PART Ⅰ

Foreword

WinEG2007

WinEG2007 is designed for field work, it can run on WinCE operating system and also suitable for your PC. WinEG2007 is Easy to operate, Powerful, User-friendly, and Practical.

Copyright

This manual will introduce you how to use WinEG2007. We suggest you read it carefully.

Registered trademarks

Technical Service

From the day you buy WinEG2007, you have the right to ask for our after service.

Mail-box: softspt@vip.sina.com.

Hardware

High efficiency ARM or MIPS CPU

16MB memory

320×240 Touch screen

Serial and USB port

Pen

Software

WinEG2007 is only suitable for the win total station with Microsoft Windows CE.net

Components:

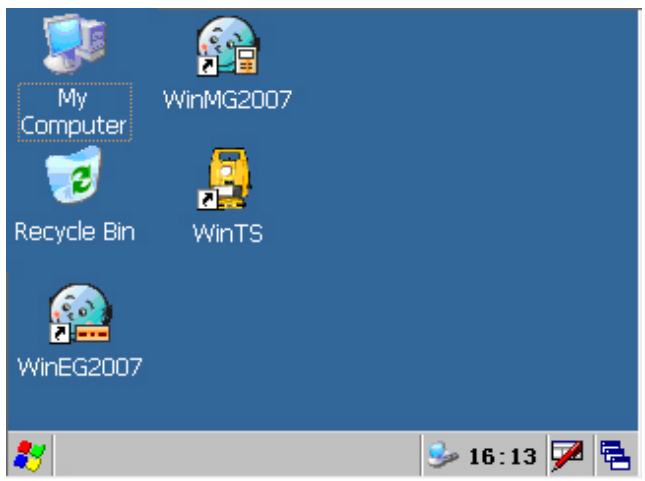
	name	Unit
1	WinEG2007 manual	1
2	Total Station Communication Cable	1

Caution:

When you use the command of Save, Save As, Coord Export, and File Export in WinEG2007, do save all the new files in the default file location SouthDisk

1. Introduction of WinEG2007

Power: Press the power key on the up right of the keyboard. See the following figure.

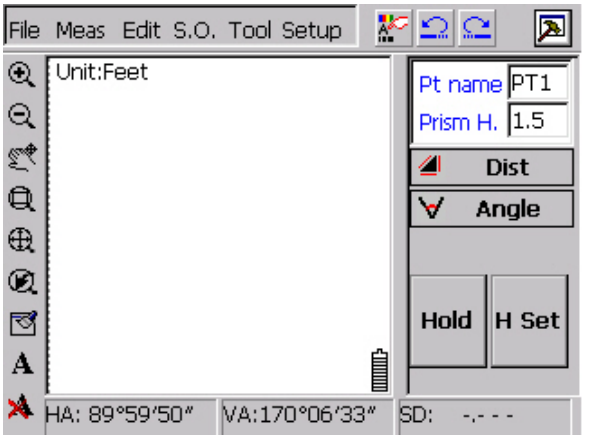


Win Total Station Interface

Run WinEG2007: Double click the icon of WinEG2007 on the desk.

1.1 Interface

See the following figure “interface”:



Interface

In the interface of WinEG2007, from left to right we have pull-down menus: FILE, Meas, Edit, S.O., Tool, Setup, and icon: Attribute, Backspace, Redo, and Window for Surveying.

View tool bar: Zoom in, Zoom out, Annotation Text Delete, Move, Windowing, Full Screen, Previous, Refresh, Annotation Text,

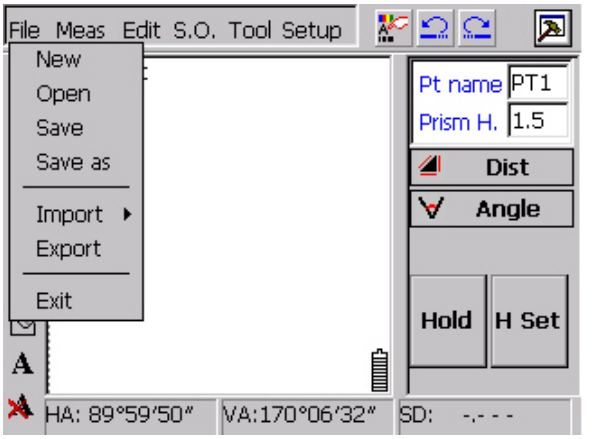
Window for angle and distance: HA, VA, SD.

On the right of the screen is window for surveying.

1.2 Pull-Down Menu

File

Click File, See the following figure:



File

The options of file list are as follows:

New: Create a new graphic file; it will be automatically saved in the folder of "~$Wineg$.%%%"before you save it.

Open: Open an existing graphic file (*.prj).

Save: Save the information of the graphic file (*.prj).

Save As: Save the current graphic file as another completely different file.

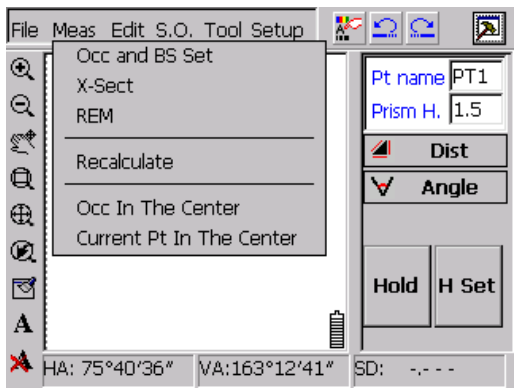
Import: Input the coordinated point into the current graphic file. There are two different ways of import: Manual Entry and Auto Import.

Export: Create Cass file (*.dat).

Exit: Quit the WinMG2007.

Meas

Click the Meas in the menu, we get the following figure:



Meas

The options of file list are as follows:

Occ & BS Set We need a backsight to start the process of surveying, there are two

ways BS Orientation and Azimuth Orientation.

X-Sect: We measure the points on the cross section, and work out the distance and height difference.

REM: REM can help you obtain the target height. Especially when the target is much higher than the place that you can put the prism on.

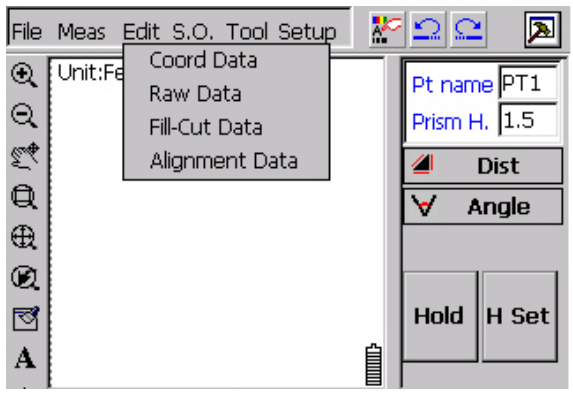
Recalculate: According to the raw data, we recalculate the current graphic file.

Occ in the center: Move the Occ point to the center of the screen, and show the whole figure in current scale.

Current Pt in the center: Move the latest point to the center of the screen, and show the whole figure in current scale.

Edit

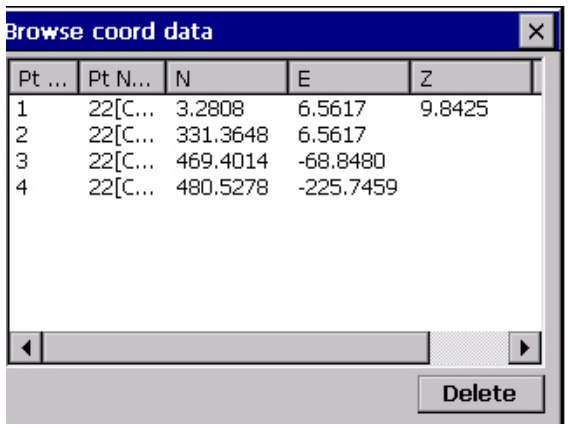
Click Edit, see the following figure:



Edit

The items of this menu are as follows:

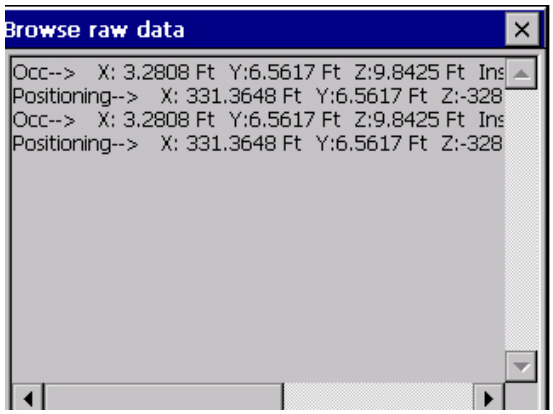
Coord Data: By clicking this item, you can browse, delete, and edit the coordinate data, see the following figure.



Edit

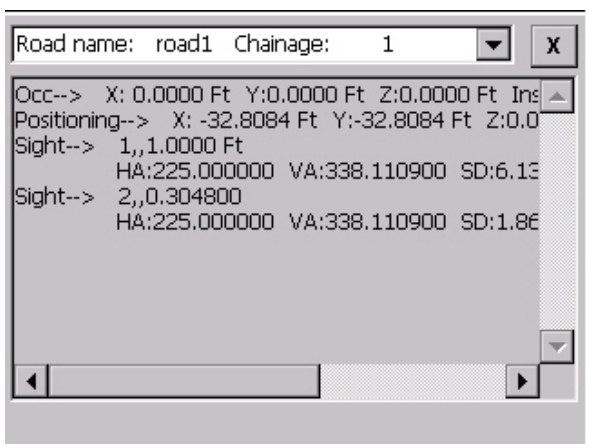
Caution: You can adjust the width of the list to see the whole information.

Raw Data: You can browse the raw data here.



Raw data

Fill-Cut Data: By clicking this command, you can browse the Occ Pt and BS Pt, but the data is unchangeable.

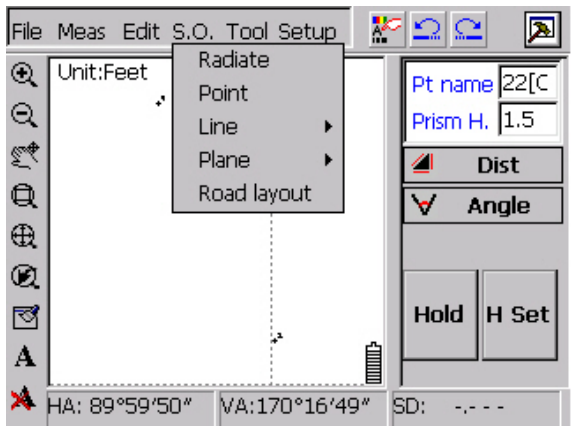


Fill-Cut Data

Alignment Data: Work out the coordinates and height according to the Horizontal alignment data and Vertical alignment data; show you the figure of vertical section,

S.O.

Click S.O., you will get the following figure:



S.O.

The items of this menu are as follows

Radiate: setout points with the distance and angle that exist between station and setout point.

Point: Layout points.

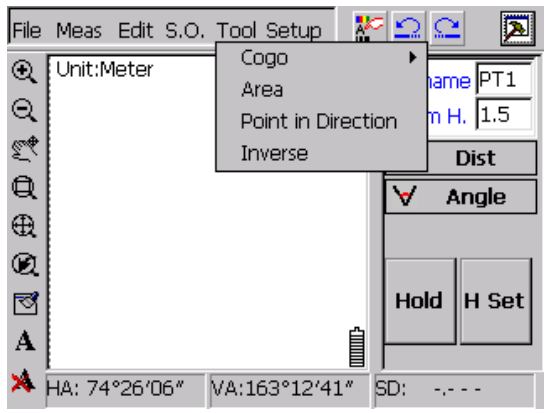
Line: Layout line, curve and arc.

Plane: Layout slope-plane, three points-plane, arc-plane.

Road Layout: Layout roads.

Tool

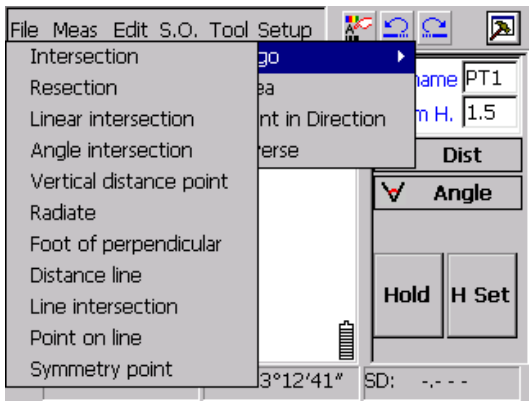
Click, Tool, you will get the following figure:



Tool

The items of this menu are as follows:

COGO: Under this menu, there are many ways to calculate unknown parameters, such as Intersection, Resection, etc. see the following figure.



COGO

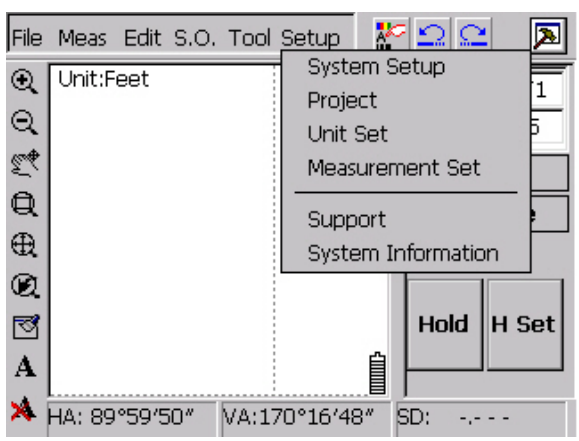
Area: Calculate the area of any figure which is composed by points (at least three, non-collinear), or polygonal line.

Inverse: work out the coordinates with a known point, a distance and azimuth angle

Reverse: work out the distance and angle with three known points.

Setup

Click setup, then you get the following figure:



Setup

The items of this menu are as follows:

System Setup; Here you can set the Screen Capture, Coord Info, 4 Points Ground Feature, Sheet Line System, Power, Quick Draw Mode, Distance Unit, North Arrow.

Project: You can check the creating data and version of project files with this function.

Unit Set; Set up the unit of angle distance pressure and temp.

Measurement Set; Set the Tilt, Atmospheric correction parameters, Vertical angel mode.
Support: http://www.southinstrument.com
System Information: Copyright and version.

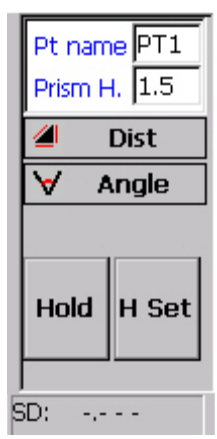
Tool Bar

Tool bar shows you the common functions of surveying and mapping. Here is the brief introduction of them;

 Control the window for surveying by hiding or showing the window.

	Zoom in		Zoom out
	Pan		Windowing
	Zoom all		Previous
	Refresh		Annotation Text
	Delete Annotation Text		Attribute
	Backspace		Revoke

The windows for surveying on the left of the screen are as follows.



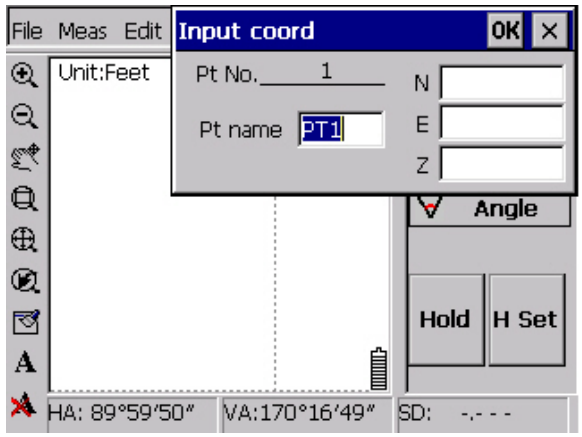
2. Meas→X-sect

2.1 New Project

Click File—New to create a new project, but the project do not have its name, so we suggest save the project and name it.

2.2 Input Control Point

We should input control points before start surveying, There are two different ways of import: Manual Entry and Auto Import.



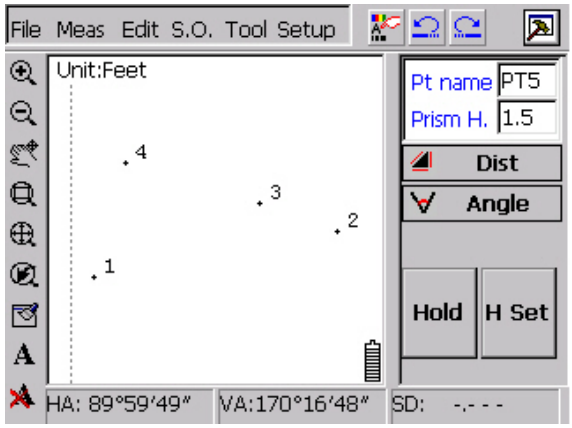
Coord Import

Click File→Import→Manual Entry, see the shown figure above.

The default name of the point is Pt1, and it will be automatically accumulated according to the former point. We input 4 points as the following excel.

Pt no.	Pt name	X	Y	Z
1	Pt1	100	200	22
2	Pt2	200	200	22
3	Pt3	300	80	21
4	Pt4	250	40	20

After inputting, Click  you can see the following figure with four control points:



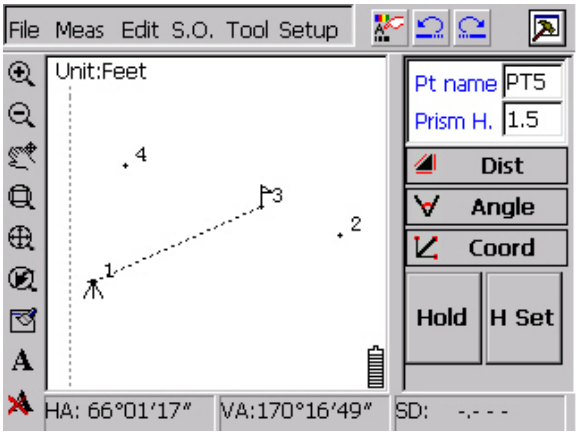
Control points

2.3 Occ & BS Set

Click Meas→Occ & BS Set, you will get the following figure, there are two ways BS Orientation and Azimuth Orientation, here we choose the BS Orientation.

Backsight

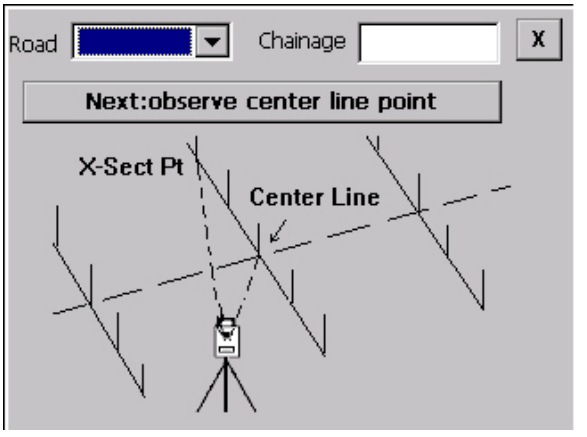
Input the Occ, BS, and inst.Ht then aim the BS point and click the √ key. Then you can see an Occ point and a BS point on the screen. See the following figure.



Occ & BS set

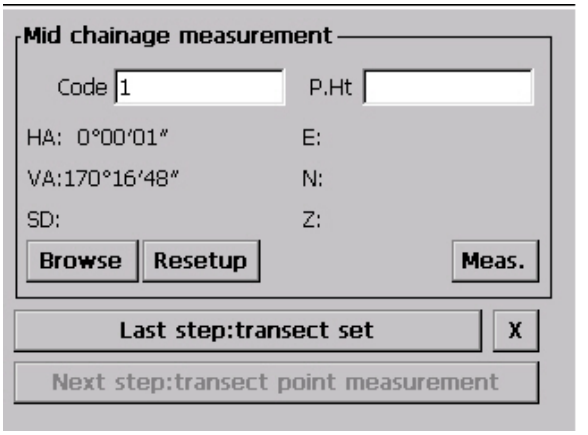
2.4 Meas→X-sect

Click Meas→X-sect, then you get the following figure.



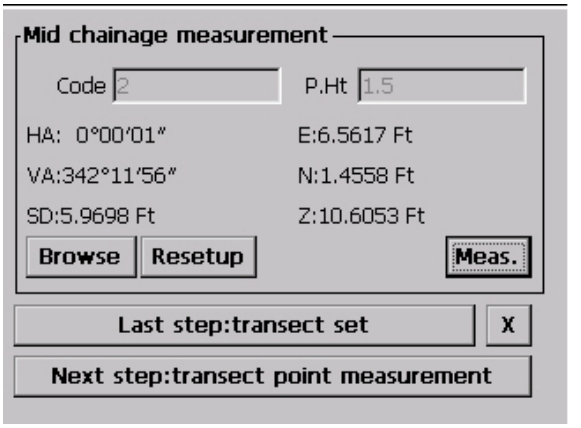
X-sect

As the figure shown above, input or select the name of the road. Also see Edit→Alignment to know how to define a road. Input chainage, click Next: obverse center line point, you will get the following figure: "middle chainage".

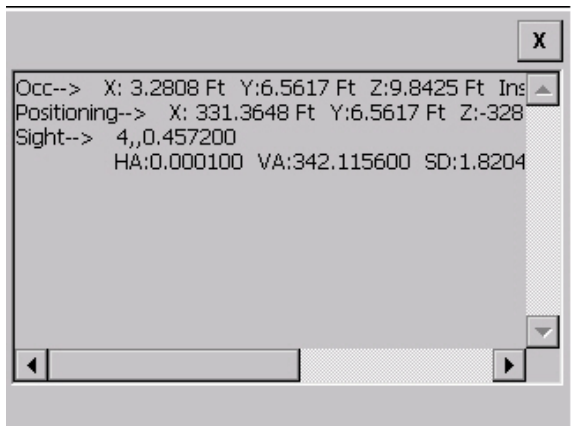


Middle Chainage

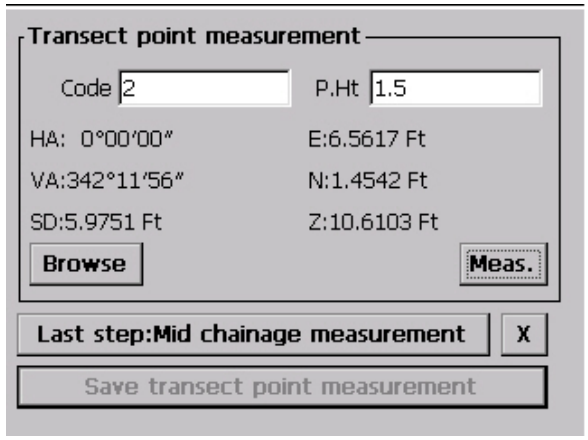
Input the code and Prism height turn the total station to the prism on the middle chainage, click Meas, you will get the figure shown above: "Middle chainage". Click browse, you will get the dialog: "raw data for x-sect", see the following figure. Click Last step: transect set, you will get the following dialog "transect mesa", now you can go on with the next middle chainage. Click Next step: Transect Point Measurement, the data in the figure "Middle Chainage" will be saved in the "Transect Meas" dialog. Click Resetup the system will make it turn back to the interface of Occ & BS.



Middle Chainage

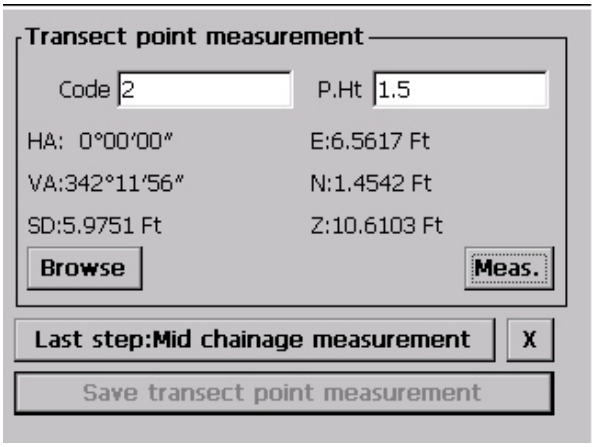


Raw Data for X-sect



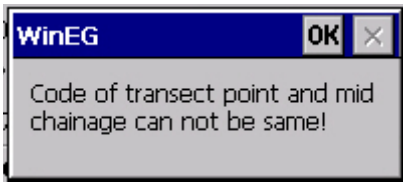
Transect Meas

Input the code and prism height, then aim the total station at the prism on the middle chainage, Click Meas; you will see the following figure: "Transect Data" click Browse; you can check the raw data, as shown in the figure "Raw Data for X-sect" below. click Last step: middle chainage Meas, you will turn back to the dialog" Middle Chainage". Click Save transect point measurement, the observation data will be saved.



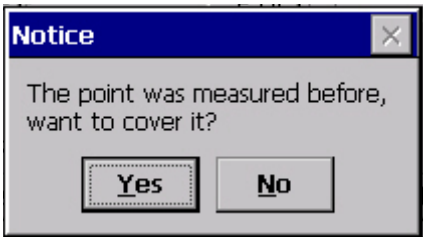
Transect Data

Caution: When you edit the code which **is** the same as the code of chainage, you will get the following dialog.



Prompt Dialog Box 1

When the code you need to edit has been existed. you will get the following dialog:



Prompt Dialog Box 2

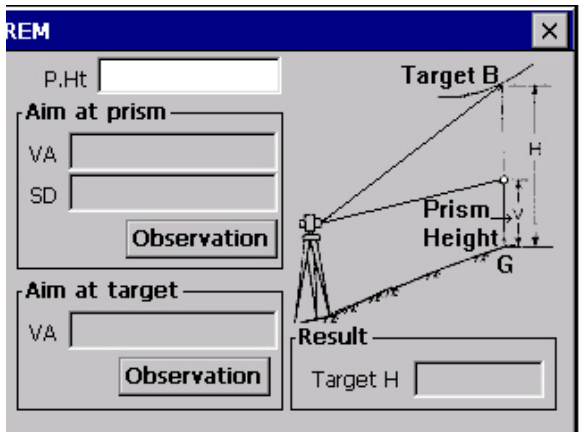
Click "Yes" button, the existing data will be covered, click "No" button, it will turn back to the **Meas.** interface, you can change the code and save it.

Click the "browse" button; you can check the information of all the points

3. Meas→REM

Meas→REM

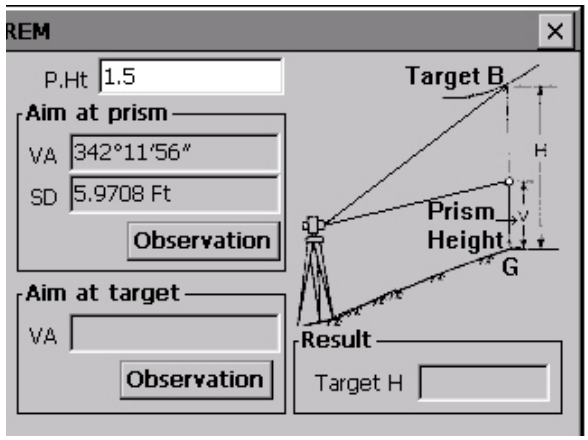
Click: Meas→REM, see the following figure: “REM”



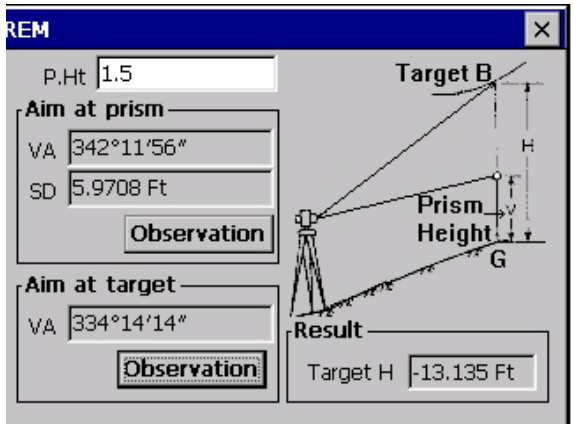
REM

Input the prism height, aim the station to the prism, and click the Observation button in the Aim at the prism part. then you will get the VA and SD value, see the figure” Observation Data with Prism”.

