VDOT GEOPAK Road II Training Manual



Training Manual 2004 Edition





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TABLE OF CONTENTS

Chapter 1: Horizontal Alignments

Chapter Objectives	1-1
Graphical Coordinate Geometry	1-1
Introduction	1-1
Accessing	1-1
Store Elements	1-2
Modify Elements	1-3
Manipulate Elements	1-4
Groups	1-5
Lab Exercise: Graphical COGO	1-6
> Storing an Alignment	1-6
Horizontal Alignment Generator	. 1-10
Introduction	. 1-10
Accessing	. 1-10
Lines / Curves Tools	. 1-11
Curve Combinations Tools	. 1-12
Spiral Combinations Tools	. 1-12
Complex Transitions Tools	. 1-13
Alignment Tools	. 1-13
Manipulate Tools	. 1-13
Lab Exercise: Graphical COGO & Horizontal Alignment Generator	. 1-14
> Storing an Alignment	. 1-14
> Storing the Alignment	
> Reverse Curves	
> Complex Transitions	
PI Alignment Tool	

Chapter 2: Coordinate Geometry

Chapter Objectives	2-1
Introduction	
Accessing COGO	
Coordinate Geometry Preferences	
Point Label Redraw	
Next Available Element	
Expanded Element Names	
1	



Rename Elements	2-4
Change Element	2-4
Database Utilities	2-5
Merge Database	2-6
Navigator User Defined Columns In-Place Editing	2-7 2-7
Export Preferences and Settings	
Parcels	
Occupied Type User Defined Attributes	
Graphical COGO	2-14
Lab Exercise: Entering Parcel Data	2-16
> Parcel Editor	
> Storing Parcel Attributes	2-19
Lab Exercise: Graphical COGO	2-21
 Storing a Right-of-Way Take 	
Lab Exercise: Chain Manipulation	2-23
> Removing Station Equations	
> Including Station Equations	2-26

Chapter 3: Vertical Alignments

Chapter Objectives	3-1
Introduction	3-1
Accessing	
Using the Vertical Alignment Generator	3-2
File	
Tools	-
User	3-3
Creating A New Profile	3-3
Precision Placement Options	3-3
Best Fit Line	3-4
Best Fit Parabola	
Best Fit Profile	
Lab Exercise: Profiles	
> Best Fit Profile	
> Vertical Alignment Generator	
Component Based Profiles	3-10
Introduction	3-10
Accessing	3-10
LAB Exercise: Component Based Profiles	
 Component Based Profiles 	
Draw Profiles	
Introduction	
Accessing	



Tabs	3-14
Surfaces Tab	3-15
Source Data	3-16
COGO Tab	3-17
Projection Tab	3-18
Lab Exercise: Profiles	
> Drawing profiles	
> Plotting Ditches	

Chapter 4: Superelevation

Chapter Objectives	
Introduction	4-1
Accessing Automated Superelevation (AutoShape Input File Maker)	
Draw Shapes into Plan View File	
Superelevation Shape Manager Tools	
Shape Analyst	
Shape Profiler	
Superelevation Preferences	
E Tab	
Runoff Tab	4-11
Tangent Runout Tab	4-12
Adjust Factors Tab	
Distribution Tab	4-13
Rotation Tab	4-14
Reverse Curves Tab	4-14
Compound Curves Tab	4-15
Short Curves Tab	4-16
Superelevation Transition Conflict Resolution	4-16
Lab Exercise: Superelevation Shape Manager Tools	4-17
> Shape Maker	4-17
> Shape Analyst	
> Shape Profiler	
> Shape Properties	

Chapter 5: Cross Sections

Chapter Objectives	5-1
Introduction	5-1
Accessing	5-2
Overview	
Update Options	5-4



Lab Exercis	e: Ancillary Data	5-4
	Mapping Utilities	
	Display Settings	
Tolerance		5-10

Chapter 6: Earthworks

Chapter Objectives	6-1
Introduction	6-1
Accessing	6-1
Earthwork Dialog	6-2
XS DGN File	
Soil Types	6-3
EW Shapes	
Output Format	
Add/Sub Volumes	6-6
Centroid Adjustment	
Skip Areas	
Ignore Areas	6-7
Split Summary Totals	6-8
Sheet Quantities	
Processing	6-9
Lab Exercise: Earthwork	6-42
> Staged Construction and Multiple Roadways	

Chapter 7: Digital Terrain Modeling

Chapter Objectives	7-1
Introduction	7-1
Creating DTM Report	7-1
Report Output	7-2
DTM Prop 3D	7-2
Report Output	
DTM Editing	
Add Vertex	
Delete Vertex	7-4
Move Vertex XY	7-5
Move Vertex Z	7-5
Polygon Move Z	7-6
Delete Line	7-6
Swap Line	7-6
Insert Break Line	7-7
Insert Drape Line	7-7
Delete Triangle	7-8
Delete Line Triangle	7-8
Lab Exercise: Cross Section Reports	7-9
> DTM Proposed 3D	
> Building the TIN File	
> Load DTM Features	
Lab Exercise: TIN Editing	7-12



>	Editing Triangles	7-12
	Adding Break lines	
	Deleting Triangles	

Chapter 8: Labelers

Chapter Objectives	8-1
Introduction	8-1
Accessing The Plan View Labeler	8-1
Plan View Labeling	8-1
Text	8-2
Parameters	8-2
Shape	8-3
Leader	8-3
Rotate	8-4
Styles	8-4
Menus	8-4
Cross Section Labeling	8-7
Accessing The Cross Section View Labeler	8-7
Profile Labeling	8-7
Accessing The Profile View Labeler	
Lab Exercise: Labeling	
> Accessing the Plan Labeler	
> Using Predefined Label Styles	
> Creating and Saving a New Label Style	8-12
> Profile Labeler	8-16

Chapter 9: Active Chain Control

Chapter Objectives	9-1
Introduction	9-1
Accessing Active Chain Control	9-1
Curvilinear Coordinates	9-3
Lab Exercise: Active Chain Control	9-4
> Setting up Chain Control	9-4
> Using Active Chain Control With Profiles	9-5
> Using Active Chain Control With Cross Sections	9-6

Chapter 10: Site Design

Chapter Objectives	10-1
Introduction	10-1
Project Overview	10-2
> Overview the supplied data and design constraints	
Design Strategy	10-4
> Formulate a Design Strategy	10-4



Lab Exerci	se: Create a Construction Object	
>	Open an existing project	
>	Create a Construction Object	
>	Create the construction surface using Composite Section	
Lab Exerci	se: Create the Roundabout Object	
>	Create the Roundabout Object.	
>	Create outside edge of traffic circle element	
>	Create the inside edge of the traffic circle	
Lab Exerci	se: Analyze the Traffic Circle	
>	Using the Analysis>Profile tool	
Lah Exerci	se: Modify the Traffic Circle	
>	Modify the Construction Object	
	se: Create Model Surface Profiles	
>	Open the Site Project Create Model surface profiles	
	se: Creating Design Profiles	
>	Show the 150 feet reconstruction constraint in Plan.	
>	Show the 150 feet reconstruction constraint in Profile	
>	Creating Design Profiles using the Vertical Component tools	
>	Storing the Proposed profile	
>	Determine the extent of reconstruction	
Lab Exerci	se: Create Roadway Surface from Control Alignment	
>	Swap to new DGN and GSF	
Lab Exerci	se: Add the Control Alignment	
>	Add the edge of pavement elements relative to the Control Alignment	
>	Add the curb and gutter sections to the edge of pavement	
>	Add the North Service road	
>	Add the other roads – Service Rd South	
>	Add the other roads – Ramp North	
>	Add the other roads – Ramp South	
Lab Exerci	se: Define the remaining Edge Of Pavement elements	
>	Swap to new DGN and GSF.	
>	Define the Curb Return Elements	
>	Re-define the Curb Return Elements using Edit Profile	
Lab Exerci	se: Add Curb and Gutter Section to Curb Returns	
>	Add Curb and Gutter Section	
Lab Exerci	se: Remove the Current Inside Edge of Traffic Circle	10-50
>	Swap to new DGN and GSF	
>	Remove the inside traffic circle element	
Lah Evoroi	se: Create Complex Center Traffic Island	
	Create the complex center traffic island	
	•	
	se: Create a New Median Object	
>	Swap to new DGN and GSF	
>	Create a Median Object	
>	Drape outside of median onto the RAB Object	
>	Add a Section to the Median Object	10-60





Horizontal Alignments

CHAPTER OBJECTIVES

In this chapter, you will create and store horizontal chains using Graphical Coordinate Geometry tools as well as the component tools within the Horizontal Alignment Generator.

GRAPHICAL COORDINATE GEOMETRY

INTRODUCTION

Graphical Coordinate Geometry is a tool that allows the user to store coordinate geometry elements into the COGO database (GPK file) graphically. Points, curves, lines, spirals, chains, and parcels can be stored, modified, or deleted. The COGO elements can be manipulated by key-in or a click of the mouse and are stored directly into the COGO database.

Note Graphical Coordinate Geometry does not read the exclusive MicroStation graphics.

ACCESSING

Graphical Coordinate Geometry is not accessed from **Project Manager**. It can be invoked by selecting **Applications > GEOPAK ROAD > Geometry > Graphical Coordinate Geometry** or by selecting the **Graphical COGO** icon from the **GEOPAK ROAD** tool frame.



Note A session of COGO must be active.

After Coordinate Geometry is activated and Graphical COGO is selected, the main COGO tool box will appear as shown below.

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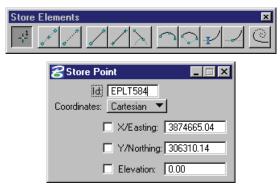
STORE ELEMENTS

The Store Elements tool box contains eleven icons.



As elements are stored, the visualization parameters in the SMD file (as defined in the user preferences) are utilized. This assumes that the temporary or permanent visualization is activated. If no visualization is active, no elements are visualized.

When a **Store Element** command is selected, the Tool Settings dialog opens to allow the user to enter data as shown below.



The Store Elements commands are detailed in the following table.

+1	Store a Point The Store a Point tool enables the user to store points utilizing either Cartesian coordinates (x, y, z or N, E, Z) or Curvilinear (station, offset, elevation).
5** ⁸	Store Equally Spaced Points The Store Equally Spaced Points stores a user-defined number of points between two previously defined points or any two data points. A line drawn between the two previously defined points is not necessary.
****	Locate Point The Locate Point command stores a point based on the distance and direction from a previously defined visualized point.
1	Store Line From Existing Points The Store Line from Existing Points utilizes two previously stored points to store a line.
1	Store Line By 2 Points The store line by two points command requires two new points, rather than existing points. The command stores the line and the new points, utilizing the "next" available point and line names.
$\left \right>$	Store Tangent Line The Store Line Tangent To Element tool stores a line and its two endpoints in the coordinate geometry database.
<u></u>	Store Curve By 3 Points The Store Circular Curve by Three Points tool stores a circular curve (using chord definition). The stationing is set to 0+00 at the P.C. The Radius can be manually typed in or defined dynamically.



\bigcirc	Store Curve By Center This tool enables the user to store a circular curve by defining the center point, radius, and sweep angle.
¥	Store Tangent Curve Constrained The Store a Constrained Tangent Curve tool places a curve tangent to the specified curve or line.
	Store Tangent Curve Unconstrained The Store an Unconstrained Tangent Curve tool places a curve through a specified point tangent to the specified curve or line.
0	Store Tangent Spiral The Store Transition Spiral tool quickly places and visually modifies spirals based on an initial line or curve.

MODIFY ELEMENTS



When a **Modify** command is selected, the Tool Settings dialog opens to allow the user to enter data as shown below.



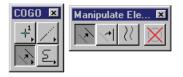
The Modify Elements commands are detailed in the following table.

	Partial Delete The Partial Delete tool enables the user to delete part of a COGO line or curve, creating two separate elements.
/	Extend Plan View Element The Extend Plan View Element tool can extend or shorten any COGO element.
	Trim Elements The Trim Elements tool trims numerous elements to their intersection with another element.
×	Intersect Elements The Compute Intersection of Two Element tool stores a new point by trimming or extending one element to its intersection with another element. Note the two elements remain intact.
×	Extend Element to Intersection The Lengthen or Shorten an Element tool works functionally the same as its MicroStation counterpart.
\sim	Extend Elements to Intersection The Lengthen or Shorten Both Elements tool works functionally the same as its MicroStation counterpart.
	Construct Circular Fillet The Construct a Fillet Between Two Elements tool works functionally the same as its MicroStation counterpart and stores a circular curve between two elements.



\neg	Construct Chamfer The Construct a Chamfer Between Two Elements tool works functionally the same as its MicroStation counterpart and stores a line between two elements. Both the line and two new endpoints are stored in coordinate geometry.
<i>þ</i> e	Cut Element The Cut Elements into Smaller Elements tool cuts elements into segments.

MANIPULATE ELEMENTS



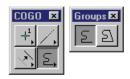
When a **Manipulate** command is selected, a sub pallet will appear to allow the user to enter data as shown below.

8 Move	Plan Element	
💌 Nu	umber of Copies:	1

X	Move Plan View Element The Move a Plan View Element enables the user to move an element or to make copies.
$\checkmark \downarrow$	Rotate Plan View Element The Rotate Plan View Element rotates the selected element about a user-defined point. The Angle may be manually entered and locked, or dynamically changing.
->>	Copy Parallel The Copy Parallel tool works functionally the same as its MicroStation counterpart.
X	Delete Element When using the Delete Element tool, no tool settings dialog opens. Select and accept the element to be deleted. The element is removed from the coordinate geometry database. This tool works with a MicroStation selection set if present.
	<i>Warning</i> There is no undo for this command.



GROUPS



When a **Group** command is selected, the Tool Settings dialog opens to allow the user to enter data as shown below.



The Groups Commands are detailed in the following table.

٤	
---	--

Store Chain

The Store Chain command works in the same manner as the MicroStation Automatic Create Complex Chain with the additional benefit that the chain is automatically stored in the COGO database.



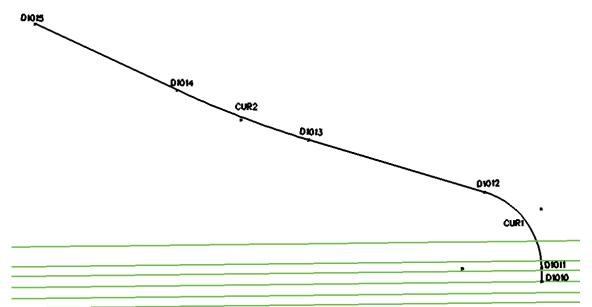
Store Parcel

The Store Parcel tool enables the user to store parcels, takings, easements, and other types of right of way features. It is very similar to the Store Chain tool with many of the same options.



LAB EXERCISE: GRAPHICAL COGO

- > STORING AN ALIGNMENT
 - 1. Open the MicroStation file *c*:*data*\geo\vdot\road2\60843\alignments.dgn.
 - 2. Attach the saved view ALIGN1.
 - 3. We will attempt to store the alignment shown below.



- 4. Access Project Manager and open the project 60843. (Select the user Mary to access).
- 5. Select the Graphical Coordinate Geometry tool by selecting Applications > GEOPAK Road > Geometry > Graphical Coordinate Geometry.



- 6. Select **Permanent Visualization** on the main COGO dialog.
- 7. From the Elements pulldown select Next Available Settings.

<u>P</u> oint	►
Line	►
<u>C</u> urve	►
<u>S</u> piral	►
Chai <u>n</u>	¥
P <u>a</u> rcel	×
Pro <u>f</u> ile	×
Ne <u>x</u> t Available Settings	



8. Enter the settings as shown below.

	名 Next Available Eleme 💶 🗵			
, I	√	Point:	D1010	
		Line:	L1	
		Curve:	CUR1	
		Spiral:	S1	
	◄	Chain:	CHN1	
		Parcel:	PAR1	
		Profile:	PRF1	
			Apply	

9. From the Graphical COGO tool box tear off the tool bar for Store Elements and click on the Store a Point option.



10. Locate point D1010 at station 119+30.36 at a zero offset.

8 Store Point	
ld) [D1010]	
Coordinates: Curvilinear 🔊	•
Chain Id: MAINLINE	. . .
🔽 Station:	119+30.36
🔽 Offset:	0.00
Elevation:	0.00

11. Select the Locate Point option and locate point D1011 at the bearing and distance shown below.

Bearing	S 72 39 19.69 W
Distance	17.29

名 Locate Point 📃 🗖 🗙			
ld: 🔽	01011		
🔽 Distance:	17.29		
Direction:	S 72 39 19.69		
🔲 Offset:			
🗖 Slope			
🔽 Store Line	L1		

12. Use the Store Tangent Curve Constrained tool to place a curve using the settings below.

名 Store Tanger	nt Curve Co 💶 🗖 🗙
ld: CUR1	
🔽 Radius:	100.00
Length	▼ 127.16

13. Select the Store Tangent Line tool to place a line with the bearing and distance shown below.



- Store Tangent Line
 ■
 ×

 Id:
 L2
 ✓

 ✓
 Angle:
 S 0° 12' 1.60''E
 ✓

 ✓
 Length:
 231.16
 ✓

 Truncate:
 None
 ▼
- 14. Use the **Store Tangent Curve Constrained** tool again to place a curve with the settings below.

궁 Store Tangent Curve Co 💶 💌			
ld: CUR2			
Radius: 1200.00			
✓ Length ▼ 176.93			

15. Finally, use the **Store Tangent Line** tool to place a line with the bearing and distance shown below.

名 Store Tan	ngent Line 📃 🔲 🗙	C
Id:	L3	
Angle:	S 8° 14' 50.59'' W	
🔽 Length:	196.65	
Truncate:	None 💌	

16. Now that all of the points, curves and lines have been stored we will store the chain in coordinate geometry. From the **Graphical COGO** tool box click the **Store Chain** tool.



17. Store the chain using the information shown below.

8 Store Chain	_ 🗆 🗵
Id:	CHN1
Begin Station:	10+00
Opposing Element:	Create 💌
Max Gap:	0.100000



18. You should now have a chain matching the description below. Describe the chain and compare to the report.

Eile Edit Element View Lools Image: Solution in the second	
COGO Keyin DESCRIBE CHAIN CHN1	
Point D6000 N 306,961.77 E 3,874,571.08 Sta 10+00	.00
Course from D6000 to D1011 S 72° 39' 19.69" W Dist 17.29	
Point D1011 N 306,956.61 E 3,874,554.57 Sta 10+17	. 29
Course from D1011 to PC CUR1 S 72° 38' 56.50" W Dist 0.00	
Curve Data	
Curve CUR1 P.I. Station 10+91.10 N 306,934.61 E 3,874,4 Delta = 72°51°26.33"(LT) Degree = 57°17'44.81" Tangent = 73.80 Length = 127.16 Radius = 100.00 External = 24.29 Long Chord = 118.76 Mid. Ord. = 19.54	R
P.C. Station 10+17.29 N 306,956.61 E 3,874,5 P.T. Station 11+44.45 N 306,860.81 E 3,874,4 C.C. N 306,861.16 E 3,874,5 Back = S 72° 39' 19.69" W Ahead = S 0° 12' 06.64" E Chord Bear = S 36° 13' 36.52" W Course from PT CUR1 to D1012 N 0° 11' 59.91" W Dist 0.00	.84.38
Point D1012 N 306,860.81 E 3,874,484.38 Sta 11+44	46
Course from D1012 to PC CUR2 S 0° 12' 01.60" E Dist 231.16	
Curve Data	
** Curve CUR2 P.I. Station 14+64.25 N 306,541.02 E 3,874,4 Delta = 8° 26' 52.03" (RT) Degree = 4° 46' 28.73" Tangent = 88.63 Length = 176.93 Radius = 1,200.00	85.50
External = 3.27 Long Chord = 176.77 Mid. Ord. = 3.26 P.C. Station 13+75.62 N 306,629.65 E 3,874,4 P.T. Station 15+52.55 N 306,453.31 E 3,874,4 C.C. N 306,625.45 E 3,873,2 Back = S 0° 12' 01.60" E Ahead = S 8° 14' 50.42" W Chord Bear = S 4° 01' 24.41" W	85.19 72.79 85.20
Course from FT CUR2 to D1015 S 8° 14' 50.59" W Dist 196.65	
Point D1015 N 306,258.70 E 3,874,444.58 Sta 17+49	. 20



HORIZONTAL ALIGNMENT GENERATOR

INTRODUCTION

The **Horizontal Layout** tools enable the user to create or modify horizontal geometry (using numerous tools) including placing spirals, curves, tapers, specified bearings and curves, complex ramp loops and connectors, and all using user-defined parameters.

Note A session of COGO must be active.

ACCESSING

Clicking **Horizontal Alignment** from the Road Project: Road1.prj dialog within Project Manager opens the tool frame shown below.

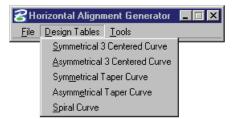
ВНо	orizontal Aligna	nent Generator	
<u>F</u> ile	<u>D</u> esign Tables	<u>T</u> ools	

When **File > Preferences** is selected, the Preferences dialog appears and allows the user to set certain preferences.

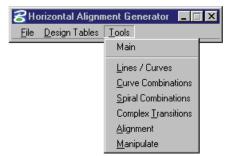
Category Element Symbology COGO Element Names Curve Design Tables Spiral Design Tables Turning Paths PI Alignment Display PI Alignment Design Parameter Formats Dynamic Increments	└ine Element : └urve Element : Spiral Element : Construction Line : Label Scale : 1.00 Grouping : Graphic Group ▼



The **Design Tables** option allows the user to set up design tables for Symmetrical 3 Centered Curves, Asymmetrical 3 Centered Curves, Symmetrical Taper Curves, Asymmetrical Taper Curves, and Spiral Curves. These files are stored in an ASCII format.



The **Tools** option allows the user to open the Main dialog or any of the dialogs needed to store a horizontal alignment.



Values within the dialogs dynamically change simultaneously with dynamic graphic modifications.

Note Spiral and compound curve commands do not support dynamic manipulation.

LINES / CURVES TOOLS

Lines / Cu	ITYES	×
\checkmark	うつくじ	ి

The Lines / Curves commands are detailed in the following table.

1	Store Line By 2 Points The store line by two points command generates two new points and a new line. The command draws the line and the new points.
\mathbf{k}	Store Tangent Line The Store Tangent Line tool stores a line and its two endpoints in the coordinate geometry database.
\sim	Store Curve By 3 Points The Store Circular Curve by Three Points tool stores a circular curve (using chord definition).
0	Store Curve By Center This tool enables the user to store a circular curve by defining the center point, radius, and sweep angle.
1	Store Tangent Curve Unconstrained The Store an Unconstrained Tangent Curve tool places a curve through a specified point tangent to the specified curve or line.
-	Place Simple Curve This tool enables the user to store a circular curve. Options include offsets, truncate,



	and the ability to modify once the first curve is displayed.
80	Place Simple Transition
	This tool enables the user to draw a transition element between two arcs. Options for the Transition element include: Tangent, Curve, or Spiral. As the Transition option is changed, the dialog dynamically changes to reflect the selection.

CURVE COMBINATIONS TOOLS



The Curve Combinations commands are detailed in the following table.

F	Place Turning Paths This tool enables the user to draw turning paths.
	Place Compound Curves This tool enables the user to draw a compound curve between two elements.
	Place Three Centered Curves This tool enables the user to draw a three-centered curve between two elements. The Design Vehicles group enables the user to select the desired vehicle, based on the data from files stored in the User Preferences.
	Place Taper Curves This tool enables the user to draw taper curves between two elements. The Design Vehicles group enables the user to select the desired vehicle, based on the data from files stored in the User Preferences.
	Place Reverse Curves This tool enables the user to store reverse curves between two elements. An option is supported for an intermediate user-defined Tangent Length.

SPIRAL COMBINATIONS TOOLS

Spiral Combinations 🛛 💌			×	
<u>ি</u> গি	े	N	°O	ୈ

1	Place SC Tangent To Line This tool enables the user to store a spiral / curve combination tangent to a line.
Ċ	Place ST Tangent To Curve This tool enables the user to store a spiral / tangent combination tangent to a curve.
૾ૻ	Place SC Tangent To Curve This tool enables the user to store a compound spiral / curve combination tangent to a curve.
7	Place SCS (Intersecting Elements) This tool enables the user to store a spiral / curve combination tangent to a line. The Design Table enables the user to select the desired Design Speed / Lanes and Degree based on the data from files stored in the User Preferences.
00	Place STS (Disjoint Curves) This tool enables the user to store a spiral tangent spiral combination tangent between two elements.





Place SCS (Disjoint Curves)

This tool stores a spiral curve spiral combination between two curves. Note the tool also works with overlapping curves. The Design Table enables the user to select the desired Design Speed / Lanes and Degree or Radius based on the data from files stored in the User Preferences.

COMPLEX TRANSITIONS TOOLS



Þ	Place Complex Ramp This versatile tool enables the user to draw simple to complex ramp geometry.
2.	Place Ramp Connector This versatile tool enables the user to draw simple to complex ramp connectors, with a variety of options.

ALIGNMENT TOOLS



9	Place Dynamic Alignment The first Alignment tool is used to place a dynamic alignment. You initially select and accept a beginning element. By moving the cursor, the length of curve and dynamic ahead element change. Continue placing data points to create curves and intermediate tangents. At any time during the process, the Entry Radius may be changed. Any subsequent curves are placed with the revised Radius.
?	Place PI Alignment The second Alignment tool is used to place a PI based alignment.
٤	Store Chain The third Alignment tool is used to store a chain comprised of graphical elements. This works similar to Automatic Create Complex Chain, while the chains are automatically being stored into the COGO database file.

MANIPULATE TOOLS

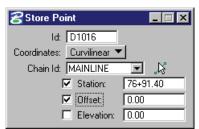
Mani	pulate	e	×
X	∖ ≁I	/	\times



×	Move Plan View Element The Move a Plan View Element enables the user to move / translate an element or to make copies.
. 🖂	Rotate Plan View Element The Rotate Plan View Element rotates the selected element about a user-defined point. The Angle may be manually entered and locked, or dynamically changed.
1	Extend Plan View Element The Extend Plan View Element tool can extend or shorten any element.
×	Delete Element When using the Delete Element tool, no tool settings dialog opens. Select and accept the element to be deleted. The element is removed from the coordinate geometry database. This tool works with a MicroStation selection set if present. Warning: there is no undo for this command.

LAB EXERCISE: GRAPHICAL COGO & HORIZONTAL ALIGNMENT GENERATOR

- > STORING AN ALIGNMENT
 - 1. Open the MicroStation file *c*:*data*\geo\vdot\road2\60843\alignments.dgn.
 - 2. Attach the saved view *ALIGN2*.
 - 3. Access **Project Manager** and open the project *60843*. (Select the user *Mary* to access)
 - 4. Access Graphical COGO and the Horizontal Alignment Generator.
 - 5. Begin by locating point D1016 at station 76+91.40 on the MAINLNE at a zero offset.
 - *Note* Use Graphical COGO to locate the point



6. Next from the **Horizontal Alignment** tools select the option **Store Line by 2 Points** and enter the information shown below. The beginning point will be point D1016 that we previously stored.

名 Store Line by 2 Points 🔳 🔲 🗙			
☑	Angle:	N 69° 30' 21.49'' E	
◄	Length:	679.06	

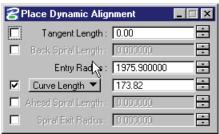
 Once the line has been placed select the tool to place a Dynamic Alignment from the Alignments tool bar. *Horizontal Alignment > Tools > Alignment*



8. Begin by data pointing on the tangent line we drew in the previous step.



9. Enter the information into dialog to control the placement of the alignment.



- 10. Data point again to store the curve.
- 11. Now enter the tangent length to place the final tangent line.

8 P	궁 Place Dynamic Alignment 📃 🔲 🗙				
☑	Tangent Length :	57.11	÷		
	Back Spiral Length :	0.000000	÷		
	Entry Radius :	1975.900000	÷		
	Curve Length 💌	12396.11	÷		
	Ahead Spiral Length :	0.000000	÷		
ΠŅ	Spiral Exit Radius :	0.000000	÷		

- **12**. Data point to place the tangent.
- 13. Right click the mouse to exit the alignment.



- > STORING THE ALIGNMENT
- 1. Select the **Store Chain** tool from the **Alignments** tool bar.

Alignment		×
ଚ	จำ	٤

2. Enter the information below and then data point on the alignment to store the chain in coordinate geometry.

名 Store Chain	
ld	CHN2
Begin Station:	10+00
Opposing Element:	Create 💌
Max Gap:	0.100000

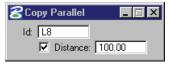
3. Review the chain description in coordinate geometry.

궁 Coordinate Geometry Job: 101 Operator: m w	. 🗆 X
Image: Contract of the second sec	
COGO Key-in DESCRIBE CHAIN CHN2	•
Chain CHN2 contains: D1019 CUR C2 D1022	•
Beginning chain CHN2 description	
Point D1019 N 302,915.56 E 3,875,834.80 Sta 10+00.00	
Course from D1019 to PC C2 N 69° 30' 21.49" E Dist 679.06	
Curve Data	
Curve C2 P.I. Station 17+66.03 N 303,183.75 E 3,876,552.34 Delta = 5° 02' 25.12" (LT) Degree = 2° 53' 59.03"	
Tangent = 86.97	
P.C. Station 16+79.06 N 303,153.30 E 3,876,470.88	
P.T. Station 18+52.88 N 303,221.24 E 3,876,630.81 C.C. N 305,004.15 E 3,875,779.10 Back = N 69° 30' 21.49" E 305,004.15 E 3,875,779.10 Back = N 64° 27' 56.37" E Chord Bear = N 66° 59' 08.93" E	
Course from PT C2 to D1022 N 64° 27' 56.37" E Dist 57.11	
Point D1022 N 303,245.86 E 3,876,682.34 Sta 19+09.99	
Ending chain CHN2 description	▼



> **REVERSE CURVES**

1. Select the **Copy Parallel** tool from the **Graphical COGO** tool bar and copy the tangent portion of CHN2 100' to the left side.



2. Next select the Place Reverse Curves from the Curve Combinations tool bar.



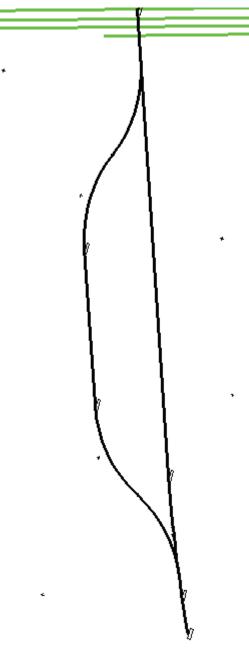
3. Enter the radius information in the dialog shown below and select the 2 tangent lines. Be sure to truncate the correct tangent.

2 Place Reverse Curves	_ 🗆 ×
🔲 Length 🔻 338.01	
Entry Radius : 200.000000	
Tangent Length : 0.000000	
Exit Radius : 200.000000	*
Loop (Exterior Construction)	
Truncate : Back 💌	

4. Change the truncate option to **Ahead** and repeat the process tying into the curve on the original alignment *CHN2*.



5. You should end up with a detour similar to the one shown below.



6. Use the Store Chain tool to store the chain into coordinate geometry.

名 Store Chain	
ld:	CHN3
Begin Station:	10+00
Opposing Element:	Transpose 💌
Max Gap:	0.100000



- > **COMPLEX TRANSITIONS**
- 1. From the MicroStation dropdown menu select Utilities > Saved Views.
- 2. Select *ALIGN3* then click **Apply**.
- 3. Dismiss the Saved Views dialog by clicking the X in the upper right corner.
- 4. Select the **Preference** pulldown and set the Element Names as shown below.

8 Preferences		×
Category Element Symbology COGO Element Names Curve Design Tables Spiral Design Tables Turning Paths PI Alignment Display PI Alignment Design Parameter Formats Dynamic Increments	 Save as COGO Elements Beginning Element Names Point : RAMPA1 Line : RAMPA Curve : RAMPA Spiral : RAMPA 	

5. Select the **Tools > Complex Transitions** pulldown to access the following menu bar.

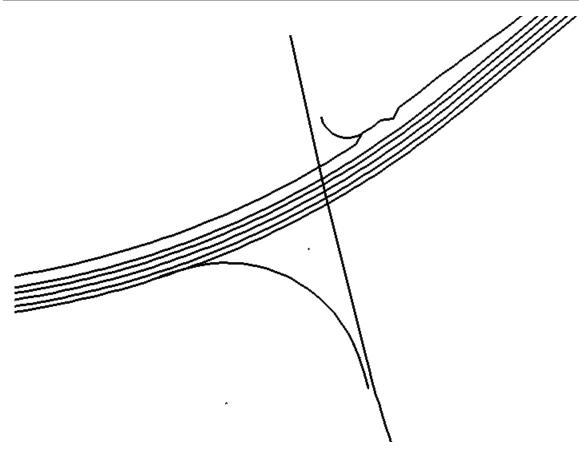


6. Select the first of the two icons to access the Place Complex Ramp dialog. Populate the dialog as shown below.

名 Place Complex Ramp 📃 🗆 🗙
Back Element(s)
Back Offset : 24.000000
Taper Length : 0.000000 🗮 Hatio : 0.000000 🗮
☑ Spiral ▼ Length ▼ 100.000(÷ Radius : 0.000000 ÷
Intermediate Curve Radius : 300.000000 👻 🖨 Ahead Element(s) V Spiral V Length V 100.0000 👻 Radius : 0.000000 🐳 Taper Length : 0.000000 👻 Ratio : 0.000000 🐳 V Ahead Offset : 12.000000 👻
Truncate : None Loop (Exterior Construction)

- 7. Use your cursor to ID chain **MAINLINE** with a datapoint, then issue another datapoint to accept it.
- 8. Next, use your cursor again to ID chain **WOLFTRAP** with a datapoint. The ramp will now dynamically visualize.
- 9. Issue a datapoint in the southwest quadrant to store the ramp as shown in the following diagram.





10. Change the toggle on the dialog to **Loop (Exterior Construction)**.

2 Place Complex Ramp 📃 🗖 🗙
Back Element(s)
Mack Offset : 24.000000
🔲 Taper Length : 0.000000 🖶 Ratio : 0.000000 🖶
☑ Spiral ▼ Length ▼ 100.0000 🖶 Radius : 0.000000 ਦ
Intermediate Curve Radius : 🛛 300.0000000 🚍 🖴
Ahead Element(s)
☑ Spiral ▼ Length ▼ 100.0000 ÷ Radius : 0.000000 ÷
🗖 Taper Length : 0.000000 🚔 Ratio : 0.000000 🚔
Ahead Offset : 12.000000
Truncate : None 💌 🔽 Loop (Exterior Construction)

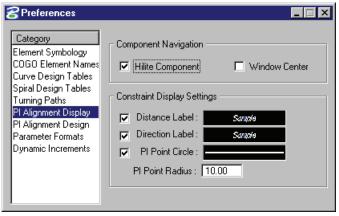


- 11. Using the technique in the previous steps place the loop in the SE quadrant of the intersection.

12. Close the Complex Transitions dialog.

> **PI ALIGNMENT TOOL**

- 1. Attached the saved view *ALIGN4*.
- 2. Select File > Preferences form the main Horizontal Alignment tool bar.
- 3. Set the preferences for **PI Alignment Display**.



4. Next make the following settings for the **PI Alignment Design**.



8 Preferences	
Category Element Symbology COGO Element Names Curve Design Tables Spiral Design Tables Turning Paths PI Alignment Display PI Alignment Design Parameter Formats Dynamic Increments	✓ Superelevation Design Superelevation Preferences Directory C:\Program Files\Bentley\geopak273\bin\ Preference Selection : e Selection : 4% e max Normal Crown % Slope : -2.00 Design Speed : 50.00

- *Note* The path to the Superelevation Preference Directory may vary depending on location of superelevation preferences.
- 5. Change the COGO Element Names to match the dialog below.

Preferences		_ 🗆 ×
Category Element Symbology COGO Element Names Curve Design Tables Spiral Design Tables Turning Paths PI Alignment Display PI Alignment Design Parameter Formats Dynamic Increments	 ✓ Save as COGO Elements Beginning Element Names ✓ Point : D110 Line : ✓ Curve C1 ✓ Spiral : 	

- 6. Close the Preference dialog.
- 7. From the **Tools** pulldown select the **Alignment** tool.





8. Click the middle icon to open the **PI Alignment** tool.

名 Place Pl A	lignment								- 🗆 🗵
<select></select>	- 🔊 📩			x 🖸 📩 🤝	< P Ca				
PIX	PLY	Station	Distance	Direction	Ls1	Radius	Ls2	Speed	е
•									►

- 9. Click the icon to Load Graphic Element To Table.
- 10. Data point on graphic and follow prompts to load.
- 11. This will place the geometry into the table for editing.

K Select> Image: Select>	e
	е
3875840.0470 302898.7430 +00.00 0.0000 0.0000 50	
283.5169 S 72° 57' 39.48''W	
3875568.9750 302815.6660 12+83.52 0.0000 930.0000 0.0000 50	4.0
428.9789 S 82* 44'51.61''W	
3875143.4280 302761.5120 17+12.11 0.0000 0.0000 0.0000 50	

- 12. Click on the curve radius and change it to 1000'.
- 13. Click on the icon to save the alignment and key in the information below.

Save Chain As				
Chain : ORI/	ANA_ALT_2			
Begin Station: 10+00.00				
<u>D</u> K Cancel				

- 14. Click OK.
- 15. Exit MicroStation.







Coordinate Geometry

CHAPTER OBJECTIVES

In this chapter, you will create and store parcel data using **Parcel Editor in COGO** as well as **Graphical Coordinate Geometry** tools.

INTRODUCTION

The Coordinate Geometry database file (*.GPK file) is comprised of stored geometric elements such as points, lines, curves, spirals, chains, parcels and profiles. When COGO calculations are completed, the results are stored in the binary database file, which is then utilized throughout the design process with many other applications.

ACCESSING COGO

When Coordinate Geometry is started, the Start-Up dialog appears.

Coordinate Geometry				
Project Name:				
Job:	Q			
Operator Code:				
Subject:				
ОК	Cancel			

Project Name	Name displayed on reports. This is an optional entry, with a maximum of 60 alphanumeric characters. If Project Manager is active, this field is populated automatically.
Job Number	Identifies coordinate geometry database file and is a required field. The job number is a maximum of three alphanumeric characters. If Project Manager is active, this field populated automatically. This field is required.
Operator Code	Unique 2-character code which enables multiple users access to database file. The user's initials are suggested. Note this field is not required for single user access, but highly recommended. If Project Manager is active, this field is populated automatically.
Subject	Description of coordinate geometry work (could relate to the project) with a maximum of 48 alphanumeric characters. This field is optional.

After the dialog is populated and OK is clicked, the main coordinate geometry dialog is invoked.

Note If Project Manager is open the COGO login dialog will not appear.



COORDINATE GEOMETRY PREFERENCES

Two options have been enhanced on the Feature Preference portion of Coordinate Geometry. The preference dialog is now made up of four optional settings in addition to the smd selection. This dialog can be accessed from **Applications > GEOPAK Road > User Preferences**. The options include:

- Apply Best Match feature
- Use Shared Cells
- Plot Scale
- Point Label Redraw

8 Feature Preferences		
Feature Database: D:\win	32app\geopak8.8\bin\defa	ult.smd 🔍 🖻
🔽 Apply Best Match Featu	ire 💦 Plot Scale: 🚺 10	0.0000
🔲 Use Shared Cells	Point Label Redraw	tion by SMD Settings 🛛 💌
OK		Cancel

The options for **Use Shared Cells** and **Point Label Redraw** add new functionality and control over how features are displayed when storing or re-visualizing in COGO.

Using the Use Shared Cells option will place features identified by cells by using the shared cell functionality of MicroStation.

The first time you place a cell with **Use Shared Cells** on, the shared cell definition (elements comprising the cell) is stored in the DGN file in much the same way as it is stored in the cell library. To place subsequent instances of the shared cell, the cell library does not need to be attached. In other words, a shared cell can have many instances in a DGN but only one definition.

For an unshared cell, on the other hand, the library definition is stored in the DGN file each time the cell is placed. Using shared cells can therefore be a way to reduce DGN file size. The reduction is greatest in files with cells that have a large number of component elements and/or instances.

The use of shared cells is recommended for these reasons:

- Shared cells are faster to place and manipulate than unshared cells. The first time a cell is placed in the DGN file, the cell library in which it is stored must be attached. If the cell is placed as a shared cell, it is not necessary to have the cell library attached to place additional instances of that cell.
- All instances of a shared cell in the DGN file are replaced when any instance of that shared cell is replaced.
- Shared cells usually reduce DGN file size, thereby improving performance.

POINT LABEL REDRAW

The **Pont Label Redraw** option that has been added to the user preferences allows control over how point labels are displayed in relation to a point symbol when visualized or redrawn.

8 Feature Preferences		_ 🗆 🗵
Feature Database: D:\w	iin32app\geopak8.8\bin'	\default.smd 🔍 🖻
🔽 Apply Best Match Fea	ture Plot Scale:	100.0000
🔲 Use Shared Cells	Point Label Redraw:	Position by SMD Settings
		Position Relative to Symbol
OK		L'ancel



Position by SMD Settings - the label is drawn with parameters defined within the specified survey database (SMD) when the map is redrawn.

Position relative to symbol – the user can move the point name, elevation, etc. using MicroStation tools and if the data is remapped the labels will retain their same position relative to the point symbol at the new mapped position.

NEXT AVAILABLE ELEMENT

In the main COGO dialog there is now an option to provide user input for the next available element names. This is located under the Element pulldown.

웅 Coord	inate Geon	netry	Job: 1	Operator:
<u>F</u> ile <u>E</u> o	it E <u>l</u> ement	<u>V</u> iew	<u>T</u> ools	
₩ %				kable Visualization
	<u>39. S</u> piral			• « < > >>
COGO Ke				
	P <u>a</u> rcel			
	Pro <u>fi</u> le			•
	Ne <u>x</u> t A	vailable	Settings	

Once accessed the following dialog appears allowing the user to key-in the desired names to begin storing COGO elements.

名 Next Available Eleme 🔳 🖬 🗙				
	Point:	1		
	Line:	L1		
	Curve:	C1		
	Spiral:	S1		
	Chain:	CHN1		
	Parcel:	PAR1		
	Profile:	PRF1		
		Apply		

EXPANDED ELEMENT NAMES

A major enhancement to the coordinate geometry database is the ability to accept expanded element names. Each element type in coordinate geometry will now accept up to 15 characters for the associated name.



