Median 4" Thk MBCL • Asphalt Pavement • Bridge End • Drive Asphalt	• Drive Concrete • GrassBuffer • Shld • Sidewalk

Table 5.2
GDOT Standard Components & Templates

Category	Component/Template

Templates	• **Bridge**
	  ○ **Bridge Deck w/Barrier**
	• **Ramp**
	  ○ **Asphalt Ramp**
	  ○ **Concrete Ramp**
	• **Rural**
	  ○ **Divided**
	  ▪ **Rural Arterial w/Median/Paved Shoulder**
	  ○ **Undivided**
	  ▪ **Rural Local Roadway**
	  ▪ **Rural Local Roadway w/Paved Shoulder**
	• **Urban**
	  ○ **Asphalt**
	  ▪ **Divided**
	  ➢ **Asphalt Urban Interstate**
	  ▪ **Undivided**
	  ➢ **Urban Local Asphalt Roadway with Bike Lanes/Planter/Sidewalk**
	  ➢ **Urban Local Asphalt Roadway with Buffer/Sidewalk**
	  ➢ **Urban Local Asphalt Roadway with Sidewalk**
	  ○ **Concrete**
	  ▪ **Divided**
	  ➢ **Concrete Urban Interstate**
	  ▪ **Undivided**
	  ➢ **Urban Local Concrete Roadway with Bike Lanes/Planter/Sidewalk**
	  ➢ **Urban Local Concrete Roadway with Buffer/Sidewalk**
	  ➢ **Urban Local Concrete Roadway with Sidewalk**

5.4 GDOT Standard Point Names

The GDOT_Standards_CE.itl Library contains the Component Categories: Barriers, Curbs and Gutters, End Conditions, Medians, Shoulders, Sidewalks and Travel Lanes. Each of the Components listed in the previous *Table 5.2* contain individual Component Points. The following Table lists the Component Points which compose each of these Components. (See *Table 5.3*).

Table 5.3
GDOT Component Points

Point Name	Point Name Description	Feature Definition
Category: Barriers		
BFG_2S	Barrier tie to finish grade for Type 2S	TL_Barrier Fnsh Grd Tie 2S
BFG_6S	Barrier tie to finish grade for Type 6S	TL_Barrier Fnsh Grd Tie 6S
BFIB	Barrier inside face footing bottom	TL_Barrier Ftg In Btm
BFIT	Barrier inside face footing top	TL_Barrier Ftg In top
BFKIB	Barrier inside face footing key bottom for Type 6S	TL_Barrier Ftg Key In Btm (6S-6SC)
BFKIT	Barrier inside face footing key top	TL_Barrier Ftg Key In Top
BFKOB	Barrier outside face footing key bottom	TL_Barrier Ftg Key Out Btm
BFKOT	Barrier outside face footing key top	TL_Barrier Ftg Key Out Top
BFOB	Barrier outside face footing bottom	TL_Barrier Ftg Out Btm
BFOT	Barrier outside face footing top	TL_Barrier Ftg Out Top (2S-2SC)
BIB	Barrier inside face bottom	TL_Barrier In Btm
BIM	Barrier inside face middle point	TL_Barrier In Mid
BIT	Barrier inside face top	TL_Barrier In Top
BM_S1	Median barrier pay item S1	TL_Barrier Med S1
BM_S2	Median barrier pay item S2	TL_Barrier Med S2
BMB	Median barrier bottom	TL_Barrier Med Btm
BMFB	Median barrier footing bottom	TL_Barrier Med Ftg Btm (S3-S3B)
BMFT	Median barrier footing top	TL_Barrier Med Ftg Top
BMGSB	Median barrier glare screen bottom	TL_Barrier Med Glare Scr Btm
BMGST	Median barrier glare screen top	TL_Barrier Med Glare Scr Top
BMGS_SW	Median barrier glare screen switch	TL_Draft-DNC
BMM	Median barrier mid point	TL_Barrier Med Mid
BMT	Median barrier top	TL_Barrier Med Top
B-NP	Type 2S/6S project to surface point	TL_Draft-DNC
BOB	Barrier outside face bottom	TL_Barrier Out Btm
BOT	Barrier outside face top	TL_Barrier Out Top
B-SW	Type 2S/6S switch for end condition	TL_Draft-DNC
BXG	Barrier tie to existing grade	TL_Barrier Exst Grd Tie (6S & 6S1)
GPB	Guardrail Post bottom	TL_Guardrail
GR	Guardrail	TL_Guardrail
GRL	Guardrail Location Insertion Point	TL_Guardrail Line
GRPI	Guardrail Post Intersection	TL_Guardrail

Table 5.3 GDOT Component Points		
Point Name	**Point Name Description**	**Feature Definition**
Category: Barriers (con.)		
WGB0	Gravity wall inside face bottom	TL_Wall Gravity In Btm
WGB1	Gravity wall outside face bottom	TL_Wall Gravity Out Btm
WGFG	Gravity wall tie to finish grade	TL_Wall Gravity Fnsh Grd Tie
WGM	Gravity wall middle point	TL_Wall Gravity Mid
WGS	Gravity Wall switch for slope tie-in	TL_Draft-DNC
WGT0	Gravity wall inside face top	TL_Wall Gravity In Top
WGT1	Gravity wall outside face top	TL_Wall Gravity Out Top
WGXG	Gravity wall tie to existing ground-project to surface pt.	TL_Wall Gravity Exst Grd Tie
WP-NP	Parapet retaining wall project to surface point	TL_Draft-DNC
WPFG	Parapet retaining wall tie to finish grade - back of wall	TL_Wall Par Ret Fnsh Grd Tie
WPFIB	Parapet retaining wall inside face footing bottom	TL_Wall Par Ret Ftg In Btm
WPFIT	Parapet retaining wall inside face footing top	TL_Wall Par Ret Ftg In Top
WPFOB	Parapet retaining wall outside face footing bottom	TL_Wall Par Ret Ftg Out Btm
WPFOT	Parapet retaining wall outside face footing top	TL_Wall Par Ret Ftg Out Top
WPIB	Parapet retaining wall inside face bottom	TL_Wall Par Ret In Btm
WPIT	Parapet retaining wall inside face top	TL_Wall Par Ret In Top
WPOB	Parapet retaining wall outside face bottom	TL_Wall Par Ret Out Btm
WPOT	Parapet retaining wall outside face top	TL_Wall Par Ret Out Top
WPXG	Parapet retaining wall tie to existing grade - front of wall	TL_Wall Par Ret Exst Grd Tie
W-SW	Parapet retaining wall switch for end condition	TL_Draft-DNC
Category: Curbs and Gutters		
CBB	Curb back bottom	TL_Curb Back Btm
CBT	Curb back top	TL_Curb Back Top
CFB	Curb front bottom	TL_Curb Front Btm
CFCB	Curb face bottom	TL_Curb Face Btm
CFD	Curb face depth	TL_Curb Face Btm
CFT	Curb face top	TL_Curb Face Top
CFT	Curb face top for Type 9032B Header TP2/7	TL_Curb Face Top 9032B Header TP2/7
CGFL	Curb gutter flow line for Type 9032B TP2/7 6"	TL_Curb Face Flow 9032B TP2/7 6in
CGFL	Curb gutter flow line for Type 9032B Dowel TP2/7	TL_Curb Face Flow 9032B Dowel TP2/7
Category: End Conditions		
EC_CUT1,3	Limit of cut point (Feature Name Override: **EC_CUT**)	TL_End Cond Cut
EC_CUT,2	Continuous Cut limit (Feature Name Override: **LOC)**	TL_End Cond LOC
EC_DITCH_IN,1-3	Ditch fore slope pt. (Feature Name Override: **EC_DITCH_IN**)	TL_End Cond Ditch In
EC_DITCH_OUT,3	Ditch back slope pt (Feature Name Override: **EC_DITCH_OUT**)	TL_End Cond Ditch Out
EC_DITCH_OUT1,4	Ditch Cut Continuous Limit pt (Feature Name Override: **LOC**)	TL_End Cond LOC
EC_DITCH_OUT2,5	Ditch Cut Limit pt (Feature Name Override: **EC_DITCH_OUT**)	TL_End Cond Cut
EC_FILL_FLT	Con. Limit of flat fill pt (3:1 or flatter) (Name Override: **LOC**)	TL_End Cond LOC