Turn the station and aim the target point, click the Observation button in the Aim at Target Part. Then you will get the VA and SD value, see the figure: “Observation Data without Target”.



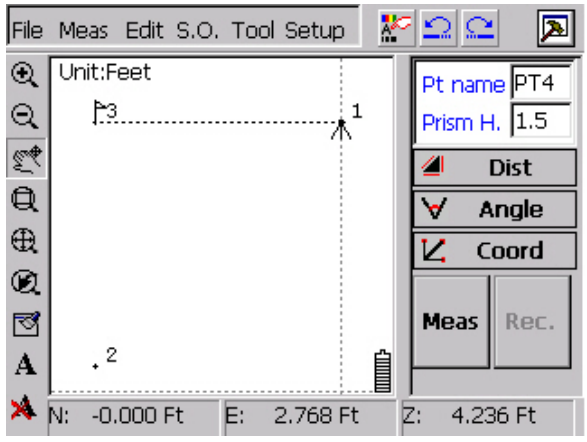
Observation Data with Prism



Observation Data of Target

4. Meas→Coord

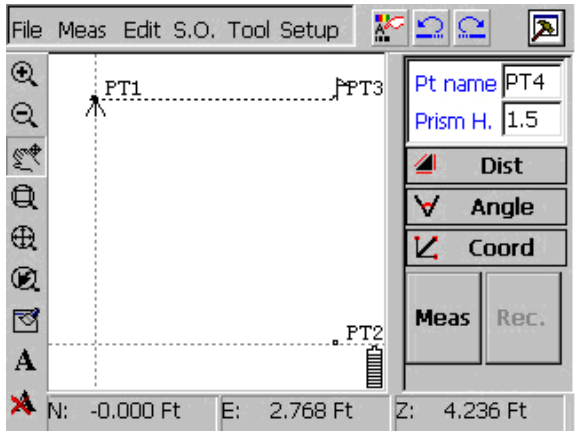
Setting Occupied Point



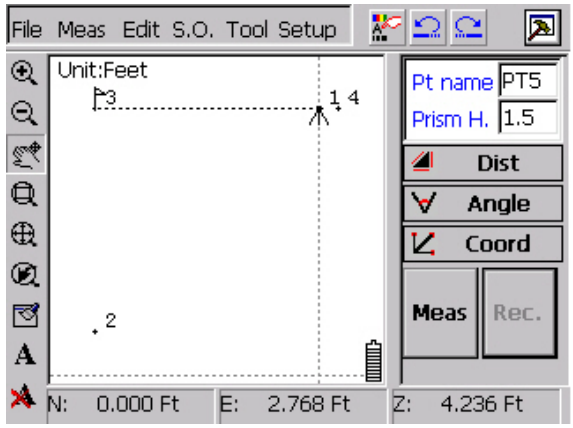
Occ set

As the figure shown above, input the point number: Pt4, P.Ht: 1.5, aim to the prism. Choose 

and click mesa, the system will work out angle, distance as the following figure shows:



Click Rec., you can save the data, and then Rec. button becomes unavailable, till new data is collected.

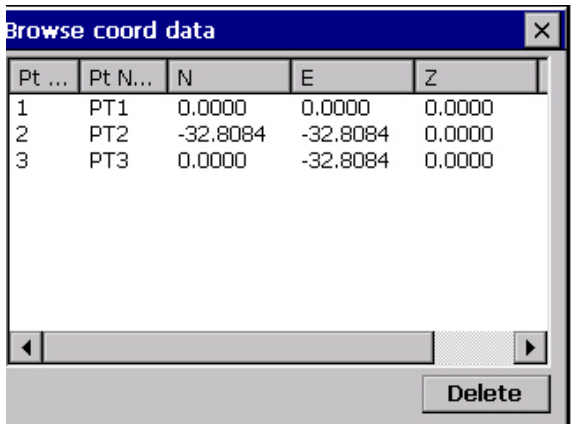


Record

5. Edit→Coord Data

Edit→Coord Data

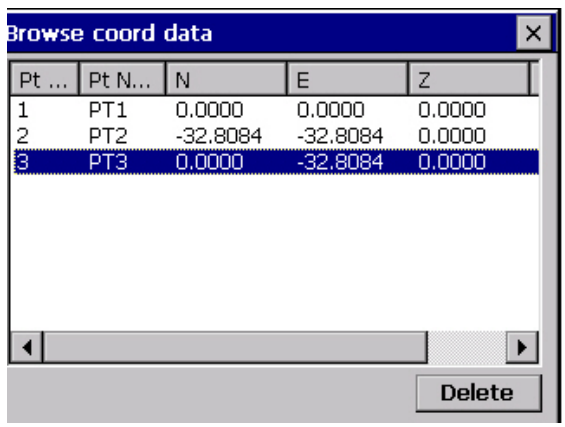
Click: Edit→Coord Data, you will get the following figure: “Coord Data”



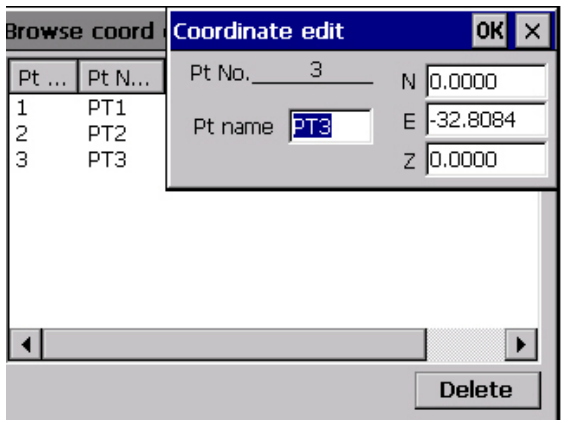
Coord. Data

Delete Coord. data: Click the point you want to delete (for example: Pt1).See the following figure: “Delete Coord Data”, then click Delete, the point you selected will be deleted.

Edit Coord. data: Double click the point then the software will show you the dialog of Coord Editing, as shown in the following figure “cord edit”. You can edit the point name and the value of the point here



Delete Coord Data

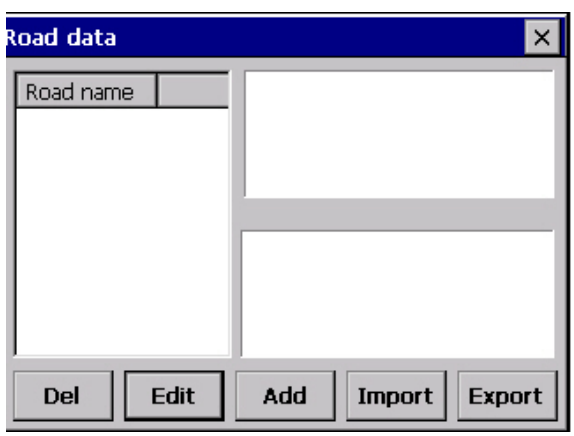


Coord edit

6. Edit→Alignment Data

6.1 Edit→Alignment Data

Click Edit→Alignment Data, you will see the following figure “road data”.



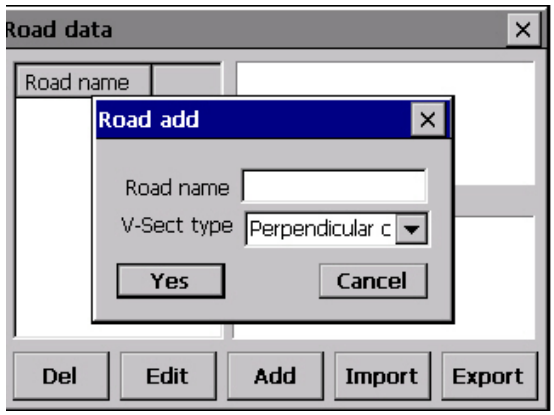
Road data

The left of the dialog will show you the existing road in the current project, see the figure shown above. The window on the top-right corner will show you the graphic horizontal alignment. The lower right corner will show you the graph of vertical alignment.

Del.: delete the road data.
Edit: edit the road you select.
Add: add a new road.
Import: import a road into the station.
Export: export the selected road (*.rod).

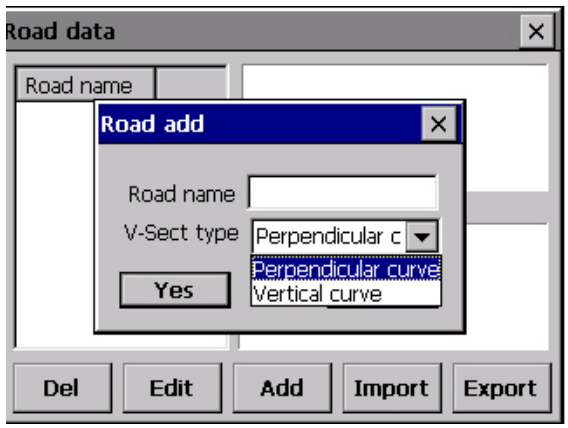
6.2 Add Road

Click Add in the dialog “road data”, you will get the following figure: “Add Road”.

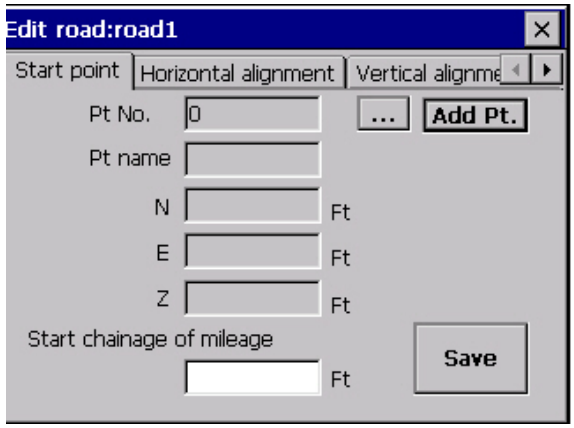


Add Road

Input the name of the road, for example: road1, choose “Vertical curve” under V-Sect type, see the following figure: “V-Sect type” click Ok you will see the interface “Add the Start Point”, if you haven’t input the road name, the system will ask you for it.



V-Sect Type



Add the Start Point

6.3 Edit the Start Point of the Road

As the figure shown above “add the star point”, there are two ways of inputting start point: first, select the point in the list, second, in put the point manually.

Point No.: point number

Point Name: point name

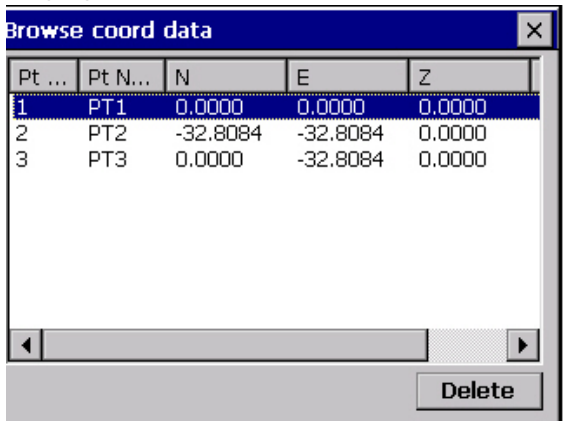
N: X coordinates.

E: Y coordinates.

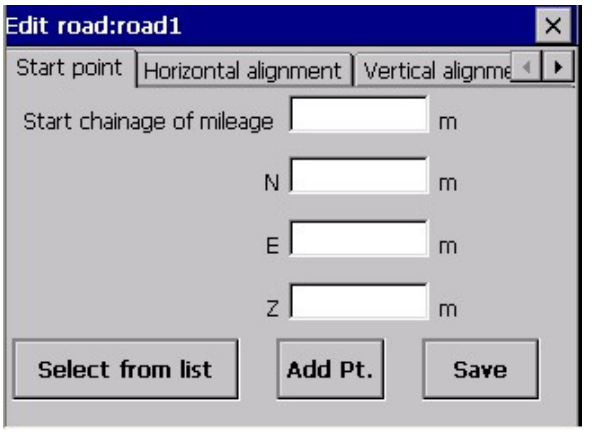
Z: Z coordinates.

Chainage: chainage, unit: m.

Click List, you will get the following figure “Select the Start Point of Road” here, you can select a start point, for example: we choose point 1, now the data is added in, as shown in the following figure: “Start Point of the Road”



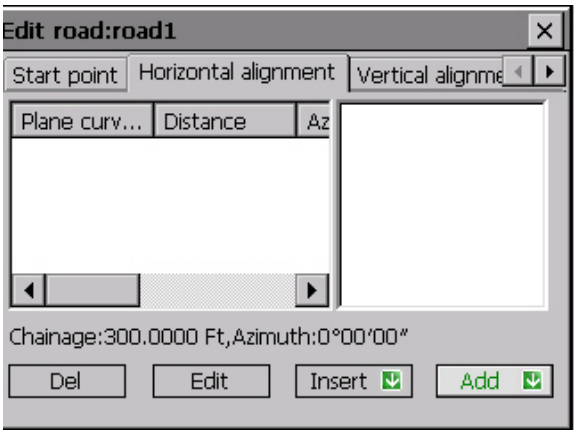
Select the Start Point



Start Point of the Road

Input the chainage of the start point, for example: 300. Click save, the system will turn to the interface of: "Horizontal alignment inputting".

Caution: No matter you input the cord of **start** point with hands or select it in the list you must click save. If you didn't input the value of the points, just click save, the Coord will be saved like this: N=0, E=0, Z=0. Chainage=0.



Horizontal Alignment Inputting

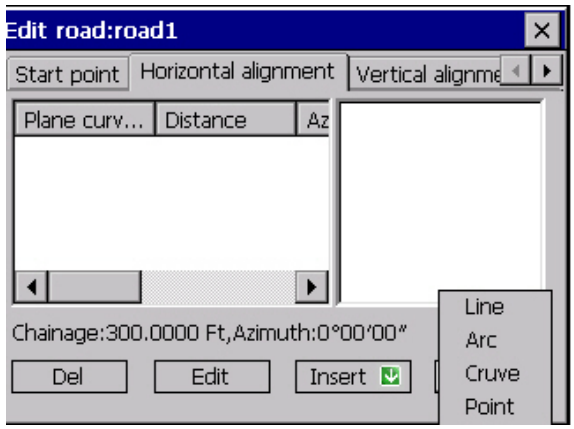
6.4 Edit Horizontal Alignment

Horizontal Alignment data includes: Points, line, arc, curve. See the figure above "Horizontal alignment inputting".

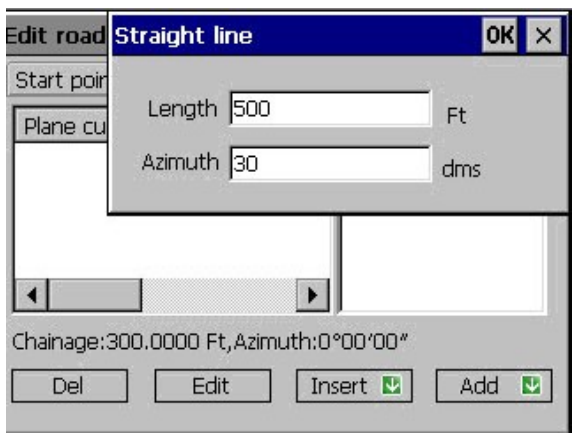
Del.: Delete the Horizontal Alignment data.

Edit: Edit the horizontal alignment data.

Insert: Insert point, line, arc, and curve.
Add: Add point, line, arc, and curve.
Click Add, here we add "line" into horizontal alignment data, choose line in the interface: "Choose Horizontal Alignment", system will show you the figure "input line"; here you can set the length and azimuth. Click OK, save the data and turn back to the interface: "Horizontal alignment inputting". Click X, the data will not be saved but the system still turns back to the inputting interface. When the data is added successfully the system will show you the figure on the screen.



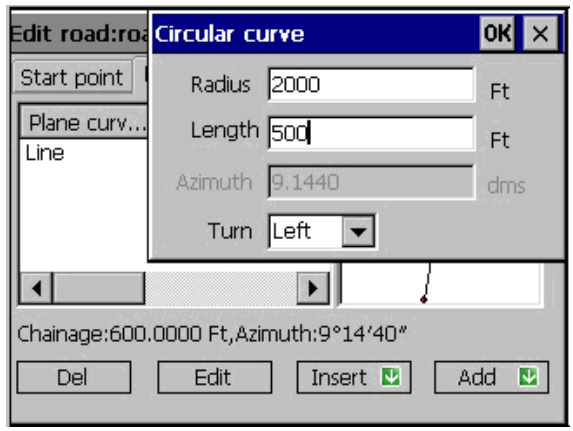
Choose Element of Horizontal Alignment



Input Line

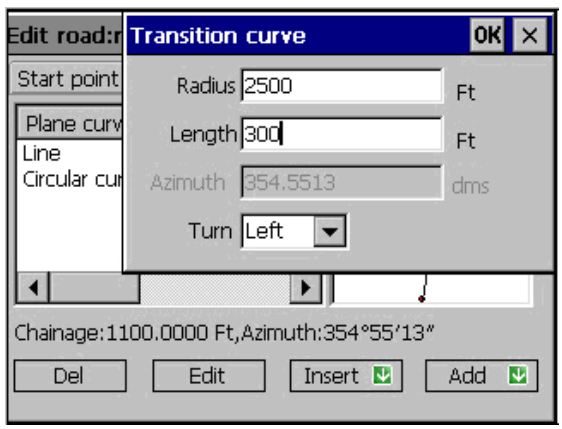
In the interface: "Choose Horizontal Alignment Data" click Arc, the system will show you the figure "Input Arc", Radius and length, in the Turn list choose "Left", click OK, save the data and turn back to the interface "Horizontal alignment inputting",

click X. the curve data will not be saved and it will automatically turn back to the figure “Input Arc”.



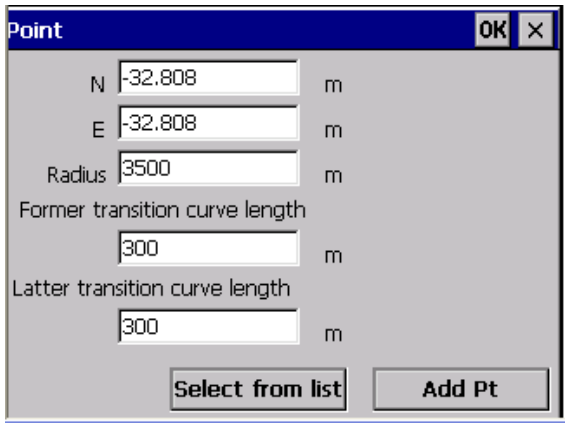
Input Arc

In the interface: “Choose Horizontal Alignment Data” click “curve”, you will get the following figure “Input Curve”. Here you can input Radius and Length; in the Turn list choose turn left. Click OK, save the data and turn back to the interface: “Horizontal alignment inputting”.

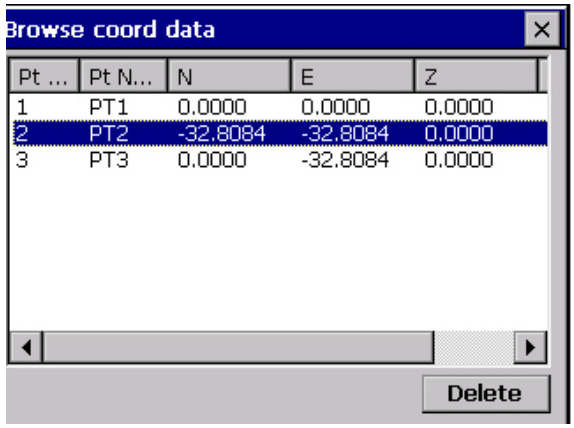


Input Curve

In the interface: “Choose Horizontal Alignment Data” click “Point”, you will get the interface of “Input Point”. There are two ways of inputting points: First, Input the data manually. Second, input the data by clicking the Select from list button, then you will get the following figure: “select the point”, now double click the point and input radius, Former transitional curve length, and latter transition curve length. Click OK, save the data and turn back to the interface of “Horizontal Alignment Inputting”.

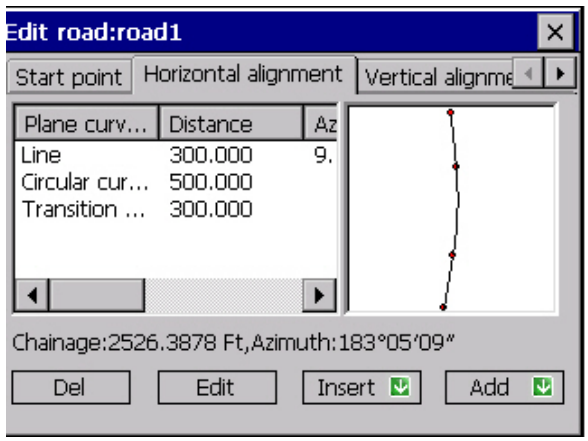


Input Point



Select Point

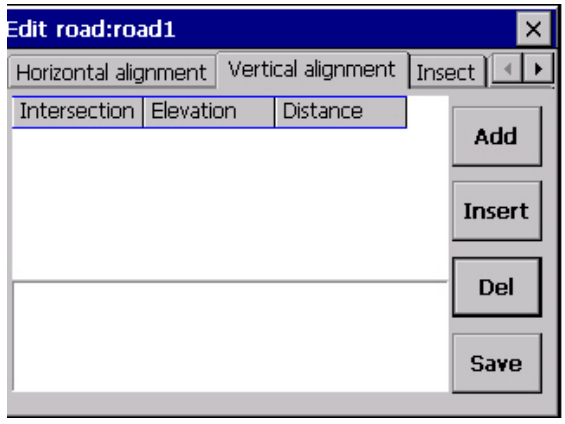
As shown in the following figure: “Data of H AL” you can see the graph. Add, Edit, Insert, Del can help you to edit, insert, and delete the data.



Data of H AL

6.5 Edit Vertical Alignment Data

The Vertical Alignment Data includes: intersection, Elevation, and Distance. See the following figure.

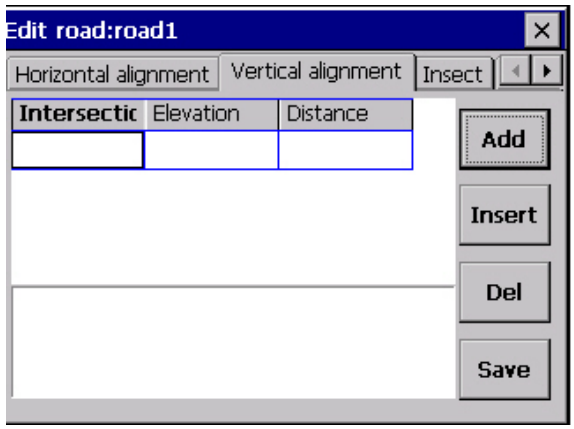


Data of V AL

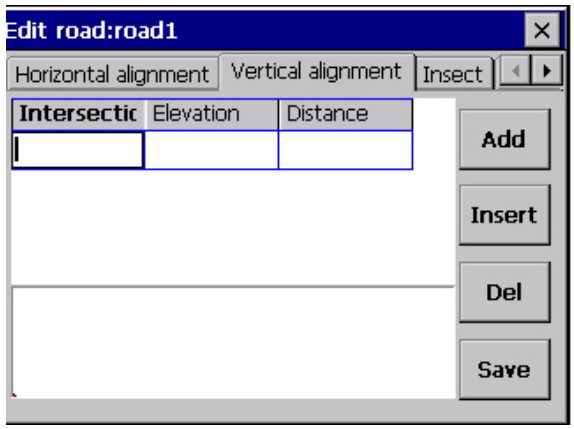
Add: Add a new line for inputting vertical alignment data.
Insert: Insert a new line for inputting vertical alignment data.
Delete: Delete the vertical alignment data.
Save: Save the vertical alignment data, we suggest you to save the data.
Click Add, the system will show you the interface "Add vertical data" now click the white space in the line and input the data with keyboard. See the following figure: "Vertical alignment data inputting". We input a group of vertical data according to the

following excels:

Intersection	Elevation	distance
400	40	60
500	35	50
600	25	70
700	30	60

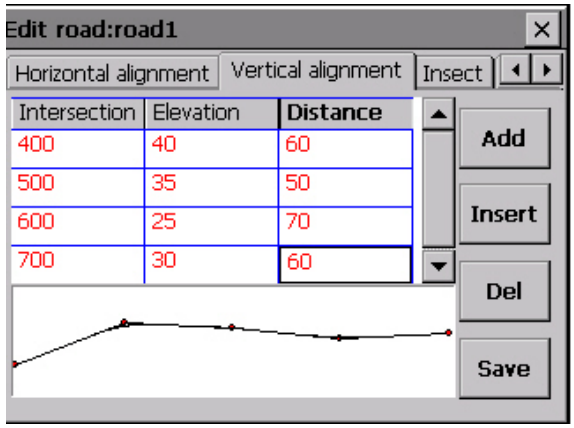


Add Vertical data



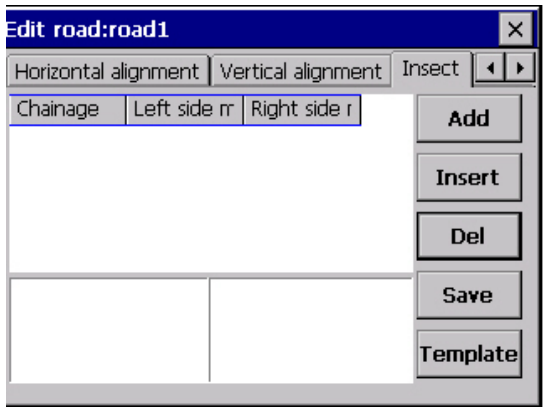
Vertical alignment data inputting

After you input all the data, click Save. You will get the following figure. “Data of vertical alignment”.



Data of Vertical Alignment

After we add all the vertical alignment data, we can enter the transect part by clicking "transect"; you will get the following figure "Transect".



Transect

6.6 Edit Transect

Transect data includes: chainage, left side model, right side model.

Add: Add a blank line for inputting the transect data.

Insert: Insert a blank line for transect

Del.: Delete the transect.

Save: Save the transect data. After you edit the transect data, please save before continuing.

Template: Add new template, check the original template and edit the current template.

Click Template, you will get the following figure: “section template”. section template data includes: section name, horizontal offset, gradient%, vertical offset distance.

New: Create a new template.

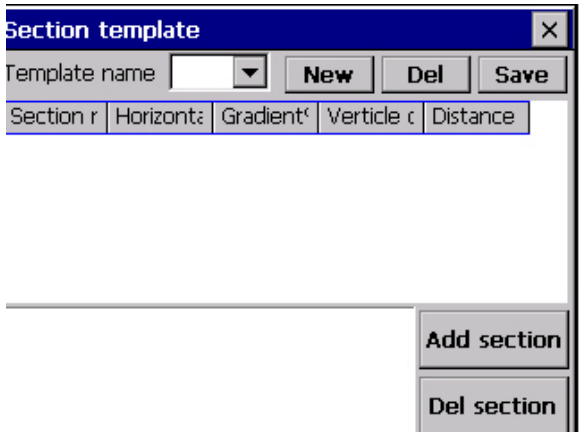
Delete: Delete the template.

Save: Save the template.

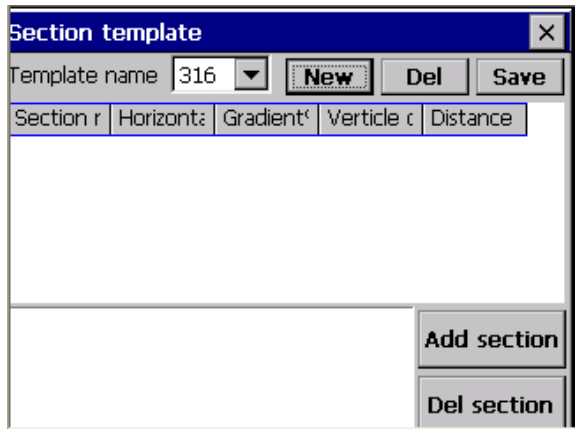
Add section: Add new section.

Del. section: Delete section.

Input the section name, and click New, you will get the figure: “Create new section template”.



