
Chapter 3

Vertical Alignment Generator

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3.1 Objectives

- Create and store vertical alignments using the **Vertical Alignment Generator**.

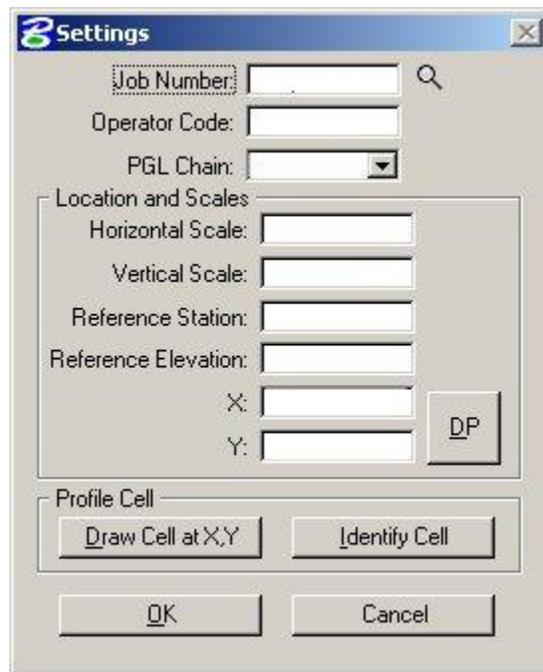
3.2 Definitions

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.

A profile may also be created with Coordinate Geometry (COGO) input.

3.3 Accessing

Vertical Alignment Generator may be invoked by **Project Manager >> Vertical Alignment** or by the **Vertical Alignment Generator** icon.

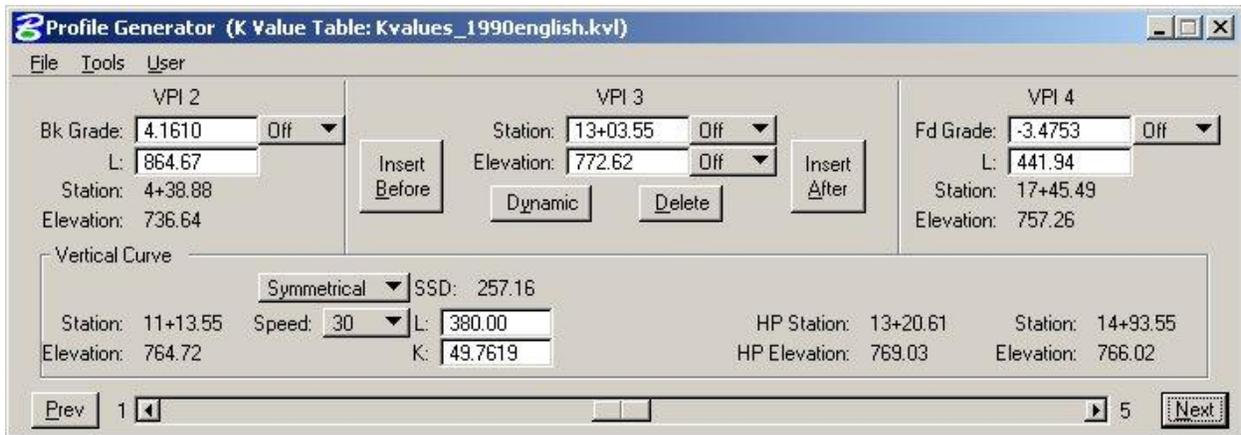
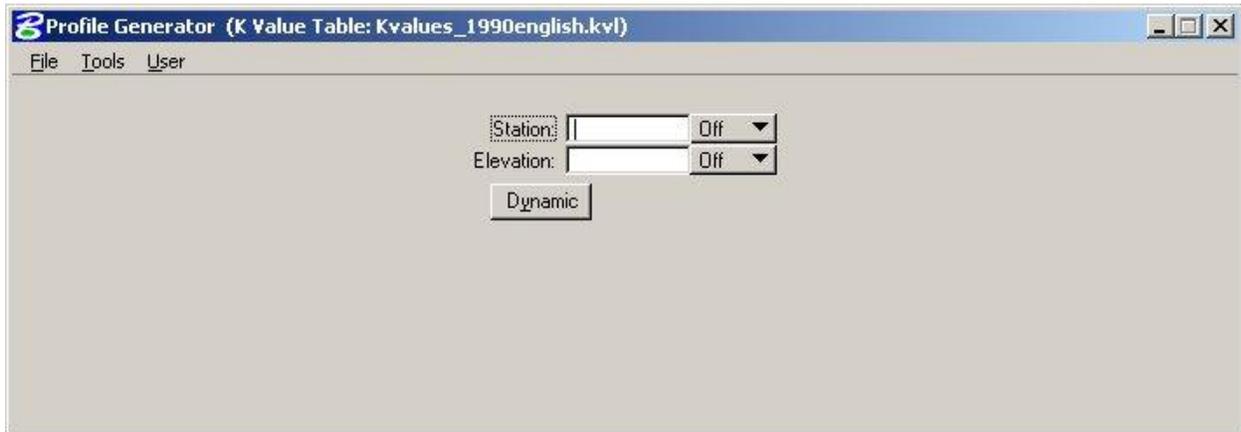


