

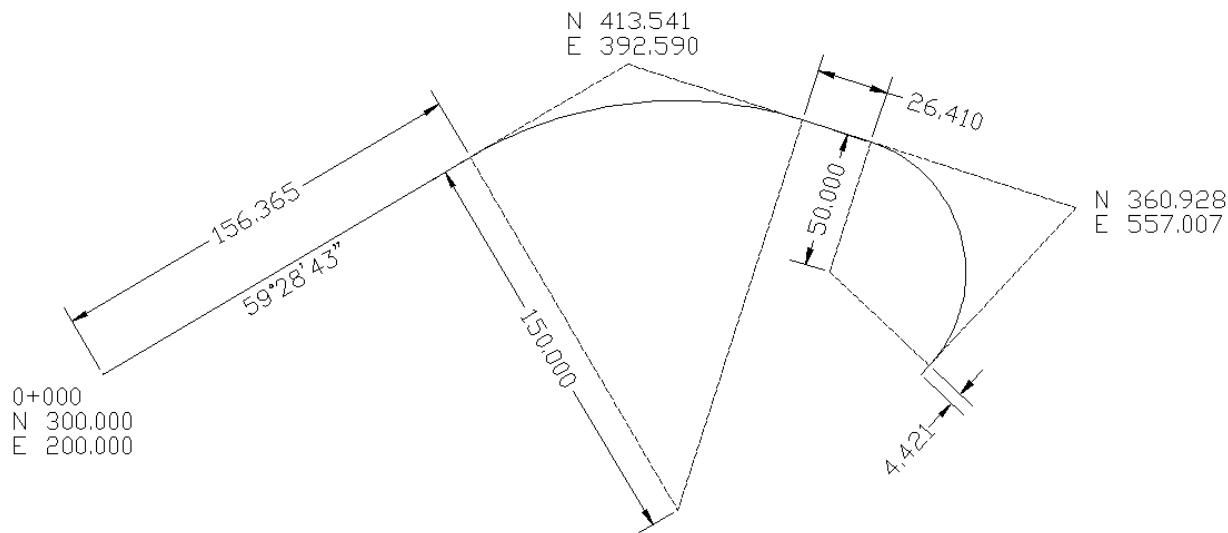
Road Alignments

Using COGO+ Pro by Simple Geospatial Solutions

The Alignments program in COGO+ Pro is found in the SURVeYing menu. Alignments are defined horizontally and vertically and cross section templates assigned, then it is possible to generate 3D coordinates for any station and offsets, or create coordinates for the entire alignment at given intervals.

Example 1

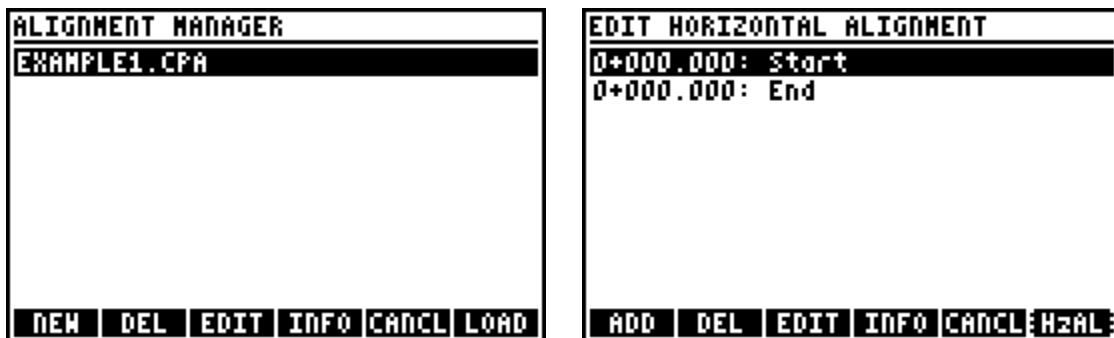
The sketch below outlines the parameters for the horizontal alignment. For this example the coordinates of the PI's are given, but any number of possible known curve parameters can be used to create the alignment.



