Triangular Volume Methods

Quantities of earthwork are specified to be measured according to volume basis, based upon the digital terrain model and calculated by triangular volume, average end area volume from cross sections, or other methods of equivalent accuracy. Within OpenRoads Designer and OpenSite Designer, the Model Analysis and Reporting>Civil Analysis group provides more than several methods from which to choose. If corrections for curvature are specified, one of two methods will need to be used to calculate earthwork volumes: Analyze Volumes (using terrains) or Quantities Report by Named Boundary (using 3D meshes).

Analyze Volumes allows you to calculate volumes between digital terrain models, which is a triangular volume method, and usually used after you have created FG and SG terrains. You can use a shape element, named fence, or a plan named boundary to limit the area. So, Analyze Volumes (Terrain Model to Terrain Model Volume) may be a good method to use during construction activities with OG and SG terrains. Analyze Volumes (Terrain Model to Plane) is a second method that is useful for calculating the volume above a flood plain or the volume of a stockpile if it was placed on level ground. Quantities are not reported by station because there is no corridor or geometry involved.

Quantities Report by Named Boundary tool may be run without a boundary selected and can be used to extract earthwork quantities (cut and fill) from the 3D model after the 3D meshes are created. Corridor meshes from template components are always included in the report if the corridor is attached as a reference. Creating the 3D solid meshes that display in the 3D model and dynamic cross section views, using Create Cut Fill Volumes, is a prerequisite to using this tool to compute cut and fill volumes.

The plan named boundary that defines the area for the calculation can be placed using civil commands and be drawn to exact stationing. The example below uses the non-civil plan method of "By Polygon" to place the boundary approximately.

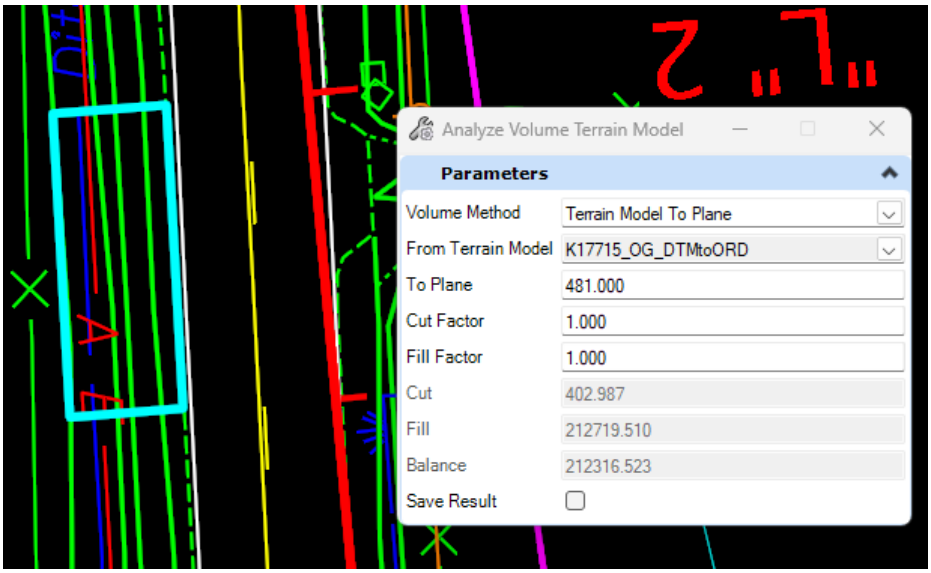
The Quantities Report by Named Boundary can also be used with a plan named boundary group selected and with an option to "Display Clipped graphics" which will create clipped copies of the 3D meshes that lie within the selected boundaries. This option provides a way to preserve the 3D meshes (as elements in the file) along with the report.

Analyze Volumes Example

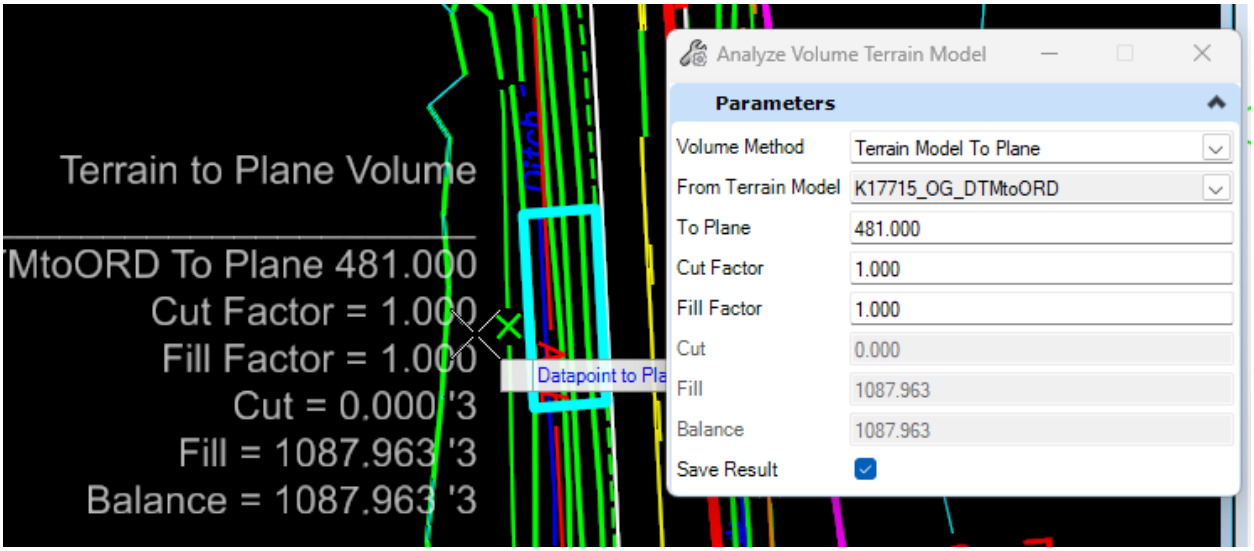
Scenario: Estimate the quantity of material that it would take to fill up 50 feet of ditch to an elevation of 481 feet.