Section template



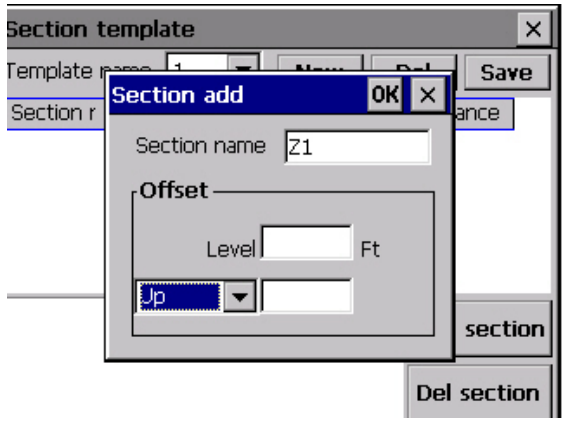
Create new section template

Click OK in the interface of “create new section template “then click Add section, you will get the following figure: “add section”. Input the section name (default value is Z1):

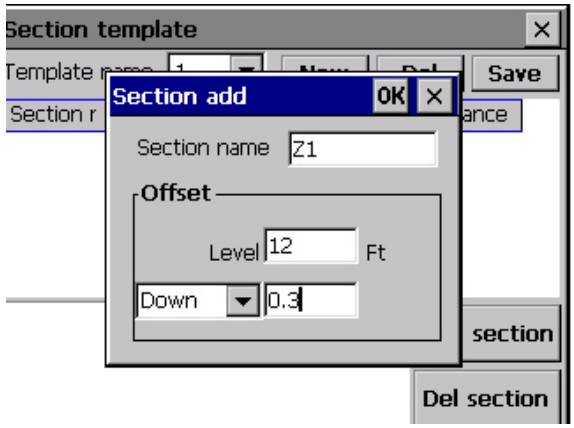
Horizontal offset: 12

Vertical offset: 2.5

Gradient%: 0.3; Select Up; see the following figure" Z1 section".



Add section



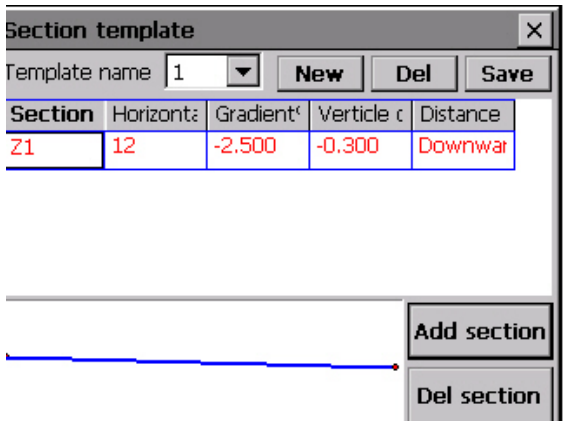
Section Z1

Click OK, add the Z1 section, and continue with the new sections.

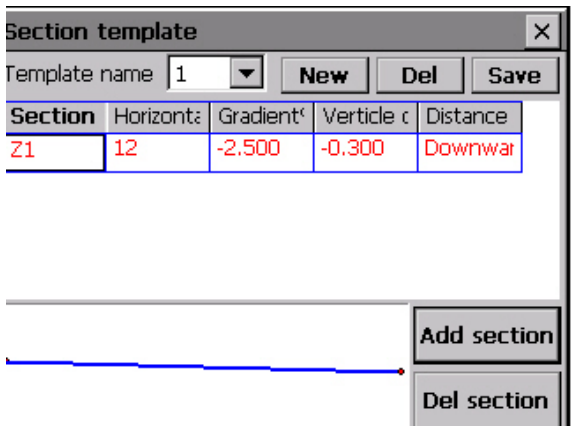
Z2: horizontal offset: 3, vertical offset: 2.5, and choose Down button.

Z3: horizontal offset: 5, vertical offset: 0, and choose Up button.

Now we create a new template, its name is sect1. See the following figure: "Section 1"

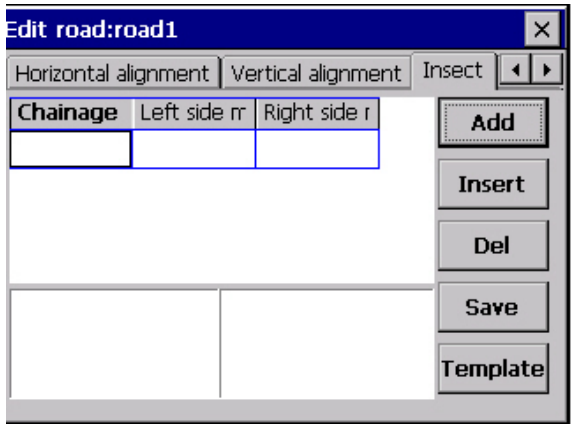


Section 1

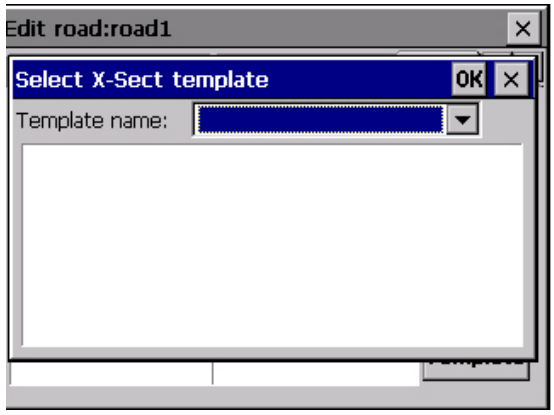


Section 1 (with figure)

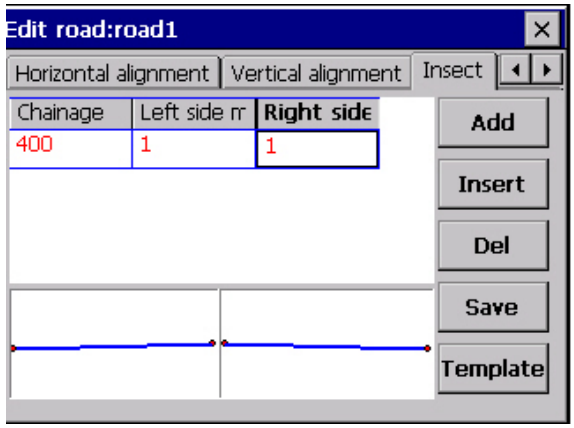
In the figure: "Transect" shown above, click Add, you will get a window: "Add Transect". Here you can input chainage and click the blank under right/left model setting you will get the interface: "select template" and now choose section 1 form the list, click OK, see the following figure: "Transect data".



Add transect

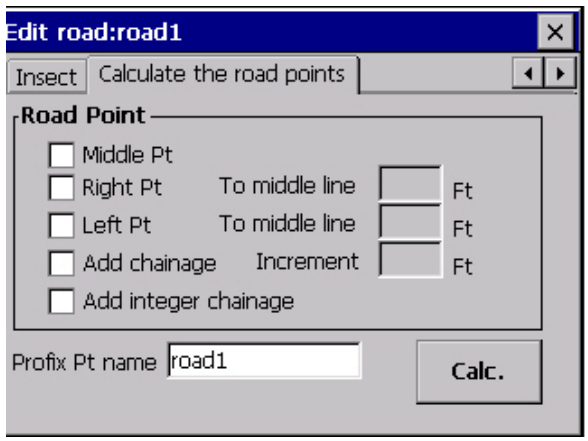


Select template



Transect data.

Click Calculate the road points tab; enter the interface of “Calculate the road point”.

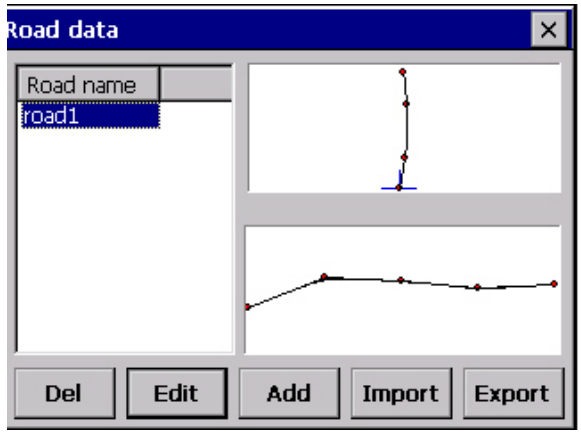


Calculate the road point

6.7 Calculate the Road Point

Road point include: middle point, right point, left point, added chainage, added integer chainage.

Select middle Pt and added chainage, input increment, click Calc.; the software will work out the point and show you on the screen.



7. S.O.→Radiation

7.1 File→Import

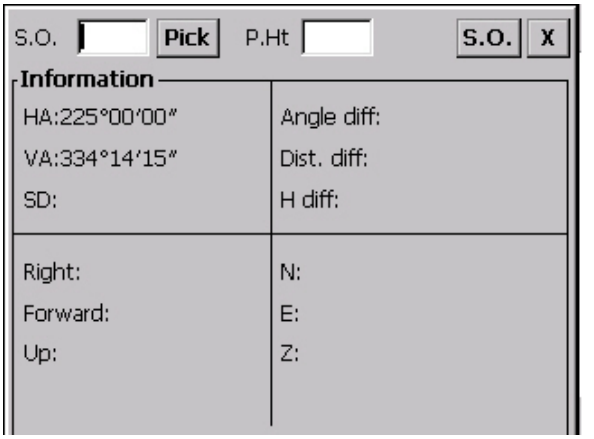
Also see Meas→X-sect→Input Control point

7.2 Meas→Occ & BS

Also see Meas→X-sect→Occ & BS.

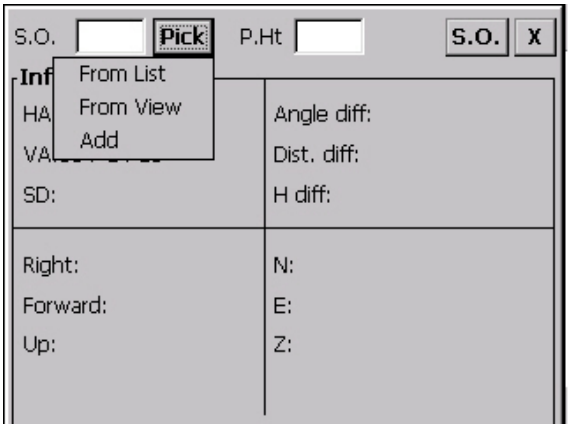
7.3 S.O.→Radiation

Click S.O.→Radiate menu, you will get the following figure: "Radiate":



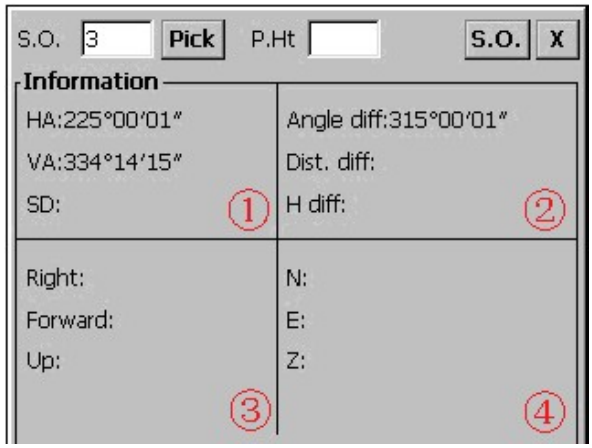
Radiate

Click Pick, here is a dropdown list, see the following figure:



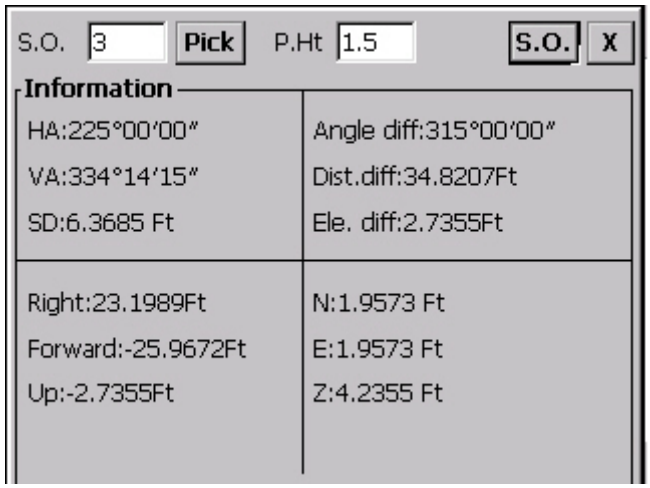
From List: once user clicks list select button, coordinate view dialogue box would pop up, use pen to click the coordinate item needed to setout, selected setout point name would be shown in setout point input box. The angle offset between setout point and zero direction would be shown on 2nd area of information display area at downside of the screen. As picture showed "Setout 1":

Interface instruction: in graph "Setout 1": "1st area" is for Occ information, displaying azimuth, zenith and SD; "2nd area" is for offset display area, showing the offset of the Setout point and real point about angle, distance and elevation. When each item is zero, that means real observing point and Setout point are same point; "3rd area" is for controlling. Find out the accurate point in practical field by moving prism upward, forward, leftward or rightward. When the value is negative that delicates it should be moved toward opposite direction; "4th area" is for coordinate display which include showing northing coordinate, easting coordinate and elevation in real time.



Setout 1

Rotate telescope to make angle offset close to zero, then the direction telescope aim at is the direction where the Setout point is. After inputting prism height, put prism on the direction corresponding to telescope's direction. Click "S.O." after sighting prism. As picture shows "Setout 2":



Setout 2

Repeat steps of "Move prism→Click S.O.", until each index reaches required conditions.

8. S.O.→Point

8.1 File→Coord Import

See Meas→X-sect→Input the Control Point for details.

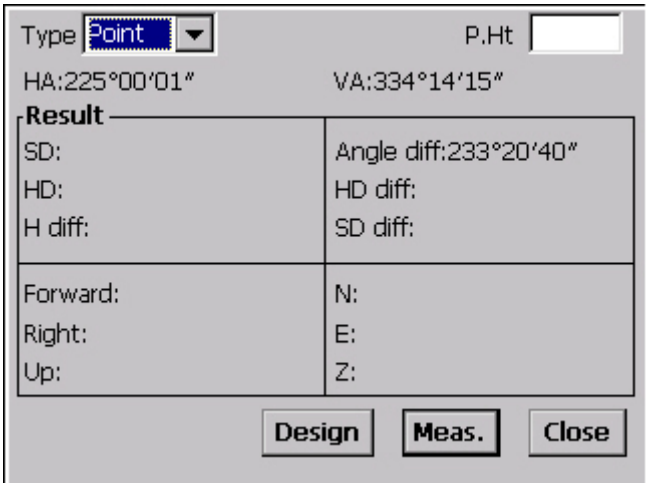
8.2 Meas→Occ& BS Set

See Meas→X-sect→Occ & BS Set for details.

8.3 S.O.→Point

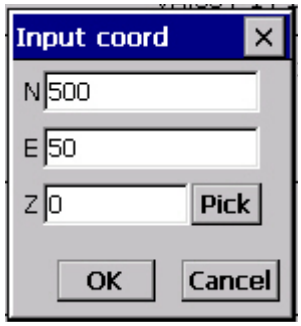
Click S.O.→Point, you will get the following dialog.

The interface of point setout is same as interface of radiation setout; refer to the "Interface Introduction" for the information of each area.



Point setout

Designed value: Click "Design", you will get the following dialog:



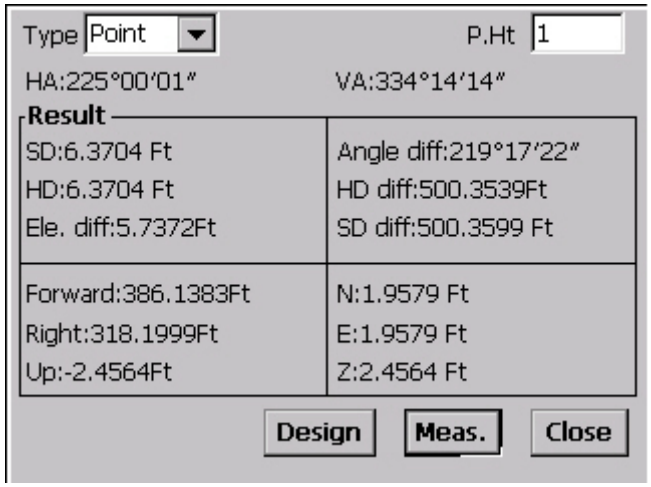
Input coord of designed Pt

Select setout Pt

1. Input the coordinate of the setout Pt directly. Users can input coordinates of the setout Pt into Input coord dialog, click OK to start setting out. （The coordinate won't be saved in this method.）
2. Click “Pick”, the selecting dialog of LIST and ADD Coord will show at the bottom of Input coord interface, see figure “Select setout Pt”.

Meas: to carry out measuring of distance and angle, calculate and show the difference between the designed point and real-measured point according to the input designed data. See figure “Calculated result of Pt setout”.
Rotate the telescope to make the Angle diff. as 0, then the current direction in which the telescope is shooting is the direction of the setout Pt. Then after inputting prism height, place the prism in that direction. Use telescope to collimate the prism, then click “Meas”, repeat the operation of “moving prism→Measuring”, until each indexes meet the precision requirement of setout, the Pt setting out is finished.

Close: to quit the Pt setout interface.



Calculated result of Pt setout

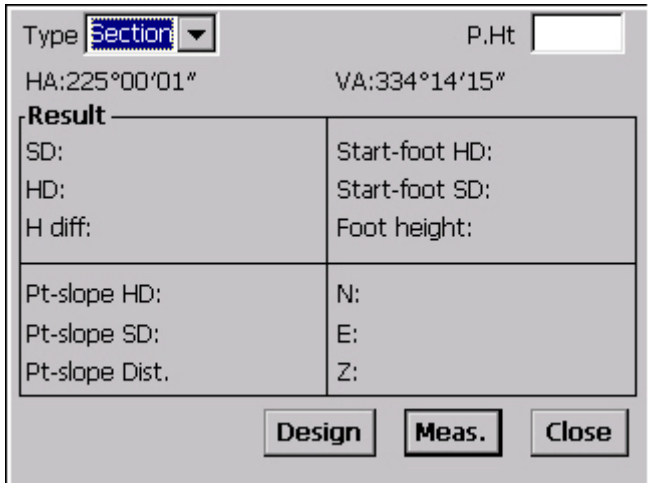
9. S.O.→Line→Poly Line

Principle; Use starting point and ending point to define a line segment, use the measured result to make the setout point on the defined line segment.

Steps: Same as Pt setout.

S.O.→Line→Poly Line

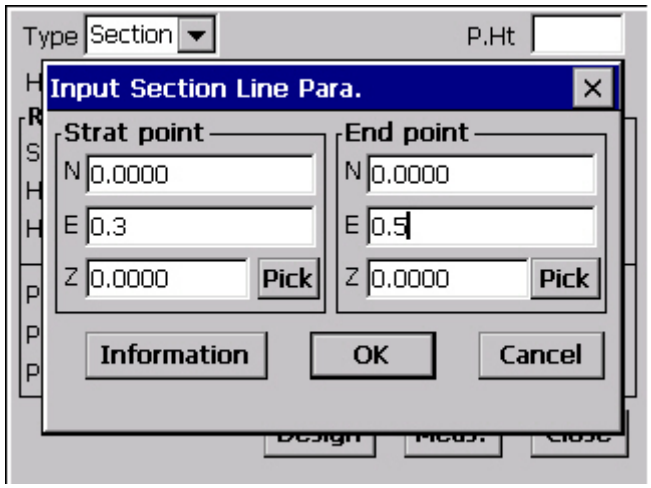
Click S.O.→Line→Poly Line, you will get the following dialog.



Line segment setout

The interface placement of line segment setout is same as radiation setout; refer to the "Interface Introduction" for the information of each area.

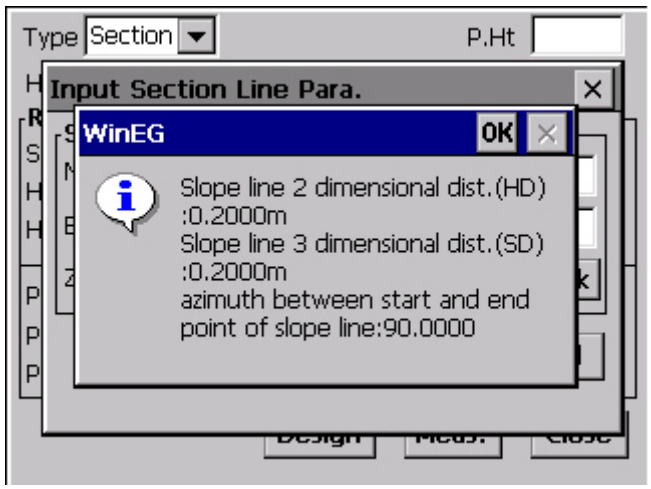
Designed value: click "Design", you will get the following dialog, see figure "Input line design parameter."



Input line design parameter

1. Input coordinates of starting Pt and ending Pt directly: Users can input coordinates of the setout segment into Input coord dialog, click OK to start setting out. （The coordinate won't be saved in this method.）

2. click “Pick”, the selecting dialog of LIST and ADD Coord will show at the bottom of Input coord interface, select or add the coordinate of starting Pt or ending Pt which are used to define a segment, see figure “Segment info”, and click OK to start setting out.



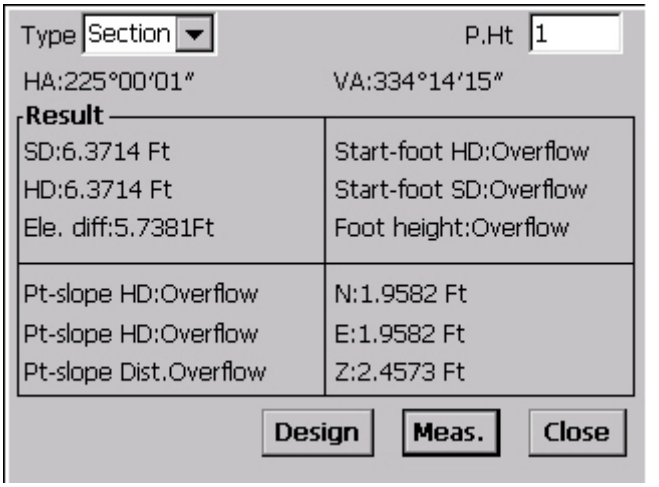
Segment information

Meas: to carry out measuring of distance and angle, calculate and show the difference between the designed segment and real-measured point, according to the input designed data. See figure “Calculated result of line segment setout”.

Repeat the operation of “moving prism→Measuring”; until each index meets the

precision requirement of setout, the line segment setting out is finished.

Close: to quit the line segment setout interface.



Calculated result of line segment setout

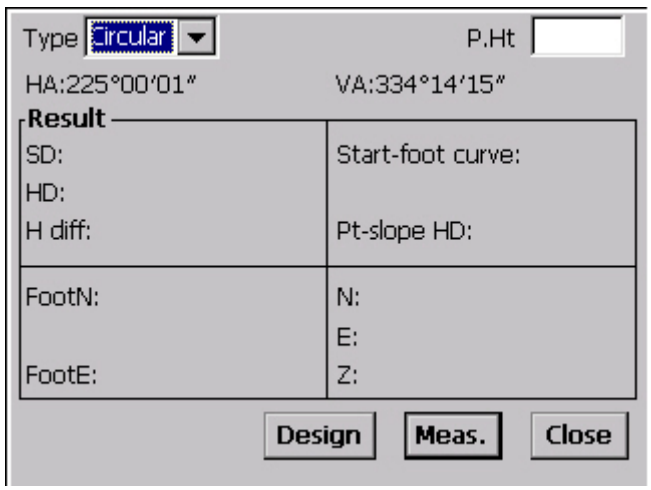
10. S.O.→Line→Arc

Principle: Use starting Pt, ending Pt and any Point on the arc to define an arc. Refer to measurement result to make the setout points on the defined arc.

Steps: same as line segment setout.

S.O.→Line→Arc

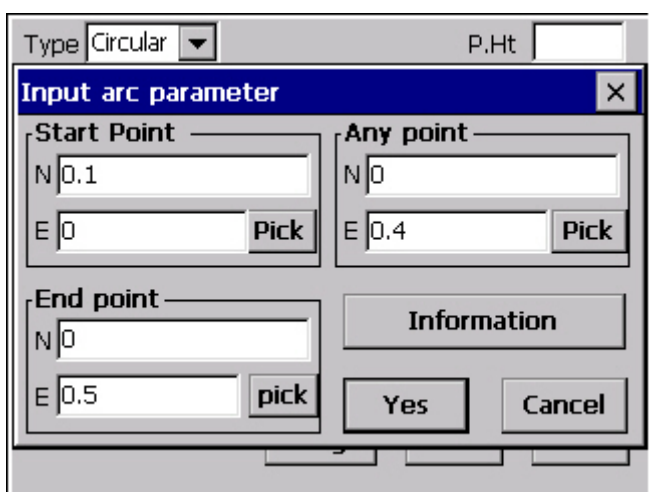
Click S.O.→Line→Arc, you will get the following dialog:



Arc setout

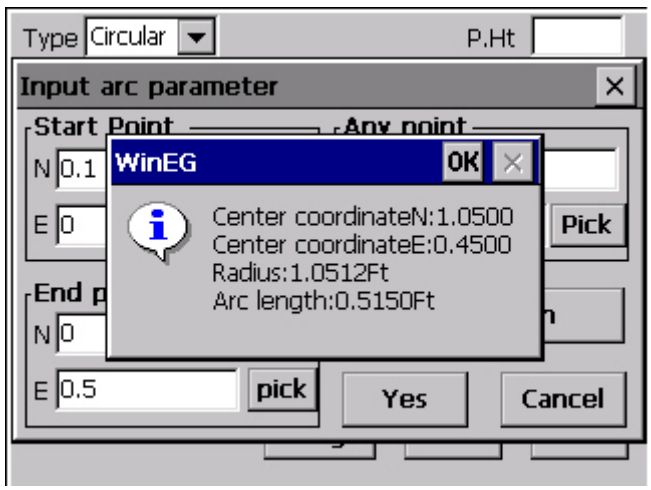
The interface placement of arc segment setout is same as radiate setout; refer to the "Interface Introduction" for the information of each area.

Designed value: Click "Design", you will get the following dialog. See figure "Input arc parameter":



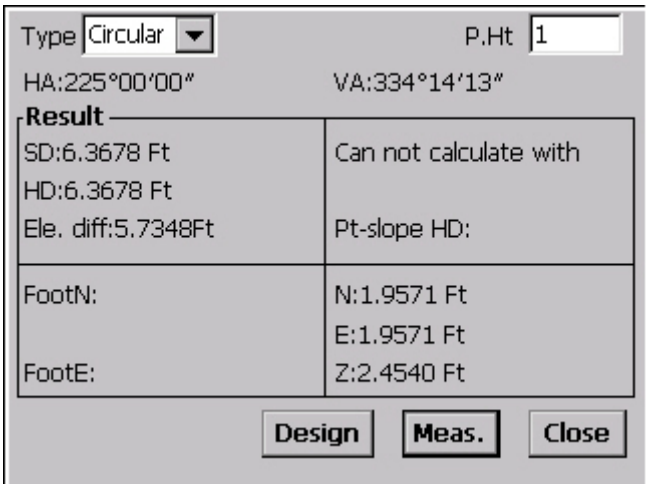
Input arc parameter

1. Input coordinates of starting Pt, ending Pt and any one Pt on the arc directly. Users can input coordinates of the setout arc into Input Coord. dialog; click Yes to start setting out. （The coordinate won't be saved in this method.）
2. Click “Pick”, the selecting dialog of List and Add Coord will show at the bottom of Input coord interface, select or add the coordinate of start Pt, end Pt and one discretional point on the arc which are used to define an arc, see figure “Arc information”, and click Yes to start setting out.



Arc Information

Meas: to carry out measuring of distance and angle, calculate and show the difference between the designed arc and real-measured point, according to the input designed data. See figure “Calculated result of arc setout”.
Repeat the operation of “moving prism→Measuring”; until each index meets the precision requirement of setout, the line arc setting out is finished.
Close: to quit the arc setout interface.



