Working With External Design Software

Introduction

This document describes methods for working with project data from external civil design packages such as *Civil 3D*® , *Bentley* civil products, *12d Model*® and others. **The examples in this document require RoadEng or Softree Optimal Version 7.0.01.1 or higher.**

Three types of data are required to automate the transfer of information between external design software packages and Softree civil products; ***Surfaces***, ***Alignments***, ***Cross Sections***.

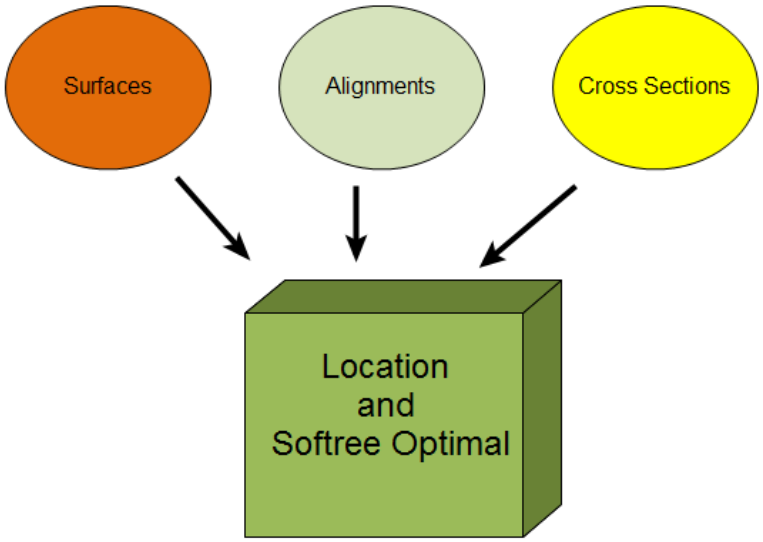

Figure 1: Location Setup Data

LandXML

LandXML is very useful for interfacing with other design software packages. LandXML specifies a non-proprietary file format for civil engineering design and survey measurement data. It is supported by all major design software vendors. More information on LandXML can be at http://www.landxml.org.

Surfaces

In Softree products, surfaces (TINs) are stored in Terrain files (*.ter). These surfaces can be created from a variety of formats including ASCII, LAS, DEM, DWG, DGN, and others.

LandXML TIN surfaces can be read directly into Location (using menu *File | New* and selecting type Landxml) or indirectly into Terrain (using menu File | Open). LandXML surfaces are very convenient because they can be directly transferred between design packages without having to create breaklines, boundaries and other surface creation issues.

Large Point Sets
Saving large point sets, such as those created by a LiDAR survey, in LandXML format is very inefficient. In this case, it is better to transfer the data in its original format such as LAS or ASCII. See Terrain documentation for more information on importing point data and creating surfaces.

Alignments

Landxml alignments contain the horizontal and vertical geometry

Landxml alignments can be read into Location by choosing menu File - New and selecting *Landxml* from the New Location Start Coordinates dialog.

Cross Sections

Cross section information can be imported and extracted in 3 ways.

3.1 Variable Sections - CSX Format (Recommended Method)
The best method to transfer cross section information is using the *.CSX format. The CSX format captures the dynamic behaviour of the cross section (e.g. sub-assembly rules and logic). Using this format, it is possible to change the alignment position. When a change is made the cross section is adjusted to approximate the behaviour of the original cross section. See Appendix 2 for more information on the CSX format.

At the present time, the CSX Format is only available to Civil 3D and 12d model users. For more information about the Civil 3D interface, see *Appendix 1: Civil 3D Export Corridor Plug-in*. For more information about 12d model contact Descalt Systems (http://www.descalt.com).

3.2 Fixed Sections - LandXML Cross Section Format
Fixed sections can be created in *Location* from LandXML:CrossSectSurf and LandXML:DesignCrossSectSurf elements.