Setup: The active file is a Construction_Engineering Working File and has the existing ground terrain attached as a reference. The OG terrain has been set as the active terrain model. Also attached is the published geometry. A cyan blue shape has been drawn in the plan view from the EP, across the ditch, out to the top back of ditch breakline outlining the area of interest.

Run the **Home>Model Analysis and Reporting>Civil Analysis>Analyze Volume** command. Use the Tool Settings dialog to select the Volume Method, the From Terrain Model, and set the To Plane elevation value. Left-click three times to accept the 1) method, 2) cut factor, and 3) fill factor.



When prompted “Boundary Reset for None“, click on the shape. The shape does not highlight but look at the Cut/Fill area and you will see (below) that the analysis has been run and values are displayed in the dialog. The volume is displayed in cubic master units of the file. To place a text node in the file, check the “Save Result” box on the tool settings dialog and left-click to accept that. Finally, left-click to place the text node. The result is 1087.963 cubic feet of fill.



Quantities Report by Named Boundary Example

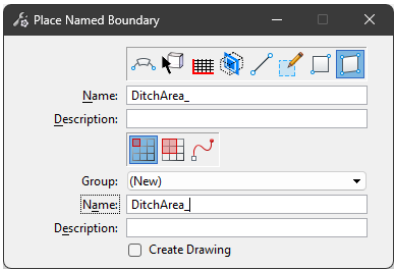
Scenario: Estimate the quantity of material that it would take to fill up 50 feet of ditch to an elevation of 481 feet.

Setup: The active file is a Construction_Engineering Working File and has the existing ground terrain attached as a reference. Also attached is the published geometry. A cyan blue shape has been drawn in the plan view from the EP, across the ditch, out to the top back of ditch breakline outlining the area of interest.

Terrain Setup: To match the first example, I created a terrain, named 481_Plane, that is a plane at 481.0’ elevation and assigned it to a Finish_4_Triangles terrain feature definition. The plane is larger

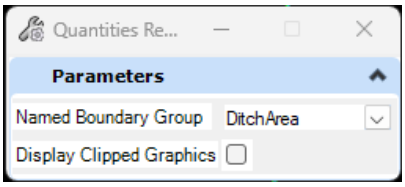
than the area of interest to show how the boundary works. What is key here is that the Volume Option for the plane terrain feature definition is set to Design, while the Volume Option for the OG Existing_Boundary feature definition is set to Existing. The Create Cut Fill Volumes command requires one terrain use Existing volume option, and the other terrain must use the Design or Subgrade volume option to create the cut and fill 3D meshes.

Named Boundary Setup: I used **Drawing Production>Named Boundaries>Place Named Boundary (By Polygon)**, then I snapped to the vertices of the area of interest that I drew in the first example. Be sure to create a Group – the Quantities Report by Named Boundary requires that the boundary be in a group.