8 Coordinate Geometry Job: 1 Operator:
<u>File E</u> dit E <u>l</u> ement <u>V</u> iew <u>T</u> ools
Image: Constraint of the state of the st
<u>E</u> dit <u>99.1234</u> ▼ <u>9^99.12</u> ▼ << < > >>
COGO Key-in DESCRIBE CHAIN SERVICEROADEAST
<* 1 DESCRIBE CHAIN SERVICEROADEAST
Chain SERVICEROADEAST contains: 1000 CUR I95-1 CUR I95-2 1001
Beginning chain SERVICEROADEAST description

This standardization includes all elements that can be stored in coordinate geometry and applies across all dialogs.

RENAME ELEMENTS

A new command has been added to facilitate renaming of COGO elements. The command structure is listed below.

RENAME element type oldname newname

Example: RENAME CURVE a12 a13

Note The RENAME operation may be done inside Navigator as an in-place edit operation to the name column.

When renaming an element inside COGO Navigator it is simply a matter of clicking on the desired element name and keying in a new name.

8Navigator(1)	_ 🗆 🗵
Select Tools	
📉 🗙 📑 📩 🔁 💦	
Element : Chain 💌	
Name	
SERVICEROADEAST	
•	F

CHANGE ELEMENT

Similar to the rename command new functionality has been added in order to change elements within COGO. The command structure is listed below.

CHANGE elementType elementName parameterName parameterValue

Examples:

CHANGE POINT name X newValue

CHANGE POINT name Y newValue



CHANGE POINT name Z newValue

CHANGE POINT name FEATURE newValue

CHANGE POINT name DESCRIPTION newValue

CHANGE POINT name STATION newValue

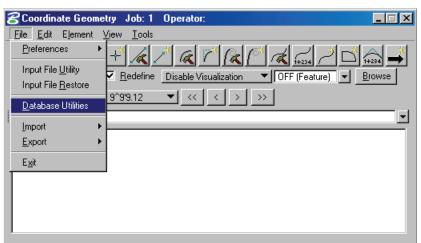
Note The CHANGE operation may be done inside Navigator as an in-place edit operation to the appropriate column.

When changing an element inside COGO Navigator it is simply a matter of clicking on the desired filed in the desired column and providing the desired change.

🖁 Navigato	or(1)							
Select Too	ols							
× × E	🚹 📥 🗎) 🖓						
Element : C	urve 🔻							
Name	P.C. Station	P.T. Station	P.I. Station	Tangent	Length	Radius	Delta	Degree of Curv (
95-1	31+86.23	48+78.66	40+55.63	869.3980	1692.4338	3000.0000	32* 19' 23.1	1* 54' 35.49"
95-2	55+28.38	61+96.83	58+68.25	339.8674	668.4485	1500.0000	25° 31' 58.2	3* 49' 10.99''
•								Þ

DATABASE UTILITIES

New database utilities have been provided in order to make it easier to validate, clean and compress the gpk file. These tools can be accessed from the File pulldown on the main Coordinate Geometry dialog.



When accessed, the following dialog will appear that contains a field for the job number and two buttons that will perform the desired operation.





Validate – Looks for problems and errors in the GPK database and reports findings. Does not attempt to clean or compress the database.

Coordinate Geometry Job: 1	Operator:	_ 🗆 🗵
<u>File E</u> dit E <u>l</u> ement <u>V</u> iew <u>T</u> ools		
	Disable Visualization V DFF (Feature)	
<u>E</u> dit <u>99.1234</u> ▼ <u>9^9'9.12</u>	▼ << < > >>	
COGO Key-in: DATABASE VALIDAT	E	•
<* 3 DATABASE	VALIDATE	
Database: c:\data\geo\ Version: 1998	road1∖job1.gpk	
Record Type	Count	
Points	2	
Chains	1	
Curves	2	
Total	5	-

Clean and Compress - Rebuilds and compresses the GPK database.

8 Coordinate Geometry Job: 1 Operator:	×
<u>F</u> ile <u>E</u> dit E <u>l</u> ement <u>V</u> iew <u>T</u> ools	
🗱 🧩 😶 🖉 🖻 Redefine Disable Visualization 🔻 OFF (Feature) 💌 Browse	
<u>Edit 99.1234 ▼ 9^9'9.12</u> ▼ << < > >>	
COGO Key-in: DATABASE CLEAN	-
	-
<* 2 DATABASE CLEAN	
Rebuild Database: c:\data\geo\road1\job1.gpk Record Type Count	
 Chain 1	
Curve 2	1
Points 2	
Total 5	
The database has been rebuilt/compressed as requested	4
· · ·	-

Both of these commands work similar to the previous key-in of *Rebuild Database*.

MERGE DATABASE

Another valuable tool that has been added to coordinate geometry is the ability to merge another gpk into the existing one. This option is located under the File > Import pulldown.



8 Coordinate Geom	etry Job: 1 Operator:	
File Edit Element Preferences Input File Utility Input File Restore Database Utilities	View Iools +	
Import	<u>G</u> PK File <u>A</u> SCII Points <u>S</u> DMS Alignments and Points <u>L</u> andXML 1.0 Geometry <u>B</u> DS <u>V</u> DOT PLT File	

The subsequent dialog will allow the selection of a secondary gpk database to import directly into the open gpk.

8 Merge GP 🔳 🛛 🗙
Job:
Merge

Note If REDEFINE is turned off there will be no risk of overwriting elements in the open gpk.

NAVIGATOR

Many new options and functionalities have been added to the coordinate geometry navigator. These include:

- User Defined Column Headers
- In-Place Editing
- Export Preferences
- Import Preferences
- Row Selection

USER DEFINED COLUMNS

User defined column headers allow the user to customize the types of column the navigator displays. By right clicking on the column headers a list is provided that controls what is displayed. The list of available headers is dictated by the toggle for element type. For example when the element type is set to Parcel then the header options are parcel specific.



8 Navigator(1)		- I X
Select Tools		
📉 🗙 📑 id 📥 🖹 🔊		
Element : Parcel 💌		
Name Description Type	✓ Name	Area
	 Description 	
	🖌 Туре	
	 Parent Tract 	
	🖌 Area	
	✓ Select	
	✓ Feature	
	✓ Owner	
	Show <u>A</u> ll	
	<u>L</u> ist	
•	<u>D</u> efault Order	F

When the element toggle is set to curves, likewise all header options are curve related.

8 Navigator(_ 🗆 🗙
Select Tools						
🦎 🗙 🛃	id 📥 🗎	⊳ ₽				
Element : Cur	ve 🔻					
Name	P.C. Station	P.T. Station	i 🗸	Name	ht	Length
195-1	31+86.23	48+78.66	~	P.C. Station	80	1692.43
195-2	55+28.38	61+96.83	~	P.T. Station	74	668.448
			~	P.I. Station		
			~	Tangent		
			~	Length		
			~	Radius		
			~	Delta		
			~	Degree of Curve		
			~	е		
			~	Feature		
			~	Select		▶
			~	Description		
			~	V		
				Show <u>A</u> ll		
				<u>L</u> ist		
				<u>D</u> efault Order		

Columns may be moved in the display by selecting the column and sliding to the location on the dialog where it is preferred.

IN-PLACE EDITING

All of the options in the Navigator will now support In-Place editing of values. This just requires a simple click on the value to be changed and then keying in the desired change. In the case of a curve name you click on the existing curve name and simply type over with the new name.



Id Image: Second station Element : Curve Name P.C. Station P.I. Station Tangent Length	Navigator(1 Select Tools)				
Name P.C. Station P.T. Station P.I. Station Tangent Length	× × 🗗	id 📥 🗎) \			
	Element : Curv	/e 🔻				
	Name	P.C. Station	P.T. Station	P.I. Station	Tangent	Length
NEWNAME 31+86.23 48+78.66 40+55.63 869.3980 1692.4338	NEWNAME	31+86.23	48+78.66	40+55.63	869.3980	1692.4338
95-2 55+28.38 61+96.83 58+68.25 339.8674 668.4485	95-2	55+28.38	61+96.83	58+68.25	339.8674	668.4485

EXPORT PREFERENCES AND SETTINGS

In order to save preferences of navigator, two new options have been added to the Tools pulldown. These are **Export Preferences** and **Export Settings**.

Export Preferences - allows the user to create and save a user defined preference file for exporting data to a csv file. The desired item in the Data column is highlighted then added to the Selected Data column using the arrows in the center of the dialog. Once all the desired data has been added, a Format Name and Format Description are provided and the file can be saved.

Multiple Format Names can be added to the same file to be used for selection when exporting.

8 Export Preferences - default.epf		_ 🗆 🗵
File		
Format Name: Curve	Format Description: Curve Data	
Data	Selected Data	
Degree	Name	
Tangent	Description	
Length	Name Description Delta Degree	
Radius	Degree	
External		
Long Chord	Radius Length	
Middle Ordinate	Length	
Back Tangent Direction		
- General Format	- Data Format	
Document Extension: csv	Prefix: Decimals:	2 🔻
Separator Character: Comma 💌	Suffix:	
Apply Special Delimiter:		
🔽 Write Column Heading		



8 Export Selection		
Output File Name:	C:\data\geo\road1\curve.csv	
Export Preferences File Name:	C:\data\geo\road1\curve.epf	
Format Name:	Curve	
Format Description:	Untitled-1	
	Append Data to Existing Output File	
	Apply Close	

Export Selection – allows exporting data using a previously defined preference file.

This option requires that the desired elements in the COGO Navigator be selected or highlighted prior to executing. Each element highlighted or selected will be exported to the selected csv file.

Select Tools X Id Im Im <th></th> <th></th> <th></th>			
Description Name	Select	Northing	Eastii
1000		599674,6130	2457
1001		604809.2070	2462
1002	 ✓ 	600110.0216	2457
1003	 ✓ 	600110.0216	2457
1004		600175.9698	2457
1005	 	600179.1159	2457
-			F

PARCELS

The parcel interface and additional attributes have been greatly enhanced with version 8.8. Enhancements include:

- Additional Occupied Type
- User Defined Attributes
- Interface Modifications

OCCUPIED TYPE

8 Store Parcel From Elements	
Parcel Name:	
Occupied 🔽	
Element List:	

The new occupied type can be added to a parcel to represent a portion of a parcel that is set aside for something such as an inhabited area. This would then be reflected in area totals where a right-of-way taking has occurred and it overlaps a portion of a parcel designated as occupied. The resulting areas would be indicated as shown below:



Parcels

Total occupied area:	59542.65531 m ² =	5.95427 ha =	14.71325 a
Occupied in taken area:	58519.61057 m ² =	= 5.85196 ha =	= 14.46045 a
Net taken area:	$23754.67123 m^2 = 2$	2.37547 ha =	5.86988 a

USER DEFINED ATTRIBUTES

Functionality has been added to the parcel element type to attach user defined attributes. These can include any information that the user wishes to associate with a parcel such as address, deed books, etc.

The command line syntax for adding attributes to parcels is shown below.

Maximum attribute name length = 24 and string size = 256

STORE ATTRIBUTE elementType elementName PARCEL parcelName NAME attributeName TYPE NUMERIC/STRING VALUE attributeValue

DELETE ATTRIBUTE elementType elementName PARCEL parcelName NAME attributeName TYPE NUMERIC/STRING

CHANGE ATTRIBUTE elementType elementName PARCEL parcelName NAME attributeName TYPE NUMERIC/STRING VALUE attributeValue

Note The user attribute may be specified in graphic COGO and COGO's Store Parcel dialog without using the command line.

The ability to setup a list of default preferences is also available. This is accomplished by accessing the **Default Attributes Preferences** option from the Element > Parcel pulldown.

名 Coordina	ate Geometry Job: 1	Operator:	
	Element <u>V</u> iew <u>T</u> ools <u>P</u> oint Line Curve	CFF (Feature)	<u></u>
9^99.12 COGO Key-ir	<u>S</u> piral Chai <u>n</u> P <u>a</u> rcel Pro <u>f</u> ile Ne <u>x</u> t Available Settings		<u> </u>

The dialog is used to compile a list of default preferences that will be displayed when storing any parcel. Values for each attribute can be changed as parcels are added to the database.



B Default Attribute Preferences					
Name	Туре	Value			
ADDRESS	String	4915 Waters Edge Dr.			
DEED	String	482.0000	51		
TAX	String	A5	- 2		
OWNER	String	Shaq	\times		
Apply	,	Cancel			

When the Store Parcel dialog is accessed the list of defaults will be displayed in the bottom.

Store Parcel Fro		Element Selection	
Parcel Name:			
Parent Tract 💌		Element Type: Point	_
Element List:		Point Name:	
Owner Name: Improvement: Attributes		<u>< Add</u>	
Name	Туре	Value	
ADDRESS	String	4915 Waters Edge Dr.	
DEED	String	482.0000	
TAX	String	A5	
OWNER	String	Shaq	

The attribute values are changed by simply clicking on any one of the three columns and providing an overriding value.

Parcel attributes can also be changed directly from the COGO Navigator. This is done by highlighting the previously stored parcel and right clicking. This action will present a menu where one option will be **Change Parcel Attribute** as shown below.



名 Navigat	or(1)			_	
Select To	ools				
× ×	📑 id 📥 🗎) 🔊			
Element :	Parcel 🔻				
Name	Description	Туре	Parent Tract	Area	
MAIN	Boundary	Parent Tract	MAIN	Add Element	
				Delete Element	
				Edit Element	
				Print/Describe Element	
				Edit Element Feature	
				Edit Element Description	
				Visualize Element	
				Unvisualize Element	
•				Select Highlighted Rows	
				Highlight Selected Rows	
				Compute Area	
				Export Selection	
				Change Parcel Type	
				Change Parcel Attribute	

Once selected, the attribute editing dialog will appear allowing for the adding, deleting or changing of the user attributes.

8 Change Par	Change Parcel Attribute					
+	➡ 1 of 1 : MA	IN				
Name	Туре	Value				
ADDRESS	String	4915 Waters Edge Dr.				
DEED	String	482				
OWNER	String	Shaq				
TAX	String	A5				
Apply		Done				



GRAPHICAL COGO

Graphical COGO also supports the addition of user defined attributes when storing graphically. This is accessed via the Store Parcel dialog as shown below.

8 Store Parc	el	_	. 🗆 🗙
	Id: PAR1		
Ty	ype: Parce	. ▼	
Opposing Elem	ent: Trans	pose 🔻	
Meth	nod: Flood	▼	
Element Ty	pe: DGN	Elements 🔻 🔍	
Max 6	ap: 0.001	000	
Owner N Improve Attribute	ment:		
Name	Туре	Value	
ADDRESS	String	4915 Wate	
DEED	String	482.0000	2
TAX	String	A5	
OWNER	String	Shaq	- × .

The functionality is identical to assigning the attributes in classic COGO.

The new Occupied type has also been added to the graphical Store Parcel dialog as shown below.

Store Par	cel		_ 🗆 ×
 Dpposing Elen Met Element Ty	nent: hod: ype: Gap: 0.0	Parcel Building Easement Taking Occupied	Q
Name	Туре	Value	
ADDRESS	String	4915 Wa	
	String	482.0000	
DEED TAX	String	A5	

New Flood functionality has also been incorporated into the store graphical parcel dialog. This will allow the use of MicroStation's flooding capabilities for generating areas.

Store Parcel		_ 🗆 🗵
ld:	MAIN	
Туре:	Parcel 💌	
Opposing Element:	Transpose 🔹	
Method:	Flood 🔻	
Element Type:	DGN Elements 🔻	Q
Max Gap:	0.001000	



Map Check / Store Parcel

The Map Check/ Parcel Editor tool enables the user to store or edit parcels (based on directions, distances, and curve data), and compute closure. Parcels can be loaded from the coordinate geometry database or manually typed in. Once a parcel is complete, clicking **Store Parcel** stores or updates the parcel in the database.

ŧ	Map Check / Store	Parcel Tool						
F	Parcel Name: 4200A Type : Parent 💌 Course Description		✓ Lo	ad Curv	Owner: I Improvement: e Parameters:		Delta 💌	Preferences Starting NEZ
	Bearing	Distance	Radius	Arc	Chord	Delta	Direction	Pt./Cur. Name
	S 17 20 34.00 E S 72 39 26.00 W	189.6713 120.9100						D151 D152
	S 14 40 18.00 E	81.4313						D153
	S 72 39 26.00 W	199.6731						D154
	N 15 05 55.34 W	82.3474						D155
	344 54 4.66	82.3474					🗌 🖪 Rt. 💌 🗖	D155
	Azimuth 💌			+ +	. /	Cir Inpt		
	1.000000 🔲 Sca	ale Factor		Clear Parce	el Store	Parcel	Describe	Closure

The top section of the dialog has several important fields, as detailed in the table below.

Parcel Name

Key-in Combo box provides for the selection of a previously stored parcel or key in for a new parcel number.

Load

If desired, a previously stored parcel may be selected. Simply select the name from the Parcel Name list, then press the Load button. GEOPAK populates all associated data within the dialog. Regardless of how the parcel was originally stored, the two specified curve parameters at the time of loading are utilized.

Curve Parameters:Radius, Arc, Chord, Delta

Two parameters must be utilized to store curves within the parcel. Select the two desired parameters, as GEOPAK does not allow selection of the same parameter in both fields. Note: they can be changed at any time during the parcel description to enable the user to use Radius and Chord for one curve, and Delta and Arc for another.

Owner:

When a previously stored parcel with attached owner is loaded, the Owner(s) are displayed. Note this is a display only field, as owners must be added within a command line in COGO.



Improvements

When a previously stored parcel with attached improvement is loaded, the Improvements are displayed. Note this is a display only field, as improvements must be added within a command line in COGO.

Preferences

名 Map Check Preferences 📃 🗆 🗙
Curve Options When storing curves, Store: Curves only
Closure Options Closure Based On: Internal Bearings & Dist.
<u>O</u> K

Compute options include Curves Only or Points and curves. When points are included, a Starting Point number is required. Closure options include Internal Bearing and Distance or Displayed Bearings an Distance.

Starting NEZ

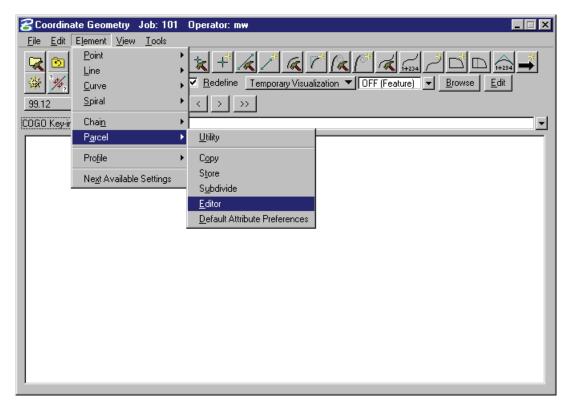
8 Enter Starting Coordinates	_ 🗆 🗵
Pt. Num D150	
Coordinates	
North (Y): 301688.8414	
East (X): 3876314.3562	DP

The starting point can be a COGO point, selected from a visualized element or type into the Pt. Num field. When populated, the North and East are automatically displayed. If a new point number is utilized, then North and East coordinates must be entered.

LAB EXERCISE: ENTERING PARCEL DATA

- > PARCEL EDITOR
- 1. Open the MicroStation file C:\DATA\GEO\VDOT\ROAD2\60843\s60843.dgn.
- 2. Attach the saved view ISTAR.
- 3. Access Project Manager and open the existing project 60843.
- 4. Use the user Mary to access the project.
- 5. Click on the button to open Coordinate Geometry.
- 6. Select Element > Parcel > Editor.





7. Begin by clicking the *Starting NEZ* button and entering the POB coordinates.

Northing	301688.7532
Easting	3876313.6897

8. Begin with point number D150.

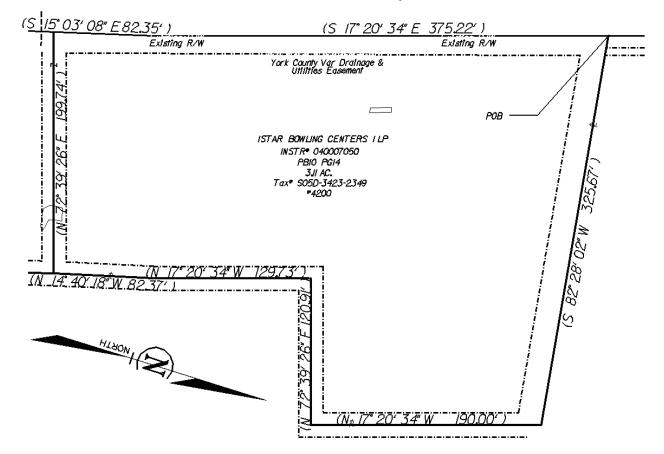
名 Enter Starting Coordinates 💶 💌				
Pt. Num: D150				
Coordinates				
North (Y): 301688.7532				
East (X): 3876313.6897	DP			

- 9. Close the Starting NEZ dialog.
- 10. Next, enter the Name 4200 for the parcel and set the Parcel Type to Parent.



Anap Check / Store Parcel Name: 4200 Type : Parent 💌 Course Description	Parcel Too			Owner: Improvement: e Parameters:	Radius 💌	Arc 💌	Preferences Starting NEZ
Bearing	Distance	Radius	Arc	Chord	Delta	Direction	Pt./Cur. Name
N 0000.00 E						Rt. V	
Bearing 🔻			+ +	• 7	Clr Inpt		
1.000000 🗖 Sc	ale Factor		Clear Parce	l Store	Parcel	Describe	Closure

- 11. Begin entering the metes and bounds outlined below.
 - *Note* Notice the **POB** and the direction of the bearings.



12. When completed you should have all of the metes and bounds entered in the dialog as shown below.



B Map Check / Store I Parcel Name: 4200 Type : Parent Course Description	Parcel Tool	Loa		Owner: Improvement: ve Parameters:	Radius 💌	Arc 💌	Preferences Starting NEZ
Bearing	Distance	Radius	Arc	Chord	Delta	Direction	Pt./Cur. Name
S 17 20 34.00 E	375.2200						D151
S 15 03 8.00 E	82.3500						D152
N 72 39 26.00 E	199.7400						D153
N 14 40 18.00 W	82.3700						D154
N 17 20 34.00 W	129.7300						D155
N 72 39 26.00 E	120.9100						D156
N 17 20 34.00 W	190.0000						D157
S 82 28 2.00 W	325.6700						D158
S 17 20 34.00 E	375.2200					- Rt 🔻 🚺	0151
Bearing 💌			+ +	• 7	Clr Inpt		
1.000000 🗖 Sca	le Factor	[Clear Parc	cel Store I	Parcel	Describe	Closure

- 13. Click the Closure button and review the closure in COGO.
- 14. Click the **Store Parce***l* button to store the parcel.

> STORING PARCEL ATTRIBUTES

- 1. Select from the COGO Element pulldown **Parcel > Default Attribute Preferences**.
- 2. Add each attribute into the dialog as shown below.

Name	Туре	Value	
OWNER	String	ISTAR Bowling Centers	
NSTR#	String	040007050	
PB	String	10	- <u>E</u> ×
PG	String	14	\times
TAX#	String	S05D-3423-2349	
#	String	4200	

- 3. Click the Apply button.
- 4. Now select **Element > Parcel > Store**.



5. Include the points as shown below and store the parcel.

Store Parcel Fro	om Elements			
Parcel Name:	4200A	Element Selection		
Parent Tract 💌		Element Type: Point		
Element List:		Point Name:		
D150-D157 D150				
Dwner Name:		1		
Improvement:	Improvement			
Attributes				
Name	Туре	Value		
OWNER	String	ISTAR Bowling Centers		
INSTR#	String	040007050		
PB	String			
PG	String	14		
TAX#	String	S05D-3423-2349		
#	String	4200 💌		
	Sto	ore Parcel		

6. From the **Navigator** print the parcel and review the information.

名 Coordinate G	ieometry Job:	101 Opera	ator: mw	_ 🗆 🗵
<u>F</u> ile <u>E</u> dit E <u>l</u> en	nent <u>V</u> iew <u>T</u> oo	ols		
Image: Constraint of the second se			+1 A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A A </th <th>→</th>	→
99.1234 💌	9^9'9.12 🔹 🔻	_ << _ <	> >>	
COGO Key-in: D	SCRIBE PARCE	L 4200A		•
Attri # INSTF OWNEF PB PG TAX#	bute	Type String String String String String String	52 D153 D154 D155 D156 D157 D150 Value 4200 040007050 ISTAR Bowling Centers 10 14 S05D-3423-2349 112.380.2336 ft ² = 2.5799 a	-
Total take		=	$0.0000 \text{ ft}^2 = 0.0000 \text{ a}$	
Remaining	area	=	112,380.2336 ft ² = 2.5799 a	
Descriptio	n of parce	1: 4200A	À	
Beginning	parent tra ======	ct descri	iption	
Point D150		N 3	301,688.7532 E 3,876,313.6897 Sta 0+00.	00
			14 001 04 000 B B' - 085 0000	-

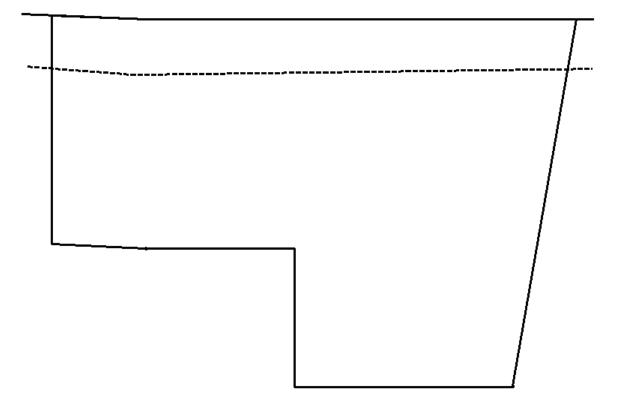


LAB EXERCISE: GRAPHICAL COGO

- > STORING A RIGHT-OF-WAY TAKE
- 1. Select Applications > GEOPAK Road > Geometry > Graphical Coordinate Geometry.



- 2. Turn off all levels with the exception of the parcel boundary including the existing right-of-way.
- 3. Set the active level to **Default**.
- 4. Place a line representing a proposed right-of-way similar to the image below.



5. Click the icon to store a parcel.



6. Enter the information as shown below.

名 Store Par	cel		_ 🗆 X		
	ld 4200	-			
Т	ype: <u>Takir</u>	ng 🔻	ROW		
Opposing Elen	nent: Trans	spose 💌			
Method: Flood 💌					
Element Type: DGN Elements 🔻 🔍					
Max Gap: 0.001000					
Owner I Improve Attribute	ement:		1		
Name	Туре	Value	_		
OWNER	String	ISTAR			
INSTR# PB	String String	04000	Ľ L		
PG	String	14	$-\times$		
		▶			

- 7. Data point inside the area making up the right-of-way take.
- 8. Enter a second data point to accept the direction for storing the right-of-way take. (A right mouse button click will reverse the direction of the arrows).
- 9. Next, move your cursor around the perimeter of the area making up the right-of-way take and pick a POB for beginning the area and enter a data point.
- 10. Print the Parcel in Coordinate Geometry and review the data.

😪 Coordinate Geometry 🛛 Job: 1	01 Operator: m	w	
<u> </u>			
Redefine Permanent Visualizati	<u>∕ </u>	€ ✓ Browse 99,12 ▼ 9^99,12	
COGO Key-in DESCRIBE PARCEL	4200		
<* 127 DESCRIBE	PARCEL 4200		•
Parcel 4200 : D150 C	UR OR4 D151 3	D152 CUR OR5 D153 D154 D155 CUR	OR6
Owner # 1: ISTAR			
Attribute	Type	Value	
#	String	4200	
INSTR#	String	040007050	
OWNER	String	ISTAR Bowling Centers	
PB		10.00	
PG	String		
TAX#	String	So5D-3423-2349	
Taken : D214 D2 Name: ROW	15 D216 D217	D218 D219 D220 D221 D222 D214	
Taken area	=	21,036.19 ft ² =	0.48 a
Total parent tract ar			2.58 a 🚽
Total taken area		21,036.19 ft ² =	0.48 a
Remaining area	=	91,347.02 ft ² =	2.10 a 🔽



LAB EXERCISE: CHAIN MANIPULATION

- > **REMOVING STATION EQUATIONS**
- 1. From the COGO Navigator set the Element toggle to Chains.
- 2. Highlight all of the chains in the list window and Visualize them.
- 3. From the COGO Navigator select **Tools > Settings**.
- 4. Turn on the setting to Window Center Visualized Element.

Settings
- Selection Set
Alert Prior to Clearing Selection Set
-Mouse Click Actions
Single Click Highlight Visualized Element
Single Click Window Center Visualized Element
Single Click Enables List Cell Editing
Double Click Action : Edit Element
Display Options
Point : All Points
Area : Square Foot 🔻 99.12 💌
<u> </u>

- 5. Click OK.
- 6. In the Navigator select chain GRAFTONLT.

Navigator(103]		
Select Tools			
📉 🗙 🛃 ia	1 📥 🗎 🔊		
Element : Chain	▼		
Name \triangle	Feature	Description	Selei_
EPLT1			
EPLT2			
EPLT3			
EPLT4			
E_TAYLOR			
FCIRCLE			
GRAFTONLT			
LAKESIDE			
MAINLINE			
MILLRD			
MLL			
MLR			_
NBL			
NBLLS			
ORIANA			
RAMPA			

- 7. Click the Print/Describe icon on Navigator and review the alignment data.
- 8. Notice the curve name is GRAFTLT. In the next steps we will modify the curve.
- 9. Change the Element toggle on Navigator to Curve.
- 10. Find the curve GRAFTLT in the list window and double click on it.
- 11. Change the radius to 100.00 (make sure that **REDEFINE** is turned ON).



8 Store Curve By Tan	gents	
Curve name: GRAFTLT	Station F	C 🔹 10+59.00
Back Tangent	Element	Ahead Tangent
Point Back: D7000 PI Point: D7001	Radius V	Point Ahead: D7002
	Store Curve	

- 12. Click Store Curve.
- **13**. Describe the chain again and review the data. (Notice that station equations have automatically been incorporated at the PC & ending stations due to the change in the curve).

8 Coordinate Geometry Job: 101 Operator: mw					
<u>File Edit Element View T</u> ools					
<u> <u> R</u>edefine Permanent Visualization ▼ OFF (Feature) ▼ Browse 99.12 ▼ 9^99.1 </u>	2 - ((()))				
COGO Keyini DESCRIBE CHAIN GRAFTONLT					
Course from D7000 to PC GRAFTLT S 72° 39' 18.75" W Dist 31.8	9				
	End Region 1				
Equation: Sta 10+31.89 (BK) = Sta 0+00.00 (AH)					
	Begin Region 2				
Curve Data					
**					
Curve GRAFTLT P.I. Station 0+84.71 N 307,585.37 E	3,874,254.16				
Delta = $80^{\circ} 31' 57.72"$ (RT) Degree = $57^{\circ} 17' 44.81"$					
Tangent = 84.71					
Length = 140.56					
Radius = 100.00 External = 31.05					
External = 31.05 Long Chord = 129.27					
Mid. Ord. = 23.70					
P.C. Station 0+00.00 N 307,610.63 E					
P.T. Station 1+40.56 N 307,660.97 E					
C.C. N 307,706.08 E Back = S 72° 39' 18.75" W	3,874,305.20				
Ahead = N 26° 48' 43.52" W					
Chord Bear = N 67° 04' 42.39" W					
Course from PT GRAFTLT to D7002 N 26° 48' 43.52" W Dist 60.51					
End Region 2					
Equation: Sta 2+01.06 (BK) = Sta 12+42.19 (AH)					
Point D7002 N 307,714.97 E 3,874,188.66	Sta 12+42.19				

- 14. From the Navigator double click on the chain GRAFTONLT.
- 15. Change the station toggle to **Begin Station** and make sure the value is 10+00.00.



8 Store Chain From Elements	_ 🗆 🗙
Chain Name: GRAFTONLT Begin Station Chain Name: GRAFTONLT Begin Station Chain Name: GRAFTLT D10000000 Element List: D7000 CUR GRAFTLT D7002	Element Selection Element Type: Point Point Add
Store Chain	

- 16. Click the Store Chain button.
- 17. Highlight the chain in Navigator and click the Print/Describe icon.
- **18**. Notice now that the chain has been re-stationed through the curve, eliminating the station equations.

2Coordinate Geometry		erator: m w				_	
<u>File E</u> dit E <u>l</u> ement <u>V</u> iev	v <u>T</u> ools						
🔍 🔤 📈 🗽 +		766	نسم (+234) الم		🗳 🖗 🞋	<u>ି</u> ମ୍ବର୍ଚ୍ଚ	
Redefine Permanent \	/isualization 🔻 🚺	FF (Feature)	Browse 99.12		3.12 🔽	$\langle \langle \langle \rangle \rangle$	>
COGO Key-in: DESCRIBE (╧╻
Beginning chain		-					-
Point D7000	N	307,620.3	13 E 3,8	74,365.49	5 Sta	10+00.00	
Course from D700	0 to PC GRAI	FTLT S 72° :	39' 18.75" 6	Dist 31	89		
			ve Data				
Curve GRAFTLT		*	*				
P.I. Station	11-	+16.60 N	307,	585.37 E	2 3	,874,254.16	
Delta =		57.72" (RT)					
Degree =	57° 17'						
Tangent = Length =		84.71 140.56					
Radius =		100.00					
External =		31.05					
Long Chord =		129.27					
Mid. Ord. =		23.70		/ 1 0 / 0 F		0.7.4 0.05 0.4	
P.C. Station P.T. Station		+31.89 N +72.45 N		610.63 E 660.97 E		,874,335.01 ,874,215.95	
C.C.	11	F72.43 N		706.08 E		,874,305.20	
Back = S	72° 39' 18	.75" ₩	,			, ,	
	26° 48' 43						
Chord Bear = N	67° 04' 42	.39" ₩					
Course from PT G	RAFTLT to D	7002 N 26°	48' 43.52" 6	Dist 60	51		
Point D7002	N	307,714.	97E 3,8	74,188.66	5 Sta	12+32.95	
Ending chain GRA							
		-					
I							•



- > INCLUDING STATION EQUATIONS
- 1. In the next example we will incorporate a desired station equation in the same alignment at PT station of the curve.
- 2. From the main COGO dialog select Element > Chain > Station Equation.
- 3. Enter the information as shown in the dialog below.



4. Now describe the chain again and review the data.

名 Coordinate Geometry Job: 101 Operator: m w 📃 🗖	×
<u>File Edit Element View I</u> ools	
Image: Second	
COGO Key-in: DESCRIBE CHAIN GRAFTONLT	-
	-
Curve Data	
Curve GRAFTLT	
P.I. Station 11+16.60 N 307,585.37 E 3,874,254.16	
Delta = 80° 31' 57.72" (RT) Degree = 57° 17' 44.81"	
Tangent = 84.71	
Length = 140.56	
Radius = 100.00	
External = 31.05 Long Chord = 129.27	
Mid. Ord. = 23.70	
P.C. Station 10+31.89 N 307,610.63 E 3,874,335.01	
P.T. Station 11+72.45 N 307,660.97 E 3,874,215.95 C.C. N 307.706.08 E 3,874,305.20	
Back = S 72° 39' 18.75" W	
Ahead = N 26° 48' 43.52" W	
Chord Bear = N 67° 04' 42.39" W	
End Region 1	
Equation: Sta 11+72.45 (BK) = Sta 15+00.00 (AH)Begin Region 2	
Point D250 N 307,660.97 E 3,874,215.95 Sta 15+00.00	
Course from D250 to D7002 N 26° 48' 43.52" W Dist 60.51	
Point D7002 N 307,714.97 E 3,874,188.66 Sta 15+60.51	
Ending chain GRAFTONLT description	
	-

5. Exit MicroStation





Vertical Alignments

CHAPTER OBJECTIVES

In this chapter, you will create and modify vertical alignments using the Vertical Alignment Generator and the Component Based Profile Generator.

INTRODUCTION

The Vertical Alignment Generator is a GEOPAK tool that can graphically create and modify proposed design profiles or modify an existing ground profile. These operations may be accomplished through a dialog box and/or by dynamic manipulation of graphic elements.

Several best fit options have been added to the Vertical Alignment Generator to provide the ability to compute profile components automatically from MicroStation graphics. Similar to the horizontal Best Fit application, it requires a selection of the graphical elements in order to perform the computations.

ACCESSING

The Vertical Alignment Generator can be accessed by selecting Applications > GEOPAK ROAD > Geometry > Layout Profiles (VPI Based). It can also be invoked from Project Manager by clicking the Vertical Alignment button or by selecting the VPI Based Vertical Alignment Design Tools icon from the GEOPAK ROAD tool frame.

When selecting the Vertical Alignment generator, the first dialog that appears is labeled Settings, as depicted here. The entries in this box set the parameters and define the location within the design file where the profile components are to be displayed. All fields must be completed before the design process can begin. Once OK is clicked, the Vertical Profile Generator dialog appears.

Note This tool also utilizes the cell that was drawn in the previous exercise by using the **Identify Cell** button.

8 Settings
Job Number:
Operator Code:
PGL Chain: < <u>None></u> Location and Scales Horizontal Scale: 1.000000
Vertical Scale: 1.000000
Reference Station:
Reference Elevation: 0.000000
X: 0.000000
Y: 0.000000
Profile Cell
Draw Cell at X,Y
Cancel



USING THE VERTICAL ALIGNMENT GENERATOR

This tool enables a user to load a previously stored profile or create a new profile. You will notice the dynamic changes in the dialog throughout the vertical alignment design.

8 Profile Generator (I	(Value Table: Kvalues_1990english.kvl)	
<u>File T</u> ools <u>U</u> ser		
	Station:Off Elevation:Off 	▼ ▼
	(¥alue Table: Kvalues_1990english.kvl)	
File Tools User VPI 1	Off ✓ VPI 2 Off Station: 304+10.00 Off Insert Elevation: 787.00 Off Before Dynamic Delete	▼ Fd Grade: 1.1236 Off ▼ Insert L: 3115.00 After Station: 335+25.00 Elevation: 822.00
Station: 302+10.00 Elevation: 786.36	Symmetrical ▼ SSD: NA Speed: 70 ▼ L: 400.00 K: 498.7792 L	LP Station: 302+10.00 Station: 306+10.00 P Elevation: 786.36 Elevation: 789.25

Various design parameters must be defined prior to designing a new profile; which are discussed in the options supported under the three menu options; **File**, **Tools**, and **User**.

FILE

<u>File T</u> ools	Clear - clears the profile display from MicroStation graphics and removes all VPIs from
⊆lear	the dialog box.
<u>D</u> raw	Draw - write the graphic elements of the profile to the MicroStation file.
<u>L</u> oad	Load - retrieves a previously stored profile from the coordinate geometry database (.gpk)
<u>S</u> ave Save As	Save - stores a new profile or updates (redefines) a previously stored profile under the

same name. **Save As -** is used to store the profile or to save a modified profile under a different name. **Exit -** ends the process.

TOOLS



<u>Fi</u>le Q

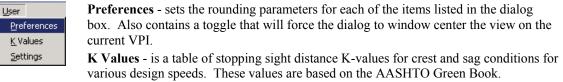
E<u>xi</u>t

Critical Points - Vertical curves may also be defined by one or two critical points – i.e. the curve will pass through these points if mathematically solvable, the vertical curve will be drawn and the design speed display adjusted to fit the current parameters. **Issue Data Point -** Permits the user to type in stations and elevations, issue a data point that can be part of a MicroStation place line, place a cell or perform other generic



operations. This is useful in displaying visual references within the profile that need to be considered in design of the vertical profile.

USER



Settings - recalls the **Settings** dialog box that first appeared upon initializing Vertical Layout.

CREATING A NEW PROFILE

Warning The enter/tab key must be used to ensure values are accepted.

A new profile can be created with the following steps:

- 1. Place the first VPI using one of the four supported options.
 - Type station and elevation of the VPI into the appropriate fields in the Profile Generator dialog.
 - Enter station of VPI as precision input (type in value), and allow the elevation to be defined through dynamic cursor placement on screen.
 - Elevation is defined via precision input, and the station is defined through dynamic cursor placement on screen.
 - Both values for the VPI can be established dynamically on screen by clicking on the Dynamic button and placing a DP in the view at the desired station and elevation.
- 2. Define ahead (or back tangent).

Station, elevation, grade and length parameters may be defined via precision input, dynamic manipulation or a combination of both.

3. Define remaining VPI's and Grades.

A repetition of Step 2 with an option to insert VPI's between two existing VPI's.

4. Define Vertical Curves.

Simply define the design speed from the Speed option button and GEOPAK will reference the K-value table and draw the vertical curve. If a *curve overlap* occurs, an overlap message will be displayed in the dialog box along with the overlap length. Length of Curve or K-value may also be keyed in.

5. Adjusting Curve Lengths

The vertical curve can be modified by directly keying in either the K-value, curve length or defining the design speed in the dialog box. You will see the values computed automatically adjust to reflect the results of any modifications.

- 6. Save the Profile.
- 7. Select **File > Save As** to name and save the newly created profile. The names of profiles are any 1-9 alphanumeric characters.

PRECISION PLACEMENT OPTIONS

Options available for creating or modifying vertical curves, VPI's and grade lines:



- OFF Values change.
- **INC** (Increment) Ensures that the designated profile parameter will be adjusted as defined in the Preferences dialog.



 LCK (Locked) - Forces selected operations to maintain the designated profile parameters.

BEST FIT LINE

The **Best Fit Line** tool is located on the Vertical Profile Generator under the Tools > Best Fit pulldown.

8Pr	ofile Generator (K	Value Table:	Kvalues_1990english.kvl)	
	<u>T</u> ools Issue Datapoint <u>C</u> ritical Points	Value Table: ▶ Line Parabola Profile	Kvalues_1990english.kvl) Station: Off Elevation: Off <<< Insert Dgnamic Delete	

The **Best Fit Line** tool will allow the user to select any graphical line, whether it is a type 3 or type 4 MicroStation element, to perform a best fit solution. This solution will be reported back in a display window similar to the one below with all geometrical information.

🛿 Best Fit Line	
🔽 Display Only 🔲 Use Fence	
Line Data:	
Begin Station: 15+84.10 R 1 Begin Elevation: 935.893091 Grade: -27.951310 Length: 148.665327 End Station: 17+27.27 R 1 End Elevation: 895.873119 RMS: 0.647189	
Identify Element	

This information can then be analyzed to aid in the input of grade information into the vertical alignment generator if desired.

BEST FIT PARABOLA

The **Best Fit Parabola** tool is located on the Vertical Profile Generator under the Tools > Best Fit pulldown.



Best Fit Profile

8 Pro	file Generator (K V	Value Table: Kvalues_1990english.kvl)	_ 🗆 🗙
<u> </u>	<u>T</u> ools		
	<u>I</u> ssue Datapoint		
	<u>C</u> ritical Points		
	<u>B</u> est Fit →		
		Profile << Insert Dynamic Delete Insert >>	

The **Best Fit Parabola** tool will allow the user to select any graphical line, whether it is a series of type 3, a type 4 or a type 12 (complex chain) MicroStation element, to perform a best fit solution. This solution will be reported back in a display window similar to the one below with all geometrical information.