3.3 Fixed Sections - LandXML Surface Format
Fixed sections can be created in *Location* from LandXML: surfaces.

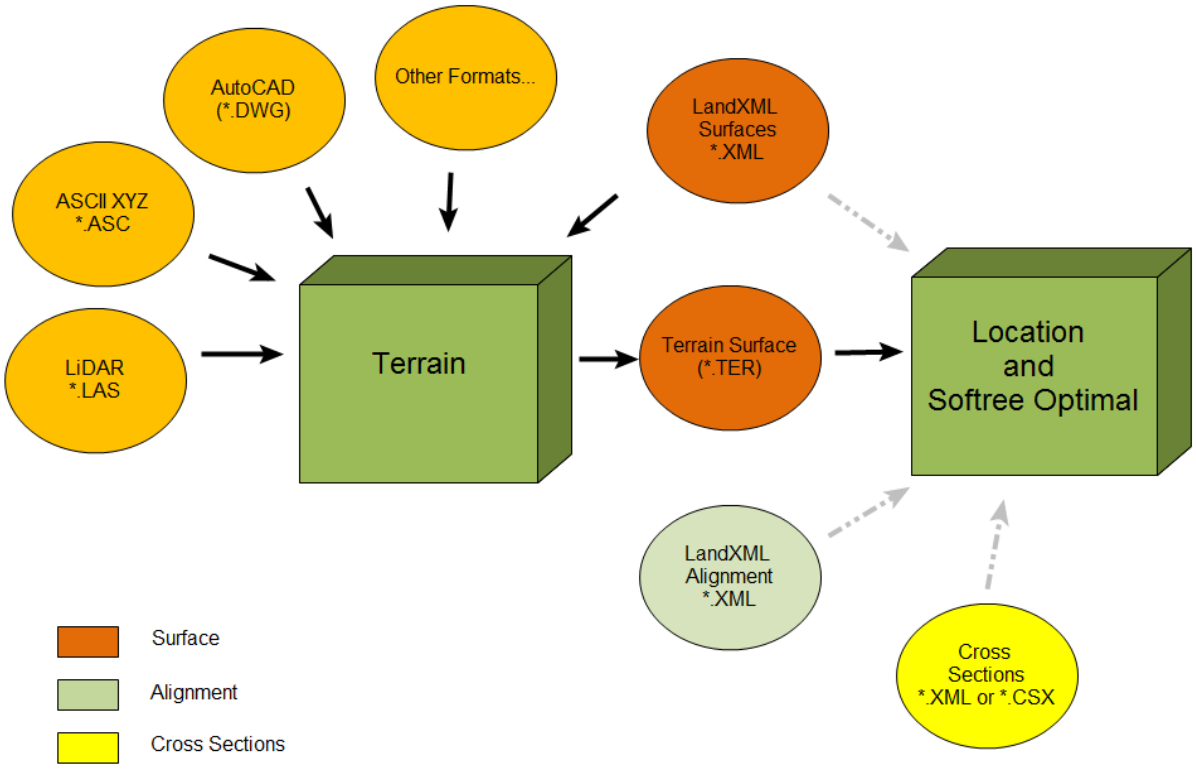

Figure 2: Location Setup Files

Example 1: Reading a Civil 3D Corridor Project Using CSX Format

In this example we will demonstrate how to create a new Location design from data exported directly from ***Civil 3D***. To do this example you will need to have Civil 3D installed and the *ExportCorridor* plug-in (see Appendix I for more information).

Part 1: Creating a CSX File in Civil 3D Using ExportCorridor Plug-In

NOTE1: Before using Export Corridor, all alignments and corridors must be included in the current drawing. To include external references into the current drawing, right click on them in the Prospector tab and choose the *Promote* command.

NOTE1: Be sure your Civil 3D file has been saved. Running the ExportCorridor will change the file, so after completion the file should be closed without saving the changes.

1. Start Civil 3D and open Simple.dwg included with this example.
2. Type **NETLOAD** into the command prompt and type in **ExportCorridor**.

The Export Corridor Panel should be displayed and the screen should appear as shown below.

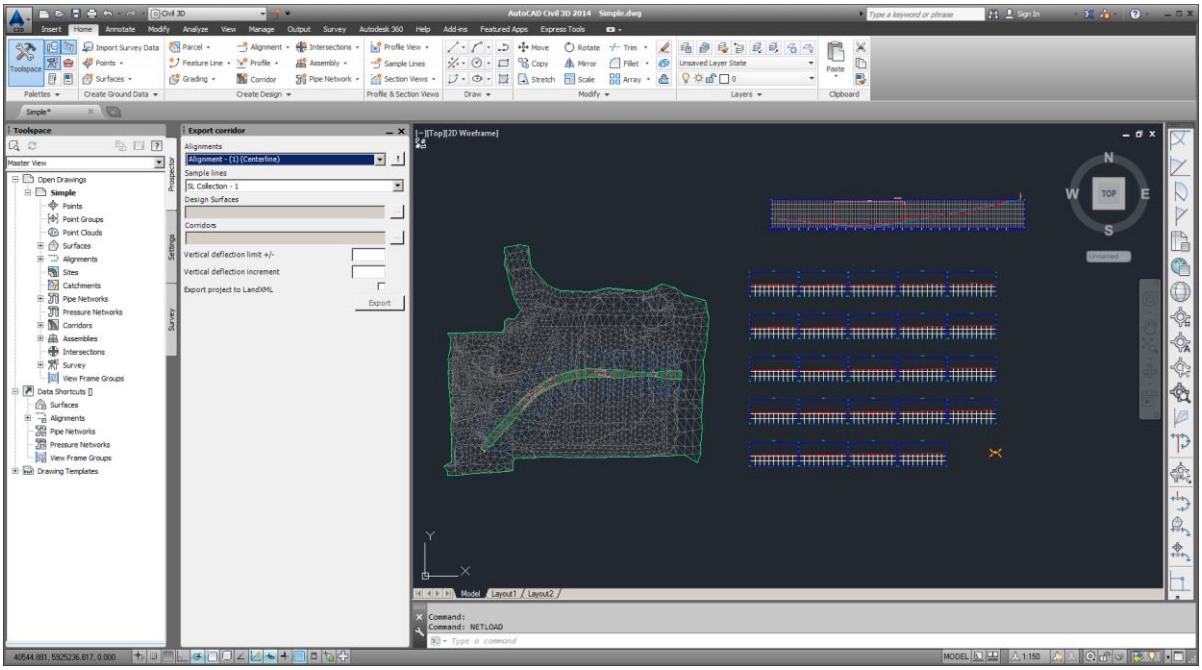

Figure 3: Civil 3D Screen WIth ExportCorridor Plug-in Panel

3. Fill in the parameters as shown in the figure below, press **Export**.

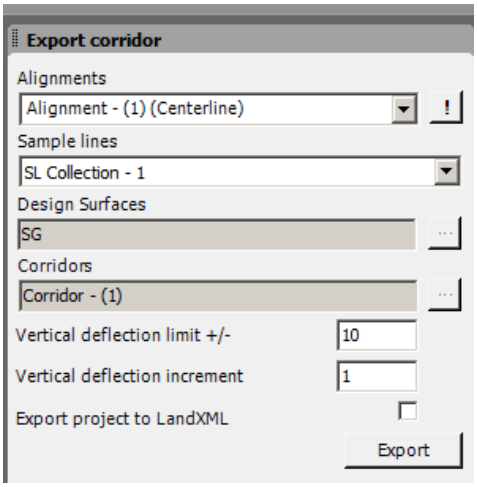

Figure 4: Civil 3D Screen wIth ExportCorridor Plug-in Panel

After several minutes of processing, the CSX file will be created. A prompt will appear asking if you would like to browse the output folder.

