

OpenRoads Designer User Manual



U.S. Department
of Transportation
**Federal Highway
Administration**

Chapter 23

PHYSICAL DATA



Chapter 23 Physical Data

This chapter covers the creation of ORD Reports, Files, and staking notes for the PE Hold File and FP-14 Section 152 deliverables.


TIP: For creating proposed surfaces, see [Chapter 22 - Proposed Terrain Model Creation](#).


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RECORD OF REVISIONS

The following record of revisions to the OpenRoads Designer Manual Chapter 23 is offered as a “quick reference” to determine the latest changes.

| DATE | SECTION | REVISION DESCRIPTION |
|---------|-----------------------------|---|
| 4/2026 | Section 23D | Revised  direction |
| 10/2025 | General | Revised to be solely Physical Data |
| 4/2025 | Section 23G | Revised Sub-Grade and Base Layers graphic and table |
| | Section 23J | Updated web link |

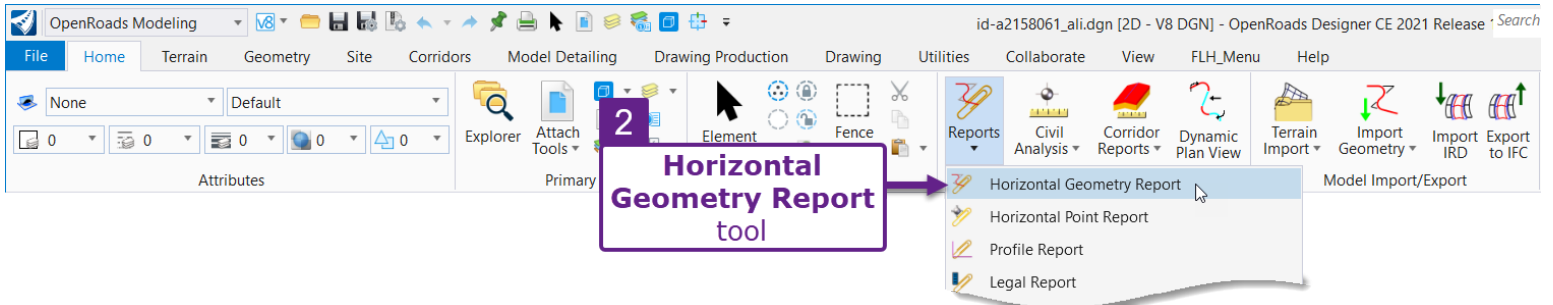
| | |
|---|--|
| 2 | From the Ribbon, select the <i>Export Geometry</i> tool: [OpenRoads Modeling → Geometry → General Tools → Import/Export]. |
| 3 | <i>Prompt: Select Export Type</i> – Select the LandXML option. |
| 4 | <i>Prompt: Locate Elements – Reset to Complete</i> – Left-Click on the desired Alignment . |
| 5 | <i>Prompt: Locate Elements – Reset to Complete</i> – Right-Click (reset) to advance to the next <i>Prompt</i> . |
| 6 | <i>Prompt: Select Version</i> – Select Version 2.0 . |
| 7 | <i>Prompt: Only Active Profiles</i> – Select Yes . If No is selected, then all Profiles found in the <i>Profile Model</i>  are included in the LandXML export. For example, if NO is selected, then the coordinate geometry data for the Existing Ground profile is included – which is typically NOT necessary. |
| 8 | Save the LandXML File in the appropriate file location. TIP: Name the Land XML File in accordance with FLH Naming Conventions. See 3F – Naming Convention for Proposed ORD Features . |

23A.2 Create PDF Reports for Alignments and Profiles

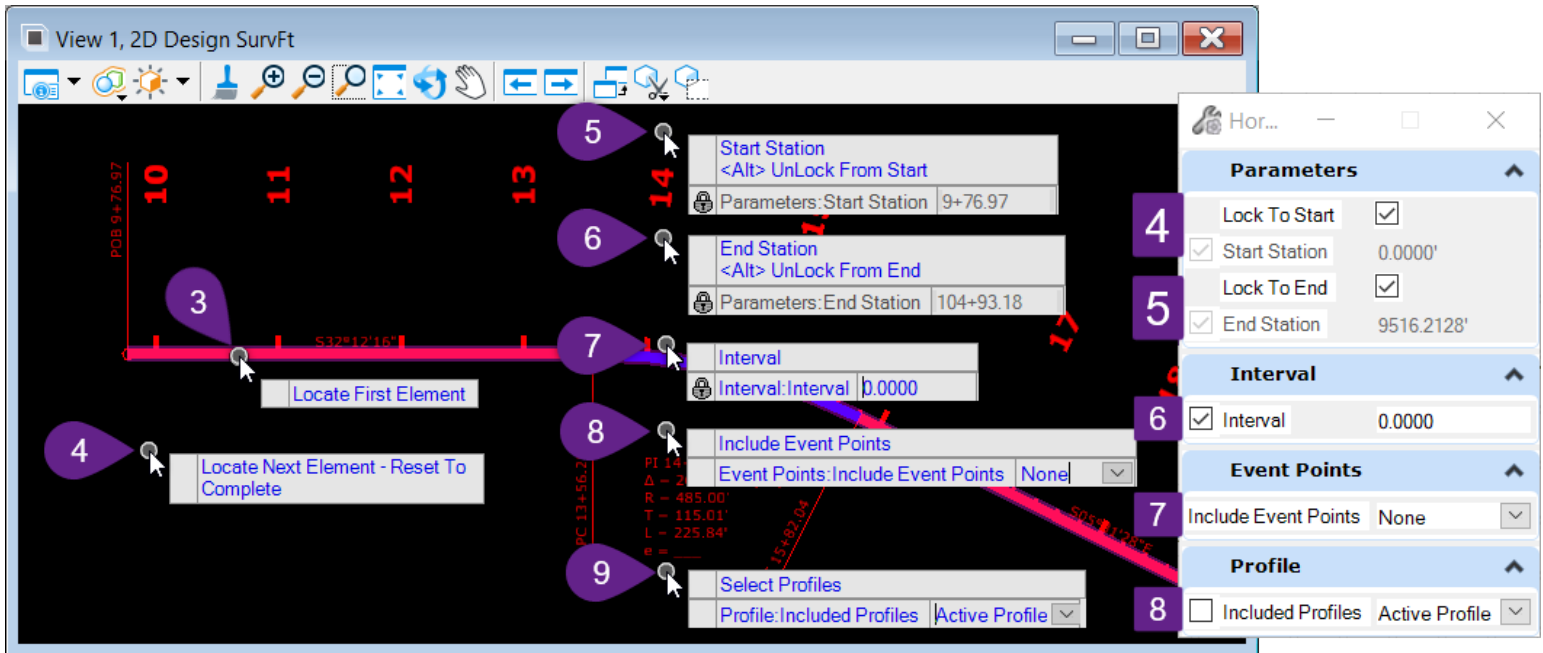
Creating a PDF Report for an Alignment and corresponding *Active Profile* is accomplished with the *Horizontal Geometry Report* tool. **NOTE:** If the **Active Profile** setting is used in Step 8, then a Vertical Profile Report is available by selecting a vertical report style. See Step 11 to access the Vertical Profile Report.

The *Horizontal Geometry Report* tool can be found in the Ribbon in the following location:

OpenRoads Modeling workflow → **Home** tab → **Model Analysis and Reporting** panel → **Report**



The procedure below demonstrates how to create a PDF Report for both an Alignment and corresponding *Active Profile*:



| | |
|----------|---|
| <p>1</p> | <p>Open the ORD File that contains the desired Alignment/Profile.</p> <p>WARNING: Ensure that the ORD File has a set Coordinate System. See 3D.1 Set the Coordinate System.</p> |
| <p>2</p> | <p>From the Ribbon, select the <i>Horizontal Geometry Report</i> tool: [OpenRoads Modeling → Home → Model Analysis and Reporting → Reports].</p> |
| <p>3</p> | <p><i>Prompt: Locate First Element</i> – Left-Click on the desired Alignment.</p> |

- 4 **Prompt: Locate Elements – Reset to Complete** – Right-Click (reset) to advance to the next *Prompt*.
- 5 **Prompt: Start Station <Alt> Lock to Start** – Press the **ALT** key to lock to the start station of the Alignment. Left-Click in the *View* to advance to the next *Prompt*.
- 6 **Prompt: End Station <Alt> Lock to End** – Press the **ALT** key to lock to the end station of the Alignment. Left-Click in the *View* to advance to the next *Prompt*.
- 7 **Prompt: Interval** – Key-in a value and Left-Click in the *View* to advance to the next *Prompt*.
NOTE: For FLH Alignment Reports, the *Interval* is inconsequential. This option will NOT have any effect on the resulting report.
- 8 **Prompt: Event Point List** – Select the **None** option and Left-Click in the *View* to advance to the next *Prompt*.
NOTE: *Event Point Lists* are typically NOT used for FLH projects.
- 9 **Prompt: Select Profiles** – Select the **Active Profile** option. Left-Click in the *View* to generate reports.

Horizontal Alignment Report

Horizontal Alignment Review Report

Report Created: Friday, January 21, 2022
Time: 5:02:46 PM

Project: 2D Design SurvFt
Description:
File Name: C:\Users\brendan\Desktop\NEW ORD CAD Files\Riverside\ld-a2158061_ali.dgn
Last Revised: 1/21/2022 13:39:38

Note: All units in this report are in feet unless specified otherwise.

| | | Station | Northing | Easting |
|-----------------------|-----|-----------|-------------|-------------|
| Element: Linear | | | | |
| START | () | 976.970 | 2567545.300 | 2463920.500 |
| PC | () | 1356.201 | 2567224.413 | 2464122.608 |
| Tangential Direction: | | S32.204°E | | |
| Tangential Length: | | 379.231 | | |
| Element: Circular | | | | |
| PC | () | 1356.201 | 2567224.413 | 2464122.608 |
| HPI | () | 1471.208 | 2567127.100 | 2464183.900 |
| CC | () | 1582.043 | 2566965.936 | 2463712.225 |
| PT | () | 1582.043 | 2567012.628 | 2464194.972 |
| Radius: | | 485.000 | | |

TIP:
See the next page to access the **Vertical Profile Report**.

Setup and Print (PDF) the Horizontal Alignment Report. See **23K – Formatting, Exporting, and Printing ORD Reports**.

- 10 At the very minimum, remove the hyperlink (URL) from the bottom footer through the **Page Setup** menu. See **23K.1.a Remove the Hyperlink (URL) from Page Footer**.

See the next page to access the Vertical Profile Report.

- 11 To access the **Vertical Profile Report**. Select the "VerticalAlignmentReview" from the report types listed on the left.
- 12 Setup and Print (PDF) the Vertical Profile Report.

Vertical Profile Report

The screenshot shows the Bentley Civil Report Browser interface. The 'File' menu is open, and 'VerticalAlignmentReview.xls' is highlighted. A callout box labeled '11' points to this menu item. Another callout box labeled '12' points to the 'Print' option in the menu. The main report area displays the 'Vertical Alignment Review Report' with the following details:

Vertical Alignment Review Report
 Report Created: Friday, January 21, 2022
 Time: 5:04:00 PM

Project: 2D Design SurvFt
Description:
File Name: C:\Users\brendan\Desktop\NEW ORD CAD Files\Riverside\id-a2158061_ali.dgn
Last Revised: 1/21/2022 13:39:38

Note: All units in this report are in feet unless specified otherwise.

Horizontal Alignment: ALI_MAIN_Riverside
Horizontal Description:
Horizontal Style: Alignment\Baseline

Vertical Alignment: PRO_Main_Riverside
Vertical Description:
Vertical Style: Alignment\Baseline

| | Station | Elevation |
|-------------------------------|---------|-----------|
| | 976.970 | 1790.200 |
| | 981.970 | 1790.276 |
| Tangent Grade: | 0.015 | |
| Tangent Length: | 5.000 | |
| Element: Symmetrical Parabola | | |
| VPC | 981.970 | 1790.276 |

A callout box labeled 'Vertical Profile Report styles' points to the report content area.

23B – CROSS SECTIONS SHEETS IN PDF

The creation and setup of the Cross Section ORD File is discussed in [Chapter 16 – Cross Sections](#).