名 Best Fit Parabola	
🔽 Display Only 🔲 Use Fence	
Parabola Data:	
VPC Station: 12+46.70 R 1 VPC Elevation: 761.120518 Back Grade: 5.423296 VPI Station: 15+45.18 R 1 VPI Elevation: 777.308241 VC Length: 596.369393 VC K Value: 50.696946 Ahead Grade: -6.351969	•
Identify Element	

This information can then be analyzed to aid in the input of grade information into the vertical alignment generator if desired.

BEST FIT PROFILE

The main difference in the **Best Fit Profile** and the other Best Fit options is that **Best Fit Profile** will actually populate the vertical alignment generator dialog with a complete profile grade.

Once the settings are made in the preference dialog and the element selected a best fit profile is generated. The user can then review and analyze the grade, deleting or inserting PI's where desired.

8 Best Fit Profile			
Use Fence Design Parameters Upper Envelope Distance: Lower Envelope Distance: Optimum Crest Curve K Value: Optimum Sag Curve K Value:	10.0000		
Minimum Vertical Curve Length:	100.0000		

When the **Identify Element** button is selected the main vertical alignment generator dialog will populate as shown below.



8 Profile Generator (K Value Table	: Kvalues_1990english.kvl)		
<u>File T</u> ools			
VPI 5	VPI 6		VPI 7
Station: 39+78.48	Station: 44+65.15	Off 🔻	Station: 61+91.17
Elevation: 763.87	Elevation: 755.84	Off 🔻	Elevation: 782.18
Back Grade: -1.6502 Off 💌	Insert Dynamic</td <td>Delete Insert >></td> <td>Fwd Grade: 1.5259 Off 💌</td>	Delete Insert >>	Fwd Grade: 1.5259 Off 💌
Length: 486.66			Length: 1726.02
	Symmetrical Vert	ical Curve 🛛 🔻	
	Speed: 55 💌	L: 486.66	
Station: 42+21.82 LP 9	Station: 44+74.67	K: 153.2258	Station: 47+08.48
Elevation: 759.86 LP Ele	evation: 757.77	SSD: NA	Elevation: 759.55
Previous 1			▶ 7 Next

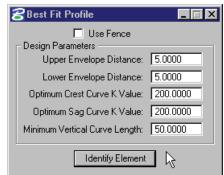


LAB EXERCISE: PROFILES

- > BEST FIT PROFILE
- 1. Open the MicroStation file C:\DATA\GEO\VDOT\ROAD2\60843\d60843prof.dgn.
- 2. Attach the saved view PRO1.
- **3**. Access the **Vertical Alignment Generator**. (Applications > GEOPAK Road > Geometry > Layout Profiles VPI Based).
- 4. In the Settings dialog click the **Identify Cell** button and data point on the profile cell displayed in the MicroStation view.

🛜 Settings 🛛 🛛 🔀
Job: 101
Operator Code: mw
PGL Chain: EPLT1
Location and Scales
Horizontal Scale: 25.000000
Vertical Scale: 5.000000
Reference Station: 0+00.00 R 1
Reference Elevation: 0.000000
×: 3910235.406C
Y: 299672.6574E
Profile Cell
Draw Cell at XY
<u>O</u> K Cancel

- 5. Key in the **Operator Code** of mw.
- 6. Click OK.
- 7. From the Vertical Alignment Generator dialog select Tools > Best Fit > Profile.
- 8. Make the settings as shown below.



- **9**. Click the **Identify Element** button and data point on the graphical profile in the MicroStation view.
- 10. Click another data point anywhere to accept.
- 11. The main Vertical Alignment Generator dialog should be populated as shown below.



8 Profile Generator (K Value Table	: Kvalues_1990englis	h.kvl)		
<u>File T</u> ools				
VPI 2	VP	13	VPI 4]
Station: 17+78.74	Station: 19-	+81.47 Off 🔻	Station: 21+31.47	
Elevation: 27.33	Elevation: 21.	77 Off 🔻	Elevation: 17.41	
Back Grade: -2.7436 Off 💌	<< Insert Dynar	mic Delete Insert >>	Fwd Grade: -2.9052	Off 🔻
Length: 202.73			Length: 150.00	
	Symmetrie	cal Vertical Curve 🛛 💌		
	Speed: <u>65</u> 🔻	L: 79.81		
Station: 19+41.57 HP 9	Station: 19+41.57	K: 493.7075	Station: 20+21.3	38
Elevation: 22.87 HP Ele	vation: 22.87	SSD: 4150.78	Elevation: 20.61	
Previous 1			9 [Next

- 12. Review and edit the proposed grade removing unwanted VPI's and adjust curve lengths as desired.
- 13. When completed select File > Save Profile As and provide the name as shown below.

Save Profile As		
Profile: EPLT1		
Input File: 101 omw.inp		
<u>D</u> K Cancel		

14. Clear the profile from the Vertical Alignment Generator.



> VERTICAL ALIGNMENT GENERATOR

- 1. Using the same existing profile as a reference we will now enter grade information to store an additional profile.
- 2. Begin by keying in the first VPI at STA=0+00 ELEV=29.78.
- 3. Using the following table key-in the remaining VPI information.

Station	Elevation
16+56.72	33.39
26+13.83	0.79
37+92.45	38.40
47+83.33	35.24

- 4. Now using the **Previous** button return to VPI 2.
- 5. Select a **Design Speed** of 60 MPH.

8 Profile Generator (K Value Table	: Kvalues_1990english	.kvl)	
<u>File T</u> ools			
VPI 1	VPL	2	VPI 3
Station: 0+00.00	Station: 16+5	56.72 Off 🔻	Station: 26+13.83
Elevation: 29.78	Elevation: 33.3	9 Off 🔻	Elevation: 0.79
Back Grade: 0.2176 Off 💌	<< Insert Dynami	ic Delete Insert >>	Fwd Grade: -3.4061 Off 💌
Length: 1656.72			Length: 957.11
	Symmetric	al Vertical Curve 🛛 💌	
	Speed: 60 💌	L: 1123.36	Overlap: 132.38
Station: 10+95.04 HP :	Station: 11+62.51	K: 310.0000	Station: 22+18.40
Elevation: 32.17 HP Ele	evation: 32.24	SSD: 641.86	Elevation: 14.26
Previous 1			▶ 5 <u>N</u> ext

- 6. Using the Next button set the Design Speed to 60 MPH for each of the following VPI's.
- 7. Select File > Save Profile As and save the profile as EPLT2.

Save Profile As		
Profile: EPLT2	2	
Input File: [j101on	nw.inp	
<u>0</u> K	Cancel	

8. Close the Vertical Alignment Generator.



COMPONENT BASED PROFILES

INTRODUCTION

The **Component Based Vertical Alignment** tools provide the user with a myriad of tools to place, modify and delete profile components. Tool boxes organize tools to include the placement of tangent lines, and a variety of vertical curves. Components interact with each other to automatically trim vertical curves, connect various elements, and modify, copy and rotate components. The user also has the option to store completed profiles with the coordinate geometry database.

ACCESSING

This tool requires the active chain control to be active. In addition, an active chain and an active profile must be defined. The profile may not have a gap. If these conditions are not met, an Alert Message is displayed.

Acti	ive Chain Control	×
Job:	101 💌 Chain: EPLT1	Id XLA LANA NO.

When the prerequisites have been met and the tool is selected, the tool frame is opened.

The **Component Based Profile** tools are accessed from **Applications** > **GEOPAK Road** > **Geometry** > **Component Based Profiles**.

L	Comp×		
Ì	Ζ.	\square	
	1		

There are four primary tool boxes for placing profile components.

Place Lines	Place VA 🗵
Places Curves	Place VA Curves
Manipulate	Manipulat
Profile Tools	Profile Tools



LAB Exercise: Component Based Profiles

COMPONENT BASED PROFILES >

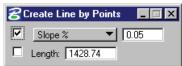
1. Using the same existing profile from the previous exercise as a reference, select **Applications** > GEOPAK Road > Project Manager > Active Chain Control.



- 2. Set the Active Chain to EPLT1.
- 3. Right click on the icon representing View 1 and set the view to Profile.
- 4. Select Applications > GEOPAK Road > Geometry > Component Based Profiles.
- 5. Select the tool to Create a Profile Line by 2 Points.



6. Key-in the grade as shown below and check the toggle ON.



- 7. Place a line from the beginning of the existing profile approximately 1400 feet.
- 8. Next select the tool to place a **Tangent Profile Curve**.



9. Snap to the end of the previously placed tangent and using the approximate values in the dialog below, place a curve.

名 Create Tangent Profile Curve 🔲 🔲 🗙			
	K Value 💌 🔀 👥 256.76		
	Length: 863.05		

10. Select the tool to place a Tangent Line Unconstrained.



11. Using the approximate values below place the tangent line from the previous curve.



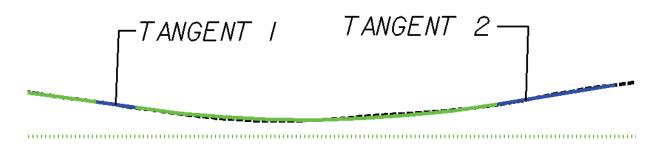
- 12. Use the Create Profile Line By 2 Points and place a line on the uphill slope (reference the image in step 14).
- 13. Select the tool to Create Profile Curve Between 2 Elements.



14. Using the approximate values below snap to the first tangent line and then the second.







- 15. Finish out the profile using the tools we just discussed.
- 16. Once completed with the profile select the Store Profile icon.



17. Provide a name and then select the profile element.

Store Vertical Alignment		
Name	PR0F1	

18. Exit MicroStation.



DRAW PROFILES

INTRODUCTION

The **Draw Profile** tool enables the user to draw several profiles simultaneously from a variety of data sources.

- GEOPAK coordinate geometry database wherein the vertical alignment is stored.
- GEOPAK binary TIN file, Site Model or Site Object. If you have not already created your binary TIN file, see the DTM online documentation for a detailed discussion of the Digital Terrain Modeling features. The Site Model or Object are created utilizing GEOPAK Site Modeler software and are stored within the GEOPAK Site project (gsf) file.

In addition, if the source data is TIN files or site components, the resultant profile may be stored within the coordinate geometry database.

ACCESSING

The generation of profiles must be completed from within the 2D MicroStation design file wherein the profile is to be drawn.

8 Draw Profile	×
File Edit Update Options	
Uob Number 101 🔽 😤 🚈 Label Scale: 0.000000	
Chain: EPLT1	
Surfaces COGO Projection	
Type Name Display Settings Draw	
Details	
TIN File:	
Method: Triangles 💌	
Display Settings	
By Level Symbology Horizontal: 0.30	
Feature: < No Entries > 💌 💾 Variance: 0.10	
Station Limits Offsets	
□ Begin: 0+00.00 ↔ Horizontal: 0.00	
End: 48+83.33 Vertical: 0.00	
Void	



The first entries required in the dialog are at the top of the dialog. These include:		
Job Number	Required to identify the coordinate geometry database wherein the chain for generating the profiles is stored.	
Chain	Required to reference an alignment within each cross section. The subsequent specifications of station ranges and left/right offsets are computed relative to this baseline when pattern by station is utilized. If pattern by design is utilized, the intersection of each pattern line with the baseline determines the station of the cross section.	
Dialog Profile Cell Control	Clicking this button opens the Profile Cell Control dialog, wherein the current profile cells are listed along with associated station, elevation, etc.	

• A profile cell is required in order to un-ghost the majority of the Draw Profiles dialog. It can be placed by any method within GEOPAK prior to drawing profiles.

Two additional buttons / fields are located at the top of the dialog and are detailed below.

Update Profile		This button updates any previously drawn profile.
Label Scale		Utilized when the By Feature Display settings option is utilized. The specified Label Scale is compared to the scale within the D&C Item and proportionalized. Note this option is only utilized if the text setting is set to scale, not fixed.
	Note	The Job Number must be defined in order to populate the Chain list. Once the chain and profile cell is defined, the dialog un-ghosts.
TABS		
Т	hree tabs or	n the dialog support the input data required to draw profiles:

Surfaces: Defines the surfaces utilized for drawing profiles. Note multiple surfaces may be drawn in a single processing. Source data includes GEOPAK TIN files, Site Models, or Site Objects.

COGO: Defines the COGO data utilized for drawing profiles.

Projection: Used when the chain / profile to be drawn is different than the chain / profile used to create the profile cell.



SURFACES TAB

The **Surfaces** tab defines the surfaces utilized as source data when drawing profiles. Multiple surfaces from a variety of sources can be drawn in a single processing.

😮 Draw Profile 📃 🛛 🗐
File Edit Update Options
Job Number: 101 Image: The second secon
Surfaces COGO Projection
Type Name Display Settings Draw
TIN s60843.tin Lv: Level 6, Co: 0, Lc: 0, Wt: 2
Details
TIN File: s60843.tin Q Method: Triangles ▼
Display Settings
By Level Symbology 🔻 Horizontal: 0.30
Feature: K No Entries > 💌 💾 Variance: 0.10
Station Limits Offsets Begin: 0+00.00 +++ End: 48+83.33 +++
🗖 Void 📃

Each surface to be drawn must be added to the list box. This is accomplished via the action / edit buttons on the right side of the dialog. When a line is added to the list box, the profile is drawn. Note: clicking on the draw toggle in the list box deletes or redraws the profile.

Edit Buttons: Add, Modify, Delete	To add to the list box, simply select the source data type and data, then populate the Display Settings, Filter Tolerances and Offsets. Then click Add to the right.
	To delete a line from the list box, simply highlight the line to be deleted and click Delete .
	Modify a line by highlighting the desired line in the list box, make the desired changes in the fields directly below the list box, then click Modify .
Store Surface as Profile in COGO	When the profile is drawn, click to open the Store Profile dialog, to store the profile in COGO.



名 Store Profile	
Profile Name: Store Profile in GPK Create Input File Operator Code File Name:	Select Files
Create 3D Profile String Apply	

The profile may be stored, or just the input file may be created. If an input file is created, the **Operator Code** and **File Name** are required. If the dialog is invoked while in a 3D file, the user may toggle on the option to create a 3D profile string.

The 3D profile string consists of the circles denoting every location where the design centerline intersects topographic elements. If the circles are not deleted at this time, they can be deleted at any time with a single application of the MicroStation "Delete Element" command.

SOURCE DATA

The list box displays the source data dialog items. These are described in the following table.

Model Object Object+Slopes Model Base TIN File	If a site model project is active when the Draw Profile dialog is opened, several options are supported for source data. When the type is set to Model, Object, Object+Slopes or Model Base, all components of the specified type in the current site project are listed. The user selects the desired component from the list. When site components are utilized, no file icon is displayed. If a site project is not open, the only option is a TIN file. Pressing the Files button invokes the TIN Files Manager, wherein the desired file may be specified.
Method: Triangles Break Lines POT Increment Even	Interval between successive VPIs in terms of master units, i.e., feet or meters. If a TIN File is utilized, triangles are interpolated to determine the elevation defining the profiles. However, if a site component is utilized, the user may select break lines. In this case, any surface line drawn between two break lines in the site component will interpolate only between the break lines, not the triangles. The Increment option creates a profile where the user specifies the incremental distance between successive VPI points on the grigting ground profile where
	 distance between successive VPI points on the existing ground profile where the first VPI point is coincident with the Beginning Station. The Even method specifies the incremental distance between successive VPI points on the existing ground profile where the first VPI point is rounded to the next highest even station from the Beginning Station. For example, if the Beginning Station is 10+015 and the Even value is 25, the VPIs would be generated at 10+025, 10+050, etc. The POT method creates a profile with VPIs at every location where a POT occurs in the referenced chain.



COGO TAB

名 Draw Pr	ofile 📃 🗌 🗙
File Edit	Update Options
Chain: EPLT	Job Number: 101 🖃 💦 🎽 Label Scale: 0.000000
Surfaces	COGO Projection
Name EPLT	Display Settings Draw PROEXIST25
- Display S By Feat	/ertical Offset: 0.00 ↔ ✓ End: 48+00.00 •••• ✓ End: 48+00.00 •••• ✓ End: 48+00.00 •••• ✓ End: 48+00.00 •••• ✓ Custom Line Style re: PR0EXIST25 ✓ Scale factor: 0.0000

Multiple profiles may be drawn by populating the tab, then utilizing the edit buttons on the right side of the list box.

Edit Buttons:

Add, Modify, Delete

To add to the list box, simply select the source data type and data, then populate the Display Settings, Filter Tolerances and Offsets. Then click **Add** to the right.

To delete a line from the list box, simply highlight the line to be deleted and click **Delete**.

Modify a line by highlighting the desired line in the list box, make the desired changes in the fields directly below the list box, then click **Modify**.

Station Limits and **Vertical Offset** are identical to the Surfaces tab. To define the symbology of the profile(s), the user may specify the parameters via the **By Symbology** option, or **By Feature**. When the By Feature option is selected, the user must identify an Item from the Design and Computation Manager. Other options which are found on the Draw Plan and Profile dialog within Design and Computation Manager are also supported within the Draw Profile dialog, i.e., General Labels, VPI, VPC, etc. Simply highlight the desired option in the list box, then set the toggles and fields accordingly. Scale for **Custom Line Styles** is also supported.



PROJECTION TAB

The Project tab can be used when the chain / profile to be drawn is different than the chain / profile used to create the profile cell. When the Projection tab is selected, the dialog dynamically changes, as shown below.

2 Draw Profile
File Edit Update Options
Job Number: 101 Image: 101 Image: 100
Surfaces COGO Projection
Type Chain Profile/Surfa Display Settings Draw
Details* Stationing Type: Cogo Chain Image: Stationing Chain: ARMORY Image: Stationing Profile: None > Image: Stationing Vertical Offset: 0.00 Image: Stationing POT POT
Filter Tolerances TIN File: Method: Triangles
Display Settings By Level Symbology Feature: No Entries >

Each projected profile to be drawn must be added to the list box. This is accomplished via the action / edit buttons on the right side of the dialog. When a line is added to the list box, the profile is drawn. Note: clicking on the draw toggle in the list box deletes or redraws the profile.

Edit Buttons:	To add to the list box, simply select the Type, Chain, Profile, and Vertical		
Add, Modify, Delete	Offset, then populate the Display Settings, Filter Tolerances and Extraction from TIN, if desired. Then click Add to the right.		
	To delete a line from the list box, simply highlight the line to be deleted and click Delete .		
	Modify a line by highlighting the desired line in the list box, make the desired changes in the fields directly below the list box, then click Modify .		
The following fields are def	ined in the Details group box.		
Туре	A COGO chain or Survey chain may be utilized.		
Chain:	After the desired Type has been selected, the Chains in the current GPK are listed for selection.		
Profile	(COGO Chain option only) Select the profile to be utilized.		
Vertical Offset	Offset in terms of master units. Any Vertical Offset is applied after the profile is generated from the source data.		



LAB EXERCISE: PROFILES

- > **D**RAWING PROFILES
- 1. Open the MicroStation file C:\DATA\GEO\VDOT\ROAD2\60843\d60843prof.dgn.
- 2. Select Applications > GEOPAK Road > Plans Preparation > Draw Profiles.
- 3. From the Draw Profiles dialog open the Profile Cell Control dialog and set the Active Chain to **EPLT1**.

8	Profile Cell Control					_	
A	ctive Chain: EPLT1	•					
	Microstation File	Station	Elevation	H. Scale	V. Scale	Gap	
	A Active Design	0+00.00	0.000000	25.00	5.00		2

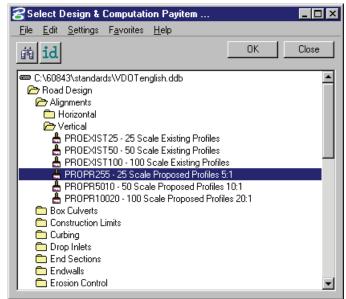
- 4. Select the COGO tab on the dialog.
- 5. In the **Display** portion of the dialog set the profile to **PROF1**.

名 Draw Pr	ofile 📃 🗆 🗙
File Edit	Update Options
	Job Number: 101 💌 🔗 🚪 Label Scale: 0.000000
Chain: EPLT	
Surfaces 0	COGO Projection
Name	Display Settings Draw
EPLT	PROEXIST25 🗹 🖸
_ Details* —	
Profile: Pr	R0F1 Station Limits
	(ertical Offset: 0.00 □ Begin: 0+50.00 +↔+
	End: 35+18.60
- Display S	- Custom Line Style
By Feat	
- Options	
Gener VPI	
VC	Grade Labels

6. In the **Display Settings** portion of the dialog set the toggle to **By Feature** and click on the paintbrush icon.



7. From the D&C Manager select the feature PROP255.



- 8. Click OK.
- 9. Click the **Add Profile** icon on the right side of the list window to add the profile in the list and draw graphically.

8Draw Profile		
	ate Options	
· · · · ·	lumber: 101 🖃 💦 🚪 Label Scale: 🖸	000000
Chain: EPLT1		
Surfaces COGO	Projection	
Name	Display Settings	Draw
EPLT	PROEXIST25	
PR0F1	PROPR255	
		\mathbf{X}
- Details		
Profile: EPLT	■ Begin: 0+00.00	+0+
Vertical L	Offset: 0.00	+0+
– Display Settings -	·	
By Feature	Custom Line Style	,
Feature: PR	ROEXIST25 💽 📇 🗖 Scale factor:	0.0000
- Options		
General	VPI Labels From VPI	
VPI	Circle 🔽	
VC	□ Grade Labels 🖓 💌	



- > **PLOTTING DITCHES**
- 1. While still on the COGO tab, change the profile to **DITCHL1**.
- 2. Set the Display Settings to By Feature and select the feature DitchL.

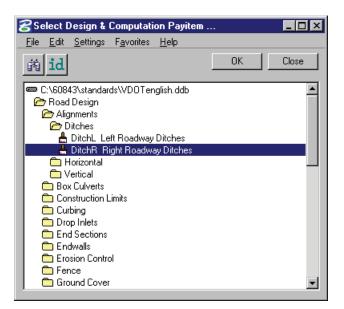
Select Design & Computation Payitem		_ 🗆 ×
<u>File Edit S</u> ettings F <u>a</u> vorites <u>H</u> elp		
商 id	ОК	Close
C:\60843\standards\VDOTenglish.ddb		
🗁 Road Design		
🗁 Alignments		
Ditches		
📥 DitchL Left Roadway Ditches		
📥 DitchR Right Roadway Ditches		
💼 Horizontal		
📥 Vertical		
💼 Box Culverts		
Construction Limits		
💼 Curbing		
💼 Drop Inlets		
💼 End Sections		
💼 Endwalls		
💼 Erosion Control		
E Fence		
📄 Ground Cover		-

- 3. Click OK.
- 4. In the **Options** settings, highlight **VPI**.
- 5. Toggle ON the Grade Labels.

File Edit Update Options Job Number: 101 Image: 101 Image: 101 Image: 100 Ima	le: 0.000000
Job Number: 101 🖃 💦 🛃 Label Sca Chain: EPLT1	le: 0.000000
Surfaces COGO Projection	
NameDisplay SettingsEPLTPR0EXIST25PR0F1PR0PR255	Draw
Details* Profile: DITCHL1 Vertical Offset: 0.00 By Feature Feature: DitchL General VPI Labels From VPI Circle VC Grade Labels '+' and ''	4.39

- 6. Make sure that all toggles are **OFF** for the other **Options** settings.
- 7. Add the ditch to the list window.
- 8. Change the feature to **DitchR**.





- 9. Change the profile to **DITCHR1**.
- 10. Add this ditch to the list window.

궁 Draw Profile		_ 🗆 X
File Edit Update	Options	
Job Num	iber: 101 💌 💦 🏄 Label Scale:	0.000000
Chain: EPLT1		
Surfaces COGO F	Projection	
Name	Display Settings	Draw
EPLT	PROEXIST25	
DITCHR1 DITCHL1	DitchR DitchL	
PR0F1	PROPR255	
Details	Station Limits	
Profile: DITCHR1	► Begin: 2+81.34	++++
Vertical Of	fset: 0.00	
_ ⊢ Display Settings —		
	Custom Line St	tyle
By Feature Feature: Ditch		r: 10.0000
· · · · · · · · · · · · · · · · · · ·		
Options		
General	VPI Labels From VPI	
VL	🔽 Grade Labels 🔄 '+' and '' 🔻	

11. These ditches can be manipulated with any MicroStation command and moved to the desired location in the profile view.





Superelevation

CHAPTER OBJECTIVES

In this chapter you will review the preferences and dialogs for computing superelevation. Also included will be instruction on **Shape Manager** tools.

INTRODUCTION

GEOPAK supports a myriad of options for the definition of pavement on proposed cross sections. They range from a single slope specification emanating from a baseline / profile on each section, to complicated multiple roadways, each with its own superelevation transitions.

The most basic is the project where no superelevation transitions are required, i.e., the roadway slope for all pavement (if any) can be specified as a single value. In this case, the slope can be defined with the proposed cross section processing and any additional superelevation work is not required. This process will be utilized in Exercise 12 when we have GEOPAK draw the existing shoulder and pavement on the sections – shapeless.

Another option is the definition of superelevation when roadways are constant widths without tapers, i.e., turn lanes, acceleration and deceleration lanes, etc. In these areas, the automated superelevation can be utilized, based on a user-defined design speed and considering the geometry of the specified roadway. After careful review of the data (in ASCII format) and overriding the computed values, GEOPAK draws pavement representations as complex shapes into a MicroStation 2D design file.

A third option is the definition of superelevation when roadways are not constant widths, i.e., gore areas, turn lanes, acceleration and deceleration lanes, etc. In these areas, graphics elements within a MicroStation 2D design file are utilized to create complex shapes which define the superelevation transitions.

A combination of these tools can be combined with a project, or even within a single roadway. The shapeless mode is excellent for rural applications, low volume city streets, frontage roads, etc., while the automated method quickly generates automated shapes for more complex roadways. Any area which cannot be defined via the automated method can be augmented by the graphical method.



ACCESSING AUTOMATED SUPERELEVATION (AUTOSHAPE INPUT FILE MAKER)

The Automated Superelevation tool can be accessed by selecting Applications > GEOPAK ROAD > Cross Sections > Superelevation Shape Manager Tools. It can also be invoked from Project Manager by clicking the Calculate Superelevation button or by selecting the Automated Superelevation icon from the GEOPAK ROAD tool frame.

The GEOPAK Superelevation package enables the user to create, edit, and run an autoshape input file quickly, basing it on an existing COGO alignment.

A set of preferences is available which gives the user complete control over every aspect of the standardization of the superelevation design process. AASHTO Method V is available as a default, along with the ability to employ user-defined lookup tables both for e (superelevation rate) and for runoff length. User-defined equations may also be entered to compute these values. A thorough set of options is available for resolving the superelevation conflicts of Reverse Curves, Compound Curves, Broken Back Curves, and Short Curves.

GEOPAK calculates superelevation transition locations for any alignment stored into the coordinate geometry database. The main superelevation dialog is simple and straightforward, allowing the user to select which preference file is to be used for the current session, as well as enabling the entry of the typical section lane configuration in the simple engineering terms of Number of Lanes, Lane Widths, Median Width (if any), and Cross Slope. More complex lane configurations may be represented as needed.

Upon computation of the superelevation parameters (cross slopes and stationing), the information is stored in an ASCII file, where the user may review and modify the transitions, if desired. After reviewing the information, the ASCII file is executed from the Autoshape Builder to generate superelevation shapes.

8 Automated Superelevation - Mainline				
Eile				
		_ Station Ra	inge	
Job:	101 🔍	Chain: MA	AINLINE 📃 💌] 🔏
Design Speed:	50	Begin: 28	35+00.00	++++
Transition ID:	Linear	End: 34	17+91.54	***
Preference File:	english_2001	- Fac	ility: <u>Undivide</u>	d 🔻
e Selection:	4% e max 🔤	L Select	ion: all cases	
L	.eft		Right	
Profile: MAINL	INE 🔽			
Tie: Offset	- -	Offset: 🔽	0.0000	
% Slope	Offset	Offset	Dependent] _
-2.0000	0.0000	-12.0000		믣
-2.0000	-12.0000	-24.0000	<u>, 1</u>	- 🗵
				₹⁄
Create Input File: shapes.inp				
Generate Superelevation Transitions				



Job	Coordinate geometry database containing the desired chains and profiles.	
Chain	GEOPAK baseline chain dictating the horizontal geometry for which superelevation transitions are calculated. This chain is also called the Shape Cluster Baseline in the Auto Shape input file.	
Begin Station	When the chain is defined, GEOPAK populates the Begin Station with the default beginning of the chain. To compute superelevation for part of a chain, adjust the station.	
End Station	When the chain is defined, GEOPAK populates the End Station with the default beginning of the chain. To compute superelevation for part of a chain, adjust the station.	
Design Speed	Design speed that determines what Design Speed is to be used either in the tables or equations for e and length computations.	
Preference File e selection L selection	The Preferences File combo box selects which Preference File is to be used for this computation. The various Preferences Files which are available in the combo box are determined by what files have the .sep file extension in the Preference Files Path on the User Directories dialog. When it is set, the available e and length Selection combo boxes are filled in according to the csv file names as specified in the Preferences File. Those combo boxes determine which table within the .csv file will be used for computation.	
Facility	Facility determines whether the roadway cross section is to be divided or undivided. This option determines two things. For the dialog box, it determines whether or not the values Profile, Tie (Offset or PGL), and or the Tie or PGL values may be different. If they are different then two shape clusters are to be generated, which usually is required for a median. The state of the Facility option button also determines which Preference is used as found on the Distribution tab of the Preferences dialog.	
Left / Right tabs	The area enclosed in the Left / Right tabs are for the determination of values specific to shape clusters. NOTE: The right and left tabs contain data pertaining to each lane within each roadway. If the Facility is undivided, then the left tab is for the left lane(s) while the right tab is for the right lane(s). If the Facility is divided, then the right tab is for the entire right roadway, while the left tab is for the left roadway.	
Create Input File	ASCII file wherein GEOPAK creates the autoshape input file. DO NOT include the extension, as GEOPAK adds .inp to the field.	
Generate Superelevation Transitions	Commence automatic superelevation calculations	
Profile	GEOPAK profile defined as the Shape Cluster Profile in the Auto Shape input file.	
Tie	Offset - Horizontal distance from the Profile (PGL) to the Chain. PGL Chain - Chain stored in the gpk file that the shapes will be computed from. This chain does not require a profile be stored with it as the defined profile will be applied to this chain.	
Offsets	Offsets define the dimension of the shape (usually a lane) by two offset distances from the baseline. Note that tapers are not supported. Offset distances are negative if measured to the left. Each lane must have the same offset on the left as the left adjacent lane and must have the same offset on the right as the right adjacent lane (no gaps in offsets). Computation may not proceed if this condition is not met.	



% Slope	Cross slope of each shape in normal crown in percent format. A negative sign denotes the roadway going downward, while emanating away from the PGL. A Normal Crown section of 2.0% would, therefore, be entered as -2.0 . Lane offset values are entered in terms of master units, i.e., feet or meters.	
Dependent / Independent	One dependent shape, which is based on the profile, is required for each cluster. Other shapes are drawn not based on the profile, but on adjoining lanes, and are independent. For example, turn lanes are drawn abutting next to the mainline roadway, so they are independent. However, a lane based on the profile for its initial elevation, such as one of the through lanes, is profile dependent.	
Edit buttons: Add Delete Modify	Add – populate the fields and click Add. To delete a line, highlight the desired line, then click the Delete button. To modify a line, highlight the desired line, click once on the value to be modified. The value will be placed in an edit mode. Change the value then hit enter or tab out of the field.	
Quick Entry (second to bottom tool to the right of the list box)	Enables the user to populate the shape cluster list boxes quickly while entering the data using engineering terminology.	
Rectify Lanes (bottom tool to the right of the list box)	If Offset values have been entered that create a gap between lanes, the Rectify Lanes option removes this gap. Click Rectify Lanes and the values will be modified so that any gaps are removed.	



Selection of the **Generate Superelevation Transitions** button performs the actual superelevation computations. Three things happen at this point.

- First, the superelevation transitions as computed by GEOPAK are written to the Autoshape Input File specified by the user (in the Create Input File field).
- Second, the log file is written.
- Finally, the Autoshape Input File is loaded into the text editor running within MicroStation. This Autoshape Input File Editor has an icon at the top that allows the Autoshape Input File to be run. Autoshape Input files can also be run from the Autoshape Builder.

BText Editor: shapes.inp	<u>- 🗆 ×</u>
<u>Fi</u> le <u>E</u> dit <u>C</u> riteria	
/* Superelevation Settings and Parameters:	
Project Name: C:\data\geo\road1\road1.prj User: C:\data\geo\road1\projdbs\john Run Name: Mainline Unit System is english. Created input file "shapes.inp". Created activity log file "shapes.log". Created on Tue, Dec 23, 2003 at 15:32. Using Preference File "english_2001" Using e Selection of "4% e max". Using Length Selection of "all cases" Using Design Speed of 50.000000.	
*/	_
auto shape job number = 101	
auto shape set shape cluster baseline = MAINLINE shape cluster profile = MAINLINE shape cluster tie = 0.0000 independent shape chain / offset MAINLINE -24.0000 MAINLINE -12.0000 filler line station / slope 285+00.000000 -2.0000	•
Line: 1 Co	1: 1



DRAW SHAPES INTO PLAN VIEW FILE

The Autoshape Builder is NOT accessible from Project Manager but can be invoked by selecting Applications > GEOPAK ROAD > Cross Sections > Superelevation Shape Manager Tools or by selecting it from the GEOPAK ROAD tool frame.

Once the shape input file (fname.inp) has been created and reviewed, the designer can run the input file to place the superelevation shapes into the specified graphics file. To use the interactive method to define roadway superelevation (in a .dgn file) the designer selects the **Autoshape Builder** from the Superelevation Shape Manager Tools tool bar (or alternately from this same tool within the Text Editor as described above).

Superelevation Autoshape Builder
Autoshape Input File: shapes.inp
Display Only Superelevation Shape Level Symbology Override Input File Level Symbology
Dependent Shape:
Independent Shape:
Draw Superelevation Shapes

Autoshape Input File	Name of .inp file (shapes.inp) created by the Automated superelevation generation containing the transitions.
Display Only	Create the shapes in "Display Only" mode. That is, they are not written to the design file and a view Update operation eliminates them, as does zoom in, etc.
Override Input File Level Symbology	This option is used to override the Plot Parameters settings in the Superelevation Shapes input file.

The shapes are placed in a 2D graphics file on level 63 by default. The plot parameters can be modified in the input file with a text editor prior to building the shapes into the graphics file or with the User > Symbologies pull down on the Automated Superelevation dialog.



SUPERELEVATION SHAPE MANAGER TOOLS

The Superelevation Shape Manager tools can be invoked by selecting Applications > GEOPAK ROAD > Cross Sections > Superelevation Shape Manager Tools or by selecting it from the GEOPAK ROAD tool frame.

The tools in the Superelevation Shape Manager Tools toolbox are detailed below.

	Automated Superelevation - performs the actual calculations and stores the results in an ASCII file, known as the autoshape input file.
2 7	Autoshape Builder - processes the autoshape input file and draws corresponding complex shapes in the specified 2D design file.
	Shape Maker - graphical method of drawing irregular superelevation shapes. This method is utilized for gore areas, turn lanes, etc.
	Shape Analyst - provides information on any point within a GEOPAK superelevation shape.
	Shape Profiler - provides profile information based on user-define increments intersecting a GEOPAK superelevation shape.
- Contraction of the second se	Shape Editor - dynamically change parameters on a previously created shape. This includes filler line stationing, dynamic moving of shapes, etc.
	Shape Selector - highlights or selects shapes based on a wide range of user queries or filters.
3	Shape Properties - provides information on any GEOPAK superelevation shape. In addition, this shape information can be modified on individual shapes of selections of shapes.
	Shape to DTM - provides the option to store a DTM Dat file from the superelevation shapes. In addition, it can plot the calculated elevations into the design file at a user specified interval.



SHAPE ANALYST

8 Shape Analyst		
<u>U</u> ser		
Job: 101 Q	🗖 Display Only 🔲 Cross Section	
Elevation Information		
Chain : Kelect>	PGL Elevation :	
Profile :	PGL Slope :	
Station :	Cross Slope :	
Offset : 0.000000	Longitudinal Slope :	
Elevation :	Flow Slope :	
Extrapolate Fixed Slope : 0.000000 %		
By Sta/Offset	DP Dynamic	

The **Shape Analyst** tool is extremely useful, as it provides information on any point within a GEOPAK superelevation shape.

Before using this tool, the Job Number must be selected. Upon selecting a Job Number, a Chain must be selected that the shapes are defined relative to. If Display Only is enabled, information like elevation and a flow arrow are drawn to the view, but they are not written as elements to the active MicroStation file.

When the **Cross Section** toggle is not activated and a data point is issued within a shape, the elevation of the data point and a flow arrow are displayed. When the toggle is activated, a dashed line is placed through the data point, radial to the shape cluster baseline. In addition to the elevation and flow arrow placed at the data point, elevations are displayed where the cross section line intersects any superelevation shape and cross slopes are labeled for each shape.

The **By Sta/Offset** button causes the current Station / Offset value to be projected back onto the shape cluster baseline and the elevation of the projected point is displayed. This option can be manual entry only and requires no data point on the screen.

The **DP** button works within a superelevation shape whose X, Y coordinates are utilized to compute station / offset from the specified shape cluster baseline, which is subsequently utilized in conjunction with the shape to compute the various slopes and elevations. After the **DP** button is clicked, numerous data points can be placed. It is not necessary to click the DP button again. Each corresponding station / offset is displayed along with the associated output information.

The **Dynamic** button activates the dynamic mode. As the cursor moves across the screen, any momentary pause places the elevation and flow arrow in the MicroStation file and computes and displays the analysis information.

The **Extrapolate Fixed Slope** toggle is another option supported in the **Shape Analyst** tool. The option is utilized when the data point, dynamic point or station / offset is outside of the shape. When the option is not activated, the data point is projected back to the shape's chain. The elevations at the edges of the shape are displayed and the slope of the outside shape is projected to the data point. When the toggle is enabled, the user defined slope is projected from the outer most shape to the data point to determine an elevation.

SHAPE PROFILER

The **Shape Profiler** tool computes elevations along any GEOPAK shape or MicroStation element at a user specified interval. The element can be inside or outside of the shapes.



🞖 Shape Profiler	_ 🗆 🗙
<u>U</u> ser	
Job: 101 Q	🗖 Display Only
Graphic Grade 🛛 💌	
Chain : 🛛 < Select> 🔄 💌	Identify Shape
From Station :	+ ⊕+
To Station :	+ ⊕+
Even 🔻 1	
Elevation Along: Element	
🗌 🔲 Continuous Extrapolation 🖉 🗌	Complex Chain
[Identify Element	

The Job field can be populated by key in or using the **Select...** button. After selecting a GPK file, click **Identify Shape** and data point on any shape along the desired Chain. Set the From Station and To Station fields by keying in values or using DP.

Even should be selected when it is desired to have the elevations compute at the even station values. Increment will allow the elevations to be computed starting at the From Station, then adding the increment value to that station. Intersect is used with an element to compute elevations at all locations that the element intersects the shape(s).

The **Elevation Along** toggle can be set to Shape or Element. When set to Shape, elevations will be computed based on the Even/Increment value along both longitudinal edges of the shape. When set to Element the elevations are computed along the element based on the **Even/Increment/Intersect** toggle.

Continuous Extrapolation allows the user to identify multiple longitudinal elements outside of the shape area and compute elevations by a user defined Slope and one of three methods: Radial to Baseline, Radial From Element, or Radial to Element.

SUPERELEVATION PREFERENCES

A set of preferences is available which gives the user complete control over every aspect of the standardization of the superelevation design process. AASHTO Method 5 is available as a default, along with the ability to employ user-defined lookup tables both for e (superelevation rate) and for runoff length. User-defined equations may also be entered to compute these values. A thorough set of options is available for resolving the superelevation conflicts of Reverse Curves, Compound Curves, Broken Back Curves, and Short Curves.

Superelevation Preferences are saved to disk in a file of ASCII format with an extension of .sep. Users may edit the file in a text editor, or they may edit it with the Superelevation Preferences Editor.

When editing a Preferences file with a text editor, comments may be inserted. Comments are delineated with a dollar sign ('\$'). Comments may take up an entire line, or may be on the same line as a data entry. When a \$ is found on a line, GEOPAK does not read that line any further. Although there is no way to edit the comments in the Preferences dialog, comments are not lost when the .sep file is edited via the dialog.



ΕΤΑΒ

The first step in the process is the computation of e for each curve. Regardless of the manner of computation, e computation is based on the curvature of each curve and the Design Speed. When the E tab is selected, the dialog dynamically changes as shown below.

8 Superelevation Preference	es:273\bin\english_1990.sep	
<u> </u>		
🔁 🛁 🖃 🔄		
e Runoff Le	ength 📋 Tangent Runout 📔 Adjust Factors)} (•••
····· ,		
e Method: 🔼	SHTO Method 5 🔹	
Table Name: en	glish_1990_AASHTO_V_ 🔍 🖻	
Speed Interpolation: Lin	ear 🔻	
Radius Interpolation: Lin	ear 🗸	
e Rounding Increment: 0.1	00000	

E Method: This option determines which method GEOPAK uses to compute **Radius** Table e. **AASHTO Method 5** Equation AASHTO Method 5 or Radius Table - this field contains the **Table name** name of the csv file in which to find the tables. Generally, no path should be given in the file name since these are controlled by Environmental Variables and/or user control in the Superelevation Computation dialog. If a path is specified along with the csv file name, that path will be used regardless of other methods of setting the path such as Environmental Variables. Equation - text field is the location where the equation is entered. Click Files to select the file. Clicking Edit opens the editor specified in the environmental variable GPK SUPER EDITOR and should normally be set to Excel or some type of spreadsheet application. **Speed Interpolation:** Specifies how GEOPAK is to interpolate between Design Speed columns if the user selects a Design Speed which is not found in Linear the table. Speed Interpolation applies to both the AASHTO **Closest Entry Conservative Entry** Method 5 table and Radius Table for e computation, **Radius Interpolation:** Radius Interpolation only applies to the Radius Table option. This interpolation option button specifies how GEOPAK is to Linear interpolate between Radius Rows if the given Radius does not **Closest Entry Conservative Entry** have a corresponding row with an exact match in the table.



E Rounding Increment

Applies to e regardless of how it is computed. This is simply rounding to the nearest evenly divisible number of the rounding value. For example, if e-rounding were set to 0.25, and e as it is computed from a table comes out to be 3.789, the value would be rounded to 3.75, which is evenly divisible by 0.25. Set a value of 0.00 to disable the rounding of e.