Calculated result of arc setout

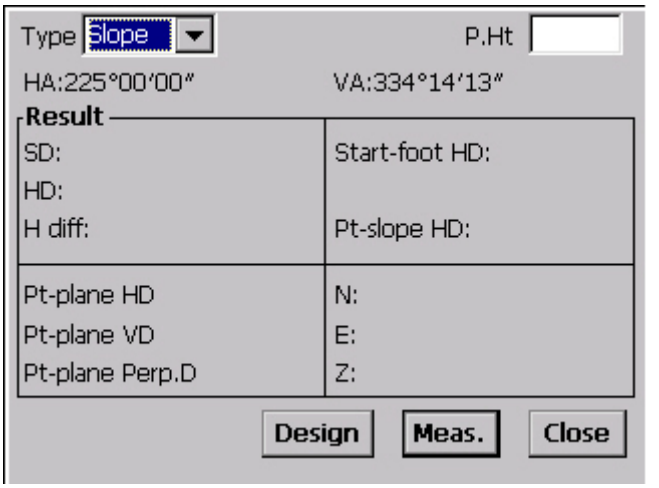
11. S.O.→Plane→Slope

Principle: define a slope, according to starting point, ending point, elevation, gradient and direction of slope.

Steps: Same as Arc Setout.

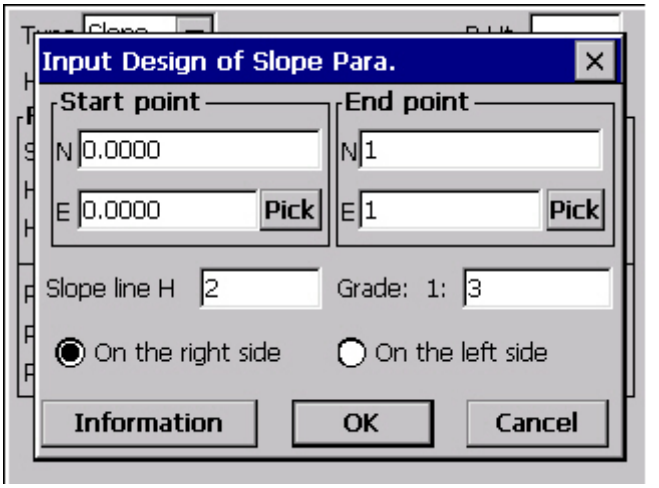
S.O.→Plane→Slope

Click S.O.→Plane→Slope, you will get the following dialog:



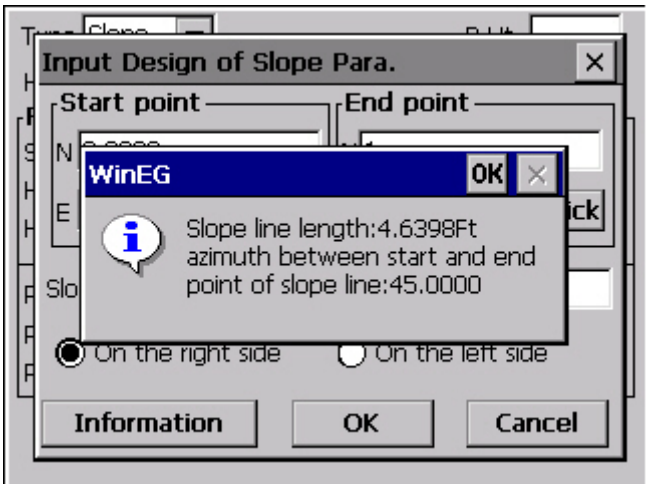
Slope Setout

Designed value: Click "Designed value", you will get the following dialog:



Input parameters of slope

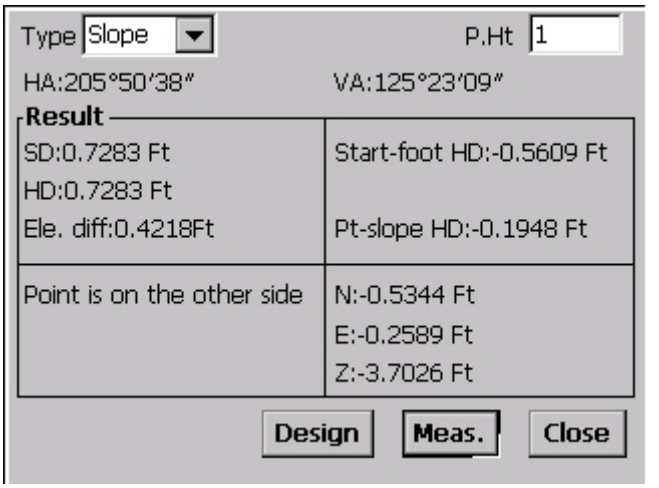
1. Input coordinates of starting Pt, ending Pt, elevation, gradient and direction of slope directly. Users can input coordinates of the setout slope into Input coord dialog, click Yes to start setting out. （The coordinate won't be saved in this method.）
2. Click “Pick”, the selecting dialog of List and Add Coordinate will show at the bottom of Input coord interface, select or add the coordinate of starting Pt, ending Pt, elevation, gradient and direction of slope which are used to define a slope, see figure “Slope info”, click yes to start setting out.



Slope info

Meas: to carry out measuring of distance and angle, calculate and show the difference between the designed slope and real-measured point according to the input designed data. See figure “Calculated result of slope setout”. Repeat the operation of “moving prism→Measuring”, until each indexes meet the precision requirement of setout, the plane slope setting out is finished.

Close: to quit plane slope setout interface.



Calculated result of slope setout

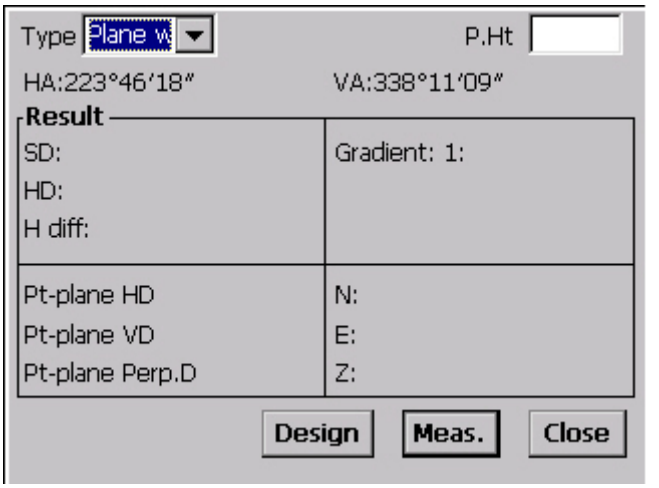
12. S.O.→Plane→3 Pts plane

Principle: Define a plane with three points.

Steps: Same as slope Setout.

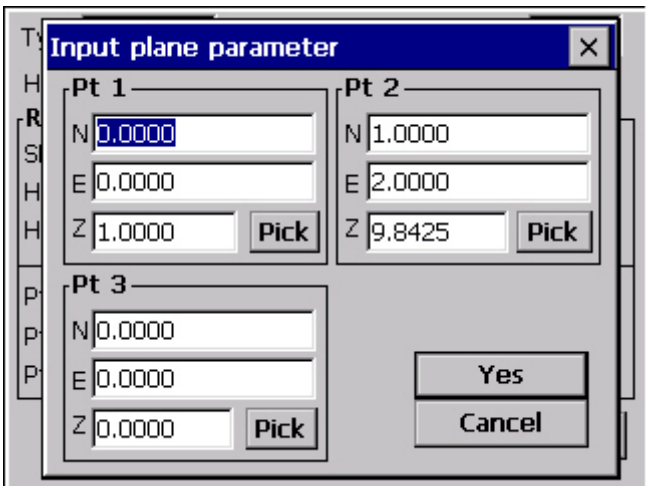
S.O.→Plane→3 Pts plane

Click S.O.→Plane→3 Pts plane, you will get the following dialog:



Three Pts plane

Designed value: Click "Designed value", you will get the following dialog:

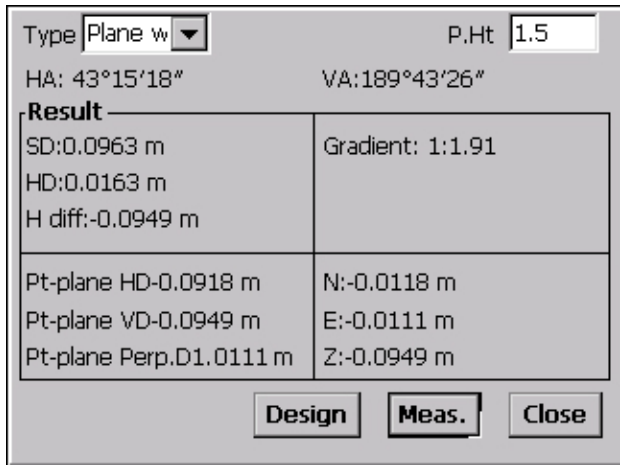


Input parameters

1. Input coordinates of point 1, point 2, and point 3 directly. Users can input coordinates into Input coord dialog, click Yes to start setting out. （The coordinate won't be saved in this method.）
2. Click “Pick”, the selecting dialog of LIST and ADD Coord Will show at the bottom of Input coord interface, select or add the coordinate of point 1, point 2, point 3 which are used to define a plane, click yes to start setting out.

Meas: to carry out measuring of distance and angle, calculate and show the difference between the designed plane and real-measured point according to the input designed data. See figure “Calculated result of three Pts plane setout”. Repeat the operation of “moving prism→Measuring”, until each index meet the precision requirement of setout.

Close: to quit three Pts plane setout interface.



Calculated result of three Pts plane setout

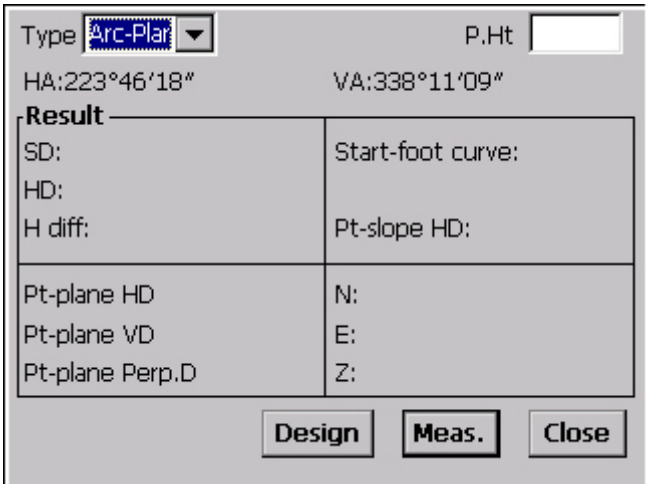
13. S.O.→Plane→Arc plane

Principle: define an arc plane according to three points.

Steps: Same as slope Setout.

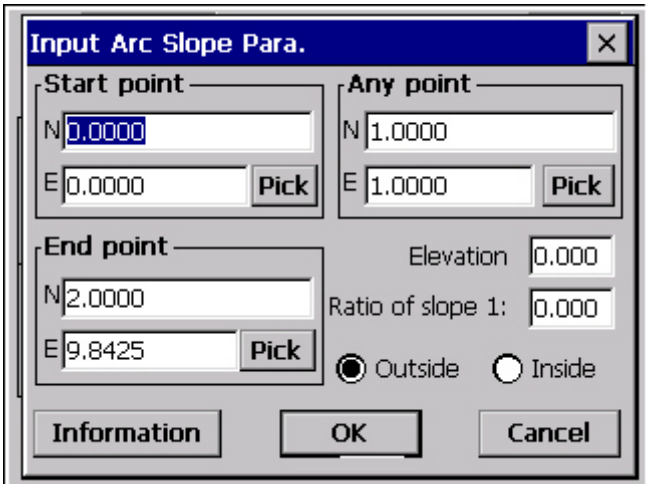
S.O.→Plane→Arc plane

Click S.O.→Plane→Arc plane, you will get the following dialog:



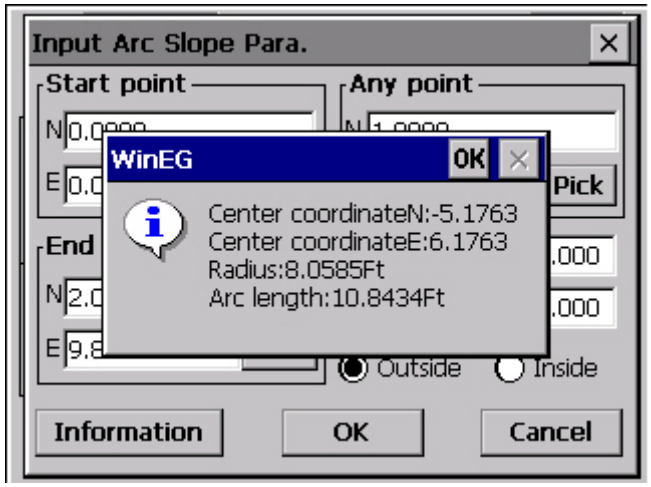
Arc plane Setout

Designed value: Click "Designed value", you will get the following dialog:



Input parameters

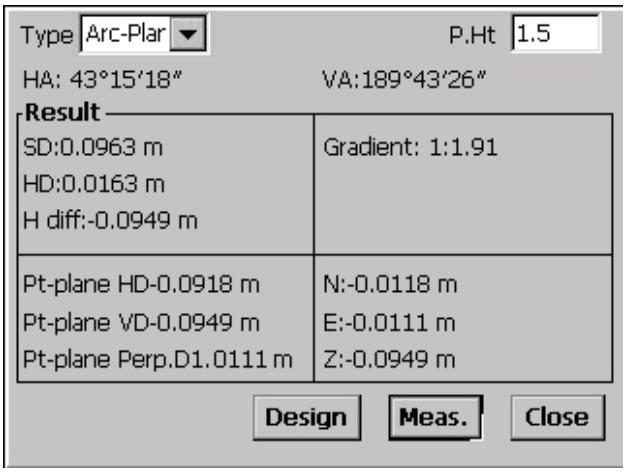
1. Input coordinates of starting Pt, ending Pt, any pt on arc line, elevation of arc line, gradient, and direction of plane directly. Users can input coordinates of the setout arc plane into Input coord dialog, click Yes to start setting out. （The coordinate won't be saved in this method.）
2. Click “Pick”, the selecting dialog of LIST and ADD Coord will show at the bottom of Input coord interface, select or add the coordinate of starting Pt, ending Pt, any pt on arc line, elevation of arc line, gradient, direction of plane which are used to define a arc plane, see figure “Arc plane info”, click Yes to start setting out.



Arc plane info

Meas: to carry out measuring of distance and angle, and calculate and show the difference between the designed plane and real-measured point according to the input designed data. See figure “Calculated result of arc plane setout”. Repeat the operation of “moving prism→Measuring”, until each indexes meet the precision requirement of setout.

Close: to quit arc plane setout interface.



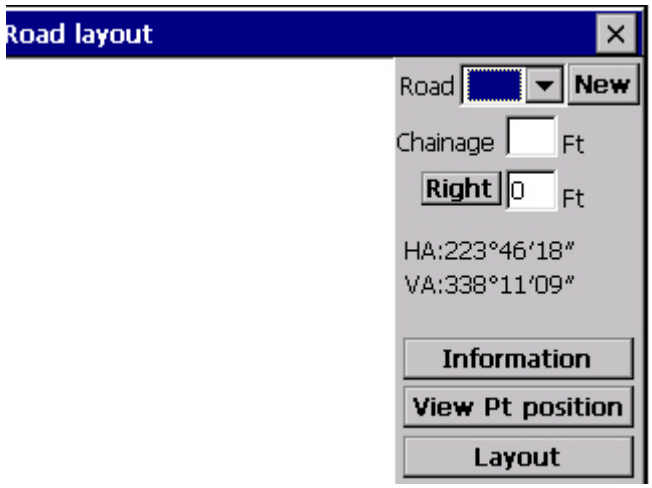
Calculated result of arc plane setout

14. S.O.→Road

Principle: define a road with designed road data.

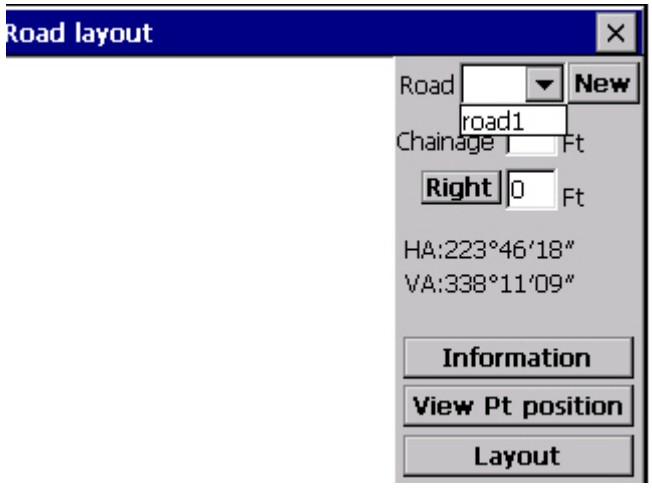
S.O.→Road

Click S.O.→Road, you will get the following dialog:



Road Setout

（1）Select road needed to setout from the dropdown list, as picture shown below:



Selecting road

After selecting, plane map of road would be drawn on the screen as shown below:

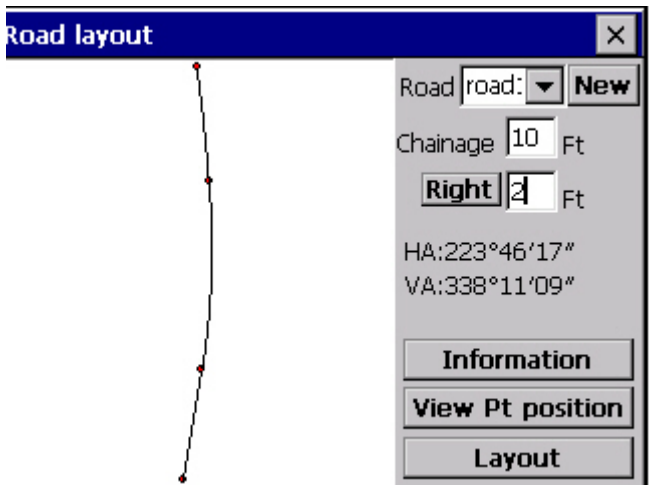
（2）Input Setout chainage in chainage edit box

（3）Select leftside or rightside of the midline. If leftside is selected. Click Right, and then if user needs to go back to rightside, click that button again. Input the distance between point and midline.

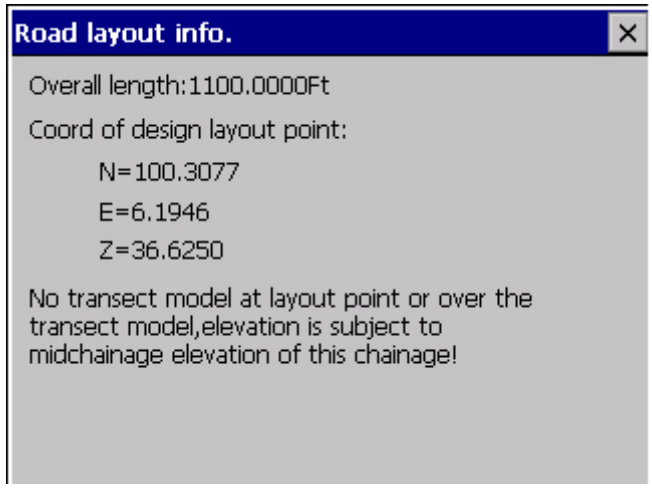
（4）Click Information, as “Road Setout information” interface shown below.

（5）Click Layout point position, as picture shown below:

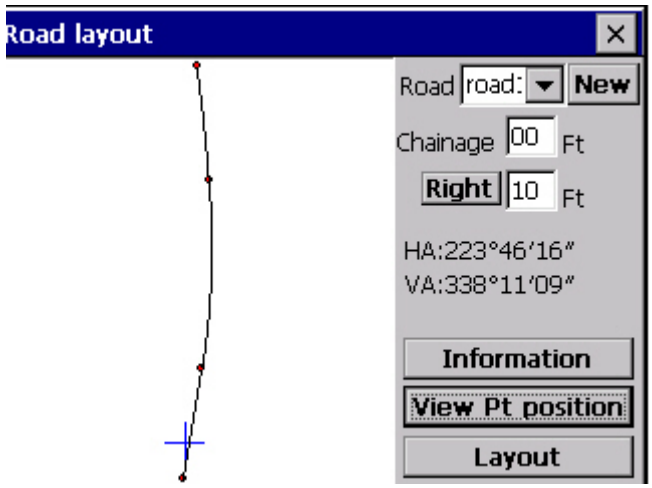
（6）Click Layout, as picture shown below:



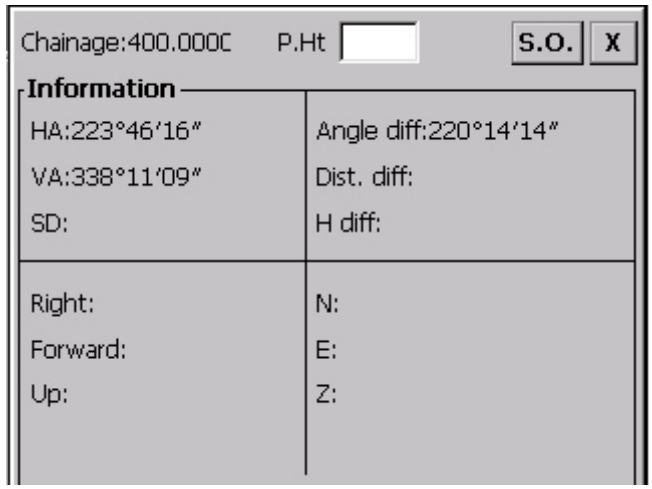
Road plane graph



Road Setout information

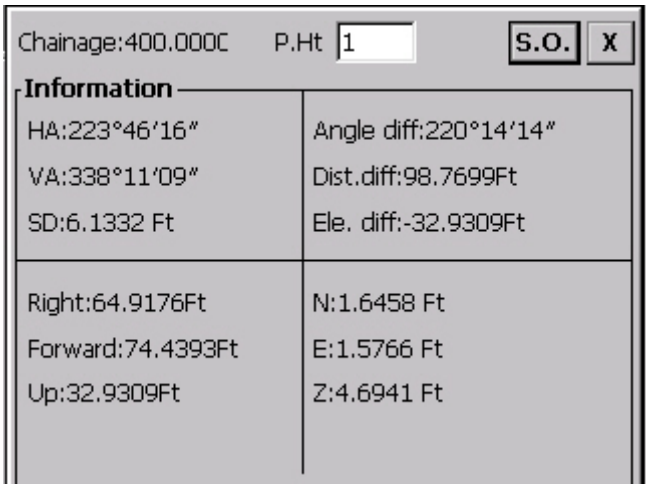


Layout point position



Road point setout

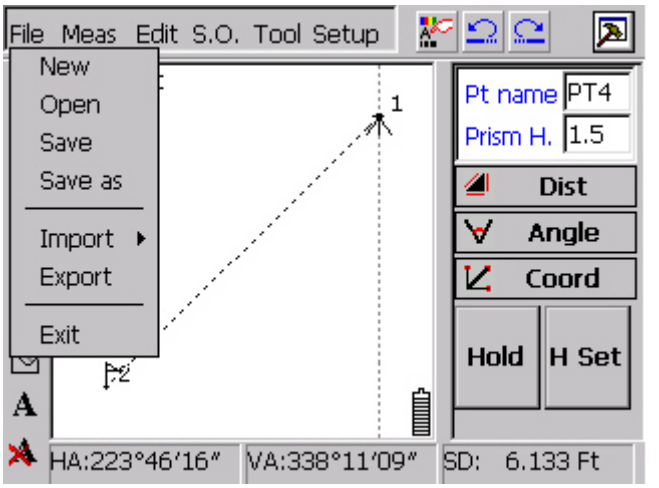
（7）Click S.O. in road Setout. Carry out measuring of distance and angle, calculate and show the difference between the designed chainage and real-measured point according to the input designed data. See figure "Calculated result of road setout". Repeat the operation of "moving prism→Measuring", until each index meet the precision requirement of setout.



Calculated result of road Setout

15. Function Introduction

15.1 File Menu



File Menu

1. New Project

Function: Create a project file with suffix * .prj.

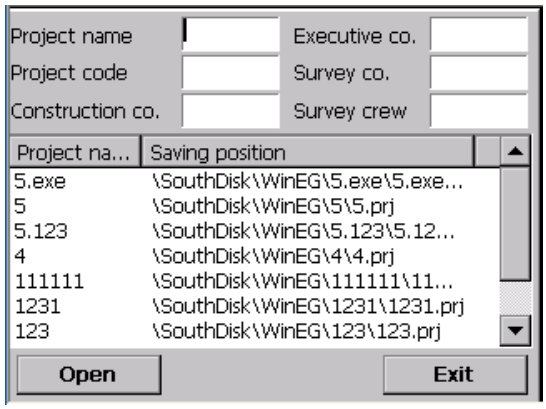
Operation: Click File→New, the system creates a blank job.

Note: When you create a new project during viewing last project, the system will ask whether to save project. Click Yes or No according to the needs.

2. Open project

Function: Open an existed project file with suffix * .prj.

Operation: Click File→Open, you will get the following dialog, see figure "File selecting dialog" select the project file you need.



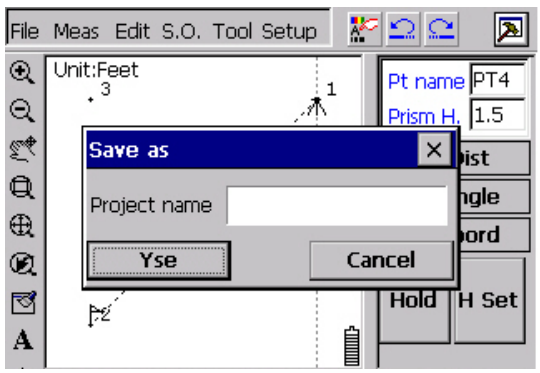
Select a File

Note: System will shut the current project off when you open a new project. Note to save the work.

3. Save

Function: Save current project.

Operation: Click File→Save, the system will save the project in your selected file route, with the format of *.prj. See figure "Save file":



Save a file

Note: If this is the first time to save the project, system will ask you to select a proper file name for the project. （see figure "Save file"）. When saving a project, users must save data into the disc directory of Genius software, i.e.: "SouthDisk". If the data is saved to other directory, it will be cleaned out after removing the battery.

4. Save as

Function: Save the current file with another name.

Operation: Click File→Save as, you will get the "Save as" dialog. Save it with a proper file name.

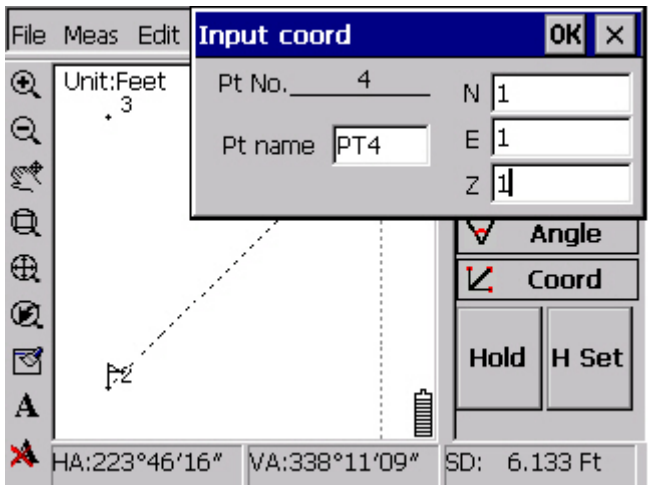
Note: When saving the file with another name, the project must be saved into the

"SouthDisk" directory.