The first dialog box that appears is labeled **Settings**. The entries in this box set the parameters and define the location within the design file where the profile is to be displayed. All fields must be completed before the design process can begin. As the **OK** button is clicked, the Vertical Profile Generator dialog box will appear.

Choosing the **Identify Cell** button and selecting a profile cell can also fill in the information. If a profile cell does not exist, the **Draw Cell at X, Y** can be used to place a profile cell using the location and scale information provided in the dialog.

3.4 Dialog

This tool allows a user to load a previously stored profile or create a new profile. You will notice changes in the configuration of this dialog box as you design a vertical alignment.



Various design parameters must be defined prior to designing a new profile; we will discuss those as we look at the options provided under the three headers, **File**, **Tools**, and **User**.

3.4.1 File



Clear - clears the profile display from Microstation graphics and removes all VPI's from the dialog box.

Draw - write the graphic elements of the profile to the Microstation file.

Load - retrieves a previously stored profile from the coordinate geometry database (.gpk)

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.

3.4.2 Tools



Critical Points - Vertical curves may also be defined by one or two critical 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 another generic operations. This is useful in displaying visual references within the profile that need to be considered in design of the vertical profile.

3.4.3 User



Preferences - sets the rounding parameters for each of the items listed in the dialog box.

K Values - is a table of stopping sight distance K-values for crest and sag conditions for various design speeds. These values are based on the AASHTO Green Book.

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

3.5 Creating A New Profile

Step 1 Place the first VPI (Note: The enter key must be used to ensure values are accepted.)

Four options:

- i. Type station and elevation of the VPI into dialog box
- ii. Enter station of VPI as precision input (type in value) Elevation is defined through dynamic cursor placement on screen
- iii. Elevation is defined via precision input Station is defined through dynamic cursor placement on screen
- iv. Both values for the VPI can be established dynamically on screen

Step 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.

Step 3 Define remaining VPI's and Grades

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

Step 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.

Step 5 Adjusting Curve Lengths

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

Step 6 Save the Profile

3.6 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 box.

Lock (Locked) - Forces all operations to maintain the designated profile parameters.

3.7 Example 3-1

1. Use the **Vertical Alignment Generator** to create the following proposed profile with the given settings.

With the **Identify Cell** button, choose the profile cell plotted previously. The dialog should fill in as follows.

VPI 1	Sta. 0+00	Elevation 824.64
VPI 2	Dynamic placement	Back Grade -1%
VPI ...	Dynamic placement	Dynamic placement
VPI n-1	Dynamic placement	Ahead Grade 0.75%
VPI n	Sta. 35+10	Elevation 859.58

Place vertical curves at each internal VPI.

Make any adjustments needed to remove any errors.

Save the profile as **ROAD1PR**.

Plot the Proposed Profile as demonstrated.