RUNOFF TAB

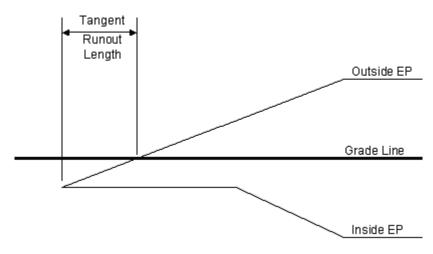
The second step in the process of computing Superelevation transitions is the computation of Unadjusted Length, which is the Runoff Length as if the roadway had two lanes only. (Adjusted Length is the true Runoff Length, adjusted for the true roadway width.) In all methods of computation of Unadjusted Length, the computation is based on the rounded e value for each curve.

名 Superelevation Preferences:273\bin\english_1990.sep 🛛 🗖 🗖 🗙		
<u>F</u> ile		
🔁 🛃 🔂		
e Runoff L	ength Tangent Runout Adjust Factors	
- Spiral	, , , , , , , , , , , , , , , , , , , ,	
	ngth O Spiral Length = Runoff Length + Tangent Runout	
- Circular Curve		
	Relative Gradient Table 🔽	
-		
Table Name:	english_1990_RGtable_I.csv 🛛 🕰	
Speed Interpolation:	Linear 💌	
e Interpolation:	Linear	
Width Basis:	Nominal Lane Width 🔹	
Nominal Lane Width:	12.00	
Consider Half Lane If Width <	9.00	
Length Rounding Increment:	5.000000	

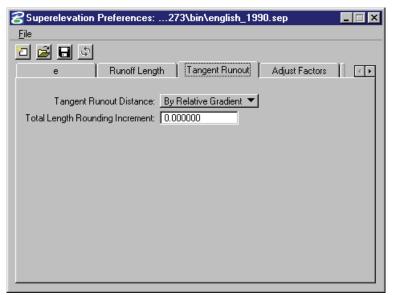


TANGENT RUNOUT TAB

Tangent Runout is the distance from a Cross Slope of Normal Crown to a Cross Slope of zero as depicted here:



Three methods are available to compute Tangent Runout Length: **By Relative Gradient**, **Fixed Distance**, or **Equation**





ADJUST FACTORS TAB

The user can control Adjustment Factor settings for three lanes up to twelve lanes. If a roadway has more than twelve lanes, the length adjustment is made according to the settings for twelve lanes.

名 Superelevation Preferences:273\bin\english_1990.sep 🛛 🛛 🗖 🗙				
<u>F</u> ile				
🖸 🖻 日	\$			
е	Runoff Length	n 📔 Tangent Runout 🗎	Adjust Factors	{ ••
	Base Adjust Factor On:	Total Number of Lanes	•	
F Multilane R	unoff Length Adjust Fac	tors		
🔽 3 Lane:	1.200000	🔽 8 Lane:	2.500000	
🔽 4 Lane:	1.500000	🔽 9 Lane:	2.500000	
🔽 5 Lane:	1.800000	🔽 10 Lane:	2.500000	
🔽 6 Lane:	2.000000	🔽 11 Lane:	2.500000	
🔽 7 Lane:	2.300000	🔽 12 Lane:	2.500000	
-				

DISTRIBUTION TAB

After Adjusted Lengths have been computed for non-spiraled ends of circular curves, the transition is distributed over the curve and its adjacent tangents and stationing is computed relative to the PC and PT. The amount of the transition which falls on the tangent is termed **Percent on Tangent**. Options are provided to base that percentage on Total Length or on Runoff Length.

名 Superelevation Preferences:273\bin\english_1990.sep 📃 🔲 🗙
Eile
Runoff Length Tangent Runout Adjust Factors Distribution
Undivided Roadway Distribute Over: Runoff Length Only 66.6666670 % On Tangent
Divided Roadway (High Side) Distribute Over: Runoff Length Only 66.6666670 % On Tangent
Divided Roadway (Low Side) Match High Side Full Super Station O Distribution: 0.000000 % On Trangent
Station Rounding: No Rounding Even: 5,000000



ROTATION TAB

The Rotation tab provides a means to indicate how the super will be rotated and the axis point the rotation will occur.

Superelevation Preferences:273\bin\english_1990.sep	_ 🗆 🗡
<u>F</u> ile	
Tangent Runout Adjust Factors Distribution Rotation	
Transition Profile: Linear V By: Slope V Outside Lane Rotation: Rotate To Match Inside Lane V Axis Of Rotation (Two Lane Undivided)	

REVERSE CURVES TAB

Reverse Curves occur when two adjacent curves which deflect in opposite directions have superelevation transitions which overlap or are in close proximity. Two levels of conflict are defined for Reverse Curves: Critical and Supercritical. The determining factors for defining a conflict as Critical or Supercritical are both based on the Length of Normal Crown existing between the two transitions. (Note that overlapping transitions may be considered to have a negative Length of Normal Crown.)



The distinction, then, between Critical and Supercritical has to do with how the conflict is handled. If the conflict is Critical, adjustments are made so that the Minimum Normal Crown Length is maintained. If the conflict is Supercritical, the transitions of the two curves are merged and Normal Crown never occurs between the conflicting curves. When GEOPAK checks for this conflict, it first checks to see if the Length of Normal Crown violates the Supercritical threshold. If it does not, GEOPAK then checks the Critical threshold. This means that if the value for Maintain Minimum Length is less than or equal to Supercritical Length, no conflict would ever be handled as Critical. Also note that either value may be negative, although this is ill-advised for Maintain Minimum Length.

名 Superelevation Preferences:273\bin\english_1990.sep 🛛 🗖 🗖 🗙			
<u>F</u> ile			
Adjust Factors Distribution Rotation Reverse Curves			
Critical Case (Maintain Normal Crown Section) Maintain Minimum Length: 15.000000 Treatment: Hold Relative Gradient, Slide Transition Stations			
Supercritical Case (Remove Normal Crown Section)			
Supercritical Length: 0.000000			
Treatment: Combine Transitions - Position 0%, Specify Relative Gradient 💌			
0% Positioning: By Degree Of Curvature			
Relative Gradient: Average			

COMPOUND CURVES TAB

The dialog contains settings for two types of conflicts in which two adjacent curves deflect in the same direction. "Compound Curves" are when two curves deflect in the same direction and have no intermediate tangent section, but instead share a common station, the PCC. "Broken Back Curves" occur when two curves deflect in the same direction and have an intermediate tangent section which is short enough that the superelevation transitions of the two curves overlap or nearly overlap.

Superelevation Preferences:273\bin\english_1990.sep		
<u>F</u> ile		
Distribution Rotation Reverse Curves Compound Curves		
Compound Curves Determine Transition Length: By Averaging Both Relative Gradients Length Distribution At PCC: By Degree Of Curvature 50,00 %		
Broken Back Curves		
Maintain Minimum Normal Crown Length 15.00		
Treatment: Lower e To Reverse Crown		
Maintain Minimum Reverse Crown Length 30.00		
Treatment: Hold Lower e Through Transition		



SHORT CURVES TAB

The Short Curve conflict occurs when the length of the fully superelevated portion of the curve is shorter than the desired minimum. This is not a conflict between two adjacent curves as the other conflict types, but is instead an undesirable situation occurring on a single curve.

Superelevation Preferences:273\bin\english_1990.sep	_ 🗆 🗵
<u>F</u> ile	
Rotation Reverse Curves Compound Curves Short Curves	
Maintain Minimum Length: 25.00 Treatment: Truncate e	•

SUPERELEVATION TRANSITION CONFLICT RESOLUTION

Superelevation Transition Conflicts occur when the stationing of the superelevation transitions of two adjacent curves overlap, or when the fully superelevated station range on one curve is too short.

When curve conflicts occur, GEOPAK attempts to resolve them by adjusting relative gradients, distribution percentages or e values, depending on the applicable preferences.

Before writing the autoshape input file, GEOPAK scans the filler line stationing created by prior processes in the superelevation flowchart for conflicts.



LAB EXERCISE: SUPERELEVATION SHAPE MANAGER TOOLS

The Shape Maker window permits graphical and interactive creation of superelevation shapes. Interactive shape creation is typically required only for those areas where the longitudinal edges of the shapes have not been stored as GEOPAK chains or offset chains. The left-turn bay shown below is an example of a shape that is typically created from the Shape Maker Window.

> SHAPE MAKER

- 1. Open the MicroStation file c:\data\geo\vdot\road2\60843\d60843work.dgn.
- 2. Attached the saved view Shape Maker.
- 3. Turn off enough levels to have a clear image of the left turn lane shown below. We need this area clear of elements in order to shape.



4. Select Applications > GEOPAK Road > Cross Sections > Superelevation Shape Manager Tools.



- 5. Click the third icon from the left to access Shape Maker.
- 6. Set the Shape Parameters portion of the dialog like the one shown below.

8 Superelevation Shape Maker	
Job Number: 101 🔍	Tolerance: 0.100000
Shape Parameters	
Baseline: NBL 💌	Class: Independent 💌
Profile: NBL	Transition ID: 0
Tie 0.000000	Symbology:
Identify Shape	Slope Label: 12.3
Filler Lines Method: <u>By DP</u> ▼ ☐ Transition Slope:	DP
Manual TD Element	Draw

- 7. In the Filler Line portion of the dialog set the Method to By Station.
- 8. Enter a station value of 121+83.00.
- 9. Key-in a slope of -3.0.



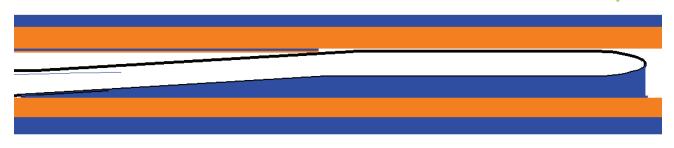
10. Click the **Create** button.

Superelevation Shape Maker			
Job Number: 101	Tolerance: 0.100000		
C Shape Parameters			
Baseline: NBL 💌	Class: Independent 💌		
Profile: NBL	Transition ID: 0		
Tie 0.000000	Symbology:		
Identify Shape	Slope Label: 12.3		
Filler Lines Method: By Station ▼ 121+83.00 ◆ Create			
Automatic Radius: 5.00	Draw		

11. Create another Filler Line at station 125+72.56 with the same slope of -3.0.

8 Superelevation Shape Maker	
Job Number: 101 🔍	Tolerance: 0.100000
- Shape Parameters	
Baseline: NBL 💌	Class: Independent 💌
Profile: NBL	Transition ID: 0
Tie	Symbology:
Identify Shape	Slope Label: 12.3
Filler Lines Method: <u>By Station</u> ▼ 125+72 □ Transition Slope: -3.0	.56
Automatic Radius: 5.00	0000 Draw

- 12. With the toggle at the bottom left of the dialog set to Automatic, click the Draw button and data point inside the turn lane.
- 13. You should now have the turn bay shaped.





> SHAPE ANALYST

The **Shape Analyst** tool is extremely useful, as it provides information on any point within or outside a GEOPAK superelevation shape. This tool supports all GEOPAK superelevation shapes, including those with non-linear (parabolic) transitions, non-zero ties and PGL chains.

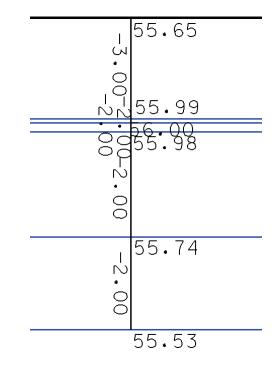
1. Click on the fourth icon from the left on the **Shape Manager** tool bar. This will invoke the **Shape Analyst** tool.

😪 Shape Analyst 📃 🗖	X	
<u>U</u> ser		
Job: 101 🔍 🔽 Display Only 🔽 Cross Sect	ion	
Elevation Information		
Chain : NBL 💌 PGL Elevation :	-	
Profile : PGL Slope :	-	
Station : Cross Slope :	-	
Offset : 0.000000 Longitudinal Slope :	-	
Elevation : Flow Slope :	-	
Extrapolate Fixed Slope : 0.000000 % By Sta/Offset DP Dynamic		
	1	

- 2. Using the chain list pull down set the chain to NBL.
- 3. Click the *DP* button and data point on a shape. (Make sure the **Extrapolate Fixed Slope** is turned OFF).



4. This should produce slope and elevation information on the shapes as shown below.



- *Note* You may have to change the symbology settings to view the text more easily. This can be done by selecting the Preference pulldown in the upper left of the dialog.
- 5. Turn ON the Extrapolate Fixed Slope toggle.
- 6. Enter a slope of -3.0.

궁 Shape Analyst			
<u>U</u> ser			
Job: 101 오	Display Only 🔽 Cross Section		
Elevation Information			
Chain : NBL 💌	PGL Elevation : 56.00		
Profile : NBL	PGL Slope : 0.05 %		
Station : 124+38.14 R 1	Cross Slope : -2.00 %		
Offset : 22.431113	Longitudinal Slope : 0.05 %		
Elevation : 55.55	Flow Slope : 2.00 %		
Extrapolate Fixed Slope : -3.000000 %			
By Sta/Offset DP Dynamic			

- 7. Click the DP button and data point outside of the shapes.
- 8. This will compute an elevation at the data point by projecting the desired slope.

Note An explanation of Extrapolate Fixed Slope is outlined below.

The **Extrapolate Fixed Slope** option is utilized when the data point, dynamic point or station / offset is outside of the shape. When the option is not activated, the data point is projected back to the shape's chain. The elevations at the edges of the shape are displayed and the slope of the outside shape is projected to the data point.



When the option is toggled ON and set to a specific slope, the slope is projected from the outside shape to the data point to calculate an elevation at that point.

> SHAPE PROFILER

The Shape Profiler will generate profile information based on projections from superelevation shapes. It can also generate profiles along any shape.

- 1. Click the fifth icon from the left on the Shape Manager tool bar.
- 2. This will invoke the Shape Profiler as shown below.

名 Shape Profiler	
<u>U</u> ser	
Job 101 Q	🔲 Display Only
Graphic Grade 🛛 💌	
Chain : NBL 💌	Identify Shape
From Station : 10+00.00	+⊕ +
To Station : 10+00.00	+ 0 +
Even 🔻 1]
Elevation Along: Element 🔹 💌]
🔲 Continuous Extrapolation 🗌	Complex Chain
Identify Element	t

3. Set the options in the dialog as shown below making sure to identify the **From Station** and **To Station**.

😪 Shape Profiler		
<u>U</u> ser		
Job: 101	Q	🔽 Display Only
Graphic Grade	•	
Chain :	NBL 💌	Identify Shape
From Station :	121+83.30	+ ⊕+
To Station :	125+72.56	+⊕ +
Increment 🔻	10.000000	
Elevation Along:	Shape 🔹 🔻	
🗖 Draw 0% Slop	ре	
	Identify Shape	

- 4. Once the settings have been made click the **Identify Shape** button at the bottom of the dialog and data point on the left turn bay shape created in the previous exercise.
- 5. Click one more data point to Accept.



6. This will compute elevations around the perimeter of the shape as shown below.

7. Next select the User > Preference pulldown in the upper left of the dialog and toggle ON the option to **Store COGO Point** setting the **Beginning Point Number** to D610.

User Preferences
Label: 12:34
Zero Line Label:
Line Style:
Arrow
Symbology:
Arrow Size: 3.000000
Elevation
Symbology: 12-34
Angle: 90.000000 Relative 🔻
Store Cogo Point Beginning Point Name: D610
Increment Point Name
Feature:
Description:
ОК

- 8. Click OK.
- 9. Click the **Identify Shape** button next to the chain field and data point on the farthest right side shape.
- 10. Set the Elevation Along option to Element.

🔗 Shape Profiler	_ 🗆 X
<u>U</u> ser	
Job: 101 오	🔽 Display Only
Graphic Grade 🛛 💌	
Chain : NBL	Identify Shape
From Station : 54+88.62	+ ⊕+
To Station : 135+36.21	+ ⊕+
Increment 10.000000	
Elevation Along: Element	▼
Continuous Extrapolation	🔲 Complex Chain
I Identify Eler	ment

11. Click the Identify **Element** button at the bottom of the dialog and data point on the existing curb line to the right of the shape.



12	2. The shap increment	be slope will be project to the element and points stored in COGO at the desired at.
010	Existing	R/W
	Note	The Store Profile By Numbers command in Coordinate Geometry generates and stores a new profile name defined by previously stored points in either A) a sequence pa-pi or B) a random list. Sequential stationing and given elevation values must be stored with points prior to execution of both formats. SYNTAX: STO PRO <i>name</i> pa-pi

> SHAPE PROPERTIES

The **Shape Properties** tool allows the user to review all the information associated with a particular shape. In addition to reviewing each aspect of the shape properties may be changed or edited.

- 1. Click the eighth icon from the left on the Shape Manager tool bar.
- 2. This will invoke the Shape Properties tool.

名 Shape Properties 📃 🗖 🗙	
Job 101	য
Shape Parameters	NBL
Profile:	NBL
🔽 PGL Chain:	<select></select>
Transition ID:	0 🔻
🔽 Tie:	0.000000
🔽 Class:	Dependent 💌
From Slope:	-2.000000
To Slope:	-2.000000
ID Set	Set Entire Selection

- 3. Toggle ON each of the properties.
- 4. Click on the ID button and data point on a superelevation shape.

Note Any of the information in the dialog may be changed by editing the values and using the **Set** button to identify the shape.







Cross Sections

CHAPTER OBJECTIVES

In this chapter we will review the Ancillary Features application and new enhancements in the latest version. These include:

- New Update Options
- AdHoc Functionality

Also a brief discussion on Tolerance settings will be included.

INTRODUCTION

The Ancillary Features application is used to draw supplemental information onto cross sections and profiles. This can be things such as right-of-way lines, drainage pipes and utilities.

8Draw Ancillary Features	
<u>F</u> ile <u>E</u> dit <u>U</u> pdate Options	
Job Q Label Scale: 1.00	Draw
Chain: <none> Station Range Begin:</none>	
View: Profile 🔽	
Offset: 0.00 End:	<u>++++</u>
Element Type Elevation Display Setting: Draw	- 7
	×
I	
Intersecting Elements	
Chain Kone>	
Cogo Profile: None>	
🗌 🔲 Extract Elevation 🔤 🕅 💙 Vertical Offset: 🚺	.00
TIN File:	Q
Display Settings	
Scale: 1.00 🗖 Apply Vertical Exaggeration	
Justification: Center Center	



ACCESSING

The Ancillary Features application can be accessed from **Applications > GEOPAK Road > Cross** Sections > Draw Ancillary Features.

OVERVIEW

The dialog settings can be saved into a settings file via the File pulldown menu. This file can then be loaded at anytime to restore the settings of the dialog.

Each ancillary feature to be drawn must be added to the list box. Once added, each feature can then be modified or deleted as needed.

8 Draw Ancillary Features	_ 🗆 🗙
<u>File</u> dit <u>U</u> pdate Options	
Job: 101 🔍 Label Sc	ale: 1.00 Draw
Unain: IMAINLINE 🔍 LAI	n Range 285+00.00
View: Profile 🔻	
Offset: 0.00	347+91.54
Element Type Elevation Display	Setting: Draw
Chain = PIPE Profile = PIPE Cell = G Lv: Buri\3 Same Element Cell = Ca	
Ev. Bunt VS Same Element Cell - Co	
I	
	Direlan 1
Level Symbolog ▼	Display
	ertical Offset: 0.00
Search Criteria:	Display
Display Settings	
Cell Cable - Telephone	<u> </u>
Scale: 1.00 Apply Vertical Exag	geration
Justification: <u>Center Center</u>	

The **Intersecting Elements** portion of the dialog is where you specify how to determine the offset (plan view location) and elevation of the ancillary feature.

Intersecting Elements		
Level Symbolog 🔻		Display
DGN File: C:\data\g	eo\road1\Plan2D.	.dgn ્
Extract Elevation	Level Symb 🔻	Vertical Offset: 0.00
Search Criteria:		Display



There are four options with which to specify the offset location of the ancillary feature:

- Chain allows you to specify any COGO chain. This chain will then be used to calculate the offset of the ancillary feature.
- **Survey Chain** allows you to specify any Survey chain. This survey chain will then be used to calculate the offset of the ancillary feature.
- Level Symbology allows you to specify the graphical symbology of a specified feature. Note that with this option you must also specify the DGN file where the feature is located.
- **Feature** allows you to specify a D&C Item Name. The symbology specified by this item name will then be used to search for the specified ancillary feature. Note that with this option you must also specify the DGN file where the feature is located.

There are also multiple options with which to specify the elevations of the ancillary feature:

- **TIN** -The TIN option works in conjunction with the Vertical Offset. First, the elevation of the DTM at the chain location will be calculated, then the vertical offset (depth of cover) will be applied to determine the elevation of the ancillary feature.
- Level Symbology The Level Symbology option also works in conjunction with the Vertical Offset. In this case the offset is calculated from a Graphical Element in the dgn file (usually either a ground line or existing profile).
- **Feature** The Feature option also works in conjunction with the Vertical Offset. This is very similar to the Level Symbology, except in this case the symbology is taken from the D&C Feature. The offset is again calculated from a Graphical Element in the dgn file (usually either a ground line or existing profile).
- AdHoc Attribute This is a new enhancement that will allow you to attribute an element and will cause the elevation to be read from a graphical element containing the adhoc name "Profile" and "Offset".

The **Display Settings** portion of the dialog is where you specify how to display the ancillary feature on the cross sections or profile.

Display Settings
Cell 🔽 Cable - Telephone 🔍 🗆
Scale: 1.00 🗖 Apply Vertical Exaggeration
Justification: Center Center 💌



You have three options with which to specify how the ancillary data will be displayed.

- **Cell** The cell library can either be attached to the dgn file OR it can be read from the MS_Celllist variable.
- **Symbol** You can control the justification of the symbol, as well as the height and width of the symbol.
- **Text** Note the standard Text Symbology dialog can be used to set the text symbology. The angle of the text can also be controlled.

UPDATE OPTIONS

The new application now supports Update Options much the way the Existing Ground Cross Section application does. These options allow the user to choose from one of four modes.

Delete Existing Elements and Redraw Delete Non-Modified Elements and Redraw Draw on Top of Existing Elements Query

The options are toggled off / on by each selection of the option. The check to the left of the option indicates the option is active. Only one option may be active at any given time, therefore, if an option is selected, the previous active option is de-activated.

Delete Existing Elements and Redraw

Any ancillary feature lines previously drawn with this tool are deleted and new features are drawn.

Delete Non-modified Elements and Redraw

Only features previously drawn with this tool AND have not been modified are deleted and new features are drawn. Any features previously drawn with this tool and modified are left intact.

Draw on Top of Existing

Any previously drawn features are ignored and a new set is drawn, resulting in two sets of features.

Query

When activated, the user is prompted each time Draw is clicked.

The user must select one of the three options and click Apply to commence processing. Clicking Cancel closes the dialog with no subsequent processing.

LAB EXERCISE: ANCILLARY DATA

> MAPPING UTILITIES

- 1. Open the MicroStation file C:\DATA\GEO\VDOT\ROAD2\60843\su60843.dgn.
- Access the Ancillary Features application. (Applications > GEOPAK Road > Cross Sections > Draw Ancillary Features).
- 3. In the main dialog set the job number to 101.





- 4. From the main Ancillary Features dialog set the **Intersecting Element** toggle to **Level Symbology**.
- 5. Open the symbology dialog and using the match button data point on the element representing the sewer line to set the symbology.

8 Inte	ersecting Eleme	nt Symb	ology	_ 🗆 ×
~	Lv Names: Le	vel 3		2
	Lv Numbers:			2
☑	Colors: 5			2
	Styles:			2
▼	Weights: 3			2
	Types:			2
	Match Di	splay	Res	et

- 6. Close the Symbology dialog.
- 7. In the field for **DGN File**, set the file to *su60843.dgn*.
- 8. Open the MicroStation file *d60843xsmainline.dgn*.
- 9. Click on the Extract Elevation toggle and set the toggle to Level Symbology.
- 10. Open the symbology dialog and using the match button data point on the element representing the existing ground to set the symbology.

8Ext	ract Elemen	t Elev Symbol	ogy 💶 🗙
	Lv Names:	Level 1	<u></u>
	Lv Numbers:		2
☑	Colors:	1	2
	Styles:	2	2
V	Weights:	5	2
	Types:		2
	Match	Display	Reset

- 11. Close the symbology dialog.
- 12. In the Vertical Offset field key-in -6.0.



2 Draw Ancillary Features
File Edit Update Options
Job: 101 Q Label Scale: 1.00 Draw Chain: MAINLINE Station Range Station Range Begin: 10+00.00 Image: 10+00.00
Element Type Elevation Display Setting Draw
Intersecting Elements
Level Symbolog Display
DGN File: C:\60843\su60843.dgn Q
Extract Elevation Level Symb Vertical Offset: 6.00
Search Criteria:
Display Settings
Symbol Justification: Center Center Width: Fixed 1.00 Height: Fixed 1.00

> **DISPLAY SETTINGS**

- 1. In the Display Settings portion of the dialog change the toggle to **Symbol**.
- 2. Set the symbology as shown below.



- 3. Click OK.
- 4. Set the symbol to the circle option.



5. Set the remaining options as shown below.

0 1	
名 Draw Ancillary Features	
<u>File Edit Update Options</u>	
Job: 101 Q	Label Scale: 1.00 Draw
Chain: MAINLINE 🗔 🔀	Station Range
View: Profile 🔻	Begin: 10+00.00
Offset: 0.00	End: 158+73.05
Element Type Elevation	Display Setting: Draw
	님
Intersecting Elements	
Level Symbolog 🔻 🦳 🔍	Display
DGN File: C:\60843\su60843.dg	<u>n </u>
Extract Elevation Level Sym	b▼ Vertical Offset: -6.00
Search Criteria:	Display
Display Settings	
Symbol 🔻 🔿 🔻 Just	ification: Center Bottom 🔽
	ith: Fixed 🔻 2.00
🔽 Heig	pht: Fixed 🔽 2.00

6. Using the icons on the right side of the list window, add the utility into the list window.

궁 Draw Ancillary Features 📃 🗖	×
<u>File</u> dit <u>U</u> pdate Options	
Job: 101 Q Label Scale: 1.00 Dra Chain: MAINLINE Station Range	
View: Profile Begin: 10+00.00	•••
Offset: 0.00 End: 158+73.05	• €•
Element Type Elevation Display Setting: Draw Lv: Level\ Lv: Level\ Symbol = Circle □	
Intersecting Elements	
Level Symbolog Display	
	<u>२</u>
Extract Elevation Level Symb Vertical Offset: -6.00	- 1
Search Criteria:	
Display Settings	
Symbol Justification: Center Bottom	
Width: Fixed V2.00	
✓ Height: Fixed ▼ 2.00	

7. Change the **Display Setting** toggle to **Text**.



8. Set the symbology and text settings as shown below.

Text Symbology
Symbology
Level: Level 53
Color: 🔲 39 📃
Weight: 2
Text Preferences Set Justification
Th: 1.000
Ft: 🔄 23 ITALICS 💽
TH/TW Fixed 💌
Traverse Offset: 2.000
Radial Offset: 0.000
<u>D</u> K Cancel

- 9. Click OK.
- 10. In the Label field key-in ELEV=.
- 11. Now select the Intrinsic Variable, Elevation using the pulldown under the yellow question mark.
- 12. This will create an elevation label and should look like the dialog below.

😪 Draw Ancillary Features		×
<u>File</u> Edit <u>U</u> pdate Options		
Job: 101 오		aw
Chain: MAINLINE 🖃 🔀	Station Range Begin: 10+00.00	+••+
View: Cross Section 🔻		_
Offset: 0.00	End: 158+50.00	+••+
Element Type Elevation	Display Setting: Draw	ы
Lv: LevelV Lv: LevelV	Symbol = Circle 🛛 🗹	븳
Intersecting Elements		
Level Symbolog 🔻 🚬 🔍	Display	
DGN File: C:\60843\su60843.dc	jn	ব
Extract Elevation Level Sym	b▼ Vertical Offset: -6.00	
Search Criteria: 🗾	Display	
Display Settings		
Text 🔻 😪	Angle: 0 00 00 📑 💡	•
Label: ELEV= {ELEVATION}		



13. Using the icons on the right side of the list window, add the text item into the list window.

名 Draw Ancilla	ary Features		_ 🗆 X
<u> </u>	date Options		
Job: 101	9	Label Scale: 1.0)0 Draw
Chain: MAINLI	NE 🔽 🔀	Station Range	
View: Cross S		Begin: [10+00.	
Offset: 0.00		End: 158+5	0.00
Element Type	Elevation	Display Setting:	Draw 📶
Lv: LevelV	Lv: Level V	Symbol = Circle	
Lv: Level\	Lv: Level\	Text = ELE	
Intersecting Eler	ments		
Level Symbolog	, ▼ ~~Q	- Display	
DGN File: C:\6	0843\su60843.d	gn	ব
Extract Elev	ation Level Syr	nb 💌 Vertical Of	fset: -6.00
	· .	Display	-
Search Crit			
Display Settings			- 1
Symbol 🔻		stification: <u>Center</u>	
		idth: Fixed	2.00
	🔽 He	ight: Fixed	2.00

- 14. Click the **Draw** button.
- 15. When prompted set the Update Option as shown below and click Apply.

Update Option	
O Delete Existing Elements and Redra	w
O Delete Non-Modified Elements and	Redraw
Draw on Top of Existing Elements	
Apply	Cancel

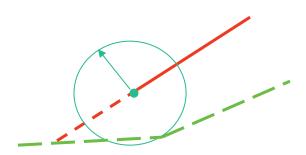


TOLERANCE

Filter Tolerance

Both **Horizontal** and **Variance** filter tolerances are considered together for each pair of cross section segments. The middle point is deleted if both segment lengths are less than the **Horizontal** filter tolerance while the projected distance between the mid-point and the chord between the two end points is less than the **Variance** tolerance.

2 Draw Cross Sections		
File Edit Update Option	s	
Job Number: 101 💌 Cł	hain: MAINLINE	▼ Draw
		🗖 DP Origin
XS Cells Surfaces		
Type Name	Display Settings	Method
TIN	Lv: Default, Co: 0, L	
		머
		\mathbf{X}
– Details –		
TIN File:		ি ব
Method: Tri	angles 🔻	Type: Line 🔻
- Display Settings		Filter Tolerances
By Level Symbology 🔻		Horizontal: 0.30
Feature: CSEGL	토	Variance: 0.10
- Text Settings		
Elevation	12	Void





Default Tolerances

Any cross section processing can accept a tolerance value that defines the distance such that two elements with endpoints closer together than the tolerance values are assumed to be connected. In addition, if two elements whose minimum distance apart is less than the tolerance then they are considered to be coincident. The table below depicts default tolerances (i.e., tolerances used by the software if the user does not explicitly define a tolerance).

Function	Default Tolerance (English)	Default Tolerance (Metric)
Ancillary data	0.10	0.030
Earthwork	0.01	0.003
Existing ground profile	0.50	0.152
Existing ground cross section	0.50	0.152
Plan view limits of construction	0.10	0.030
Proposed profile from cross sections	0.10	0.030
Proposed cross sections	0.10	0.030
Reports - Hydraulic	0.10	0.030
Reports - Critical Points	0.01	0.003
Reports - All Others	0.01	0.003
Auto shapes	0.75	0.03
Sheet layout	1.00	0.300







Earthworks

CHAPTER OBJECTIVES

In this chapter, you will learn:

- The procedures for calculating earthwork quantities with GEOPAK
- How to use Project Manager to set up and process an earthwork run

INTRODUCTION

GEOPAK forms graphical earthwork shapes in a (MicroStation) cross section design file to represent the end areas used to calculate volumes by the end-area method. These shapes are created when the designer processes an earthwork run in which the existing ground, finished grade, base, etc. are identified by level, color, weight and type.

ACCESSING

When Earthwork in the Road Project Manager is clicked, the Select Run dialog is displayed. An existing run may be selected or new run may be started. When complete, click OK, which closes the Select Run dialog and opens the earthwork dialog.

The left side of the dialog contains the list of parameters required to compute earthwork. When each parameter is selected, the dialog changes the key-in fields to reflect the selection.



For example, when EW Shapes is selected, the dialog changes as illustrated below.

名 Earthwork - Untitled		_ 🗆 ×
<u>F</u> ile		
XS DGN File Soil Types Earthwork Shapes Output Format Add/Subtract Volume Centroid Adjustment Skip Areas Ignore Areas Sheet Quantity	 Draw Earthwork Shapes Stratify Shape Color 	

EARTHWORK DIALOG

XS DGN FILE

In **XS DGN File** the user can specify the file name in which to find the cross-sections. Tolerance specifies the maximum distances between two elements (in a cross section) to be considered as adjoining. Vertical Search Distance specifies the distance above and below the cross-section to look for elements pertaining to that cross-section. Baseline specifies the GEOPAK COGO chain the cross-sections are based from. Begin/End Station specifies the beginning and ending stations to perform the earthwork calculations.

Earthwork - Untitled	
<u>F</u> ile	
XS DGN File	XS DGN File: C:\60843\d60843xsmainline.dgr Q
Soil Types	Tolerance: 0.010000
Earthwork Shapes Output Format	Vertical Search Distance: 500.00
Add/Subtract Volume	Baseline: MAINLINE
Centroid Adjustment Skip Areas	Begin Station: 10+00.00 R 1
Ignore Areas	End Station: 158+50.00 R 1
Sheet Quantity	



SOIL TYPES

The Soil Types dialog requires the user to define the symbology and shrinkage/swell factors to be used.

名 Earthwork - Untitled	
<u>F</u> ile	
XS DGN File Soil Types Earthwork Shapes Output Format Add/Subtract Volume Centroid Adjustment	Soil Type Items
Skip Areas Ignore Areas Sheet Quantity Class <u>Existing Ground</u>	Search Criteria
Soil Type: Multiplication Factors Roadway Excavation: 1.000 Subsoil Excavation: 1.000 Fill: 1.000	✓ Lv Names: □ ✓ Lv Numbers: □ ✓ Colors: 1-2,32-34,67,96,99 □ ✓ Styles: □ ✓ Weights: □ ✓ Types: □
Add	Match Display Reset

The user must first select the Class of the soil type.

Existing Ground - Identifies the surface of the existing ground. This classification is required to calculate earthwork. It also defines the default excavation material.

Proposed Finish Grade - Surface of the proposed roadway. This classification is required to calculate earthwork and defines the default fill material.

Existing Suitable - Material between excavation limits that is to be removed only when it encroaches on the proposed design. For example, if the proposed design is in fill, therefore above the existing suitable, it is not removed.

Existing Unsuitable - Material between excavation limits that is to be removed in all circumstances.

Proposed Undercut - Proposed layers that are not part of the finish grade, i.e. pavement layers, shoulder layers.

Excavation Limit - Pairs of vertical lines drawn in the cross-sections to define the limits of removal for any existing suitable or unsuitable material.



Once the Classification is chosen, a Soil Type, the element symbology of the material, and the shrinkage/swell factors need to be entered. A Classification, except Existing Ground, can be listed multiple times. The Soil Type determines how the cut and fill are calculated. For example, a user creates an earthwork run with a classification of Existing Ground with a soil type of Existing, classification of Proposed Finish Grade with a soil type of Suitable_Grading, and a classification of Proposed Undercut with a soil type of Pavement. The output from the run would look as follows.

Material Name Station	End Areas	Unadjusted Volumes	Adjusted Volumes	Mult Factor	Mass Ordinate
	(square	(cubic	(cubic		
	ft)	ft)	ft)		
287+00					
SUITABLE_GRADING					
Excavation	0.00	0	0	1.00	
Fill	12.32	336	336	1.00	2887
EXISTING					
Excavation	25.88	654	654	1.00	
Fill	0.00	0	0	1.00	3541

In the same example, if both classifications of Existing Ground and Proposed Finish Grade had the soil type of Suitable_Grading, then the output would look as follows.

Material Name Station	End Areas (square ft)	Unadjusted Volumes (cubic ft)	Adjusted Volumes (cubic ft)	Mult Factor	Mass Ordinate
287+00 SUITABLE_GRADING Excavation Fill	25.88 12.32	654 336	654 336	1.00 1.00	3541

As can be seen from the above examples, when the soil types for the Existing Ground and Proposed Finish Grade classifications were named differently, both soil types appeared in the output. When the soil types for the Existing Ground and Proposed Finish Grade classifications were named the same, the quantities for each classification were combined into one soil type. By paying close attention to the soil types, the user can specify when material can be re-used and exactly where a specific soil type should be placed.

Once the Classification and Soil Type are chosen, the user can select the Element Symbology to define that particular Soil Type and the Multiplication Factors for the Soil Type. The Match button can be used to select the Element Symbology. Once the Match button is selected, the user can select the elements in the MicroStation view. The symbology of that element will be added to the symbology list used to define the Soil Type.



EW SHAPES

Earthwork Shapes enables the earthwork shapes to be drawn with the associated symbology. The colors of the earthwork shapes can be stratified, so that cut and fill or each soil type are different.

ZEarthwork - Untitled		_ 🗆 ×
<u>F</u> ile		
XS DGN File Soil Types Earthwork Shapes Output Format Add/Subtract Volume Centroid Adjustment Skip Areas Ignore Areas Sheet Quantity	Draw Earthwork Shapes Stratify Shape Color	

OUTPUT FORMAT

Output Format enables the user to specify which items to show in the earthwork report.

名 Earthwork - Untitled	
Eile XS DGN File Soil Types Earthwork Shapes Output Format Add Cohere Michael	Accumulate Adjusted Volume Column Accumulate Unadjusted Volume Column Calculate only between Excavation Limits
Add/Subtract Volume Centroid Adjustment Skip Areas Ignore Areas Sheet Quantity	✓ End Area Decimal Places 1 ▼ Common Exc Subgrade Exc Subsoil Exc Fill

With this command, any combination of the three classifications of excavation volumes can be formulated. For example, if the user desires to combine all three into an earthwork listing of simply cut and fill, press the < or > arrows until the desired option is displayed. Options include:

- Common Exc, Subgrade Exc, Subsoil Exc, and Fill
- Excavation (Common and Subgrade), Subsoil Exc, and Fill
- Excavation (Common and Subsoil), Subgrade Exc, and Fill
- Excavation (Subgrade and Subsoil), Common Exc, and Fill
- Excavation (all types) and Fill



ADD/SUB VOLUMES

Add/Subtract Volumes allows the user to enter volumes to be added or subtracted from the total earthwork calculated from the available sections. The user can specify whether to add excavation or fill, the soil type, the station, and the volume to be added.

名 Earthwork - Untitled					
<u>F</u> ile					
XS DGN File Soil Types Earthwork Shapes Output Format Add/Subtract Volume Centroid Adjustment Skip Areas Ignore Areas	Class	ess Add/Subtract \	/olumes Soil Type	Station	Volume
Sheet Quantity	Earthwo	Soil Type Station: k Operation <u>Com</u> Volume:	mon Exc 💌		Add Delete Modify

CENTROID ADJUSTMENT

Earthwork volumes are calculated by averaging end areas and then multiplying these averaged areas by the distance between two successive cross sections as measured along the baseline. If the bulk of the cross section areas are located predominantly to either the left or the right of the baseline, as in a detour, an error occurs in the volume calculations for all non-tangential portions of the baseline. This error can be negligible or substantial depending on the degree of baseline curvature as well as the degree to which cross section areas are offset about the baseline. These types of errors can be optionally accounted for via specification of the **Centroid Adjustment**.

名 Earthwork - Untitled	
<u>F</u> ile	
XS DGN File Soil Types Earthwork Shapes Output Format Add/Subtract Volume <u>Centroid Adjustment</u> Skip Areas Ignore Areas Sheet Quantity	Centroid Adjustment



SKIP AREAS

Skip Areas enables the user to specify an area (i.e. bridge exception) in which not to calculate earthwork volumes. These volumes, though not included in the Mass Ordinate, will still display in the station reporting.

名 Earthwork - Untitled		_ 🗆 🗙
<u>F</u> ile		
XS DGN File Soil Types Earthwork Shapes Output Format Add/Subtract Volume Centroid Adjustment Skip Areas Ignore Areas	Process Skip Areas Begin Station End Station	
Sheet Quantity	Begin Station: End Station: Add Delete Modify	

IGNORE AREAS

There have been a couple of enhancements to the earthwork computations to provide better reporting of earthwork functions. The first of these is the addition of **Ignore Areas**.

Ignore Areas allows the user to insert a range of stations to be completely ignored during earthwork computations. The end areas and volumes will not be computed between the beginning and ending station as if the sections did not exist.

名 Earthwork - Untitled		_ 🗆 🗙
<u>F</u> ile		
XS DGN File Soil Types Earthwork Shapes Output Format Add/Subtract Volume Centroid Adjustment Skip Areas	Process Ignore Areas Begin Station End Station	
Sheet Quantity	Begin Station: End Station: Add Delete Modify	J



9+00.00 EARTH					
Excavation	140.9	546	546	1.00	
Fill	976.2	3689	3689	1.00	-3143
10+00.00 EARTH					
Excavation	141.9	524	524	1.00	
Fill	990.7	3642	3642	1.00	-6261
11+00.00 EARTH					
Excavation	116.5	478	478	1.00	
Fill	1180.6	4021	4021	1.00	-9804
14+00.00 EARTH					
Excavation	0.0	647	647	1.00	
Fill	2625.6	21146	21146	1.00	-30303
16+00.00 EARTH					
Excavation	20.3	75	75	1.00	
Fill	3422.0	22398	22398	1.00	-52626

SPLIT SUMMARY TOTALS

The second enhancement involves the reporting of earthwork quantities. There is now the ability to report **Split Summary Totals**. This will report any addition or subtraction of volumes in a separate column in the summary portion of the report as shown below.

8	Process Cross Se	ections Displa	ay					
		GR	AND SUN	MARY	ΤΟΤΑΙ	LS		
		Materia	l Name	Unadjusted	Adjusted	Mult		
				Volumes	Volumes	Factor		
				(cu.yd.)	(cu.yd.)			
	EARTH		F			1 00		
				8524				
				224952		1.00 ТОТАЦ 9	-	
11.			JFL.			Add/Sub Quant		
		Material	Name			Unadjusted		Mult
		10002101	HOME			Volume		Factor
						(cu. yd.)		
	EARTH							
			Excavation	6524	6524	2000	2000	1.00
			Fill	224952	224952	0	0	1.00
								_
	Next Run					E	xit	



SHEET QUANTITIES

Sheet Quantities allows a user to write an earthwork quantity file to be used when plotting crosssection sheets.