5. Coord Import

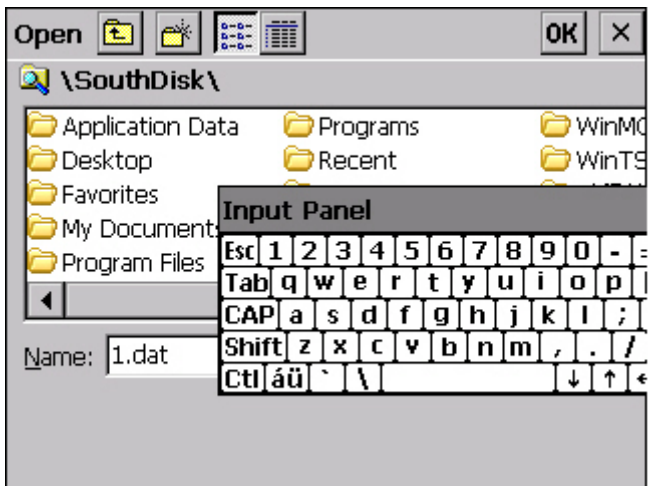
Function: Import the known coordinate to current project file. There are two methods to input: Manually Entry and Auto Import.

Operation: Click File→Import→Manual Entry, you will get the following dialog, input the Pt name and coordinates and then click OK, The input data of Pt coordinate will be saved to Project coordinate database. The system prompts to input the next point. After inputting coordinates, click × to quit Input Coord



Input Coord

Click File→Import→Auto Import, you will get the following dialog, select the data file（*.dat）which you need to import into this project. Click OK to confirm the importing. See figure "Open coord data":



Open coord data

6. Export

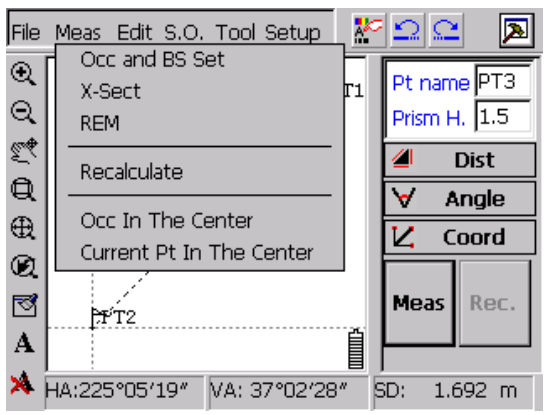
Function: Export coord data file to create CASS coord data file（*.dat）

Operation: Click File→Export, you will get the Save as dialog, input the file name, and then the coord data can be saved as *.dat format.

7. Exit

Function: to quit this software. System will give prompt to ask if you really need to save current project.

15.2 Meas Menu



Meas Menu

1. Occ & BS Set

Before collecting or setting out data, occupied point and backsight point must be set; otherwise all measured coord data are incorrect. Before Occ & BS Setting, known points have to be input first.

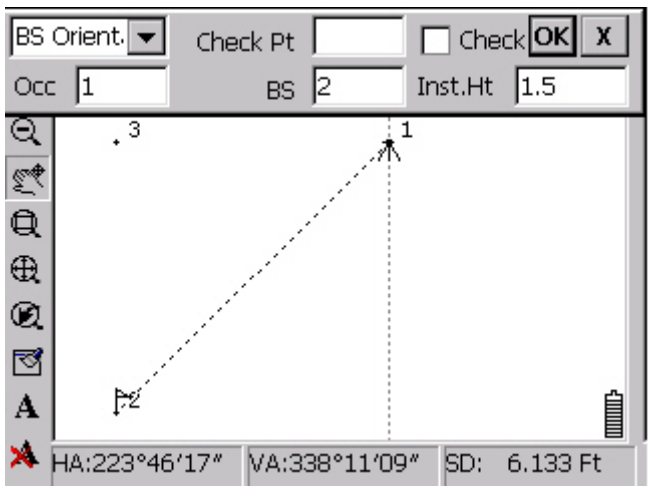
There are 2 ways to set the Occ & BS points: BS Orientation and Azimuth Orientation.

BS Orientation:

Click: Meas→Occ and BS Set, you will get the following dialog, see figure "BS Orientation", Select BS Orientation, the cursor first locates in Occ editing box. There are two ways to input Occ Pt: one is to press the numeric keys on the display board to input directly. If the Pt# doesn't exist, after clicking √, there would be a Notice: "Occ coordinate does not exist! Need to input manually?". The other one is that using the pen to select known point or control point on the touch screen. This requires zooming out the Occ Pt and BS Pt to current view. The two methods can be used to input BS point.

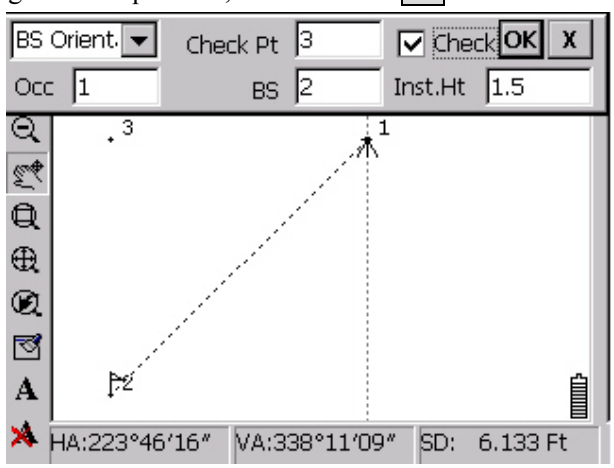
During orientation, the Inst. Ht is default as 1.5m, use steel tape to measure the Inst. Ht. accurately, and input this accurate value to the Inst. Ht item.

After inputting, rotate the telescope to sight the orientation Pt precisely, click √ to finish Occ & BS orientation. System will prompt: "Occ has been set successfully……", and then an Occ symbol shows at the occupied point, and a dotted line appears to connect occupied point and orientation point, indicating that orientation has been finished.

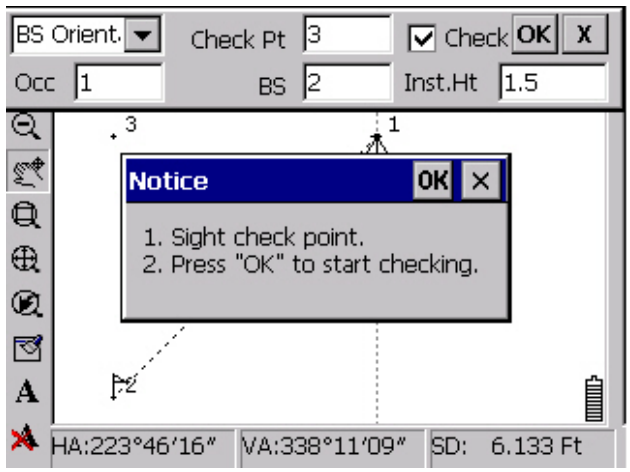


BS Orientation

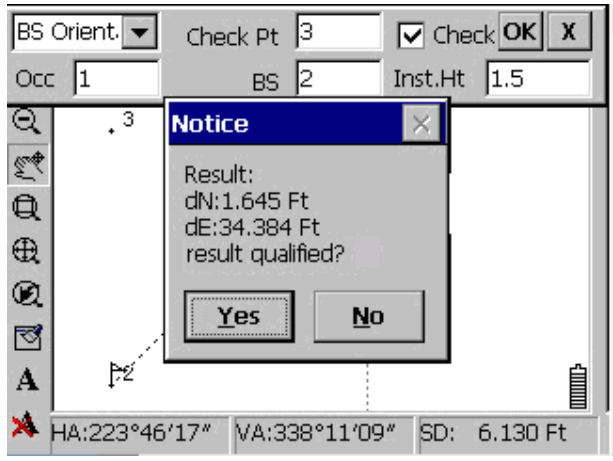
If there are checking points（known points）, you can check Occ Pt and orientation Pt. See figure "Check Occ Pt". Input Occ Pt, BS Pt and check Pt, and then click √ before Check, system prompts "1. Sight check point. 2. Press "OK" to start checking. See figure "Check Notice". Press OK to return to check result, see figure Check result. If the check result is disqualified, click No, system will return to the interface of Check Occ Pt. Users can adjust the telescope and do the Occ Pt checking again. Repeat this until the checking result is qualified, and then click Yes to finish Occ Pt checking.



Check Occ Pt



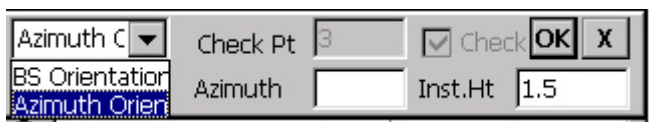
Check Notice



Check result

Azimuth Orientation:

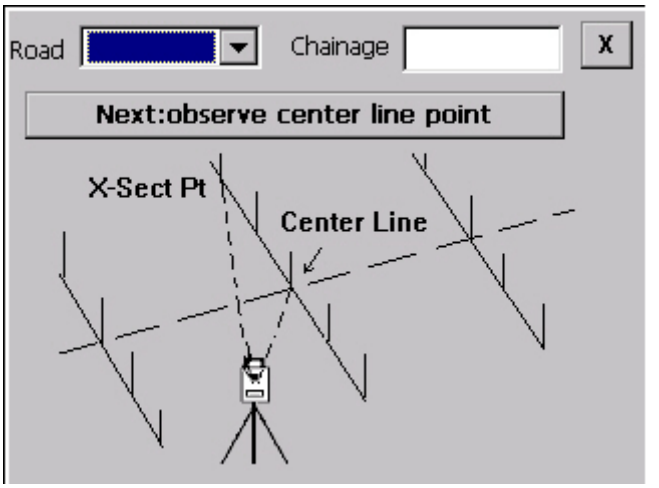
In the Occ Pt checking box select Azimuth Orientation, see figure "Azimuth Orientation", the BS changed into Azimuth, which requires to input BS azimuth as per the format of "degree, minute, second" manually. Other operations are same as BS Orientation.



Azimuth Orientation

2. X-Sect

After setting Occ, click Meas→X-Sect, as graph 'X-Sect':



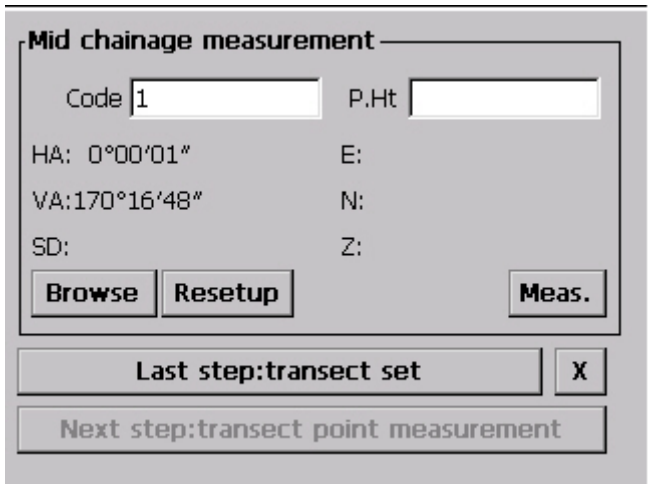
X-Sect

Setting occupied point before measuring transect. After that, click Meas→X-Sect, then get into window of measuring transects.

At the first time of measuring transect, user can input number of the road needed to measuring transect in the road list. Then input chainage in rightside chainage box, such as "Set road and chainage":

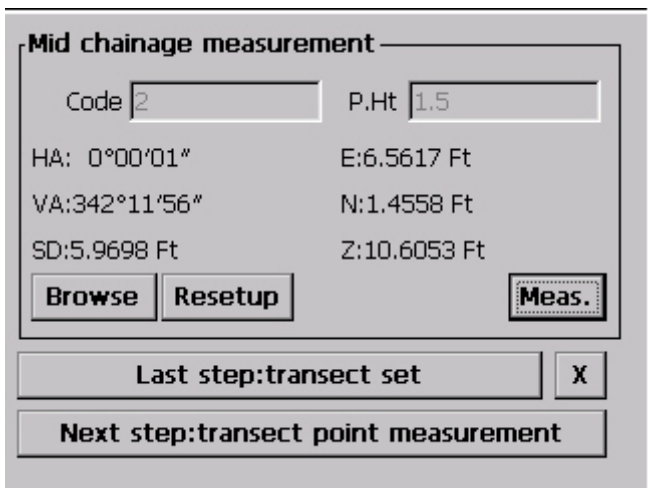
Set road and chainage

Click "Next: observe center line point" to get into midchainage observing window, as "Midchainage observing":



Midchainage observing

After inputting chainage code and prism height, rotating telescope to sight at prism on midchainage, click "Next: observe center line point". Window will show the observing result when measuring step is over, as picture show "Midchainage measuring results":

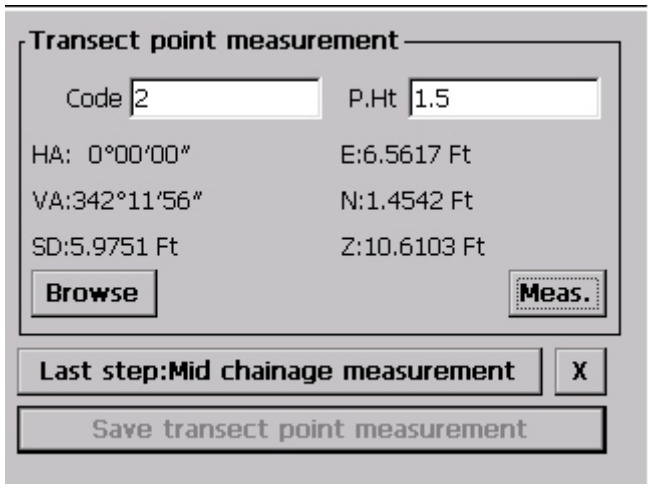


Midchainage measuring results

After measuring midchainage, click "Next step: transect point measurement" to get into the measuring step for transect point, as picture shows "Transect observing":

If at this time, it is required to reset transect, click "Last step: Transect set", system will save the transect data already measured, and to enter into next transect observing step.

If at this time, user finds that error of Occ setting or Occ has been changed, you can click "Resetup" to get back to Occ setting window. After user sets Occ correctly, system will get back to "Midchainage observing" dialogue box.

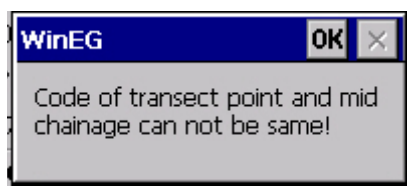


Transect observing

When observing the transect, transect point code will accumulate automatically and user can change the code and prism height.

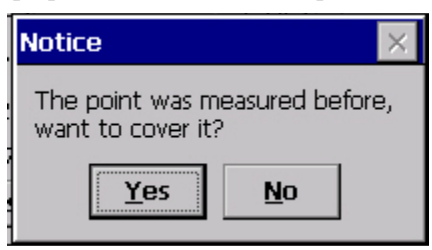
After rotating the telescope to sight prism put on transect, click "Meas" to enter into window for transect point observing. When a transect point measurement is completed, click "Save transect point measurement" to save the observing data. System will show automatically next window for transect observing, code will accumulate 1; prism height will be the same as last time.

Notice: If user has changed code, and code is the same as midchainage code, system will pop up a notice box, show as picture "Notice 1".



Notice 1

If user has changed code, and the transect code has already existed at former transect code, system will also pop up a notice box, show as picture" Notice 2".



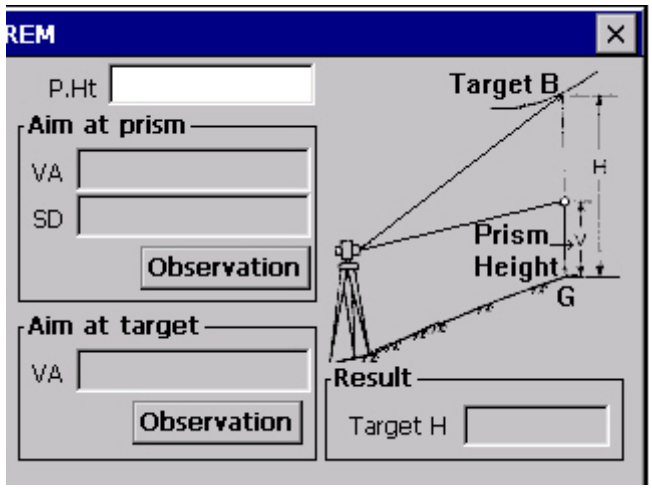
Notice 2

Clicking “Yes” will cover all of the measured data, if click “No”, system will turn back to transect point observing window to wait for modifying code and save transect observing data again.

Click “Browse” in window of transect observing, all of the Occ and observing information could be viewed. Click “×”to quit transects observing.

3. REM

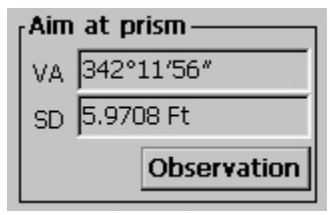
Click Meas→REM to get into remote height window, show as picture “REM”:



REM

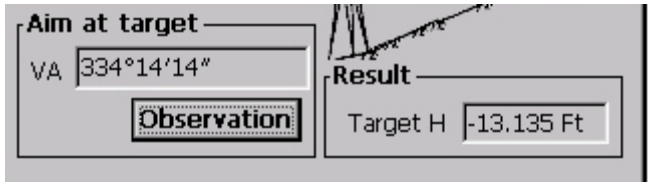
In REM dialogue box, default prism height is empty; user can change the prism height.

First step: Rotate telescope to sight at the prism on basic point and click “Observation”, system will show back the vertical angle and SD of prism, as picture shows “Sight prism”:



Sight prism

Second step: Rotate telescope to sight the point needed to observe, click “Observation”, system will show back the vertical angle of observing point and show the result of the height of observing point. Show as picture “Calculation results”:



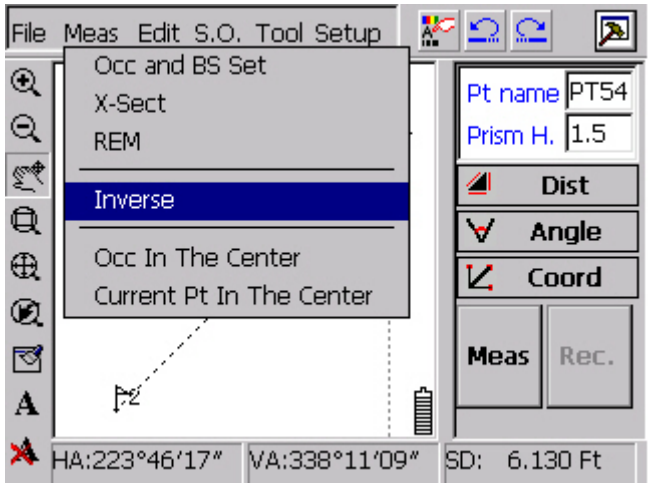
Calculation results

Notice: If user need to change the prism height after calculation result showed, then need to click "Observation" to recalculate remote height.

4. Coordinate recalculation

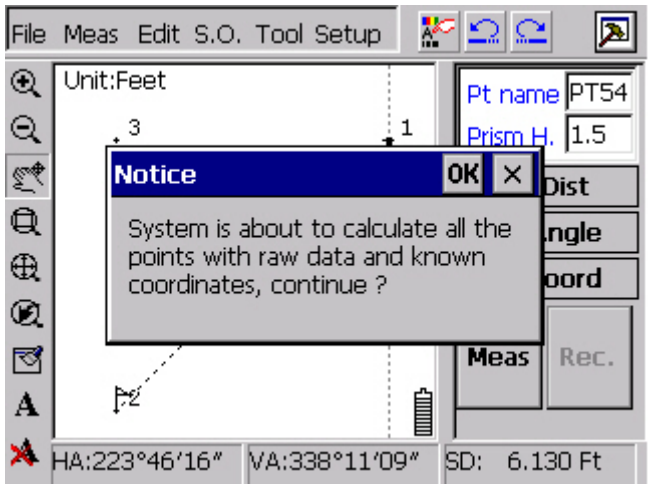
This function recalculates coordinate data of drawing graph, according to raw data. User should use this function to recalculate coordinate after modifying error of raw data.

Click menus in turn: Meas→Inverse, as graph "Inverse menu" below:



Inverse menu

Dialogue box showing as below will pop up:

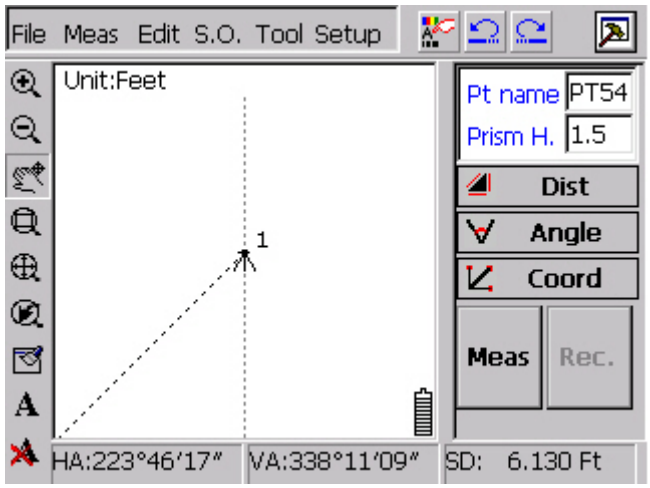


Coordinate recalculation notice

Click "Yes" to recalculate, click "No" to turn back to software main window.

5. Centering the Occ

In measuring process, surveyor usually needs to find the location of Occ quickly. Click Meas→Occ In The Center, current Occ would be centered and shown on screen. The display scale would be the same as before. As picture shows below:

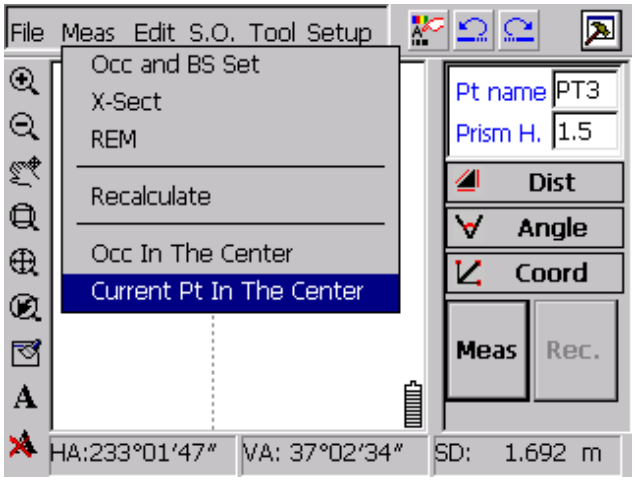


Centering Occ

6. Centering point

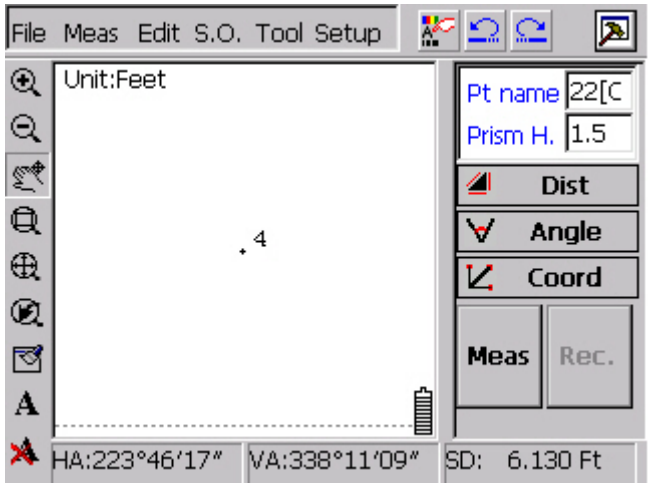
This function could make the last measured point centered and shown on screen.

Click menus in turn: Meas→Current Pt in The Center, as picture shown below:



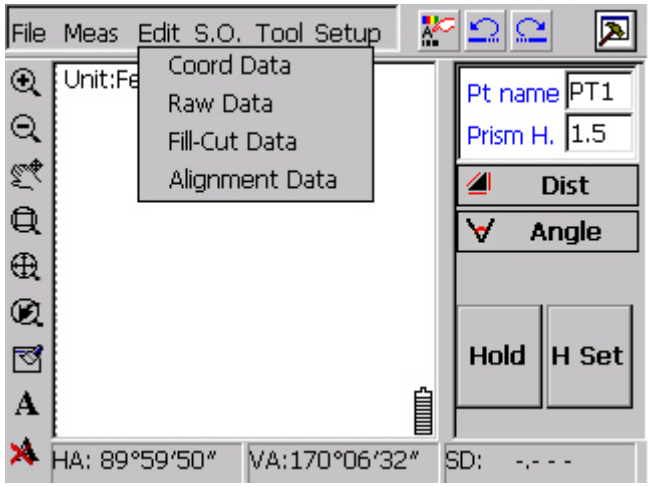
Centering point menu

At this time, the 4th point measured would be centered and shown on screen, shown as picture:



Center and display point

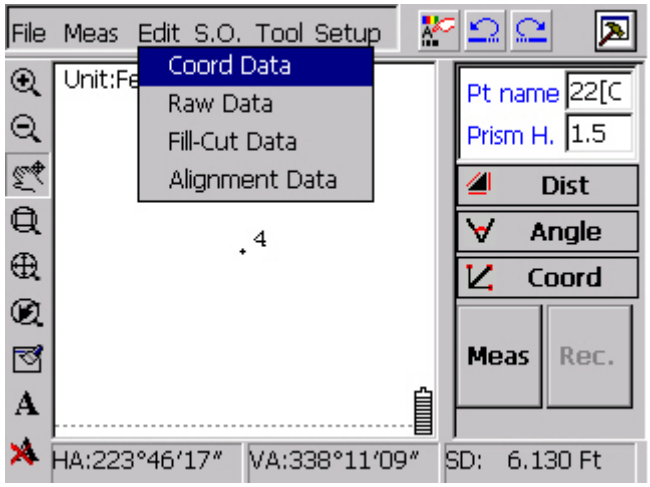
15.3 Edit menu



Edit menu

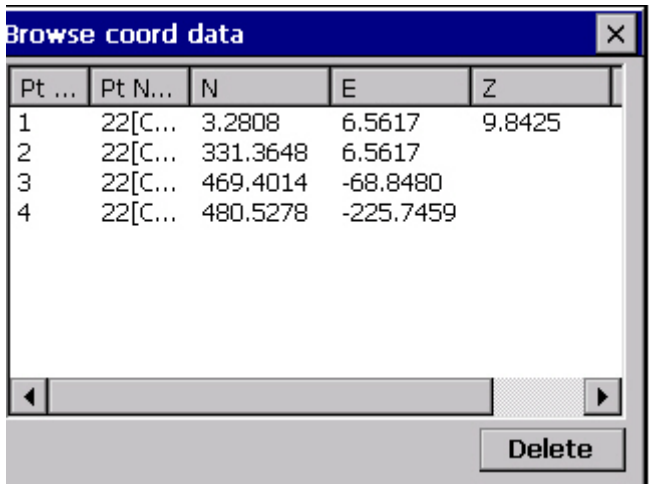
15.3.1 Coordinate data

Click Edit→Coord data, show as picture below:



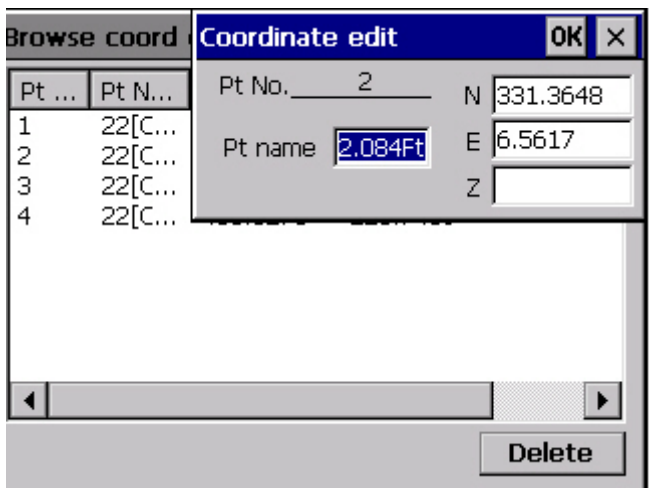
Edit menu for coordinate data

Click “Coord data” to get into view coordinate dialogue box, shown as picture below:



View coordinate data

Contents shown in “View coordinate” window by sequence are point number, point name, coordinate X, coordinate Y, coordinate Z. Use pen click one of coordinate records. System will pop up edit window of this coordinate record, as picture shown below:



Edit coordinate

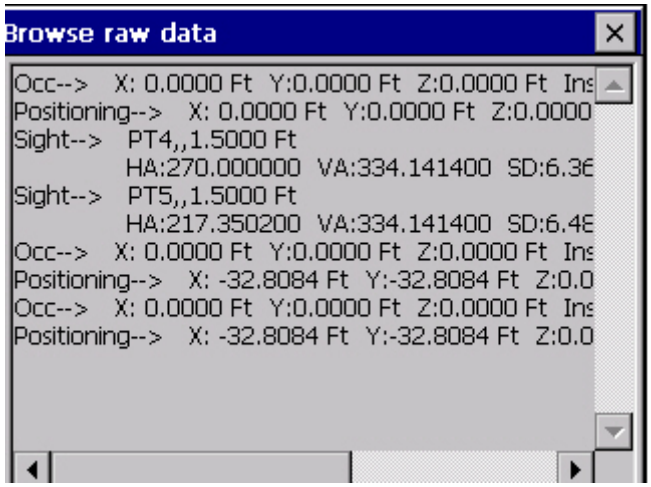
User could edit the point name and coordinate of this point with coordinate edit window.

