

NC Department of Transportation



Engineering Applications Development

Gore Area Calculation Program (GACP) And NCDOT Profiler User Guide

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Chapter 1 The Gore Area Calculation Program (GACP)

Overview

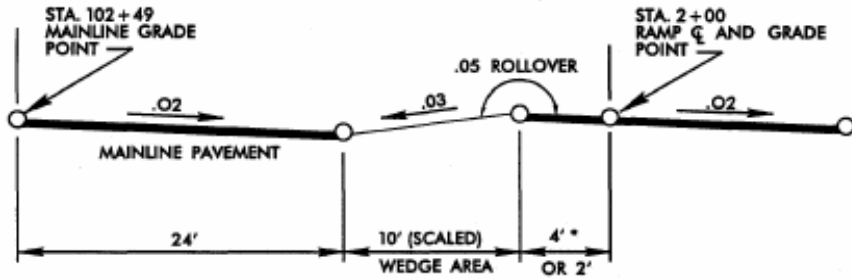
The Gore Area Calculation Program (GACP) is mainly used to calculate profile control points through the gore areas of a typical interchange layout. With the maximum rollover rate of 5% for gore areas, the GACP uses Geopak shapes to calculate the minimum, maximum, and desirable control points for ramps and loops. At the functional and preliminary phases of design, since the proposed grade for ramps and loops has not been established, and Geopak shapes are required by GACP, then a “dummy” profile can be used to create the Geopak shapes for ramps and loops. Once the GACP has been processed, a CSV file is created outlining the control points for the gore area. The policy set forth in the Roadway Design Manual, Part I, Chapter 8, Section 5, Procedure for Establishing Ramp Grades with Control Points, has been used as a guide for the GACP.

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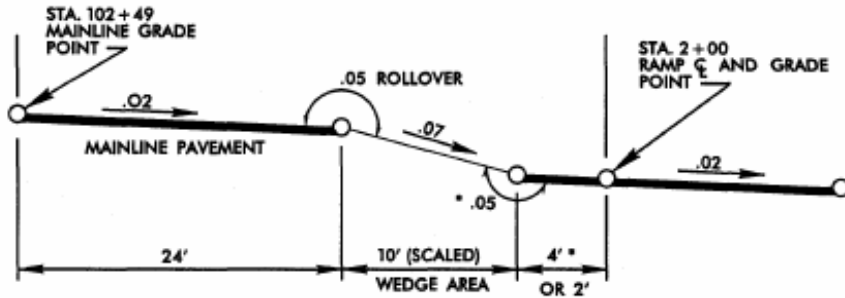
Overview

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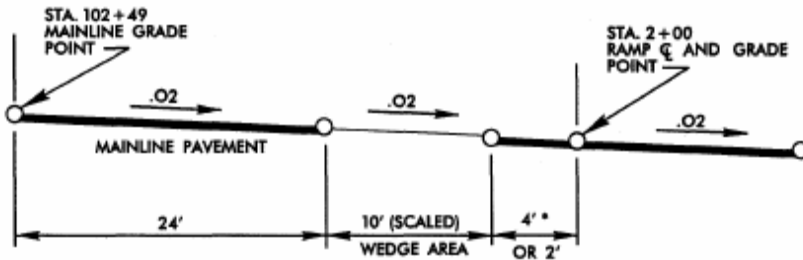
Maximum Gore Controls



Minimum Gore Controls



Desirable Gore Controls

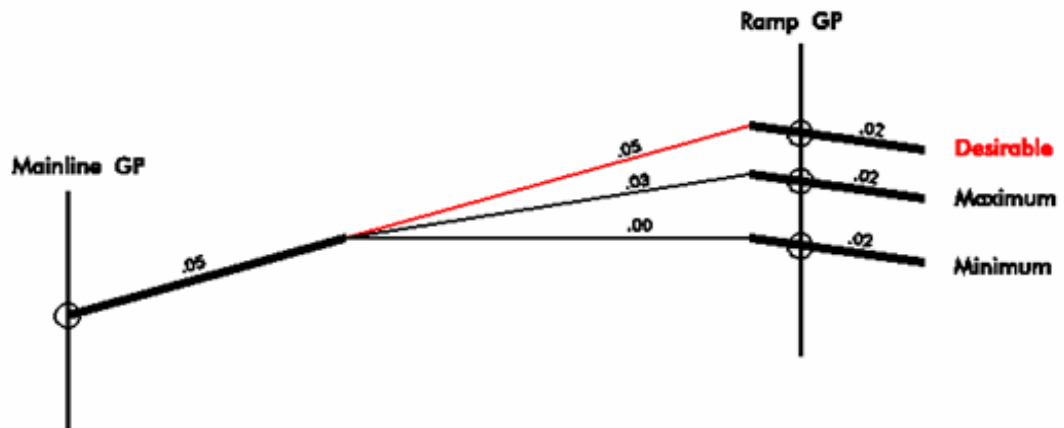


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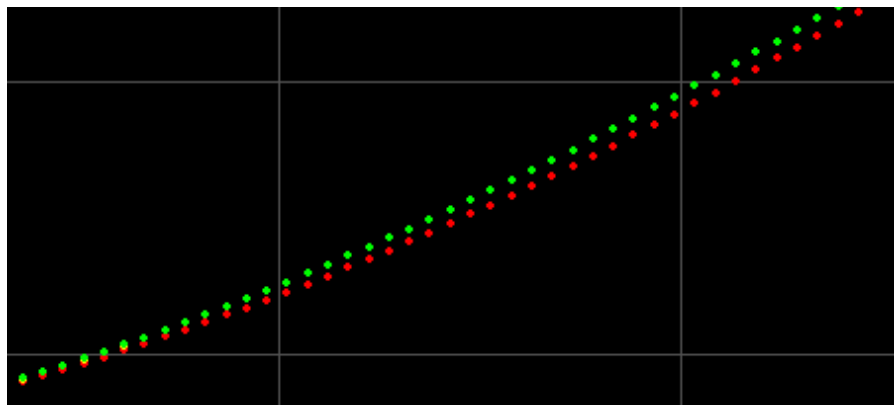
Overview

(Continued)

NOTE: The product presented by the program is a reflection of the standards, to which the calculation process strictly adheres. "Desirable" refers to the slope value, not the resulting control elevation, and the desirable slope (according to the Design Manual) always matches the mainline slope. If the program over-rides that and represents the max or min as desirable, then it would not be presenting factual data to the Engineer.