名 Earthwork - Untitled	
<u>F</u> ile	
XS DGN File Soil Types Earthwork Shapes Output Format Add/Subtract Volume Centroid Adjustment Skip Areas Ignore Areas Sheet Quantity	Write Sheet Quantities File ASCII File: Decimal Places O Column Soil Type Earthwork Operatio Quantity Type +/- Column Soil Type Earthwork Operatio Quantity Type +/- I ✓ Common Exc End Area Add Delete Modify

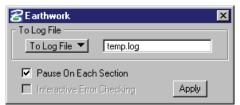
The name of the ASCII file can be chosen or entered. The user then selects the columns in which to place the quantity, the number of decimal places, the total column width, the soil type, the earthwork operation, and the type of quantity.

This information is written to the ASCII file, and can be used to plot the quantities on the cross-section sheets.

From the **Files** menu, the **Run** option processes all parameters that have been set in the Earthwork dialog. The **Save Settings** option saves all information in the Earthwork dialog. The **Export** option saves the parameters in the Earthwork dialog as an ASCII input file. The **Exit** option exits the Earthwork dialog.

PROCESSING

After all necessary information has been entered, the user has two options. The preferred method of running the earthwork is to select the **Run** option. The following dialog appears and the user may proceed by entering a log file name, choosing the **Pause On Each Section** option and then clicking **Apply**. The second method is to export the information as an ASCII input file, then use the **Process Cross Sections** tool.

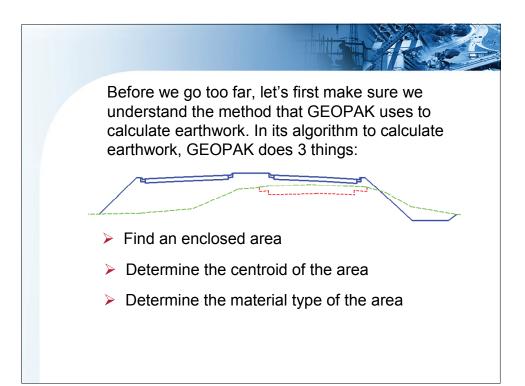


The earthwork quantities are written to the bottom of the log file and can be reviewed in any standard ASCII text editor.

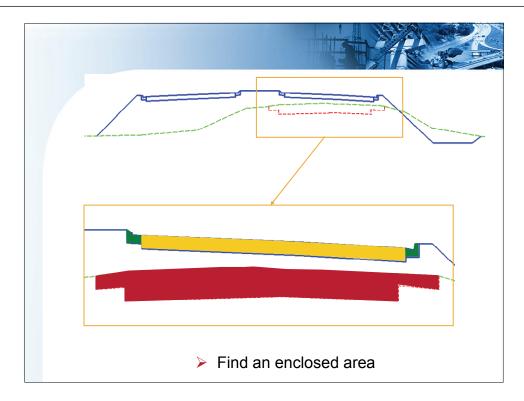


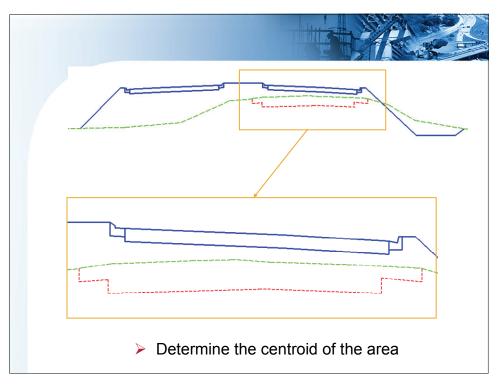
Most people are comfortable dealing with earthwork as long as it involves standard cut and fill volumes. However, once it goes beyond standard cut and fills it can sometime become confusing.

We will now delve into these more advanced earthwork topics. GEOPAK is fully capable of calculating just about any type of earthwork scenario a user can come up with. However, in order to utilize these capabilities the user must understand both how the earthworks are calculated and the different material classes and their uses.

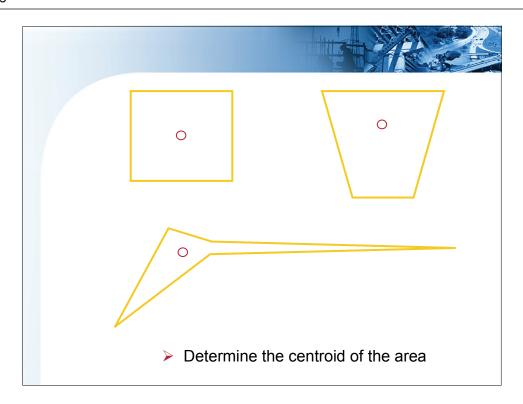


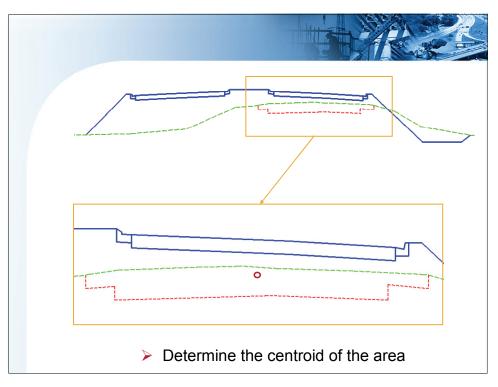




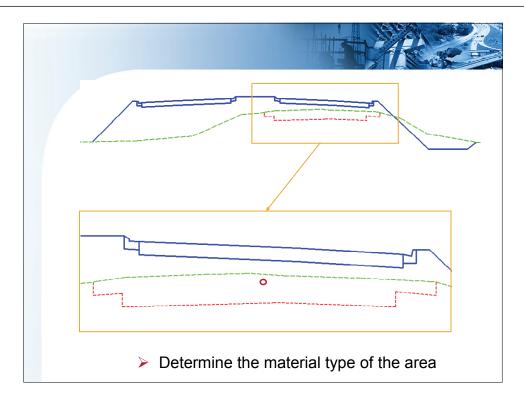


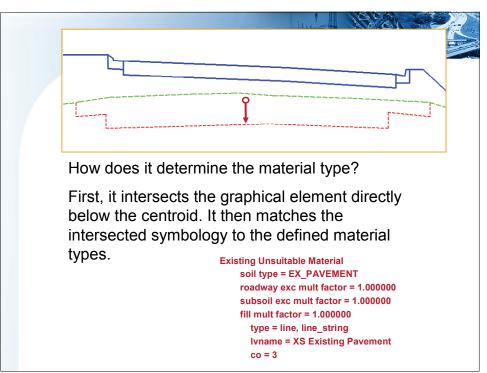




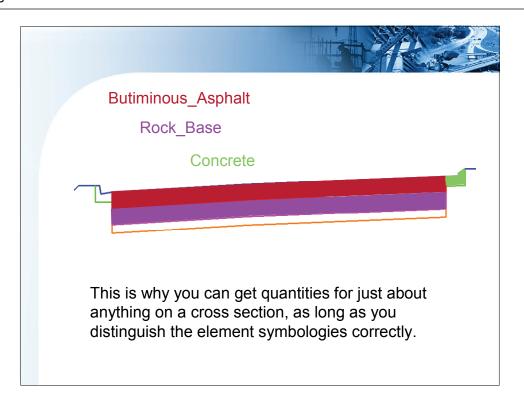


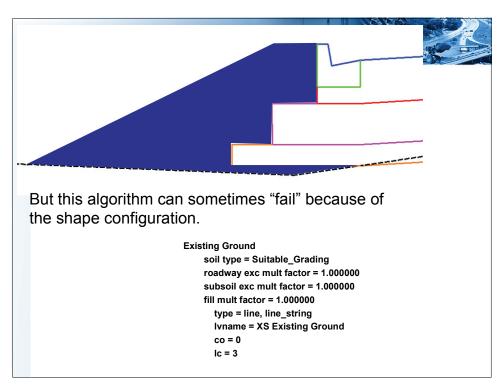




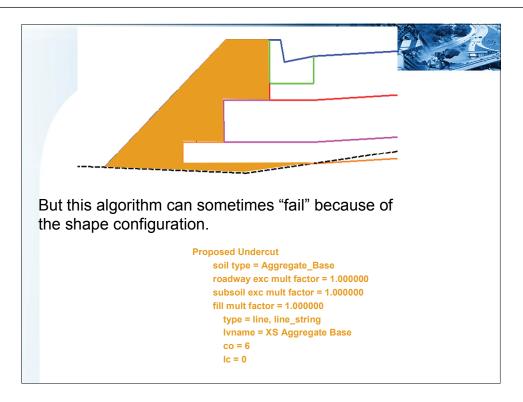


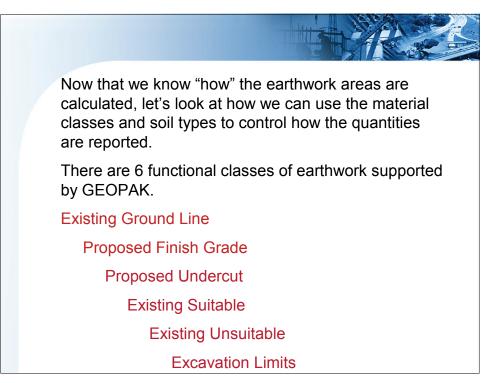




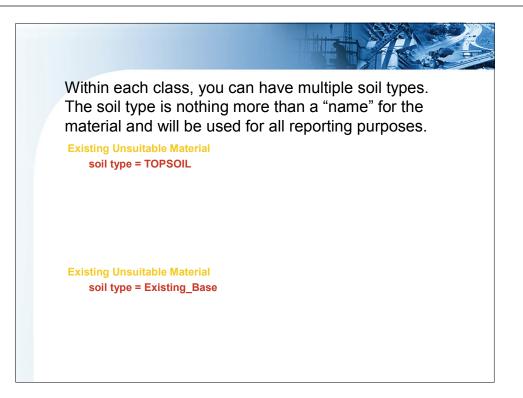


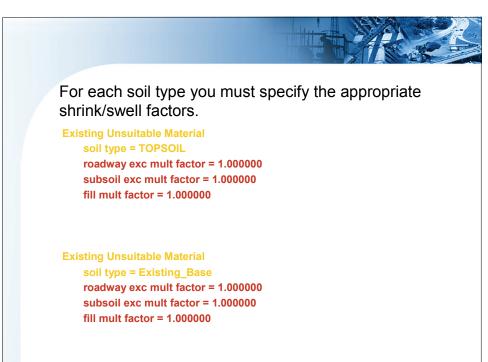




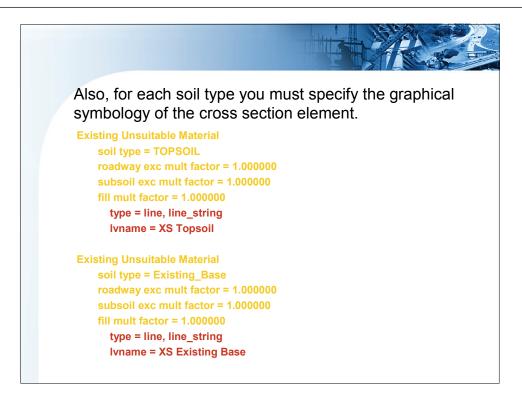


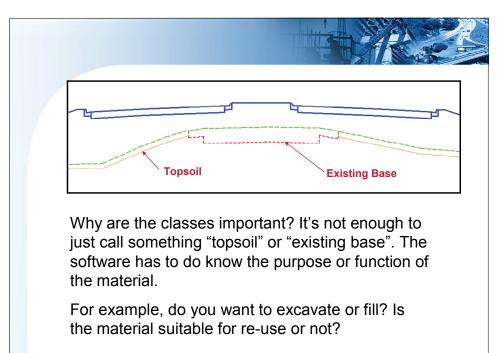




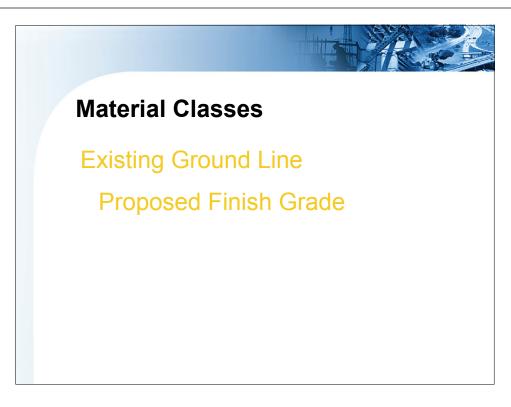


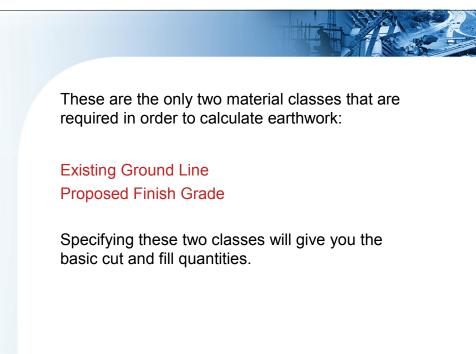














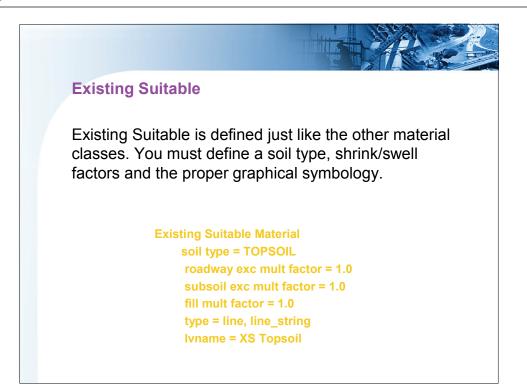


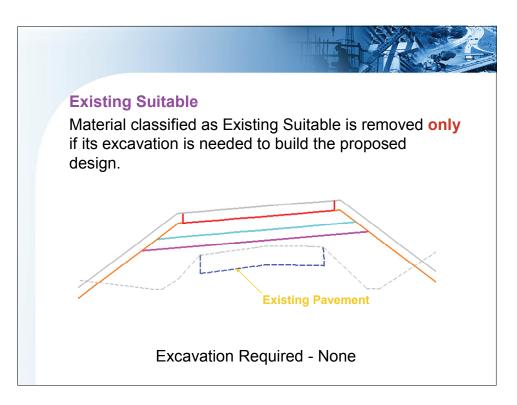
The soil types specified with the proposed finish grade and existing ground are important as they are used as the default fill material and default excavation material.

Note: Always use the same name!

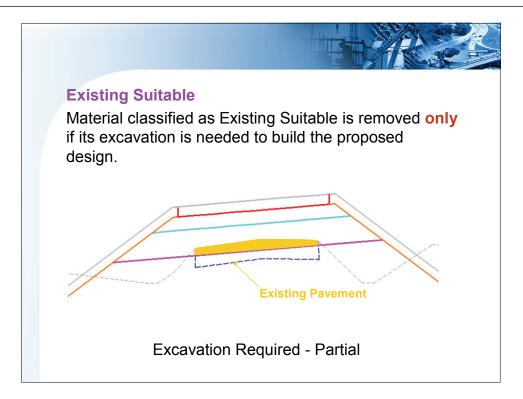
Proposed Finish Grade soil type = **Suitable_Grading** roadway exc mult factor = 1.0 subsoil exc mult factor = 1.0 fill mult factor = 1.0 type = line, line_string lvname = XS Finish Grade Existing Ground Line soil type = **Suitable_Grading** roadway exc mult factor = 1.0 subsoil exc mult factor = 1.0 fill mult factor = 1.0 type = line, line_string lvname = Existing Ground

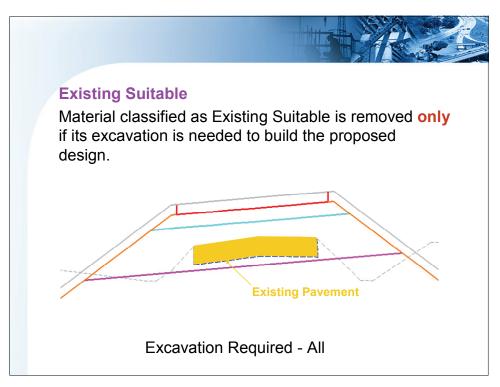




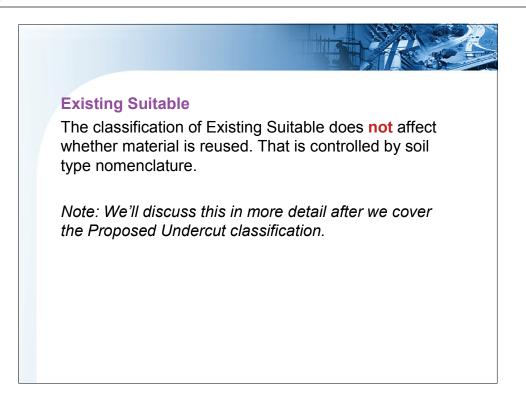






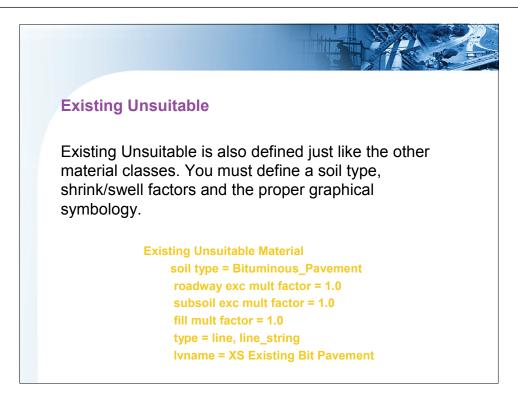


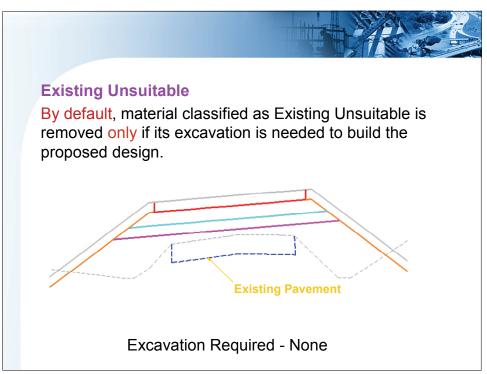




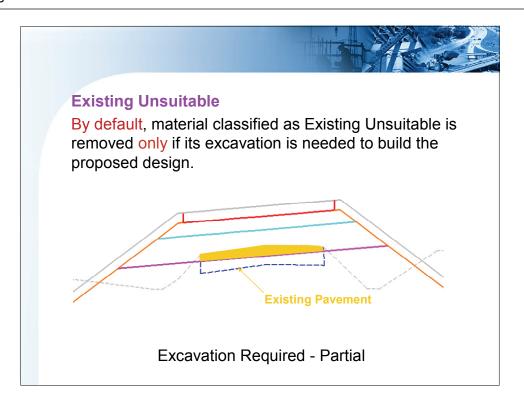


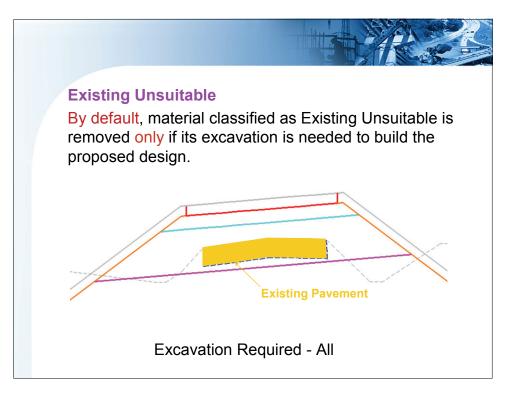




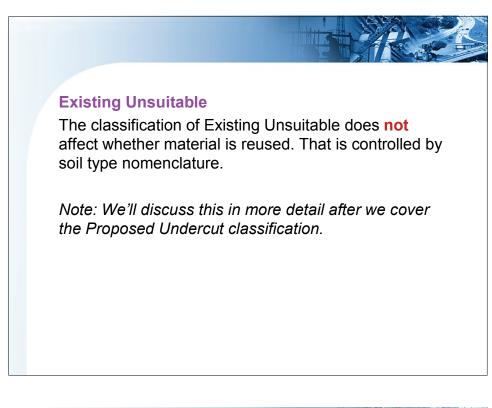


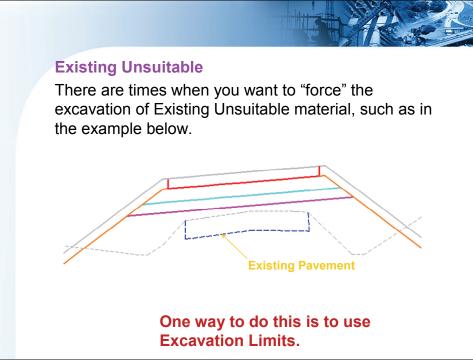






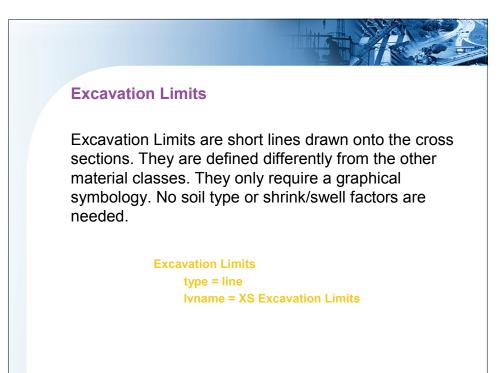




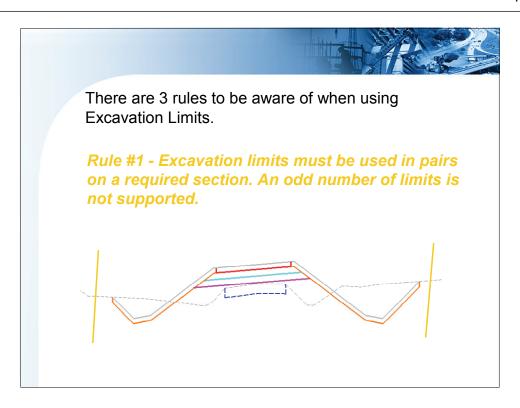


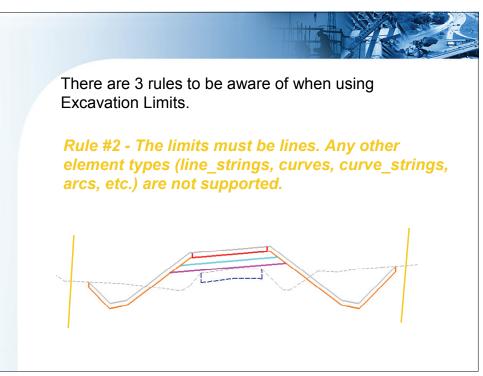




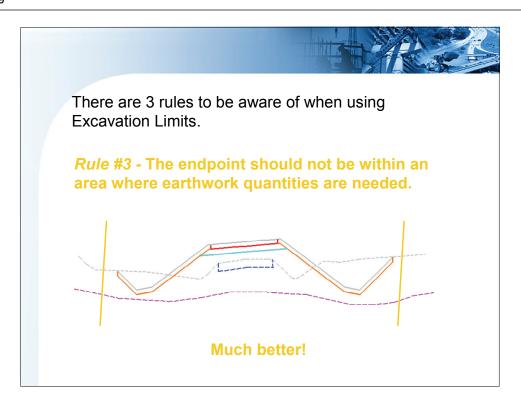


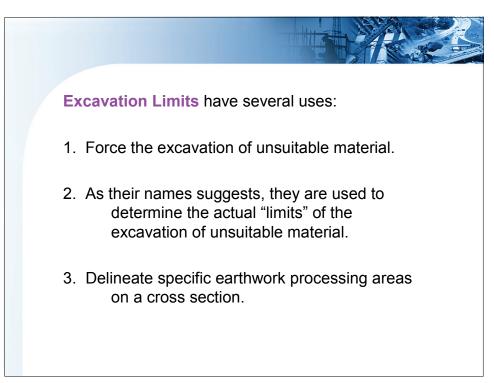




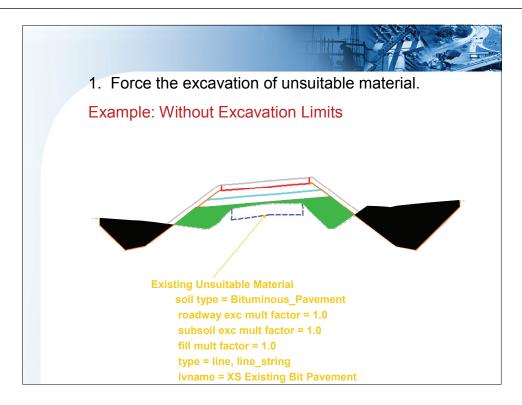


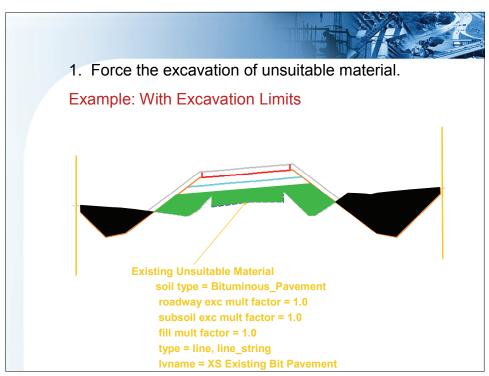




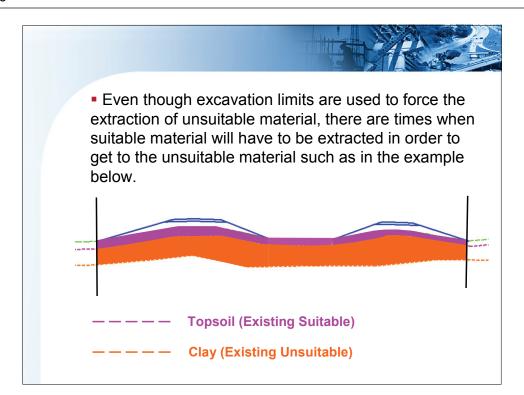


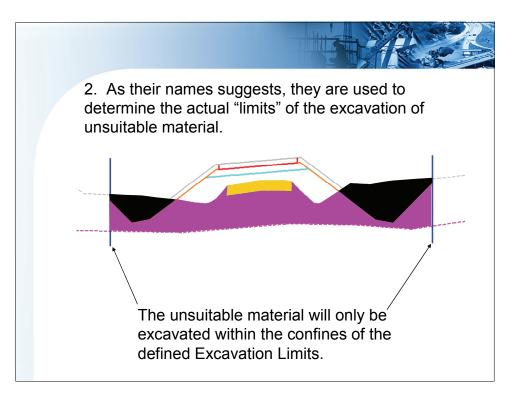




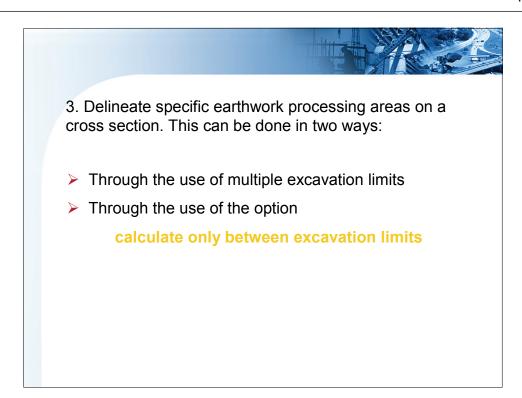


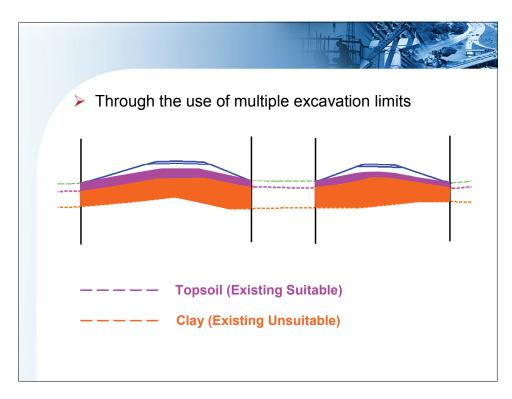




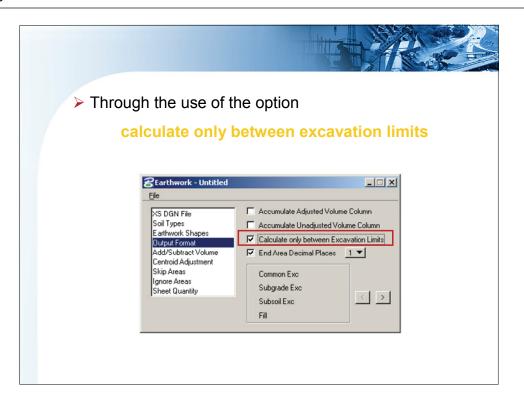


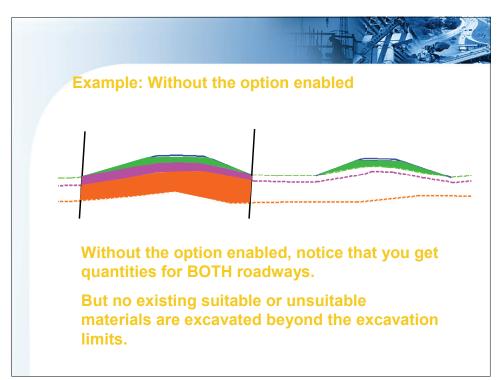




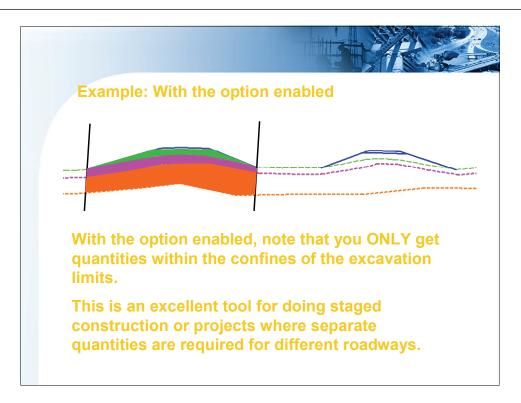






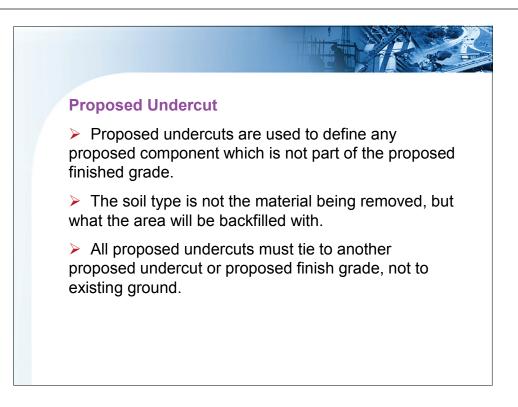


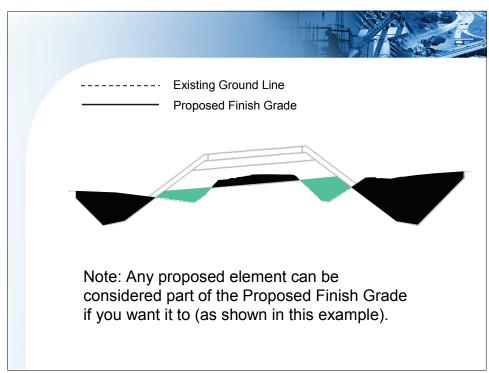




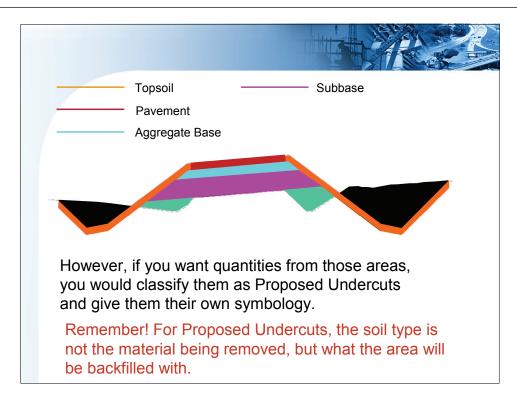


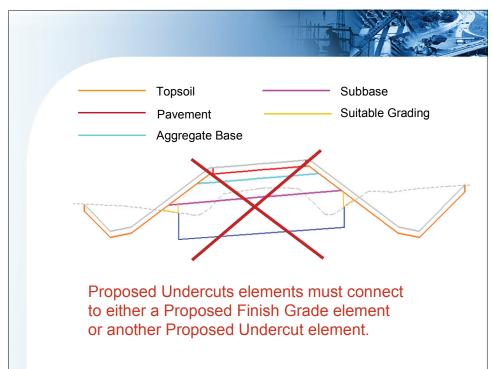




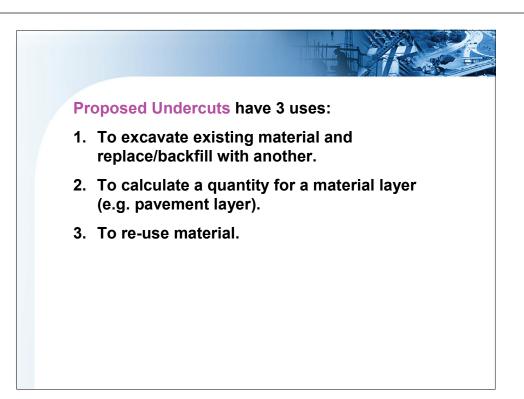


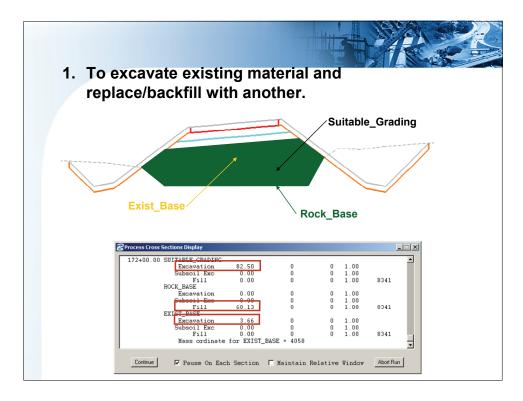




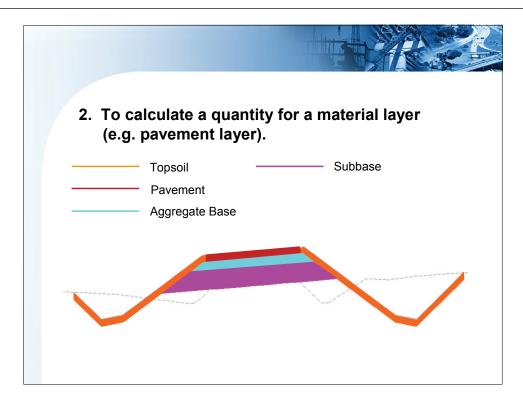


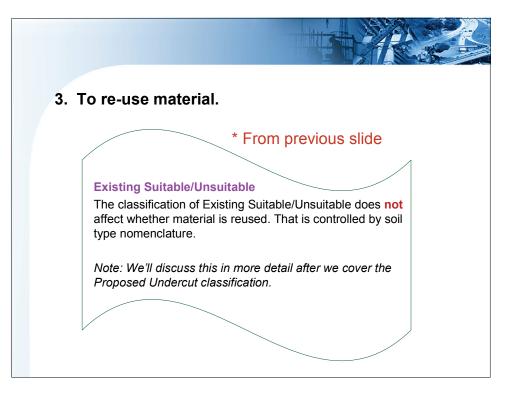




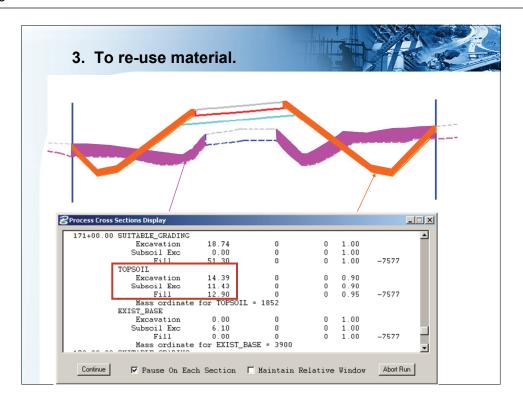


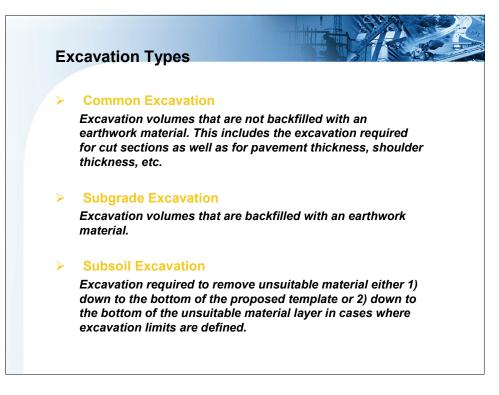




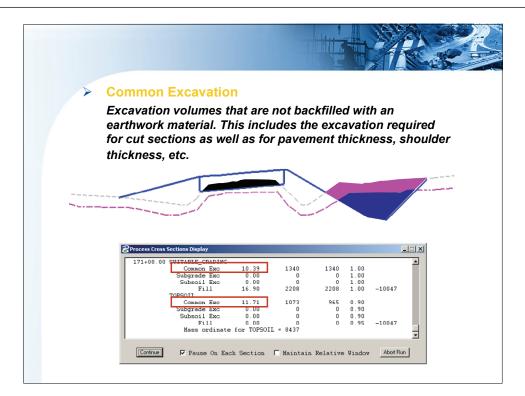


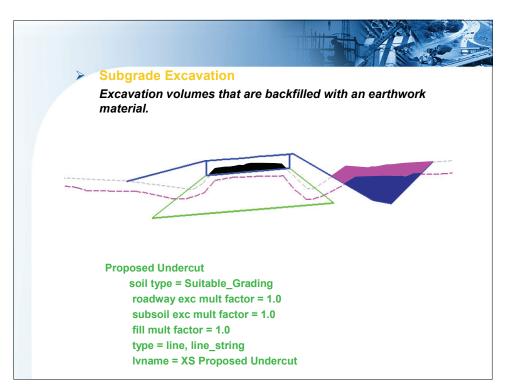




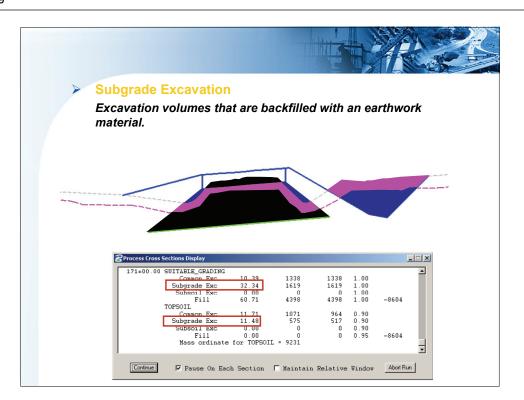


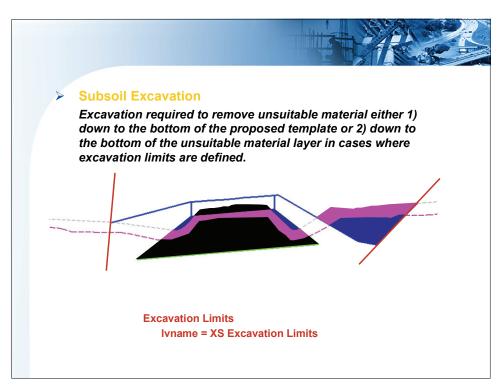




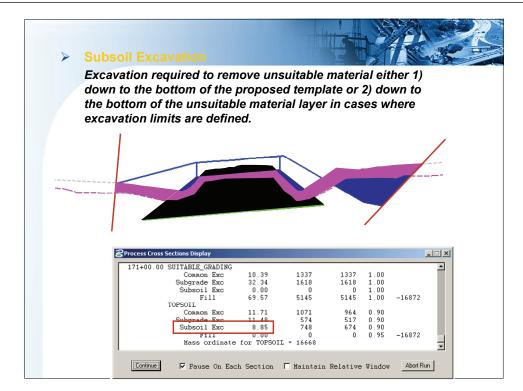


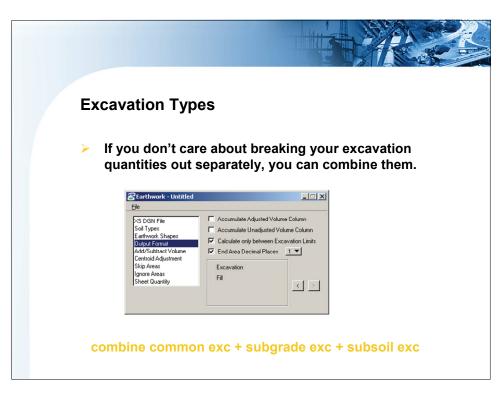














LAB EXERCISE: EARTHWORK

- > STAGED CONSTRUCTION AND MULTIPLE ROADWAYS
- 1. Open the file C:\DATA\GEO\VDOT\ROAD2\60843\d60843xsmainline.dgn.
- 2. Access the project 60843 through Project Manager using the user name Mary.
- 3. Click the Earthwork button and create a new run Mainline.
- 4. The XS DGN File portion of the dialog should fill automatically from the Working Alignment information.

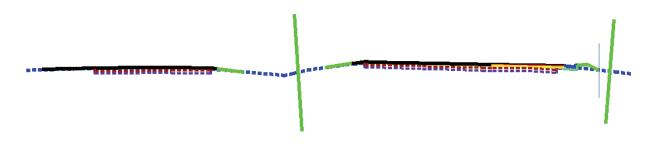
名 Earthwork - Mainline	
<u>F</u> ile	
XS DGN File	XS DGN File: C:\60843\d60843xsmainline.dgr. Q
Soil Types	Tolerance: 0.010000
Earthwork Shapes Output Format	Vertical Search Distance: 500.00
Add/Subtract Volume	Baseline: MAINLINE
Centroid Adjustment Skip Areas	Begin Station: 10+00.00 R 1
Ignore Areas	End Station: 158+50.00 R 1
Sheet Quantity	

5. Select the **Soil Types** option and set **Existing Ground** and **Proposed Finished Grade**. These should match the **Working Alignment** definitions set in **Project Manager**.

名 Earthwork - Mainline	
<u>F</u> ile	
XS DGN File Soil Types Earthwork Shapes Output Format Add/Subtract Volume Centroid Adjustment Skip Areas Ignore Areas	Soil Type Items Existing Ground Proposed Finish Grade
Sheet Quantity Class Proposed Finish Grade ▼ Soil Type: A2 Multiplication Factors Roadway Excavation: 1.000 Subsoil Excavation: 1.000 Fill: 1.000	Use Working Alignment Definition Lv Names: Level 4,Level 11,Level 1 Lv Numbers: Image: Colors: 0,2,12,17 Colors: 0,2,12,17 Image: Colors: 0 Veights: 3,5 Image: Colors: 3,5 Types: 3-4 Image: Colors: 0 Match Display Reset
Add	Delete Modify



6. In this step we will place **Excavation Limits** just on the right side of the typical. Set the level to **Default** and place the Excavation Limit lines on several sections as shown below.