Click “OK” to confirm edit after modifying the coordinate and turn back to coordinate view dialogue box or click “×”directly to cancel edit and turn back to coordinate view dialogue box.

If user needs to delete one coordinate record, could use pen choose this record, and click “Delete” in coordinate view window to delete record.

15.3.2 Raw Data

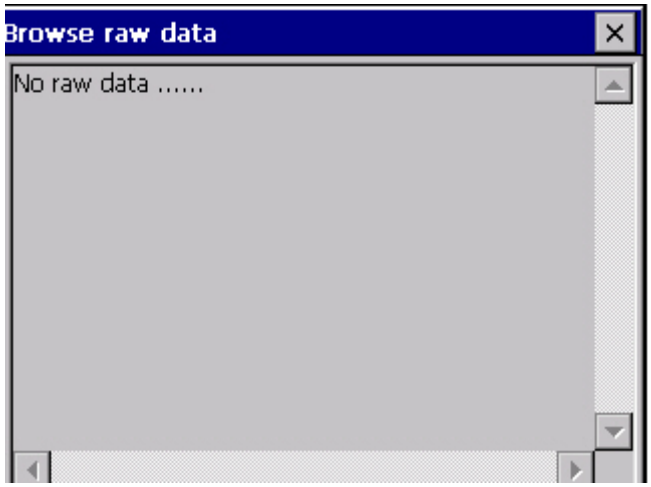
Click Edit→Raw data, as picture showed below "View raw data":



View raw data

Occ information, position information and sight point information of project are included in raw data view dialogue box. Date in dialogue box only can be viewed, not be modified.

If there is no raw data record before, the view dialogue box will show as below:



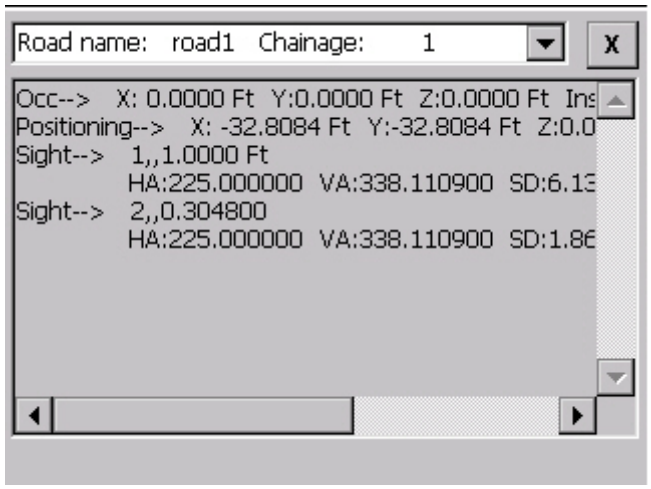
No raw data

15.3.3 Fill-Cut Data

Click Edit→Fill-Cut Data, as picture "Fill-Cut Data" show:

User can select the road and chainage needed to view from the "Road name and chainage" dropdown list. Corresponding Occ information and each transect point observing information would be showed at synchronizing data display area downside of screen.

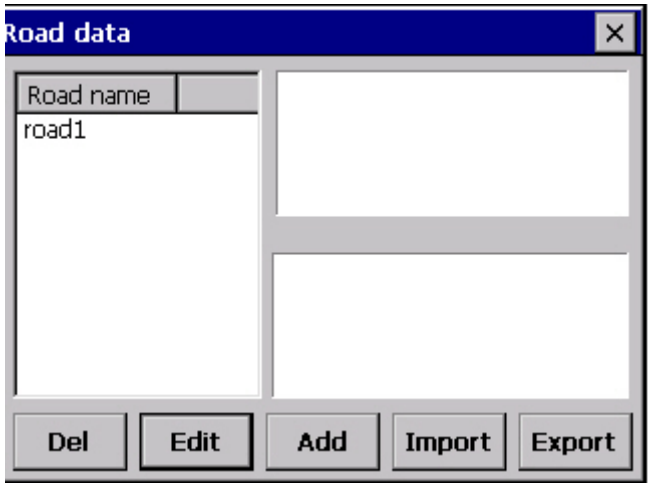
Notice: Data in dialogue box can only be viewed, not be modified.



Transect observing data

15.3.4 Alignment Data

Click Edit→Alignment Data, design window for road will pop up, as picture show "Road design".



Road design

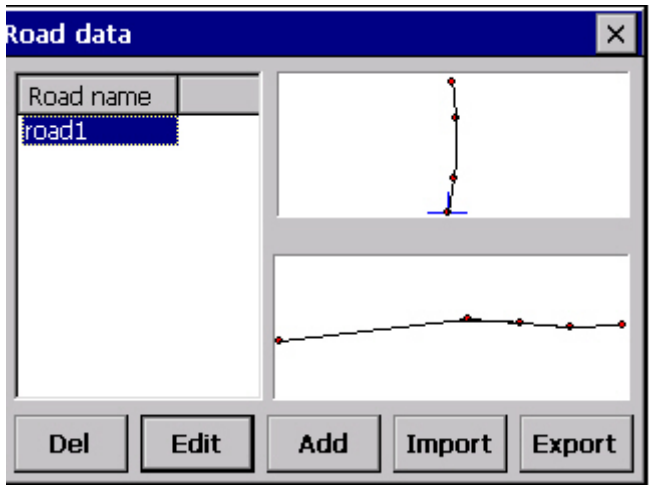
In road design window, functions of four icon downside from left to right are: Del.: delete the road design data user selects. Edit: edit and modify the horizontal and vertical alignment of road user selects. Add: add one road alignment data. Import: input road design data from files. (Suffix of road design is rod, please refer to "Appendix A: File forms for Engineering genius" about rod form.).Export: export the selected road design data and save them as file form.

Add road design data:

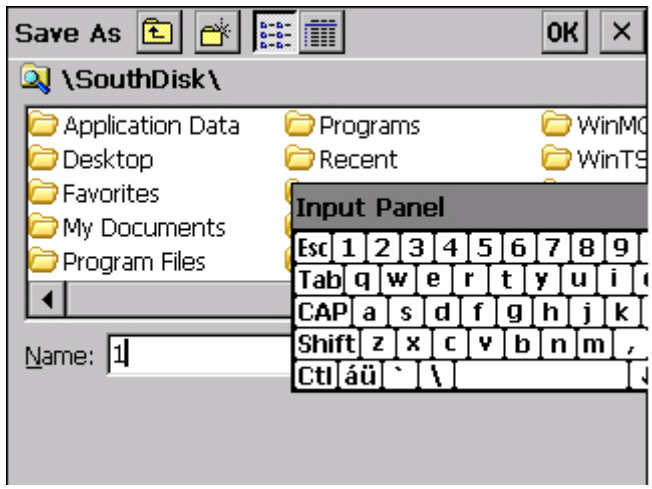
Refer to "Edit→Alignment Data" to get more details

Export road design data:

Choose the road name needed to export, as picture "Select road" shows. Use pen to select the road needed to export from road name list. When one road is selected, chose road name would be brighter, and the horizontal, vertical alignment graph would display. Click Export, system would pop up a "save as" dialogue box, input the file name needed to export at the name box. As: Road 1, as picture showed below:



Select road



Export road name

Edit road design data:

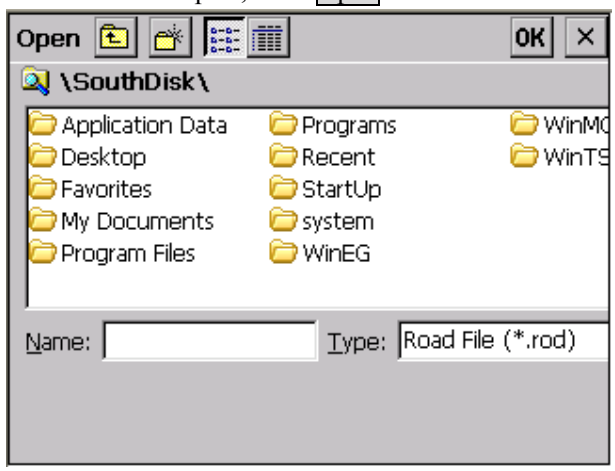
Refer to "Edit→Alignment Data" to get more details

Delete road design data:

Select road name needed to delete from road list, as picture showed "Select road". When one road is selected, chose road name would be brighter, and the horizontal, vertical alignment graph would display. Click Del., Notice dialogue box would pop up, as picture showed below. OK Delete, X Cancel.

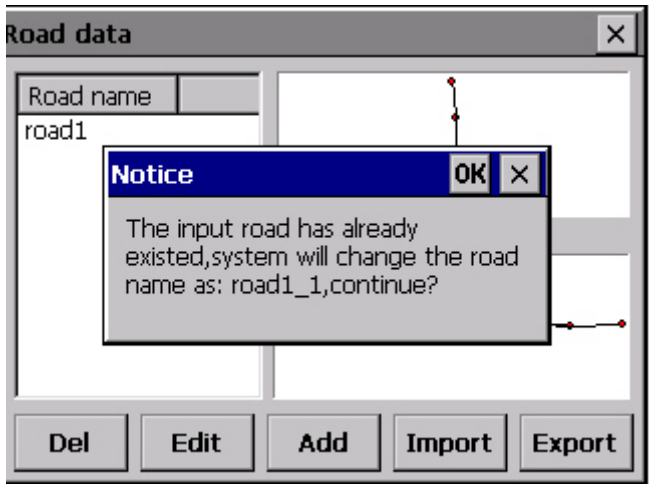
Import road design data:

In picture "Road design", click Import; "Open file" dialogue box would pop up. Select the file name needed to import, click Open:



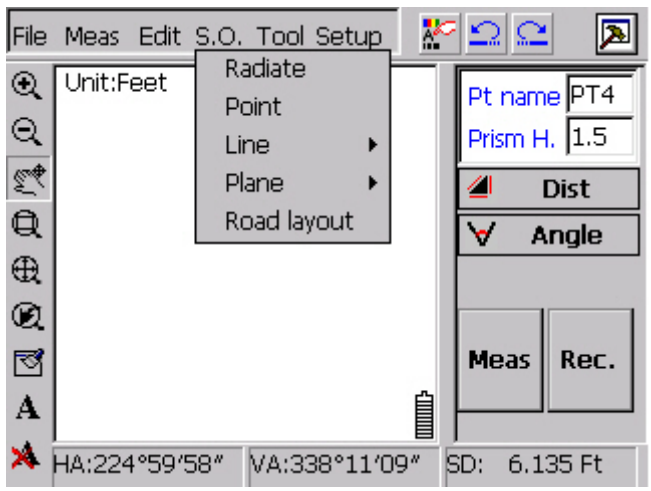
Open file

If there is same file in imported files as the road name in road name list, dialogue "Same road name" would pop up automatically, and modify the road name in imported files. OK Continue, X Cancel.



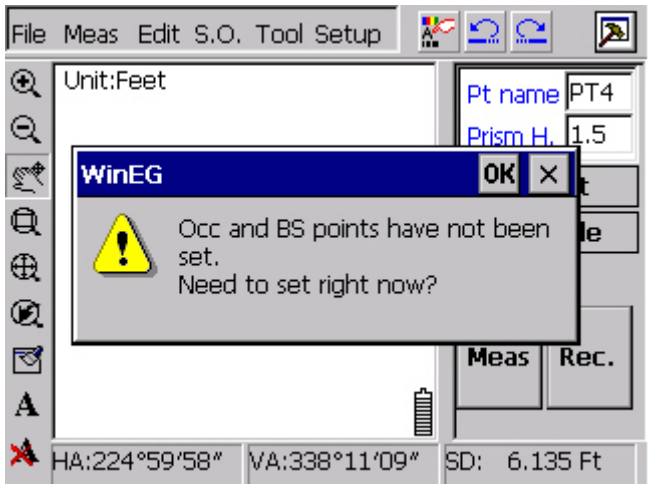
Same road name

15.4 S.O. menu



S.O. menu

Notice: Before Setout starts, user must complete setting Occ correctly. If still not set Occ, system will notice that needing user to set Occ first when any Setout function is clicked. Showed as picture" Set Occ notice"

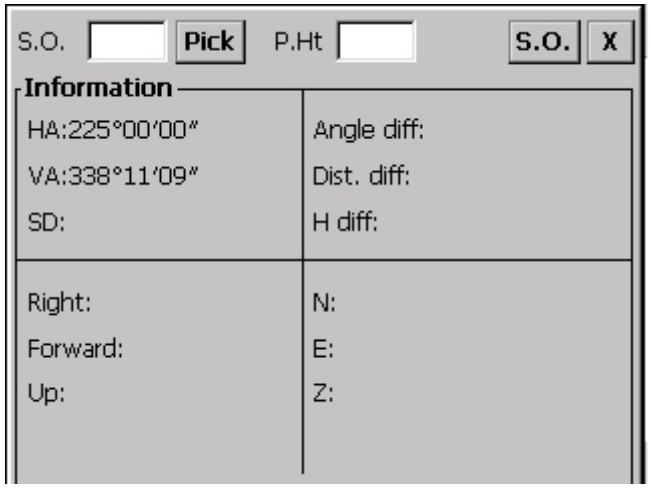


Set Occ notice

Select "OK", system would enter into Occ set automatically, if choose "X", system would give up setting Occ and turn back to main menu directly.

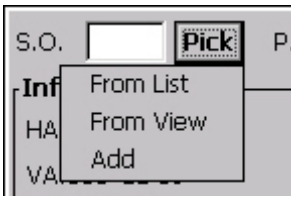
15.4.1 Radiate Setout

Function: set equipment at one reference point, get accurate position information of known point according to the angle from the line passes through known point and Occ to zero direction of Occ and the distance from Occ to known point.



Radiate Setout

Click Select at rightside of Setout point input box, Setout point choosing dialogue box would pop up under the Setout point input box, as below:

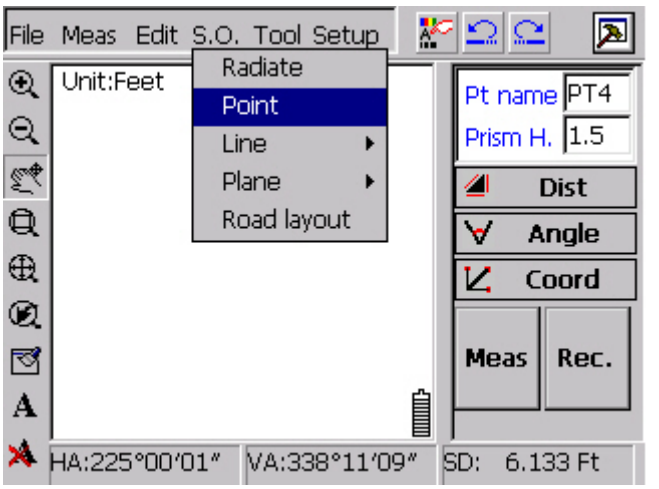


Refer to "S.O.→Radiate" to know more about details.

15.4.2 Setout point

Click S.O.→Point. As picture "Setout point menu" showed.

Refer to "S.O.→Point" to know more about details.

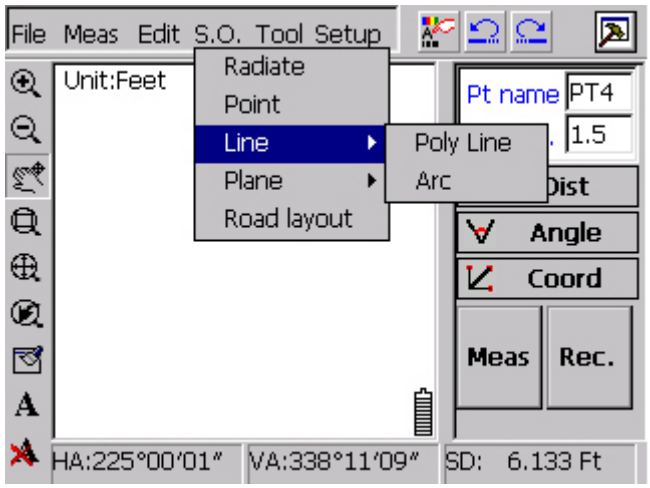


Setout point menu

15.4.3 Setout line

Click S.O.→Line. As picture "Setout line menu" shows.

Refer to "S.O.→Line→Poly Line", "S.O.→Line→Arc" to know more about details.

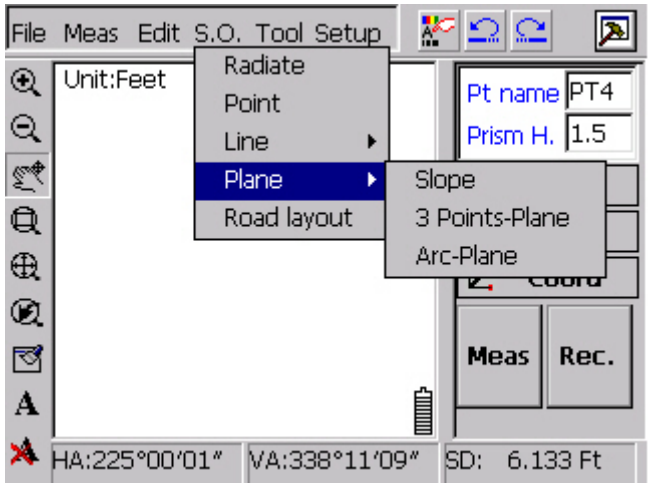


Setout line menu

15.4.4 Setout plane

Click S.O.→Plane. As picture "Setout plane menu" showed.

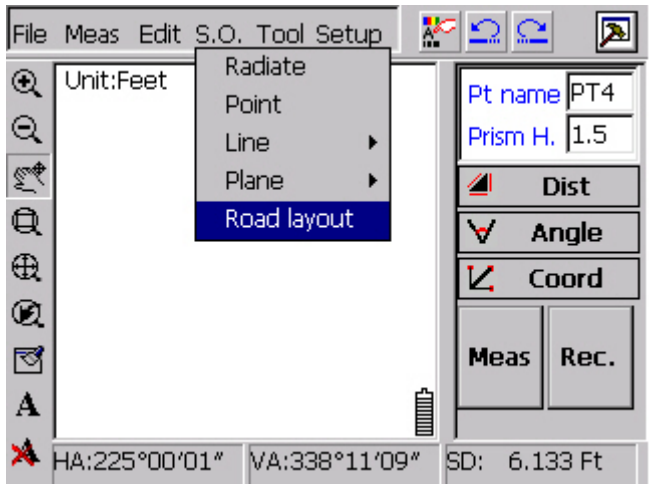
Refer to "S.O.→Plane→Slope", "S.O.→Plane→3 points-plane", "S.O.→Plane→Arc plane" to know more about details.



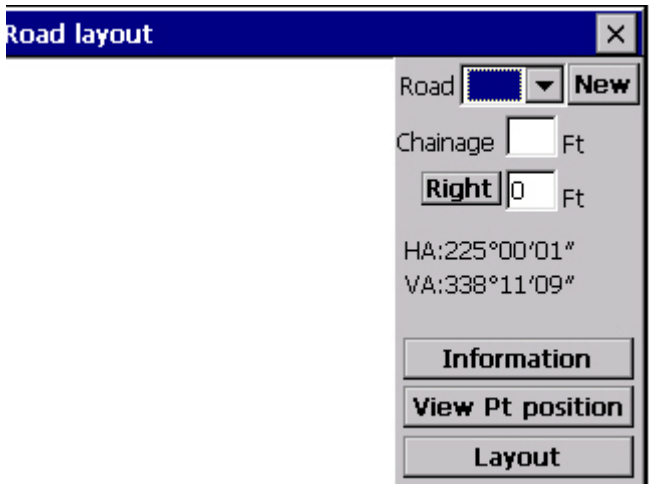
Setout plane menu

15.4.5 Road design

As picture shows "Road Setout menu". Click S.O.→Road layout, graph showed as below:



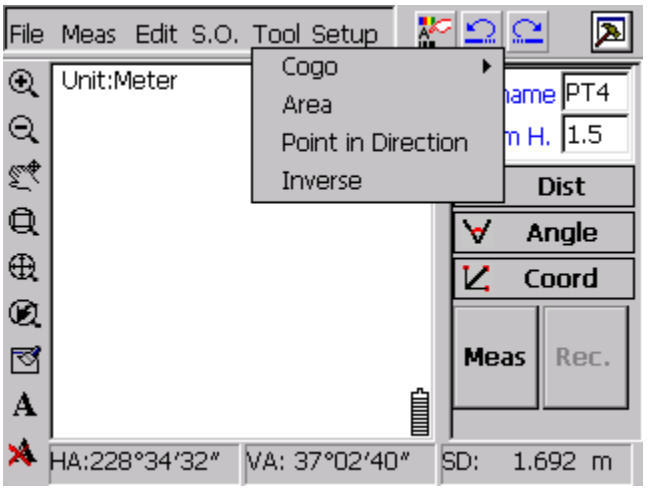
Road Setout menu



Road Setout

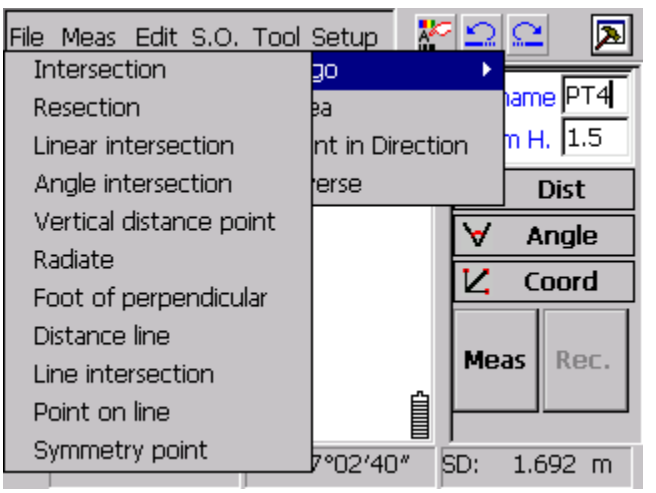
Refer to S.O.→Road layout to know more details about Setout.

15.5 Tool menu



Tool menu

15.5.1 COGO



COGO menu

In WinMG2007 software, COGO contains Forward Intersection, Resection, Linear Intersection, Angle Intersection, Radiate, Foot of perpendicular, Distance line, Lines Intersection, Point on line, Symmetry point eleven coordinate calculating functions.

Each coordinate calculating function has simple picture to instruct. System supplies manually input, capture on screen with pen and select from coordinate list three types methods to input point number at every place where to input point number.

If coordinate has already existed at the point we need to calculate, software will reserve a coordinate data which has same coordinate with the existed point. And the point number of that new point will be equal to the sum of the max number of existent point number plus one. Software will show the notice of failure if there is no such intersection.

Forward intersection

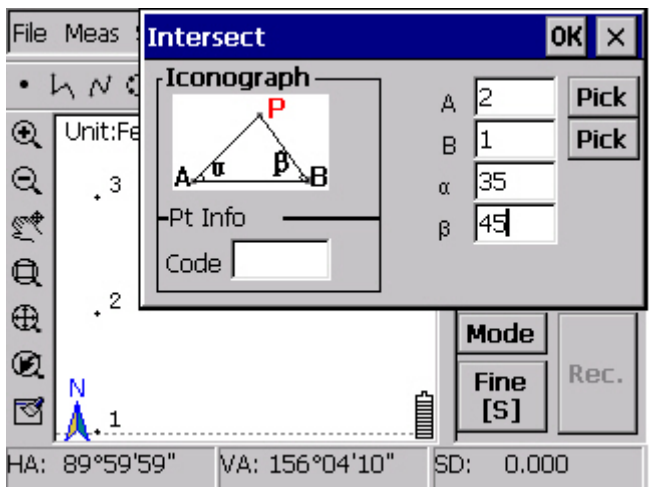
According to forward intersection, we have point 1, point 2, both of them are known points. Set occupation at these two points and get value of ∠1, ∠2, to calculate unknown point P. The mathematical model as below:

$$xP=\frac{x1\times ctg\angle 2+x2\times ctg\angle 1-y1+y2}{ctg\angle 1+ctg\angle 2}$$

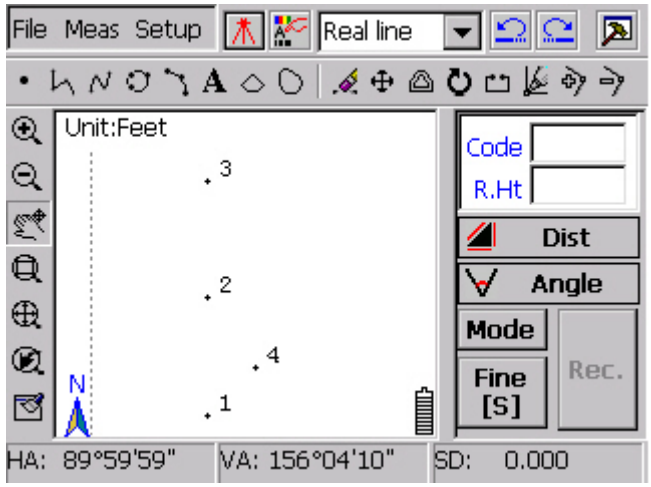
$$yP=\frac{y1\times ctg\angle 2+y2\times ctg\angle 1-x1+x2}{ctg\angle 1+ctg\angle 2}.$$

As picture ‘Forward intersection’ shows, point 1 and point 2 are known, input angle value and click OK. Point position will be shown on the screen, new point number will be equal to the sum of the max number of existent point number plus one. As No.5 point in picture ‘Forward intersection results’.

Notice: The intersection points locate in the leftside of the direction of forward motion.



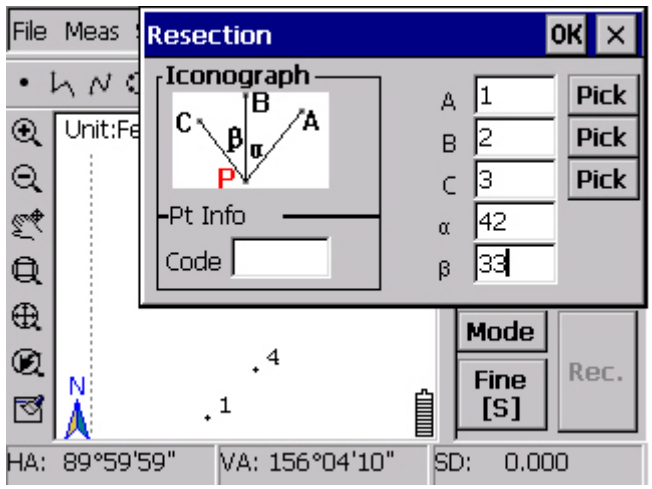
Forward intersection



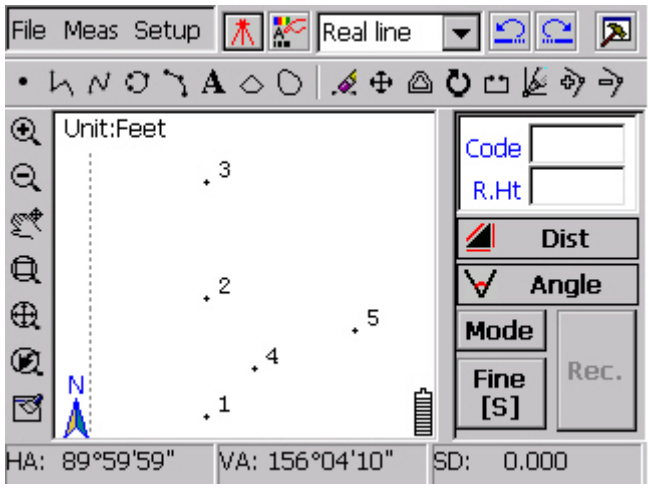
Forward intersection results

Resection

According to resection, we need three known points 1, 2, 3, two known angles α β, click OK. Intersection position will be shown on screen, new point number will be equal to the sum of the max number of existent point number plus one. As point 6 in picture 'Resection results'.