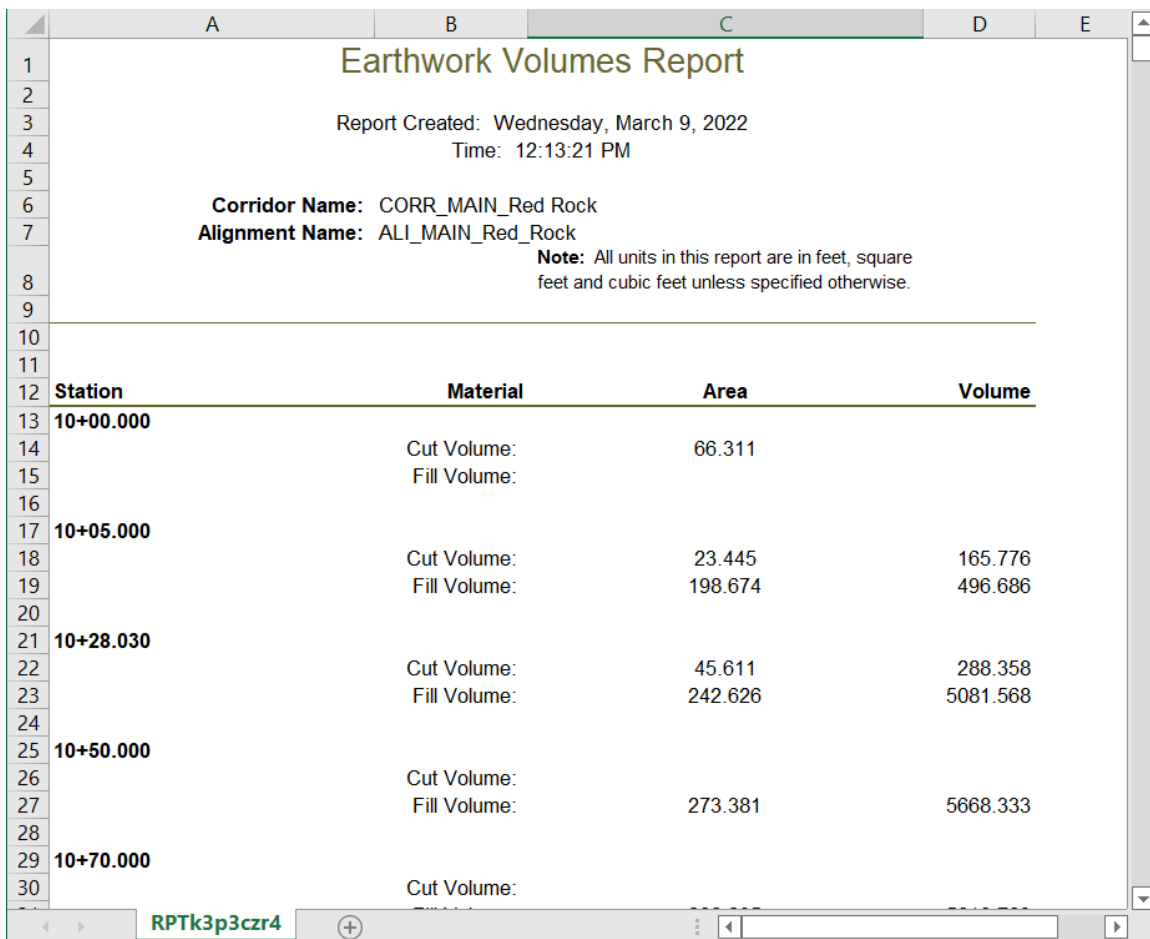
Printing Cross Sections to PDFs is discussed in [16I – Print Cross Sections](#).

23C – EARTHWORK VOLUME REPORT

The Earthwork Volume Report lists Cut/Fill areas and volumes at stationing intervals.

The Earthwork Volume report is created with the *Component Quantities* tool in conjunction with the mainline Corridor. Operation of this tool is shown in [20C.1 Component Quantities tool for Corridors](#).

WARNING: Before creating a report with the *Components Quantity* tool, set the Corridor Feature Definition to **Final**. Setting the Feature Definition to Final reduces the distance between Corridor Template Drops, which makes the Corridor model denser and fine-tunes earthwork calculations. To change the Corridor Feature Definition, see [9D.2 Corridor Feature Definitions: Design and Final](#).



| Station | Material | Area | Volume |
|-----------|--------------|---------|----------|
| 10+00.000 | Cut Volume: | 66.311 | |
| | Fill Volume: | | |
| 10+05.000 | Cut Volume: | 23.445 | 165.776 |
| | Fill Volume: | 198.674 | 496.686 |
| 10+28.030 | Cut Volume: | 45.611 | 288.358 |
| | Fill Volume: | 242.626 | 5081.568 |
| 10+50.000 | Cut Volume: | | |
| | Fill Volume: | 273.381 | 5668.333 |
| 10+70.000 | Cut Volume: | | |

Important Information Regarding the Earthwork Volume Report and Component Quantities tool:

- In addition to Cut and Fill volumes, the *Component Quantities* tool generates quantities for all materials used in the Corridor (i.e., asphalt and aggregate base). The *Component Quantities* report must be exported to Microsoft Excel to remove extraneous material quantities and format the report. To export a report to Excel, see [23K.2 Export a Report to Microsoft Excel \(.xlsx\)](#).

- The *Component Quantities* tool calculates and lists cut/fill area and volume quantities at EVERY Corridor Template Drop station interval. This means cut/fill quantities will be shown at irregular station intervals (i.e., 10+00, 10+05, 10+28) With the *Component Quantities* tool, it is NOT possible to create a report that lists cut/fill quantities at regular station intervals (i.e., 10+00, 10+50, 11+00).

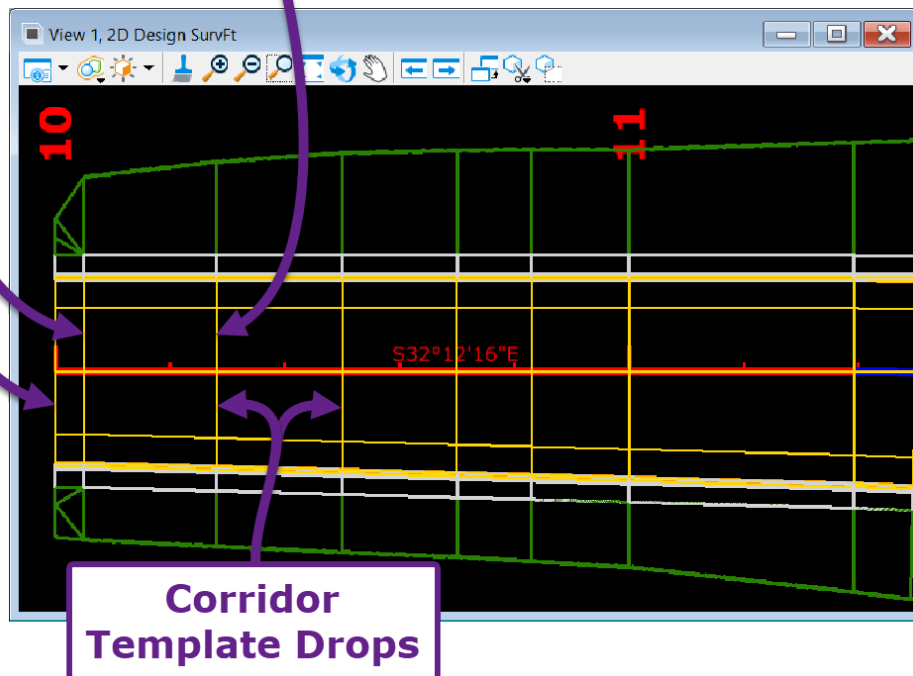
Earthwork Volumes Report

Report Created: Wednesday, March 9, 2022
Time: 12:13:21 PM

Corridor Name: CORR_MAIN_Red Rock
Alignment Name: ALI_MAIN_Red_Rock

Note: All units in this report are in feet, square feet and cubic feet unless specified otherwise.

| Station | Material | Area | Volume |
|-----------|--------------|---------|----------|
| 10+00.000 | Cut Volume: | 66.311 | |
| | Fill Volume: | | |
| 10+05.000 | Cut Volume: | 23.445 | 165.776 |
| | Fill Volume: | 198.674 | 496.686 |
| 10+28.030 | Cut Volume: | 45.611 | 288.358 |
| | Fill Volume: | 242.626 | 5081.568 |
| 10+50.000 | Cut Volume: | | |
| | Fill Volume: | 273.381 | 5668.333 |
| 10+70.000 | Cut Volume: | | |



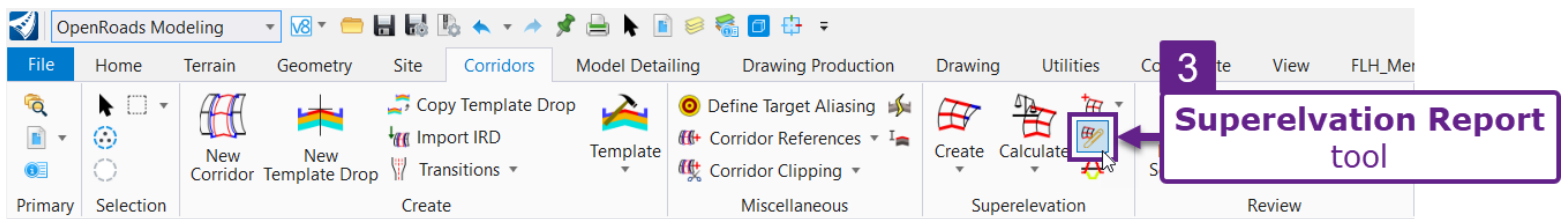
- WARNING:** Do NOT calculate earthwork quantities with the *Component Quantities* tool and/or *Quantity Report By Named Boundary* tool (**Prismatic** calculation methods) and then create a separate Earthwork Volumes Report with the *End Area Volumes Report* tool (**Average End Area** method). The values calculated with the **Prismatic** method and **Average End Area** method will NOT match. For more information on **Prismatic** and **Average End Area** calculations, see [20A.2 Calculation Methods: Prismatic vs Average End Area Method](#).

- Earthwork Volume Reports created with the *Components Quantities* tool do NOT account for the removal of topsoil and/or unsuitable materials.
- The *Components Quantities* tool is ONLY compatible with a single Corridor or Linear Template model. It is NOT possible to select multiple Corridors and/or Linear Templates with the *Component Quantities* tool. Earthwork quantities associated with approach roads and driveway models will NOT be included when the *Component Quantities* tool is used in conjunction with the mainline Corridor model.
- The *Component Quantities* tool is NOT compatible with Surface Templates. It is NOT possible to create an Earthwork Volume Report for parking lots or other site design features that use Surface Templates.

23D – SUPERELEVATION REPORT

Creating a Superelevation Report is accomplished with the *Superelevation Report* tool. This tool can be found in the Ribbon in the following location:

OpenRoads Modeling workflow → Corridor tab → Superelevation panel

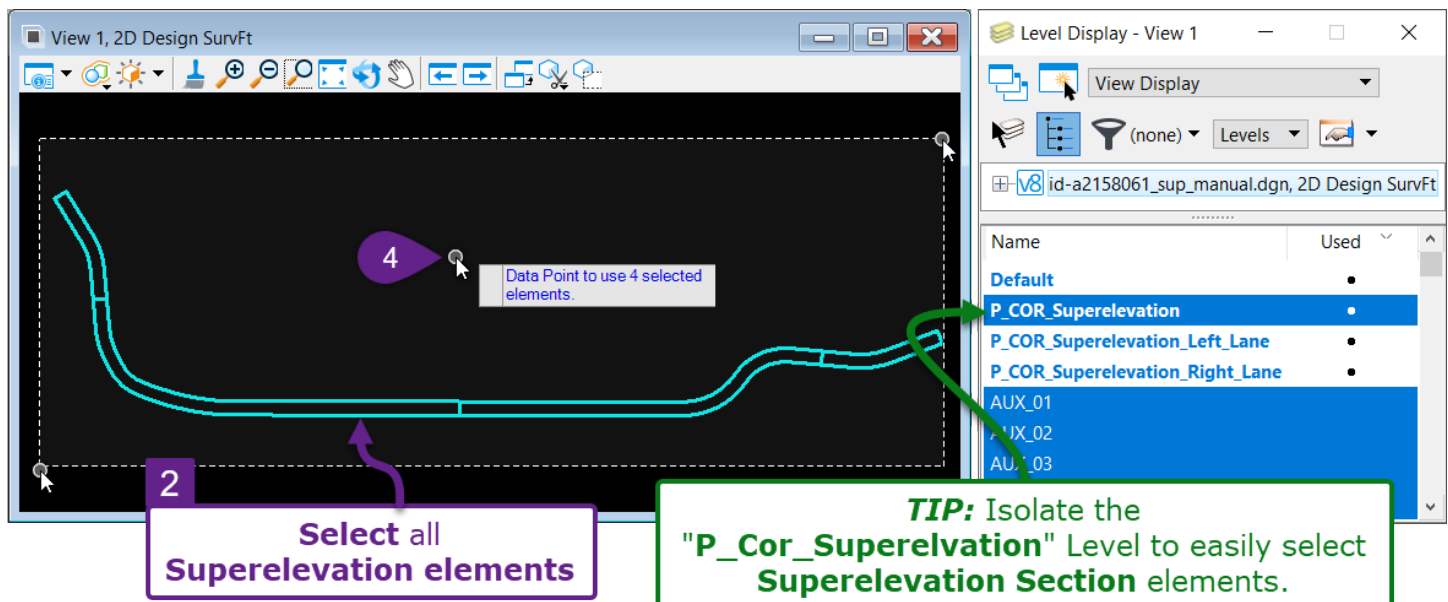


NOTE: To create and decipher the resulting report, familiarity with *Superelevation Sections* and *Superelevation Lanes* is required. See **10A.2 Superelevation Elements in the 2D Design Model**.