4. In the Prospector tab, right click on **Surfaces** and choose menu Export LandXML. Choose SG and TN surfaces. Save them as **Surfaces.xml** in the same folder as the CSX file above.

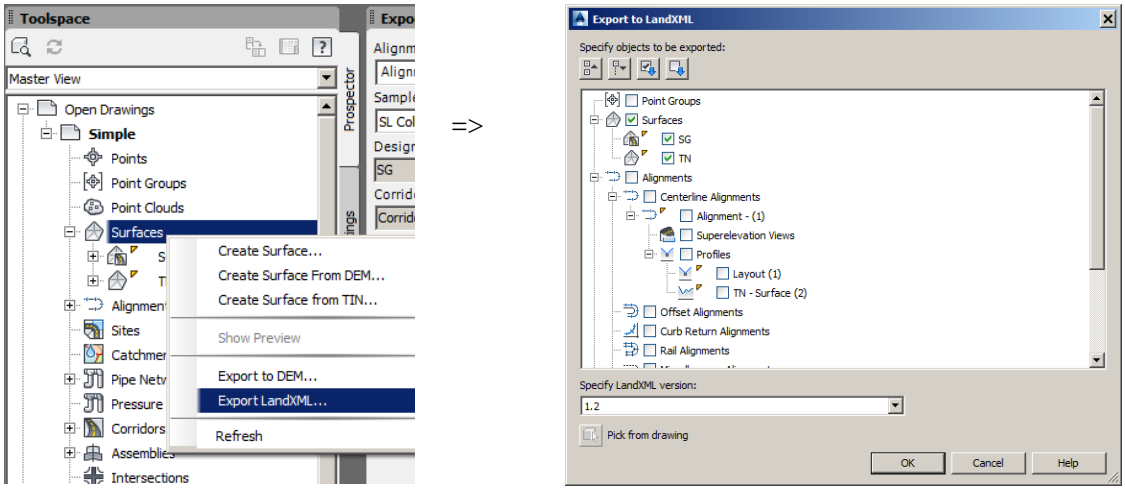

Figure 5: Civil 3D Screen wIth ExportCorridor Plug-in Panel

5. Similarly, in the Prospector, right click on **Alignments** and choose Export LandXML. Choose SG and TN surfaces. Save them as **Alignments.xml** in the same folder as the CSX file above.

6. Close Civil 3D and don't save the changes.

Part 2: Importing Civil 3D into Location

7. Open the Location module  application.
8. *File | New*. Choose ***LandXML (*.xml)*** in Files of Type combo (lower right corner). Browse to the folder from Part 1 of this example. Select **Surfaces.xml**. Press *Open*.

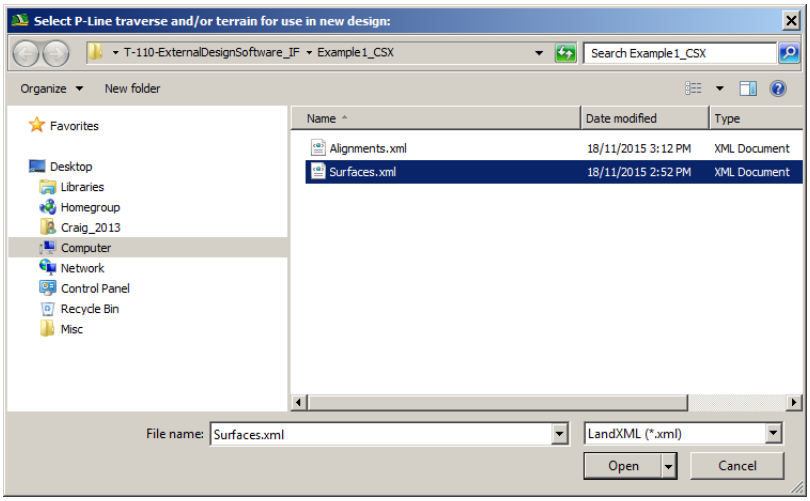

Figure 6: Existing Ground Surface XML file

NOTE : the **Surfaces.xml** file contains the existing ground TIN surface, exported in LandXML format (from the external design software).

9. When the *LandXML Options* dialog appears, choose the options as shown in Figure 7 below. Press OK.

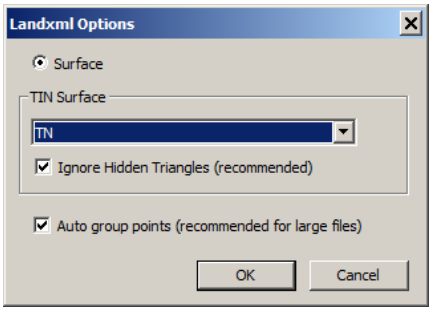

Figure 7: LandXML Options dialog

10. When the *Save LandXML surface to Terrain* dialog appears (Figure 8 below), choose **RoadExample.ter**.

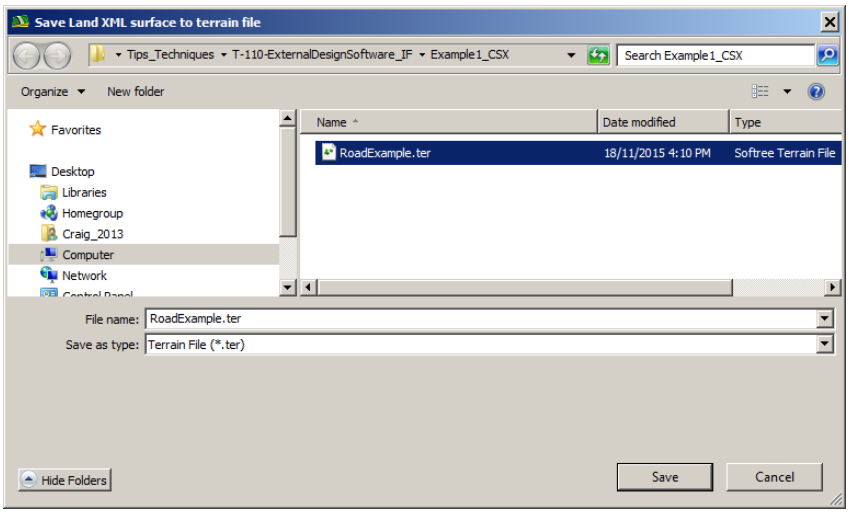

Figure 8: Save LandXML surface to Terrain dialog

NOTE : the **RoadExample.ter** is a Softree Terrain file format.