Table 5.3
GDOT Component Points

Point Name	Point Name Description	Feature Definition
Category: End Conditions (con.)		
EC_FILL_FLT1	Limit of flat fill point (3:1 or flatter)	TL_End Cond Fill
EC_FILL_STP	Con. Limit of steep fill pt (2:1 or steeper) (Name Override: **LOC**)	TL_End Cond LOC
EC_FILL_STP1	Limit of steep fill point (2:1 or steeper)	TL_End Cond Fill
Category: Medians		
MB	Median edge bottom	TL_Median Btm (9032B 4in)
MCL0	Median baseline top	TL_Median Baseline Top
MCL1	Median baseline bottom	TL_Median Baseline Btm
MDB	Median ditch bottom	TL_Median Ditch Btm
MDCL	Median ditch baseline	TL_Ditch Baseline
MDT	Median ditch top	TL_Median Ditch Top
MT	Median edge top	TL_Median Top
Category: Shoulders		
EIS-1	Edge of inside shoulder layer -1 (drainage course)	TL_Inside Shldr -1
EIS0	Edge of inside shoulder top	TL_Inside Shldr Top
EIS1	Edge of inside shoulder layer 1	TL_Inside Shldr 1
EIS2	Edge of inside shoulder layer 2	TL_Inside Shldr 2
EIS3	Edge of inside shoulder layer 3	TL_Inside Shldr 3
EIS4	Edge of inside shoulder layer 4	TL_Inside Shldr 4
EIS_OVRLAP	Drainage Course Inside shoulder overlap wedge pt	TL_Pvd Shldr Top
EOS	Edge of shoulder	TL_Edge of Shldr
EPS-1	Edge of paved shoulder layer -1 (drainage course)	TL_Pvd Shldr -1
EPS0	Edge of paved shoulder top	TL_Pvd Shldr Top
EPS1	Edge of paved shoulder layer 1	TL_Pvd Shldr 1
EPS2	Edge of paved shoulder layer 2	TL_Pvd Shldr 2
EPS3	Edge of paved shoulder layer 3	TL_Pvd Shldr 3
EPS4	Edge of paved shoulder layer 4	TL_Pvd Shldr 4
EPS_EXT0	Curb gutter flow line for Type 9032B Dowel TP2/7	TL_Ext Pvd Shldr Top
EPS_EXT1	Drainage Course Outside shoulder overlap wedge pt	TL_Ext Pvd Shldr 1
EPS_EXT2	Ditch fore slope point	TL_Ext Pvd Shldr 2
EPS_OVRLAP	Drainage Course Outside shoulder overlap wedge pt	TL_Pvd Shldr Top
IS-1	Edge of inside shoulder layer -1 (drainage course)	TL_Inside Shldr -1
IS0	Edge of inside shoulder top	TL_Inside Shldr Top
IS1	Edge of inside shoulder layer 1	TL_Inside Shldr 1
IS2	Edge of inside shoulder layer 2	TL_Inside Shldr 2
IS3	Edge of inside shoulder layer 3	TL_Inside Shldr 3
IS4	Edge of inside shoulder layer 4	TL_Inside Shldr 4
OGS	Outside graded shoulder	TL_Edge of Shldr
PW	Asphalt Pavement Wedge point	TL_Pvmt Wedge

Table 5.3 GDOT Component Points		
Point Name	**Point Name Description**	**Feature Definition**
Category: Shoulders (con.)		
SE0	Concrete Safety edge at paved shoulder EOP top	TL_Safety Edge
SE1	Concrete Safety edge at paved shoulder EOP bottom	TL_Safety Edge 1
Category: Sidewalks		
SWB0	Sidewalk Back Top	TL_Sidewalk Back Top
SWB1	Sidewalk Back Btm	TL_Sidewalk Back Btm
SWF0	Sidewalk Front Top	TL_Sidewalk Front Top
SWF1	Sidewalk Front Btm	TL_Sidewalk Front Btm
Category: Travel Lanes		
EP-1	Outside edge of roadway layer -1 (drainage course)	TL_Edge of Pvmt -1
EP0	Outside edge of roadway layer top	TL_Edge of Pvmt Top
EP1	Outside edge of roadway layer 1	TL_Edge of Pvmt 1
EP2	Outside edge of roadway layer 2	TL_Edge of Pvmt 2
EP3	Outside edge of roadway layer 3	TL_Edge of Pvmt 3
EP4	Outside edge of roadway layer 4	TL_Edge of Pvmt 4
IEP-1	Inside edge of roadway layer -1 (drainage course)	TL_Edge of Pvmt -1
IEP0	Inside edge of roadway layer top	TL_Edge of Pvmt Top
IEP1	Inside edge of roadway layer 1	TL_Edge of Pvmt 1
IEP2	Inside edge of roadway layer 2	TL_Edge of Pvmt 2
IEP3	Inside edge of roadway layer 3	TL_Edge of Pvmt 3
IEP4	Inside edge of roadway layer 4	TL_Edge of Pvmt 4
LANE-1	Lane line within the roadway layer -1 (drainage course)	TL_Lane Line -1
LANE0	Lane line within the roadway layer Top	TL_Lane Line Top
LANE1	Lane line within the roadway layer 1	TL_Lane Line 1
LANE2	Lane line within the roadway layer 2	TL_Lane Line 2
LANE3	Lane line within the roadway layer 3	TL_Lane Line 3
LANE4	Lane line within the roadway layer 4	TL_Lane Line 4
PE1	Outer limit of roadway layer extension 1	TL_Pvmt Ext 1
PE2	Outer limit of roadway layer extension 2	TL_Pvmt Ext 2
PE3	Outer limit of roadway layer extension 3	TL_Pvmt Ext 3
PGL-1	Profile grade line of roadway layer -1 (drainage course)	TL_Profile Grade Line -1
PGL0	Profile grade line of roadway layer top	TL_Profile Grade Line Top
PGL1	Profile grade line of roadway layer 1	TL_Profile Grade Line 1
PGL2	Profile grade line of roadway layer 2	TL_Profile Grade Line 2
PGL3	Profile grade line of roadway layer 3	TL_Profile Grade Line 3
PGL4	Profile grade line of roadway layer 4	TL_Profile Grade Line 4

5.5 GDOT Standard Feature Definitions

The GDOT_Standard_CE.itl Library has standard GDOT Feature Definitions applied to all Components and Component Points in each template, summarized in *Table 5.4* below:

Table 5.4
GDOT Feature Definitions for Components

Feature Definition	Description
(Category: Barriers)	
TC_Barrier 2S	Type 2S Barrier
TC_Barrier 6S-6S1	Bridge barrier and Type 6S-6S1 Barrier
TC_Barrier Cut	Type 6S Cut End Cond & Type 2S Barrier Footing Earthwork helper
TC_Barrier Fill	Fill End Condition on Type 2S Barrier
TC_Barrier Ftg TP 2S-2SC	Type 2S to 2SC Barrier Footings
TC_Barrier Ftg TP 6S-6SC	Type 6S to 6SC Barrier Footings
TC_Barrier Med Glare Scr	Median Barrier Glare Screen
TC_Barrier Med TP S1-S3	Median Barrier TP S1 to S3
TC_Barrier Med Ftg TP S3HL	Median Barrier Footing TP 3 High Left
TC_Barrier Med Ftg TP S3HR	Median Barrier Footing TP 3 High Right
TC_Barrier Med Ftg TP S3AHL	Median Barrier Footing TP 3A High Left
TC_Barrier Med Ftg TP S3AHR	Median Barrier Footing TP 3A High Right
TC_Barrier Med Ftg TP S3BHL	Median Barrier Footing TP 3B High Left
TC_Barrier Med Ftg TP S3BHR	Median Barrier Footing TP 3B High Right
TC_Barrier TP 7CS	Barrier TP 7 CS
TC_Barrier TP 7WS	Barrier TP 7 WS
TC_Guardrail Beam	Guardrail Beam
TC_Guardrail Block	Guardrail Block
TC_Guardrail Post	Guardrail Post
TC_Wall Gravity	Gravity Wall Types A or C
TC_Wall Parapet Cut	Earthwork helper on outside footing
TC_Wall Parapet Fill	Fill End Condition on Parapet Retaining Wall
TC_Wall Parapet Ret	TP P1-P3 Parapet Retaining Wall
TC_Wall Parapet Ret Ftg P1-P3B	TP P1-P3 Parapet Retaining Wall
(Category: Curbs and Gutters)	
TC_Curb	9032B Curb TP 2/7
(Category: Grading/End Conditions)	
TC_Cutslope	Cut End Conditions
TC_Draft-DNC	Tie-ins to ensure no gaps in construction limits in corridor modeling
TC_Fillslope	Fill End Conditions

Table 5.4 GDOT Feature Definitions for Components	
Feature Definition	**Description**
(Category: Medians)	
TC_Ditch	Median Ditch
TC_Median 9032B 4in	Concrete Median 9032B 4” thick
(Category: Shoulders)	
TC_Asph Pvd Shldr Aggr	Asphalt Paved Shoulder Aggregate Course
TC_Asph Pvd Shldr Base	Asphalt Paved Shoulder Base Course
TC_Asph Pvd Shldr Int	Asphalt Paved Shoulder Intermediate Course
TC_Asph Pvd Shldr Top	Asphalt Paved Shoulder Surface/Drainage Course & Safety Wedge
TC_Conc Pvd Shldr Top	Concrete Paved Shoulder Surface Course & Concrete Safety Wedge
TC_Conc Pvd Shldr Aggr	Concrete Paved Shoulder Aggregate Base Course
TC_Conc Pvd Shldr Int	Concrete Paved Shoulder Intermediate Course
TC_Shldr	Finished Graded Shoulder
(Category: Sidewalks)	
TC_Shldr	Grass Strip
TC_Sidewalk	Sidewalk
(Category: Travel Lanes)	
TC_Asph Pvmt Aggr	Asphalt Aggregate Base Course
TC_Asph Pvmt Base	Asphalt Base Course
TC_Asph Pvmt Int	Asphalt Intermediate Course
TC_Asph Pvmt Top	Asphalt Surface/Drainage Course
TC_Conc Pvmt Aggr	Concrete Aggregate Base Course
TC_Conc Pvmt Int	Concrete Intermediate Course
TC_Conc Pvmt Top	Concrete Surface Course