IMPORTANT: The resulting report may need modification to be understood by the construction contractor and field personnel. The report is separated by *Superelevation Sections* and then further subdivided by *Superelevation Lanes*. *Superelevation Lanes* are automatically named according to the corresponding Road Template Component. It is **BEST PRACTICE** to export the Superelevation Report to the Microsoft Excel and then re-name the *Superelevation Lanes* to logically correspond with the Typical Road Section configuration. See the next page for suggested edits to the report

The *Superelevation Report* tool works by individually selecting **Superelevation Sections** for inclusion in the report.

TIP: For longer projects with numerous Section elements, **select the Superelevation Sections before using the Superelevation Report tool**. Isolate the "P_COR_Superelevation" Level for quick selection.



- 1 Open the **Superelevation ORD File** or the File that contains the desired *Superelevation Sections*.
- 2 Before using the *Superelevation Report* tool, **select all Superelevation Sections**.

- 3 From the Ribbon, select the *Superelevation Report* tool:
[**OpenRoads Modeling** → **Corridor** → **Superelevation**].
- 4 *Prompt: Data Point to use X selected elements* – Left-Click in the view to generate the report from the selected *Section* elements.

The graphic below shows suggested edits to be made to the Superelevation Report. If edits are NOT required, then proceed to **23K – Formatting, Exporting, and Printing ORD Reports**.

The procedure below shows how to export the Superelevation Report to Microsoft Excel for custom edits.

- 5 Go to **File** → **Save As** → **Microsoft Excel (*.xlsx)**.
- 6 Save the report in the desired file location.
Open the report from the specified file location.
Edit the Microsoft Excel File as desired.
Print the Microsoft Excel File as a PDF for inclusion in the Physical Data deliverable.

6 Save the report as an Excel File to edit names.

Save As > Microsoft Excel (*.xlsx)

SUGGESTION: Change the Section Names to correspond with the Station Range of the Section element.

SUGGESTION: Change the Superelevation Name to correspond with Typical Road Section and the Lane Side (i.e., Lt, Rt).

Name of Superelevation Lane

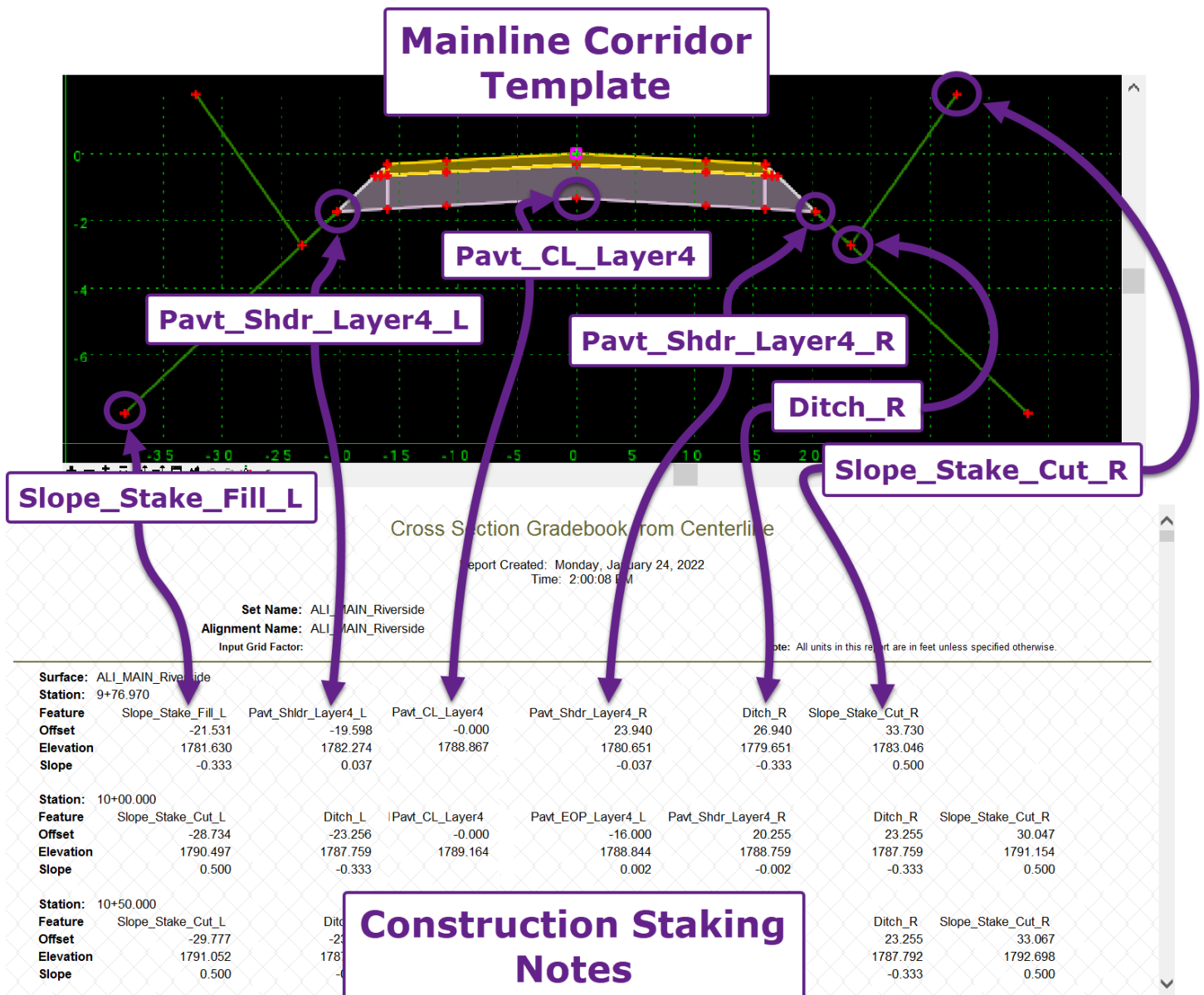
| Station | Cross Slope | Point Type | Transition Type |
|----------|-------------|---------------|-----------------|
| 976.970 | -0.020 | Normal Crown | |
| 1200.000 | -0.020 | Normal Crown | Linear |
| 1245.000 | 0.000 | Level Crown | Linear |
| 1300.000 | 0.020 | Reverse Crown | Linear |
| 1410.000 | 0.058 | Full Super | Linear |
| 1525.000 | 0.058 | Full Super | Linear |
| 1635.000 | 0.020 | Reverse Crown | Linear |
| 1695.000 | 0.000 | Level Crown | Linear |
| 1740.000 | -0.020 | Normal Crown | Linear |
| 1805.000 | -0.020 | Normal Crown | Linear |

23E – CONSTRUCTION STAKING NOTES

Construction Staking Notes provide elevation, offset, slope, and coordinate information at a specified stationing interval.

As shown below, **Template Points** from the **Mainline Corridor** are manually selected for inclusion in the Construction Staking Notes.

BEST PRACTICE: As shown below, each inflection point along the sub-grade of the Template must be selected for the Construction Stake Notes report. The location of inflection points may be different for each project/typical section.



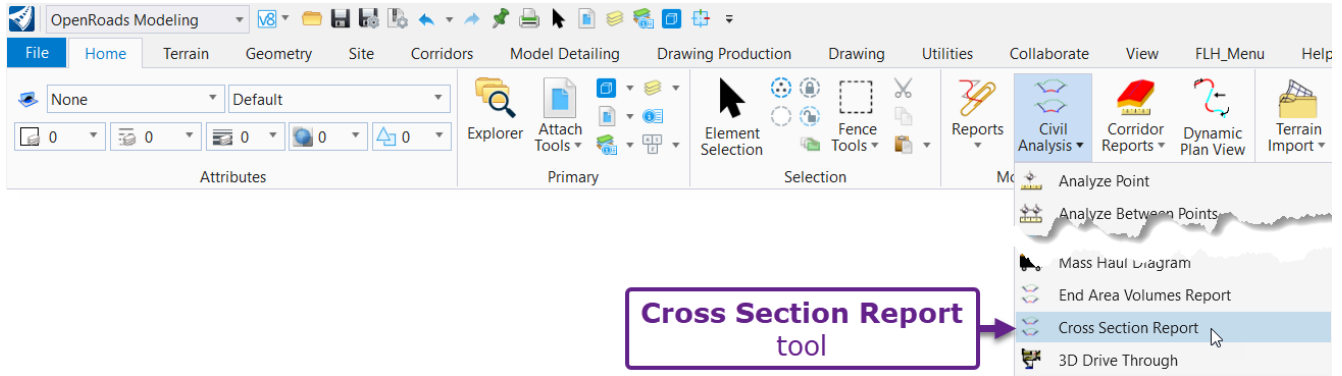
WARNING: Construction Staking Notes reports are created with the *Cross Section Report* tool. ONLY a single Corridor can be analyzed per report. Points from adjacent models (i.e., parking lots, approaches) will NOT be included in the report.

Clearing Limits Discussion: As shown above, the Road Template does NOT include Clearing Limits points. If the Clearing Limits are NOT built into in the Road Template, then create a separate report as shown in [23F – Clearing Limits Report](#).

23E.1 Cross Section Report tool

Construction Staking Notes are created with the *Cross Section Report* tool. This tool can be found in the Ribbon in the following location:

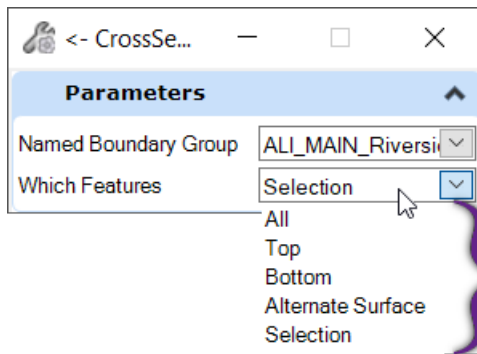
OpenRoads Modeling workflow → **Home** tab → **Model Analysis and Reporting** panel → **Civil Analysis**



This tool uses **CROSS SECTION Named Boundaries** to determine the station interval spacing for report.

BEST PRACTICE: The **Cross Section ORD File** should already contain CROSS SECTION Named Boundary elements that are spaced at the appropriate station interval. Use the *Cross Section Report* tool from within the Cross Section ORD File.