2. Complete the **Profile View** and **Location** sections of the **Road1 Working Alignment**.

3.8 Exercise 3-1

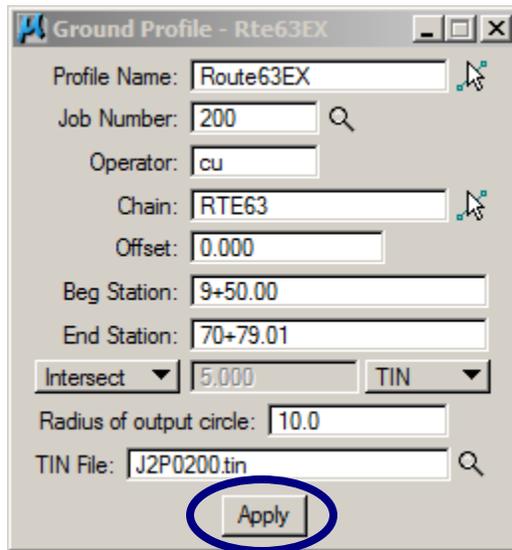
1. Using ProjectWise open the following MicroStation file:
PW:\District CADD\Design\Randolph\J2P0200\data\plan.dgn.

2. Choose the **Route63** working alignment.

3. Choose **Existing Ground Profile** from the **Project Manager** dialog.
 Copy the **MoDOT** run and name the new run **Route63**

4. Create an original ground profile for the project.

Profile Name: **Route63Ex**
 Job Number: **200**
 Operator: **cu**
 Chain: **Route63**
 Offset: **0**
 Beg. Station: *Will be filled in when chain is chosen.*
 End Station: *Will be filled in when chain is chosen.*
 Mode: **Intersect** **TIN**
 TIN File: **J2P0200.tin**



5. Open the following MicroStation file:

PW:\District CADD\Design\Randolph\J2P0200\data\Profile.dgn.

6. If not already done, attach the files **Plan.dgn** from the following directory, as references and fit the screen:

District CADD\Design\Randolph\J2P0200\data

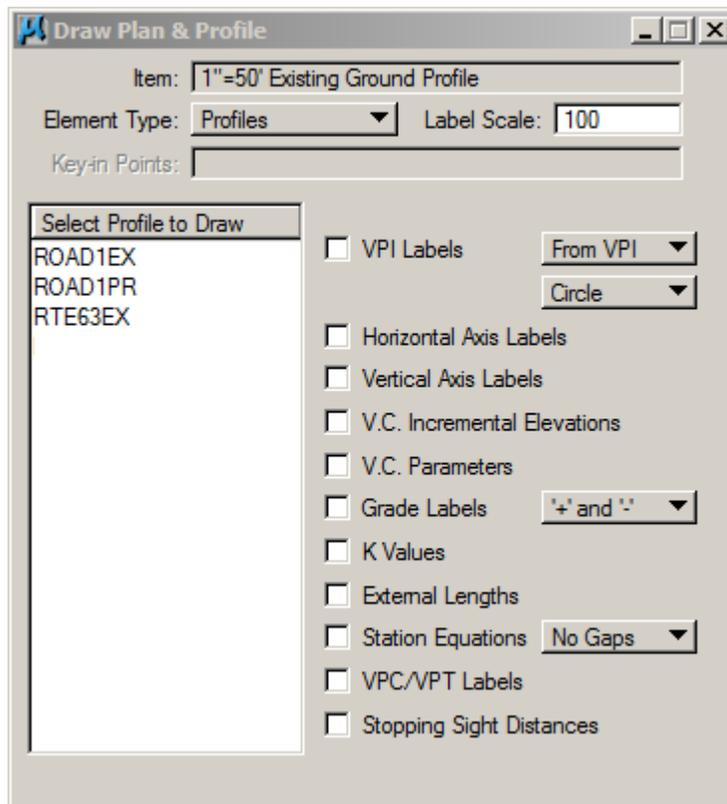
Move to a blank area of the drawing.

- Plot the existing ground profile using **Design and Computation Manager** item **Drafting Standards\Profile\Existing Ground Profiles\1"=50' Existing Ground Profile**. After selecting the item in D&C Manager, Click on **Draw Plan & Profile** in the Operations box.