5.6 GDOT Template Help Files (UNDER DEVELOPMENT)

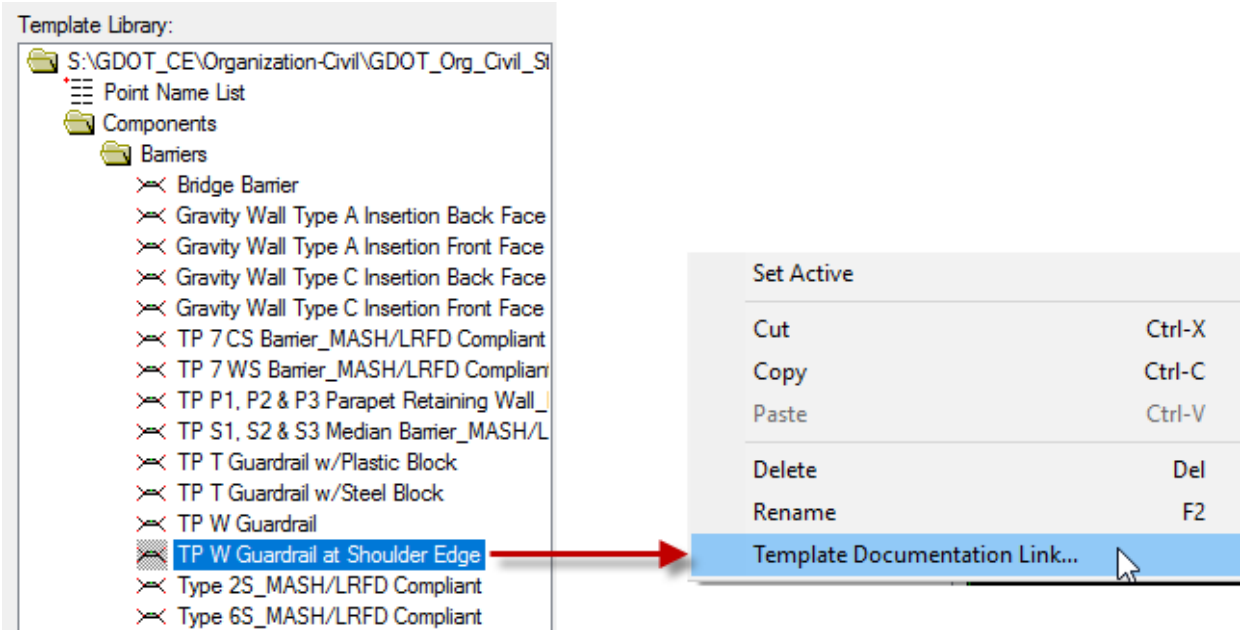
Help Files have been created for each of the GDOT Components and Templates. These Help Files are included in the GDOT ProjectWise Workspace, as well as the GDOT_Org_Civil_Standards_CaddAll.exe executable for consultants. When installed, Help Files are downloaded to the following location (note, that the drive letter can be changed during the unzipping process):

C:\GDOT_CE\Organization-Civil\GDOT_Org_Civil_Standards\Template Library\Documentation

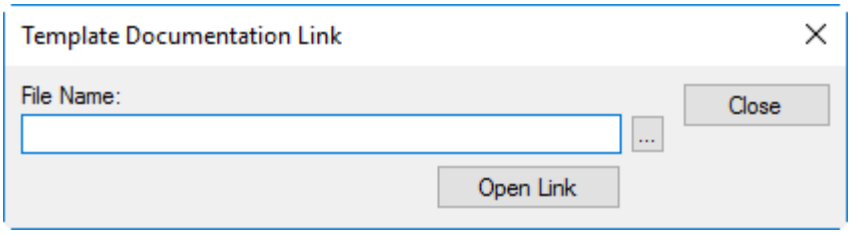
These Help Files provide detailed information regarding the composition of the Component/Template, the Default Parameters, Graphic representation and the Component Points/Feature Definitions which are utilized in the Component.

When inserting the Components or Templates in the **Create Template** dialog, the user may access the Help Files to assist in the design of the templates. Following is information on how to access these Help Files from the **Create Template** dialog.

- In the **Create Template** dialog - Right mouse click over any component and select **Template Documentation Link**… as shown here.



- In the **Template Documentation Link** dialog – either click the **Open Link** button if it has already been saved, or in the case of consultants, browse to the desired location to save for users to access. The location will be saved for future use.



5.7 GDOT Civil Cells

Civil Cells specific to GDOT have been provided to model either repetitive tasks, such as driveways, or other features, such as Roundabouts or T-Intersections. Civil Cells use Linear and Surface Templates, listed in *Table 5.2*. Unless you are only using a few Civil Cells (~10 or less), these should generally be placed in a separate .DGN file. See *Table 5.5* for example file names. Placing Civil Cells in their own .dgn file does present challenges, as you cannot clip a corridor that is referenced, but it will help in the processing time of the corridor. If using ~10 or fewer Civil Cells, these may be placed in the appropriate Corridor .dgn file. The number used/file is general guidance and may differ based on which Civil Cells are used or how large your Corridor file is that may be including a particular Civil Cell in. If you experience issues with processing, splitting your Civil Cells into separate files may help.

Listed below in *Table 5.5* are all GDOT Civil Cells. Links to video documentation on how to insert/use these civil cells may be found here: http://www.dot.ga.gov/PartnerSmart/DesignSoftware/OpenRoads/GDOT%20OpenRoads%20Designer%20(ORD)%20Civil%20Cell%20Videos.pdf.

Table 5.5

Civil Cell DGNLIB	Civil Cell	File Name Examples (Logical Name CORD#)
GDOT_Basin	Sediment Detention Pond – 4’ depth	PI#CCEL_Basin#.dgn
GDOT_BridgeItems	Bridge EndRoll	PI#CCEL_EndRoll#.dgn
GDOT_Connector	Connector - Rural	PI#CCEL_Connector_RoadName.dgn
	Connector - Urban	
GDOT_Cul-de-Sac	Cul-de-Sac (Rural)	PI#CCEL_CuldeSac_RoadName.dgn
	Cul-de-Sac (Urban)	
GDOT_CurbRamps	Curb Ramp – Type A	PI#CCEL_CurbRamps.dgn
	Curb Ramp – Type B – LT Side	
	Curb Ramp – Type B – RT Side	
	Curb Ramp – Type B or C - Landing	
	Curb Ramp – Type C – LT Side	
	Curb Ramp – Type C – RT Side	
	Curb Ramp – Type D	
	Curb Ramp – Skewed - LT	
	Curb Ramp – Skewed - RT	
GDOT_Drives	Drive – Rural	PI#CCEL_Drives.dgn
	Drive – Urban	
	Drive – Urban (Tapered)	
	Drive – Urban (Tapered w-SW)	
	Drive – Urban (Variable Radius)	
GDOT_Interchange	Ramp – Entrance	PI#CCEL_Interchange_CrossRoadName.dgn
	Ramp – Exit - Parallel	
	Ramp – Exit - Tapered	
	Turn Lane – Entrance – Tapered	
	Turn Lane – Exit – Tapered	

Table 5.5 (con.)		
Civil Cell DGNLIB	**Civil Cell**	**File Name Examples (Logical Name CORD#)**
GDOT_Medians	Median Turn Lane (Rural)	PI#CCEL_Median_RoadName.dgn
	Median Turn Lane (Urban)	
	Median X-Over (Type A) (Rural) (3-Center)	
	Median X-Over (Type A) (Urban) (3-Center)	
	Median X-Over (Type B or C) (Rural) (Simple Curve)	
	Median X-Over (Type B or C) (Urban) (Simple Curve)	
	Raised Median	
	RCUT	
	U-Turn Add'l Pave Width	
GDOT_Roundabouts	Approach (Basic)	PI#CCEL_RndAbt_RoadName(s).dgn
	Approach (Deflection LT)	
	Bypass Lane	
	Curb Cut Ramp	
	Ramp (Deflection LT)	
	Ramp (Deflection RT)	
	Rotary (Placed on Alignments)	
	Rotary (Placed on Shape)	
	Splitter Island	
	Splitter Island w-Curb Cut Ramp	
	Splitter Median	
	Splitter Median w-Curb Cut Ramp	
GDOT_T-Intersections	Basic T (Rural)	PI#CCEL_T_Int_RoadName.dgn
	Basic T (Rural) – Overlay & Widen	
	Basic T (Urban)	
	Basic T (Urban) – Overlay & Widen	
	Island – LT	
	Island – RT	
	Island – Single	
	Median Nose	
	Median Turn Lane (2D)	
	Turn Lane – Rural Entrance	
	Turn Lane – Rural Exit	
	Turn Lane – Urban Entrance	
	Turn Lane – Urban Exit	

Chapter 6: Corridor Creation - Contents

Chapter 6: Corridor Creation

This section provides a brief overview of the requirements for creating Corridors in ORD. A Corridor is necessary in order to generate Cross Sections. Generic Bentley training is available on how to create/manipulate Corridors and define Superelevation.

6.1 Corridor Creation Overview

The following section depicts an overview of the Corridor Creation process used to generate cross sections in ORD. In order to create corridors to GDOT standard conventions, the following information shall be adhered to:

a) Corridors should be limited to roughly 1 mile in length. If a baseline alignment is longer than 1 mile, the corridor needs to be split up into lengths of about 1 mile each, in order to help speed up data/graphics processing. The DGN file/s should be named according to the standard conventions explained in Section 6.3 below. Corridors may be split into separate dgn files, if so desired, which may help facilitate multiple designers working on the same corridor.

b) The Corridor Name itself (not the dgn file name) should match the name of the baseline Horizontal Alignment (Ex. SR100). If multiple Corridors are needed for a single baseline Horizontal Alignment, and they reside in the same DGN file, the Name is automatically appended with a consecutive # (Ex. SR1001), so some editing/renaming of the Corridor Names may be needed by the Designer. Note: If the Corridor Name is blank, it will present problems later on when creating an Earthwork Volume Report.

c) Superelevation in ORD is created by using the *Create>Superelevation Sections/Lanes* command, using the latest AASHTO standards xml file, currently AASHTO 2018 imperial.

d) If an end condition fails to solve because there is no Existing Terrain (an obscured area) to intersect, the Designer is instructed to contact the Office of Design Policy and Support/Location Bureau to request additional Terrain Coverage in that area.

e) In order to place a temporary Template so that the Station at the obscured area can close, Target Aliasing is utilized. Target Aliasing consists of creating a Bogus Terrain in order to cut a Cross Section to form a closed area. **Additional Survey shall be requested to provide a correct Terrain**.

f) The Naming Convention for the temporary Bogus Terrain used in Target Aliasing is PI#Bogus1 (Ex. 1234567Bogus1).

g) Do not place more than around 10 Civil Cells in a single Corridor .dgn file; otherwise, the processing time could be negatively impacted.