The **Which Features** setting determines which **Template Points** are included in the report. There are several methods for automated or manual selection of Template Points:



Methods for specifying which **Template Points** are included in the report

| Cross Section Report tool | |
|---------------------------|---|
| Method: | Description: |
| All | ALL Template Points contained in the Mainline Corridor Templates are included in the report. Do NOT use this option because extraneous data is contained in the Staking Notes. |
| Top | All Template Points that are positioned on the top surface of the Mainline Corridor Template (finished grade) are included in the report. Do NOT use this option because Construction Staking Notes are typically given for sub-grade points. |
| Bottom | All Template Points that are positioned on the bottom surface of the Mainline Corridor Template are included in the report. NOTE: Slope Stake (Cut/Fill) points are included with this method. WARNING: In most situations, there are Template Points positioned on the bottom of the Road Template that are NOT to be included in the Construction Staking Notes. |

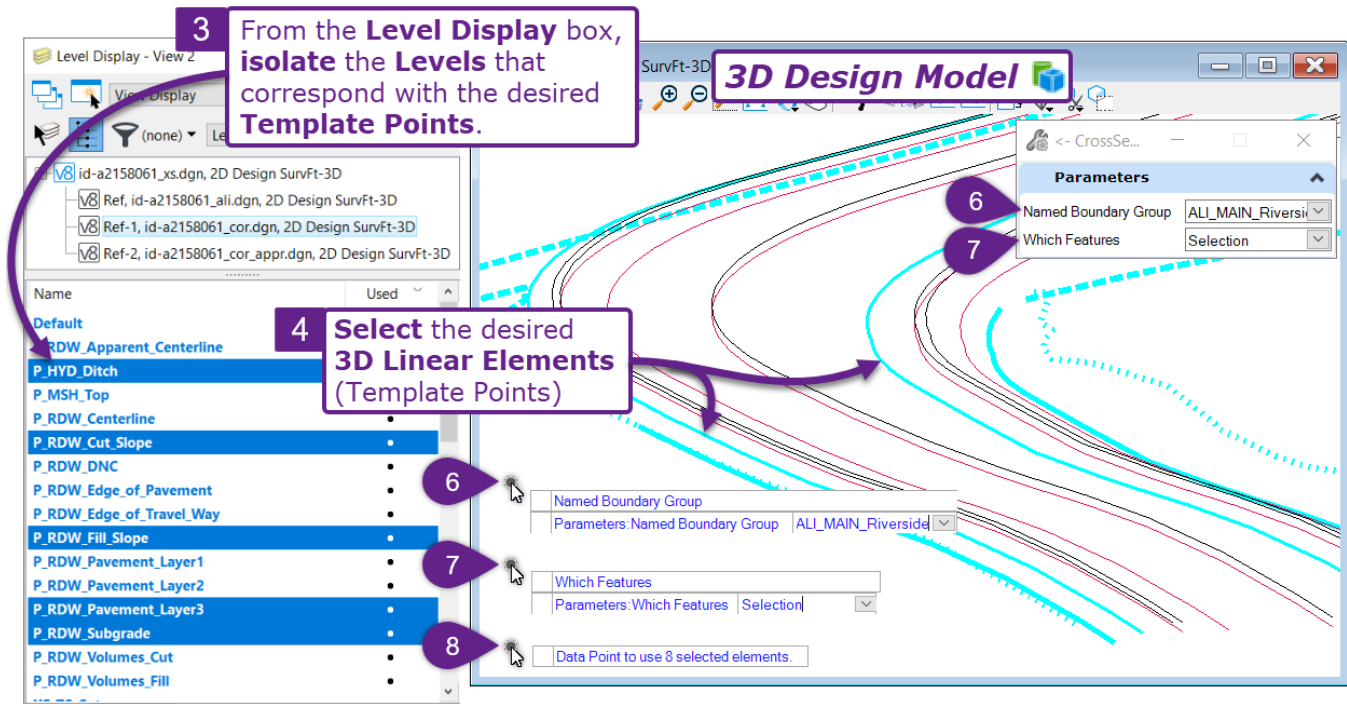
| Cross Section Report tool | |
|---------------------------|--|
| Method: | Description: |
| Alternate Surface | With this method, Template Points that are designated for an Alternate Surface are included in the report. See 8C.4 Alternate Surface and 22B – Alternate Surfaces (Intermediate Layers) . |
| Selection | PREFERRED METHOD: This method allows for manual selection of Template Points for inclusion the report. This method is demonstrated in the following workflow. |

23E.2 Creating Construction Staking Notes using Selection method

TIP: Before using the *Cross Section Report* tool, select the desired **Template Points** from the *3D Design Model*. Every Template Point has a corresponding *3D Linear Elements* in the *3D Design Model*.

TIP: In the *3D Design Model*, turn OFF all Levels – EXCEPT for the Levels that correspond with the Template Points to be included in the report. Selecting the desired *3D Linear Elements* is extremely difficult when extraneous Levels are ON.

NOTE: Multiple Template Points may be assigned to the same Level. Only select Template Points that should be included in the report.



- 1 Open the **Cross Section ORD File**. This ORD File should already contain CROSS SECTION *Named Boundary* elements that are spaced at the appropriate interval.
- 2 Access the *3D Design Model* view.
- 3 Turn OFF all Levels – EXCEPT for the Levels that correspond with the desired Template Points.
- 4 Select the *3D Linear Elements* which correspond with the desired Template Points.
TIP: Hold down the CTRL key to select multiple elements.

- 5 From the Ribbon, select the *Cross Section Report* tool:
[**OpenRoads Modeling** → **Home** → **Model Analysis and Reporting** → **Civil Analysis**].
See the previous page for Ribbon location for this tool.
- 6 *Prompt: Named Boundary Group* – Select the **Named Boundary Group** that was used for Cross Section production.
- 7 *Prompt: Which Features* – Use the **Selection** method. See the previous page for an explanation of the other methods.
- 8 *Prompt: Data Point to use X selected elements* – Left-Click (Data Point) in the *View* to proceed with the report creation.

IMPORTANT: From the right-side of the report window, select the “CrossSectionGradebookNE” report style.

- 9 Select the “CrossSectionGradebookNE” report style from the right-side of the report window.
- 10 Setup and Print (PDF) the Construction Staking Notes report. See **23K – Formatting, Exporting, and Printing ORD Reports**.

The screenshot shows the Bentley Civil Report Browser interface. The title bar reads 'Bentley Civil Report Browser - C:\Users\brendan\AppData\Local\Temp\RPT00yvysob.xml'. The main window displays a report titled 'Cross Section Gradebook with Northing/Easting Report' with a subtitle 'Report Created: Wednesday, March 9, 2022 Time: 1:24:32 PM'. A callout box with the number 9 points to 'CrossSectionGradebookNE.xsl' in the left-hand file list. The report content includes a table of data for three stations: 10+00.000, 10+23.030, and 10+73.030. A note at the bottom right states 'Note: All units in this report are in feet unless specified otherwise.'

| Station | Feature | Offset | Elevation | Northing | Easting | Existing Ground | Slope |
|-----------|-----------------|---------------------------|-----------|----------|---------|-----------------|-------|
| 10+00.000 | Surface | | | | | | |
| | Feature | Pavt_Shldr_Layer4_Hinge_L | | | | | |
| | Offset | -20.256 | | | | | |
| | Elevation | 1783.715 | | | | | |
| | Northing | 2567353.005 | | | | | |
| | Easting | 2464065.554 | | | | | |
| | Slope | 0.020 | | | | | |
| 10+23.030 | Feature | Slope_Stake_Fill_L | | | | | |
| | Offset | -36.030 | | | | | |
| | Elevation | 1783.485 | | | | | |
| | Northing | 2567341.939 | | | | | |
| | Easting | 2464091.167 | | | | | |
| | Existing Ground | 1783.483 | | | | | |
| | Slope | 0.333 | | | | | |
| 10+73.030 | Feature | Slope_Stake_Fill_L | | | | | |
| | Offset | -38.646 | | | | | |
| | Elevation | 1782.656 | | | | | |
| | Northing | 2567291.025 | | | | | |
| | Easting | 2464065.554 | | | | | |
| | Existing Ground | 1783.483 | | | | | |
| | Slope | 0.333 | | | | | |

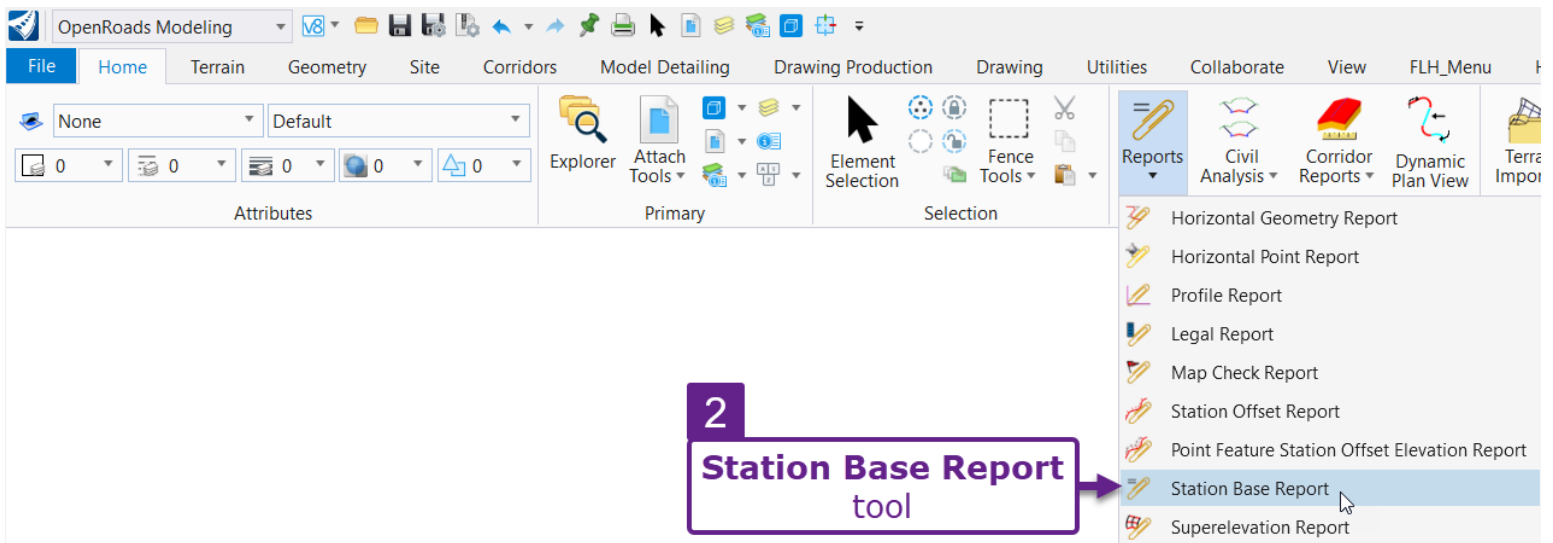
23F – CLEARING LIMITS REPORT

The Clearing Limits Report provides offset distance for the clearing limits, relative to the Mainline Alignment. This workflow is intended to create a report for Clearing Limits linework that were manually created with linework elements (i.e., NOT built into the Mainline Corridor Template).

NOTE: If the Clearing Limits were built into the Mainline Corridor Template, then the Construction Staking Notes can be configured to include Clear Limits information. See [23E – Construction Staking Notes](#).

Creating a Clearing Limits Report is accomplished with the *Station Base Report* tool. This tool can be found in the Ribbon in the following location:

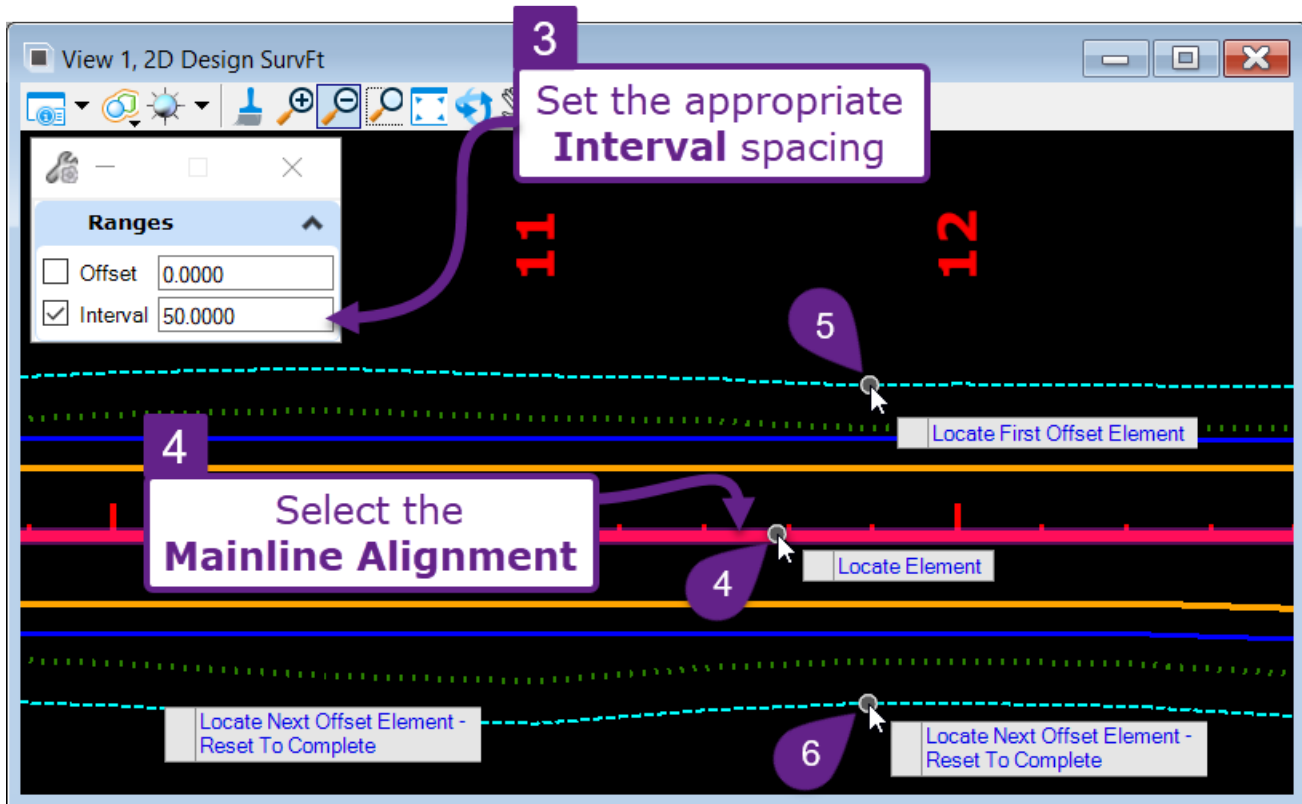
OpenRoads Modeling workflow → **Home** tab → **Model Analysis and Reporting** panel → **Reports**