In cases where the elevation of the desirable control is higher than the maximum or lower than the minimum, the cross-sections will be laid out accordingly, as portrayed in the above picture. However, the desired controls (yellow) will not be shown on the NCDOT Profiler grid. The desired controls will be plotted out in normal condition when it is between the maximum and minimum controls.



Requirements

You will need the following in order to get started using the Gore Area Calculation Program (GACP).

1. **GPK**
 2. **Geopak Shapes (SHP DGN file)**
 3. **Design File (Used as referenced file for gore area limits.)**
-

Procedures

To calculate a Gore Area:

Step	Action	Result
1	Click the button to the right of the JOB field to bring up a list of applicable GPK files. 📁 NOTE: The default is RDY.	The Job Number dialog box will appear.

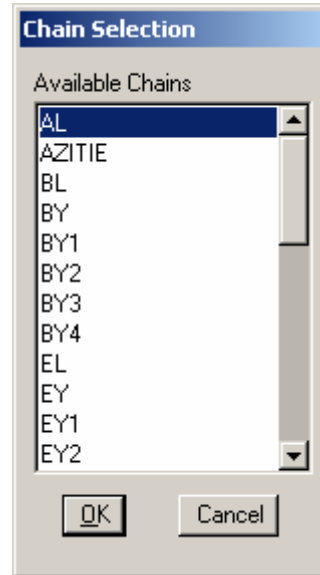


2	Select the applicable GPK file from the list and click the OK button. 📁 NOTE: You can also type the job number in the JOB field.	The selected job number will appear in the JOB field.
3	Click the button to the right of the RAMP/LOOP CHAIN field to bring up a list of available chains.	The Chain Selection dialog box will appear.

Continued on Following Page

Procedures

(Continued)



Begin Profile Section

4	Select the applicable chain type from the list and click the OK button. ☞ NOTE: You can also type the Ramp or Loop Chain Name in the RAMP/LOOP CHAIN field.	The selected chain will appear in the RAMP/LOOP CHAIN field.
5	In order to complete the information in the Begin Profile section, click the check box beside BEGIN PROFILE .	N/A

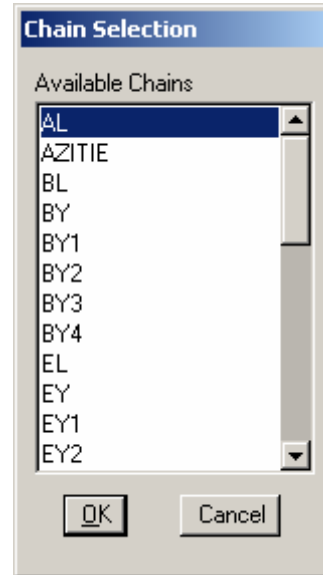
☞ **NOTE:** This is required information pertaining to the evaluation of the gore area at the beginning of the ramp or loop alignment.


6	If the profile is tied to a chain, click the TIE TO check box.	N/A
7	Click the button to the right of the CHAIN field to bring up a list of available chains.	The Chain Selection dialog box will appear.

Continued on Following Page

Procedures


(Continued)



8	<p>Select the Mainline Chain Name from the list and click the OK button.</p> <p> NOTE: This is usually the chain to which the beginning ramp or loop alignment is tied.</p>	<p>The selected chain will appear in the CHAIN field.</p>
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If you clicked the check box beside **TIE TO** in step 6, the **COMPUTE GORE CONTROLS** check box will also be checked and the **DP GORE NOSE** button will be enabled.

If you did not click the check box beside **TIE TO** in step 6, the **COMPUTE GORE CONTROLS** check box will not be checked and the **DP GORE NOSE** button will be disabled.


 **NOTE:** The **COMPUTE GORE CONTROLS** check box computes the minimum, maximum, and desired control points. If unchecked, the software will attempt to compute control points at the edge of shape and center of alignment of the tie chain.

Continued on Following Page


Procedures

(Continued)

9	Click the DP GORE NOSE button.	The text in the status bar will read: “Identify Begin Profile Gore Area Nose.”
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 **NOTE:** The **DP GORE NOSE BUTTON** requires a data point where the nose of the paved gore area is located. Usually, this is the located in the paved area of the gore where there are shoulder breaks. Paved areas beyond the gore nose can be chosen for analysis. However, be aware that the shoulder rollovers are not considered by the GACP, just the gore area rollovers.

10	Click the data point where the nose of the paved gore area is located.	The text in the status bar will read: “Gore Area Nose Accepted.”
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 **NOTE:** If you did not click the check box beside **TIE TO** in step 6, a station and elevation are required for the beginning of the profile controls.

11	Type the station in the BEGIN STATION field.	N/A
12	Type the elevation in the BEGIN ELEVATION field.	N/A

At this point, the **GORE INCREMENT** field will default to a value determined by the gore area measurement.

 **NOTE:** The **Gore Increment** is the distance along the mainline or -Y- line, starting from the corresponding first or last station of a ramp or loop alignment. This value determines the spacing between cross sections being analyzed, as well as the corresponding control points at that cross section. Default is 5 feet. Minimum is 1 foot.

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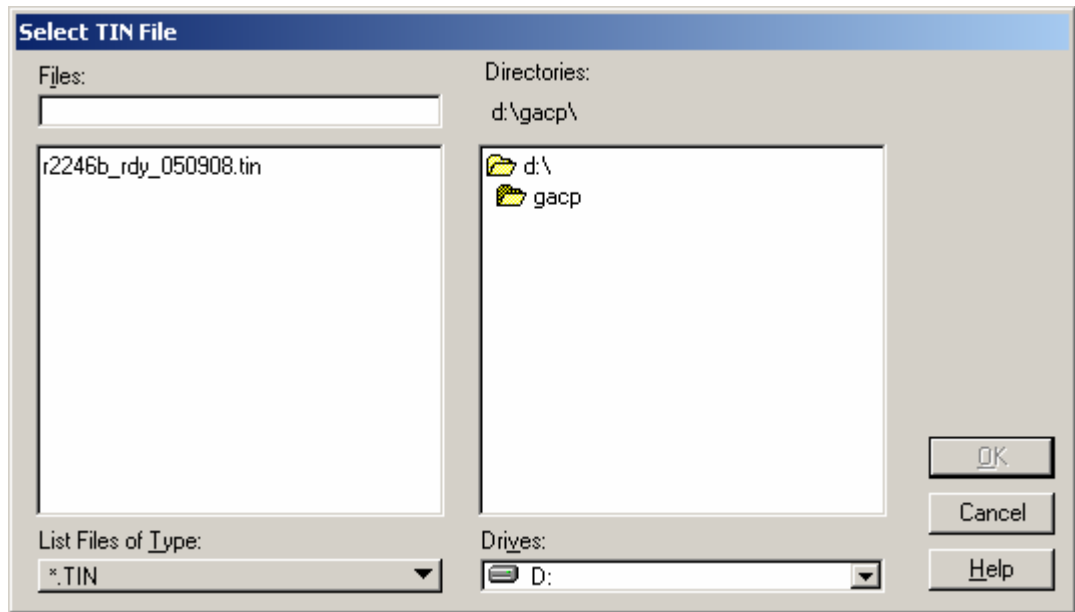
Procedures

(Continued)

Ground Profile Section

This optional feature is used to produce existing ground points along the ramp or loop chain when brought to the NCDOT Profiler.