7. Change the **Classification** toggle to **Excavation Limits** and set the symbology then **Add** to the list window.

8 Earthwork - Mainline	
<u>F</u> ile	
XS DGN File Soil Types Earthwork Shapes Output Format Add/Subtract Volume Centroid Adjustment	Soil Type Items Existing Ground Proposed Finish Grade Excavation Limit
Skip Areas Ignore Areas Sheet Quantity	Search Criteria
Class Excavation Limit 🔹 💌	
Soil Type: A2	🔽 Ly Names: Default 🔄
Multiplication Factors Roadway Excavation: 1.000 Subsoil Excavation: 1.000 Fili: 1.000	Ly Numbers: □ ✓ Colors: 24 ✓ Styles: □ ✓ Weights: 5 □ ✓ Types: 3 □ Match Display Reset
Add	Delete Modify

8. Select the Earthwork Shape option and set as shown below.

Earthwork - Mainline		
<u>F</u> ile		
XS DGN File Soil Types Earthwork Shapes Output Format Add/Subtract Volume Centroid Adjustment Skip Areas Ignore Areas Sheet Quantity	Draw Earthwork Shapes Stratify Shape Color	

9. Set the **Output Format** as shown below.



Bearthwork - Mainline	
XS DGN File Soil Types Earthwork Shapes Output Format Add/Subtract Volume Centroid Adjustment Skip Areas Ignore Areas Sheet Quantity	 Accumulate Adjusted Volume Column Accumulate Unadjusted Volume Column Calculate only between Excavation Limits End Area Decimal Places 1 Common Exc Subgrade Exc Subgrade Exc Subsoil Exc
	Fill

10. Select **File > Save Settings** then **File > Run** and make the settings shown below.

8 Earthwork	×
To Log File	
To Log File 🔻 temp.log	
Pause On Each Section	
Interactive Error Checking	Apply

11. Click Apply.

12. Review the sections and the output.

Process Cross	Sections Display					
Output File COMPUTING EA COMPUTING EA FORMING LIST BEGINNING EA	: ewkprj.inp : temp.log ARTHWORKS FOR BAS ARTHWORKS FOR JOE F OF XSCELLS ARTHWORKS COMPUTA	3 = 101	NLINE			
∎ Station	Material Name		Unadjusted Volumes (cu. yd.)	Volumes		Mass Ordinate
10+00.00	A2 Common Exc Subgrade Exc Subsoil Exc	0.0	0 0 0	0 0 0		
10+25.00		0.0		0 0 0 0		0
10+50.00	Fill A2 Common Exc Subgrade Exc Subsoil Exc	14.2 0.6 0.0	0	14 0 0 0	1.00 1.00 1.00 1.00	-14
		12.2	12	12	1.00	-26
Continue	└ Criteria V ☑ Pause On Ea		🗖 Maintai	n Relative	Window	Abort Run





Digital Terrain Modeling

CHAPTER OBJECTIVES

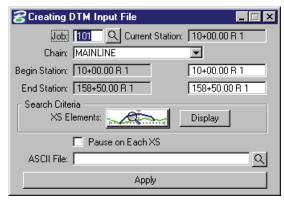
In this chapter we will review the process of creating proposed Digital Terrain Models from proposed cross sections.

INTRODUCTION

The GEOPAK Cross Section Report Utility can extract up to sixteen different reports from original and design cross-sections. For each report generated, the user must set the parameters of the existing and/or design cross sections.

CREATING DTM REPORT

For each station, GEOPAK locates every specified cross section element and generates an x, y, z file of spot elevations suitable for use with the DTM tools. The created file is a DAT file which can be directly utilized in the Build Triangles dialog. Additional fields not required for the Build Triangles application are ignored. Note that no decision tree is provided to differentiate between existing ground and proposed finish grade elements. If this is required, utilize the DTM Prop 3D report.





REPORT OUTPUT

The first column (1) is utilized by the DTM software to identify the rest of the line as a spot elevation. The next three columns are x, y, and z respectively. Note that no header is added to the file as it is not required by the DTM software.

1 522741.21734264 1832287.79561256 7417.00300000

 $1\ 522747.84993873\ 1832281.28536007\ 7417.25310000$

DTM PROP 3D

GEOPAK locates specified proposed cross section elements and existing ground, and generates an x, y, z file of vertices for break lines suitable for use with GEOPAK's Digital Terrain Modeling. Each cross section generates one break line. In the hierarchy, the path follows (from left to right) existing ground until a proposed finish grade element is intersected. The proposed path is followed until it ties back to an existing ground element.

CDTM Proposed 3D Report	_ 🗆 🗵
Job: 101 Q Current Station:	20+00.00 R 1
Chain: MAINLINE	-
Begin Station: 10+00.00 R 1	10+00.00 R 1
End Station: 158+50.00 R 1	20+00.00 R 1
Search Criteria Existing Ground Line:	Display
Proposed Finish Grade:	Display
Pause on Each XS	
ASCII File: temp.dat	<u> </u>
Apply	

REPORT OUTPUT

The first column (2 or 3) is utilized by the DTM software to identify the line as the beginning or subsequent vertex of a break line. The next three columns are x, y, and z respectively. The rest of the line is comment information and not utilized by GEOPAK. Note that no header is added to the file as it is not required by the DTM software.

- 3 498007.60673158 223314.62880123 882.96601000 1 1 118+00.0 r 1
- 3 498015.72589151 223316.31181223 884.00901000 1 1
- 3 498017.58141269 223317.52559625 884.95300000 1 1
- 3 498017.78633116 223319.43367284 885.93900000 1 1
- 3 498077.29111542 223329.07359423 885.93900000 1 1
- 3 498098.50954625 223333.47193751 884.95300000 1 2
- 3 498102.80506063 223334.36234957 889.27347000 2 2
- 3 498113.04417381 223336.48480316 890.47812000 2 2
- 3 498117.85853969 223338.93378900 892.08431000 2 2
- 3 498155.18206826 223345.21952737 891.28121000 -1 1 118+50.0 r 1
- $2\ 498172.50980731\ 223348.81138133\ 888.87192000\ 2\ 2$
- $3\ 498188.65610203\ 223352.15833458\ 874.01462000\ 2\ 2$
- $3\ 498200.07665864\ 223354.52569315\ 874.01462000\ 2\ 2$



DTM EDITING

GEOPAK provides an editing tool that allows the user to change, modify or manipulate any feature contained in the model. The tool facilitates placing or inserting break lines, modifying contours and triangles as well as changing elevation of existing triangles.

8TIN Edit Tools	
Preferences	
Add Vertex Delete Vertex Move Vertex XY Move Vertex Z Polygon Move Z Delete Line Swap Line Insert Break Line Insert Break Line Insert Drape Line Delete Triangle	Add Vertex X: 0.000000 V: 0.00000 Z: 0.0000 Add

Edits made with this tool will not be saved until the Save button is selected. This allows the user to abandon an editing session without having an impact on the tin file.

There is also an **Undo** option so that modifications may be undone up to the last time there was a **Save** operation performed.



ADD VERTEX

The **Add Vertex** tool is utilized to add additional spot elevations either internal or external to an existing model.

The user has the option of keying in the desired values in the X, Y, and Z fields or interactive editing by clicking **DP**. Moving the cursor over the screen displays the cursor coordinates in the dialog. The X and Y values are the true coordinates of the cursor, while the Z value is the elevation of the specified TIN at the cursor's X, Y value. GEOPAK will also display the triangles on the fly, i.e. as the cursor is moved, the generated triangles are adjusted.

名 TIN Edit Tools	
Preferences Add Vertex Delete Vertex Move Vertex XY Move Vertex Z	
Polygon Move Z Delete Line Swap Line Insert Break Line Insert Drape Line Delete Triangle	Add Vertex X: 0.000000 DP Y: 0.000000 Z: 0.0000
TIN Update Undo To Last Save Save	Add

DELETE VERTEX

Another option is **Delete Vertex**. Two options are supported for editing: **Re-Triangulate** or **Create Void**.

The **Re-Triangulate** option deletes the specified point, then re-triangulates the model without it. When **ID Vertex** is clicked and the specified point is identified on the screen with a data point, the affected vertex, triangle sides, and all associated display elements (i.e., contours, flow arrows, etc.) are highlighted.

CTIN Edit Tools Preferences	
Add Vertex Delete Vertex Move Vertex XY Move Vertex Z Polygon Move Z Delete Line Swap Line Insert Break Line Insert Drape Line Delete Triangle	Delete Vertex
TIN Update Undo To Last Save Save	Edit: <u>Re-Triangulate</u>



MOVE VERTEX XY

This tool provides a means to change the horizontal location of an existing vertex.

Click **ID Vertex** and the point to be moved is identified by a data point on the screen. The affected vertex, triangle sides, and display elements are highlighted, while the **X**, **Y**, and **Z** values of the vertex are displayed in the dialog.

名 TIN Edit Tools	
Preferences	
Add Vertex Delete Vertex Move Vertex XY Move Vertex Z Polygon Move Z Delete Line Swap Line Insert Break Line Insert Drape Line Delete Triangle	Move Vertex XY X : 3876148.0106 Y : 296846.3597 Z : 30.6700
TIN Update Undo To Last Save Save	Id Vertex

MOVE VERTEX Z

This option allows the user to change the elevation of an existing vertex. Click **ID Vertex** and the vertex whose elevation is to be moved is identified by a data point on the screen. The affected vertex, triangle sides, and display elements are highlighted.

🚰 TIN Edit Tools	
Preferences	
Add Vertex Delete Vertex Move Vertex XY Move Vertex Z Polygon Move Z Delete Line Swap Line Insert Break Line Insert Drape Line Delete Triangle	Move Vertex Z X : 3876148.0106 Y : 296846.3597 Z : 30.6700
TIN Update Undo To Last Save Save	Elevation: 100.0000



POLYGON MOVE Z

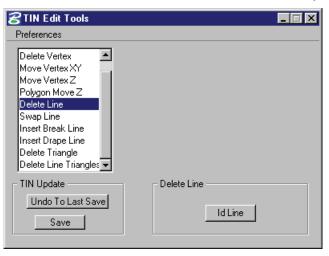
This tool will allow the user to move a specified polygon by changing the elevation on each vertex. Two options are supported to specify the value of the change in elevation: **Drape** or **Elevation**. In **Drape**, either positive or negative values (in master units) dictate the amount GEOPAK moves the polygon above or below the model. In the other option, **Elevation**, GEOPAK moves the appropriate vertices and optionally, the polygon, to the specified elevation. The toggle next to the desired option must be activated.

If the polygon has been placed prior to selecting the Polygon Move Z option, then the **Select** option should be utilized. If the **Place** button is pressed, the software prompts for drawing the polygon as part of the Move procedure. To commence the procedure, press the **Apply** button.

名 TIN Edit Tools	
Preferences	
Add Vertex Delete Vertex Move Vertex XY Move Vertex Z Polygon Move Z Delete Line Swap Line Insert Break Line Insert Break Line Insert Drape Line Delete Triangle	Polygon Move Z Drape +/- 1.000000 Elevation 0.00000 Do Not Insert Polygon Place Select Apply

DELETE LINE

This option will allow the user to delete a line external to the main body of the tin file.



SWAP LINE

The Swap Line option will change the direction in which a triangle has been computed.



Z TIN Edit Tools	
Preferences	
Delete Vertex Move Vertex XY Move Vertex Z Polygon Move Z Delete Line Swap Line Insert Braek Line Insert Drape Line Delete Triangle Delete Triangle	
TIN Update Undo To Last Save Save	Swap Line

INSERT BREAK LINE

In contrast to the **Insert Drape Line**, the **Insert Break Line** utilizes the x, y, and z coordinates from the break line element, so it must be placed at the desired X, Y, and Z location.

Two methods of insertion are supported: **Place** and **Select**. **Select** is utilized if the break line has been previously drawn, while **Place** is used if no prior break line elements have been drawn.

😤 TIN Edit Tools	
Preferences	
Delete Vertex Move Vertex XY Move Vertex Z Polygon Move Z Delete Line Swap Line Insert Break Line Insert Drape Line Delete Triangle Delete Line Triangles V TIN Update Undo To Last Save Save	Insert Break Line Place Select Insert
2 Define Break Line	
DP 1 Active Elevation Drape +/- 0.0000 Elevation = 0.0000 DTM Snap: None Start Insert	DP 2 Active Elevation Drape +/- 0.0000 Elevation = 0.0000 Slope = 0.0000 22 Slope = 0.0000 Length = 50,0000 dz = 0.0000 Length = 50,0000 dz = 0.0000

INSERT DRAPE LINE

The **Insert Drape Line** option utilizes the X, Y coordinates of an element placed in the MicroStation file however the Z value is determined from the TIN model.



If the drape element has been previously drawn into the MicroStation file, then the **Select** option should be utilized. When **Select** is clicked, GEOPAK prompts the user to identify and accept the previously drawn element. When **Place** is clicked, the user is prompted to draw the desired drape line. Note that the Z value of the drape line being drawn is inconsequential, as the Z values are determined from the specified TIN model.

After the drape line has been identified, click **Insert** to commence the process. The drape element is drawn for reference onto the original TIN model.

名 TIN Edit Tools	
Preferences	
Delete Vertex ▲ Move Vertex XY Move Vertex Z Polygon Move Z Delete Line Swap Line Insert Break Line Insert Drape Line Delete Triangle Delete Line Triangles ▼	
TIN Update Undo To Last Save Save	Insert Drape Line Place Insert Insert

DELETE TRIANGLE

If an external triangle is selected, it is deleted from the model and the TIN hull is updated accordingly. If an internal triangle is selected, a void will be created in the model. The void will be reflected in subsequent processing of either the **Load Voids** tool or **Triangle Statistics** tool.

名 TIN Edit Tools	
Preferences	
Delete Vertex Move Vertex XY Move Vertex Z Polygon Move Z Delete Line Swap Line Insert Break Line Insert Drape Line Delete Triangle Delete Line Triangles ▼	
TIN Update Undo To Last Save Save	Delete Triangle Id Triangle

DELETE LINE TRIANGLE

The **Delete Triangle Line** tool uses a user-placed line and deletes all triangles which intersect the line. If external triangles are selected, they are deleted from the model and the TIN hull is updated accordingly. If internal triangles are selected, a void will be created in the model. The void will be reflected in subsequent processing of either the **Load Voids** tool or **Triangle Statistics** tool.



STIN Edit Tools Preferences	
Delete Vertex Move Vertex XY Move Vertex Z Polygon Move Z Delete Line Swap Line Insert Break Line Insert Drape Line Delete Triangle Delete Line Triangles	
TIN Update Undo To Last Save Save	Delete Line Triangles Place Delete Line Delete Line Triangles

LAB EXERCISE: CROSS SECTION REPORTS

- > DTM PROPOSED 3D
- 1. Open the MicroStation dgn file C:\DATA\GEO\VDOT\ROAD2\60843\d60843xsmainline.dgn.
- 2. Access the project 60843 via Project Manager using Mary as the user name.
- 3. From Project Manager click the **Reports & XS Quantities** button.
- 4. Click the **DTM Proposed 3D** button.

名 XS Rep 💶 🛛 🗙
User
Blue & Red Top
Clearing
Closure
DTM Input
DTM Proposed 3D
HEC-2
HEC RAS
Multi-Line
Profile Grade
Radial Staking
RT40
Seeding
Slope Stake
Staking Detail
WSPRO
XS List
🗖 Hilite

5. Provide a file name to be created from the process.



2 DTM Proposed 3D Report	
Job: 101 Q Current Station:	10+00.00 R 1
Chain: MAINLINE	V
Begin Station: 10+00.00 R 1	10+00.00 R 1
End Station: 158+50.00 R 1	158+50.00 R 1
Search Criteria Existing Ground Line:	Display
Proposed Finish Grade:	Display
Pause on Each XS	
ASCII File: 3d.dat	<u> </u>
Apply	

- 6. The symbology for **Existing Ground** and **Proposed Finish Grade** should populate according to the **Working Alignment Definition**.
- 7. Change the ending station to 49+00.
- 8. Click Apply.



- > **BUILDING THE TIN FILE**
- 1. Create a new dgn file named *3D.DGN*.
- 2. Make sure to use a 3D seed file or create a 3D model in the new dgn.
- 3. Click the Existing Ground button on Project Manager and create a new run.
- 4. Select the **DAT** file created in the previous exercise.
- 5. Provide a **TIN** file name.
- 6. Set **Dissolve Option** to **Side** and enter a value of 50.

8 Build Triangles	_ 🗆 ×
Data File: 3d.dat	٩
TIN File: 3d.tin	Q
Dissolve Option: Side 💌	
Side Length: 50.000000	
Process	

- 7. Click Process.
- 8. Close the Build Triangles dialog.

> LOAD DTM FEATURES

- 1. Access the Load DTM Features dialog.
- 2. Use the Browse button to locate the file *3D.TIN*.

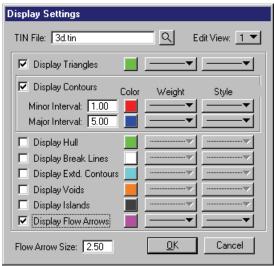
Load DTM Fea jie	tures					_	
oad File: TIN	▼ 3d.tin				Q	Loa	d
Display Preference	s						
Load: Extent	🗾 🔲 Displa	y Only	🔽 Gr	aphic G	iroup		
Feature	Level	Color	Weight	Style	Display		
Triangles	Default	2	0	0	ON		Q ‡
TIN Hull	Default	0	0	0	OFF		<u>et</u>
Contours	-	-	-		OFF		-
Major Lines	Default	4	3	0	ON		<u> </u>
Major Label	Default	5	3	0	ON		9
Minor Lines	Default	1	1	0	ON	-	
				_	V		
					1.		
							_

- 3. Turn all features off except for **Triangles**.
- 4. Click Load.
- 5. Review the Proposed DTM.



LAB EXERCISE: TIN EDITING

- > EDITING TRIANGLES
- 1. Click the icon to access the **TIN Edit Tools**.
- 2. Enter the settings in the **Display Settings** dialog as shown below.



- 3. Click OK.
- 4. Zoom in anywhere on the DTM.
- 5. Select the option to Add Vertex.

😪 TIN Edit Tools	
Preferences Add Vertex Delete Vertex Move Vertex XY Move Vertex Z Polygon Move Z Delete Line Swap Line Insert Break Line Insert Drape Line Delete Triangle	Add Vertex X: 3876610.951291 DP Y: 299274.689290 Z: 1.1860
TIN Update Undo To Last Save Save	Add

- 6. Click the **DP** button and move your cursor onto the screen.
- 7. Data point on the screen to set the coordinates in the dialog.
- 8. Key-in the desired elevation.
- 9. Click the Add button.



- > ADDING BREAK LINES
- 1. Select the option to Insert Break Line.

😪 TIN Edit Tools	
Preferences	
Add Vertex Delete Vertex Move Vertex XY Move Vertex Z Polygon Move Z Delete Line Swap Line Insert Break Line Insert Drape Line Delete Triangle	
TIN Update Undo To Last Save Save	Insert Break Line Place Select Insert

- 2. Click the **Place** button.
- 3. In the following dialog make the settings as shown.

名 Define Break Line	
DP 1	DP 2
O Active Elevation	O Active Elevation
Drape +/2.0000	Drape +/- 0.0000
O Elevation = 0.0000	O Elevation = 0.0000
DTM Snap: None 💌	O Slope = -3.0000 🛛 🖉 💌
	O Slope = 0.0000 Length = 50.0000
	O dz = 0.0000 Length = 50.0000
Start	• dz = • • • • • • • • • • • • • • • • • •

- 4. Click the Start button and Data Point on the screen.
- 5. Place the second data point some distance from the first.
- 6. Click the right mouse button to end the operation.
- 7. Click the **Insert** button on the dialog.
- 8. This will place a break line that begins 2' lower than the original ground at the start point and tie to existing ground at the second point.



- > **DELETING TRIANGLES**
- 1. Select the option to **Delete Triangles**.

궁 TIN Edit Tools	
Preferences	
Add Vertex Delete Vertex Move Vertex XY Move Vertex Z Polygon Move Z Delete Line Swap Line Insert Break Line Insert Drape Line Delete Triangle	
TIN Update Undo To Last Save Save	Delete Triangle

- 2. Click the Id Triangle button.
- 3. Data point on a triangle in the MicroStation view.
- 4. This tool effectively removes unwanted triangles from the TIN file.





Labelers

CHAPTER OBJECTIVES

In this chapter we will:

- Learn how to label plan information with Plan View Labeler
- Familiarize the user with the other labelers

INTRODUCTION

GEOPAK's labeling tools allow a user to place "smart" labels in a MicroStation drawing. These labels have the ability to calculate XYZ coordinates, station, offset, direction, length, radius, degree of curvature, etc. of the associated element.

ACCESSING THE PLAN VIEW LABELER

The Plan View Labeler can be accessed by selecting **Applications > GEOPAK ROAD > Plans Preparation > Plan View Labeling**. It can also be invoked from Project Manager by clicking the **Plan View Design** button or by selecting the **Plan View Labeling** tool from the GEOPAK ROAD tool frame.

PLAN VIEW LABELING

When the Plan View Labeling icon is selected, the dialog shown below is displayed.

名 Plan View Labeler - Style:\bin	\def_plan.lsf -> Unnamed Style	
Style <u>Fi</u> les <u>O</u> ptions <u>S</u> cale <u>T</u> ools		
Text Params. Shape Leader Ro	otate Styles	
Job No.: 101	Computed Inserts O User Inserts	
Element: Point	Computed Text	
Chain: MAINLINE 💌	X Coordinate	
TIN File:	Y Coordinate Z Elevation GPK	Space Return
Label Feature	Z Elevation TIN	Clear Delimit
	Z Elevation Modeler Station	Place Label
<u>₹</u> + 1 t	Partial Station	
	Not Available	



The label to be placed is displayed in the box on the right side of the dialog as shown above. The **Space** button places a space in the label at the cursor position. The **Return** button starts a new line of text. The **Clear** button starts a new label. The **Delimit** button places a line above or below a line of text. The **Place Label** button attaches the label to the cursor for placement in the drawing.

The user can select the various tabs to define / modify the label appearance.

Техт

For data to be computed, the job number and the chain need to be selected. If elevations are to be calculated, a TIN file needs to be chosen.

The Computed Inserts are items that GEOPAK has the ability to calculate for the chosen item. The list of Computed Inserts changes with the type of element that is chosen. If a line is chosen, the list of Computed Inserts will show inserts of bearing, and length. If a curve is chosen the list of Computed Inserts will change to show inserts of radius, curvature, chord length, etc.

The User Inserts are items that a user may use on a regular basis. This list can be customized for a specific user's needs.

The **Identify Element** button allows the user to choose the element to use for calculations in the label. The **Data Point** button will let the user pick a specific point to calculate the coordinates, station, or offset for.

PARAMETERS

8 Plan View Labeler - Style:\bin\def_plan.lsf -> AzLen - Active	
Style <u>Fi</u> les <u>O</u> ptions <u>S</u> cale <u>T</u> ools	
Text Params Shape Leader Rotate Styles Text Preferences / Symbology Height: 2.000 Justification: Width: 2.000 Image: Construction of the symbol of the sy	Az 70^ 16' 12.46" · 106.2781 Space Return Clear Delimit Place Label

The **Parameters** tab enables the user set up the text size and symbology for the label.

By Current sets the symbology to the current MicroStation settings. **By Element** allows the user to set the symbology by choosing a MicroStation element. **Set All** sets the symbology for all elements in the label (text, delimiters, leader lines, etc.).

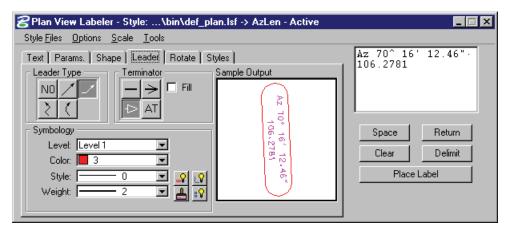


SHAPE

8 Plan View Labeler - Style:\bin\def_plan.lsf -> AzLen - Active	
Style <u>Fi</u> les <u>O</u> ptions <u>S</u> cale <u>T</u> ools	
Text Params. Shape Leader Rotate Styles Shape Preferences Sample Output AZ XX XX XX Offset: 200 XX XX Level: Level 1 XX XX Style: 0 XX XX Weight: 2 XX XX	Az 70^16'12.46" 106.2781 Space Return Clear Delimit Place Label

The **Shape** tab allows the user to place a shape around the label, and set the symbology for the shape.

LEADER



The **Leader** tab allows the user to attach a leader from the label to the point. Different leader types and terminators can be chosen. The active terminator can also be used.

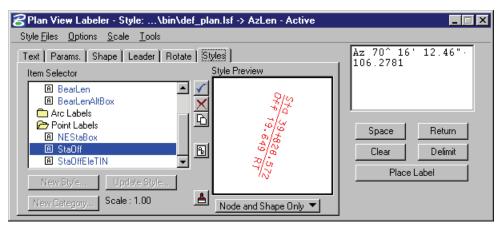


ROTATE

8 Plan View Labeler - Style:\bin\def_plan.lsf -> AzLen - Active	
Style <u>Fi</u> les <u>O</u> ptions <u>S</u> cale <u>T</u> ools	
Text Params. Shape Leader Protate Styles Text Angle Sample Output Image: 0.000 Image: Image: <td>Az 70^ 16' 12.46" 106.2781 Space Return Clear Delimit Place Label</td>	Az 70^ 16' 12.46" 106.2781 Space Return Clear Delimit Place Label

The **Rotate** tab allows the label to be rotated. The rotation can be determined from the current angle, the angle of the element, or the alignment angle. The angle can also be set by two data points (first data point set the location, next data point sets the angle) or the active angle.

STYLES



The **Styles** tab allows a user to choose label symbology from a library of pre-defined styles. When the user chooses the style, all symbology, leaders, shapes, etc. are set up for the user.

MENUS

The Style Files menu allows the user to open a new style library. You must be under the **Styles** tab in order to open a style library.

Options > Minimize Dialog minimizes the main dialog (when the **Place Label** button on the main dialog is pressed) to allow for easier label placement. The Label Viewer can be used in conjunction to still view the sample contained in the Label dialog.

The main labeling window can be maximized by selecting the **Restore Label Dialog** icon within the appropriate View Label Control tool frame or the labeling tool on the main Road, Site, or Drainage tool frame.

Options > Use Reference File Coordinates - When labeling elements within a reference file, it is useful to utilize the reference file coordinates, rather than the current active file. Simply activate the toggle, and subsequent computed text inserts using reference file elements or data points will reflect the reference file coordinates, if the snap and locate in the reference file are active.

Options > Use DP Element Association - This option will enable the association between MS elements and DP (data point) labels that are snapped to the element. If the element is modified, the



point labels will move with the element when the **Label Update** feature is used. This applies only to elements within the active design file.

Options > Label Tools invokes the tool frame shown below which enables the user to modify GEOPAK labels.



Options > Label Viewer brings up a dialog that allows a user to view and place a label.



The **Scale > Scale Style** menu allows the user to choose a plan scale. All labels will be adjusted according to the plan scale. The user simply keys in a scale, and chooses a **Labeling Style**. The corresponding label will be placed at the correct size for the scale that was chosen.

Tools > Label Updater - The Label Update tool is a powerful tool for updating GEOPAK labels. When alignments are updated, TIN files modified, labels moved, etc., GEOPAK "remembers" the computed text information utilized in the placement of the original label. Therefore, the software can update the label based on updated data. The tool utilizes the dialog shown below.

名 Update Labels 🛛 🗖 🗙		
Select By Single Select 🔹 💌		
🗖 Center Label		
Start Update Label		
Skip U <u>p</u> date All		
Highlight Labels		
Content Correct 🔹		
Highlight		



Tools > Selection Set Labeling - The Selection Set Label tool is a powerful tool for placing or updating labels within a selection set.

When the Selection Set Labeling tool is activated from the pulldown menu, the dialog shown below opens.

名 Selection Set Labe 💶 🗖 🗙		
🔽 Use F	Power Selector	
🗌 Usel	label Tables	
	- Bearing / Azimuth	
1 de la compañía de l	O North Quadrant	
	O South Quadrant	
	By Element	
	Apply	

Tools > Plan Label Preferences – Allows for the customization of the plan view labels. Options include Bearing, Distance, Elevation, and Area.

When the **Plan Label Preferences** tool is activated from the pulldown menu, the dialog shown below opens.

名 Plan Label	Preferences			
🔽 Use Label I	Preferences:			
Bearing D	istance Elevat	ion Area		
Leading Cha	aracters: Zero	•		
🗖 Allow D	ue Cardinal Direc	tion 🗖	Round Bearings By	Length
Min Dist	Max Dist	Increment	Component	Drop 00
				酒
0.000	0.000	0.001	Seconds 🔻	
			[Apply



CROSS SECTION LABELING

The **Cross Section Labeling** dialog differs from the **Plan View Labeling** dialog only on the text tab. Cross Section Labeling works with the Cross Section Navigator. The current Cross Section Navigator station is shown on the Text tab. The Computed and User Inserts contain values and phrases related to cross-sections.

BCross Section Labeler - Style: .	\bin\def_xs.lsf -> Unnamed Style		- 🗆 ×
Style <u>Files</u> Options <u>S</u> cale <u>T</u> ools			
Text Params. Shape Leader F	Rotate Styles		
Navigator Station 10+00.00	Computed Text Plan View X Coordinate Plan View Y Coordinate XS Elevation XS Elevation (Alt. Units)	Space Return Clear Delimi	
Label Feature	XS Station XS Partial Station XS Offset Not Available	Place Label	

ACCESSING THE CROSS SECTION VIEW LABELER

The *Cross Section View Labeler* can be accessed by selecting *Applications* > *GEOPAK ROAD* > *Cross Sections* > *Cross Section Labeling*. It can also be invoked by selecting the Cross Section Labeling icon from the GEOPAK ROAD tool frame.

PROFILE LABELING

The **Profile Labeling** dialog differs from the **Plan View Labeling** dialog only on the text tab. The Chain and Profile must be defined, in addition to profile settings. The **Computed** and **User Inserts** contain values and phrases related to profiles.

The user must supply the **Reference Station**, **Elevation**, **Scales**, and **Profile Reference Point** which were used to draw the profile. If a profile cell has been previously placed, **Identify Cell** can be clicked and the cell identified. This automatically populates the fields in the Profile Settings. In addition, whether the profile was drawn with gaps or no gaps in the presence of station equations must also be set.

8 Profile Labeler - Style:\bin\d	ef_prof.lsf -> Unnamed Style	
Style <u>Files</u> <u>Options</u> <u>S</u> cale <u>T</u> ools		
Text Params. Shape Leader F	Rotate Styles	
Job No.: 101	Computed Inserts O User Inserts	
Element:	Computed Text	
Chain: MAINLINE Profile: SBL Profile Settings	Profile Station Profile Partial Station Point Elevation Profile Grade % @ Point Chain Name Profile Name	Space Return Clear Delimit Place Label
	Not Available	



ACCESSING THE PROFILE VIEW LABELER

The **Profile View Labeler** can be accessed by selecting **Applications > GEOPAK ROAD > Plans Preparation > Profile Labeling**. It can also be invoked by selecting the **Profile Labeling** icon from the **GEOPAK ROAD** tool frame.

Note If after placing any label with any of the labeling tools a label should need to be modified, it is important that the **Label Tools** be used to modify the label. Each label is in fact a cell with intelligence and the **Label Tools** accessed from any of the labelers will maintain the intelligence associated with each label.

Plan View Label Control	×
<u>*************************************</u>	9 🚱 🖪 🂻



LAB EXERCISE: LABELING

- > ACCESSING THE PLAN LABELER
 - 1. Open the MicroStation file C:\DATA\GEO\VDOT\ROAD2\60843\d60843work.dgn.
 - 2. Access the project 60843 via Project Manager.
 - 3. Click the Plan View Design button on the main Project Manager dialog.
 - 4. From the Plan View Design tool bar, click DP Station Offset.
 - 5. Zoom in around Sta. **10+00.00**, near the beginning station of the Curb & Gutter section, and complete the dialog as shown below.

名 DP Station Offset 📃 🗖 🗙
Job: 101 🔍
Chain: MAINLINE 🔽 🔀
Station: 10+00.00
Offset:
Tangent 🗾 🗖 A <u>u</u> to Angle

- 6. Next, select the MicroStation **Zoom In** tool and click the **DP** button on the above dialog. Continue to data point as the view is zoomed in onto this area of interest.
- 7. Close the DP Station Offset dialog.
- 8. From the Plan View Design tool bar, click the Plan View Labeler tool.

名 Plan View Labeler - Style:\bin			
Style <u>Files</u> <u>Options</u> <u>Scale</u> <u>T</u> ools			
Text Params. Shape Leader Ro	tate Styles		
Job No.: 101	Computed Inserts O User Inserts		
Element: Point	Computed Text		
Chain: MAINLINE	X Coordinate		
TIN File:	Y Coordinate Z Elevation GPK	Space	Return
Label Feature	Z Elevation TIN	Clear	Delimit
	Z Elevation Modeler Station	Place L	abel
<u>₹</u> + ≠ 🕸	Partial Station		
	Not Available		



- > Using Predefined Label Styles
 - 1. Select the **Styles** tab.
 - Traverse with the Item Selector box to locate the following style: Labels > Point Labels > StaOff.
 - 3. Next, double click the **StaOff** style.

4. Move back to the **Text** tab and complete as defined below:

Job No.	101
Chain	MAINLINE
TIN File	s60843.tin

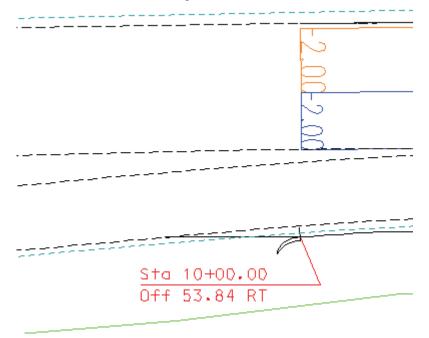
- *Note* In the following steps, we will use the **Plan View Labeler** to label the beginning station and offset for the sidewalk and curb section as well as the ending station and offset for the paved shoulder sections.
- 5. To begin the process, select the **DP** button and then identify the location that you wish for the Station and offset to be computed. The labeler automatically calculates the information.

😤 Plan View Labeler - Style:\bin	\def_plan.lsf -> StaOff - Active	
Style <u>F</u> iles <u>O</u> ptions <u>S</u> cale <u>T</u> ools		
Text Params. Shape Leader Ro Job No.: 101	otate [Styles] © Computed Inserts © User Inserts	Sta 10+00.00. d-e-l-i-m-i-t Off 53.84 RT
Element: Point	Computed Text	
Chain: MAINLINE	X Coordinate Y Coordinate Z Elevation GPK Z Elevation TIN Z Elevation Modeler Station Partial Station	Space Return Clear Delimit Place Label
	Not Available	

- 6. Use the **Params.**, **Shape**, **Leader** and **Rotation** tabs to experiment with different labeling styles.
- 7. To place the label, return to the Text tab and click the Place Label button.
- 8. The label is now attached to your cursor (without the leader for the delimiter).
- 9. Data point at the location you wish the text to be located.



10. A second data point will define the side of the label, which the leader line will be drawn from the delimiter line to the computed location.





> CREATING AND SAVING A NEW LABEL STYLE

- 1. Select the **Text** tab then click **Clear** below the label composition window.
- 2. Start Coordinate Geometry and set visualization to Permanent Visualization.
- 3. Select Tools > Navigator. In the Navigator window, set the Element to Parcel.

Select Too Select Too Element P	ols 7 id 🔒	<u>₽</u> ⊳ ₽]			
Name	Feature	Description	Select	Туре	Parei
4200				Parent Tract	4200
ROW				Taking	4200
4200A				Parent Tract	4200
YORK				Easement	4200
					▶

4. Select Tools > Settings and toggle ON the option to Window Center Visualized Elements.

Settings		
C Selection Set		
Alert Prior to Clearing Selection Set		
Mouse Click Actions		
 Single Click Highlight Visualized Element Single Click Window Center Visualized Element Single Click Enables List Cell Editing Double Click Action : Edit Element 		
Display Options		
Point : All Points		
Area : Square Foot 💌 99.12 💌		
<u>D</u> K Cancel		

- 5. Highlight the Parcel 4200.
- 6. Click on the **Paintbrush** to visualize it then close COGO.
- 7. On the Plan View Labeler dialog, click the Select GEOPAK or MS Element icon, then identify any of the lines representing the parcel and accept. The computed text inserts should now contain items such as Name, Area, and Perimeter.



8. In the composition window key-in NAME.

ZPlan View Labeler - Style:\bin\def_plan.lsf -> Unnamed Style	
Style <u>Fi</u> les <u>O</u> ptions <u>S</u> cale <u>T</u> ools	
Text Params. Shape Leader Rotate Styles	Name
Job No.: 101 © Computed Inserts O User Inserts	
Element: PARCEL 4200 Computed Text	
Chain: MAINLINE 💌 Name	
TIN File: C:\60843\s60843.tin Area Area (Alt. Units)	Space Return
Perimeter	Clear Delimit
	Place Label
	Continuous Place
4200	

9. Double click on the item in the Computed Text window shown as Name.

8 Plan View Labeler - Style:\bin\c	def_plan.lsf -> Unnamed Style	
Style <u>Fi</u> les <u>O</u> ptions <u>S</u> cale <u>T</u> ools		
Text Params. Shape Leader Rota	ate Styles	Name 4200
Job No.: 101	Computed Inserts O User Inserts	
Element: PARCEL 4200	Computed Text	
	Vame	
LIN File: 11.35018433501843 fin 1 S& 1 1	Area Area (Alt. Units)	Space Return
F	Perimeter	Clear Delimit
	Perimeter (Alt. Units)	Place Label
📲 🛧 💉 🖘 🛛		Continuous Place
4	200	

- 10. Enter a carriage return in the composition window.
- 11. Key-in Area=.



- 12. Double click on the item in the Computed Text window shown as Area.
- 13. Key-in SF after the area.

₽Plan View Labeler - Style:\bin\def_plan.lsf -> Unnamed Style	
Style <u>Fi</u> les <u>O</u> ptions <u>S</u> cale <u>T</u> ools	
Text Params. Shape Leader Rotate Styles Job No.: 101 Q © Computed Inserts O User Inserts	Name 4200 Area= 112383.22 SF
Element: PARCEL 4200 Computed Text Chain: MAINLINE Name	
TIN File: C:\60843\s60843.tin Area Area (Alt. Units) Perimeter	Space Return Clear Delimit
Label Feature Perimeter (Alt. Units)	Place Label Continuous Place
112383.22	

14. Select the **Params**. Tab and set the **Height**, **Width**, and **Line Sp.** to **5.0** and the **Justification** to **Center-Center**.

8 Plan View Labeler - Style:\bin\def_pl	an.lsf -> Unnamed Style	_ 🗆	×
Style <u>Fi</u> les <u>O</u> ptions <u>S</u> cale <u>T</u> ools			
Text Params. Shape Leader Rotate S Text Preferences / Symbology Height: 5.000 Width: 5.000 Line Sp.: 5.000 Font 3 BENGINEERING Level: Level 1 Color: 5 Weight: 2 Weight: 2 State State	tyles Sample Output Name 4200 Ariea= 112383+22 SF	Name 4200 Area = 112383.22 SF Space Return Clear Delimit Place Label Continuous Place	

15. Select the Shape tab, set the Shape Preferences to No Shape.

8 Plan View Labeler - Style:\bin\def_plan.lsf -> Unname	ed Style 📃 🗖 🗙
Style <u>Fi</u> les <u>O</u> ptions <u>S</u> cale <u>T</u> ools	
Text Params. Shape Leader Rotate Styles Shape Preferences Sample Output Image: Style state Image: Style state Sample Output Offset: 2.00 Image: Style state Nome 4: Color: 3 Image: Style s	j space j neturn j



16. Select the Leader tab and set the Leader Type to NO Leader and the set the Terminator to No Terminator.

Plan View Labeler - Style:\bin\def_plan.lsf -> Unnamed Style	
Style Files Options Scale Tools	
Text Params. Shape Leader Rotate Styles Leader Type Terminator Fill Sample Output No Image: Arr or other styles Fill Sample Output Symbology Image: Arr or other styles Name 4200 Level: Level 1 Image: Arr or other styles Color: 3 Image: Arr or other styles Style: 0 Image: Arr or other styles Weight: 2 Image: Arr or other styles	Name 4200 Area= 112383.22 SF Space Return Clear Delimit Place Label Continuous Place

17. Click Rotate tab. Set the angle to zero.

8 Plan View Labeler - Style:\bin\def_plan.lsf -> Unnamed St	tyle 📃 🔀
Style <u>F</u> iles <u>O</u> ptions <u>S</u> cale <u>T</u> ools	
Text Params. Shape Leader Fotate Styles Text Angle Sample Output Image Current Angle: 0.000 Image Element Angle: 0.000 Name 4200 Alignment Angle: 0.0 Image Name 4200 Arreg Image Arreg 112383-2	I Space I neturn I

- 18. Click the Place Label button and place the label in the parcel.
- 19. Select the Styles tab.
- 20. In the Item Selector window, double click Labels.
- 21. Click New Category.
- 22. Create a category named Parcels.

Create Category		
Category Name: Parcels		
OK Cancel		
UK	Lancel	

23. Highlight the Parcels category and click New Style.



24. Create a Style named Area.

Create Style
Name 4200 Area= 112383-22 SF
Style Name: Area Style Scale: 1.000 OK Cancel

25. Exit MicroStation.

> **P**ROFILE LABELER

- 1. Open the MicroStation file C:\DATA\GEO\VDOT\ROAD2\60843\d60843prof.dgn.
- 2. Attach the saved view PRO1.
- 3. Access the Profile Labeler (Applications > GEOPAK Road > Plans Preparation > Profile Labeling.

8 Profile Labeler - Style:\bin\	def_prof.lsf -> Unnamed Style	
Style <u>Files</u> <u>Options</u> <u>S</u> cale <u>T</u> ools		
Text Params. Shape Leader	Rotate Styles	
Job No.: 101	Computed Inserts O User Inserts	
Element:	Computed Text	
Chain: MAINLINE 💌	Profile Station	
Profile: SBL	Profile Partial Station Point Elevation	Space Return
Profile Settings	Point Profile Elevation	Clear Delimit
	Profile Grade % @ Point	Place Label
	Chain Name Profile Name	
	Not Available	

4. Click the **Profile Settings** button on the main dialog.



5. Click the Identify Cell button and data point on the profile cell.

名 Profile Settings 📃 🗖 🕨	<
Reference Station: 0+00.00	
Reference Elevation: 0.0000	
Horizontal Scale: 25.000	
Vertical Scale: 5.000	
Stationing with: No Gaps 💌	
Profile Reference Point	1
DP X: 3910235.4061	
Y: 299672.6575	
Profile Cell	1
Identify Cell	
OK Cancel	

- 6. Click OK.
- 7. Set the **Chain** and **Profile** on the main dialog as shown below.