11. When *the Initial Horizontal Alignment dialog* appears (Figure 9 below), choose *Landxml file*.

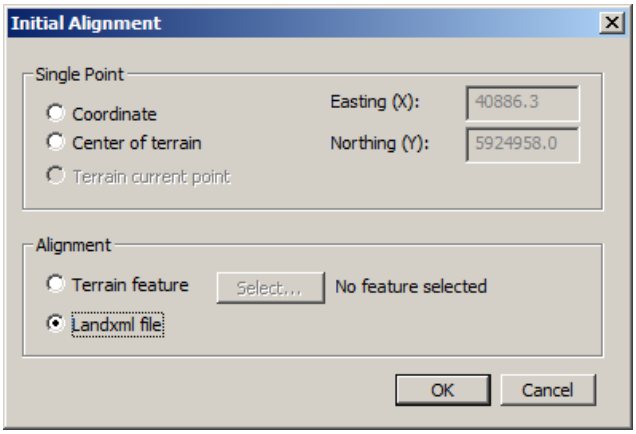

Figure 9: Initial Horizontal Alignment dialog

12. Choose Alignments.xml (the Landxml file containing the horizontal and vertical alignments exported from the external design software).
13. Select the horizontal and vertical alignments (**Alignment-(1)** and **Layout(1))** as shown in Figure 10 below.