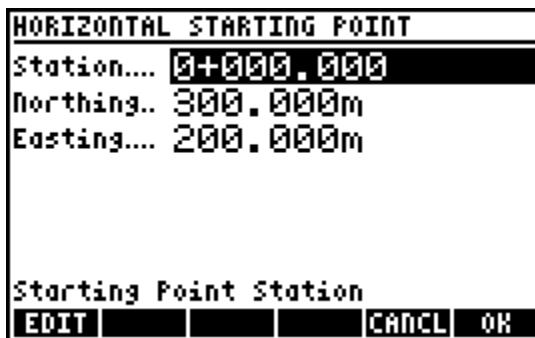
Step 1: Start the Alignments program and press [NEW] to create a new alignment.



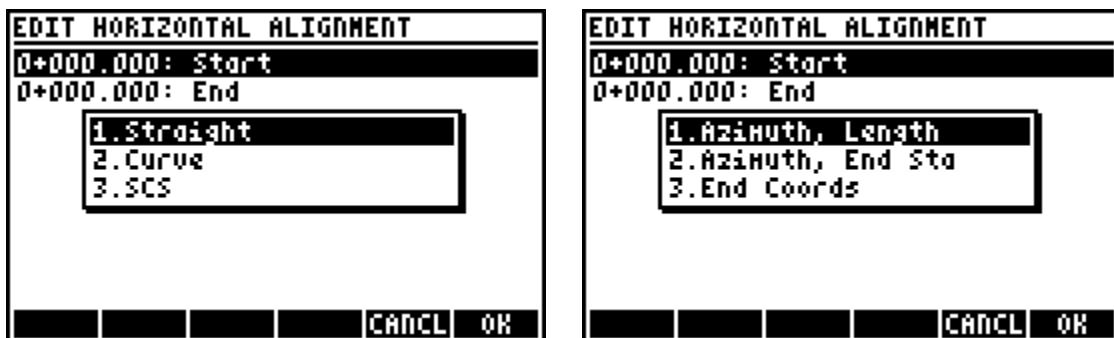
Step 2: Next press **F3 [EDIT]** to edit the newly created alignment. Note: The EDIT HORIZONTAL ALIGNMENT screen always starts by default, use **F6 [HzAL]** to toggle between horizontal/vertical/cross sections.



Step 3: Press **F3 [EDIT]** to edit the station and coordinates for the selected Start point. For this example the starting station is 0+000, and the coordinates are N=300, E=200.



Step 4: Press **F1 [ADD]** to add a horizontal element, and select "1.Straight" to add a straight element. Next choose the known parameters for the straight element, choose "1.Azimuth, Length".



Step 5: Enter the azimuth and length. The screen updates to show the newly added element.

ADD HORIZONTAL STRAIGHT	EDIT HORIZONTAL ALIGNMENT							
Start Station.. 0+000.000	0+000.000: Start							
Azimuth..... 59°28'43"	0+000.000: Straight							
Length..... 156.365m	0+156.365: End							
Azimuth of Straight Segment								
EDIT	CANCEL	OK	ADD	DEL	EDIT	INFO	CANCEL	OK

Step 6: Press **[F1]** **[ADD]** to add the next element, a curve. Choose the known parameters "5.Radius, PI Coord".

EDIT HORIZONTAL ALIGNMENT	EDIT
0+000.000: Start	0+000
0+000.000: Straight	0+00
0+15	1. Radius, Length
1. Straight	2. Radius, Delta
2. Curve	3. Radius, PI Sta
3. SCS	4. Radius, EC Sta
	5. Radius, PI Coord
	6. Radius, EC Coord
	7. CC + PI Coords
	8. CC + EC Coords
	9. 3 Point Curve
CANCEL	OK

Step 7: Enter the parameters, and make sure you select the correct direction for the curve Right or Left. Again the screen updates to show the newly added element.

ADD HORIZONTAL CURVE	EDIT HORIZONTAL ALIGNMENT					
Start Station.. 0+156.365	0+000.000: Start					
Curve Direc..... Right	0+000.000: Straight					
Radius..... 150.000m	0+156.365: Curve					
PI Northing..... 413.541m	0+282.726: End					
PI Easting..... 392.590m						
Curve Direction	ADD	DEL	EDIT	INFO	CANCEL	OK
CHOOSE	CANCEL	OK				

Step 8: Add the second straight element. The azimuth is automatically calculated from the last element.