Be sure all options are turned off, and the **Labeling Scale** is set to **50**.

Choose the profile **Route63Ex**.



7. (Continued)

Set the following parameters:

Horizontal Scale: **50**
Vertical Scale: **10**
DP Station: **445+30.94**
DP Elevation: **800**
DP X and Y: *Data point on the screen in an open area.*
PGL Chain: **Route63**

Draw the profile cell with the **Draw Cell at XY** button.

Draw the profile by selecting **OK**.

Profile - RTE63EX

Profile Range

Begin Station: 9+50.00

End Station: 70+79.01

Begin Elevation: 844.93

End Elevation: 859.41

Maximum Elevation: 859.76

Minimum Elevation: 820.60

Plot Settings

Horizontal Scale: 50

Vertical Scale: 10

Begin Station: 9+50.00

End Station: 70+79.01

Strip Grade Increment:

Profile Reference Point

Reference Station: 9+50

Reference Elevation: 800

X: Use DP

Y: Use DP

Profile Cell

PGL Chain: RTE63

Draw Cell at XY

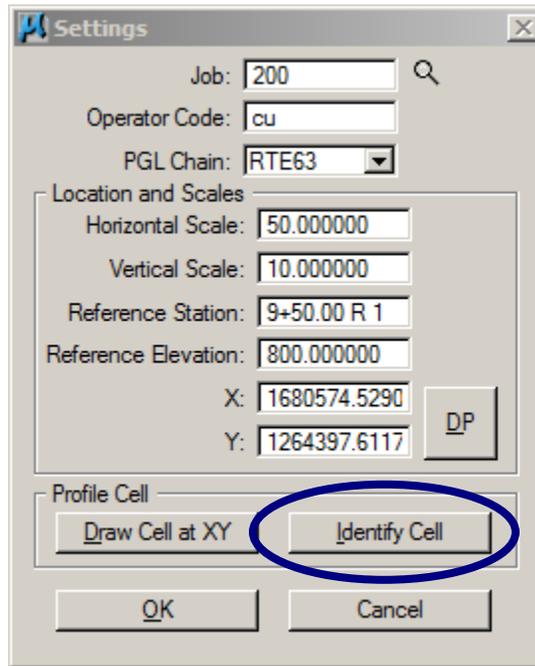
Identify Cell

OK

Cancel

- Use the **Vertical Alignment Generator** to create the following proposed profile with the given settings.

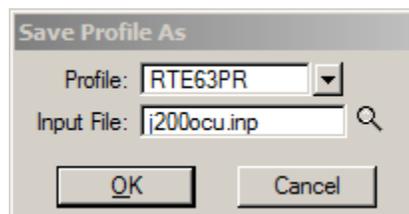
With the **Identify Cell** button, choose the profile cell plotted previously. The dialog should fill in as follows.



***** Enter all VPI information first, then come back and define the Curve Lengths.**

VPI 1	Sta. 9+50	Elevation 844.71	
VPI 2	Sta. 23+50	Elevation 820.21	Vertical Curve Length 410'
VPI 3	Sta. 35+10	Back Grade 0.5%	Vertical Curve Length 275'
VPI 4	Sta. 57+90	Back Grade 2.0%	Vertical Curve Length 725'
VPI 5	Sta. 70+79	Elevation 859.80	

Save the profile as **Route63PR**.



Exit the Vertical Alignment tool and save the settings.

9. Plot the proposed profile using Design and Computation Manager item Drafting Standards\Profile\Proposed Ground Profiles\50 Scale Proposed Ground Profile 1"=50' H & 1"=10' V.

