

Preparing for Earthwork

Design Manual
Chapter 20
Project Automation
Information

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Earthwork quantities are to be determined by using the end area method. Earthwork should be processed from 2D cross sections using Geopak analysis tools.

Preparing the Microstation file for Earthwork Processing

To prepare the cross sections for earthwork calculation, the following criteria should be followed:

- Final earthwork quantities should be processed on cross sections that have been plotted at 25 foot increments and at key stations.
- Soils Design Section should have supplied subsurface soil layer lines for calculations for subsurface material volumes.
- For Earthwork to be run on cross sections, all line work needs to connect to adjacent line work within the tolerance allowed in the input files. The default is 0.1 feet (this value may be changed in the individual input files if undesirable earthwork shapes are the result of this tolerance).
- Earthwork should not be run against skewed cross sections that are present in the Microstation file.

Topsoil Stripping

The topsoil stripping elements should be placed from exterior limit to exterior limit of the need lines. This can be done using Corridor Modeler overlay/stripping components as a post processing run after the final cross sections have been established. This process is similar to how topsoil placement elements are generated in the Top Soil Placement video (http://www.iowadot.gov/design/videos/Topsoil_Placement).

All topsoil that will be cut from the project limits must be included on the Microstation level **dsnXsExTsStripping**. The earthwork calculation file (see Section [20J-62](#)) determines topsoil cut quantity from the topsoil stripping run, which must always be run. See Figure 1 below for an example.

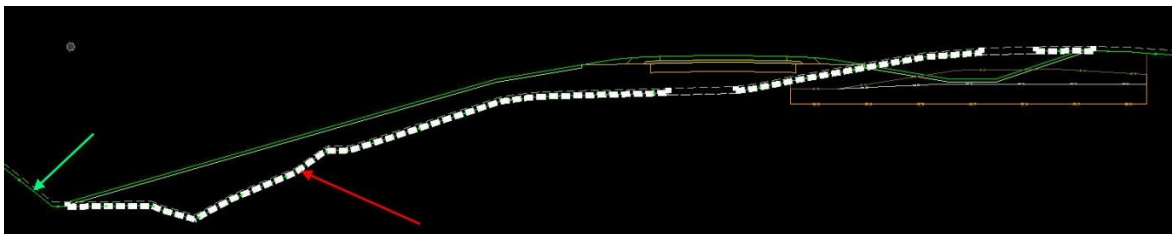


Figure 1: Cross section for determining topsoil stripping.

The red arrow points to the topsoil stripping line work (heavy white dashed line) and the green arrow points to the topsoil layer as drawn by the soils section.

Existing Pavement Cut

All existing pavement elements that will be removed with the project need to be included in the existing pavement cut level, **dsnXsExPaveCut**. If there is existing pavement within the cross section limits that is not to be disturbed, it should not be included on the existing pavement cut level. The earthwork calculation file (see Section [20J-62](#)) determines pavement cut quantities from existing

pavement cut Microstation elements. These elements are identical to any existing pavement elements within the Microstation file that will be cut out.

Earthwork Processing with Geopak Input Files

After all of the preprocessing work to the cross sections has been completed, input files can be created using the “Create Input Files” tool found within the T Sheet Calculation file. Geopak uses these input files to run the cross sections. Refer to Section [20J-62](#) for additional information on the creation tool.

Every cross section file will need its own set of input files: Cut and Fill, Existing Pavement Cut, Topsoil Stripping, Plowing and Shaping, Undercut for Subgrade Treatment, and Topsoil Plus-Cut. If a cross section file does not include existing pavement, subgrade treatment, or plowing and shaping, these input files may be omitted.

Cut & Fill Input File (Required)

This input file is always required. It calculates the Class 10 cut and fill quantities for all materials except topsoil, subgrade treatments, and existing pavement. Any stations skipped while running this file will cause errors in the T Sheet Excel file if the following runs contain data for the same stations, so care should be taken to have the exact same stations run and skipped. The text file produced should begin with “CF_”. An example would be CF_ML020.txt. This input file will draw shapes on the level dsnXSEarthworkShapes1.

Topsoil Stripping Input File

This input file is required if a project has topsoil stripping. It calculates the volume of topsoil material that will be cut from the project limits. The difference between the cut volume calculated in this run and the cut volume in the main Cut/Fill run will determine the volume of Class 10 material that would be needed to fill areas that have been stripped below a fill section. The text file produced should begin with “TPS_”. An example would be TPS_ML020.txt. This input file will draw shapes on the level dsnXSEarthworkShapes2.

Existing Pavement Cut Input File

This input file is required when a project has existing pavement removals. It calculates the volume of Class 10 material that may need to be replaced by removal of existing pavement underneath areas of fill. The difference between the volume calculated in this run and the main Cut/Fill run will determine the volume of Class 10 material that would be needed to fill areas that have been removed below fill sections. The text file produced should begin with “EXPC_”. An example would be EXPC_ML020.txt. This input file will draw shapes on the level dsnXSEarthworkShapes3.