6.2 Corridor Creation Workflow

The Corridor Creation process consists of the following steps (Note: after Step 1, the Steps do not need to be performed in any particular order; in fact, not all Steps are necessary on every project):

Step 1: Create a New Corridor – The Corridor (or Corridors, if needed) is created for a specific baseline horizontal alignment and associated vertical alignment. During the initial Corridor Creation process, a Template will be dropped along the Corridor for a specified Station Range at a user-defined Interval. This Template may be edited later, and additional Templates may also be dropped as well, if needed. There are 6 Feature Definitions that define how the Corridor is displayed, which can be changed at any time:

- **Conceptual**: Will drop Templates at 5X the Interval (i.e. If Interval is 5', the drops will occur every 25' instead). This Feature Definition has the quickest processing time.
- **Design**: Will drop Templates at 2X the Interval (i.e. If Interval is 5', the drops will occur every 10' instead).
- **Final**: Will drop Templates at 1X the Interval (i.e. If Interval is 5', the drops will occur every 5' instead).
- **Final Bottom Mesh**: As Final but used only for creating a final surface XML deliverable.
- **Final Top Mesh**: As Final but used only for creating a final surface XML deliverable.
- **Final w/Contours**: Will drop Templates at 1X the Interval (i.e. If Interval is 5', the drops will occur every 5' instead) and will also display Contours.

Step 2: Add Template Drops – Once created, Design will add any additional needed Template Drops to specified station ranges in the Corridor/s.

Step 3: Add Key Stations – Add any special Key Stations where a Template Drop is desired, such as a Driveway baseline.

Step 4: Add Corridor References – Graphical elements used to target for Corridor processing. Example: Using an intersection matchline with a side road as a Corridor Reference to target in order to turn off the shoulder, curb, sidewalk and end condition at this precise Station Range.

Step 5: Add Parametric Constraints – Many Templates have Parametric Constraint Labels already assigned, such as Gutter Width/Height/Slope, Ditch Width, End Condition Slopes, etc. Use Parametric Constraints to vary Template Point Constraints over a specified Station Range, when needed. **Important**: ORD has a known bug whereby any parametric constraint labels on components placed on the left side of a template will automatically prepend a minus sign ("-") to the label name. Unfortunately, the bug is that any parametric constraint label with this minus sign will not appear in the Corridor Objects window as a selectable Constraint Label. This has been filed as a defect, but unless and until it is fixed, users may need to manually remove this minus sign and instead add a "_L" or "_R" (for left/right side) onto any labels to ensure they are usable.

Step 6: Add Secondary Alignment – Secondary Alignments change the processing of the Templates to be perpendicular to the Secondary Alignment instead of the original baseline of the Horizontal Alignment. Useful for tapers/turn lanes, ramps, etc.

Step 7: Add Control/Target Alignments – Create geometry in a PI#CTRL.dgn file for use in conjunction with Point Controls, to help refine how a particular template is constructed over a station range. The PI#CTRL.dgn file is not plotted, but rather used as a reference file to control the corridor in the PI#CORD.dgn file, if needed. For this reason, the PI#CTRL.dgn file is not included in the level setting buttons located in the GDOT PDF Plotting ORD workflow.

Step 8: Add Point Controls – Point Controls are used in cross section design to override a point's usual Template constraint. Example uses of Point Controls in a cross section design would be to have the point representing the outside edge of a travel lane instead follow a horizontal alignment to widen for an auxiliary lane (such as a turn lane) or having a point follow a different vertical alignment for split grades.

Step 9: Add Corridor Clipping Reference – Used to remove a portion of an intersecting Corridor, useful in certain design situations like a Bridge.

Step 10: Define Target Aliasing – Used on End Conditions to seek/target Terrains, Corridors or other Features.

Step 11: Add End Condition Exceptions – End Condition Exceptions are applied to End Conditions during cross section design when the normal behavior of an End Condition is not sufficient for actual conditions and it is not desirable to create and place new templates. Examples include steepening slopes to stay inside Right-of- Way and additional shoulder widening for guardrail anchorage.

Step 12: Add Superelevation – Superelevation Control Lines are added to control the Roadway cross slope in horizontal curve areas. ORD utilizes Superelevation Tables based on the AASHTO 2018 Green Book. Superelevation for each alignment should be in its own file, e.g. *PI#SUPR_Alignment Name.dgn*.

Step 13: Add Annotation – Annotate elements, such as adding Ditch Flow Arrows, by using the command *Element Annotation>Annotate Element*, and then selecting the elements you want annotated.

6.3 Corridor Naming Conventions

The DGN file/s should be named PI#CORD#A_RoadName.DGN (Ex. 1234567CORD1B_SR92.DGN). Keep the file names as concise as possible by only using the applicable SR/CR/US/CS number, as shown above. For roads that do not have a route designation or when it is unknown, again, be as concise as possible (for example, instead of 1234567CORD3_Bell Bottoms Lane.dgn, truncate to 1234567CORD3_BBLN.dgn). The **#** and **Letter** that comes after CORD in the file name is unique to that corridor. Each corridor must have its own **unique** # and only if there are multiple corridor files desired due to its length (> 1 mile), will it require an alphanumeric designation (i.e. for a 2-mile project on SR 92, it may require 2 corridor files, named 1234567CORD1A_SR92.dgn and 1234567CORD1B_SR92.dgn). Multiple DGN files for a long project consisting of multiple corridors are not required, but it may help facilitate in file-sharing amongst multiple designers working on the same project. (See *Table 6.1*).

Table 6.1
Standard Corridor File Names

Single Corridor File Name (< 1 mile in length)	**Example**
PI#CORD#_RoadName.DGN	1234567CORD1_SR92.DGN
Multiple Corridor File Names (> 1 mile in length)	**Example**
PI#CORD#A_RoadName.DGN PI#CORD#B_RoadName.DGN PI#CORD#C_RoadName.DGN etc.	1234567CORD1A_SR92.DGN 1234567CORD1B_SR92.DGN 1234567CORD1C_SR92.DGN etc.

A Corridor is a strip of land defined by a horizontal and vertical alignment or alignments. It can be considered the project's footprint. Cross section design is performed in the Corridor and the Final Surface is created from the corridor. The Corridor Name should match the corresponding Alignment's Name as closely as possible. (See *Table 6.2*).

Table 6.2 Standard Corridor Name (Roadway or Alignment Name)	
Roadway or Alignment Name	Example: SR100

6.4 Bogus Terrain Naming Conventions for Target Aliasing

When a Template's End Condition encounters an obscured area or extends beyond the available Existing Terrain, the End Condition fails to solve and is not placed. ORD does not extend the existing ground in order to finish the placement of the Template. **When these situations are encountered, the Designer is instructed to request additional Terrain coverage from the Office of Design Policy and Support/Location Bureau**. The Location Bureau will provide a new Existing Terrain (TOPO.DGN file) to the Designer with the additional coverage. Until Location provides the updated terrain, the designer may get a temporary estimate of the end condition extents by using a 'Bogus Terrain'. Target Aliasing may then be used with the 'BogusTerrain'.

The creation of a Bogus Terrain is necessary in ORD if there are obscured areas in which cross-sections cannot form a closed area for earthwork calculations. These cross sections shown on the cross section sheets are generated from the Final Proposed Terrain and Bogus Terrain. The Naming Convention for the Bogus Terrain used in Target Aliasing is PI#BogusTerrain.DGN (Ex. 1234567BogusTerrain.DGN). (See *Table 6.3*).

Table 6.3
Standard Bogus Surface for Target Aliasing

PI#BogusTerrain.DGN	Example: 1234567BogusTerrain.DGN

Chapter 7: Cross Section Sheets/Annotation Generation - Contents

Cross Section Sheets/Annotation Generation

This section provides an overview of the requirements for generating Cross Section Sheets and Updating Annotation after Design changes. For generic training on this process, please go through the Bentley Learning path Drawing Production – Creating Cross Section Sheets: https://learn.bentley.com/app/Public/ViewLearningPathWithMasterCourseExpanded?lpId=114110&mcId=103518

7.1 Cross Section Sheets/Annotation Overview

The following section depicts an overview of the processes to create Cross Section Sheets to GDOT standards in ORD. In order to generate Cross Sections, the following information must be followed:

a) In order to generate cross sections, an Existing and Finished Terrain must first exist (and therefore, Horizontal/Vertical Alignments, Corridor, etc.). The cross sections are then cut from the Finished Terrain.

b) The **Place Named Boundary ▶ Civil Cross Section** command is used to create the Cross Sections, which are saved as Models within the PI#_23.DGN file. There are three custom Drawing Seed options provided to define the Scale, L/R Offsets, and other parameters. See Section 7.2 for descriptions of the various Drawing Seeds used by GDOT.

c) The Cross Section "Cut Sheets" use cells for the grids and border instead of DGN Reference Files.

d) The Annotation of Cross Sections is done automatically. See Section 7.3 for how to Update Annotation when changes are made to the Design.

7.2 Cross Section Sheet Drawing Seed Preferences

The generation of Cross Section Sheets is accomplished by using the **Place Named Boundary ▶ Civil Cross Section** command. This command uses Drawing Seed Preferences which have been set up in order to create the Cross Section Sheets to GDOT Standards. In order to generate/view Cross Sections to GDOT Standards, the desired Drawing Seed must be set. The Drawing Seed options are described below. (See *Table 7.1*).