13	Click the button to the right of the TIN FILE field to bring up a list of TIN files.	The Select TIN file dialog box will appear.
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14	Select the applicable TIN file for the ramp or loop existing ground profile and click the OK button.	The selected TIN file will appear in the TIN FILE field.
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NOTE: If you have selected a TIN file, the **STATION INCREMENT** field will default.

The **Station Increment** is the distance increment along the ramp or loop chain to extract the existing ground profile

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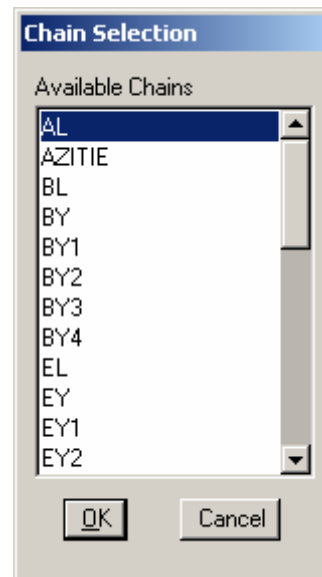
Procedures

(Continued)

End Profile Section

This is an optional feature. Information pertaining to the evaluation of the gore area at the end of the ramp or loop alignment. For loop alignments, the gore area between the -Y- line and the loop alignment. For ramp alignments, the chain (-Y- line) to which the ramp alignment ties to. The superelevation of the -Y- line is factored in as the ramp ending profile grade.

15	If the profile is tied to a chain, click the TIE TO check box.	N/A
16	Click the button to the right of the CHAIN field to bring up a list of available chains.	The Chain Selection dialog box will appear.



17	Select the -Y- line Chain Name from the list and click the OK button. NOTE: This is usually the chain to which the end of the ramp or loop alignment is tied.	The selected chain will appear in the CHAIN field.
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Procedures


(Continued)

If you clicked the check box beside **TIE TO** in step 15, the **COMPUTE GORE CONTROLS** check box will also be checked and the **DP GORE NOSE** button will be enabled.

If you did not click the check box beside **TIE TO** in step 15, the **COMPUTE GORE CONTROLS** check box will not be checked and the **DP GORE NOSE** button will be disabled.

 **NOTE:** The **COMPUTE GORE CONTROLS** check box computes the minimum, maximum, and desired control points.

<p>18</p>	<p>Click the DP GORE NOSE button.</p> <p> NOTE: The DP GORE NOSE BUTTON requires a data point where the nose of the paved gore area is located.</p>	<p>The text in the status bar will read: “Identify End Profile Gore Area Nose.”</p>
<p>19</p>	<p>Click the data point where the nose of the paved gore area is located.</p>	<p>The text in the status bar will read: “Gore Area Nose Accepted.”</p>

 **NOTE:** If you did not click the check box beside **TIE TO** in step 15, a station and elevation are required to for the end of the profile controls.

<p>20</p>	<p>Type the station in the END STATION field.</p>	<p>N/A</p>
<p>21</p>	<p>Type the elevation in the END ELEVATION field.</p>	<p>N/A</p>

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Procedures

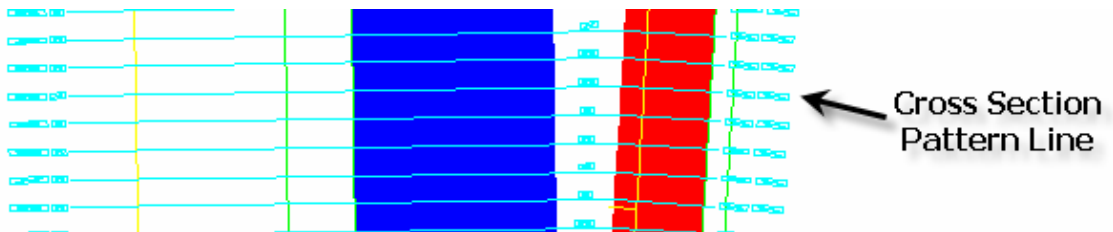
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Performing the Gore Area Calculation

22	Click the COMPUTE button.	Using the data provided, the application will perform the Gore Area Calculation .
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The results of the calculations are dynamically displayed as cross-section pattern-lines.

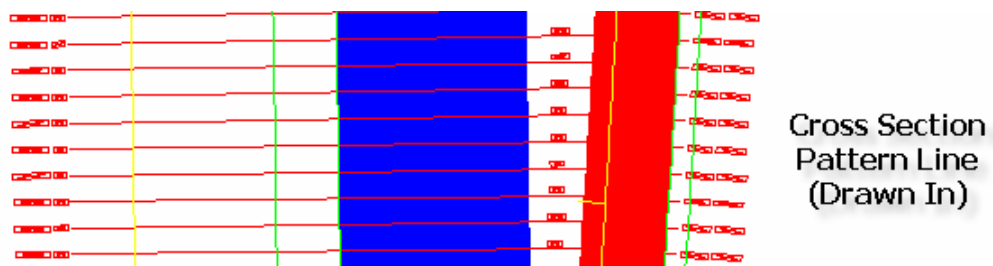
DYNAMIC GORE LAYOUT DISPLAY (The cross section pattern line information is displayed only if this box is checked. When Dynamic Gore Layout Display is checked on, sometimes this will slow down the PC. The number of cross section pattern lines and CPU speed will determine if this needs to be off or just drawn into the file by using the Draw Gore Layout button. The cross section pattern lines are only displayed after the entire gore area has been computed, via the Compute button.)



Drawing the Gore Layout

After computations are complete, this option draws the gore area layout and cross section pattern line information in the active DGN file. Turn on Dynamic Gore Layout Display to view the pattern lines.