Resection



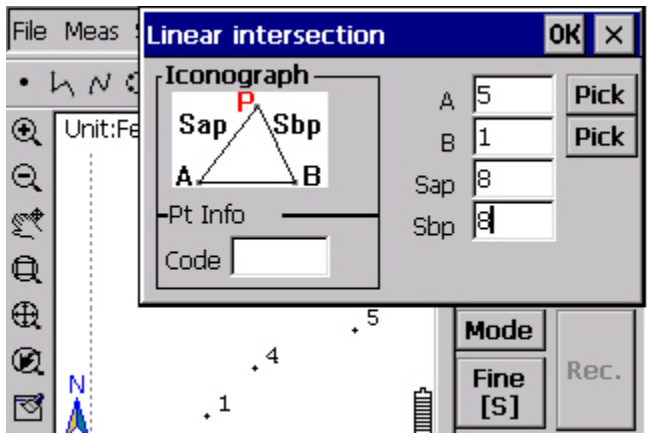
Resection results

Linear intersection

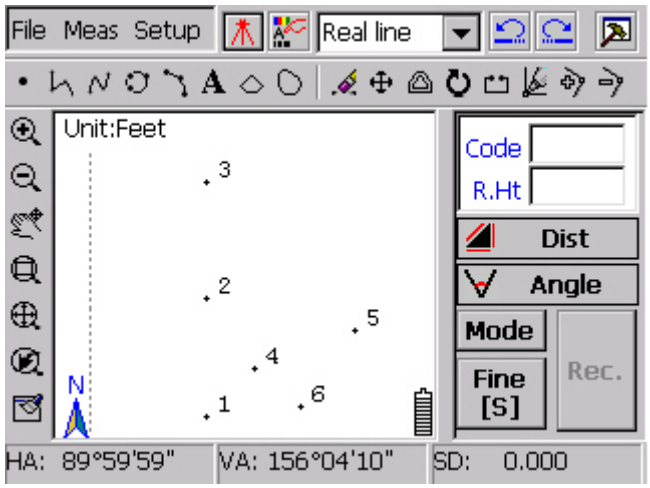
According to linear intersection, we need to set occupation at point P, get two distances from point P to point 6 and to point 1, to calculate coordinate of point P.

As picture 'Linear intersection' shows, point 1 and point 6 are known points, input the distances from two known points to intersection point P. Click OK, Dialogue will show P number as 7.Point P position will be shown on screen m and new point number will be equal to the sum of the max number of existed point number plus one. Shown as point 7 in the picture 'Linear intersection results'.

Notice: The intersection points locate in the leftside of the direction of forward motion.



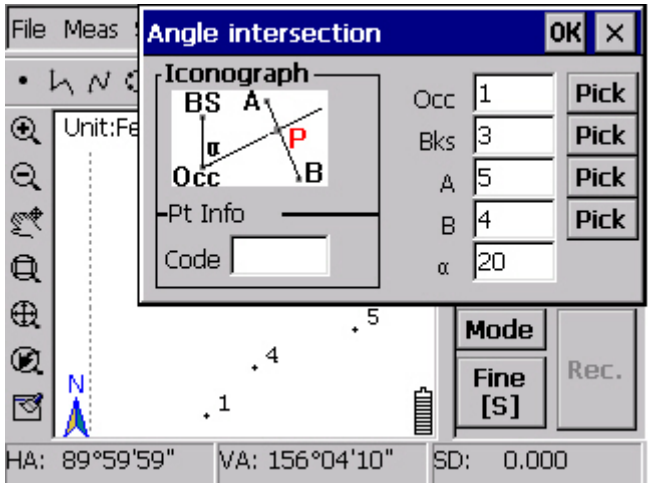
Linear intersection



Linear intersection results

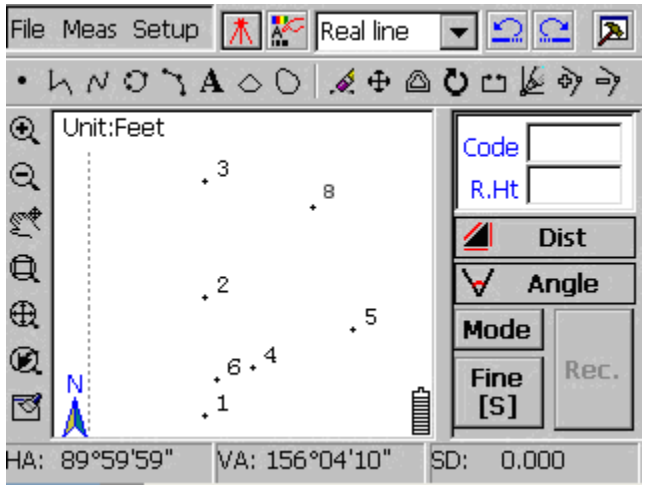
Angle intersection

In practical measuring, some problems like finding no place to put prism will appear. If unknown point and the two known points are on same line, you can use this function to get point P.



Angle intersection

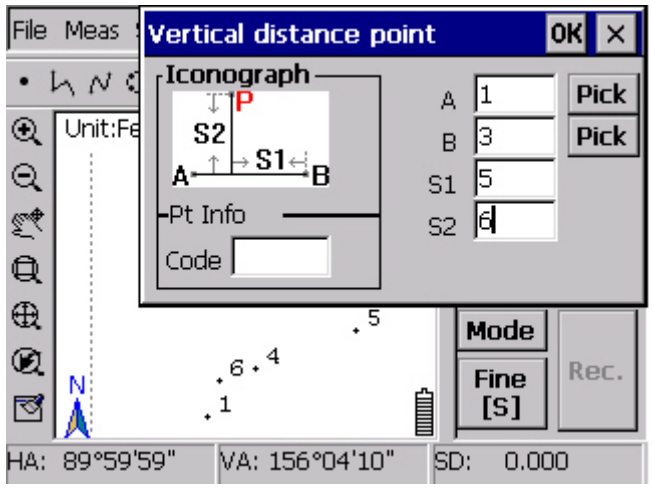
As picture ‘Angle intersection shows points 4, 6 are known, Point 1 is occupation point, point 3 is back point. Input turn angle α and click OK to calculate point P. Dialogue box will show intersection number as 8 points position will be shown on screen. New point number will be equal to the sum of the max number of existent point number plus one. As 8 points in the picture ‘Angle intersection results’.



Angle intersection

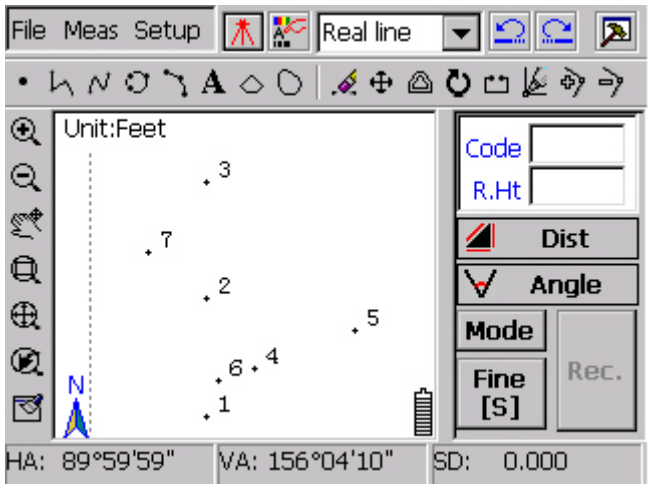
Vertical distance point

Point A, point B are known, distance between B and foot is S1, the distance from unknown point P to the line pass through point A and B is S2, to get point P coordinate.



Vertical distance point

As picture 'Vertical distance point' show, point 1 and pint 2 are known, input distance S1, S2, click OK and get coordinate of point P. Point P's number is 4.Position of it will be shown on screen. New point number will be equal to the sum of the max number of existent point number plus one. Shown as point 4 in picture' Vertical distance point results'.

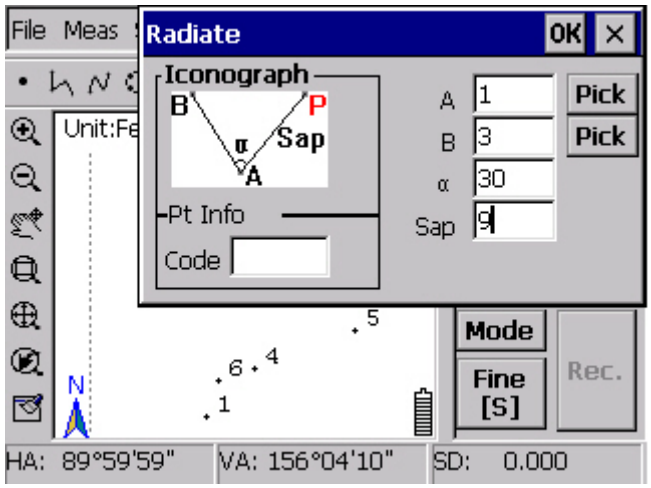


Vertical distance point results

Notice: When the sequence of point 1 and point 2 is counterclockwise rotation, let S1 be positive value, otherwise be negative value. When foot is located between two known points or on the extending line for the opposite direction of the straight line, S2 should be positive value. When it's located just on the extending line for opposite direction of the straight line, S2 should be negative value.

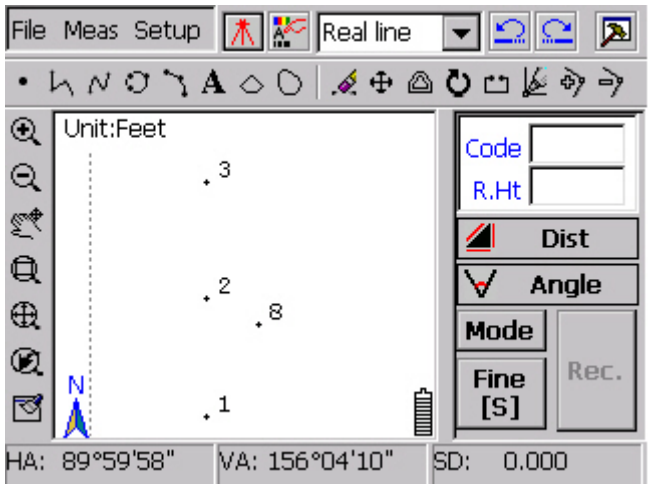
Radiate

Point A and B are reference points, set occupation at A and set B as start direction, get horizontal angle and distance S by measuring, to calculate point P coordinate. Show as picture 'Radiate'.



Radiate

Set occupation at point 1, set point 2 as start direction, input the distance from pint 1 to point P and horizontal angle α, click OK, then get coordinate of point P. Point number of P point is 5,position will be shown on screen. New point number will be equal to the sum of the max number of existent point number plus one. As point 5 in picture 'Radiate results'.

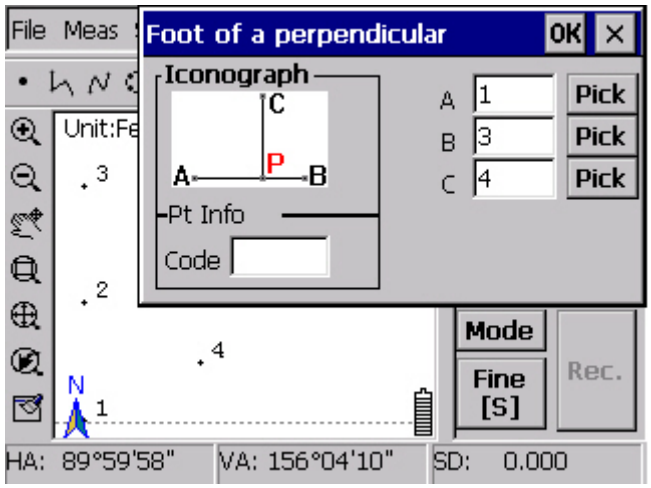


Radiate results

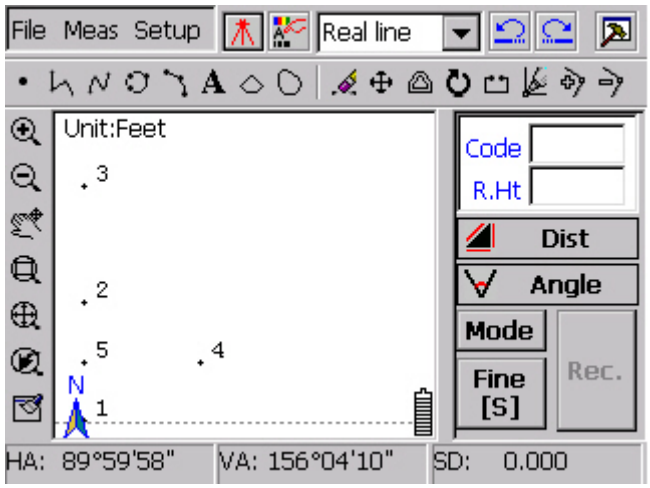
Foot of perpendicular

Points A, B, C are known points, make C as reference point, to calculate point P which is foot of perpendicular for line AB and point C.

As picture 'Foot of perpendicular' show, straight line pass through point 1 and point 2, point 5 is reference point, click OK ,then could get point P. Position is shown on screen. New point number will be equal to the sum of the max number of existent point number plus one. As point 6 in picture 'Foot of perpendicular results'.



Foot of perpendicular

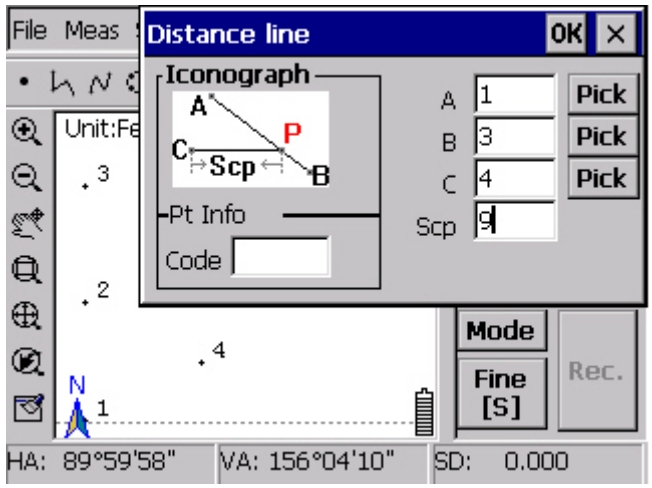


Foot of perpendicular results

Distance line

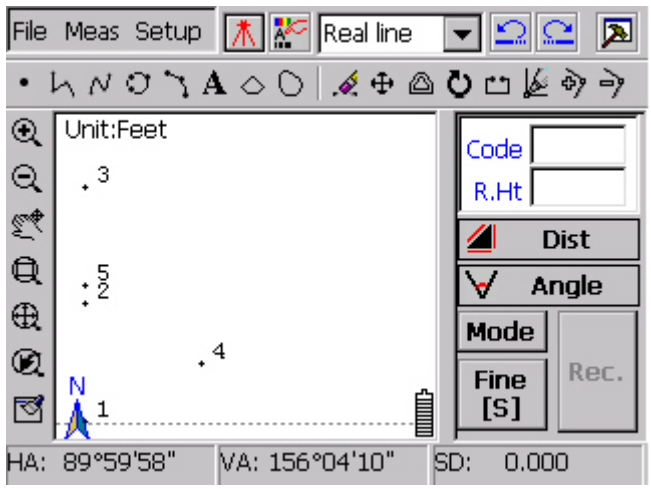
Point A, B, C are all known points, AB is a straight line, S is a distance needed to join calculation, to get the point which is on AB line and the distance from which to point C is S.

As ‘Distance line’ show, a straight pass through point 1 and 2.Input distance from unknown point to point 5, click OK to get point P. Position will be shown on screen. New point number will be equal to the sum of the max number of existed point number plus one. As point 7 in picture ‘Distance line results’.



Distance line

Notice: According to the limitation of known conditions, this method would produce two intersections, our software will judge by choosing the one which is far from first point. When operator needs to get another point, you can change the sequence of point 1 and 2.



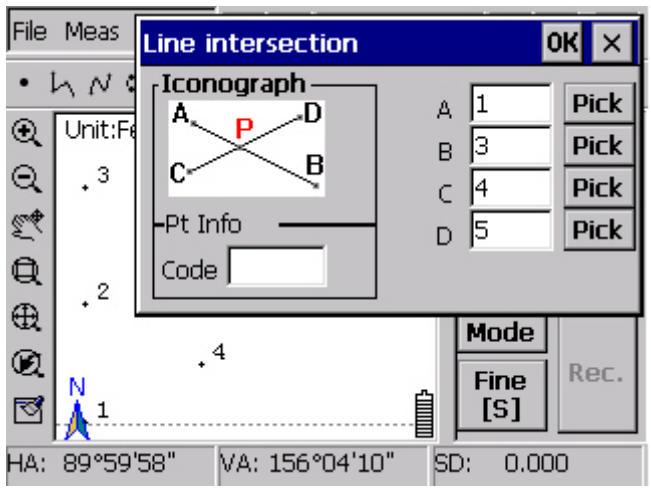
Distance line results

Lines intersection

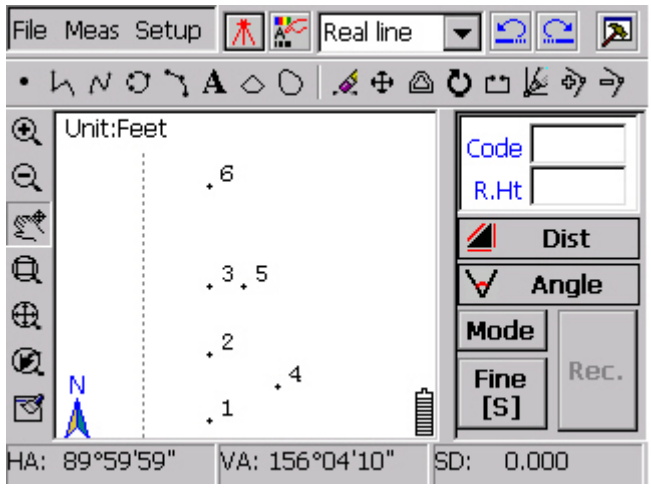
There is one line passing through point A and point B, and another one passing through point C and point D, to calculate the intersection pint P of these two lines.

As 'Lines intersection' show, one line passes through point 7 and 5 another passes

through point 1 and 4. Click OK, intersection P will be calculated. Point's position will be shown on screen immediately. New point number will be equal to the sum of the max number of existent point number plus one. Calculation result will be saved automatically as point 8.



Lines intersection

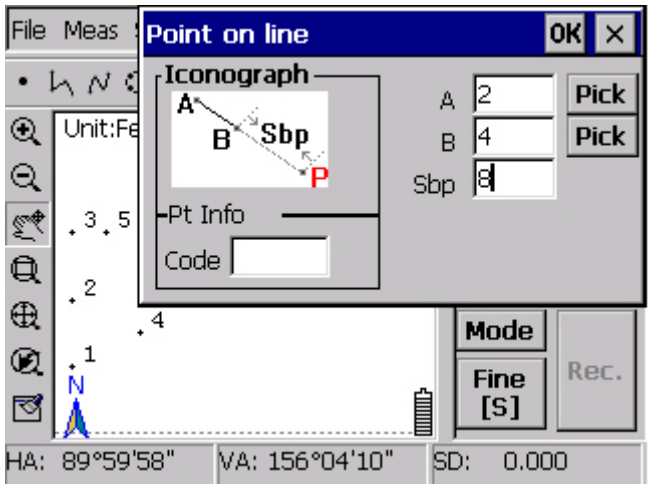


Lines intersection results

Notice: when user inputs these four points by sequence, software will judge that whether the two lines are parallel, if they are, system would notice that "calculating failed, please check input data again."

Point on line

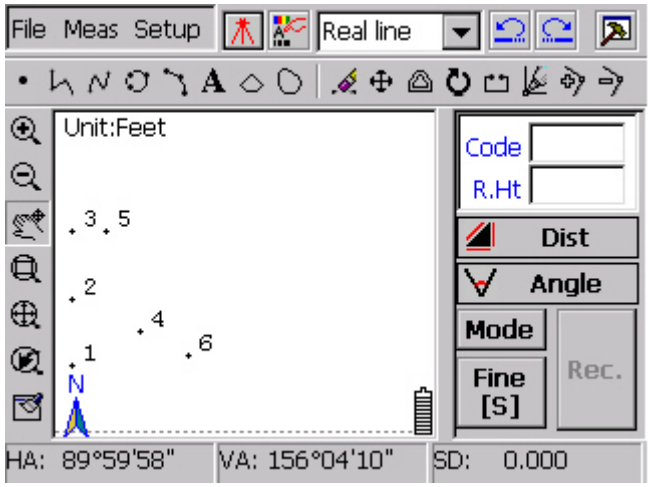
Point A and B are known points, a straight line passes through point A and B, P is inside point or outside point on line, S is distance from B to P, to calculate coordinate of inside point, outside point P.



Point on line

As picture 'Point on line' show, a straight line passed through point 1 and 5, after inputting the distance from unknown point to point 5, click OK ,point P will be calculated and shown on screen immediately. New point number will be equal to the sum of the max number of existent point number plus one. As point 9 in picture 'Point on line results'.

Notice: If the input distance is positive value, the unknown point is on positive extending line of straight line; if the distance is negative value, the unknown point is on opposite extending line of straight line.



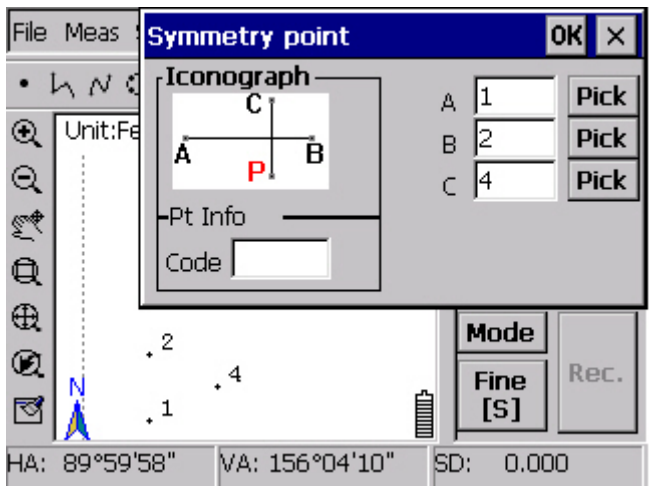
Point on line results

Symmetry point

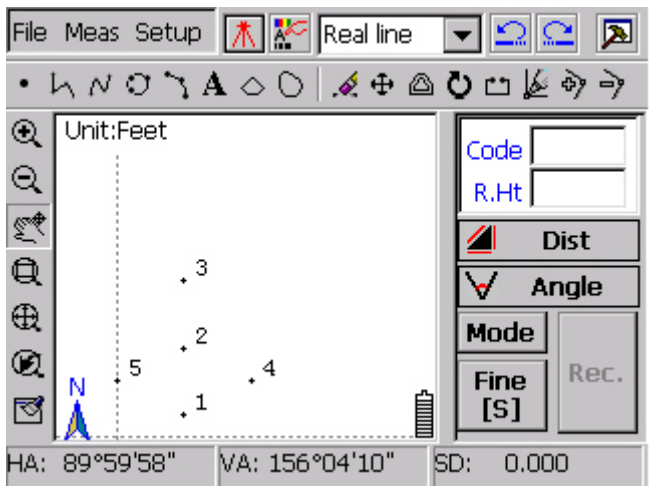
Point A, B, C are all known points. Line AB passes through point A, B, then calculate symmetry point of point C about line AB.

As picture 'symmetry point' show, one straight line passes through point 1 and point 9.

Point 4 is reference point. After clicking OK, symmetry point P of point 4 could be calculated. Point position will be shown on screen. New point number will be equal to the sum of the max number of existent point number plus one. Show as point 10 in picture ‘symmetry point results’.



Symmetry point



Symmetry point results

15.5.2 Area computations

Area computation could calculate area of every closed polygon and area which is made by three or more points that not on same straight line. The points could be known coordinate points and also could be unknown point in graph.

Calculate area made by three points which not on same line: In area computation dialogue box, user could input coordinate point by screen capture function with pen. Also could use digital keyboard to input coordinate point. If the point is known point, the point number would be shown in display window. If the point is an unknown point. "-" would display in point number box. As picture "Area computation" described below:

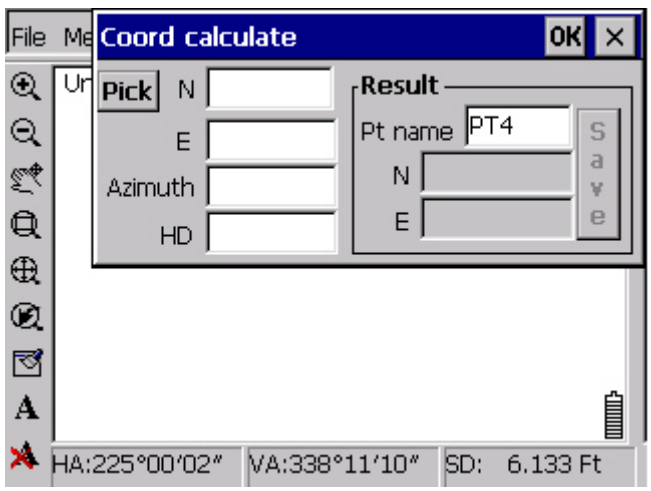
Area calculation

Notice: As the differences of the coordinate point positions, the shape points make can be different. As a result, the area would be different too. So user has to input the points by correct sequence, in order to get the correct area data you want.

15.5.3 Point in Direction

Function: Calculate unknown point, according to a known point, HD and azimuth.