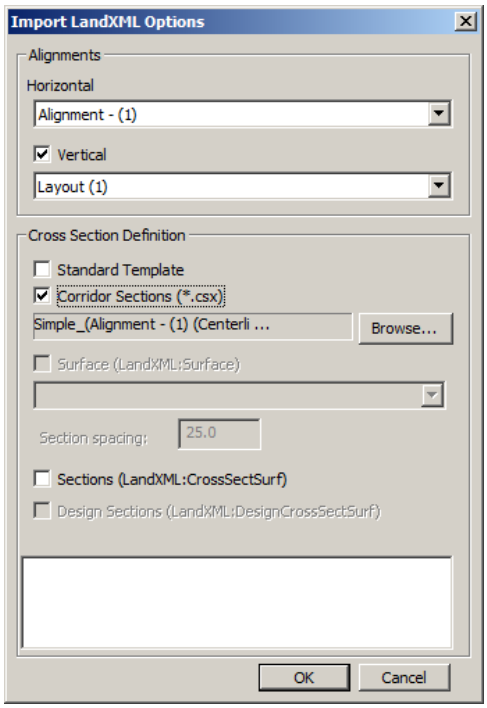

Figure 10: Initial Horizontal Alignment dialog

14. Click on Corridor Sections (*.csx) and choose Simple_(Alignment - (1) (Centerline))_(ExportData).CSX.

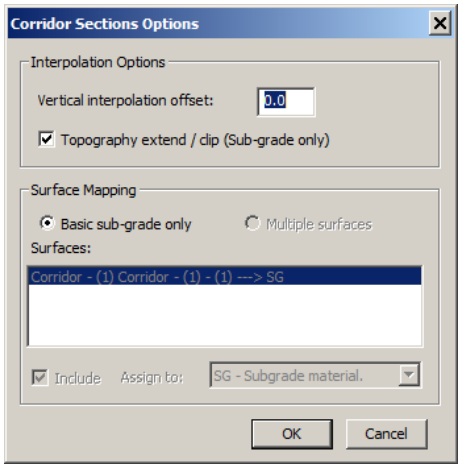

Figure 11: Corridor Section Options

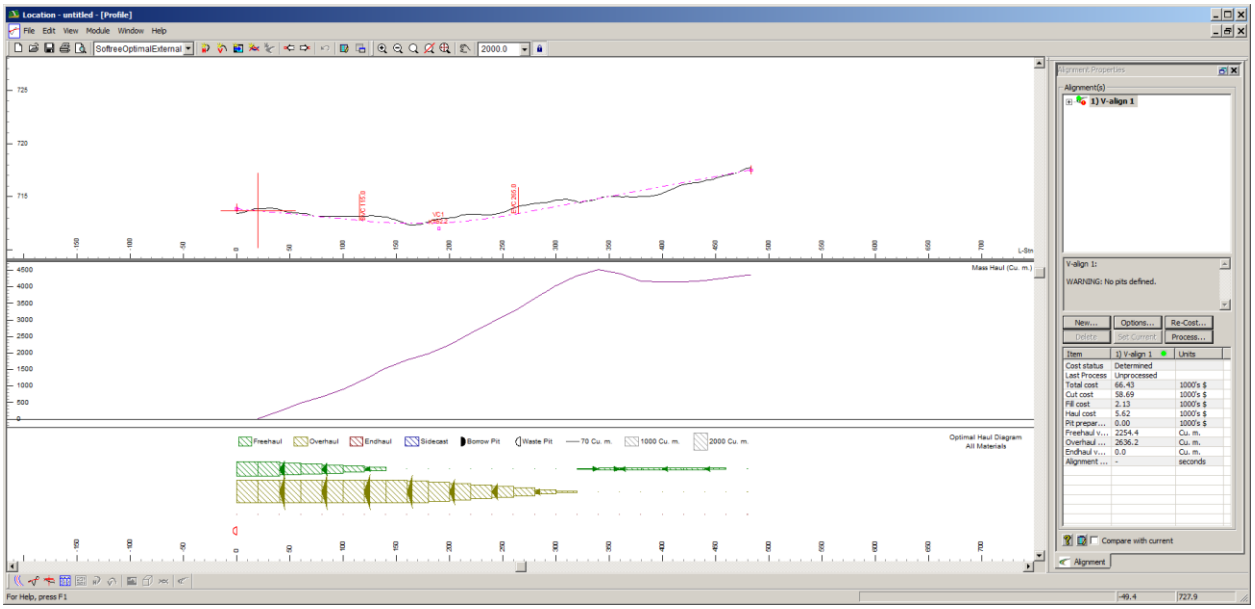

Figure: 12 Initial Screen

15. You are now be ready to start design optimization.
16. File | Close. Don't save the changes.

Example 2: Creating a Corridor Project Using a LandXML Surface

This example will demonstrate how to create a new Location design from a LandXML subgrade surface. This is useful for products which don't currently support the *.CSX format such as Geopak®, InRoads® and any design software which supports LandXML export of surfaces and alignments. The technique described here uses the designed SG surface on *Fixed Sections* to approximate the cross section template. Once in Location, the alignment can be modified both horizontally and vertically with a vicinity of the existing alignment.

In the example the following LandXML files were exported from the external design software:

a) **OG.xml** - origional ground surface in LandXML format

b) **Alignment_SG.xml** - horizontal and vertical alignment and sub-grade surface.

Part 1: Setting up the Terrain Surfaces

The first step is to setup *Existing Ground* surface in Terrain.

1. Open the Terrain module application.
2. File | Open. Choose All Supported Files (*.asc...) in Files of Type combo (lower right corner). Browse to the Example2_SG folder included with this example. Select **OG.xml**. Press Open.

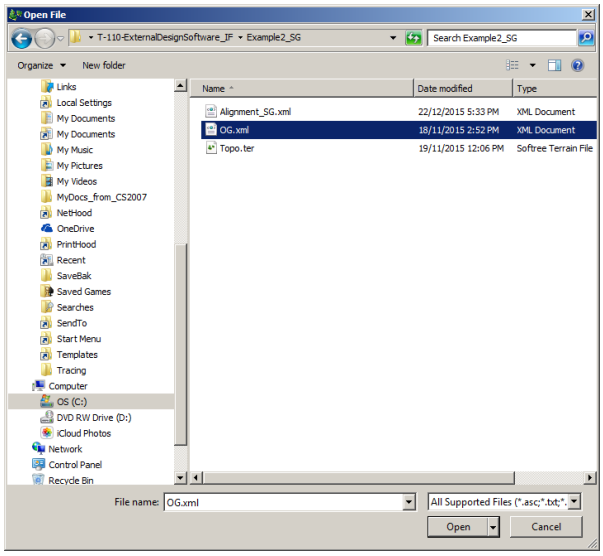

Figure 13: Surface XML file

NOTE : the **OG.xml** file contains the existing ground TIN surface, exported in LandXML format (exported from the external design software) and the SG surface.

3. When the LandXML *Import Options* dialog appears, choose the options as shown in Figure 14 below. Press OK.

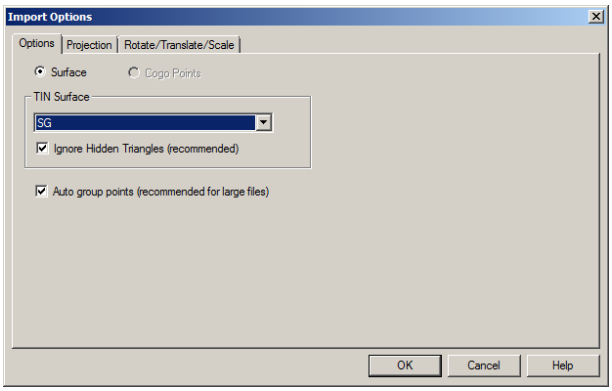

Figure 14: LandXML Import Options dialog

4. Choose menu File | Save and save the surface as **Topo.ter** (overwrite the existing file if required).

Part 2: Setting up the SG Surface in Location Design

5. Open the Location module  application.
6. *File* | *New*. Browse to the folder from Part 1 of this example and select **Topo.ter**. Press *Open*.
7. When the *Initial Alignment* dialog appears, choose *Landxml file*.

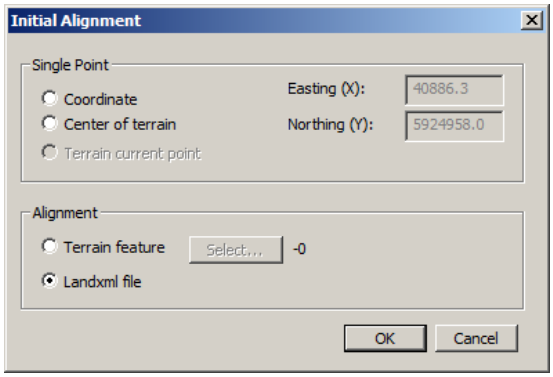

Figure 15: LandXML Import Options dialog

8. When prompted, choose **Alignment_SG.xml** (the Landxml file containing the horizontal and vertical alignments and SG surface, exported from the external design software).
9. Select the horizontal and vertical alignments (Alignment-(1) and Layout(1)) as shown in Figure 16 below.