23	Click the DRAW GORE LAYOUT button.	The application will draw the Gore Layout .
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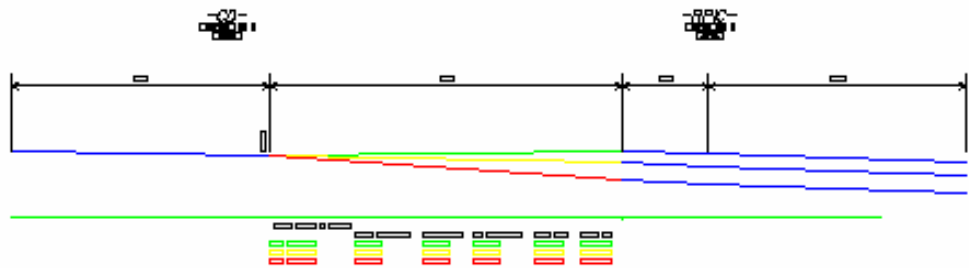
Procedures

(Continued)

Drawing the Gore Cross Section

This button draws the gore area analysis as cross sections in the active DGN file. The cross section templates run from south to north and can be navigated by the Geopak Cross Section Navigator or the Roadway Design Cross Section Movie Player. In a cross section view, the minimum, maximum, and desired control points can be displayed.

24	Click the DRAW GORE XS button.	Using the data provided, the application will draw the Gore Cross Section.
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CSV

The analysis is written to a CSV file. The CSV file is created in the active working directory.

25	Click the CSV button.	The CSV file will be created.
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Sample CSV Output

15+71.34	0	-0.02	12	331.25	0	1.028	0.03	-0.07	0	331.263	-4	-0.02	5+69.89	331.201	331.149	331.098
15+76.34	0	-0.02	12	331.302	0	1.388	0.03	-0.07	0	331.31	-4	-0.02	5+74.91	331.264	331.195	331.125
15+81.34	0	-0.02	12	331.355	0	1.747	0.03	-0.07	0	331.358	-4	-0.02	5+79.92	331.327	331.24	331.153
15+86.34	0	-0.02	12	331.408	0	2.107	0.03	-0.07	0	331.405	-4	-0.02	5+84.93	331.391	331.285	331.18
15+91.34	0	-0.02	12	331.46	0	2.467	0.03	-0.07	0	331.453	-4	-0.02	5+89.94	331.454	331.331	331.207
15+96.34	0	-0.02	12	331.513	0	2.827	0.03	-0.07	0	331.5	-4	-0.02	5+94.96	331.517	331.376	331.235

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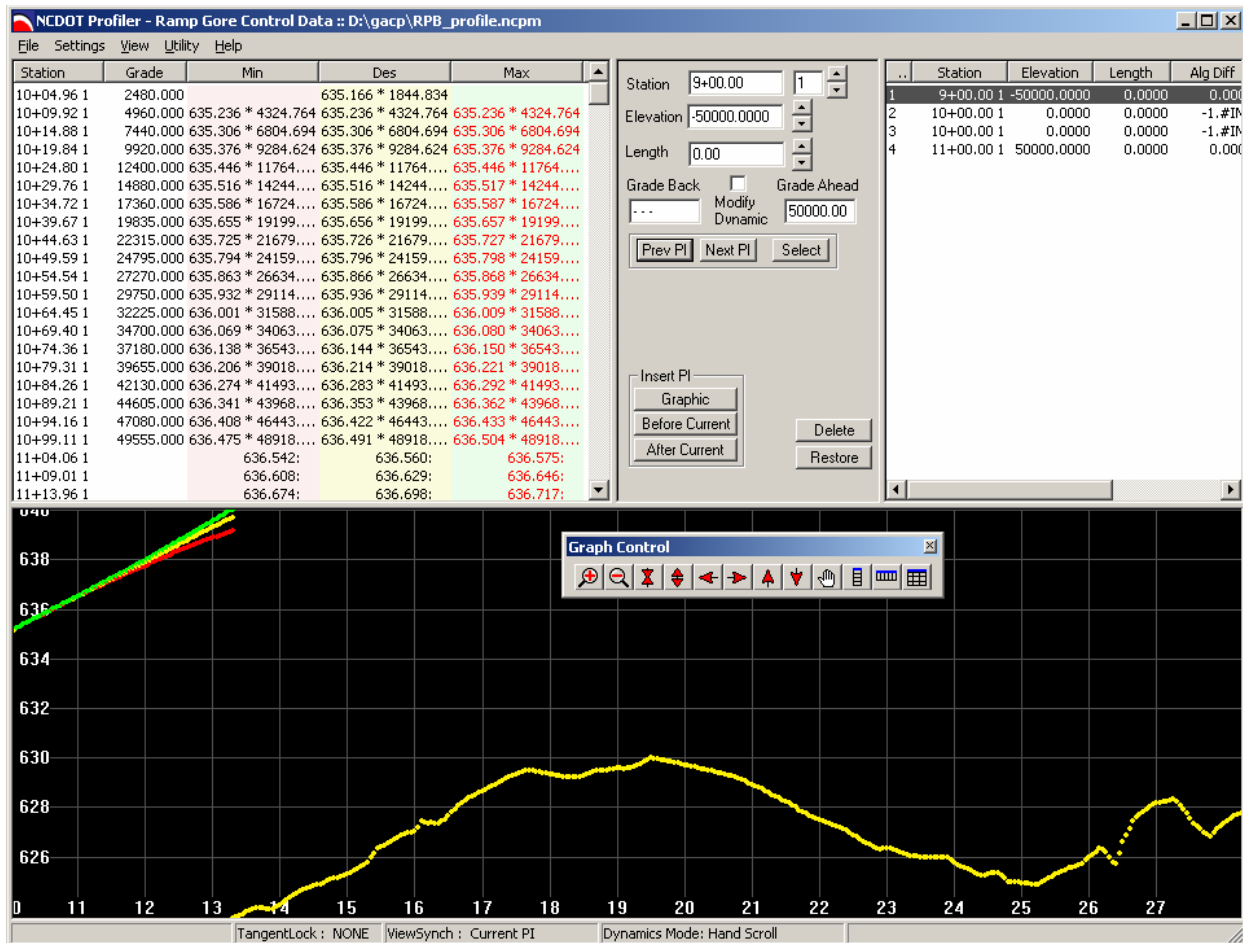
Procedures

(Continued)

Profile

Once the gore area calculation has been computed, the **NCDOT_Profiler** application can be used to design the proposed grade for ramps and loops. Clicking the **PROFILE** button will create an .NCPM file. This will automatically start the **NCDOT Profiler**

26	Click the PROFILE button.	The NCDOT Profiler window will appear.
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Chapter 2 NCDOT Profiler

(For the Gore Area Calculation Program Application)

Overview

The NCDOT Profiler Program was created to help Roadway Engineers design proposed grades. Since it is a Windows-based application, the NCDOT Profiler can be used outside of Microstation. In addition, other programs, such as the GACP, NCWedge (v8), and Geopak COGO, can be used in conjunction with the Profiler to set proposed grades.