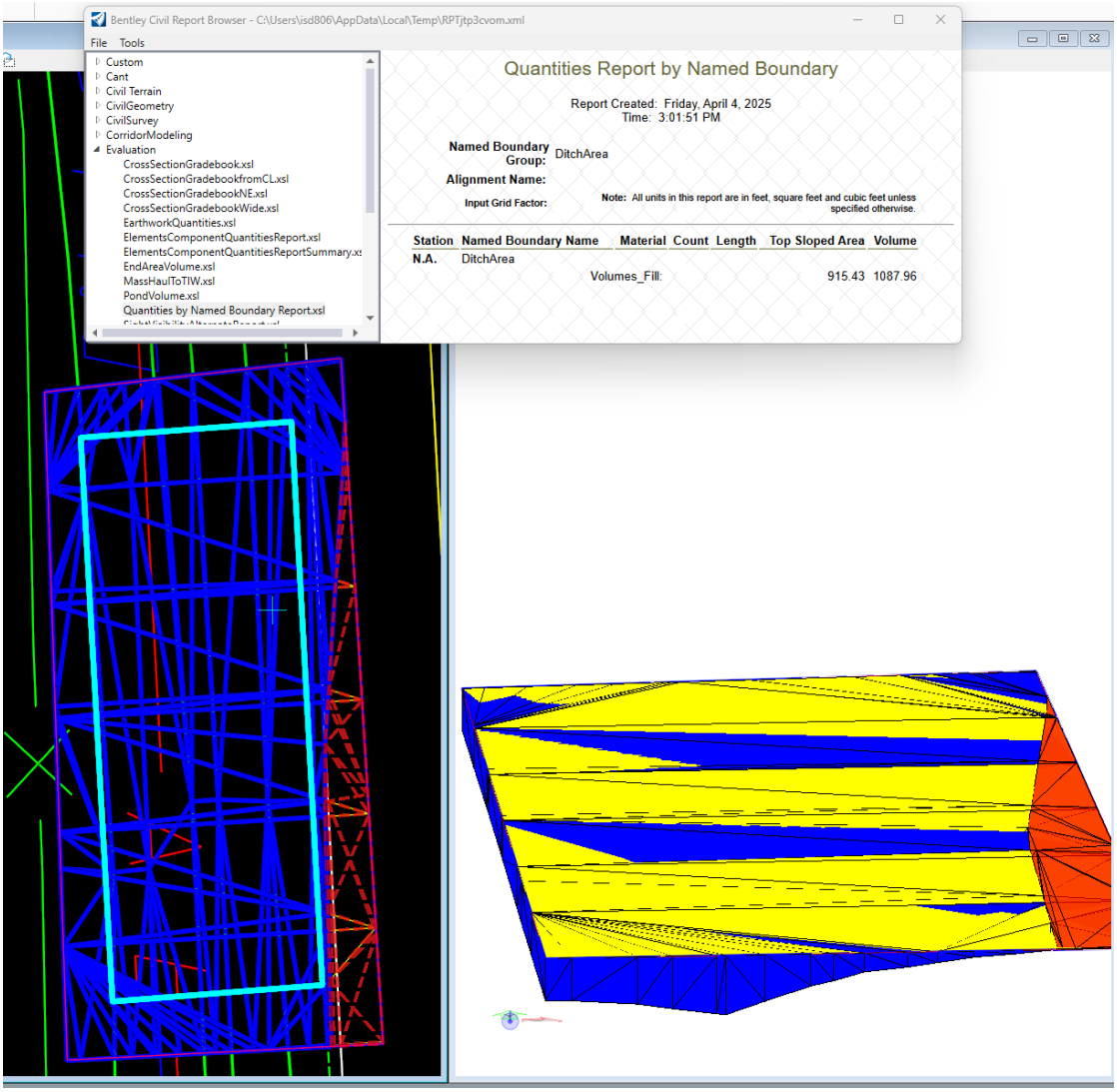
Step 1: Run the **Home>Model Analysis and Reporting>Civil Analysis>Create Cut Fill Volumes** command. Left-click six times to accept the default tool settings and finally accept the selection. You will see the 3D meshes appear – blue is fill, red is cut.

Step 2: Run the **Home>Model Analysis and Reporting>Civil Analysis>Quantities Report by Named Boundary** command. In the tool settings dialog, select the Named Boundary Group, then left-click twice to run the command.



The Civil Report Browser will automatically open to the Quantities Report by Named Boundary. Open the Tools>Format Options and uncheck “Convert to Cubic Yard” across from “Cubic Units” near the bottom to see the results in cubic feet.

In the picture on the next page, you can see that the Volumes_Fill volume is 1087.96 cubic feet. The plan view on the left side shows that the cyan blue area of interest (the named boundary) does not get into the red (cut) mesh. The 3D view on the right shows the blue (Fill) 3D solid mesh below the yellow plane. At the far right, the existing terrain popped up above 481 feet and there you can see the red (Cut) 3D solid. There was no cut mesh within the area of interest, so the report shows only fill.


Bentley Civil Report Browser - C:\Users\isd806\AppData\Local\Temp\RPTjtp3cvom.xml
File Tools
Custom
Cant
Civil Terrain
CivilGeometry
CivilSurvey
CorridorModeling
Evaluation
CrossSectionGradebook.xsl
CrossSectionGradebookfromCL.xsl
CrossSectionGradebookNE.xsl
CrossSectionGradebookWide.xsl
EarthworkQuantities.xsl
ElementsComponentQuantitiesReport.xsl
ElementsComponentQuantitiesReportSummary.xs
EndAreaVolume.xsl
MassHaulToTIW.xsl
PondVolume.xsl
Quantities by Named Boundary Report.xsl
Quantities Report by Named Boundary
Report Created: Friday, April 4, 2025
Time: 3:01:51 PM
Named Boundary Group: DitchArea
Alignment Name:
Input Grid Factor:
Note: All units in this report are in feet, square feet and cubic feet unless specified otherwise.
Station Named Boundary Name Material Count Length Top Sloped Area Volume
N.A. DitchArea
Volumes_Fill: 915.43 1087.96