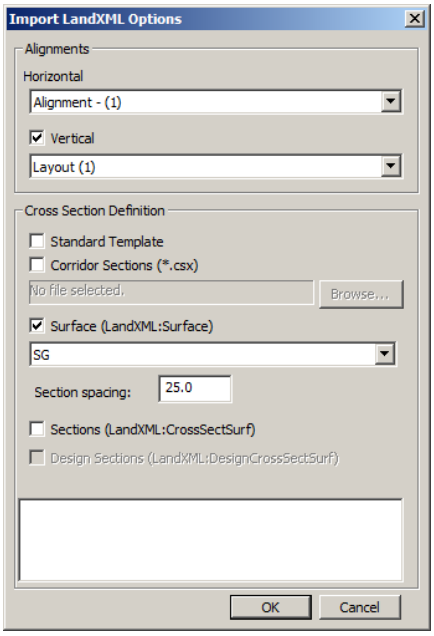

Figure 16: Initial Horizontal Alignment dialog

10. Select *Surface (LandXML:Surface)*, choose *SG surface* and set the *Section Spacing* to *25 as* shown in *Figure 16* above.
11. Press OK and when prompted save the surface as **SG.ter**. Press OK to set up the design.

The subgrade surface is now being used as the template surface in Location.

12. Choose menu View | Jump To Station. Choose station 25.

NOTE: The screen should appear as shown in figure 17 below.

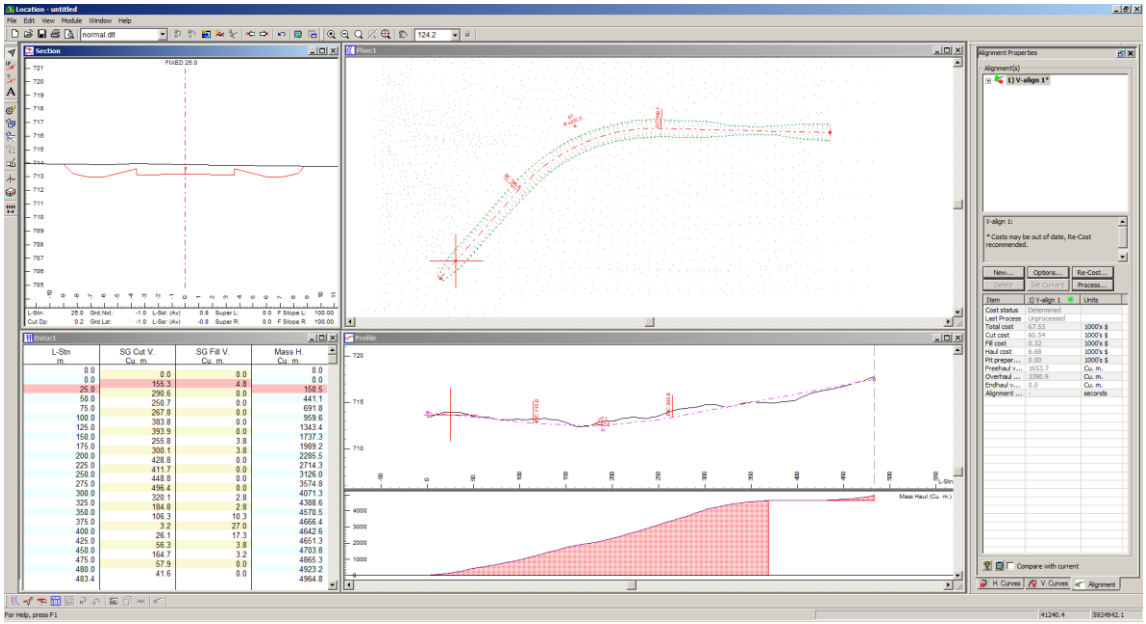

Figure 17: Design with Fixed Sections based on SG

13. Pressing the *Next / Previous* buttons will allow you to see the cross sections displayed in the Section Window.

NOTE: Moving the alignment horizontally or vertically will have no effect on the cross section. The cross sections are set to follow the sub-grade surface. If you wish to modify or optimize the alignment you will need to create Fixed Cross Sections since they can be moved. This process is described in the following steps.

14. Choose menu Edit | Edit Templates to activate the template editor.
15. Hold down the Left mouse button and move the mouse down on the screen. The position of the cross section should change.

NOTE The template editor allows you move the cross section and see how the template 'behaves' at different positions. Notice that after you move the section,

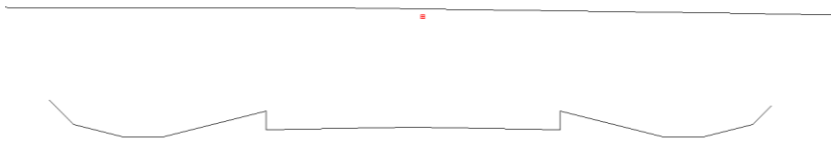

Figure 18: Cross Section Not Closing After a Move.

16. Click on the Properties button to activate the Fixed Section Layer Properties Dialog. Turn on Auto Extend / Clip and press OK.