This documentation describes how the Profiler is used in conjunction with the GACP. The maximum, minimum, and desired control points for gore areas are to be used as a guide in proposing a ramp or loop grade.

A back grade of 100 ft before the beginning of the ramp or gore alignment is automatically computed by the GACP. This to be used at the discretion of the Engineer to assure a smooth transition from the Mainline to the ramp or gore initial grade.

File Location

The **NCDOT_Profiler.exe** file should be located in the standard application folder in the NCDOT Workspace.

The standard file extension for NCDOT Profiler is *.ncpm)

Parts of the Window

Drop-Down Menus

The screenshot shows the NCDOT Profiler software interface. At the top, a menu bar includes 'File', 'Settings', 'View', 'Utility', and 'Help'. Below the menu bar is a table with columns for Station, Grade, Min, Des, and Max. A red box labeled 'Station Controls Window' highlights a portion of this table. To the right of the table is a control panel with fields for Station (9+00.00), Elevation (-50000.0000), and Length (0.00). It also includes checkboxes for 'Grade Back' and 'Grade Ahead', a 'Modify Dynamic' field set to 50000.00, and buttons for 'Prev PI', 'Next PI', 'Select', 'Graphic', 'Before Current', 'After Current', 'Delete', and 'Restore'. A red box labeled 'Design Grade Center' highlights the 'Modify Dynamic' field. To the right of the control panel is a table with columns for Station, Elevation, Length, and Alg Diff. A red box labeled 'Proposed Grade Window' highlights this table. Below the control panel is a 'Graph Control' toolbar with various icons for zooming and navigation. A red box labeled 'Graph Control Toolbar (Float and Dockable)' points to this toolbar. The main area of the window is a 'Profile Graph Window' showing a yellow line graph of the profile. A red box labeled 'Profile Graph Window' highlights the graph area. At the bottom of the window, there is a status bar with text: 'TangentLock : NONE | ViewSynch : Current PI | Dynamics Mode: Hand Scroll'.

Station Controls Window

Design Grade Center

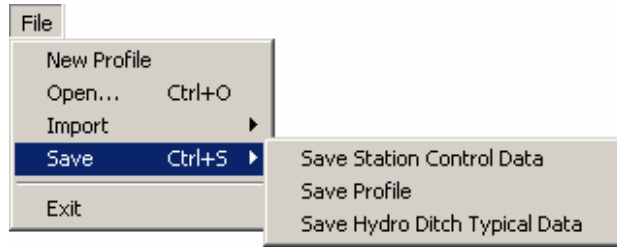
Proposed Grade Window

Graph Control Toolbar (Float and Dockable)

Profile Graph Window

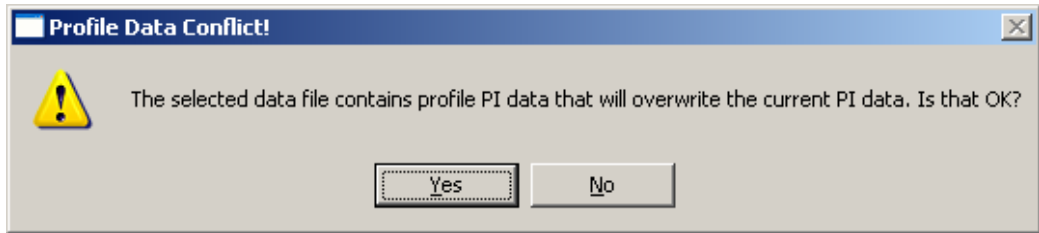
Drop-Down Menus

File Menu



New Profile Creates a new profile.

NOTE: If a profile exists, the following message will appear.



Open Select **Open** from the **FILE** drop-down menu. Then select the *.ncpm file you wish to open.

Import **NOTE:** The following option is the only one in the import menu related and applicable to **GACP**.

Import GPK Profile Imports a proposed profile from an existing *.inp input file.

NOTE: The following options are unrelated and not applicable to **GACP**.

Import RGC Imports Resurfacing Grade Control data from .par files created by the old version of NCWedge.

Import RPG Imports Resurfacing Profile Grade files (.grd) created by the old version of NCWedge.

Median Data **GPK XS Report**
GPK Ground Profile

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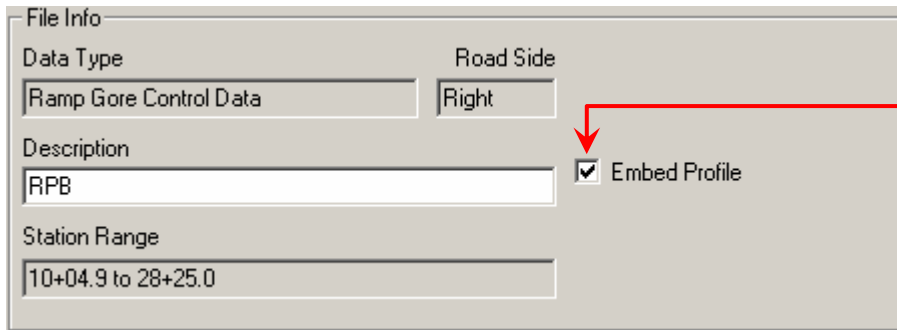
Drop-Down Menus

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File Menu (continued)

Save There are 3 options in the **File-Save** drop-down menu:

Save Station Control Data If stations have been deleted from the GACP data, within the NCDOT Profiler, use this menu option to rewrite the NCPM file.



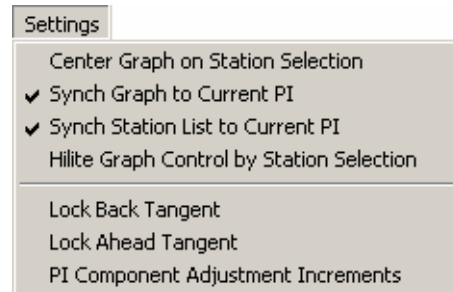
The **Save Station Control Data** dialog contains an **Embed Profile** checkbox, which will embed the profile data in the NCPM file.

Save Profile Save the current proposed profile, either as a COGO input file. (.inp) or a Profiler NCPM file.

Save Hydro Ditch Typical Data Unrelated and not applicable to GACP

Exit Select **Exit** from the **FILE** drop-down menu to close the application

Settings Menu



Center Graph on Station Selection When checked, this setting will cause the **Profile Graph** window to always center at the station of the selection in the **Station Control** window.