Before creating the Clearing Limits report, consider the following:

- The Clearing Limits linework should be a single element. The Clearing Limits line on the left-side should be a single element. As well as the Clearing Limits line on the right-side.
- The Clearing Limits linework should be running in the same direction as the Mainline Alignment. If the Clearing Limits linework is aligned in the opposite direction, then the resulting report will read backwards.
- In the resulting report, the Clearing Limits line is listed by the **Feature Name**. Before creating the report, assign the Clearing Limits linework logically **Feature Names** (i.e., "Clearing Limits Right").
TIP: If the Clearing Limits line does NOT contain a Feature Name, then use the *Set Feature Definition* tool to assign a Name.

| | |
|---|--|
| 1 | Open any ORD File that displays the Clearing Limits linework and the Mainline Alignment. |
| 2 | From the Ribbon, select the <i>Station Base Report</i> tool: [OpenRoads Modeling → Home → Model Analysis and Reporting → Reports]. |
| 3 | In the <i>Dialogue Box</i> , set the Interval spacing. TIP: The Interval value should match the Cross Section and Construction Staking Notes interval (i.e., 25' or 50'). |
| 4 | <i>Prompt: Locate Element</i> – Select the Mainline Alignment . |
| 5 | <i>Prompt: Locate First Offset Element</i> – Select a Clearing Limit line |
| 6 | <i>Prompt: Locate Next Offset Element – Reset to Complete</i> – Select the other Clearing Limit line. |
| 7 | <i>Prompt: Locate Next Offset Element – Reset to Complete</i> – Right-Click (reset) to generate the Clearing Limits report. |



IMPORTANT: From the right-side of the report window, select the "StationOffsetNorthingEasting" report style.

- 8 Select the "StationOffsetNorthingEasting" report style from the right-side of the report window.
- 9 Setup and Print (PDF) the Construction Staking Notes report. See **23K – Formatting, Exporting, and Printing ORD Reports.**

Clearing Limits Report

The screenshot shows the Bentley Civil Report Browser interface. The 'File' menu is open, and 'Page Setup' is highlighted. A callout '9' points to this menu item. In the background, the 'Station Offset Northing Easting Report' window is visible, showing report metadata and a table of clearing limits data. A callout '8' points to the 'StationOffsetNorthingEasting.xls' file in the file list on the left.

Station Offset Northing Easting Report
 Report Created: Wednesday, February 16, 2022
 Time: 3:21:50 PM

Project: 2D Design SurvFt
Description:
Baseline (Active) Alignment: ALI_MAIN_Riverside
File Name: C:\Users\brendan\Desktop\NEW ORD CAD Files\Riverside\lid-a2158061_cor.dgn
Last Revised: 2/16/2022 15:17:55
Input Grid Factor: Note: All units in this report are in feet unless specified otherwise.

| Offset Alignment (Clearing Limits Left) Point Name | Baseline Alignment (ALI_MAIN_Riverside) Station | Baseline Alignment Offset | Offset Alignment Northing | Offset Alignment Easting |
|--|---|---------------------------|---------------------------|--------------------------|
| | 10+00.000 | -38.736 | 2567546.457 | 2463965.550 |
| | 10+50.000 | -39.779 | 2567504.705 | 2463993.080 |
| | 11+00.000 | -38.009 | 2567461.454 | 2464018.229 |
| | 11+50.000 | -36.804 | 2567418.505 | 2464043.857 |
| | 12+00.000 | -36.047 | 2567375.793 | 2464069.863 |
| | 12+50.000 | -35.512 | 2567333.201 | 2464096.057 |
| | 13+00.000 | -35.617 | 2567290.949 | 2464122.793 |
| | 13+50.000 | -31.703 | 2567246.556 | 2464146.129 |
| | 14+00.000 | -38.813 | 2567203.989 | 2464178.820 |
| | 14+50.000 | -31.216 | 2567151.969 | 2464193.754 |
| | 15+00.000 | -52.247 | 2567106.947 | 2464230.636 |

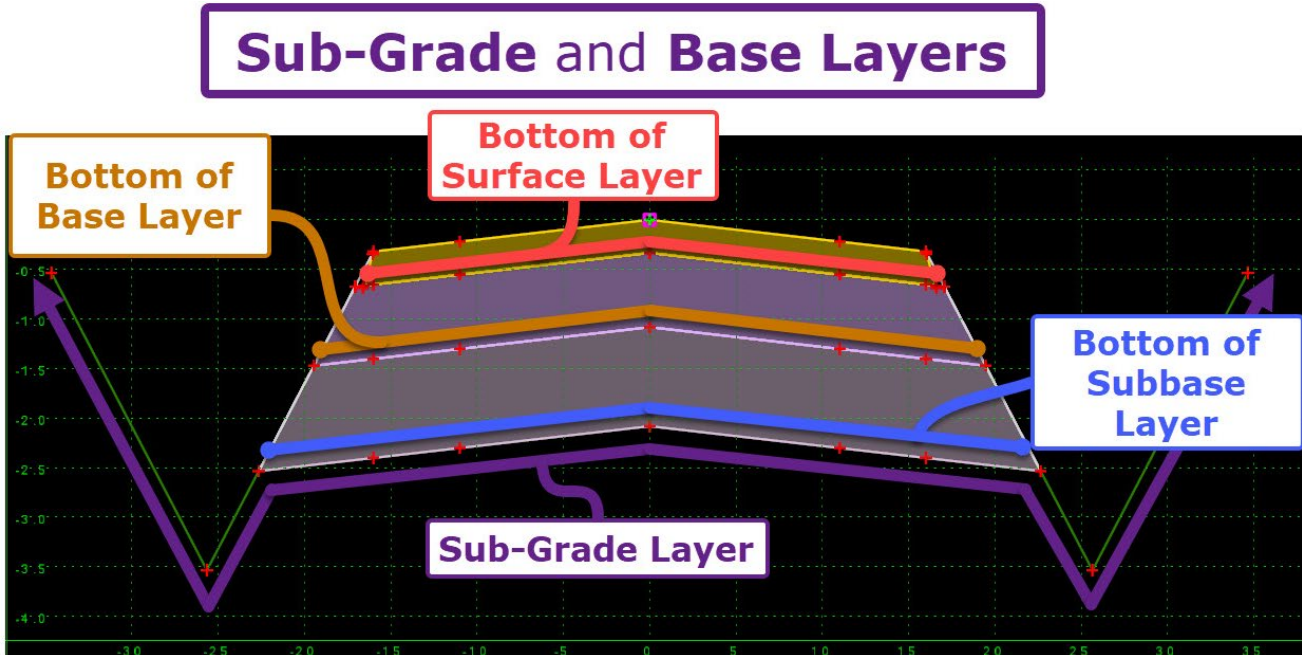
23G – X, Y, Z COORDINATES FOR SUB-GRADE AND BASE LAYERS REPORT

Sub-Grade and Base Layers reports provides X, Y, and Z coordinate information for construction staking of sub-grade and base layers.

The creation of this report is the same process shown in [23E – Construction Staking Notes](#).

The difference between this report and the Construction Staking Notes report is the particular Template Points (*3D Linear Elements*) that are selected for the report. Create a separate report for each sub-grade and base layer used in the typical road section.


For the Sub-Grade and Base Layers Report choose points corresponding the following layers:

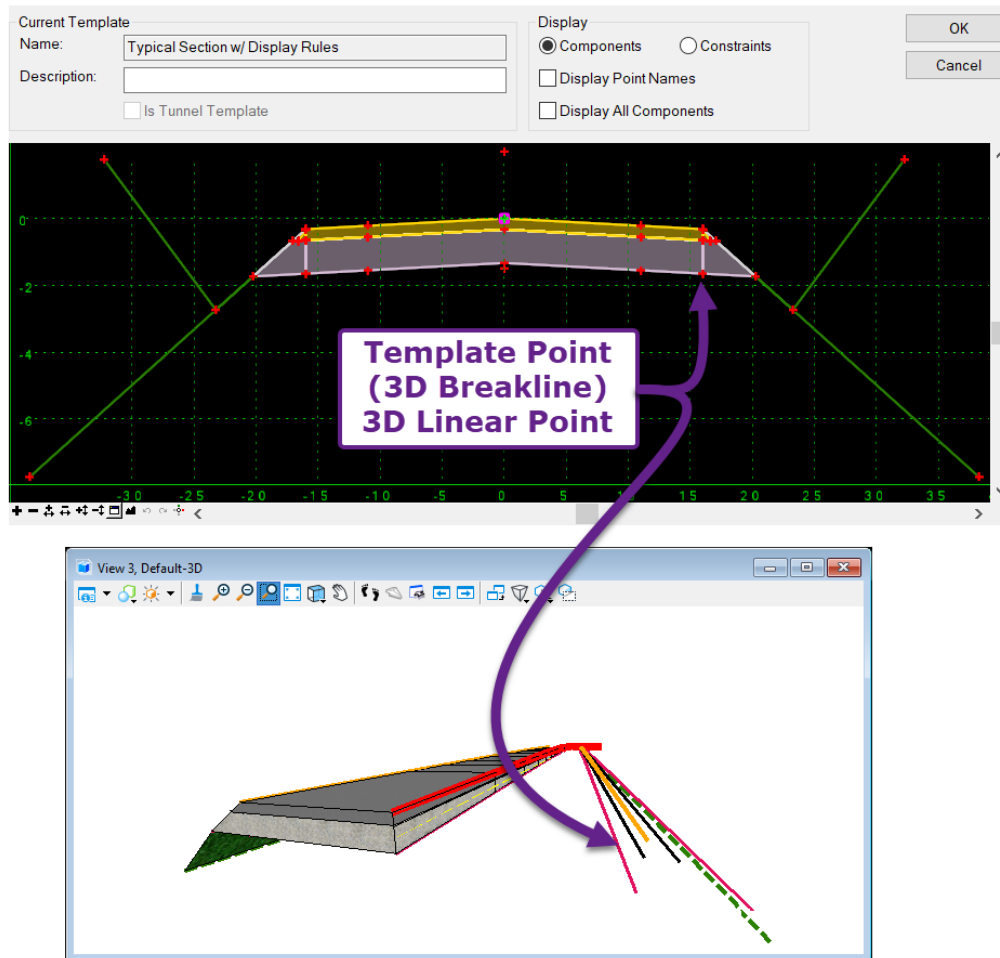


| Sub-Grade and Base Layers | |
|--------------------------------|--|
| Layer: | Description: |
| Bottom Of Surface Layer | Includes points that form the bottom layer of the wearing surface layer. |
| Bottom of Base Layer | Includes points that form the bottom of the base layer. |
| Bottom of Subbase Layer | Includes points that form the bottom layer of the subbase layer. NOTE: Subbase and Sub-grade are similar. However, Ditch and cut/fill points are NOT included in the Subbase Layer |
| Sub-Grade Layer | Includes points that form the bottom of the typical road section layer. NOTE: The sub-grade layer includes ditch, cut/fill, and all points outside of the pavement section. |

NOTE: Only inflection points need to be included in the Sub-Grade and Base Layers reports.