8 Profile Labeler - Style:\bin\	def_prof.lsf -> Unnamed Style	
Style <u>Files</u> <u>Options</u> <u>Scale</u> <u>T</u> ools		
Text Params. Shape Leader	Rotate Styles	
Job No.: 101	Computed Inserts O User Inserts	
Element: Point	Computed Text	
Chain: EPLT1 💌	Profile Station	
Profile: EPLT	Profile Partial Station Point Elevation	Space Return
Profile Settings	Point Profile Elevation	Clear Delimit
	Profile Grade % @ Point	Place Label
🍝	Chain Name Profile Name	
	EPLT	

8. Click the Styles tab and double click on the Sta/Elev label style in the Point category.

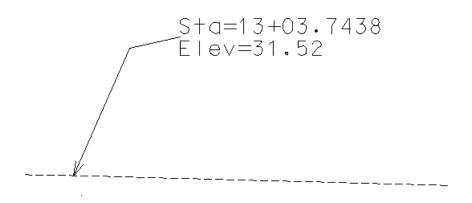
8 Profile Labeler - Style:\bin\def_p	rof.lsf -> Sta/Elev - Active	
Style <u>Fi</u> les <u>O</u> ptions <u>S</u> cale <u>T</u> ools		
New Style	Styles) Style Preview Style Preview Style Preview Style Preview Style Preview Style Preview Style Preview Style Preview	Sta=13+03.7438 · Elev=31.52 Space Return Clear Delimit Place Label
New Category Scale : 1.00	Node and Shape Only 🔽	

- 9. Return to the **Text** tab and click the **Point** icon.
- 10. Snap to a point on the profile.



11. Click the Place Label button on the main dialog and place the label in the DGN file.				
Profile Labeler - Style:\bin\def_prof.lsf -> Sta/Elev - Active				
Style <u>Files</u> <u>Options</u> <u>Scale</u> <u>T</u> ools	Style <u>Fi</u> les <u>O</u> ptions <u>S</u> cale <u>T</u> ools			
Text Params. Shape Leader I Job No.: 101 Q Element: Point	Rotate Styles Computed Inserts O User Inserts	Sta=13+03.7438· Elev=31.52		
Chain: EPLT1 Profile: EPLT Profile Settings	Profile Station Profile Partial Station Point Elevation Profile Grade % @ Point Chain Name Profile Name	Space Return Clear Delimit Place Label		
	Not Available			

12. You should now have a Station and Elevation label as shown below.



13. Exit MicroStation.

Note If after placing any label with any of the labeling tools, a label should need to be modified, it is important to use **Label Tools** to modify the label. Each label is a cell with intelligence and the **Label Tools** accessed from any of the labelers will maintain the intelligence associated with each label.

Plan View Label Control	×
"∥∥≫⊙⊻⊠⊠+≵∢∜₽	





Active Chain Control

CHAPTER OBJECTIVES

In this chapter, you will be familiarized with the **Active Chain Control** tool so that it can be used to review projects in multiple views with ease.

INTRODUCTION

The GEOPAK **Active Chain Control** is an excellent tool, enabling the user to manage plan, profile, and cross section views simultaneously. It also allows usage of MicroStation tools to place elements in any view in accordance with the curvilinear coordinates settings. One advantage of this tool is that you can use stations beyond the limits of the chain with any MicroStation command.

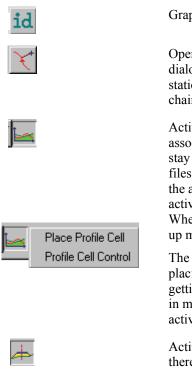
ACCESSING ACTIVE CHAIN CONTROL

The tool can be opened by selecting **Applications > GEOPAK Road > Active Chain Control**. When invoked the dialog shown below opens.



First select the desired *Job* and *Chain* name from the combo boxes to use as the active chain. Four icons are supported to the right of the chain list field and are detailed in the following table.





Graphically select the active chain candidate.

Opens the "Precise Curvilinear Coordinates" dialog that allows entering stations/offsets/elevations relative to the active chain.

Activates the current Profile system, which is associated to a Profile Cell. The Profile Cell can stay in the master file or in any of the reference files. If there are several Profile cells relative to the active chain, it is possible to designate the active one in the Profile Cell Control dialog. When the right mouse button is pressed, a popup menu appears :

The first option of the pop-up menu allows placing a Profile cell. The second option allows getting information about Profile cells that stays in master and reference files and selects the active one if there are several profile cells.

Activates the current Cross Section system. If there are several reference files containing XS cells relative to the active chain, it is not possible to activate the Cross Section Representation System. In this case, an alert dialog is displayed

The right side of the toolbox has eight icons which set each view to plan, profile or cross section view. By right clicking an icon, any view can be set to any of the 3 possible views. For example, if there is an active profile cell, setting a view to profile will immediately fit the profile within the limits of the view.

Active Chain Control	X
Job: 101 Chain: MAINLINE	M M M M M H H H H H H H H H H H H H H H



CURVILINEAR COORDINATES

The **Curvilinear Coordinates** tool enables the user to enter precise curvilinear coordinates relative to the active chain. It can be utilized in conjunction with generic MicroStation commands such as place line and place cell.

8 Curv	ilinear Coordinat	es	_ 🗆 🗙
🔲 S:	100+92.96	DS:	3167.78
Ext.:	0.00		
D:		🗖 D0:	-12092.83 60.19
🗖 Z:	60.19	🗖 DZ:	60.19
🗖 Perr	manent Lock		Apply

S:	Station along actual active chain. If the lock toggle is on, the cursor follows a perpendicular to the chain in plan views, and a vertical line in Profile views.
Ext.:	Extension to the station along actual active chain. A negative value means that the extension is before the beginning of the chain. A positive value means that the extension is after the end of the chain.
0:	Offset from the actual active chain. If the lock toggle is on, the cursor follows a fixed offset to the chain in plan views.
Z:	Use this field to enter elevation. If the lock toggle is on, the cursor follows a horizontal line in Profile views.
DS:	Delta station from the previous data point or tentative point. If the lock toggle is on, the cursor will follow a perpendicular to the chain in plan views, and a vertical line in Profile views.
DO:	Delta offset from the previous data point or tentative point. If the lock toggle is on, the cursor follows a fixed offset to the chain in plan views.
DZ:	Use this field to enter delta elevation from the previous data point or tentative point. If the lock toggle is on, the cursor will follow a horizontal line in Profile views.
Permanent Lock	When this toggle is checked, coordinate locks remain active, even after a data point is issued.
Apply	Click to send a data point to the input queue. Entering a data point by a click in a view has the same effect.



LAB EXERCISE: ACTIVE CHAIN CONTROL

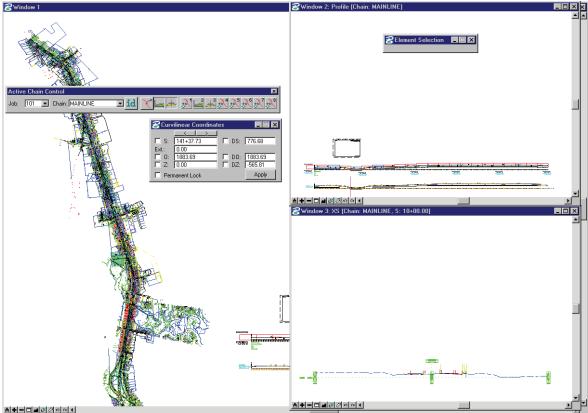
- > SETTING UP CHAIN CONTROL
- 1. Open the MicroStation file C:\DATA\GEO\VDOT\ROAD2\60843\d60843work.dgn.
- 2. Reference the files *d60843prof.dgn* and *d60843xsmainline.dgn* to coincidently.
- 3. Access the Active Chain Control (Applications > GEOPAK Road > Active Chain Control).



- 4. Set the **Job** and **Chain** as shown above.
- 5. Open Views 2 and 3 and stack them on the right side of View 1.
- 6. Right click on each icon 1 thru 3 and set accordingly.

1	Plan
2	Profile
3	Cross Section

7. You should have your views setup looking similar to the image below.



- - 8. Zoom into the beginning of the project in Plan view.
 - 9. Click the Curvilinear Coordinates icon.
 - 10. Select the MicroStation Place Line command.
 - 11. Key in a station of 10+25 and an offset of -100. (Lock the values).



- 😤 Curvilinear Coordinates _ 🗆 × 🗹 S: 🗖 DS: 0.00 10+25.00 Ext.: 0.00 □ D0: 0.00 □ DZ: 0.00 $\mathbf{\nabla}$ 0: -100.00 Г Z: 0.00 Permanent Lock Apply
- 12. Click Apply.
- **13**. After moving the cursor back to the view, you will notice that the line began at the desired location.
- 14. In the Curvilinear Coordinates dialog, key in delta station values of 500 and delta offset value of 0.

8 Curv	ilinear Coordinat	es	_ 🗆 ×
🔲 S:	15+25.00	🔽 DS:	500.00
Ext.:			
E 0:	-100.00	🗹 D0:	
🗖 Z:	0.00	🗖 DZ:	0.00
🗖 Pern	nanent Lock		Apply

- 15. Click Apply.
- 16. This will place the second endpoint of the line at station 15+25 offset -100.

> Using Active Chain Control With Profiles

- 1. Click on the icon for View 2 on the main tool bar.
- 2. Move you cursor in View 2. (Notice the cross hair following along in View 1).
- 3. This can be used the same as in the previous exercise to place elements at certain elevations along the profile.
- 4. Key-in the Station and Elevation values in the Curvilinear Coordinate dialog as shown below.

8 Curv	ilinear Coordinat	es	_ 🗆 ×
-			
	24+32.00	🗖 DS:	10.00
	7569.13		7569.13
	23.98	DZ:	7569.13
🗖 Pern	nanent Lock		Apply

- 5. Select the MicroStation command Place Circle.
- 6. Set the **Method** to **Diameter**.



- 7. Click the Apply button on the Curvilinear Coordinates dialog.
- 8. Move you cursor to the profile view to place the second point on the circle.



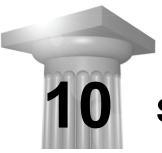
- > Using Active Chain Control With Cross Sections
- 1. Click on the icon for **View 3** on the main tool bar.
- 2. Right click on the same icon and select Cross Section Navigate.



3. You can use the Navigator to traverse through the cross sections.







Site Design

CHAPTER OBJECTIVES

In this chapter we will:

- Overview the original data supplied for this project
- Formulate a design strategy

INTRODUCTION

Designers will realize that every "at grade" intersection has its own specific design issues.

What may look the same from plan view may be a totally different design vertically due to the existing vertical conditions or specific requirements.

The amount of reconstruction of existing roadway can completely change the designers approach to two seemingly similar geometrical layouts.

We shall investigate the design constraints of this particular project and formulate an initial design strategy. This strategy may need to be varied or modified further along the design path based on outcomes at each step, but we need some strategy to begin with to make a start.

We will overview the supplied data and constraints for this specific situation.



PROJECT OVERVIEW

This training session evolved from a project sent to Bentley by a client who was seeking assistance. The steps we will undertake in this training session mirror those formulated during the process of assisting the client.

We will look at the information that was supplied when this project started.

The client had completed a survey of the existing conditions, created a TIN file, completed the geometric layout of the new intersection, and designed a controlling Chain and Profile.

The Chain (VAN1) and Profile (PROPVAN1), together forming the control alignment, were approved by the project engineer and could not be modified.

Other constraints included the strict requirement to tie down to original within the existing Right Of Way and a maximum length of reconstruction on the services roads of 150 feet.

> **OVERVIEW THE SUPPLIED DATA AND DESIGN CONSTRAINTS**

1. Open the file C:\data\geo\site\roundabout\Step2\LHSRAB.dgn.

This file will initially display the reference file that contains the survey information from the existing intersection arrangement.

2. We shall discuss in the class the existing arrangement on the intersection.

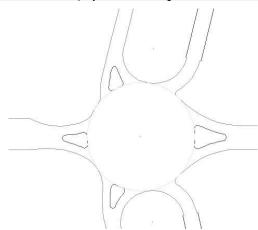
Note that the controlling alignment is based on an existing overpass bridge.

- 3. Continuing with the file LHSRAB.dgn, select the File>Reference tool.
- 4. Toggle OFF the reference file *existing.dgn* and toggle ON the reference file *proposed.dgn*.

We shall discuss the proposed layout and, based on this layout, what are the requirements to begin a Site Modeler project.

- 5. Toggle **OFF** the reference file *proposed.dgn*.
- 6. Select Settings > Level > Display and turn on all levels in the active DGN.

This shows all of the plan view graphical elements required to begin this project. We shall discuss the graphical elements that are displayed and their significance.

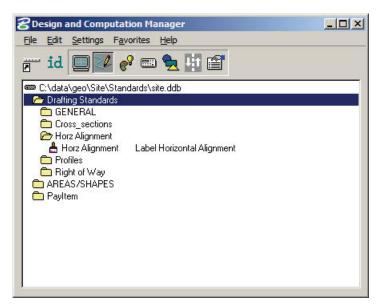


7. Open Design and Computation Manager (Applications > GEOPAK Site > Design and Computations Manager).

In PowerCivil the menu item is Civil > Plans Production > Design and Computation Manager.

- 8. Open the file *C*:*Data**Geo**Site**Standards**site*.*ddb*.
- 9. Using the ID function of D&C Manager, review the features attached to the various lines drawn in the DGN file.





10. Close the Design and Computations Manager dialog.



DESIGN STRATEGY

We need to formulate a design strategy based on the constraints of the project, the given information and the desired project outcome.

This strategy could change during the course of this project due to design issues or constraints that are either unknown or unforeseen at this time.

Modification of a design strategy is typical of intricate design projects. Site Modeler tools provide the flexibility required to incorporate changes as they arise.

> FORMULATE A DESIGN STRATEGY

There are a number of different design philosophies for designing roundabouts. We will not be examining all of the different theories in this class. The philosophy that we will use is one that treats the traffic circle portion of the intersections as an "upside down plate". This means that irrespective of the orientation of the traffic circle, the outside edge always forms a plane surface.

STEP 1

Constraints

The control alignment is set. It cannot be changed.

Maximum allowable reconstruction of the services roads is 150 feet.

Right Of Way cannot be altered.

This means we stay as close as possible to the existing intersection elements and elevations.

- 1. Given the constraints, we need to design the intersection based around the control alignment and create the traffic circle portion of the intersection so it is as close to the existing intersection elevations as possible.
- 2. Creation of the traffic circle will be based on a plane that is defined relative to the Control Alignment. After the plane is created the outside edge of the Traffic Circle will be draped onto the construction plane and then the inside edge of the Traffic Circle will be created at a positive 2% slope from the outside edge.
- **3.** We shall then analyze the difference in elevation between the outside edge of the traffic circle and the existing surface at critical points and, if required, redesign the traffic circle until we have achieved a satisfactory stage of the design.
- 4. The incoming roadway profiles (other than the control alignment) will be designed based on the traffic circle elevations.
- 5. The incoming roadways will be modeled based on the design profiles.
- 6. Curb returns will initially be defined based on the most appropriate adjacent element then modified as required.
- 7. The median islands will be created based on the finished pavement surface.



STEP 2

Objectives

- Create a construction object based on the control alignment
- Create and analyze the traffic circle
- Modify and re-analyze the traffic circle

Introduction

Based on the design strategy that we have set, we need to devise a way to assign elevations to the outside edge of the traffic circle.

As an additional consideration, we should formulate this step with the thought that it may need to be redesigned (*probably will need to be redesigned*) and that we should create this element with the redesign issue in mind.

The use of construction objects with Site Modeler is a very powerful way to assign elevations to irregular or complex elements AND provide a way to make redesign a very fast and painless process.

Tools to be used

- Site Modeler > Object > New
- Site Modeler > Elements > Composite Section
- Site Modeler > Elements > New/Edit > Drape on Model/Object
- Site Modeler > Elements > New/Edit > Section
- Site Modeler > Elements > Information
- Site Modeler > Analysis > Profile



LAB EXERCISE: CREATE A CONSTRUCTION OBJECT

A *construction object* is defined as a site modeler object that is in the modeler project but not necessarily part of the model. Its primary use is to simplify the process of assigning, and then reassigning, elevations to irregular or complex site modeler elements.

The methodology we will use to create the construction object is to create a new object and, within that object, define a surface plane based on the Control Alignment.

> **OPEN AN EXISTING PROJECT**

- 1. Open the DGN file c:\data\geo\data\Site\RoandAbout\Step2\LHSRAB.dgn.
- Select the site modeler tool (Applications > GEOPAK Site > Site Modeler > Site Modeling).

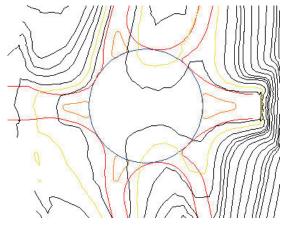
In PowerCivil select Civil > Modeler.

8Project Wizard	
Open Existing Project: <pre> </pre>	ОК
C:\data\geo\Site\Roundabout\Step	Cancel
O Create New Project	Browse
Don't show this dialog on Startup	2101100

3. Click Browse. Select the file C:\Data\Geo\Site\Roundabout\Step2\LHSRAB.gsf.

This is a Site Modeler project that has already been created that includes the existing ground TIN file as the Object "Ground 1" and a Model called "RAB" that has the Ground 1 Object as its base.

4. Click OK.





> CREATE A CONSTRUCTION OBJECT

1. Select the new object tool (Modeler > Object > New).

Create New	Object	
Object Type:	Construction	OK
Object Name:	Temp1	Cancel
	Add to Active Model	

2. Select object type "Construction" and name "Temp1" as shown above. Also make sure to turn off the check mark for "Add to Active Model."

We are not including this object in the model because it is not part of our design. This object will be used simply to define a plane on which to drape our traffic circle.

3. Click OK.

> CREATE THE CONSTRUCTION SURFACE USING COMPOSITE SECTION

- 1. Select the composite section tool (Modeler > Tools > Composite Section).
- File > Open. Select the Composite Sections setting file C:\Data\Geo\Site\Roundabout\Step2\TempObjectZeroPercentSlope.sec.

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	ype: <u>Parallel</u>	Featur	e Type: <u>E</u>	Boundary	▼	
Create Elem	ient		4-14-14-			
User Slope	(%)	0.000		evel Symbo Entries >	ology 🔻 📃	1

3. Turn on the check mark to Add to Active Object and set the object to Temp1.



4. Set the Primary Element Definition to "Chain-Profile" and then press the Alignment Definition button and set as shown below. The feature "TempCL" is located in D&C Manager at *Drafting Standards > General > TempCL*.

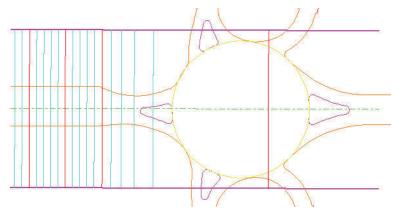
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Profile: PROP	VAN1	
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Payitem: TempCL		- =
Exclude from	n Object	

5. Click OK

Ensure that the Active Object is "Temp 1". Check the Active Object Control dialog.

6. Click Apply.

We have now created a surface that is 190 feet wide (95 feet both sides of the control alignment) and is projected at 0% from on the control alignment. While this surface has no slope in the north/south direction, it will still drain based on the longitudinal slope of the alignment it was created from.





LAB EXERCISE: CREATE THE ROUNDABOUT OBJECT

Based on the design strategy that was discussed earlier, we will now start to create the elements that will make up our intersection (roundabout).

We first need to create an object to place the roundabout elements into.

Then we will drape the outside edge of the traffic circle onto the Construction Object.

Last step is to create the inside edge of the traffic circle to give us the 2% pavement cross slope within the traffic circle.

> CREATE THE ROUNDABOUT OBJECT.

1. If you have not done so already, save your site project (Modeler > Project > Save).

2. On the Active Site Object Control set the active model back to RAB.



Create New Object		
Object Type: Roadway	▼ OK]
Object Name: RAB1	Cancel	

- 4. Select they Object type "Roadway".
- 5. Overwrite the default Object Name with "RAB1".
- 6. Toggle ON Add to Active Model.

This object is an actual part of our design so we add it to the model.

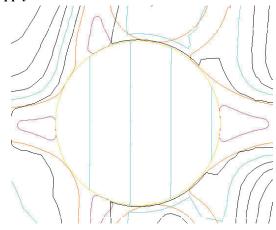
7. Click OK.



- > CREATE OUTSIDE EDGE OF TRAFFIC CIRCLE ELEMENT
 - 1. Select the new element tool (Modeler > Elements > New/Edit).
 - 2. Set dialog as shown below.

del / Object 📃 🗖
New Apply
Redefine Site Element

- 3. Click **Define Elements > Select Elements** (indicated by arrow above).
- 4. Select the outside edge of the traffic circle.
- 5. Click Apply.





> CREATE THE INSIDE EDGE OF THE TRAFFIC CIRCLE

- 1. We will use the section capabilities of the **New/Edit** element tools to compute the inside edge of pavement of the traffic circle. Select **Modeler > Elements > New/Edit > Section**.
- 2. Populate the dialog as shown below.

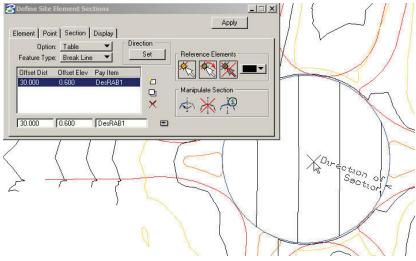
Define Site Element Sections	
Element Point Section Display	Apply
	Set Reference Elements
Offset Dist Offset Elev Pay Item 30.000 0.600 DesRAB1	Manipulate Section
30.000 0.600 DesRAB1	

- 3. Key in the values in the key in fields. Offset distance = 30.0, Offset Elev = 0.6. This is equivalent to 2%.
- 4. Click Select (indicated by lower arrow) and select the D&C Manager item "DesRAB1".
- 5. Click Add List Item (indicated by upper arrow).

The Design and Computation Manager item "RAB" can be located at Payltem > Plan > Roadway > DesRAB1.

6. Click Reference Elements > Select Reference Elements.

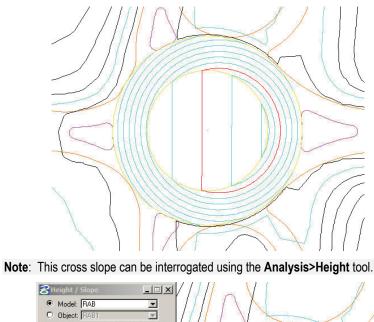
- 7. Select the outside edge of the traffic circle.
- 8. Click Set. Point the direction of the dynamic graphic *inside* the selected element as shown below. Data point to accept the direction.

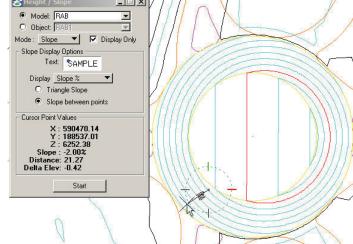


9. Click Apply.

There should be a new element created and the contours of the RAB Object should indicate a 2% pavement cross slope.









LAB EXERCISE: ANALYZE THE TRAFFIC CIRCLE

At this time, we need to determine if this first attempt at the traffic circle meets the design constraints which were set. Specifically, how closely do we match the existing elevations? We need to determine the difference in elevation between the proposed and the existing ground.

The critical locations to check this difference in elevation are at the centerline of the incoming ramps and service roads.

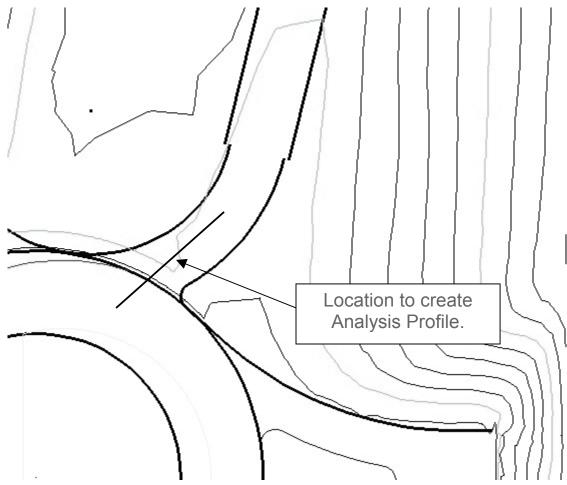
As the control alignment has previously been set as a constraint, there is no need to check the elevation differences for these roads.

There is more than one tool that would be suitable for the analysis task that we have. The tool we will use is the **Analysis > Profile** tool. Another option would be the **Elevation Differences** tool.

We will opt for the **Profile** tool in this case due to the very visual and specific feedback it provides.

> Using the Analysis>Profile tool

1. Use the Microstation view controls to set the focus of your view window to the North Ramp (as shown below).





2. Open the profile tool (Modeler > Analysis > Profile). The following dialog will activate.

Туре	Feature	Level	Color	Weight	Style	Extract
OBJ OBJ	Ground 1 RAB1	Default Default	0	0	3	On On

- 3. Populate the dialog as shown.
- 4. Click the Profile tab.
- 5. Click Place Element and draw a line in plan.

Note: The line should pass from the traffic circle surface onto the North Ramp roadway at approximately the ramp centerline.

The profile view of the Site Profile tool will now display the two surfaces. We can immediately see the difference in elevation between the surfaces.

Profile				
<u>Fi</u> le				
Selection Profile	Preferences			
Select Element	Place Element	Place Profile	Curve Stroking: 0.0	00
Extracted Profile	/iew			
		J		

- 6. Click the **Preferences** tab.
- 7. Toggle ON the Major and Minor Vertical Grid intervals.



lection Profile Preference	es		
Scale	Elevations	Stationing	9
Horizontal: 10.000	Minimum: 6249.00	00 Minimun	n: 0.000
Vertical: 1.000	Maximum: 6253.00	00 Maximun	n: 56.279
	Reset Vertical	Re	set Stations
orizontal Grid	Verti	cal Grid	
🗖 Major Interval: 🗍 100.00		Major Interval: 5.0	00
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Major Symbology:		ajor Symbology: 📃	
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8. Click the **Profile** tab. The Profile will now be displayed showing the vertical grid intervals.

Profile		
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election Profile	eferences]	
Select Element	Place Element Place	Profile Curve Stroking: 0.000
Extracted Profile Viev	r	
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9. Investigate the elevation difference in the same manner at the South Ramp and the North and South Service Roads.



LAB EXERCISE: MODIFY THE TRAFFIC CIRCLE

Our analysis determines that the current elevations of the traffic circle are not acceptable. We will modify these elevations and re-analyze the result.

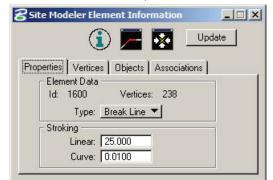
As the traffic circle elevations are based on the plane created in the construction Object, all we need to do is modify the construction Object and the traffic circle will automatically reflect these changes.

This can be accomplished due to the Site Modeler "association" technology. Site Modeler tracks and remembers the way that elements are created. Using this tracking system provides the User with a powerful tool to automatically update linked pieces of data.

If we remember back to what we have done, the construction object is a simple surface based on the control alignment chain and profile. The outside of the traffic circle is dependent on that construction surface and was created from it (Elements > New/Edit > Drape on Object). The inside of the traffic circle was created based on the outside element (Elements > New/Edit > Section). Therefore, if we modify the construction surface, all of the traffic circle elements will update to reflect the surface change.

> MODIFY THE CONSTRUCTION OBJECT

- 1. If you haven't done so already then save the project (Modeler > Project > Save).
- 2. Make sure level TempCL is turned on. It contains the elements for the Temp1 object which we need to modify.
- 3. Start the element information tool (Modeler > Elements > Information).



Note: This tool is also located on the Active Site Object toolbar.



4. Choose the construction surface centerline element.



5. Click the Association tab and set the options to Dependent Associations.



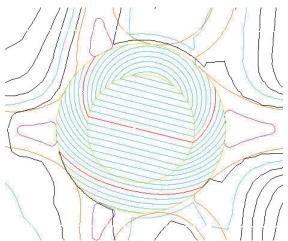
6. Click composite section button. The composite section dialog will open with the settings used to create this element.

Note: We will edit the Left Side and Right Side element so they provide a 1% cross slope from left to right.

- 7. Left Side. Select the parallel element. Change the slope to 1%.
- 8. Click Modify List Item to modify the value.
- 9. Right Side. Select the parallel element. Change the slope to -1%.
- 10. Click Modify List Item to modify the value.
- 11. Click Apply.

This will update all of the elements that are linked to the construction surface.

Set RAB 1 as the active Object on the Active Site Object Control dialog to see the effect on the RAB object.



Use the *Analysis*>*Profile* tool to repeat the analysis of the incoming roadways to visually see the difference that this has made.

Note: We will accept this design and move on to the next design stage.



Do Not Duplicate

STEP 3

Objectives

Design the incoming profiles for the ramps and service roads.

Introduction

Now that we have decided that the first design step is acceptable, the next logical step is to design the incoming roadway profiles.

This could have been completed earlier in the design process but would have been quite difficult and resulted in data that may have needed to be revised.

Starting this process now gives us a distinct advantage in that we now know what the elevations of the traffic circle are and we can use this information to make intelligent design decisions.

The process we shall use is as follows.

- Create existing surface profiles based on the Model for each incoming roadway.
- Design the proposed profile for each incoming roadway.

Tools to be used

- Site Modeler > Object > Draw Profile.
- Applications > GEOPAK Site > Active Profile Control.
- Applications > GEOPAK Site > Geometry > Layout Profile (Component Based).



LAB EXERCISE: CREATE MODEL SURFACE PROFILES

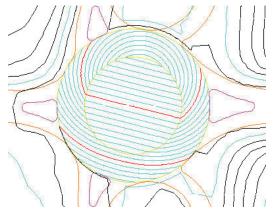
To ensure that all students have the same data, we will start this exercise in a new dataset.

- > **OPEN THE SITE PROJECT**
 - 1. Open the file C:\Data\Geo\Site\Roundabout\Step3\LHSRAB.dgn.
 - 2. Start modeler (Applications>GEOPAK Site>Site Modeler>Site Modeling).

Note: In PowerCivil use menu (Civil > Modeler).

8 Project Wizard	
Open Existing Project <pre></pre>	OK Cancel
Create New Project	Browse
Don't show this dialog on Startup	5101100

- 3. Click Browse.
- 4. Select the file C:\Data\Geo\Site\Roundabout\Step3\LHSRAB.gsf.
- 5. Click OK.





> CREATE MODEL SURFACE PROFILES

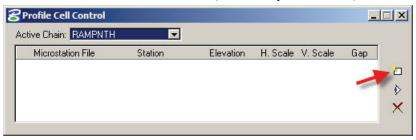
- 1. Open another Microstation window (view 2) and pan across to an empty portion of screen. We will use this window for working with profiles.
- 2. Select the draw profiles tool (Modeler > Object > Draw Profiles).

The Draw profile dialog should be familiar to most students as it is a standard GEOPAK tool. When used as a Site Modeler tool, it has additional functionality. It has the ability to not only create profiles from TIN files, but also from Site Objects and Models.

- 3. Set Job Number to 99.
- 4. Set Chain to RampNth.

BDraw Profile	
File Edit Update Options	
Job Number: 99	9 💌 🚓 🚪 Label Scale: 🛛 .000000
nain: RAMPNTH	
Surfaces COGO Projectio	on] 🔨
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Details	
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Method: Tria	
Display Settings	Filter Tolerances
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Station Limits	Offsets
Г Ведіп: 0.00	+ Horizontal: 0.00
End: 0.00	+ Vertical: 0.00
└ Void └────	BreakLine Text
and the second sec	

5. Click Profile Cell Control button (indicated by arrow above).



6. Click Place Profile Cell button. (indicated by arrow).



7. Populate the dialog as shown below.

Place Profile Cell	
Station:	0.00
Elevation:	6200.00
Horizontal Scale:	10.000000
Vertical Scale:	1.000000
	No Gap 🛛 🔻
Cell Range	
Top Delta 🔻	100.00
Bottom Delta 🛛 💌	0.00

- 8. Place the Profile cell into a clear part of the graphics (in Window 2).
- 9. Populate the Draw Profile dialog as shown below.
- 10. Set the Details portion of the dialog.
- 11. Click Add Surface Settings.

8 Draw Profile	×
File Edit Update Options	
Chain RAMPNTH	Label Scale: 0.000000
Surfaces COGO Projection	
Type Name Display Settings	Draw
	8*
Model Kethod: Triangles	
Display Settings	Filter Tolerances
By Feature	Horizontal: 0.30
Feature: ExProCL	Variance: 0.10
Station Limits	sets
☐ Begin: 0+00.00 +++ Hor	izontal: 0.00
	'ertical: 0.00
T Void BreakLine	Text Sample

- 12. The **Details>Display Settings** show that a Design and Computation Manager item is used. This item can be found within the D&C Manager as *Drafting Standards>Profiles>ExProCL*.
- 13. The same process will now be repeated to create the Model profiles for the Chains RampSth, ServNth and ServSth.
- 14. Exit and save the Site Modeler project. It is not required for the remainder of this step.



LAB EXERCISE: CREATING DESIGN PROFILES

Now that we have drawn the Model surface profiles, we are ready to create design profiles.

We already have some constraints that affect this next step.

The Model profiles show us the elevation at the proposed traffic circle edge – so the design profiles must start at that elevation.

The cross slope of the traffic circles is 2%. For us to get a smooth transition for the incoming roadways to the traffic circle, we must start the design profiles using a 2% tangent from the location that we join to the traffic circle.

The service roads cannot be reconstructed any more than 150 feet. We will draw this location into the plan and profile to give us a visual indication of this design constraint.

- > Show the 150 FEET RECONSTRUCTION CONSTRAINT IN PLAN.
 - 1. Start the COGO tool (Applications>GEOPAK Site>Geometry>Coordinate Geometry).

Note: In PowerCivil, (Civil > Geometry > Coordinate Geometry).

Project Name:		
Job:	99	Q
perator Code:	rg	
Subject:		
ПК		Cancel

- 2. Select Job Number 99 and enter your initials for operator code.
- 3. Click OK.

BCoordinate Geometry Job: 99 Operator: rg	
Eile Edit Element View Tools	
Temporary Visualization ▼ ROW ▼ Browse 99.12 ▼ 9^99 ▼ << < >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	
	-
Navigator	

4. Set visualization to Temporary.



5. Click **Navigator** and minimize the COGO window.

3 Navigator(99)	<u>×</u>
Select Tools	
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Element : Chain	-
Name	
BAMPNTH	
RAMPSTH	
SERVNTH SERVSTH	
VAN1	
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	/isualize
	v isualize
- 30 V2	
•	Þ

- 6. Set Element to Chain.
- 7. Select and visualize the chains RampSth, RampNth, ServSth and ServNth.
- 8. Close Navigator.
- 9. Select the place line tool. (Microstation > Place Line). Draw a line that is perpendicular to the chains ServSth and ServNth at the point where they intersect the traffic circle.
- **10**. Copy the lines parallel 150 feet.

Note: This gives us an approximate location for the 150 feet reconstruction constraint in plan view.

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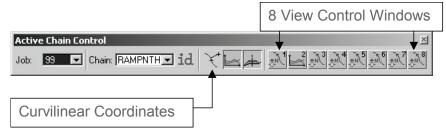


> Show the 150 FEET RECONSTRUCTION CONSTRAINT IN PROFILE

1. Open the active chain control tool (Applications > Geopak Site > Geometry > Active Chain Control).

Note: PowerCivil, (Civil > Geometry > Active Chain Control).

2. Set Window 2 to a Profile view in the Active Chain Control. This is accomplished by right clicking on the **View 2** button in the dialog and setting the view to profile.



- 3. Set View 1 to plan.
- 4. Set Active Chain Control to the Chain ServNth and synchronize the views.

Note: Synchronize the views by clicking in the ACC Plan view window and Profile View window.

5. Click Curvilinear Coordinates button.

	<u></u>		
5:	4+50.51	DS:	0.00
st.:	0.00		
0:	-103.65	DO: DZ:	0.00
Z:	0.00	DZ:	0.00
Per	manent Lock		Apply

6. As you move in plan view the curvilinear coordinates will display station and offset. As you move in profile view the curvilinear coordinates will display station and elevation.

Note: You may need to click the reset button on your mouse once to start coordinate tracking.

- 7. In Plan, tentative snap to the line that indicates the maximum extent of reconstruction.
- 8. Lock the Station and Permanent Lock controls in the curvilinear coordinates dialog.

Note: The stations may be different as we did not accurately draw the reconstruction limit line.

8 Curv	ilinear Coordinat	es	_ 🗆 🗙
✓ S:	3+48.68	DS:	0.00
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□ 0:		🗖 D0:	0.00
□ Z:	0.00	DZ:	0.00
Perr	manent Lock		Apply

9. MicroStation > Place Line.

10. Draw a line in the profile view.

Note: Due to the effect of the curvilinear coordinates tool, the line will be drawn at the correct station and can only be drawn vertically.

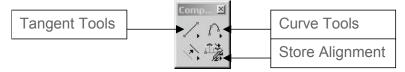
- 11. Unlock the Station and Permanent Lock controls.
- 12. Set Active Chain Control (ACC) to the Chain ServSth and synchronize the views.
- 13. Repeat step 7 to step 11 for the ServSth chain.

Note: This gives us a visual cue of the 150 feet reconstruction constraint in profile view.



- > CREATING DESIGN PROFILES USING THE VERTICAL COMPONENT TOOLS
 - 1. Set active chain control to the chain ServNth.
 - 2. Synchronize the views.
 - **3**. Use MicroStation view controls to set the allowable reconstruction portion to fill the plan and profile designated views.
 - 4. Start the component profile tools (Applications > GEOPAK Site > Geometry > Layout Profile (Component Based)).

PowerCivil, (Civil > Profiles > Layout Profiles (Component based)).

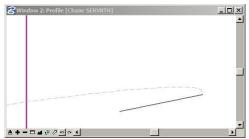


5. Tear off the tangent tools and the curve tools.



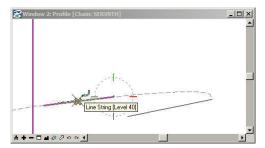
Note: These tools provide an alternate to the VPI based Vertical Alignment Generator. They allow the user to place vertical components (tangents and curves) to assemble a profile. Where the user has many constraints (as it the situation here) they are a very useful alternative to the traditional design profile method.

- 6. From the tangent tools, click Create Profile Line by Points.
- 7. Snap to the end of the Model profile that represents the elevation at the edge of the traffic circle.
- 8. Set the slope to 2%.
- 9. Draw in the tangent.



- 10. From the Curve tools, click Create Profile Curve by 3 Points.
- 11. Set the Microstation snap control to nearest.
- 12. Snap to 3 locations on the Model profile in the area of the extent of reconstruction.

Note: This gives us a vertical curve that represents the existing service road centerline – so w can join back to existing.

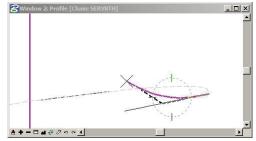


13. From the Curve tools, click Create Tangent Profile Curve.

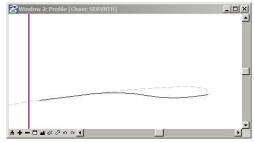


Do Not Duplicate

14. Select the profile tangent, data point in the profile view to designate a "through" point on the curve and then data point again to finish the curve.



- 15. From the Curve tools, click Create Profile Curve between 2 Elements.
- 16. Select and accept the first profile curve.
- 17. Select and accept the second profile curve.
- **18**. Data point to locate a "through point" for the profile curve and to complete the new profile curve.



Note: Wait and follow you instructor before you attempt these steps if you have not used these tools before.



> STORING THE PROPOSED PROFILE

1. From the vertical components tools, click Store Vertical Alignment.

If you receive alert messages that COGO needs to be open then answer in the affirmative. The alert message is telling us that we need COGO open to store the vertical profile and then asking us if we want to open COGO. After answering these prompts then you will need to start the store vertical alignment tool again

- 2. Key in the proposed profile name "ServNth".
- 3. Select any proposed profile component from the profile view (Window 2).
- 4. Data point again to string the components together.
- 5. Data point again to actually store the alignment to COGO.
- 6. Click **COGO** this will raise the COGO window. You can see the commands that have been created to store the profile.

Note: Remember to follow the prompts displayed in the MicroStation message area during the design and store profile process.

The stored profile can now be loaded into the VPI profile tool in order to round off the grades and stations of VPIs as well as check curve lengths for design speed.

> **DETERMINE THE EXTENT OF RECONSTRUCTION**

While we have the ServNth profile activated, we will use this to determine the extent of reconstruction. Effectively, where the proposed profile joins back to the existing surface is the end of proposed reconstruction.

- 1. Set MicroStation snap to intersection mode.
- 2. Click Curvilinear Coordinates.
- 3. In the profile view, snap to the intersection of the existing and proposed profiles.
- 4. Lock the Station and Permanent Lock controls in the curvilinear coordinates dialog.

Note: After locking the station you could overtype an even station value if desired. For example, type in 7+10.00 rather than the exact computed value of 7+10.50. This could make your final plans more presentable.

- 5. Now in plan view draw a line across the ServNth pavement lines. Because of the curvilinear coordinates locks it will only draw perpendicular to the alignment.
- 6. Now trim the proposed edges of pavement to the line just drawn.
- 7. Repeat the proposed profile design for ServSth, RampNth and RampSth.



STEP 4

Objectives

 Model the incoming roadway pavement areas based on the profiles we just designed and the alignment we were provided

Introduction

Now that chains and profiles have been created for all of the incoming roadways, the next step is to model the incoming roadway surfaces based on those design alignments.

This involves defining the alignment elements, edge of pavements and curb and gutter sections in the Site Model.

There are two methods that can be employed to do this.

We will attempt both methods and discuss reasons to choose one method over the other.

Firstly, we will add the control alignment and then define the associated edge of pavement elements using the basic Site Modeler tools.

Then we will define the other 4 incoming roadways using the Composite Section tool.

Tools to be used

- Site Modeler > Elements > New/Edit > Alignment
- Site Modeler > Elements > New/Edit > Slope/Offset from Site Element
- Site Modeler > Elements > New/Edit > Section
- Site Modeler > Elements > Composite Section



LAB EXERCISE: CREATE ROADWAY SURFACE FROM CONTROL ALIGNMENT

To ensure that all students have the same data, we will start this exercise in a new dataset.

- SWAP TO NEW DGN AND GSF >
 - 1. Open the file C:\Data\Geo\Site\Roundabout\Step4\LHSRAB.dgn.
 - 2. Start Modeler (Applications>GEOPAK Site>Site Modeler>Site Modeling).