Continued on Following Page

Drop-Down Menus

(Continued)

Settings Menu (continued)

Synch Graph to Current PI

When checked, this setting will cause the **Profile Graph** window to center on the station of the currently selected profile PI. The re-centering occurs when the current PI is changed; either by double-clicking on a row in the **Proposed Grade** window or using the **PREV PI** or **NEXT PI** buttons.

Sync Station List to Current PI

When checked, this setting will cause the **Station Controls** window to center at the station of the currently selected profile PI.

Highlight Graph Controls by Station Selection

Selecting a row in the **Station Controls** window will enlarge the control point(s) at the selected station on the **Profile Graph** window.

Lock Back Tangent / Lock Ahead Tangent

When checked, this setting will force all calculations for PI stations and elevations to use current tangent values.

Examples:

- If a PI is inserted graphically, the PI elevation will be computed using the back/ahead tangent values and the station of the mouse click.
- If a PI is dynamically modified, the PI will *slide* along the existing *back/ahead* tangent slope.

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Drop-Down Menus

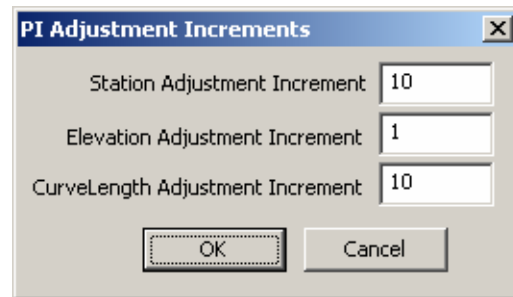
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Settings Menu (continued)

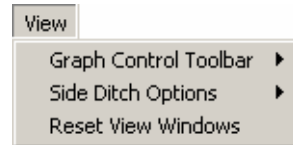
PI Component Adjustment Increments

These controls only affect the up and down buttons in the **Design Grade Center**.

The **PI STATION**, **PI ELEVATION**, and **CURVELENGTH** values increment or decrease each time the up or down button is pressed.



View Menu



Graph Control Toolbar

Open Activate or deactivate the **Graph Control Toolbar**.

Dock Dock the toolbar onto the **NCDOT Profiler** window, or float the toolbar anywhere on the screen.

Side Ditch Options

XS View Unrelated and not applicable to GACP

Reset View Windows

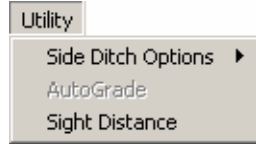
This resets the **Station Controls** window, **Design Grade Center**, and **Proposed Grade** window to the default size and location.

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Drop-Down Menus

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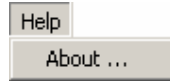
Utility Menu



Side Ditch Options	Typical Sections Unrelated and not applicable to GACP
Auto Grade	Unrelated and not applicable to GACP

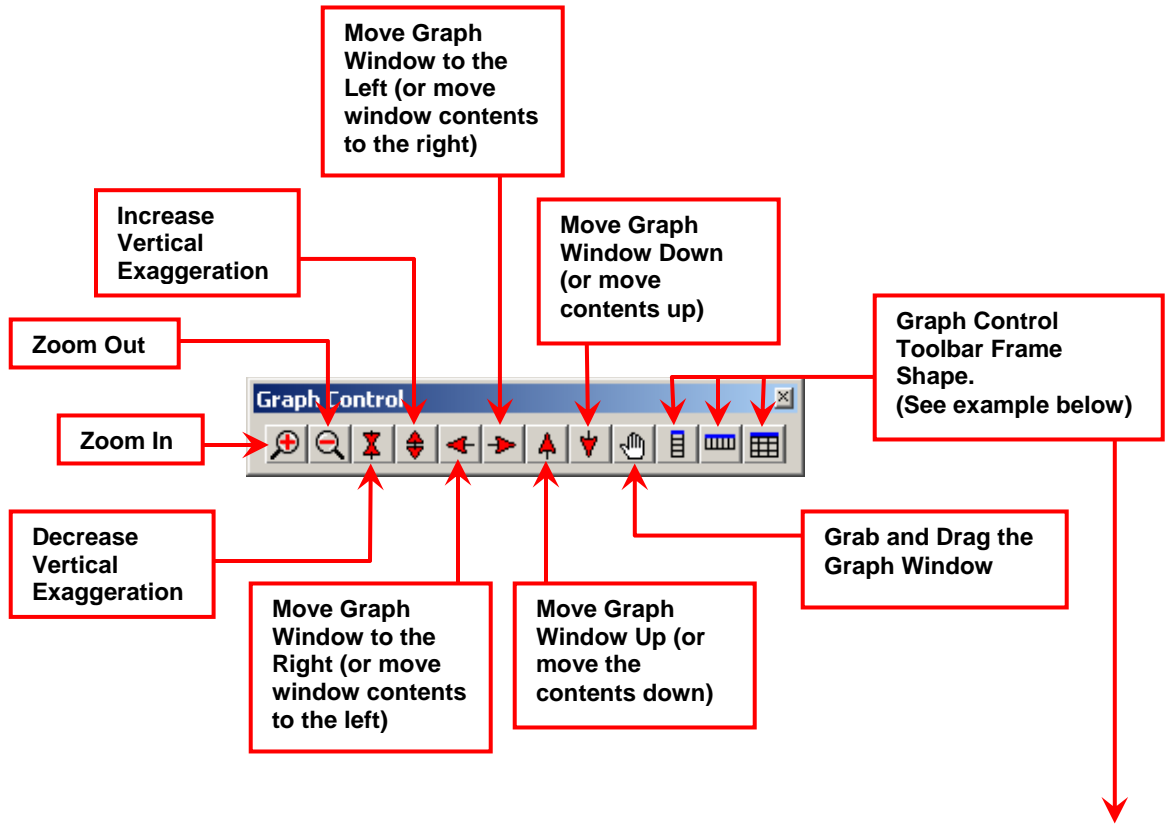
Sight Distance If a proposed grade is displayed with vertical curves, then the vertical stopping sight distance information is displayed as the cursor moves around the **NCDOT Profiler Graph** area.