23H – PROPOSED 3D BREAKLINES IN DXF FILE FORMAT

3D Breaklines are typically generated by Corridors, Linear Templates, and Surface Templates. Each Template Point creates a **3D Breakline** in the *3D Design Model* . In the ORD Software, 3D Breaklines are referred to as *3D Linear Elements*.



A DXF File (Drawing Exchange File) is a universal file type that is recognized by most Survey and CAD (Computer Aided Drafting) software. An ORD File is converted to a DXF File by performing a **Save As**.

The procedure for creating a DXF File consisting of only proposed 3D Breaklines is as follows:

Create a new ORD File

IMPORTANT: Use a **3D Seed File** when creating the new ORD File.

Reference in Design ORD Files that contain Corridors, Linear Templates, and Surface Templates

Turn Off all Levels – except for 3D Breakline Levels

Use the *Merge Into Master* tool to bring Reference Files into the Current ORD File.



Save the ORD File as a DXF File

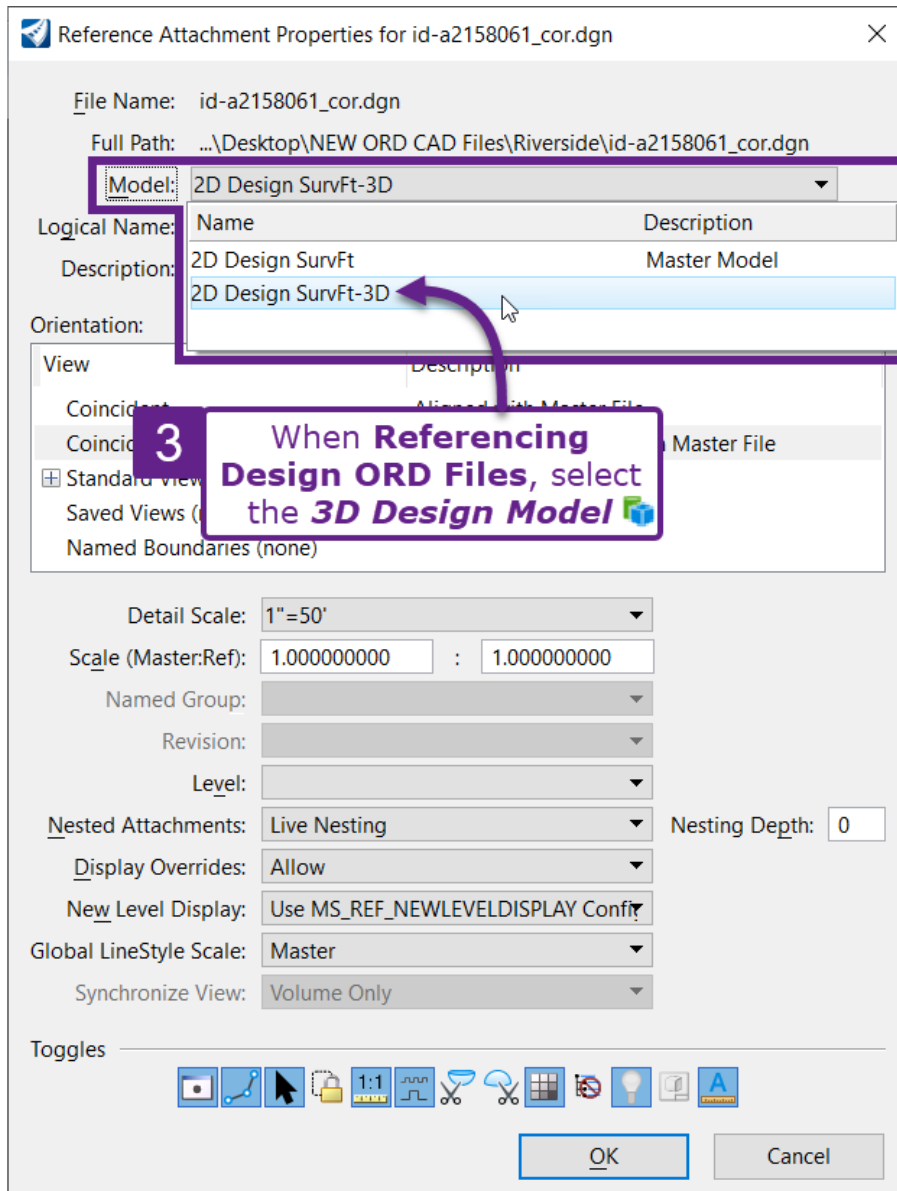
Create a new ORD File:

- Create a new ORD File to be eventually converted into a DXF File.

IMPORTANT: Use a **3D Seed File** when creating the new ORD File. For more information on Seed Files, see [3B.3 The Seed File](#).

Seed Files are found in the FLH WorkSpace at the following location:
...\OpenRoads Designer CE 10.10\Configuration\Organization-Civil\FLH_Stds-WS10.10.1V\Seed
- In the new ORD File, set the appropriate **Coordinate System**. See [3D.1 Set the Coordinate System](#).
- In the new ORD File, **reference** in Design ORD Files that contain all proposed Corridors, Linear Templates, and Surface Templates used into the project.

IMPORTANT: When using a **3D Seed File**, reference the **3D Design Model**  of the Design ORD File. The *3D Design Model*  is selectable through the **Model** drop-down, as shown below.



Turn OFF all Levels, except for 3D Breakline Levels

- 4 Open the **Levels Display** box.
- 5 Select (highlight) a Design ORD File reference from the top.
- 6 Turn OFF all Levels, except for the Level's that contain 3D Breaklines.
TIP: Another strategy is to turn OFF all Levels. Scroll through the Level list and toggle ON only Level's that contain 3D Breaklines. To turn OFF all Levels, right-Click and select **All Off**.

The screenshot shows the OpenRoads Modeling software interface. The top ribbon includes File, Home, Terrain, Geometry, Site, Corridors, Model Detailing, Drawing Production, Drawing, and Utility. The Levels Display box is open, showing a list of levels. A right-click context menu is open over the list, with the 'All Off' option selected. A 3D Design Model is displayed in the background, showing a terrain with various colored lines representing different levels. A callout box points to the 'All Off' option in the context menu, and another callout box points to the 3D Design Model.

4

5

6

3D Design Model with only 3D Breakline Levels displayed.

Referenced ORD Files

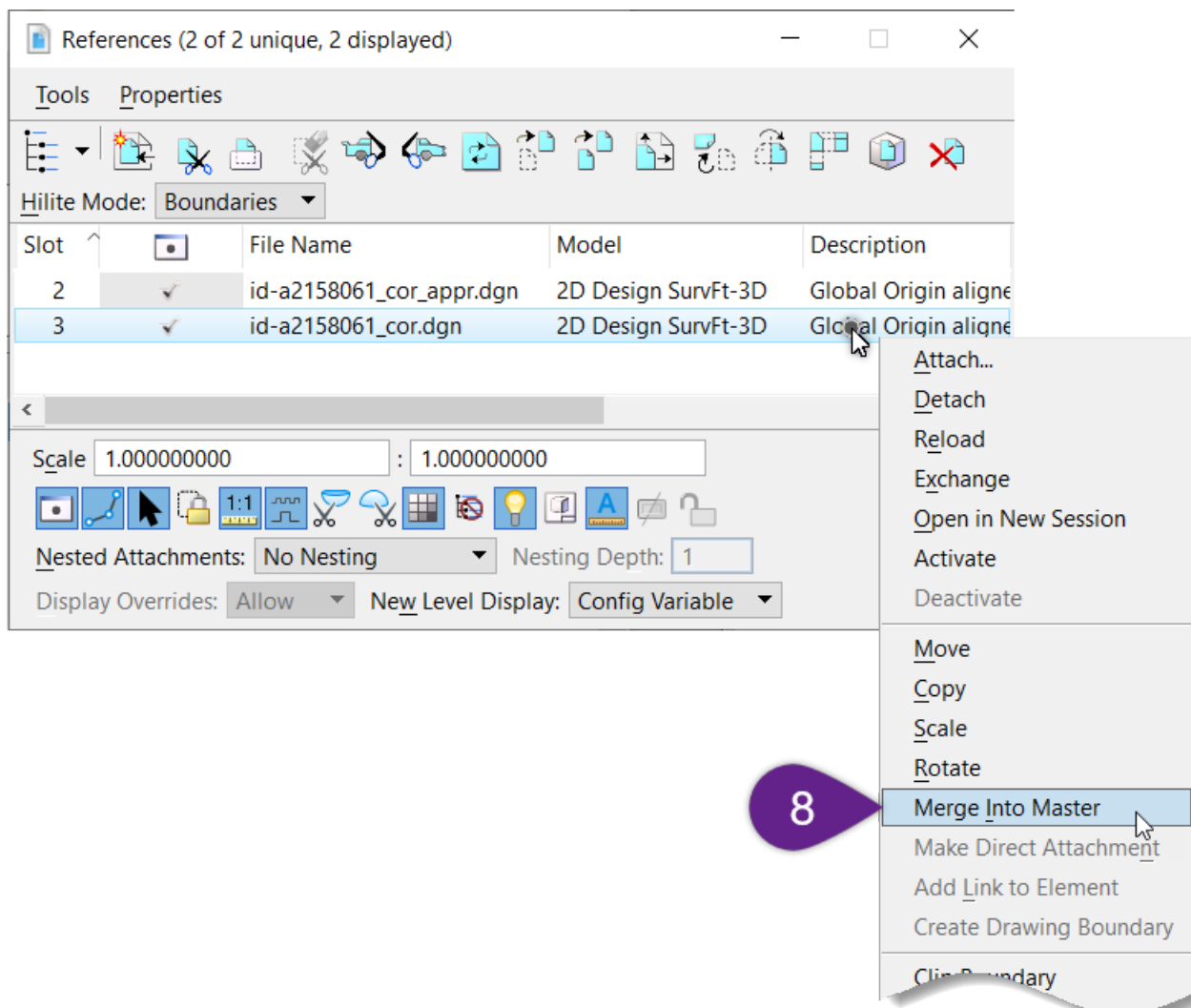
TIP: Use the All Off command to turn OFF all Levels.

Turn OFF all Levels - EXCEPT for the Level's that contain 3D Breaklines.

Use the Merge Into Master tool to bring 3D Breaklines into the ORD File:

In this process, the **Merge Into Master** tool is used to transfer the referenced 3D Breaklines into the current ORD File. The **Merge Into Master** tool will only transfer **Levels that are turned ON** into the current ORD File.

- 7 Open the **References** box.
- 8 **Right-Click** on a Design ORD File reference and select the **Merge Into Master** tool.
For more information on the **Merge Into Master** tool, see [1E.7.a Merge Into Master tool \(Import Reference into Current ORD File\)](#).
Repeat this process for all Design ORD Files references in the current ORD File. Before creating the DXF File, there should be NO references in the current ORD File. All references must be merged to the current ORD File.



Save the ORD File as a DXF File:

- 9 Go to **File** → **Save As**.
- 10 In the **Save as type** drop-down, change the file type to **Autodesk(R) DXF Files (*.dxf)**.

The screenshot shows the OpenRoads Modeling software interface. The 'File' menu is open, and the 'Save As' option is highlighted. A callout box with the number '9' points to the 'File' menu. The 'Save As' dialog box is open, showing the file name '3D Breaklines.dgn' and the 'Save as type' dropdown menu. The dropdown menu is open, and 'Autodesk(R) DXF Files (*.dxf)' is selected. A callout box with the number '10' points to this option. A large purple box with white text says: **IMPORTANT: Select Autodesk(R) DXF Files (*.dxf) for the File Type.**

TIP: To verify the DXF was created correctly, reference the DXF file into a project ORD File and compare the DXF linework to the design linework. **NOTE:** The correct Survey Unit (i.e., Survey Feet or International Feet) must be selected when referencing the DXF file to ensure it is located and oriented correctly within the project ORD File.