ADD HORIZONTAL STRAIGHT			
Start Station..	0+282.726		
Azimuth.....	107°44'42"		
Length.....	26.410m		
Azimuth of Straight Segment			
EDIT		CANCL	OK

Step 9: Add the second curve.

ADD HORIZONTAL CURVE			
Start Station..	0+309.136		
Curve Direc....	Right	↔	
Radius.....	50.000m		
PI Northing.....	360.928m		
PI Easting.....	557.007m		
Curve Direction			
CH003		CANCL	OK

Step 10: Add the third and final straight element. All the elements of the horizontal alignment are now shown on the EDIT HORIZONTAL ALIGNMENT screen.

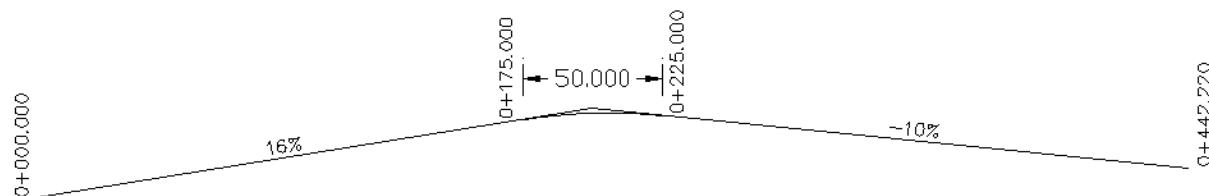
ADD HORIZONTAL STRAIGHT			
Start Station..	0+409.799		
Azimuth.....	228°05'42"		
Length.....	4.421m		
Azimuth of Straight Segment			
EDIT		CANCL	OK

EDIT HORIZONTAL ALIGNMENT			
0+000.000: Start			
0+000.000: Straight			
0+156.365: Curve			
0+282.726: Straight			
0+309.136: Curve			
0+409.799: Straight			
0+414.220: End			
ADD DEL EDIT INFO CANCL HZAL			

Step 11: Press **F6** [**HzAL**] to switch to the EDIT VERTICAL ALIGNMENT screen.

EDIT VERTICAL ALIGNMENT	
0+000.000: Start	
0+000.000: End	
ADD DEL EDIT INFO CANCL VERTAL	

The sketch below outlines the parameters for the vertical alignment. For this example the elevation at station 0+000 is known to be 100.000m.



Step 12: Press **F3** [**EDIT**] to edit the starting elevation.

ALIGNMENT START ELEVATION			
Start Station..	0+000.000		
Elevation.....	100.000m		
Starting Point Elevation			
EDIT	get2	CANCL	OK

Step 13: Press A [ADD] to add the first straight element, and select “2.End Sta, Grade”.

EDIT VERTICAL ALIGNMENT	
0+000.000: Start	
0+000.000: End	
1.Straight	
2.Curve (Parabola)	
CANCL OK	

EDIT VERTICAL ALIGNMENT	
0+000.000: Start	
0+000.000: End	
1.Length, Grade	
2.End Sta, Grade	
3.Length, End Elev	
4.End Sta, End Elev	
CANCL OK	

Step 14: Enter the known parameters for the straight element. The screen updates to show the newly added element.

ADD VERTICAL STRAIGHT

Start Station.. 0+000.000
Start Elev..... 100.000m
End Station..... 0+175.000
Grade..... 16.000 %

End Station of Segment

EDIT [endHZ] **SOLVE** **CANCEL** **OK**

EDIT VERTICAL ALIGNMENT

0+000.000: Start
0+000.000: Straight
0+175.000: End

ADD **DEL** **EDIT** **INFO** **CANCEL** **VERTAL**

Step 15: Add the vertical curve.