Table 7.1

Cross Section Drawing Seeds

Location: Place Named Boundary ▶ Civil Cross Section	
Drawing Seed	**Description**
XS - Narrow 20h 20v	Used for Plans Production of Cross Section "Narrow" Sheet generation. This Preference loads the settings into the Place Named Boundary dialog to view Cross Sections in a Narrow format on the GDOT SUXSEN Cross Section plan sheet cell. The Preference loads settings for a 1"=20' Scale Horizontally and Vertically.
XS - Wide 20h 20v	Used for Plans Production of Cross Section "Wide" Sheet generation. This Preference loads the settings into the Cross Sections dialog to view Cross Sections in a Wide format on the GDOT SUXSEW Cross Section plan sheet cell. The Preference loads settings for a 1"=20' Scale Horizontally and Vertically.
XS - Wide 40h 40v	Used for Plans Production of Cross Section "Extra Wide" Sheet generation. This Preference loads the settings into the Place Named Boundary dialog to view Cross Sections in a Wide format on the GDOT SUXSEW Cross Section plan sheet cell. The Preference loads settings for a 1"=40' Scale Horizontally and Vertically. This allows for cross sections with offsets up to 300' L/R.

7.3 Cross Section Sheet Annotation Updates

The typical annotation of Cross Section Sheets is done automatically. This includes annotation text for slopes, station/offset, elevations, L/R offsets, ditch elevations, etc. However, if any changes are made to the Corridor Design (i.e. altering the Horizontal/Vertical Alignment, adding a turn lane, changing the Superelevation, etc.), the Cross Section Sheet Annotation will need to be redone. This is easily accomplished in ORD by using the **Drawing Production ▶ Annotations ▶ Drawing Model Annotation ▶ Remove Drawing Model Annotations** command. Unless you are only impacting a small area that is known, it is typically better to choose **All Drawing Models**, when prompted. After removal, simply reannotate them by selecting the **Drawing Production ▶ Annotations ▶ Drawing Model Annotation ▶ Annotate Drawing Model** command, again selecting **All Drawing Models**, when prompted (unless the impact is localized and known, in which case you may select the specific Sheet Models to update). Note: Be sure to choose the correct Annotation Group when annotating.

Chapter 8: Earthwork - Contents

Earthwork

This section provides a brief overview of the requirements and processes for generating Earthwork Quantities and Earthwork Volume Reports. For generic training on how to generate Earthwork information please see the Bentley Learning path Quantities and Earthwork: https://learn.bentley.com/app/Public/ViewLearningPathWithMasterCourseExpanded?lpId=113539&mcId=103116

8.1 Earthwork Overview

The following section depicts an overview of the processes to generate Earthwork Quantities and Earthwork Volume Reports to GDOT Standards in ORD. In order to generate these Quantities and Volume Reports, the following information shall be adhered to:

a) In order to generate Earthwork Quantities and Volume Reports, a Corridor must first be created.

b) Place a Named Boundary Civil Cross Section using a standard Drawing Seed (see below for Drawing Seed descriptions).

c) To see End Area Volumes Report, click on *Home>Civil Analysis> End Area Volumes Report*. Select the Style Sheet named **EndAreaVolume.xsl** in the **Bentley Civil Report Browser**.

d) Make sure that each Cross Section at each applicable Station forms a closed area. If the areas do not close, the volume calculations will be inaccurate. This is especially the case if there are obscured areas. The Designer is reminded to contact the Office of Design Policy and Support/Location Bureau for any additional survey required in the obscured areas. If these areas are not resolved – inaccurate volume calculations will result.

8.2 Cross Section Drawing Seeds

The generation of Cross Section Sheets is accomplished by using the **Place Named Boundary** command in ORD. This command contains Preferences which have been set up in order to create the cut Cross Section Sheets to GDOT Standards. In order to generate/view Cross Sections to GDOT Standards for Earthwork Volumes, Drawing Seed Preferences must be set. Drawing Seed Preferences set the viewing/creation of Cross Sections when using the **OpenRoads Modeling ▶ Drawing Production ▶ Named Boundary ▶ Place Named Boundary Civil Cross Section** command. (See *Table 8.1*).

Table 8.1

Drawing Seeds – Named Boundary Civil Cross Section

Location: OpenRoads Modeling ▶ Drawing Production ▶ Named Boundary ▶ Place Named Boundary	
Drawing Seed Name	**Description**
XS - Narrow 20h 20v (Use for Plans Production)	Used for Plans Production of Cross Section "Narrow" Sheets and/or Earthwork Volumes generation. This Preference loads the settings into the Place Named Boundary Civil Cross Section dialog to view Cross Sections in a Narrow format on the GDOT SUXSEN Cross Section plan sheet cell. The Preference loads settings for a 1"=20' Scale Horizontally and Vertically.
XS - Wide 20h 20v (Use for Plans Production)	Used for Plans Production of Cross Section "Wide" Sheet and/or Earthwork Volumes generation. This Preference loads the settings into the Place Named Boundary Civil Cross Section dialog to view Cross Sections in a Wide format on the GDOT SUXSEW Cross Section plan sheet cell. The Preference loads settings for a 1"=20' Scale Horizontally and Vertically.
XS - Wide 40h 40v (Use for Plans Production)	Used for Plans Production of Cross Section "Wide" Sheet and/or Earthwork Volumes generation. This Preference loads the settings into the Place Named Boundary Civil Cross Section dialog to view Cross Sections in a Wide format on the GDOT SUXSEW Cross Section plan sheet cell. The Preference loads settings for a 1"=40' Scale Horizontally and Vertically.

8.3 GDOT Earthwork Volume Report

The generation of the Earthwork Volume Report may be accomplished by using the generic Bentley Style Sheet **EndAreaVolume.xsl** Style Sheet. This Style Sheet is accessed by selecting the following command: **OpenRoads Modeling ▶ Home ▶ Civil Analysis ▶ End Area Volumes Report**. Click the **EndAreaVolume.xsl** Style Sheet after the **Bentley Civil Report Browser** opens. The Style Sheet can be saved as an HTML file.

Chapter 9: Required Right of Way - Contents

Required Right of Way

This section provides a brief overview of the requirements and processes for storing R/W Parcels and generating Right of Way Tables to GDOT Standards.

9.1 Right of Way Overview

The following section depicts an overview of the processes to generate Required R/W and Easement Alignments, R/W DGN Files and R/W and Easement Tables to GDOT Standards. Failure by the Designer to follow the correct Point and Alignment naming convention may cause problems with Survey Enhancements during the life of the project and with Stakeout Report generation. In order to generate these Required R/W and Easements, the following information shall be adhered to:

a) Required Right of Way and Easement Alignments and Points must be stored in 2 separate models within the PI#REQD.dgn file:
   - a *RWParcelGeom* model for creating the non-plotting closed shapes necessary to create the Right of Way Tables and .out files for Deed generation
   - a *REQD* model to display all the necessary Right of Way/Easement alignments that need to be plotted

b) Follow the Required Right of Way and Easement Alignment workflows detailed in the GDOT ORD Design Workflow Processes document on ROADS.

9.2 R/W Alignment and Point Names/Feature Definitions

The Right of Way Horizontal Alignments and Points must be stored with a DE Prefix, with a unique number identifier (i.e. DE50, DE 61, etc.) and must be assigned the appropriate Feature Definition. See *Table 9.1* for a list of Feature Definitions.

Table 9.1
Feature Definitions For R/W Design Points and Alignments

Proposed Design Point Feature Definitions	REQD_P_DWESMT REQD_P_PESMT REQD_P_REQD REQD_P_RWRM REQD_P_TESMT	
Proposed Right of Way Description	**Feature Definition**	**Feature Name Example**
R/W Monument	REQD_P_RWRM	DE35
Reqd. R/W	REQD_P_REQD	DE35
Perm. Const. Esmt.	REQD_P_PESMT	DE35
Temp. Const. Esmt.	REQD_P_TESMT	DE35
Driveway Esmt.	REQD_P_DWESMT**	DE35

** Note: All other Types of Miscellaneous Easements should use the REQD_P_DWESMT Feature Definition.

9.3 R/W and Easement Tables (Style Sheets)

The generation of the R/W and Easement Tables is accomplished in the **OpenRoads Modeling** workflow with the command: **Geometry ▶ General Tools ▶ Reports ▶ Legal Report**. In the **Bentley Civil Report Browser** select the **GDOT RW Table_ORD.xsl** Style Sheet (or for Railroad easements, the **GDOT RailRoad RW Table_ORD.xsl** Style Sheet). The Report can be saved as a .txt file and then imported into ORD as a table. For additional information regarding the Style Sheet, review the Style Sheet Help File which is included with the **GDOT_Org_Civil_Standards_CaddAll.exe** standard files (external users) or on ProjectWise (internal users). See *Table 9.2*).

Table 9.2

Style Sheet Report (Table) – GDOT RW Table_ORD.xsl & GDOT RailRoad RW Table_ORD.xsl

OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Legal Report	
Style Sheet Name	**Description**
GDOT RW Table_ORD.xsl	The GDOT RW Table_ORD.xsl Style Sheet is utilized to create Right-of-Way Table textfiles for placement in OpenRoads Designer with *File* ▶ *Import* ▶ *Text* command. Please Refer to the **GDOT RW Table_ORD.xsl** Style Sheet Help File for additional information.
GDOT RailRoad RW Table_ORD.xsl	The GDOT RailRoad RW Table_ORD.xsl Style Sheet is utilized to create Railroad Right-of- Way Table text files for placement in OpenRoads Designer with *File* ▶ *Import* ▶ *Text* command. Please Refer to the **GDOT RailRoad RW Table_ORD.xsl** StyleSheet Help File for additional information.