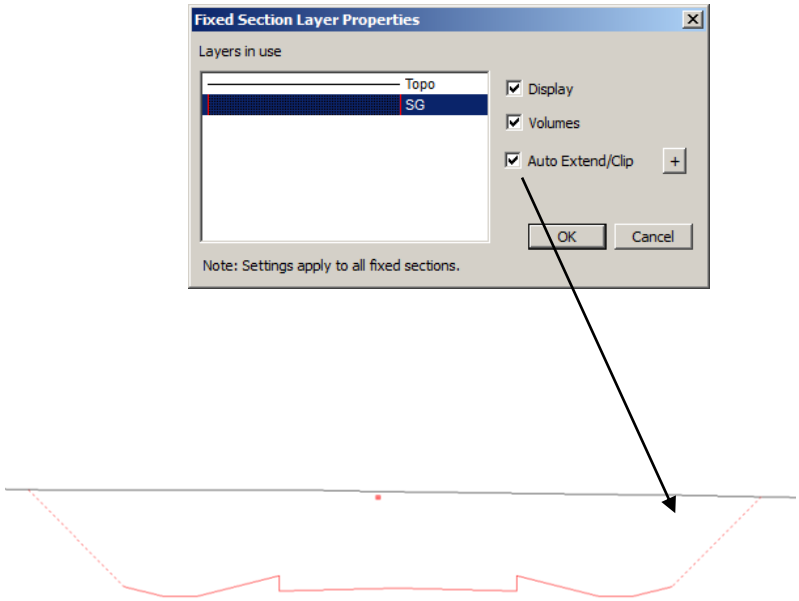

Figure 19: Auto Extend / Clip Option

NOTE As mentioned earlier in this section, using the SG surface technique is only an approximation of the cross section behavior. It is possible to improve the interpolation. See *Appendix 3: Auto Extend / Clip Options* for more information.

17. Press OK then choose menu File | Exit. Don't save changes.

Appendix 1: Civil 3D Export Corridor Plug-in

ExportCorridor is an AutoCAD Civil 3D plug-in used to create a Corridor Sections File (see Appendix 2 for more information about CSX files).

Installation and Startup

The Civil 3D Export Corridor Plug-in is available for download from the Software Updates section of the web site.

The Civil 3D Export Corridor Plug-in consists of the following files:

ExportCorridor.dll

ExportCorridor.dll.config

a) Create a folder called ExportCorridor in your Civil 3D .NET Assembly folder e.g. ProgramData\AutoDesk\ApplicationPlugins\. To determine the your Civil 3D .NET Assembly folder on your system, start Civil 3D and type NETLOAD at the command prompt. This will place you in the Civil 3D .NET Assembly folder.

b) Copy the files above into the ExportCorridor folder created in step a) above.

Civil 3D Project Requirements

In order to export a corridor in CSX format you will need the following in Civil 3D.

	**Corridor(s)**	One or more corridors.
	**Centerline Alignment**	The main centerline alignment.
	**Samplelines**	A sample line group based on the centerline alignment.
	**Design Surface(s)**	Corridor surfaces to be included in the CSV file. Typically this is the Sub-grade (Datum) surface. **This surface must be included in the sample lines.**

User Interface

With Civil 3D running type in **NETLOAD** at the command prompt. Browse and select **ExportCorridor.dll**. The ExportCorridor panel as show in the figure below will appear.

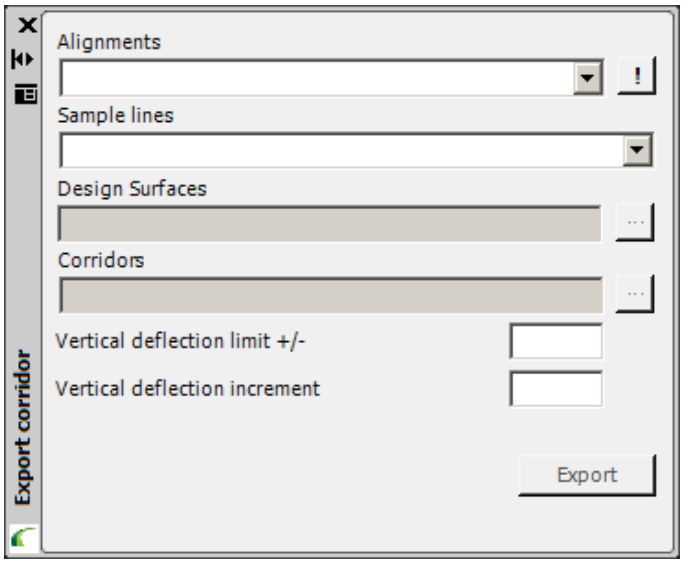

Figure 20: ExportCorridor Panel

Alignments Combobox
The Alignments combo box lets you select a centerline alignment for the corridor.

Sample Lines Combobox
The samples lines combo box let you choose the sample lines group to use.

Design Surfaces Textbox
The Design Surfaces text box will allow you to select surfaces using the "…" button. One or more surfaces can be selected.

Corridors Textbox
The Design Surfaces text box will allow you to select surfaces using the "…" button. One or more surfaces can be selected.

Vertical Deflection Limit
The Vertical deflection limit defines the maximum vertical deflection distance measured from the vertical alignment. See Appendix 2: CSX File for more information.

Vertical Deflection Increment

The Vertical deflection increment" defines the increment for vertical sampling. See Appendix 2: CSX File for more information.

NOTE: The "!" button beside the combo box lets you refresh the content of the combo box after additions and changes the active project.

NOTE: If you close the ExportCorridor panel, it can be reinstated by typing ExportCorridor into the AutoCAD command line.

Usage

In the example below, the limit is set to 10 and the increment to 3.

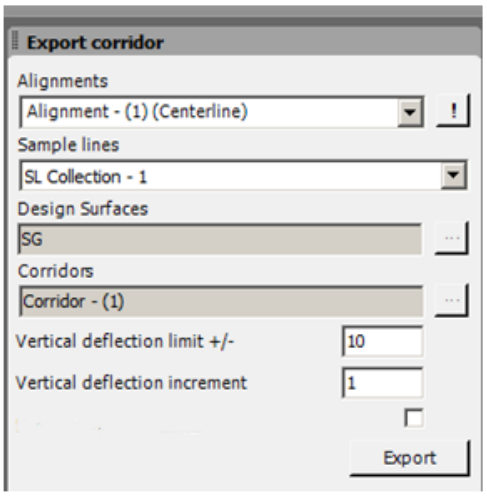

Figure 21: ExportCorridor Example

In this case the limit is not an exact multiple of the increment. ExportCorridor takes care of this by generating increments one step past the limit in both directions. Thus, we will have an export file for these deflections: -12, -9, -6, -3, 0, 3, 6, 9 and 12.