EDIT VERTICAL ALIGNMENT

0+000.000: Start
0+000.000: Straight
0+175.000: End

1. Straight
2. Curve (Parabola)

CANCEL **OK**

EDIT VERTICAL ALIGNMENT

0+000.000: Start
0+000.000: Straight
0+175.000: End

1.Length, Grades
2.EVC Sta, Grades
3.3 Elevations

CANCEL **OK**

ADD VERTICAL CURVE

Start Station.. 0+175.000
Start Elev..... 128.000m
Length..... 50.000m
Entry Grade..... 16.000 %
Exit Grade..... -10.000 %

Length of Vertical Curve

EDIT [endHZ] **SOLVE** **CANCEL** **OK**

EDIT VERTICAL ALIGNMENT

0+000.000: Start
0+000.000: Straight
0+175.000: Curve
0+225.000: End

ADD **DEL** **EDIT** **INFO** **CANCEL** **VERTAL**

Step 16: Add the second and final straight element. Note: Press **[endHZ]** to calculate the length to be the end of the horizontal alignment.

EDIT VERTICAL ALIGNMENT

0+000.000: Start
0+000.000: Straight
0+175.000: Curve
0+225.000: End

1.Length, Grade
2.End Sta, Grade
3.Length, End Elev
4.End Sta, End Elev

CANCEL **OK**

ADD VERTICAL STRAIGHT

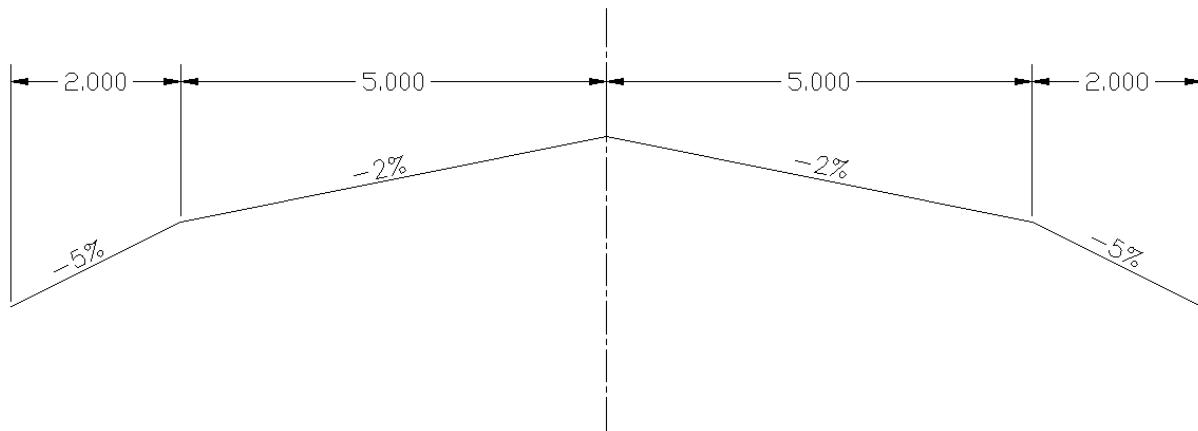
Start Station.. 0+225.000
Start Elev..... 129.500m
Length..... 189.220m
Grade..... -10.000 %

Segment Length

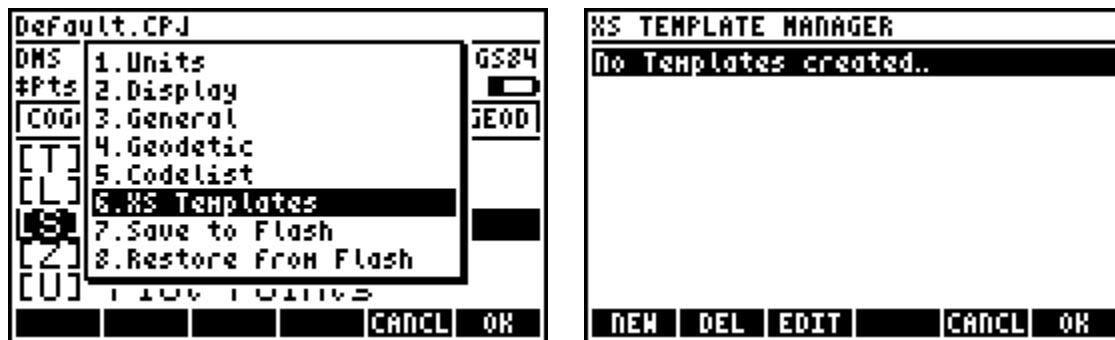
EDIT [endHZ] **SOLVE** **CANCEL** **OK**

Step 17: Exit the Alignments program to create a new cross section template, return to the main menu.