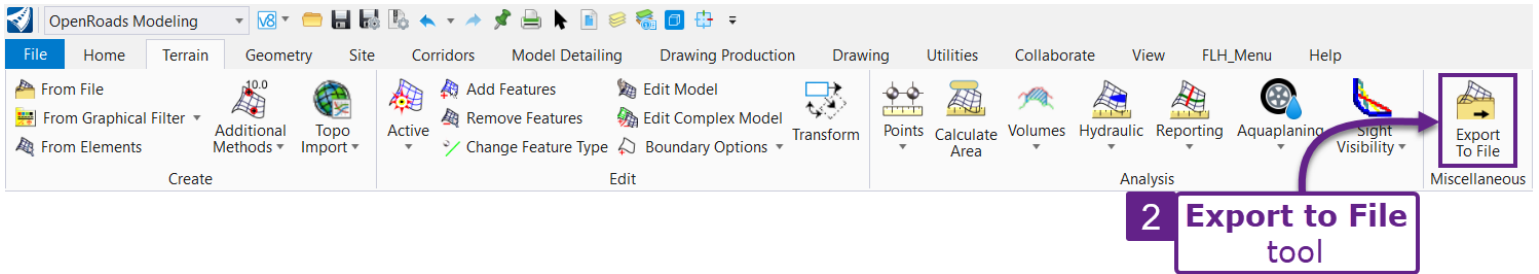
TIP: Reference the DXF File into a Project ORD File.
Set the correct **Survey Units** when referencing.

The screenshot shows the 'DWG/DXF Units' dialog box. The text reads: 'OpenRoads Designer requires that the file units be accurately specified in order for "True" scaling to be calculated correctly when working with cells and reference files. It is not possible to infer the units for the DWG or DXF file: "c:\Users\Katherine.Alexander\Desktop\grte2017_GCTH_3D Breaklines_9.2.2022.dxf" for the following reason: The "Design Center Units" option has been selected, but Design Center units are not specified in this file.' The 'Units' dropdown menu is set to 'US Survey Feet'. There is a checkbox for 'Do not display again (Use this setting for all DWG/DXF files of this type)'. An 'OK' button is at the bottom right.

23I – EXISTING AND PROPOSED SURFACE IN LANDXML (.XML) FORMAT

Creating a LandXML (.xml) file from a **Terrain Model** (surface) is accomplished with the *Export to File* tool. This tool can be found in the Ribbon in the following location:

OpenRoads Modeling workflow → **Terrain** tab → **Miscellaneous** panel

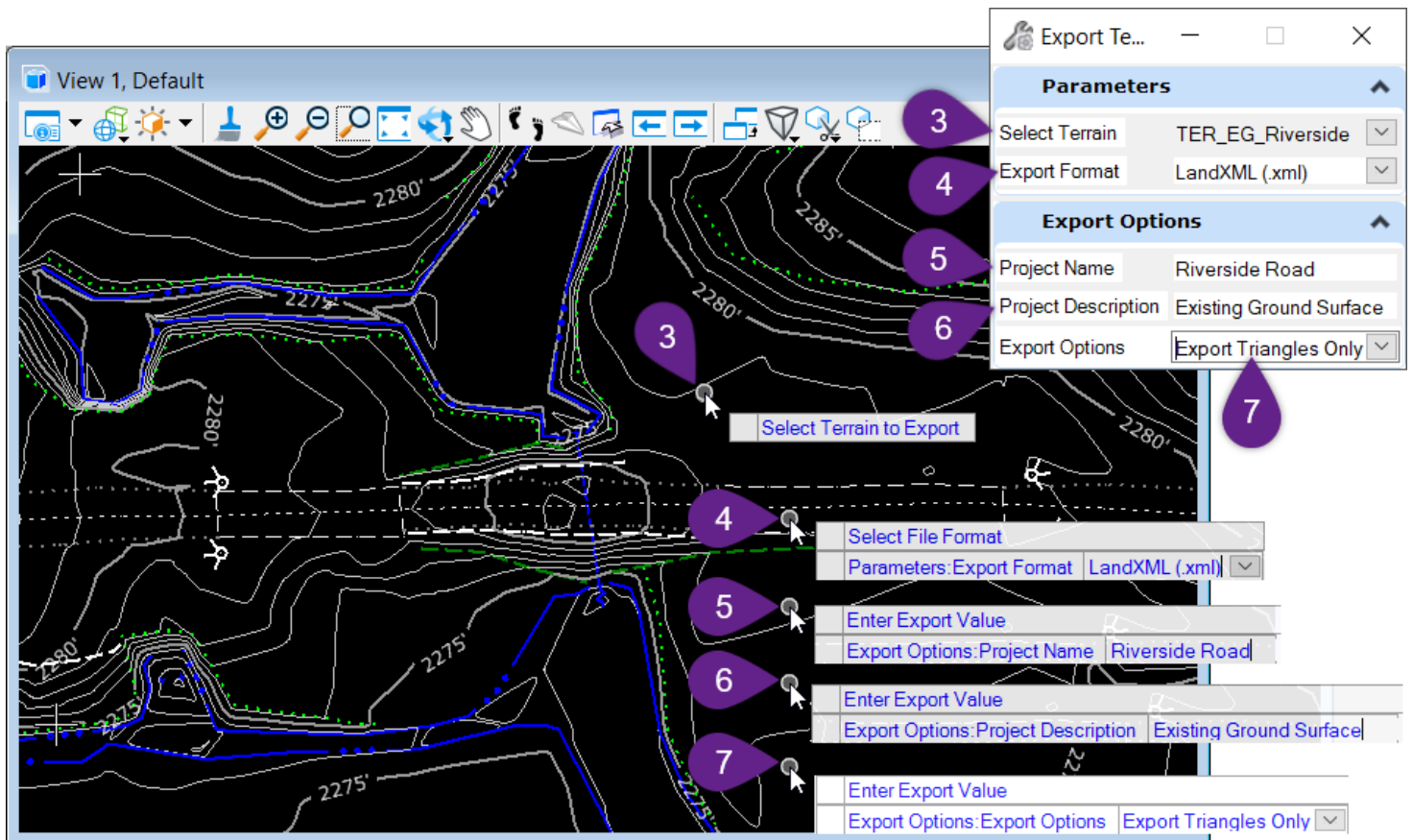


The procedure below demonstrates how to export the Existing Ground Terrain Model as a LandXML (.xml) File. The procedure for exporting the Proposed Terrain Model is identical.

Existing Ground Surface: The Existing Ground Terrain Model is typically located in the Survey File. For older projects, there may be a dedicated ORD File for the Existing Ground Terrain Model.

Proposed Surface: The creation of the Proposed Terrain Model is shown in [Chapter 22 – Proposed Terrain Model Creation](#). The Proposed Terrain Model should be located in a dedicated ORD File.

IMPORTANT: Set the **Export Option** to *Export Triangles Only*. When this option is used, the resulting LandXML only contains surface elevation and coordinate data. **WARNING:** Do NOT use the *Export Features Option*. See Step 7 below.



| | |
|---|---|
| 1 | <p>Open the ORD File that contains the desired Terrain Model.</p> <p>WARNING: Ensure that the ORD File has a set Coordinate System. See 3D.1 Set the Coordinate System.</p> |
| 2 | <p>From the Ribbon, select the <i>Export Geometry</i> tool: [OpenRoads Modeling → Terrain → Miscellaneous Tools].</p> |
| 3 | <p><i>Prompt: Select Terrain to Export</i> – Left-click on the Terrain Model for export.</p> |
| 4 | <p><i>Prompt: Select Export Format</i> – Select the LandXML option.</p> |
| 5 | <p><i>Prompt: Project Name</i> – Type in the appropriate Project Name</p> <p>NOTE: The Project Name is stored within the resulting LandXML (.xml) file. This name will be displayed when the LandXML is loaded into other software and survey equipment.</p> <p>NOTE: The name given to the LandXML file is specified in Step 8.</p> |
| 6 | <p><i>Prompt: Project Description</i> – If desired, type in a description for the Project.</p> <p>NOTE: The Project Description is stored within the resulting LandXML (.xml) file. The description will be displayed when the LandXML is loaded into other software and survey equipment.</p> |
| 7 | <p><i>Prompt: Export Options</i> – Select the Export Triangles Only option.</p> <p>Export Triangles Only – The resulting LandXML file ONLY contains surface elevation and coordinate data. The elevation and coordinates of all triangle vertices are listed to define the Terrain Model. PREFERRED METHOD.</p> <p>Export Features Only – Features refer to the surveyed breaklines used to create and calibrate the Existing Ground Terrain Model. If this option is selected, then the LandXML File consists of information and data relating to survey breaklines. Do NOT use this option for Physical Data deliverables.</p> <p>Export Both – The resulting LandXML file contains both triangle and feature data.</p> |
| 8 | <p>Save the LandXML File in the appropriate file location.</p> <p>TIP: Name the Land XML File in accordance with FLH Naming Conventions. See 3F – Naming Convention for Proposed ORD Features.</p> |

23J – CONTROL POINT COORDINATES IN MICROSOFT EXCEL FORMAT

The Control Point Coordinates report is typically created and compiled by the project surveyor. Request the Microsoft Excel (.xlsx) format version of the Control Point Coordinates file from the project surveyor.

A blank Control Point Sheet template, can be found at the following location:

<https://highways.dot.gov/federal-lands/survey/cfl-control-sheet>

23K – FORMATTING, EXPORTING, AND PRINTING ORD REPORTS

Very few report formatting options are offered from directly within the ORD software. For extensive formatting operations, **export the report to Microsoft Excel**.

23K.1 Formatting in the ORD Software

From within the ORD Software, there are only two relevant formatting changes to be made:

- 1

Remove the hyperlink (URL) or file path from the bottom of the page (footer). This procedure should be done as a standard practice.

TIP: To remove the hyperlink, go to **File** → **Page Setup**. Set the **Footer** drop-down to **Empty**.
- 2

Change the format or accuracy (precision) of values in the report.

For example, the station values listed in the report below are to the thousandth of a foot (0.123). The station accuracy (precision) should be changed to a hundredth of a foot (0.12).

TIP: TO change the format or accuracy (precision), go to **Tools** → **Format Options**

Page 1 of 4

Station Base Report

Report Created: Tuesday, January 25, 2022
Time: 3:59:19 PM

side

Note: All units in this report are in feet unless specified otherwise.

| ----- Baseline Alignment ----- (ALI_MAIN_Riverside) | | | | ----- Offset Alignment ----- (Clearing Limits Left) | | | |
|--|------|-----------------------------|------------------|--|------|-----------------------------|-----------------|
| Station | Type | Distance to Offset Point | Radial Direction | Station | Type | Distance to Offset Point | Radial Directic |
| 10+00.000 | POT | 0.000 | S57.796°W | 0+29.696 | POT | -38.736 | S56.600 |
| 12+50.000 | POT | 0.000 | S57.796°W | 2+79.799 | POT | -35.512 | S60.910 |
| 13+00.000 | POT | 0.000 | S57.796°W | 3+29.800 | POT | -35.617 | S57.658 |
| 13+50.000 | POT | 0.000 | S57.796°W | 3+79.972 | POT | -31.703 | S47.244 |
| 14+00.000 | POC | 0.000 | S62.970°W | 4+33.730 | POT | -38.813 | S56.751 |
| 22+00.000 | | 0.000 | S64.959°W | 12+54.535 | POT | -46.479 | S52.403 |
| 22+50.000 | | 0.000 | S62.758°W | 13+03.090 | POT | -50.465 | S62.239 |
| 23+00.000 | | | | 53.629 | POT | -44.822 | S39.278 |
| 23+50.000 | | | | 01.205 | POT | -60.983 | S33.946 |
| 24+00.000 | | | | 44.191 | POT | -77.206 | S28.829 |

file:///C:/Users/brendan/AppData/Local/Temp/RPTeltegfqz.html 1/25/2022

23K.1.a Remove the Hyperlink (URL) from the Page Footer

As a standard practice, the hyperlink in the page footer should be removed from reports printed directly from ORD.

| | |
|---|---|
| 1 | Create a report. |
| 2 | Go to File → Page Setup |
| 3 | Footer: Locate the Footer drop-down and change the selection to Empty . |
| 4 | Select OK . |

The screenshot shows the Bentley Civil Report Browser interface. The 'Page Setup' dialog box is open, and the 'Footer' dropdown menu is expanded, showing the 'Empty' option selected. The background report grid displays stationing and offset data.

| Station | Offset | Offset Type | Offset Value | Stationing | Offset Type | Offset Value | Stationing | Offset Type | Offset Value |
|-----------|--------|-------------|--------------|------------|-------------|--------------|------------|-------------|--------------|
| 14+00.000 | POC | 0.000 | S68.877°W | 4+89.788 | POT | -31.216 | S23.617° | | |
| 15+00.000 | POC | 0.000 | S74.783°W | 5+51.943 | POT | -52.247 | S71.561° | | |

23K.1.b Change the Format or Accuracy of Report Values

Under **Tools** → **Format**, there are a few controls for the units (Mode and Format) and accuracy (Precision) of values found in the report.