Help Menu

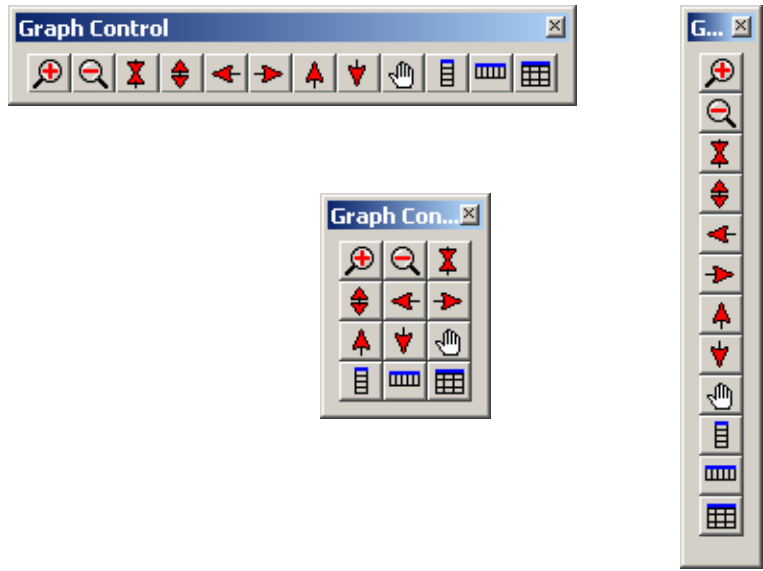


About Displays the current **NCDOT Profiler** version number.

Graph Control Toolbar



You can click the **GRAPH CONTROL TOOLBAR FRAME SHAPE** button  to customize its appearance any way you'd like.



Station Controls Window

Station	Grade	Min	Des	Max
10+04.96 1			635.166:	
10+09.92 1		635.236:	635.236:	635.236:
10+14.88 1		635.306:	635.306:	635.306:
10+19.84 1		635.376:	635.376:	635.376:
10+24.80 1		635.446:	635.446:	635.446:
10+29.76 1		635.516:	635.516:	635.517:
10+34.72 1		635.586:	635.586:	635.587:
10+39.67 1		635.655:	635.656:	635.657:
10+44.63 1		635.725:	635.726:	635.727:
10+49.59 1		635.794:	635.796:	635.798:
10+54.54 1		635.863:	635.866:	635.868:
10+59.50 1		635.932:	635.936:	635.939:
10+64.45 1		636.001:	636.005:	636.009:
10+69.40 1		636.069:	636.075:	636.080:
10+74.36 1		636.138:	636.144:	636.150:
10+79.31 1		636.206:	636.214:	636.221:

Station Column

Control Point Station and Region Number

Grade Column

Proposed Grade Elevation

Min Column (Red)

Minimum Control Point Elevation *

Difference between Proposed Grade Elevation and Minimum Control Point Elevation. Column text turns **red** if proposed grade is below the minimum control point elevation.

Des Column (Yellow)

Desired Control Point Elevation * Difference between Proposed Grade Elevation and Desired Control Point Elevation. Column text turns **red** if proposed grade is below the desired control point elevation.

Max Column (Green)

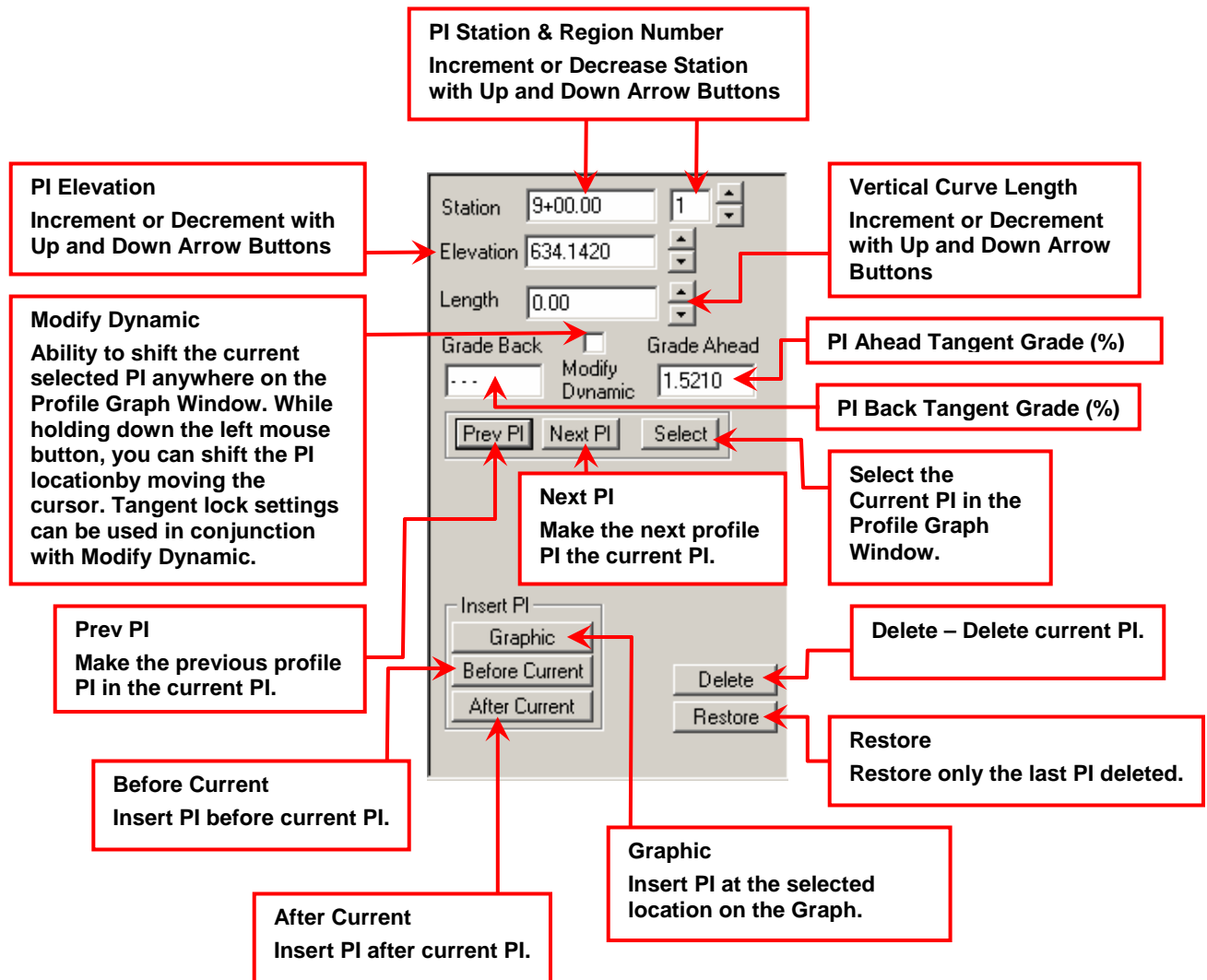
Maximum Control Point Elevation * Difference between Proposed Grade Elevation and Maximum Control Point Elevation. Column text turns **red** if proposed grade is above the maximum control point elevation.