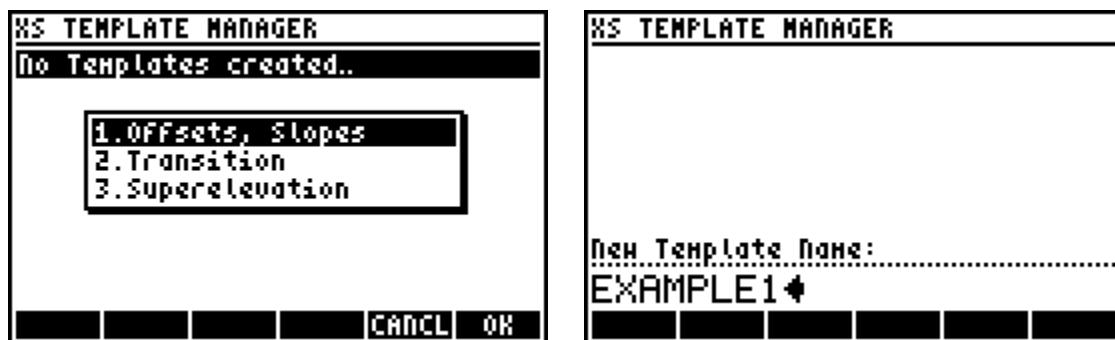
The sketch below outlines the cross section template parameters.



Step 18: Go to User Settings, and choose “6.XS Templates”.



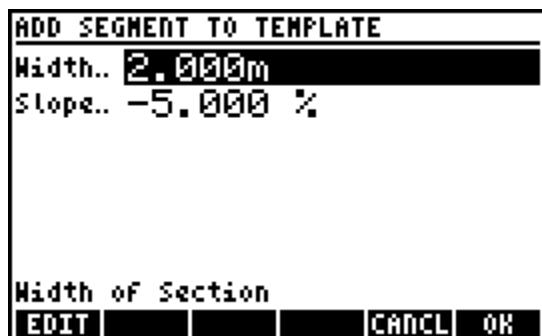
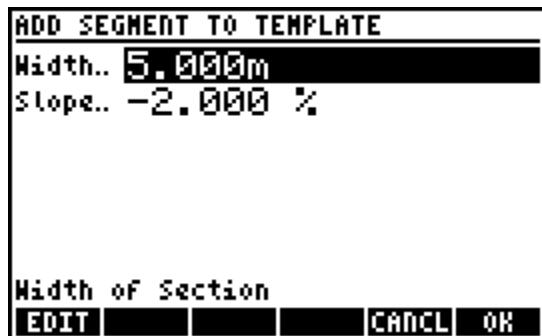
Step 19: Press **Fl** [NEW] to create the new template, then choose “1.Offsets, Slopes” as the type of template and provide a name for the template.



Step 20: Press **EDIT** to edit the new template and define the offsets and slopes. The default template contains only the centerline.



Step 21: Press **ADD** to add an offset, and then enter the width and slope of the offset. All offsets should be entered starting from the centerline and moving away from it. Enter the offsets left, and then right to complete the template.



Step 22: Verify your final template looks as shown below.

TEMPLATE EDITOR		
L-7.000, -5.000 Z		
L-5.000, -2.000 Z		
Centerline		
R+5.000, -2.000 Z		
R+7.000, -5.000 Z		
ADD	DEL	CANCL

Step 23: Return to the Alignments program, and EDIT the EXAMPLE1.CPA alignment, and then press **F6** **[HzAL]** / **F6** **[VtAL]** until you are at the CROSS SECTION ASSIGNMENTS screen.

CROSS SECTION ASSIGNMENTS		
No Templates assigned..		
ADD	DEL	EDIT INFO CANCL XSec

Step 24: Press **F1** **[ADD]** to add a cross section assignment. For this example we will use only one template for the entire alignment.

ADD XS ASSIGNMENT		
Start Station.. 0+000.000		
XS Template..... EXAMPLE1		
End Station..... 0+414.220		
Choose Template to use		
CHOOSE	CANCL	OK

CROSS SECTION ASSIGNMENTS		
0+000.000: EXAMPLE1		
ADD	DEL	EDIT INFO CANCL XSec

Once assigned, this completes the creation of the alignment. You can press **F5** **[CANCL]** to return to the main ALIGNMENTS MANAGER screen.