Plowing & Shaping Input File

This input file is required when a project has plowing and shaping (Standard Road Plan [EW-101](#)). It calculates the volume of material cut out for plowing and shaping. For this file, run only the station range where plowing and shaping exists. The text file produced should begin with “PS_”. An example would be PS_ML020.txt. This input file will draw shapes on the level dsnXSEarthworkShapes4. If multiple areas require plowing and shaping, multiple files will need to be created, as shown below. Name the file using the existing roadway name structure along with additional information to differentiate the files, for example adding a _1 or _A. The multiple files names could look as follows:

CF_NBL075(92).txt	8/5/2016 3:29 PM	Text Document	24 KB	or	CF_NBL075(92).txt	8/5/2016 3:29 PM	Text Document	24 KB
CF_SBL075(92).txt	8/5/2016 10:17 AM	Text Document	25 KB		CF_SBL075(92).txt	8/5/2016 10:17 AM	Text Document	25 KB
CF_SRKEST(92).txt	8/16/2016 3:28 PM	Text Document	1 KB		CF_SRKEST(92).txt	8/16/2016 3:28 PM	Text Document	1 KB
EXPC_NBL075(92).txt	8/3/2016 2:40 PM	Text Document	6 KB		EXPC_NBL075(92).txt	8/3/2016 2:40 PM	Text Document	6 KB
EXPC_SBL075(92).txt	8/5/2016 10:17 AM	Text Document	7 KB		EXPC_SBL075(92).txt	8/5/2016 10:17 AM	Text Document	7 KB
PS_NBL075(92)_1.txt	8/16/2016 1:25 PM	Text Document	2 KB		PS_NBL075(92)_A.txt	8/16/2016 1:25 PM	Text Document	2 KB
PS_NBL075(92)_2.txt	8/16/2016 1:25 PM	Text Document	1 KB		PS_NBL075(92)_B.txt	8/16/2016 1:25 PM	Text Document	1 KB
TPS_NBL075(92).txt	8/3/2016 2:40 PM	Text Document	5 KB		TPS_NBL075(92).txt	8/3/2016 2:40 PM	Text Document	5 KB
TPS_SBL075(92).txt	8/5/2016 10:17 AM	Text Document	6 KB		TPS_SBL075(92).txt	8/5/2016 10:17 AM	Text Document	6 KB
TPS_SRKEST(92).txt	8/16/2016 3:28 PM	Text Document	1 KB		TPS_SRKEST(92).txt	8/16/2016 3:28 PM	Text Document	1 KB
UCTP_NBL075(92).txt	8/3/2016 2:40 PM	Text Document	8 KB		UCTP_NBL075(92).txt	8/3/2016 2:40 PM	Text Document	8 KB
UCTP_SBL075(92).txt	8/5/2016 10:17 AM	Text Document	8 KB		UCTP_SBL075(92).txt	8/5/2016 10:17 AM	Text Document	8 KB
UCTP_SRKEST(92).txt	8/16/2016 3:28 PM	Text Document	1 KB		UCTP_SRKEST(92).txt	8/16/2016 3:28 PM	Text Document	1 KB

Undercut for Subgrade Treatment File

This input file is provided to contractors, but is not necessary for the calculations. It calculates the volume of cuts made beyond the subgrade lines, for instance how much additional cut is required to place select treatment under the subgrade line and the existing ground line. This information will be available in the T Sheet Excel file, but will not appear on the T Sheets. The text file produced should begin with "UCSG_". An example would be UCSG_ML020.txt. This input file will draw shapes on the level dsnXSEarthworkShapes5.

Undercut for Topsoil Placement File

This input file is provided to contractors, but is not necessary for the calculations. It calculates the volume of topsoil cuts made beyond the subgrade lines, for instance how much additional cut is required to place slope dressing under the subgrade line and the existing ground line. This information will be available in the T Sheet Excel file, but will not appear on the T Sheets. The text file produced should begin with "UTPS_". An example would be UTPS_ML020.txt. This input file will draw shapes on the level dsnXSEarthworkShapes6.

Staged Projects

The staged .txt files need to be grouped in folders by stage, with the stage names as folder names. For instance, the Folders could be titled "Stage_1" and "Stage_2". This is how the calculation file will group them.

Earthwork Checks



Once the input files have been run, designers should check each of the dsnXSEarthworkShape levels and ensure that the expected shapes were drawn in. For example, the Topsoil Stripping input file should fill in only the topsoil within the limits of construction. Once satisfied that the correct shapes drew in, designers should spot check end areas and volumes with hand calculations to ensure accuracy.

Only after the designer is satisfied with these results should the T Sheet Excel file be loaded. For information on how to use the T Sheet Excel file, see Section [20J-62](#).

Chronology of Changes to Design Manual Section:

020F-030 Preparing for Earthwork

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|-----------|---|
| 6/25/2019 | Revised
Updated hyperlinks.
Updated header logo and text. |
| 9/14/2016 | Revised
Added instruction and examples to allow the user to add multiple plowing and shaping files to a roadway. |
| 8/5/2016 | NEW
New. Material from old Section 5C-1. |