9.4 R/W Deed (Style Sheets)

The generation of the Right of Way Deed is accomplished in the **OpenRoads Modeling** workflow with the command: **Geometry ▶ General Tools ▶ Reports ▶ Legal Report**. In the **Bentley Civil Report Browser** select the **GDOT Deed_ORD.xsl** Style Sheet. The Style Sheet **MUST BE** saved as a .out file. This .out file is then used in the stand-alone Deed Writer Program to generate GDOT Deeds for purchase of Right of Way. For additional information regarding the Style Sheet, review the Style Sheet Help File which is included with the **GDOT_Org_Civil_Standards_CaddAll.exe** standard files (external users) or on ProjectWise (internal users). (See *Table 9.3*).

Table 9.3

Style Sheet Report (Table) – GDOT Deed_ORD.xsl

OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Legal Report	
Style Sheet Name	**Description**
GDOT Deed_ORD.xsl	The GDOT Deed_ORD.xsl Style Sheet is utilized to supply a Deed.out file to the Right-of- Way office. The Right-of-Way office utilizes the Deed.out file to generate a Deed. Please Refer to the **GDOT Deed_ORD.xsl** Style Sheet Help File for additional information.

Chapter 10: Survey Enhancements - Contents

Survey Enhancements

This section provides a brief overview of the processes to include Additional Survey Enhancements received from Photogrammetry/Survey during the Design Phase of a project.

10.1 Survey Enhancements Overview

The following section depicts an overview of the processes to incorporate Survey Enhancements during the Design Phase of a project according to GDOT Standards. In order to add the Survey Enhancement Data, the following information shall be adhered to:

a) During the life of a Design project, additional Survey Enhancements may need to be incorporated into the project and the new survey data re-submitted to the Designer in order for the Designer to update the design database.

b) All location survey data and all requests for additional survey/property data should be submitted to the Office of Design Policy and Support/Location Bureau.

c) Depending on what type of enhancements are collected, the SDE will process the additional survey data and send the Designer the appropriate files as required. This could result in the SDE sending the Designer all of the updated files or just certain files depending on what data was collected.

d) The Designer will receive a new PI#TOPO.dgn and/or a new PI#UTLE.dgn from the SDE when Enhancements are requested and incorporated for Existing Terrain/Property/Utility Data. These files supersede the old files and the Designer will need to use the new files instead. In ProjectWise, this is as simple as dropping it into the same Project Folder, which will create a new version of the .dgn file and automatically update any .dgn files using it as a reference.

e) A new Enhanced TOPO file may not always be provided to the Designer if no changes were made to the property or survey data by the SDE. The SDE will only provide an Enhanced PI#TOPO.dgn file if new Features have been surveyed and incorporated into the PI#TOPO.dgn file.

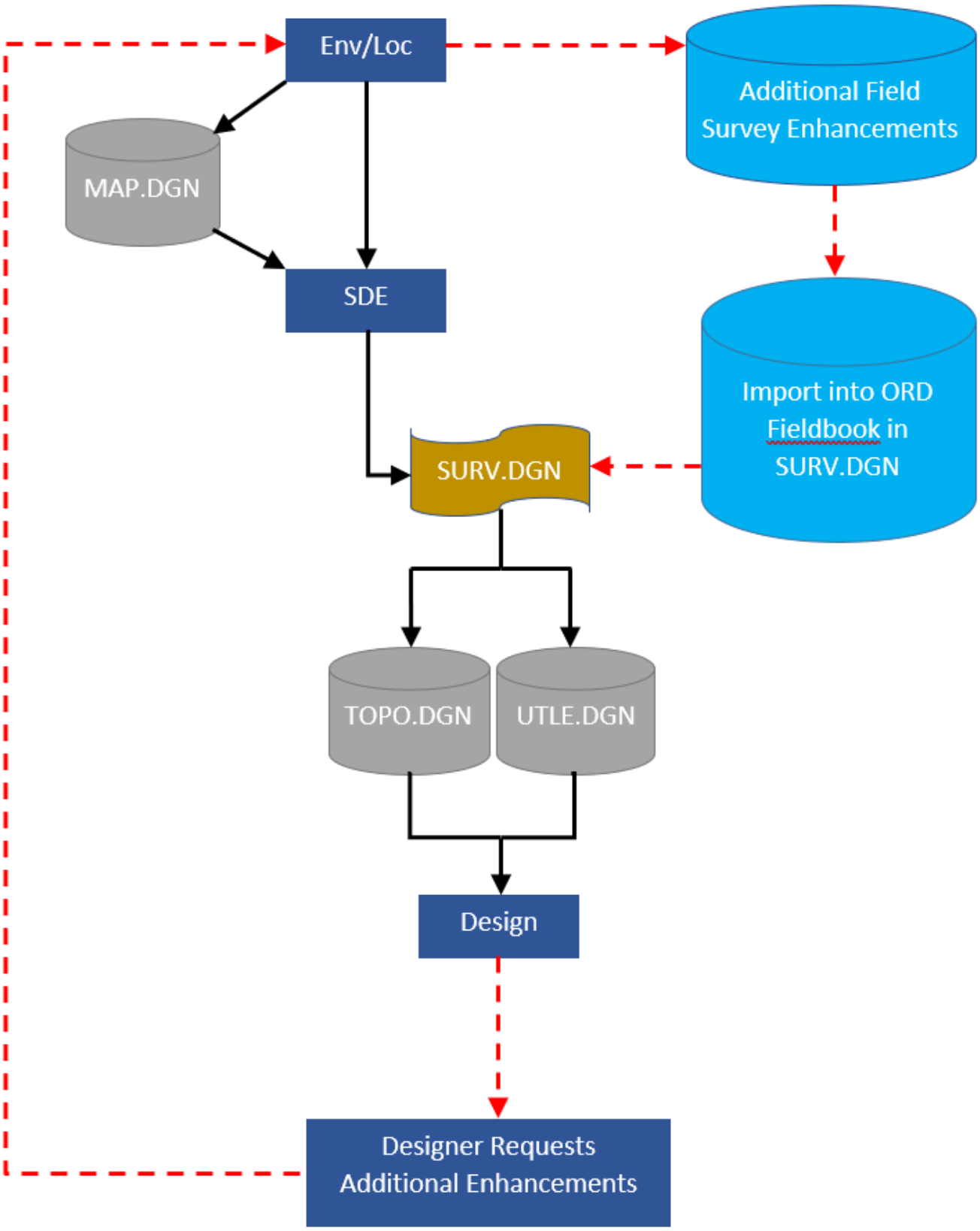
f) A new Enhanced UTLE file may not always be provided to the Designer if no changes were made to the Utility Features by the SDE. The SDE will only provide an Enhanced PI#UTLE.dgn file to the Designer if new data has been surveyed and incorporated into the PI#UTLE.dgn file.

g) The PI#TOPO.dgn file received from the SDE contains all of the Terrain Points, Breaklines, Features, along with the triangulated data. It also contains the Property/Existing Alignment information, including the SV Prefix Alignments and the Survey Points.

h) In most cases the following files (or a combination) of these files will be submitted to the Designer for use as Additional Survey Enhancements:
   - **PI#TOPO. dgn** (if applicable)
   - **PI#UTLE.dgn** (if applicable).

Additional Survey Enhancement Process

(Red Dotted Line represents Additional Survey Enhancement Process Overview)



10.2 Survey Enhancements to the DGN files

The following section depicts information regarding the DGN file(s) submitted to the Designer whenever Survey Enhancements have been incorporated by the SDE. The following DGN File(s) are updated (if applicable) by the SDE after merging the new data into the original PI#SURV.dgn file: PI#UTLE.dgn and PI#TOPO.dgn files. The PI#SURV.dgn is for SDE use only and is used to create the PI#TOPO.dgn and/or PI#UTLE.dgn files for Design. The Designer may not always receive both of the aforementioned files. The Designer will only receive the updated DGN files if changes were made to the DGN files by the SDE.

If Enhanced DGN Files are provided by the SDE, these shall supersede those files used previously by the Designer. It is best to keep versioned copies, rather than simply deleting/overwriting the previous files. This can easily be accomplished in ProjectWise by simply dragging the files into the correct Project Folder and selecting to create a new version of the existing file.

Chapter 11: ORD Style Sheets - Contents

ORD Style Sheets

This section provides a brief overview of the requirements and processes for generating Reports/ Style Sheets to GDOT Standards. For additional information regarding the processing of Style Sheets, please refer to the more detailed documentation provided for each Style Sheet.

11.1 ORD Style Sheets Overview

Style Sheets are used by ORD to present data in a particular Report Format. The StyleSheets are XSL files which can be saved in different extensions depending on the Style Sheet used.
Formats can be saved as .HTML, .OUT, .TXT, etc. depending on the function of the Style Sheet. GDOT has several Style Sheets which can be used to generate Report Data in a format for use in submitting Report deliverables for Design, Survey, Construction, etc. In order to generate these Style Sheets to GDOT Standards, the following information shall be adhered to:

a) The Style Sheet Data is based on XML (Extensible Markup Language) code which is used to generate the data from ORD into an XSL (Extensible Style Sheet Language) Report Format.
b) In order to generate Style Sheets to GDOT Standards for deliverables, use the Style Sheets in the GDOT folder in the Bentley Civil Report Browser.
c) It is very important that only the Style Sheets that have the name GDOT in it are used for submitting deliverables according to GDOT Standards. Designers may use the generic ORD Style Sheets during the Design Process, but all deliverable Reports MUST use the GDOT Style Sheets according to Design Policy.

11.2 Location of GDOT Style Sheets

As mentioned previously, in order to generate Reports to GDOT Standards for deliverables, the GDOT Standard Style Sheets shall be utilized. The GDOT Style Sheets are included in the **GDOT_Org_Civil_Standards_CaddAll.exe** download executable file. They can be accessed, both internally and externally, by navigating to the GDOT folder in the Bentley Civil Report Browser.