Turn on the following options:

VPI Labels

Horizontal Axis Labels

Vertical Axis Labels

V.C. Parameters

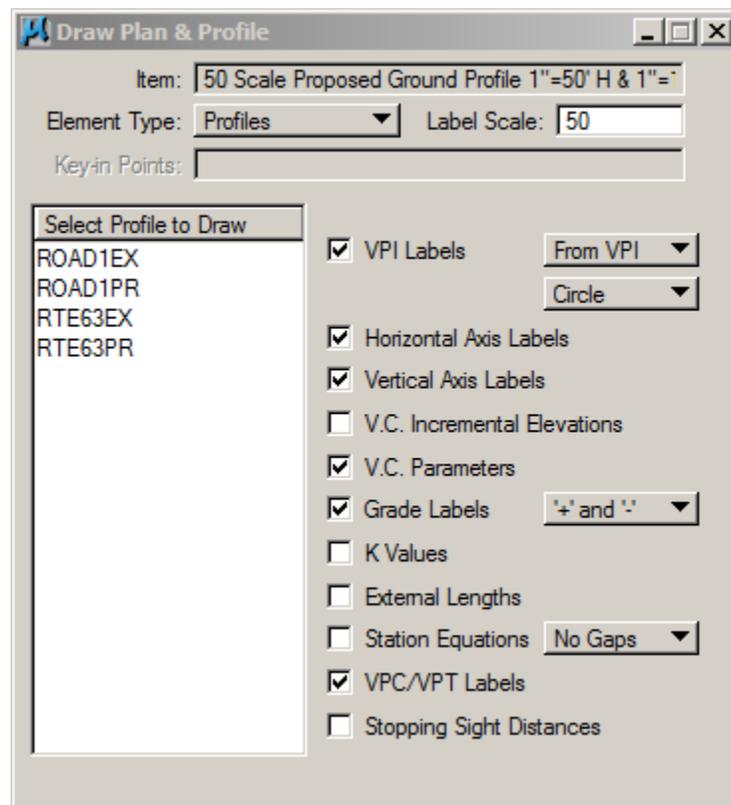
Grade Labels

K Value

VPC/VPT Label

Stopping Sight Distance

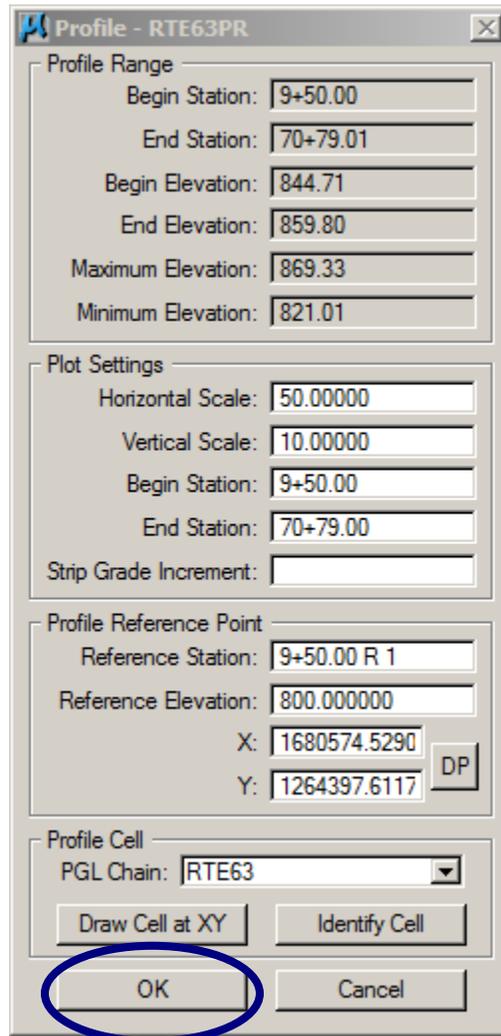
Choose the profile **Route63PR**.



9. (Continued)

Use the **Identify Cell** button to select the profile cell placed in step 6.

Plot the profile **Route63pr** by selecting the **OK** button.



Exit D&C Manager and save the changes to the MicroStation Drawing.

10. Complete the **Profile View** and **Location** sections of the **Route63 Working Alignment**.

Design File: **profile_J2P0200.dgn**
 Existing Profile: **Route63EX**
 Proposed Profile: **Route63PR**

For the **Location** section, use the **Identify Cell** button to choose the profile cell.