Option 1: Solve any station and offset. Press **F6** **[LOAD]**, then select “1.Solve Sta, Offset”. Enter any station and offset to calculate the 3D coordinates.

EXAMPLE1.CPA	SOLVE STATION AND OFFSET
1.Solve Sta, Offset	Station.. 0+200.000
2.Create Report	Offset.... 3.100m
3.Create Coordinates
	North..... 392.8221m
	East..... 375.7029m
	Elev..... 130.3130m
	Enter Station to Solve
	EDIT STORE CANCL OK

Option 2: Create a report of the entire alignment, at a given interval. For example at a 20m interval including all transition points.

EXAMPLE1.CPA	CREATE ALIGNMENT REPORT
1.Solve Sta, Offset	Station Interval.. 20.000
2.Create Report	Transition Pts..... <input checked="" type="checkbox"/>
3.Create Coordinates	
	Include Transition Points?
	EDIT ✓ CHK CANCL OK

The data is written and you are given the option to save the file as an ASCII file or to review the data on the screen.

Writing Station 0+020.000	REPORT COMPLETED..
	1.Export as ASCII File
	2.Review on Screen
	CANCL OK

Coordinates at each station and each break point on the cross section are solved for.

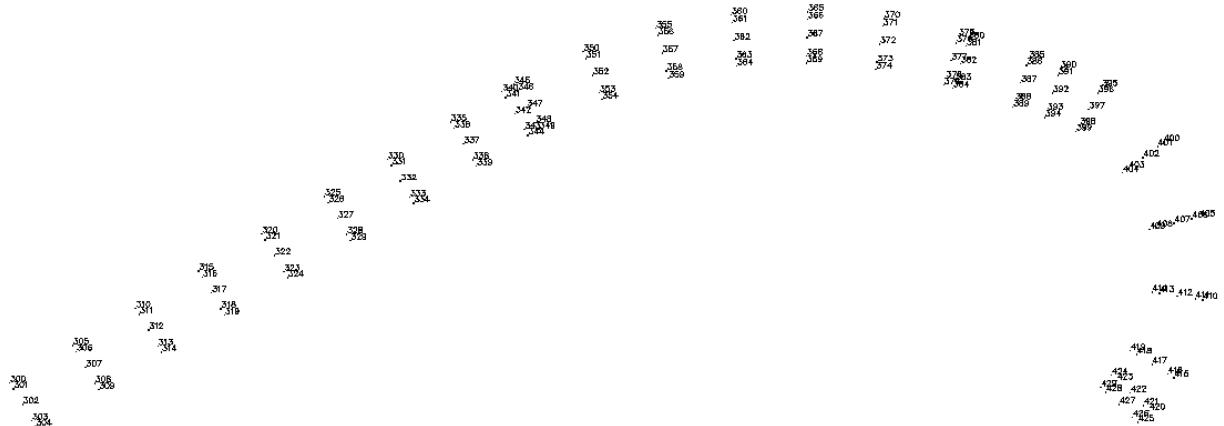
```
Offset Right: 7.000
D: 334.599
E: 272.470
Z: 112.600
-----
0+100.000
Offset Left: 7.000
D: 356.816
E: 282.589
GRAPH [ ] [ ] [ ] OK
```

Option 3: Create coordinates of the entire alignment, or of a subset of the alignment. Again, using the 20m, but also creating transition points, and using a starting point number of 300, see below.

EXAMPLE1.CPA	COORDINATE ALIGNMENT
1.Solve Sta, Offset	station Interval... 20.000m
2.Create Report	Transition Pts..... ↘
3.Create Coordinates	Starting P#..... 300
	Start Station..... 0+000.000
	End Station..... 0+414.220
	Start calculations at Station ?
	EDIT [] [] CANCEL [] OK []

```
Storing Point 314
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The points 300-429 are calculated left to right across each cross section and along the alignment from start to finish.



Now these points can be used further for any number of possible uses, including staking out, etc. from known control points within the project area.