11.3 Location of GDOT Style Sheet Help Files

GDOT Style Sheet Help Files are available for internal GDOT users in ProjectWise here: Style Sheets

For external users, these are included in the **GDOT_Org_Civil_Standards_CaddAll.exe** download executable file. Once **GDOT_Org_Civil_Standards_CaddAll.exe** is executed and installed, the GDOT Style Sheets will be installed and located in the following path (Drive Letter is C: by default, but is variable):

\GDOT_CE\Organization-Civil\GDOT_Org_Civil_Standards\Reports\GDOT\Style Sheet Help Files

These GDOT Style Sheet Help Files depict detailed information regarding the usage of the Style Sheets, the format of the Style Sheets and the type of extension (.html, .txt, .etc.) in which the Style Sheet should be saved.

11.4 Descriptions of GDOT Style Sheets

Customized Style Sheets have been created to GDOT Standards in order to provide Reports for ORD Data. These Style Sheets correspond to GDOT Policy and shall be utilized for Report deliverables when required. The following Table lists the current available GDOT Style Sheets, the Location to Access the Style Sheets in ORD and a brief Description of the Style Sheets. Detailed Help Files are also available as discussed in Section 11.3.

Table 11.1
Style Sheet Descriptions

Style Sheet Name (.xsl)	Location of Command	Description
GDOT 3D Alignment Comparison Report_ORD	OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Station Base Report	Reports the Station, Elevation, Horizontal Offset and Vertical Offset from one alignment (Baseline Alignment) to a second alignment (Offset Alignment).
GDOT Alignment File Descriptions_ORD	OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Horizontal Geometry Report	Reports a text file description of the baseline alignments to the Contractor.
GDOT Alignment Report_ORD	OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Horizontal Geometry Report	Reports Horizontal Alignment information to the Contractor for use in GPS equipment. The Report depicts the Alignment information located at 50 Foot Station intervals at a Zero Offset. The Alignments may all be generated at one time and listed in a single Report.
GDOT Deed_ORD	OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Legal Report	Utilized to supply a Deed.out file to the Right-of-Way office. The Right-of-Way office uses the Deed.out file to generate a Deed using the DeedWriter program.

Style Sheet Name (.xsl)	Location of Command	Description
GDOT Feature-StationElevationOffset Report_ORD	OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Station Offset Report	Creates a Station, Elevation and Offset Report from the Roadway Baseline to selected Features in the Terrain model.
GDOT HEC RAS Bridge Features Report_ORD	OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Station Offset Report	Creates a Station, Elevation and Offset Report from the Roadway Baseline to selected Terrain Features representing the existing Bridge Geometry. This Report is then used for input of the Bridge Geometry data into HEC RAS.
GDOT HEC RAS Cross Section Geometry Report_ORD	OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Profile Report	Creates a comma-delimited Station and Elevation Report from the Roadway Baseline for use in importing Cross Sectional geometric data into HEC RAS. The cross-sectional data is reported based on the Offset Parallel Alignments/Profiles from the Roadway Baseline through a Stream Center.
GDOT Parcel Check Report_ORD	OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Horizontal Geometry Report	Utilized during quality assurance checks on existing property in the TOPO.DGN file. The report identifies parcels that have not been stored clockwise and parcels that are not closed.
GDOT Ponding Report_ORD	OpenRoads Modeling ▶ Home ▶ Model Analysis and Reporting ▶ Reports ▶ Station Base Report	Reports profile stations where the longitudinal grade < 1.0% and the road cross slope < 0.5%.
GDOT RailRoad RW Table_ORD	OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Legal Report	Creates Railroad-specific Right-of-Way Table text files for placement in ORD with *File* ▶ *Import* ▶ *Text* command.

Style Sheet Name (.xsl)	Location of Command	Description
GDOT RW Table_ORD	OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Legal Report	Creates Right-of-Way Table text files for placement in ORD with *File* ▶ *Import* ▶ *Text* command.
GDOT Station-Offset Report_ORD	OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Point Feature Station Offset Elevation Report	Supplies Station and Offset information of selected Points to a selected Horizontal alignment.
GDOT SUE Utility QL-A Location Report_ORD	OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Point Feature Station Offset Elevation Report	The **GDOT SUE Utility QL-A Location Report_ORD.xsl** Style Sheet is utilized to supply a report depicting Test Hole Name, Description, Station and Offsets for SUE QL-A Test Holedata.
GDOT Superelevation Data Report_ORD	OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Superelevation Report	The **GDOT Superelevation Data Report_ORD.xsl** Style Sheet is utilized to provide superelevation information that was applied using the Create Superelevation Wizard. The **GDOT Superelevation Data Report** lists the Station, Cross Slope and Point Type (Normal Crown, Zero Cross Slope, Reverse Crown, and Full Super) for each superelevation transition location.
GDOT Surface Check Report-MPCKGRD_ORD	OpenRoads Modeling ▶ Terrain ▶ Analysis ▶ Points ▶ Analyze Elevation	The **GDOT Surface Check Report-MPCKGRD_ORD.xsl** Style Sheet is utilized to verify the tolerance and accuracy of an Existing Digital Terrain Model (original terrain surface) as compared against associated field survey points along the ground.
GDOT Surface Check Report-MPCKPAV_ORD	OpenRoads Modeling ▶ Terrain ▶ Analysis ▶ Points ▶ Analyze Elevation	The **GDOT Surface Check Report-MPCKPAV_ORD.xsl** Style Sheet is utilized to verify the tolerance and accuracy of an Existing Digital Terrain Model (original terrain surface) as compared against associated field survey points along the pavement.

Chapter 12: Additional File Deliverables - Contents

Additional File Deliverables

This section provides a brief overview of Additional File Deliverables which are required to be submitted when using ORD. Several Additional Files are generated in ORD for use by other Offices internal to GDOT. Additional Files are also provided to Contractors when a Project is complete and let to Construction.

This section covers the following topics:

- Additional File Deliverables Overview
- ORD File Deliverables to GDOT
  - Write Stakeout Data to a Data Collector
  - Generate GDOT Deed File(s)
  - ORD Project Data Sheet(s)
  - GDOT ORD Design Data Quality Assurance Checklist
- ORD File Deliverables to Contractors
  - Alignment File Description(s)
  - Alignment Report File(s)
  - 3D Model Files

12.1 Additional File Deliverables Overview

The following section depicts an overview of the Style Sheets, Data Files and Reports which are required as Additional File Deliverables. In order to generate these Additional File Deliverables, the following information shall be adhered to:

a) The GDOT Standard Style Sheets for generating the Additional File Deliverables are included in the **GDOT_Org_Civil_Standards_CaddAll.exe** download for external use. Internally, these are stored in ProjectWise and can be accessed by navigating to the GDOT folder in the Bentley Civil Report Browser. To set the GDOT folder as the default folder in the Bentley Civil Report Browser, click on *Tools>Style Sheet Root*, highlight the GDOT folder and click OK.

b) For Detailed Help Instructions on using the Style Sheets, please see the GDOT Style Sheet Help Files, included in the GDOT_Org_Civil_Standards_CaddAll.exe download for external use. Internally, the Help documentation can be found in ProjectWise here: Style Sheets.

c) To generate the GDOT Stakeout Data File for staking of R/W, see Section 12.2.1 below.

d) To generate the Deed output files for use in writing Deeds, the following Style Sheet should be used: **GDOT Deed_ORD.xsl**.

e) To generate the Alignment File Descriptions which depict the Alignment information (including the Curve Data and Coordinate information), the following Style Sheet should be used: **GDOT Alignment File Descriptions_ORD.xsl**.

f) To generate the Alignment Report files which depict the Alignment information at 50' intervals for use by Contractors, the following Style Sheet should be used: **GDOT**

Alignment Report_ORD.xsl.

g) The Project Data Sheet is a required Deliverable that should list all of the pertinent ORD Design information. This file is used by Designers to help document associated files and data for use during the Design process. This file is also submitted as a deliverable with the ORD project files so that users who inherit the project can easily identify project data. This File is available on the ROADS webpage here.

h) A Quality Assurance Control Checklist is also required. This is a checklist that the Designer should utilize to ensure that all pertinent Design Data is included for Project Delivery. This File is available on the ROADS webpage here.

12.2 ORD File Deliverables to GDOT

As mentioned previously, there are several Additional File Deliverables which are required to be submitted by the Designer for use by other Offices in the Department. The following Section contains information on how to generate the following Report/Data Files:

- Write Stakeout Data to a Data Collector using ORD LandXML
- Generate GDOT Deed File(s)
- ORD Project Data Sheet(s)
- GDOT ORD Design Data Quality Assurance Checklist

12.2.1 Write Stakeout Data to a Data Collector as LandXML

The following procedure is used to export Stakeout Data such as COGO Points, Horizontal/Vertical Alignments, etc. from ORD to a LandXML file. This must be done in 2 parts: one for the Survey Features, and another for the Geometry Alignments/Points. The resulting 2 LandXML files can then be uploaded to the GDOT Trimble Business Center/GDOT Trimble Data Collectors for use in staking out Survey Data.

12.2.1.1 Workflow Procedure for Survey Features:

A. Open the PI#TOPO.dgn file in ORD.

B. View Required Survey Features for Stakeout Data

1. Deselect ALL Point Features and ALL Linear Features in the Field Book so that nothing is viewing on screen.
2. Select the **Stakeout Data Point Features** *Survey Filter* so that all required features are viewed on screen. See *Table 12.1* below for list of Feature Definitions in the *Survey Filter*.
3. Select All features viewed.