The export files are named based on the source DWG file and are saved in the same folder:

<DWG file>_(<alignment name>)_(LandXML).xml and <DWG file>_(<alignment name>)_(ExportData).CSX.

Appendix 2: CSX File

The *Corridor Sections File* is a 4 dimensional file which captures the geometry and behavior of a cross section template or assembly. It is an XML format file made up of a collection of vertical *Increments,* where each Increment is a vertical offset from an existing alignment (or ground). For each *Increment,* a collection of *Stations* (cross sections or sample lines), where each *Station* contains a collection of *SectionPolylines* and *Shapes*.

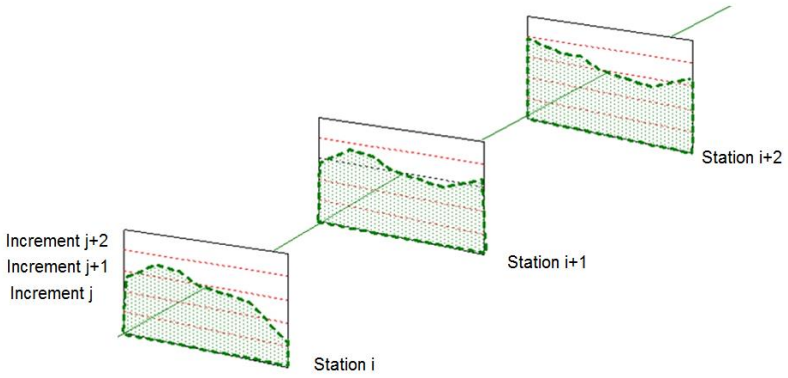

Figure 22: Increments and Stations

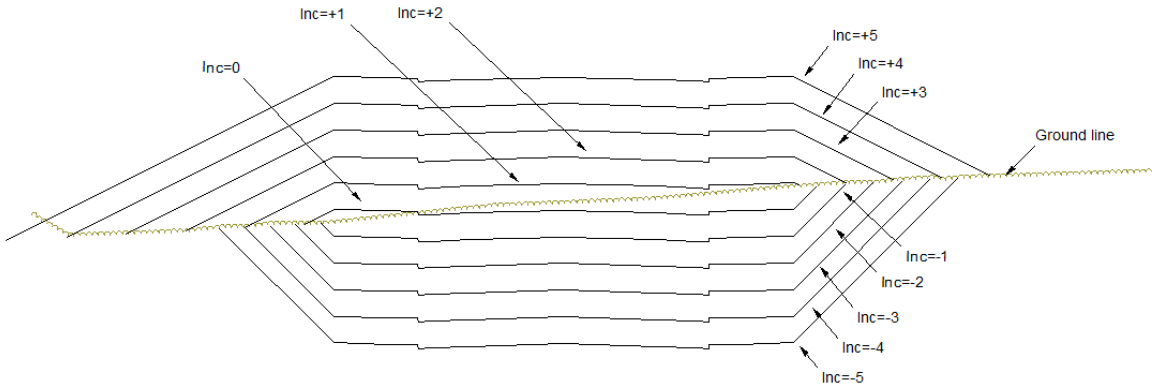

Figure 23: CSX File Single Station Increments

Appendix 3: Auto Extend / Clip Options

Extend Clip Options Dialog Options

These options are applied when a fixed section is moved horizontally or vertically by an alignment change. The last leg in the fixed section is automatically extended until it intersects ground and/or clipped when it cross ground.

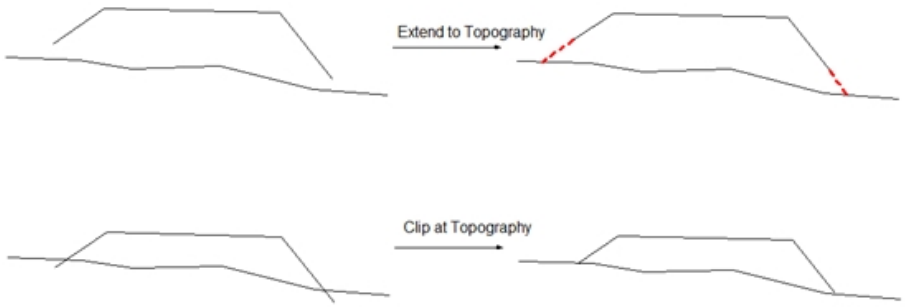

Figure 24: Extend / Clip Options

Maximum extension distance

This is the extension distance ground. It is measured from the start of the last leg (closing leg).

Simplification tolerance

This tolerance is used to remove co-linear points on the last leg before it is extended.

Auto correct Closing

Auto correction is only applied if Extend/Clip (above) fails. The example below illustrates a situation where Auto correct is applied. In this case, the specified cut/fill slopes are applied.

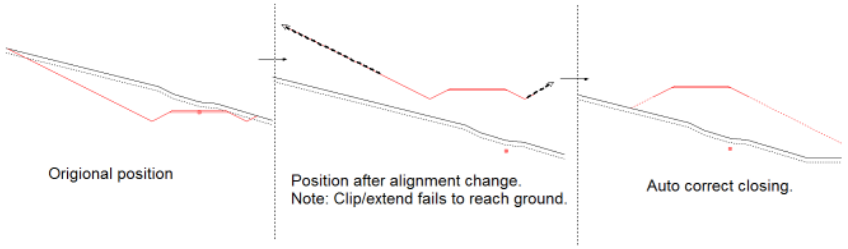

Figure 25: Auto Correct Closing