Double-clicking a row in the **Station Controls** window opens a pop-up menu. In a GACP file, the only option on this menu is **DELETE**. Select this option to delete the selected station from the Station Controls data. The edited station control data can be written back to the NCPM file by selecting **SAVE STATION CONTROL DATA** from the **FILE** drop-down menu.

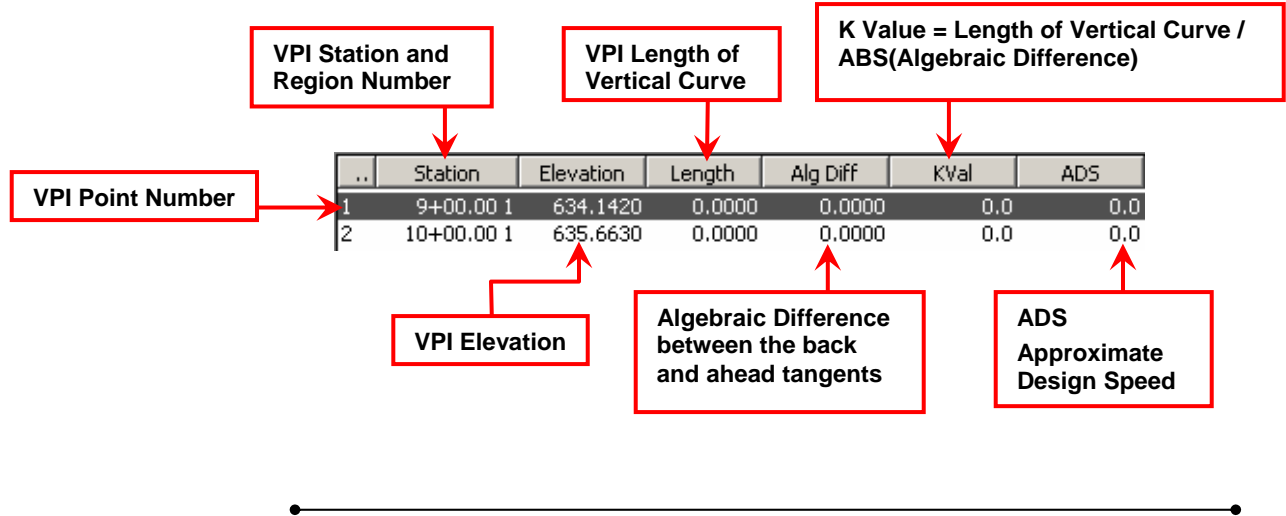
Design Grade Center

Vertical curve data entered in the **Design Grade Center** are displayed in the immediate **Proposed Grade** window. The proposed grade control points are displayed under the **GRADE** column of the **Station Controls** window. The whole profile is displayed on the **Profile Graph** window.

The profile PI represented is referred to as the **Current PI**.

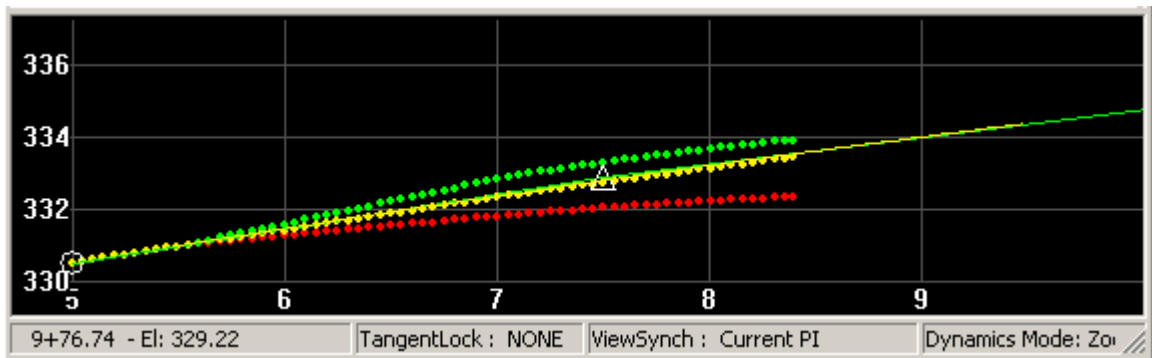


Proposed Grade Window

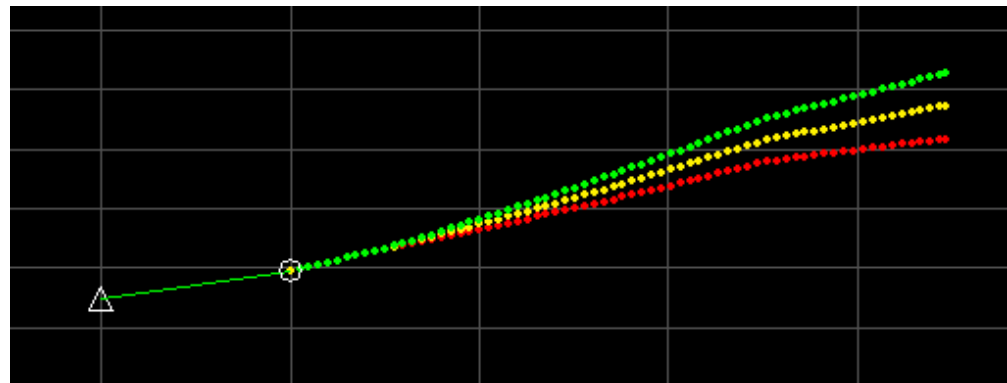


Profile Graph Window

The controls displayed on the graph are a direct output of the information on the **Station Controls** window. The graph VPI and proposed profile data are direct outputs of the information on the **Proposed Grade** window. Current status, settings, and messages are displayed in the status bar at the base of the graph. The current active VPI is shown with a triangular symbol. All other VPI's are shown as a circle.



A back grade of 100 ft before the beginning of the ramp or gore alignment is automatically computed by the GACP. This is to be used at the discretion of the Engineer to assure a smooth transition from the Mainline to the Ramp or Loop initial grade.



Right-click anywhere on the graph to make this menu appear.

- Center Graph on Station Selection
- ✓ Synch Graph to Current PI
- ✓ Synch Station List to Current PI
- Hilite Graph Control by Station Selection

- Lock Back Tangent
- Lock Ahead Tangent
- PI Component Adjustment Increments

- Set As Current
- Delete
- Dynamic Modify
- Fit Curve Length
- Snap to Control

Right-click on a VPI to make this menu appear.