C. Create the LandXML File

1. In the Survey Workflow, select **Field Book ▶ Export ▶ LandXML**
2. Accept the defaults by left-clicking.
3. Save the file as *PI#SURV.xml*

Table 12.1: Survey Point Feature Definitions to Export to LandXML

PROP_E_RWC	PROP_E_RWM	PROP_E_PPC	PROP_E_PCF
TOPO_E_SBNCHMK	TOPO_E_SDCD	TOPO_E_SLCD	TOPO_E_SLCM
TOPO_E_SNGSCM			

12.2.1.2 Workflow Procedure for Design Features:

A. Open your main geometry file (PI#GEOM.dgn) in ORD, with all levels turned on.

B. Ensure that the following files are referenced, and all levels are on (at least temporarily for this workflow):

1. All other geometry files (if more than 1 exists)
2. PI#TOPO.dgn
3. The model *RWParcelGeom* within the PI#REQD.dgn file.

C. In *OpenRoads Modeling* workflow, select **Geometry>General Tools>Design Elements>Select by Graphical Filter.**

1. Select the **Stakeout Data** *Graphical Filter Group* and data point to accept. This should select all of the features needed to export, whether referenced or existing in the opened file. See *Table 12.2* below for list of Feature Definitions included in this *Graphical Filter Group*.
2. Select **Geometry>General Tools>Import/Export>Export Geometry**
3. Using Settings below, data click to accept. Save file as *PI#Alignments.xml*.

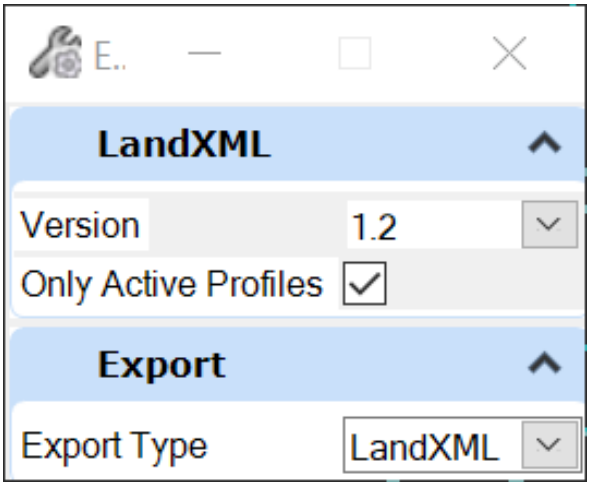


Table 12.2: Alignment Feature Definitions to Export to LandXML

MAIN_P_CONSTCL 100	MAIN_P_CONSTCL 500	MAIN_P_SIDECL 100	MAIN_P_SIDECL 500
PROP_E_PAR	PROP_E_POEL	PROP_E_RWE	PROP_E_LTD-ACCESS
PROP_E_RWE-LTD-	PROP_E_RWU		
REQD_P_DWESMT	REQD_P_PESMT	REQD_P_REQD	REQD_P_TESMT

12.2.2 Generate GDOT Deed File(s)

In order to write out data from ORD to use as the Metes and Bounds description for generation of Deeds, the **GDOT Deed_ORD.xsl** Style Sheet is used. The **GDOT Deed_ORD.xsl** Style Sheet is utilized to create an output (.OUT) file which is imported into the stand-alone GDOT Deed Writer program.
The Deed Writer Program is used by the Office of Right of way to create Deeds for the purchase of Right of Way on the project.

NOTES:

a) For Detailed Instructions on using the **GDOT Deed_ORD.xsl** Style Sheet, please see the GDOT Style Sheet Help Files included with the **GDOT_Org_Civil_Standards_CaddAll.exe** download for external use. Internally, these are located in ProjectWise, here: Style Sheets.

b) Points must be stored at the PC and the PT of Curves in order to generate an accurate Metes and Bounds Deed file.

c) The Points must be stored in a clockwise direction to facilitate the Deed Writing process.

d) To access the Style Sheet, select the following command in the ORD menu:
OpenRoads Modeling ► Home ► Reports ► Legal Report

e) The **GDOT Deed_ORD.xsl** Style Sheet Report should be saved with an .OUT Extension.

f) The Naming Convention for the **GDOT Deed_ORD** .OUT File will be **Alignment Name.out** (Example: DE31.out).

Table 12.1
File Naming Convention – GDOT Deed

Location: OpenRoads Modeling ► Home ► Reports ► Legal Report	
File Name	**Example**
Alignment Name.out	DE31.out

12.2.3 ORD Project Data Sheet(s)

The **Project Data Sheet** is used to document the design files and data contained in the ORD Database File(s). This documentation not only assists the Designer during the Design process but also is used by other personnel who may inherit the project in latter stages to help identify the correct design files and design objects. This Project Datasheet File should be submitted as an Additional Deliverable along with the associated ORD Project Database File(s).

NOTES:

1. The **Project Data Sheet** is available on the ROADS webpage here, under the Design Guidelines section.
2. The Designer should store this file, along with any other project documentation and ORD Project Database File(s), in appropriate folders in ProjectWise (internally) or Project Folders (externally).

12.2.4 GDOT ORD Design Data Quality Assurance Checklist

The **GDOT ORD Design Data Quality Assurance Checklist** shall be documented and submitted by the Designer or Design Consultant. This document is an overall checklist to ensure that the applicable Design Deliverables are submitted to Construction and/or GDOT Design Personnel after the Design aspect of the Project is completed. Some of the areas listed in the checklist include: Design Data submitted, Proposed Terrain Surface information, Geometry Data, Templates, Corridors, Cross-Sections, etc. The Designer is to use this checklist to verify that the Project Deliverables contain all the requisite data before submittal for the Field Plan Reviews, Letting and Construction Phases.

NOTES:

a) The **GDOT ORD Design Data Quality Assurance Checklist** may be downloaded from the ROADS webpage here:

b) The Designer should store this file, along with any other project documentation and ORD Project Database File(s), in appropriate folders in ProjectWise (internally) or Project Folders (externally).

12.3 ORD File Deliverables to Contractors

When a project is complete and let to construction, there are several additional File Deliverables which are required to be submitted by the Designer for use by Contractors. The following Section contains information on how to generate the following deliverables:

- Alignment File Description(s)
- Alignment Report File(s)
- 3D Model File(s)

NOTE: The Alignment File Descriptions and Alignment Report Files will be provided Pre-Award of the contract.

12.3.1 Alignment File Descriptions

Text file descriptions of the Baseline Alignments (Feature Definitions of **MAIN_P_CONSTCL 100, MAIN_P_CONSTCL 500, MAIN_P_SIDECL 100** and **MAIN_P_SIDECL 500**) will be provided to the Contractor. These text files will list all of the applicable Baseline Alignment information including the associated Curve Data. A Graphical Filter Group may be used to select the above-listed Feature Definitions so that the Descriptions can be generated for each Alignment at the same time and included in one .TXT output file.

NOTES:

a) For Detailed Instructions on using the **GDOT Alignment File Descriptions_ORD.xsl** Style Sheet, please see the GDOT Style Sheet Help Files found in the **GDOT_Org_Civil_Standards_CaddAll.exe** download for external use. Internally, these can be found in ProjectWise here: Style Sheets.

b) To access the Style Sheet, select **OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Horizontal Geometry Report**

c) Following the command prompts, select all alignments that are required for inclusion in the Alignment Report

d) The **GDOT Alignment File Descriptions.xsl** Style Sheet Report should be saved with a .TXT Extension.

e) The Naming Convention for the **GDOT Alignment File Descriptions** will be **PI#_AL.txt** (Example: 1234567_AL.txt).

f) The following Feature Definitions will be written to the Alignment File Descriptions Report:
   - **MAIN_P_CONSTCL 100**
   - **MAIN_P_CONSTCL 500**
   - **MAIN_P_SIDECL 100**
   - **MAIN_P_SIDECL 500**

12.3.2 Alignment Report Files

Alignment Report Files will be utilized to supply alignment information to the Contractor for use in GPS equipment. This report depicts the alignment information located at 50 Foot Station intervals at a Zero offset. The report is required for each of the alignments with Feature Definitions of **MAIN_P_CONSTCL 100, MAIN_P_CONSTCL 500, MAIN_P_SIDECL 100** and **MAIN_P_SIDECL 500**.

NOTES:

a) For Detailed Instructions on using the **GDOT Alignment Report_ORD.xsl** Style Sheet, please see the GDOT Style Sheet Help Files found in the **GDOT_Org_Civil_Standards_CaddAll.exe** download for external use. Internally, these can be found in ProjectWise here: Style Sheets.

b) To access the Style Sheet, select **OpenRoads Modeling ▶ Geometry ▶ General Tools ▶ Reports ▶ Horizontal Geometry Report**

c) The GDOT Alignment Report.xsl Style Sheet should be saved with an .HTML Extension.

d) The Naming Convention for the **GDOT Alignment Report** will be **PI#_Alignment Report.html** (Example: 1234567_Alignment Report.html).

e) The following Feature Definitions will be written to the Alignment File Descriptions Report:

- **MAIN_P_CONSTCL 100**
- **MAIN_P_CONSTCL 500**
- **MAIN_P_SIDECL 100**
- **MAIN_P_SIDECL 500**

12.3.3 3D Model Files

3D Model files are now required Letting deliverables for any projects that propose earthwork/grading operations. These files will be provided "for information only" and will not be considered contract documents. There are no changes to the required earthwork files to be submitted at final plans; earthwork quantities and files should be submitted using the average end area method/reports. Instructions for creating Land XML files are currently under development, for eventual inclusion in the ORD Workflow Processes document available on GDOT's website at this link:

http://www.dot.ga.gov/PartnerSmart/DesignSoftware/OpenRoads/ORD%20Design%20Workflow%20Processes.pdf

The two files, in Land XML format, that shall be delivered are:

- PI#_EXIST.XML (containing the complete existing ground surface)
- PI#_FINISH.XML (containing a single merged final finished grade of the proposed surface)

For more details on these 3D Model deliverables, please see the 3D Modeling Best Practices & FAQ on ROADS:
http://www.dot.ga.gov/PartnerSmart/DesignManuals/OtherResources/3D%20Model%20Best%20Practices%20FAQ.pdf