- 1 Create a report.
- 2 Go to **Tools** → **Format Options**
- 3 Change the units and accuracy as desired.
- 4 Select **Close**.

The screenshot shows the Bentley Civil Report Browser interface. The 'Tools' menu is open, and 'Format Options' is selected. The 'Format Options' dialog box is displayed, showing settings for various report values. The 'Station' row is highlighted, and the precision is set to 0.123. A callout box points to the precision dropdown, and another callout box points to the 'Close' button.

| Mode | Precision | Format |
|---------------------------------------|-----------|--|
| Northing/Easting/Elevation: | 0.123 | |
| Angular: Degrees | 0.123 | ddd.ddd |
| Slope: | 0.123 | 0.5 |
| Use Alternate Slope if Slope Exceeds: | 0.00% | |
| Alternate Slope: | 0.123 | 0.5 |
| Linear: | 0.123 | |
| Station: | 0.123 | ss+ss.ss |
| Acres/Hectares: | 0.123 | |
| Area Units: | 0.123 | |
| Cubic Units: | 0.123 | <input type="checkbox"/> Convert to Cubic Yard |
| Direction: Bearings | 0.123 | ddd.ddd |
| Face: Right Face | | |
| Vertical Observation: Zenith | | |

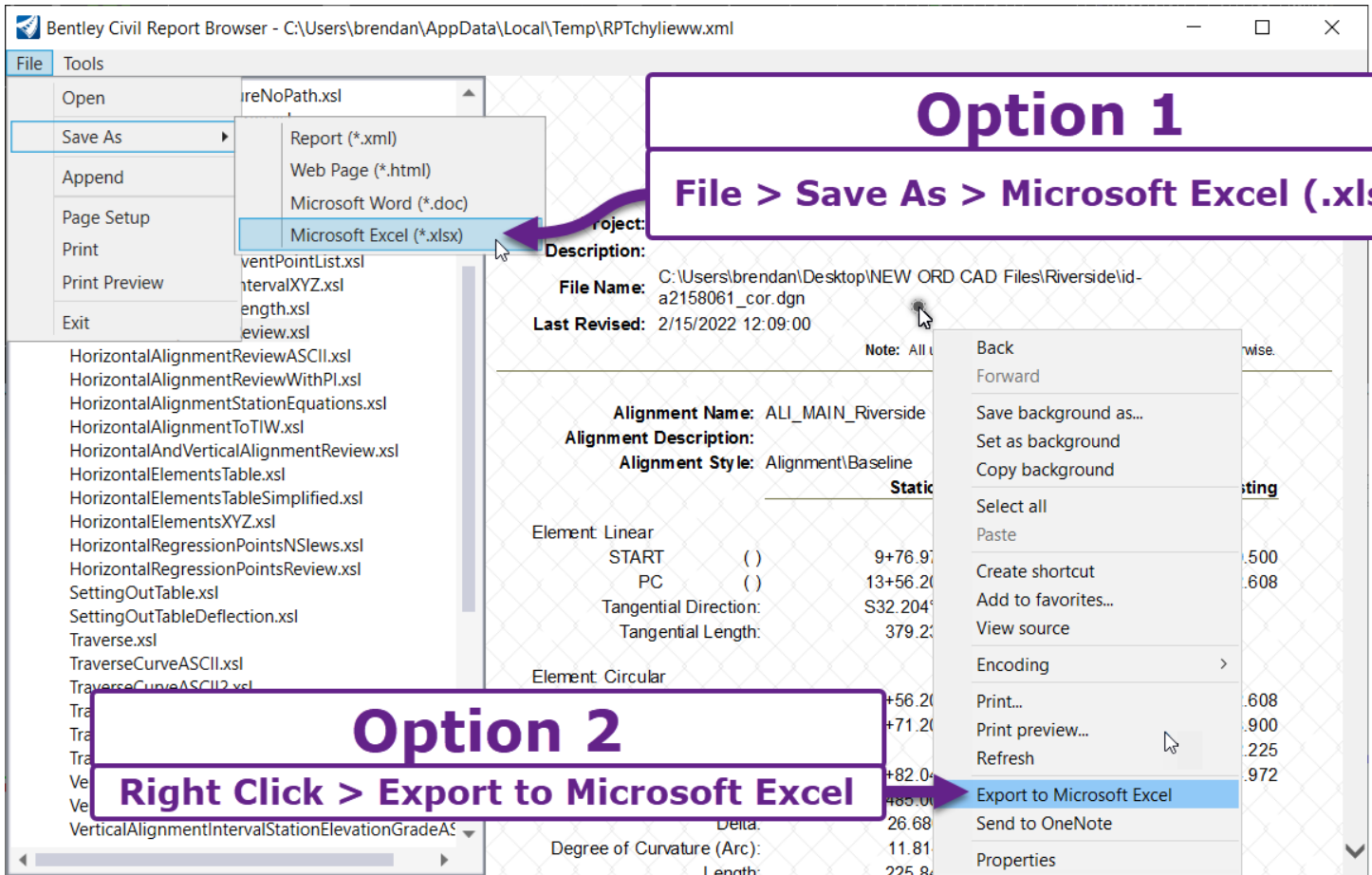
Delta: 26.680° Right
Degree of Curvature (Arc): 11.814°

23K.2 Export a Report to Microsoft Excel (.xlsx)

A report can be exported to Microsoft Excel for extensive formatting and manipulation operation. There are two options for exporting the report. In Microsoft Excel, the appearance (format) of the report depends on which option is used.

Option 1: File → Save As → Microsoft Excel (*.xlsx). When this option is used, the report appears identically formatted to the ORD Report.

Option 2: Right-Click → Export to Microsoft Excel. When this option is used, the report is unformatted. In Microsoft Excel, all report text shown with the same font, font size, and justification.



See the next page for a comparison of the two options when viewed in Microsoft Excel.

TIP: After formatting in Microsoft Excel, print the report directly from Microsoft Excel.

The left graphic shows the Microsoft Excel sheet by using **Option 1: File** → **Save As** → **Microsoft Excel (*.xlsx)**. The report is formatted identical to the ORD Report.

The right graphic shows **Option 2: Right-Click** → **Export to Microsoft Excel**. The report is unformatted.

Option 1

File > Save As > Microsoft Excel (.xlsx)

Horizontal Alignment Review Report

Report Created: Tuesday, February 15, 2022
Time: 7:56:23 PM

Project: 2D Design SurvFt
Description:
File Name: C:\Users\brendan\Desktop\NEW ORD CAD Files\Riverside\id-a2158061_cor.dgn
Last Revised: 2/15/2022 12:09
Note: All units in this report are in feet unless specified otherwise.

Alignment Name: ALI_MAIN_Riverside
Alignment Description:
Alignment Style: Alignment\Baseline

| | Station | Northing | Easting |
|-----------------------|---------------|-------------|-------------|
| Element: Linear | | | |
| START | () 9+76.970 | 2567545.3 | 2463920.5 |
| PC | () 13+56.201 | 2567224.413 | 2464122.608 |
| Tangential Direction: | S32.204°E | | |
| Tangential Length: | 379.231 | | |
| Element: Circular | | | |
| PC | () 13+56.201 | 2567224.413 | 2464122.608 |
| HPI | () 14+71.208 | 2567127.1 | 2464183.9 |
| CC | () | 2566965.936 | 2463712.225 |

RPTnmipvlc1

Option 2

Right Click > Export to Microsoft Excel

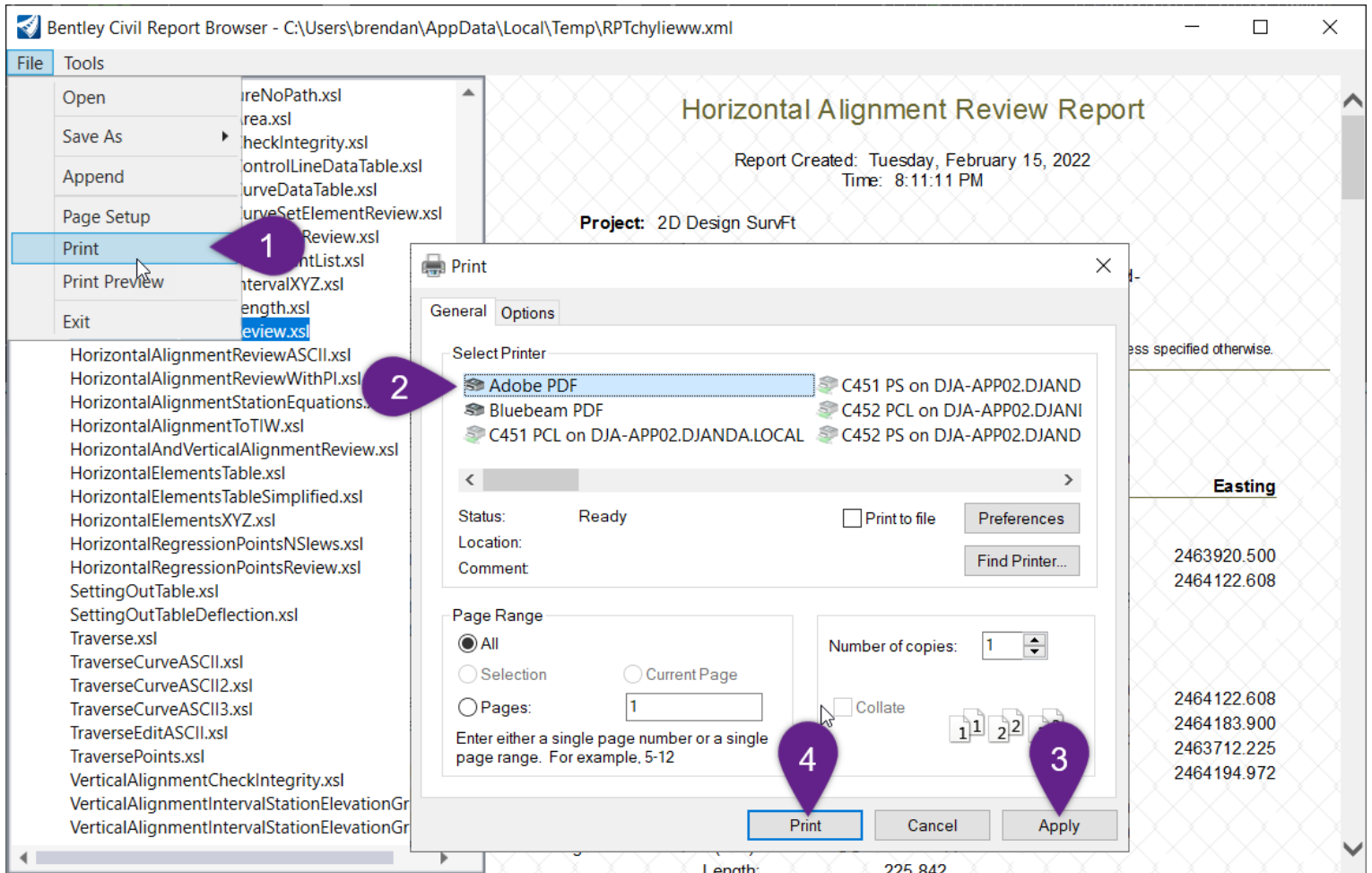
Alignment Name: ALI_MAIN_Riverside
Alignment Description:
Alignment Style: Alignment\Baseline
 Station Northing Easting
 Element: Linear
 START () 9+76.970 2567545.3 2463920.5
 PC () 13+56.201 2567224.413 2464122.608
 Tangential Direction: S32.204°E
 Tangential Length: 379.231
 Element: Circular
 PC () 13+56.201 2567224.413 2464122.608
 HPI () 14+71.208 2567127.1 2464183.9
 CC () 2566965.936 2463712.225
 PT () 15+82.043 2567012.628 2464194.972
 Radius: 485
 Delta: 26.680° Right
 Degree of Curvature (Arc): 11.814°
 Length: 225.842
 Tangent: 115.007
 Chord: 223.807
 Middle Ordinate: 13.086
 External: 13.449
 Back Tangent Direction: S32.204°E
 Back Radial Direction: S57.796°W

Sheet1

23K.3 Print the Report to PDF

To create a PDF of an ORD Report, go to **File** → **Print** and select a **PDF** print driver.

TIP: Select the **Adobe PDF** or **Bluebeam PDF** printer driver.



| | |
|---|---|
| 1 | Go to File → Print |
| 2 | Select a PDF print driver. |
| 3 | Push the Apply button. |
| 4 | Push the Print button and specify a file location for the resulting PDF. |