Note: PowerCivil menu, (Civil > Modeler).

3. This will open the GEOPAK Site Modeler tool.

8 Project Wizard	
Open Existing Project: <pre></pre>	OK
C:\data\geo\Site\Roundabout\Step[Cancel
O Create New Project	Browse
Don't show this dialog on Startup	0101/30

- 4. Click Browse.
- 5. Select the file C:\Data\Geo\Site\Roundabout\Step4\LHSRAB.gsf.
- 6. Click OK.
- 7. In Microstation, turn off level TempCL so the elements there do not confuse us. Remember that this level contains the elements for the construction object we created in Step 2.

LAB EXERCISE: ADD THE CONTROL ALIGNMENT

1. On the Active Site Object Control make sure the active object is set as RAB1.



2. Now start the new element tool (Modeler > Elements > New/Edit > Alignment).

We do not want the alignment element to impact on the traffic circle, only the pavement outside it. Because of this, we will add the Control Alignment to the Object in 2 parts, leaving out the portion across the Traffic Circle.

Apply
and Discussion
ement Definition
2

3. Set the dialog as shown above.

Note: The begin station is the limit of construction on the west. This was purposely set at an even station to make the plans easier to read. The end station is the point where the alignment meets the traffic circle. You can dynamically set these ranges by snapping to the appropriate points.

4. Click Apply.



5. Populate the dialog as shown below.

8 New / Edit Site Elements -> Alignment	
Add to Active Object: RAB1	New Apply
Element Point Section Display	
Image: Constraint of the second state of the second sta	Primary Element Definition Job: 99 Chain: VAN1 Profile: PROPVAN1 ✓ Use Station Range: Begin: 16+39.25 End: 18+07.78 Include Element ✓

6. Click Apply.

This will add the 2 required portions of the control alignment to the Object.



- > ADD THE EDGE OF PAVEMENT ELEMENTS RELATIVE TO THE CONTROL ALIGNMENT
 - Continuing with the new element tool (Modeler > Element > New/Edit > Slope/Offset from Site Element).
 - 2. Set the dialog as shown below.

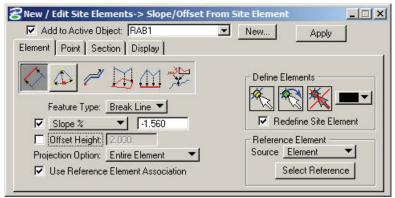
New Apply
Define Elements
Reference Element
Source Element
Select Reference

Note: As there are two (2) different sections of the control alignment. The cross slope for the road area is -2%. The cross slope for the bridge area is -1.56%. We will need to project the edge of pavement elements to the centerline in 2 steps.

- 3. Click Define Elements>Select Element.
- 4. Select the 2 edge of pavement complex chains on the western approach.
- 5. Click Reference Element>Select Reference.
- 6. Select and accept the left western portion of the control alignment element.
- 7. Click Apply.

Now we will repeat these steps for the right hand portion of the control alignment – the pavement over the bridge.

8. Set the dialog as shown below.



9. Click Define Elements>Select Element.

- 10. Select the four (4) edge of pavement complex chains on the eastern approach.
- 11. Click Reference Element>Select Reference.
- 12. Select and accept the eastern portion of the control alignment element.
- 13. Click Apply.



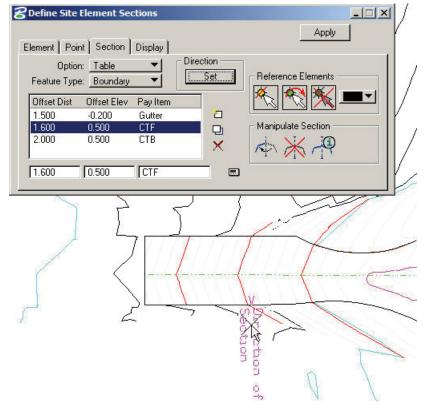
- > ADD THE CURB AND GUTTER SECTIONS TO THE EDGE OF PAVEMENT
 - Continuing with the new element tool change to the section tab (Modeler > Elements > New/Edit > Section).
 - 2. Populate the dialog as shown below.

名 Define Site	Element Se	ctions		
Element Poir	nt Section	Display		Apply
	n: <u>Table</u> e: <u>Boundary</u>	▼ Dire	ction Set	
Offset Dist	Offset Elev	Pay Item		
1.500	-0.200	DesGutter	2	
1.600	0.500	DesCTF	- D	Manipulate Section
2.000	0.500	DesCTB	×	$\Rightarrow \mathbb{X} \xrightarrow{\mathbb{P}}$
1.500	-0.200	DesGutter		

Note: The required DDB items can be found in the DDB /PayItem/Plan/Roadway directory.

3. Click Reference Elements > Select Reference Elements.

- 4. Select the six (6) previously defined edge of pavement Site Elements.
- 5. Click Set.
- 6. Move the cursor into the graphics and set the direction so that the arrow points to the outside of the edge of pavement.



Note: There is a dynamic graphic that is attached to the selected elements. GEOPAK is waiting for the User to set the positive horizontal (offset) direction for the section elements.

7. Click **OUTSIDE** of the selected graphics (so the positive direction is to the outside of the edge of pavement).



8. Click Apply.

We have added the curb and gutter to the edge of pavement elements.

We will now create the other 4 incoming roadways in a more automated manner using **Composite Section**.



> ADD THE NORTH SERVICE ROAD

1. Start the composite section tool. (Modeler > Tools > Composite Section).

Note: A number of steps are required to populate this dialog with the required information. Shown below are dialog captures of each of these steps.

Composite Section
<u>File</u>
✓ Add to Active Object: RAB1 ✓ New Apply Primary Element Definition Chain: SERVNTH By Chain-Profile Alignment Definition Chain: SERVNTH Profile: SERVSTH Section Manager Left Side Details Right Side Details
Elem. Type Feat. Type Definition Slope Offset Max. Dist 🔁 👘 💼
Define Element Type: Element V Feature Type: Boundary V
Method Superelevation (%) Radial To: Projection Option: Entire Element
Search Extent Max. Distance: 40,000

2. Press Alignment Definition button and populate as shown below.

Job:	99 🖻 🗃	
Chain:	SERVNTH	
Profile:	SERVNTH	
Stationin	g	
	🔽 Use Statio	n Range
Begin:	6+70.00	+0+
End:	7+87.70	+\$+
Alianmen	t Element Symbo	oloav
	······································	
Feature		
Feature Pavitem:	DesChains	-



3. To define the edge of pavement elements, set the dialog as shown in the lower portion of the dialog below. Click **Add List Item**. (indicated by arrow).

Composite	Section					
Primary Eleme By Chain-Pro		nment Definition		w VNTH VNTH		
Section Mana	iger Left Side	Details Right Si	de Details 🛛			2
Elem. Type	Feat. Type	Definition	Slope	Offset	Max. Dist	
Feature	Break Line	DesEofP	-2.000	0.000	32.000	
Define Element Ty	pe: Feature	▼ Fe	ature Type: _E	Break Line	•	4
Method			_			
	(%) al To: <u>Primary</u> ption: <u>Entire El</u>	▼ -2.000 ▼ ement ▼	Vertica	ll Offset: 👖	0.000	
	ent em: DesEofP nce: 32.000		8			

4. To define the curb and gutter, set the dialog as shown below.

Composite Section 📃 🗌 🗙									
<u>F</u> ile									
Add to Ac	Add to Active Object: RAB1 New Apply								
Primary Eleme	ent Definition —								
By Chain-Pro	ofile 🔻 👘 Aligi	nment Derinition	Chain: SER∖						
🗖 Superelev	vation By: Tabl		rofile: SER∖	'NTH					
Section Mana	ager Left Side	Details Right Side	e Details 🛛						
Elem. Type	Feat. Type	Definition	Slope	Offset	Max. Dist	l 🎦 🛱 🗖			
Feature	Break Line	DesEofP	-2.000	0.000	32.000				
Section	Boundary	By Table	n/a	n/a	n/a	× 🕆 🗖			
- Define Element Tu	pe: Section	▼I Feat	ure Type: B	oundaru	v I				
	pe. <u>Section</u>		аю турс. <u>- Б</u>	oundary					
- Method		-1							
	By: Table	Side: Left							
Section Name: Select									
Offset Dist	Offset Elev	Pay Item							
1.500	-0.200	DesGutter							
1 600 0 500 DesCTE									
2.000	0.500	DesCTB	×						
2.000	0.500 D	esCTB 🔳							

5. Click Add List Item.



6.	Select both list	items. Click	Copy	List Item.
----	------------------	--------------	------	------------

Composite Section				_ 🗆 ×				
<u>F</u> ile								
Image:								
Section Manager Left Side Details Right Side D	etails]							
Elem. Type Feat. Type Definition	Slope	Offset	Max. Dist	h 🖬 🗖				
Feature Break Line DesEofP Section Boundary By Table	-2.000 n/a	0.000 n/a	32.000 n/a	□ 4 < × ♥ □				
r Define				6				
	e Type: Br	eak Line 🗅	<u>-</u>					
Method User Slope (%) ▼ 2.000								
Radial To: Primary Vertical Offset: 0.000								
Projection Option: Entire Element								
Search Extent Payitem: DesEofP 💌 📼 Max. Distance: 32.000								

- 7. Click Right Side.
- 8. Click Paste List Item.
- 9. Select the first row item for the right side.

8Composite Section								
<u>F</u> ile								
Image: Chain Profile Alignment Definition Chain: SERVNTH By Chain-Profile Alignment Definition Chain: SERVNTH Superelevation By: Table Image: Chain Section Manager Left Side Details Right Side Details								
Elem. Type Feat. Type Definition Slope Offset Max. Dist Feature Break Line DesEofP -2.000 0.000 25.500 Section Boundary By Table n/a n/a								
Define Element Type: Feature Type: Method User Slope (%) ✓ Radial To: Primary Vertical Offset: 0.000 Projection Option: Entire Element Search Extent								
Payitem: DesEofP Max. Distance: 25.500								

- 10. Reset the Max. Distance value to 25.5.
- 11. Click Modify List Item.
- 12. Edit the Right Side Section row.



Set the Side to Rig	ght.
---------------------------------------	------

웅 Composite	Composite Section							
<u>F</u> ile	File							
	tive Object: R/ ent Definition —	\B1	✓ New			Apply		
By Chain-Pro		nment Definition	ain: SERV	'NTH				
		Pro	file: SERV	NTH				
	vation By: Tabl	e 🔻				A		
Section Mana	ager Left Side	Details Right Side D)etails]					
Elem. Type	Feat. Type	Definition	Slope	Offset	Max. Dist	🔁 🖻 🗖		
Feature	Break Line	DesEofP	-2.000	0.000	25.500			
Section	Boundary	By Table	n/a	n/a	n/a	X 🕆 🗖		
						6		
Define								
Element T	ype: <u>Section</u>	▼ Feature	e Type: B	oundary	•			
Method								
Section	By: Table	Side: Right	-					
Section Na	Section Name: Select							
Offset Dist	Offset Dist Offset Elev Pay Item 👝 🚲							
1.500								
1.600	0.500	DesCTF	<					
2.000	0.500	Deserb						
2.000	0.500 D	esCTB 📰						

14. Click Modify List Item.

15. Click Apply.

Note: Composite Section settings files can be saved and reused. To save a file, use the **File > Save** option at the top of the dialog.



> ADD THE OTHER ROADS – SERVICE RD SOUTH

The Composite Section files have been saved for the other roadways. We can open these files to complete the incoming roadways.

- 1. Site Modeler > Elements > Composite Section.
- 2. File > Open. Select C:\Data\Geo\Site\Roundabout\Step4\ServSth.sec.
- 3. Populate the **Primary Element** portion of the dialog as shown below.

8 Composite	Section - Ser	vSth.sec					
<u>F</u> ile							
Primary Elemer By Chain-Profi	ile 🔻 🛛 🖾 Align ation By: 🔄 Table	iment Definition Ch Pro	■ Nev ain: SER\ file: SER\ Netails	/STH		Apply	
Elem. Type	Feat. Type	Definition	Slope	Offset	Max. Dist	26 🖬	Alignment Definition
Feature Section	Break Line Boundary	DesEofP By Table	-2.000 n/a	0.000 n/a	28.500 n/a	□	Job: 99 😅 Chain: SERVSTH 🔽
							Profile: SERVSTH
Element Typ	pe: Element	▼ Featur	e Type: B	reak Line	▼		Stationing
- Method							Begin: 7+65.00
User Slope (%		• 0.000		Offset: 🚺			End: 9+14.51 +0+
	To: Primary	Alignment Element Symbology					
Projection Option: Vertices						Feature	
- Search Exten	nt —						Payitem: DesChains 💌 📼
Max. Distanc	ce: 0.000						ОК

4. Click Apply.



> ADD THE OTHER ROADS – RAMP NORTH

- 1. Site Modeler > Elements > Composite Section.
- 2. File > Open. Select C:\Data\Geo\Site\Roundabout\Step4\RampNth.sec.
- 3. Populate the **Primary Element** portion of the dialog as shown below.

File Image: Add to Active Object: RAB1 Image: New Apply Primary Element Definition Image: New Apply By Chain-Profile Alignment Definition Chain: RAMPNTH Profile RAMPNTH Profile: RAMPNTH Superelevation By: Table Image: New Image: New
Primary Element Definition Chain: BAMPNTH By Chain-Profile Alignment Definition Profile: BAMPNTH Profile: RAMPNTH
By Chain-Profile Alignment Definition Chain: BAMPNTH Profile: BAMPNTH
By Chain-Prohile Alignment Definition Profile: RAMPNTH
Section Manager Left Side Details Right Side Details
Elem. Type Feat. Type Definition Slope Offset Max. Dist 🔁 💼 🔀 Alignment Definition 💶 🗆 🗙
Feature Break Line DesEofP -2.000 0.000 18.500 🗖 🕼 🔬 🚺 Job: 🧐 😅
Section Boundary By Table n/a n/a n/a K I Chain: RAMPNTH
Profile: RAMPNTH
- Define
Element Type: Feature V Feature Type: Break Line V Vise Station Range
Method Begin: 3+95.00
User Slope (%) ▼ -2.000 End: 5+07.95 +0+
Radial To: Primary Vertical Offset: 0.000 Alignment Element Symbology
Projection Option: Entire Element
Search Extent Payitem: Baseline-Chains 💌 🖽
Payitem: DesEofP Exclude from Object
Max. Distance: 18.500
OK

4. Click Apply



> ADD THE OTHER ROADS – RAMP SOUTH.

- 1. Site Modeler>Elements>Composite Section.
- 2. File > Open. Select C:\Data\Geo\Site\Roundabout\Step4\RampSth.sec.
- 3. Populate the **Primary Element** portion of the dialog as shown below.

Composite Section - RampSth.sec	I XI
File	
Image: Chain Primary Element Definition New Apply Primary Element Definition Chain: RAMPSTH By Chain-Profile Alignment Definition Profile: RAMPSTH Profile: RAMPSTH Superelevation By: Table Image: Chain Profile	
Section Manager Left Side Details Right Side Details	
Elem. Type Feat. Type Definition Slope Offset Max. Dist Feature Break Line DesEofP 2.000 0.000 2.500 Section Boundary By Table n/a n/a n/a Define Element Type: Section Feature Type: Boundary Feature Type:	Job: 99 🗁
Method Section By: Table Side: Right ▼ Section Name: Select Offset Dist Offset Elev Pay Item 1.500 -0.200 DesGutter 1.600 0.500 DesCTF 2.000 0.500 DesCTB	Begin: 5+80.00 End: 6+55.89 ↔ Alignment Element Symbology Feature ▼ ■ ■ ■ ■ Payitem: DesChains ▼ ■ Exclude from Object

4. Click Apply.

This completes the areas of the incoming roads that can be defined based solely on the Chain and Profile for each roadway.



Step 5

Objectives

• Create the curb return elements and then, where required, edit these to ensure that all pavement areas provide smooth transitions and drain correctly.

Introduction

At this point, we have defined all of the larger pavement areas that have a direct relationship to a specific geometric element.

The traffic circle was defined based on a surface generated from the original control alignment. The incoming roadways have been based on their respective chains and profiles.

The curb return elements, in general, will be defined based on extending recently created pavement areas. Deciding where and how these elements will be created will require some educated Engineering design "best guesses".

Tools to be used

- Site Modeler > Elements > New/Edit > Slope/Offset from Site Element.
- Site Modeler > Elements > New/Edit > Drape On Model/Object.
- Site Modeler > Elements > Edit Profile.
- Site Modeler > Elements > Section.



LAB EXERCISE: DEFINE THE REMAINING EDGE OF PAVEMENT ELEMENTS

To ensure that all students have the same data, we will start this exercise with a new dataset.

- > SWAP TO NEW DGN AND GSF.
 - 1. Open the file C:\Data\Geo\Site\Roundabout\Step5\LHSRAB.dgn.
 - 2. Start Modeler (Applications > GEOPAK Site > Site Modeler > Site Modeling).

Note: PowerCivil menu, (Civil > Modeler).

8 Project Wizard	
Open Existing Project: <pre></pre>	OK
C:\data\geo\Site\Roundabout\Step.	Cancel
O Create New Project	Browse
Don't show this dialog on Startup	2101100

- 3. Click Browse.
- 4. Select the file C:\Data\Geo\Site\Roundabout\Step5\LHSRAB.gsf.
- 5. Click OK.



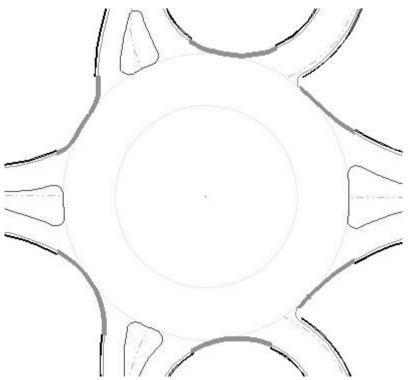
> Define the Curb Return Elements

19. Select the site element slope offset tool (Modeler > Elements > New/Edit > Slope/Offset From Site Element).

Note: Most of the remaining curb return elements can be defined by projecting from the outside edge of the traffic circle at -2%.

Site Element 📃 🗖 🗙
New Apply
Define Elements
Reference Element
Source Element
Select Reference

- 2. Set the dialog as shown above.
- 3. Click **Define Elements > Select Elements** and select all of the curb return elements that are shown in heavy weight below (should be 6 elements).

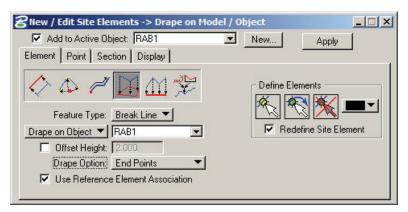


- 4. Click **Reference Element>Select Reference.** Select and accept the outside edge of the Traffic Circle.
- 5. Click Apply.

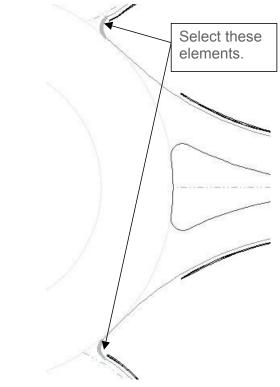
Note: The remaining curb returns we can define by draping the endpoints on the design thus far.

6. Modeler > Elements > New/Edit > Drape on Model/Object.





- 7. Set dialog as shown above.
- 8. Click **Define Elements>Select Elements** and select all of the curb return elements that are shown in heavy weight below.



9. Click Apply.



> Re-define the Curb Return Elements using Edit Profile

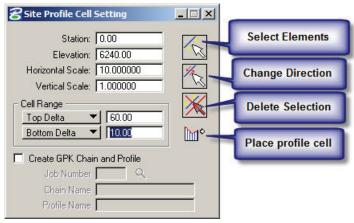
The GEOPAK Site Modeler Edit Profile tool is a very powerful design tool. It allows the User to redefine any existing Site Element or series of Site Elements by creating a Profile view of the elements and then using Vertical Component tools to modify the elevations.

1. Modeler > Elements > Edit Profile. This will activate the Active Profile Control dialog.



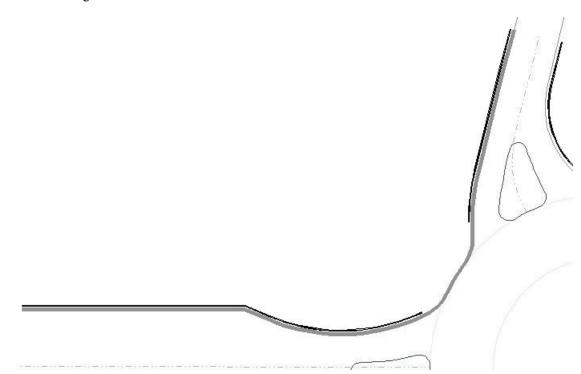
The dialog contains a number of different tools.

- The **Profile Cell Status** button.
- An id button to synchronize between plan view elements and the corresponding profile.
 - The Vertical Component Tools.
- The **Define Site Element Profile** button: this applies the new profile back to the Site Element.
- The Curvilinear Coordinates button.
- t^{1} t^{2} t^{3} t^{4} t^{5} t^{5} t^{7} t^{8} The Active Chain Control view control windows.
 - 2. Open Window 2 and Zoom/Window Area to give you a clear drawing space to place the Element Profile.
 - 3. Right Click on the Profile Cell Status button and select Profile Cell Setting.
 - 4. Set the dialog as shown below.



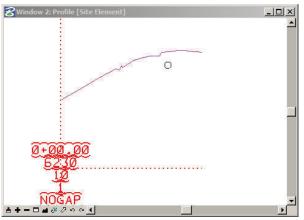


5. Click **Select Element**. Select all of the edge of pavement elements shown in heavy line weight below.



Note: Each element needs to be selected and accepted. When the elements are correctly selected, they will highlight with a series of light blue dots over the element.

6. Click **Place Site Pcell**. Move your mouse cursor into a clear drawing space in Window 2 and data point. This will place the profile representation of the Site Elements into a Site Profile Cell in Window 2.



- 7. Right click over the Active Chain Control view control window number one (1) and set View 1 to a Plan view.
- 8. Right click over the Active Chain Control view control window number two (2) and set View 2 to a Profile view.

This will synchronize between Plan and Profile views.

9. Press the Vertical Component Tools button. The following dialog will activate.





10. Use the **Vertical Component Tools** to redefine the portions of the current profile where required.

Note: Follow your instructor. There will be a discussion on what portions of this profile need to be redefined and what portions must not be modified.

- **11.** After the proposed vertical components have been added to the Profile, we need to return this new vertical information back to the Site Elements.
- 12. Click Active Profile Control > Define Site Element Profile.
- 13. Select one of the proposed vertical components.
- 14. Click again this will string all of the components together.
- 15. Click again this will return the new elevations to the Site Modeler elements.

Note: We will redefine the other five (5) curb returns using the same steps.



LAB EXERCISE: ADD CURB AND GUTTER SECTION TO CURB RETURNS

The curb returns have been defined to ensure a smooth pavement surface within the intersection. We now need to add the missing pieces of curb and gutter to the curb return elements.

> ADD CURB AND GUTTER SECTION

- 1. Start the site element section tool Modeler > Elements > New/Edit > Section.
- 2. Populate the dialog as shown below.

😤 Define Site	Element Se	ctions		
Element Poir	nt Section	Display		Apply
Option Feature Type	n: <u>Table</u> e: <u>Boundary</u>	▼ [Direction Set	
Offset Dist	Offset Elev	Pay Item		
1.500	-0.200	DesGutter	1	I
1.600	0.500	DesCTF		Manipulate Section ————————————————————————————————————
2.000	0.500	DesCTB	×	$\Rightarrow \mathbb{X} \mathbb{P}$
2.000	0.500	DesCTB		

Note: The required DDB items can be found in the DDB /PayItem/Plan/Roadway directory.

The section can be read from other edges of pavement that already have a section attached with the **Query** button (indicated by arrow).

- 3. Click Reference Elements>Select Reference Elements.
- 4. Select the eight (8) previously defined edge of pavement Site Elements.
- 5. Click Set.
- 6. Move the cursor into the graphics to set the direction.

Note: There is a dynamic graphic that is attached to the selected elements. GEOPAK is waiting for the User to set the positive horizontal (offset) direction for the section elements.

- 7. Click **OUTSIDE** of the selected graphics (so the positive direction is to the outside of the edge of pavement).
- 8. Click Apply.

We have added the curb and gutter to the curb returns.



STEP 6

Objectives

• Create the complex traffic circle center island.

Introduction

In Step 2 we originally defined the inside edge of the traffic circle. This was a temporary (and fast) method to give us a visual indication of what a 2% pavement slope would look like.

We now need to create the more complex median/island arrangement that was requested by the client.

Tools to be Used

- Site Modeler>Elements>New/Edit>Section.
- Site Modeler>Elements>Composite Section.



LAB EXERCISE: REMOVE THE CURRENT INSIDE EDGE OF TRAFFIC CIRCLE

To ensure that all students have the same data, we will begin this exercise in a new dataset.

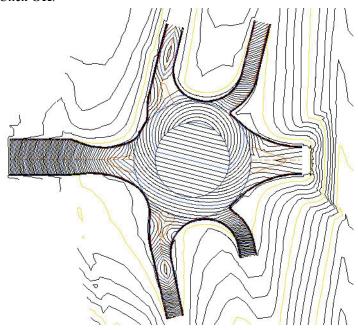
- > SWAP TO NEW DGN AND GSF
 - 1. Open the file C:\Data\Geo\Site\Roundabout\Step6\LHSRAB.dgn.
 - 2. Start Modeler (Applications>GEOPAK Site>Site Modeler>Site Modeling).

Note: PowerCivil menu, (Civil > Modeler).

3. This will open the Site Modeler tool.

8 Project Wizard	
Open Existing Project <pre></pre>	ОК
C:\data\geo\Site\Roundabout\Stepi	Cancel
O Create New Project	Browse
Don't show this dialog on Startup	

- 4. Click Browse.
- 5. Select the file C:\Data\Geo\Site\Roundabout\Step6\LHSRAB.gsf.
- 6. Click OK.





> **REMOVE THE INSIDE TRAFFIC CIRCLE ELEMENT**

1. Select the Section tool. (Modeler > Element > New/Edit > Section).

Note: The inside element of the traffic circle was created as a Site section element. To remove this element we use the **Section** tool.

lement Poir Option	Element Section		Direction	_ Apply
Offset Dist 1.500 1.600 2.000	Offset Elev -0.200 0.500 0.500	Pay Item Gutter CTF CTB		Manipulate Section
1.600	0.500	CTF		
			Remove S	ection

- 2. Select **Reference Elements**>Select **Reference Elements**. Select and accept the outside edge of the traffic circle.
- 3. Click Remove Section.
- 4. The section element will be removed and the traffic circle will be re-triangulated.



LAB EXERCISE: CREATE COMPLEX CENTER TRAFFIC ISLAND

- > **C**REATE THE COMPLEX CENTER TRAFFIC ISLAND
 - 1. Start the composite section tool (Modeler > Tools > Composite Section).
 - 2. File > Open. Select C:\Data\Geo\Site\Roundabout\Step6\RABCenterIsland.sec.
 - 3. This will populate the Composite Section dialog as shown below.

e Add to Activ						
			100			
time and Elements	/e Ubject: R,	4B1	Nev	N	1	Apply
rimary Elemen	t Definition —					
By Site Elemen	nt 🕶	ID Element				
Superelevat	tion By:					
nation Manage	abi2 the L	Details Right Si	de Detaile Ì			
scuon Manage	er I cert side	Decails Hight Sh	ue Decails [erosent.
Elem. Type 🛛 I	Feat. Type	Definition	Slope	Offset	Max. Dist	2 🖻 🖬
Parallel	Break Line	DesEofP	2.000	n/a	15.000	
Section I	Break Line	By Table	n/a	n/a	n/a	
Parallel I	Break Line	DesEofP	2.000	n/a	7.500	X 🗘 🗖
Section I	Break Line	By Table	n/a	n/a	n/a	-CD
Define						
Element Type	e Parallel	▼I Fa	ature Type: B	traak Lina	+ 1	
Clement Typ			atore rype. <u>–</u>	ICAN LINE		
Create Elemer	nt					
User Slope (%	า	▼ 2.000	- By Fe	eature	▼ ■	
	To: Primary		ayitem: DesE			
naulai	TO. Thinaly		ayitem. (Dese	UIF	_ =	

4. Rather than using a COGO chain and profile we will be using a site element for the primary element which will be the outside edge of the traffic circle.

Note: We shall look at the settings inside the Composite Section file in detail.

The inside of the traffic circle has 2 pavement areas and 2 different types of curbing.

The first row of the dialog creates the first pavement edge. The pavement is 15 feet wide at a pavement slope of 2%.

This is shown in the dialog above.



The second row creates the first of the curbing sections.

	tive Object: ∥R ent Definition — ent ▼I	AB1	<u>Ne</u>	w		Apply
Superelev						
ection Mana	iger Left Side	Details Right Sid	de Details			
Elem. Type	Feat. Type	Definition	Slope	Offset	Max. Dist	1 👝 📾 🖬
Parallel	Break Line	DesEofP	2.000	n/a	15.000	
Section	Break Line	By Table	n/a	n/a	n/a	
Parallel	Break Line	DesEofP	2.000	n/a	7.500	X 🗘 🛛
Section	Break Line	By Table	n/a	n/a	n/a	Ch (
Method	ppe: <u>Section</u> By: <u>Table</u> me:	▼ Fex Side: Le Select	ature Type: <u>I</u> it T	Break Line	<u>-</u>	
Offset Dist	Offset Elev	Pay Item	0			
	0.030	DesGutter	Π.			
1.500 2.250	0.358	DesCTF				

The "gutter" portion of this section is actually created at the same slope as the adjacent pavement (2%). Then there is a curbing.



The third row creates the second pavement surface – in the finished intersection this will be a concrete pavement.

Primary Elema By Site Elem Superelev	ration By:	ID Element	Ne	w		
ection Mana Elem. Type	iger Left Side Feat. Type	Details Right Si	de Details Slope	Offset	Max. Dist	1 – 6 –
Parallel	Break Line	DesEofP	2.000	n/a	15.000	
Section	Break Line	By Table	n/a	n/a	n/a	
Parallel	Break Line	DesEofP	2.000	n/a	7.500	× † □
Section	Break Line	By Table	n/a	n/a	n/a	-Cb
Create Elem User Slope		▼ 2.000	ature Type: <u>E</u> <u>By F</u> ayitem: DesE	eature		

This pavement is also at a 2% slope but note that the elevations for this pavement edge will be based on the adjacent element rather than the primary element.

In effect, the edge of pavement elevations will be calculated from the top back of the curb.



The forth row creates the second of the curb and gutter sections.

This section also has a positive slope on the gutter section, thus forcing all surface water towards the outside of the traffic circle.

Note: Draining water to the outside of the traffic circle is a typical design arrangement for this type of intersection. While it means that the circulating traffic have an adverse cross slope to maneuver, it does prevents ponding at the center island. If the cross slope falls towards the center island and the drainage inlets become blocked, the drainage runoff could pond (submerge) the entire intersection before it would drain away.

		AB1	Ne Ne	w		
Section Mana	ager Left Side	Details Right Si	de Details 📔			
Elem. Type	Feat. Type	Definition	Slope	Offset	Max. Dist	🔁 🖻 🗖
Parallel	Break Line	DesEofP	2.000	n/a	15.000	
Section	Break Line	By Table	n/a	n/a	n/a	
Parallel	Break Line	DesEofP	2.000	n/a	7.500	🗙 🕸 🗖
Section	Break Line	By Table	n/a	n/a	n/a	LC L
Define Element T	ype: <u>Section</u> By: <u>Table</u>	Fe.	ature Type: <u>E</u> .ft v	Break Line	-	
Define Element T Method Section	By: Table	▼		Break Line	_	
Define Element T Method Section Section Na) By: <u>Table</u> ame:	▼ Side: Le		Break Line	-	

- 5. Select **Primary Element > ID Element**. Select and accept the outside edge of the traffic circle.
- 6. Click Apply.



Step 7

Objectives

• Create the median islands for the incoming roadways.

Introduction

The only portion of the project that has not been modeled is the traffic medians/islands. These will now be created.

Tools to be Used

- Site Modeler>Elements>New/Edit>Drape on Model/Object
- Site Modeler>Elements> Section



LAB EXERCISE: CREATE A NEW MEDIAN OBJECT

To ensure that all students have the same data, we will begin this exercise with a new dataset.

- > SWAP TO NEW DGN AND GSF
 - 1. Open the file C:\Data\Geo\Site\Roundabout\Step7\LHSRAB.dgn.
 - Open Modeler (Applications > GEOPAK Site > Site Modeler > Site Modeling). This opens the site modeler.

8 Project Wizard	
Open Existing Project <pre></pre>	ОК
C:\data\geo\Site\Roundabout\Step	Cancel
O Create New Project	Browse
Don't show this dialog on Startup	

- 3. Click Browse.
- 4. Select the file C:\Data\Geo\Site\Roundabout\Step7\LHSRAB.gsf.
- 5. Click OK.



> CREATE A MEDIAN OBJECT

- 1. Our preferences do not contain a type for medians, so we will create one.
- 2. Open the project preferences (Modeler > Project Preferences).
- 3. Choose the Objects section as shown below.

Options	Object Type	Naming Prefix		
Tolerances	Pond	Pond	1 2	
Project Components	Roadway	Roadway		
/isualization	Lot	Lot		
Dijects	Openspace	Open	→ ×	
Jpdating	Roadway	Roadway		
Save	Cobject Details -	Thodomay		
		· · · · · · · · · · · · · · · · · · ·	a construction of the second	
OK Cancel	 Visualization Triangles: Boundary: 	i O Slope Indi	icators O Default Slope	s 2.34
OK Cancel	🔲 Triangles:	n O Slope Indi		
OK Cancel	Triangles:	O Slope Indi	🗖 Vertices:	
OK Cancel	Triangles:		Minor Contour	2.34
OK Cancel	Triangles: Boundary: Major Contour – Place:		Minor Contour Place: Elev. Interval: 0.1	2.34

4. Since the Roadway type has most of the settings we want, we can use it to start, so highlight Roadway.

Options	Object Type	Naming Prefix		
Tolerances	Pond	Pond		Add list
Project Components	Roadway	Roadway		item
Visualization	Lot	Lot		
Objects	Openspace	Open	<u> </u>	
Updating	Median	Median		
Save	Contractor and the second s	Threeten		
OK L Canad L	Object Details -	o O Slope In	udicators O Defai	ut Slopes
OK Cancel	Visualization	n O Slope In	ndicators O Defau	ult Slopes
OK Cancel	 Visualization Triangles: 			
OK Cancel	 Visualization Triangles: Boundary: 		Vertices:	ult Slopes
OK Cancel	 Visualization Triangles: 			
OK Cancel	 Visualization Triangles: Boundary: 		Vertices:	
OK Cancel	 Visualization Triangles: Boundary: Major Contour Ø Place: 		Minor Contour –	12.34
OK Cancel	 Visualization Triangles: Boundary: Major Contour Ø Place: 	val: 1.000	Vertices:	al: 0.100
OK Cancel	 Visualization Triangles: Boundary: Major Contour Ø Place: 		Minor Contour –	12.34

- 5. Overtype the Object type and Name prefix as shown above and press the add list item button. This will create a new object type named median with all the same settings as roadway objects.
- 6. Click Default Slopes and set the default slopes for the Median Object type to "No Slopes".
- 7. Click **Modify List Item** to modify the slopes.
- 8. Press **OK** on the preferences and save the project.
- 9. Now, create a new site object. Modeler > Object > New.
- 10. Select the Object Type "Median".



Object Type	Median 🔽	OK
Object Name	Median1	Cancel

- 11. The default Object Name is Median1. Leave this as it is.
- 12. Click OK.

> DRAPE OUTSIDE OF MEDIAN ONTO THE RAB OBJECT

- Open the new site element tool (Modeler > Element > New/Edit > Drape on Model/Object).
- 2. Set the dialog as shown below.

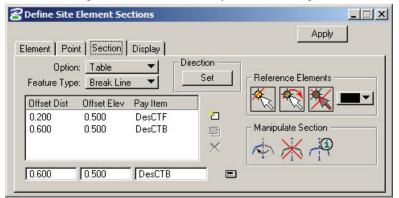
\mathcal{B} New / Edit Site Elements -> Drape on Model /	Object
Add to Active Object: Median1	New Apply
Element Point Section Display	
Feature Type: Boundary	Define Elements
Drape on Object 🔻 RAB1 💌	Redefine Site Element
Dffset Height: 0.000	
Drape Option: _Entire Element 🛛 💌	
Use Reference Element Association	

- 3. Click **Define Elements>Select Elements**. Select the purple graphic that represents the outside edge of one of the Medians.
- 4. Click Apply.

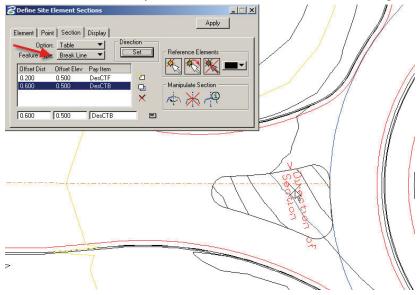


> ADD A SECTION TO THE MEDIAN OBJECT

- 1. Change the new/edit element to the section tab.
- 2. Set the dialog as shown below. Modify the rows as required.



- 3. Click **Reference Elements > Select Reference Elements**. Select and accept the edge of median element that was created in the previous step.
- 4. Click Set. Point the dynamic direction arrow inside the median shape and data point.



5. Click Apply.

This completes creation of the first of the four (4) medians.

6. Create the other 3 medians using the same process.

This completes our intersection.





INDEX

Active Chain Control
Accessing
Introduction
Adjust Factors Tab (Superelevation Preferences) . 4-13
Alignment Tools (Horizontal Alignments)1-13
Change Element (Coordinate Geometry) 2-4
COGO Tab (Draw Profile) 3-17
Complex Transitions Tools (Horizontal Alignments) 1- 13
Component Based Profiles
Accessing
Introduction
Compound Curves Tab (Superelevation Preferences)4- 15
Coordinate Geometry
Accessing COGO
Introduction
Coordinate Geometry Preferences
Cross Sections
Accessing
Introduction
Overview
Curve Combinations Tools (Horizontal Alignments) 1- 12
Curvilinear Coordinates (Active Chain Control)9-3
Database Utilities (Coordinate Geometry) 2-5
Digital Terrain Modeling
Creating DTM Report7-1
Introduction7-1
Distribution Tab (Superelevation Preferences) 4-13
Draw Profiles

Accessing	. 3-13
Introduction	. 3-13
DTM Editing	7-3
Add Vertex	7-4
Delete Line	7-6
Delete Line Triangle	7-9
Delete Triangle	7-8
Delete Vertex	7-4
Insert Drape Line	7-8
Move Vertex XY	7-5
Move Vertex Z	7-5
Polygon Move Z	7-6
Swap Line	7-7
E Tab (Superelevation Preferences)	. 4-10
Earthwork Dialog	6-2
Add/Sub Volumes	6-6
Centroid Adjustment	6-6
EW Shapes	6-5
Ignore Areas	6-7
Output Format	6-5
Sheet Quantities	6-9
Skip Areas	6-7
Soil Types	6-3
XS DGN File	6-2
Earthworks	
Accessing	6-1
Introduction	6-1
Processing	6-9
Processing Split Summary Totals	
•	6-8



Export Preferences and Settings (Coordinate
Geometry)2-9
Graphical COGO (Coordinate Geometry) 2-14
Horizontal Alignment Generator
Accessing
Introduction
Horizontal Alignments
Accessing Graphical Coordinate Geometry 1-1
Graphical Coordinate Geometry Introduction 1-1
Groups Commands 1-5
Manipulate Elements 1-4
Modify Elements 1-3
Store Elements
Lab Exercises
Active Chain Control9-4
Add Curb and Gutter Section to Curb Returns 10-48
Add the Control Alignment 10-29
Analyze the Traffic Circle 10-13
Ancillary Data
Chain Manipulation
COGO & Horizontal Alignment Generator 1-14
Component Based Profiles 3-11
Create a Construction Object
Create a New Median Object 10-57
Create Complex Center Traffic Island 10-52
Create Model Surface Profiles 10-19
Create Roadway Surface from Control Alignment
Create the Roundabout Object
Creating Design Profiles
Cross Section Reports
Define the Remaining Edge of Pavement Elements 10-42
Earthwork
Entering Parcel Data
Graphical COGO1-6, 2-19
Labeling

Modify the Traffic Circle	10-16
Profiles	3-7, 3-19
Remove the Current Inside Edge of Traffic	
Superelevation Shape Manager Tools	4-17
TIN Editing	7-12
Labelers	
Accessing the Cross Section View Labeler	
Accessing The Plan View Labeler	
Accessing the Profile View Labeler	8-8
Cross Section Labeling	
Introduction	
Plan View Labeling	
Profile Labeling	
Leader (Plan View Labeler)	
Lines / Curves Tools (Horizontal Alignments)	1-11
Manipulate Tools (Horizontal Alignments)	1-13
Merge Database (Coordinate Geometry)	2-7
Navigator (Coordinate Geometry)	2-7
Next Available Element (Coordinate Geometr	y)2-3
Parameters (Plan View Labeler)	
Parcels (Coordinate Geometry)	2-10
Point Label Redraw (Coordinate Geometry)	2-2
Projection Tab (Draw Profile)	3-18
Rename Elements (Coordinate Geometry)	2-4
Reverse Curves Tab (Superelevation Preference	ces) 4-14
Rotate (Plan View Labeler)	
Rotation Tab (Superelevation Preferences)	4-14
Runoff Tab (Superelevation Preferences)	4-11
Shape (Plan View Labeler)	
Shape Analyst (Superelevation)	
Shape Profiler (Superelevation)	
Short Curves Tab (Superelevation Preferences	s)4-16
Site Design	
Design Strategy	10-4
Introduction	10-1
Project Overview	10-2



Spiral Combinations Tools (Horizontal Alignments) 1- 12
Styles (Plan View Labeler)
Superelevation
Accessing Automated Superelevation (AutoShape Input File Maker)
Draw Shapes into Plan View File 4-6
Introduction 4-1
Superelevation Preferences
Superelevation Shape Manager Tools
Superelevation Transition Conflict Resolution 4-16
Surfaces Tab (Draw Profile)
Tangent Runout Tab (Superelevation Preferences)4-12
Text (Plan View Labeler)
Tolerance (Cross Sections)
Update Options (Cross Sections)5-4
User Defined Attributes (Coordinate Geometry) 2-11
Vertical Alignments
Accessing
Best Fit Line
Best Fit Parabola
Best Fit Profile
Creating A New Profile
Introduction
Precision Placement Options
Using the Vertical Alignment Generator