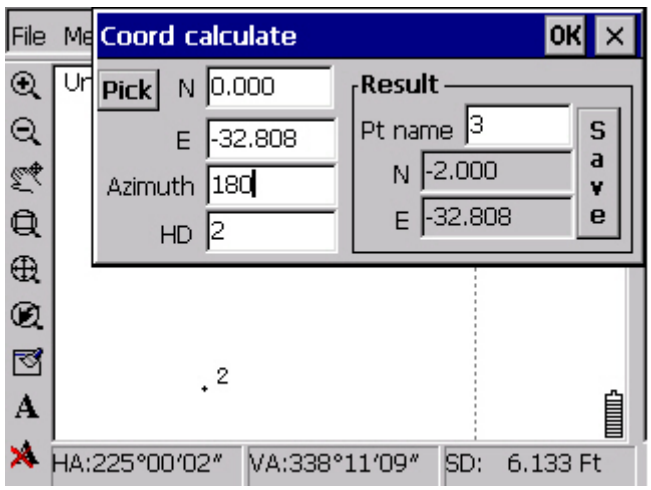
Steps: Click Tool→Point in Direction, showed as graph below:



Point in Direction

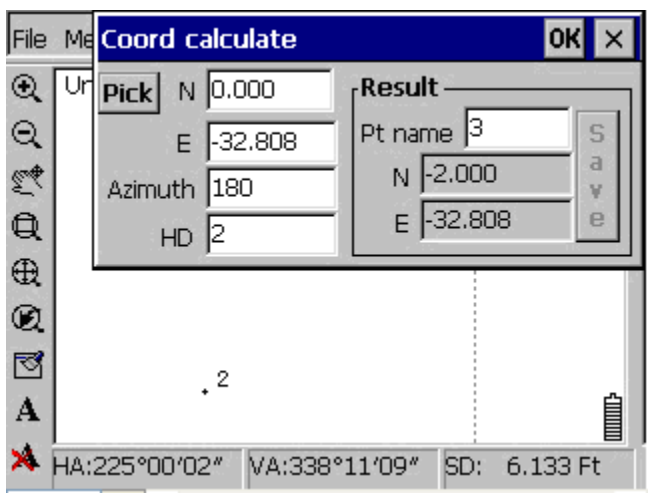
Input known point, HD, azimuth and calculate with clicking OK. If select "Save calculation point", this point would be shown on screen and added to project file. As graph below showed:

Known data: Point 1; Azimuth, 180°; HD, 1. as picture showed below:



Calculation result

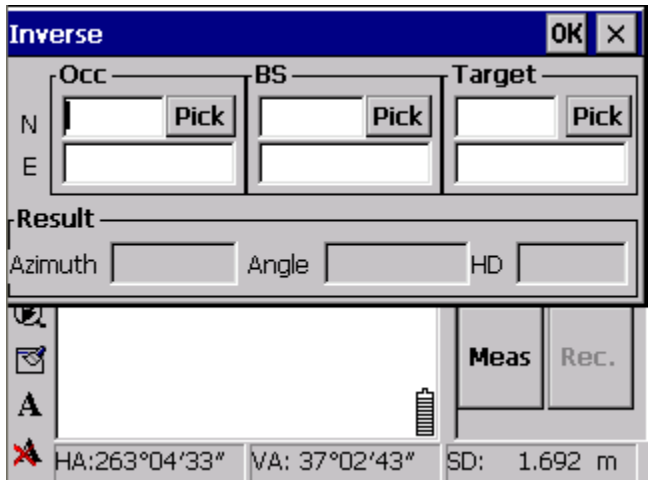
Click to save coordinate, as picture shown below:



Saving coordinate notice

15.5.4 Inverse

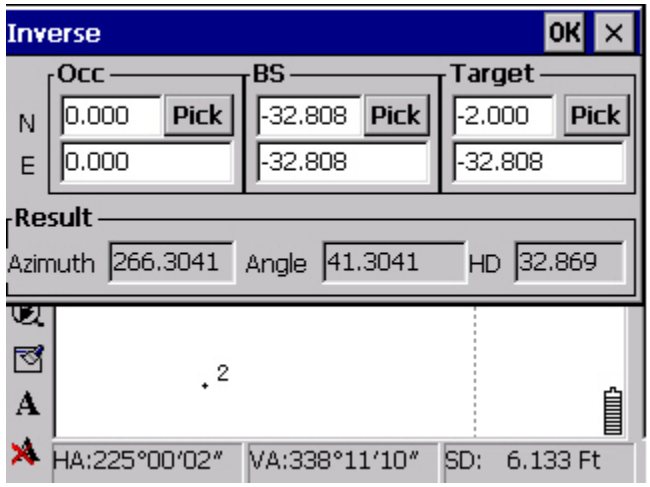
Function: calculate the horizontal distance from Occ to known point and angle from known point to BS point with Occ, BS point and one known point.



Inverse

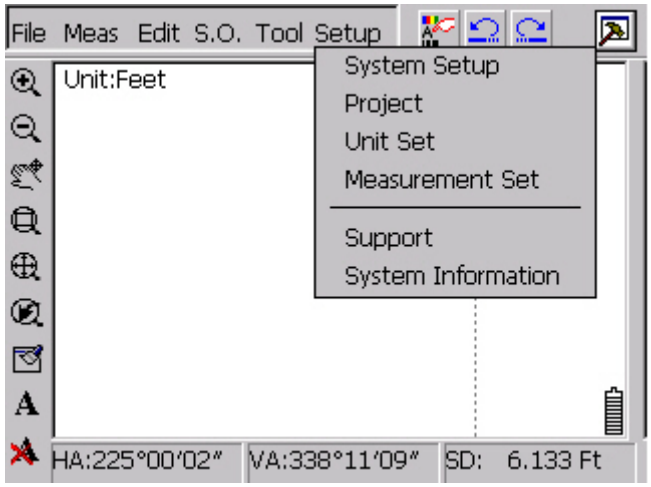
Steps: Click Tool→Inverse. Input Occ, BS points, known point and click Calculate to get horizontal distance and angle. Shown as the picture below:

Known data: Occ point 1, BS point 7, and known point 9. As picture "calculation result" shown.



Calculation result

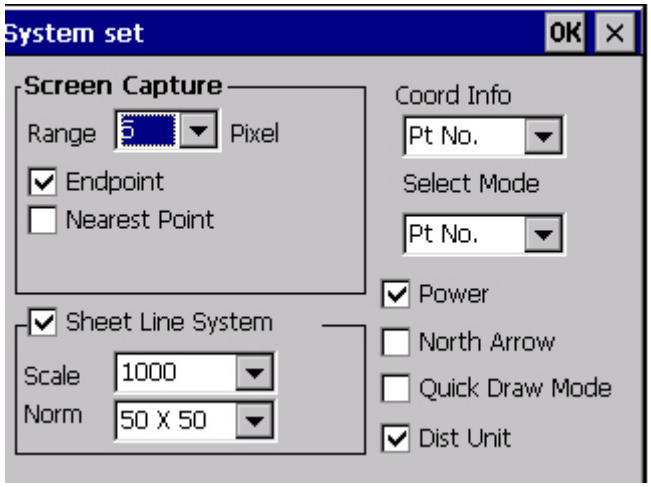
15.6 Setup menu



Setting menu

15.6.1 System Setup

Click Setup→System Setup, setting graph dialogue box would pop up, as picture "Graph setting":



Graph settings

Screen capture: The accuracy arrange of screen capture is about 1～10 Pixels. Bigger the pixel is, larger the screen capture is. At same time, accuracy of screen capture would be lower. In order to reach the requirement of job, user could set the arrangement by them. The system default arranges is 5 pixels.

Map subdivision: Set the drawing scale and subdivision size, there are 1; 500 1; 1000 1; 2000 different size and 50×50 50 × 40 different subdivisions to select. The system default drawing scale is: 1:1000, man subdivision is: 50×50.

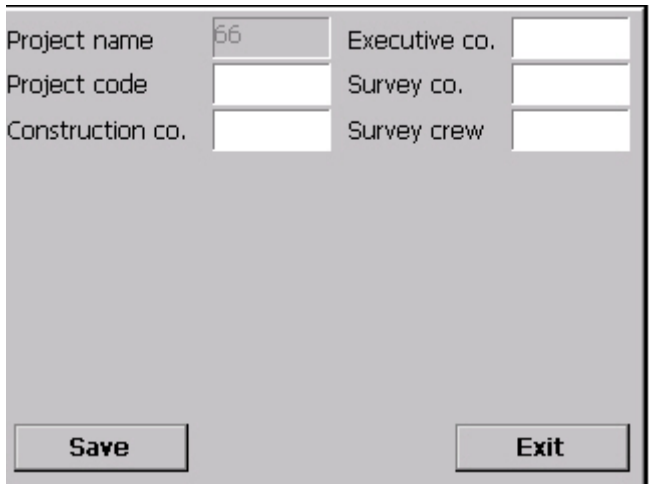
Coordinate drawing style: Set display type of coordinate. System has None, Pt, Pt number, Pt name, Elevation five display types to choose. User could select the display type for showing coordinate according to their habit. System display type default is Pt name.

Coordinate selecting type: Set the searching style for choosing coordinate point. System has Pt number, Pt name two kinds of searching type to choose. User could select the display type for showing coordinate according to their habit. Searching type default in system is: Pt name.

The functions of three icons downside of the window are: 1 Battery capacity: system would display battery capacity if this function is activated; 2 North arrow: system would display north arrow if this function is activated; 3 Speedy drawing.

15.6.2 Project information

Click Setup→Project, System info dialogue box would pop up, as picture shown "Project information"



System information

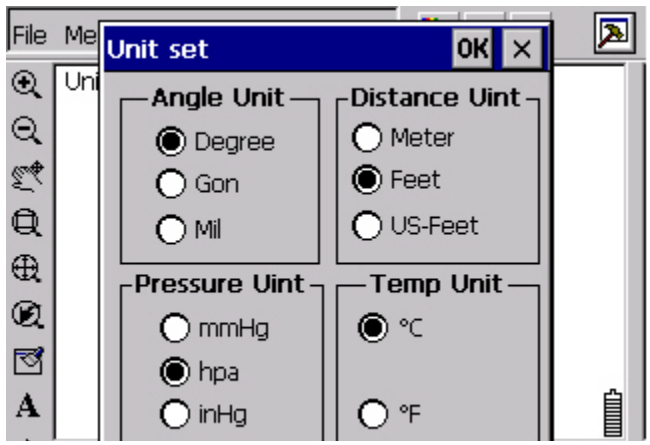
Saving path, project file name, file version and creating date of project file would be included in system info dialogue box.

15.6.3 Setup unit

Click these two options in turn Setup→Unit Set, "Unit Set" dialog box will be shown

as below. User can set the unit of angle, distance, pressure, temperature here. For example: when angle unit is set as Gon, distance unit set as Feet, corresponding sets would be changed in the whole software.

Note: Once change the unit, system will change all of the data into the data in the unit user set.



Unit setting

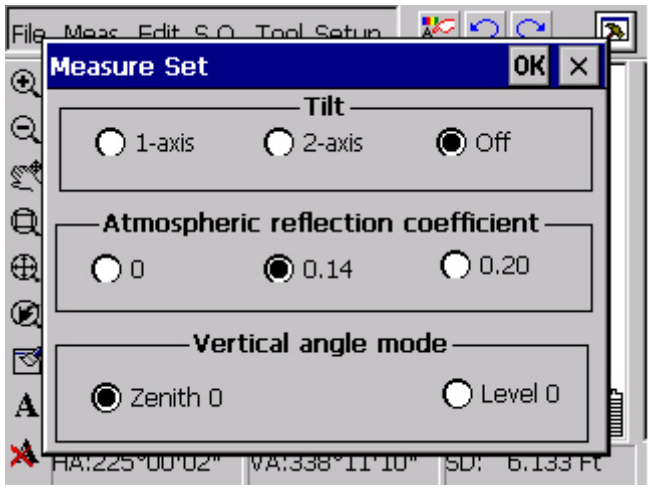
Unit setting options

Menu	Selecting Item	Contents
1. Ang. Unit	Degree/Gon/Mil	Select degree (360°) , gon (400 G) or mil (6400 M) for the measuring angle unit to be shown on the display
2. Dist. Unit	Meter/Feet/ U.S-Feet	Select the distance measuring unit Meter, Int. Feet or U.S Feet.
3. Temp.Unit	℃/ ℉	Select the temperature unit for the atmospheric correction
4. Pres.Unit	mmHg/ hPa/ inHg	Select the air pressure unit for the atmospheric correction.

Measurement unit setting

15.6.4 Measurement setting

Click these two options in turn: Setup→Measurement Set, “Measurement Set” dialog box will be shown as below:

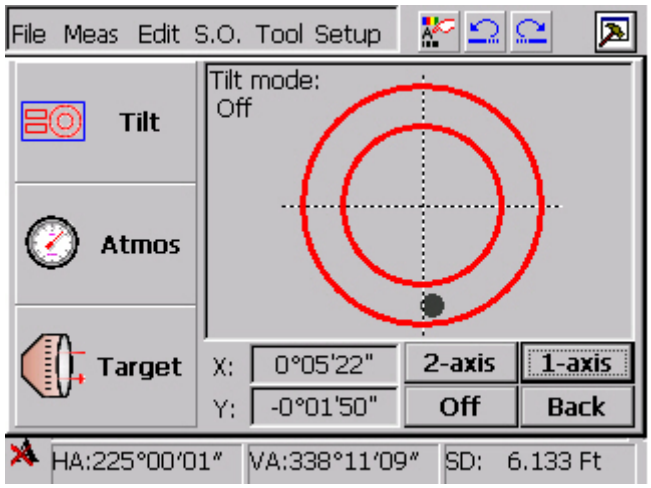


Measurement setting

Measurement settings:

Menu	Selecting Item	Contents
1. Tilt	OFF/1 axis/2 axis	Select the tilt sensor option for OFF, (1 axis) vertical only or (2 axis) vertical and horizontal
2. Correction for atmosphere refraction	0/0.14/0.20	Select the coefficient correction for refraction and earth curvature. Selections for the refraction coefficient are : OFF(No Correction) , K =0.14 or K =0.20
3.Vertical angle model	Zenith/Level	Select the vertical angle reading for Zenith 0 or Horizontal 0.

When Off is chose, Tilt will not be working with the vial plate over the range; When 1 or 2-axis mode is chose, Tilt will be working automatically with the vial plate over the range. And The Tilt dialog box pop up. This dialog box will not disappear until total station is leveled. Shown as below:



Tilt

The rest functions are described in Win total station manual specifically, read Win total station manual, if want to know more.

Atmospheric Refraction and Earth Curvature Correction

The instrument will automatically correct the effect of atmosphere refraction and the earth curvature when calculating the horizontal distance and the height differences.

The correction for atmosphere refraction and the earth curvature are done by the formulas as follows:

Corrected Horizontal Distance;

$D=S * [\cos\alpha + \sin\alpha * S * \cos\alpha (K-2) / 2Re]$

Corrected Height Differentia;

$H= S * [\sin\alpha + \cos\alpha * S * \cos\alpha (1-K) / 2Re]$

If the correction of atmosphere refraction and the earth curvature is neglected, the calculation formula of horizontal distance and the height differentia are:

$D=S \cdot \cos\alpha$

$H=S \cdot \sin\alpha$

In formula: K=0.14 ……Atmosphere Refraction Modulus

Re=6370 km ……The Earth Curvature Radius

A (orβ) …….....The Vertical Angle Calculated From Horizontal Plane (Vertical Angle)

S ……Oblique Distance

NOTE: The atmosphere refraction modulus of this instrument has been set as: K=0.14. It ALS can be set as: K=0.2, or be set shut (0 VALUE).

15.6.5 Technical supports

WinEG2007 technical support website, Address: http://www.southinstrument.com

15.6.6 Software information

WinEG2007 Version, copyright information.

Appendix A: File format of Engineering Genius

*.dat Coordinate data file
Format of coordinate data file as below;
Point 1 name, Point 1 code, Point 1 Y（East）coordinate,Point 1 X（North）coordinate, Point1 Elevation
…
Point N name, Point N code, Point N Y（East）coordinate, Point N X（North）coordinate, Point N Elevation

Instruction:
Each line in file indicates one point; Unit of coordinate Y, X, Z of every point is meter; comma can not be contained in code.

***.rod** Road data file
Data file form is as below:
[HEADER]
ROADNAME, road1
VALTYPE, 0
[END]

[ALIGN]
START, 300.000, 488342.493, 2552134.180
STRAIGHT, 30.0000, 500.00000000000
ARC,-2000.000, 500.000000
SPIRAL,-2500.000, 300.000000
Pt, 489996.699, 2558932.226, 3500.000, 300.000, 300.000
[END]

[VLIGN]
400.000, 40.000, 60.000
500.000, 35.000, 50.000
600.000, 25.000, 70.000
700.000, 30.000, 60.000
[END]

[SECT]
400, sect1, sect1
[END]

[TEMPLATE]
TEMPLATENAME, sect1, 3
ZONE, Z1, 1, 12.000, 0.300
ZONE, Z2, 1, 3.000, 2.500
ZONE, Z3, 0, 5.000, 0.000
[END]

Instruction:
[HEADER] Road information
ROADNAME, Road name
VALTYPE, Vertical curve type（0, vertical curve;1, erect curve）
[END]Road information is over

[ALIGN] Horizontal alignment
START, Start chainage, East coordinate, North coordinate（Only one start point data is allowed）
STRAIGHT, azimuth, length（straight segment）
ARC, radius, arc length（Arc section）
SPIRAL, radius, transition length（transition curve section）
Pt, coordinate east, coordinate north, radius, last transition length, next transition length（point）
[END] Horizontal alignment is over

[VLIGN] vertical alignment
chainage, elevation（gradient）, length
[END] vertical alignment is over

[SECT] transect
chainage, transect model name of road leftside, transect model name of road rightside
[END] transect is over

[TEMPLATE] transect template
TEMPLATENAME, template name, section number

ZONE, section name 1, offset type, horizontal offset, vertical offset

……

ZONE,section name N, offset type, horizontal offset, vertical offset

[END] transect template is over

Appendix B: Upgrade and install WinEG2007

We sent along a CD and instruction manual with every total station. You can find winMG2007, Microsoft ActiveSync, and driver for Win Total Station on the CD.

1. Install Microsoft ActiveSync and Driver
Caution:

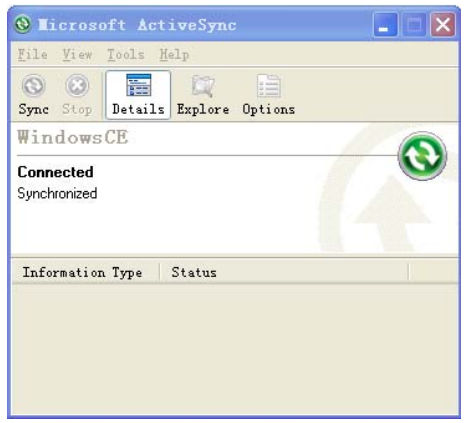
After the installation of Microsoft ActiveSync, you must restart the computer. We suggest that you close all the programs and save your work.
Connect the computer with Win Total Station, and then you will get a message asking for the installation of Drivers. Please download them on the CD attached with total station.

2. Install Microsoft ActiveSync

Put the CD in to CD-ROM drivers and run “Microsoft ActiveSync”
The setup wizard will guide you through the process of installation.

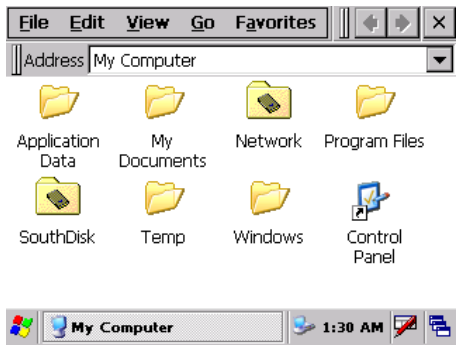
After the installation, please restart the computer.
Connect the computer and the total Station with Communication Cable.
Then turn on the total station, once the connection is successful, you will get the

following figure as shown



Browse

Click the browse button, then you can see all the data of this connected total station and, you can also delete, copy, and move the files.



3. Installation of Driver for Win Total Station

If you do not have the driver for the Win total station on your computer the connection will stop and prompt for it, then follow the setup wizard to finish the installation.
After the installation, reconnect the computer and the total station.

4. Installation of WinEG2007

After the succeed connection between the computer and the total station, you can setup or upgrade the WinEG2007. Click the “setup.exe” under the folder of WinEG2007 on your CD, you get the following figure.

WinEG2007 installation 1

Click setup as shown in the following figure.;

WinEG2007 installation 2

The setup will cost you 2-5 minutes, then click OK, and finish the installation.

PART Ⅱ

1 Introduction

WindowsCE operating system Total Station (WINTS for short) has the Graphical User Interface (GUI for short) which makes the Total Station very simple and easy to operate even who has never used a Total Station before. And that's why WINTS is one of the most popular Total Station. EK is the final data processing software of WINTS which has the linetype design, calculation function and data analysis function, it makes the Road Design and Construction Work integrated.

The EK program window is divided into six parts: Menu, Toolbar, Control Panel, Information Output Area, Status Bar and View Area, as shown in Figure 1-1

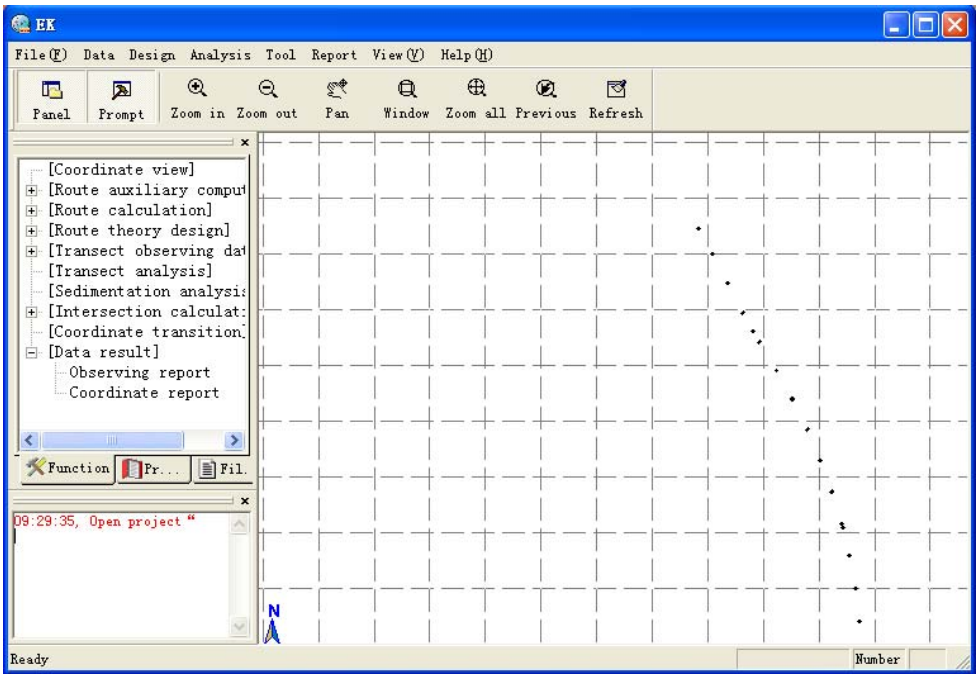


Figure 1-1: Arrangement of the elements in the EK window

Arrangement of the elements in the EK window: Along the top is the pull-down menu: File, Data, Design , Analysis, Tool, Report, View, Help; Below the Pull-down menu is the Toolbar: Panel, Prompt, Zoom In, Zoom Out, Pan, Window, Zoom all, Previous, Refresh; On the left is the Control Panel: Function, Property, File list; Below the Control Panel is the Information Output Area; On the right is the View Area;

At the bottom is the Status Bar.

2 Functions

2.1 File

Click File in the menu bar. The list of items appears as shown in Figure 2-1:

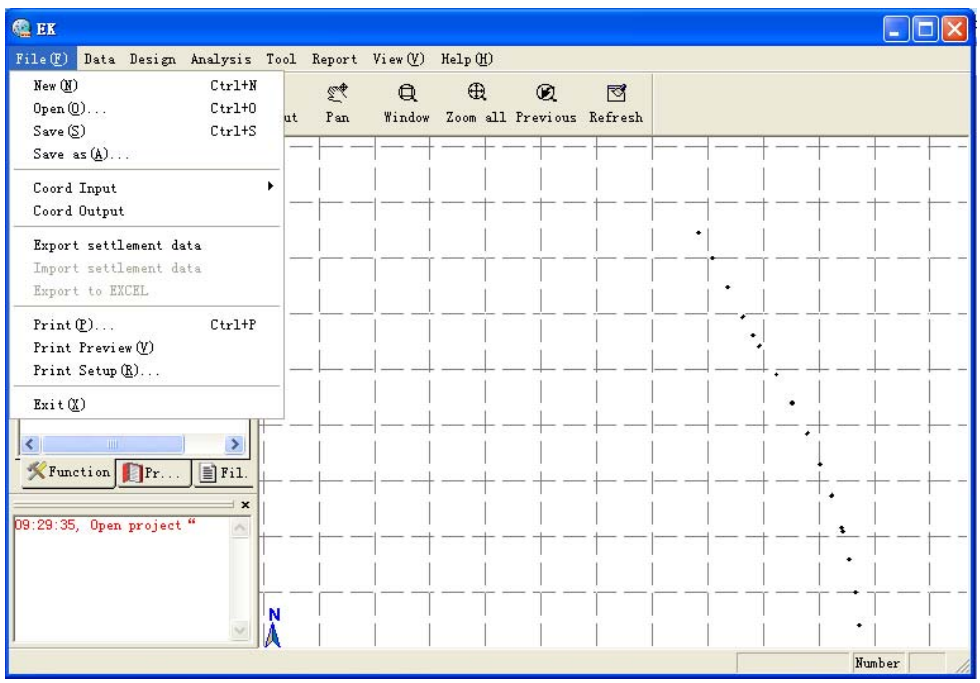


Figure 2-1: File Menu

Functions of the File Menu:

New: Create a new project file. Input the Project Name, Project Code, Company Info. Etc. and choose the Save Path when creating a new project file. Then click OK.

Open: Open an existing project file (*.prg)

Save: Save a project (*.prg)

Save as: Save a copy of the current file with a new file name. (*.prg)

Coord Input: Import existing coordinate to a project. It has two ways to import coordinate: Manual and Auto. Manual allows users to input coordinates by using keyboard; the coordinate code will be automatically accumulated. Auto allows users to import coordinates automatically by using coordinate files. (*.dat)

Note: For details about *.dat data format please see the "Appendix A: Data Format"

Coord Output: Export the coordinate data from current project to a *.dat file.

Export settlement data: Export the Last Settlement Data, Users can specify which coordinate need to export and its saving path, note, etc. The exported file will be saved in *.txt format.

Import settlement data: Import the Former Settlement Data. Users can Import an existing settlement data into a project. (*.txt)

Export to EXCEL: Export the data file into EXCEL.

Print: Print data report, data analysis etc.

Print Preview: Preview the print result.

Print Setup: Setup the printer and papers.

Exit: Close the EK program.

2.2 Data

Click Data in the menu bar. The list of items appears as shown in Figure 2-2:

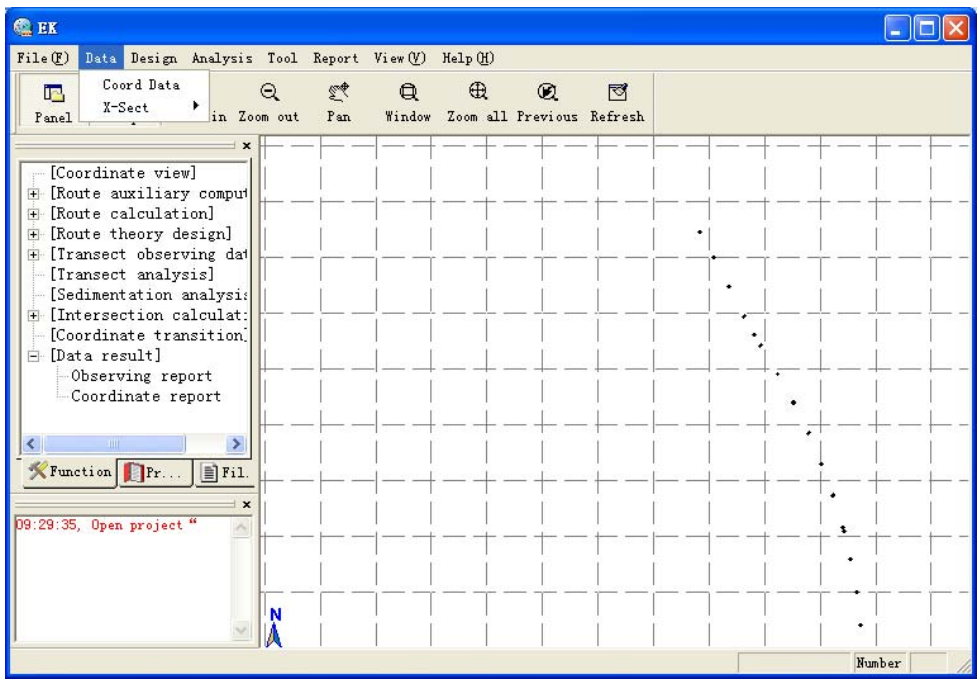


Figure 2-2: Data Menu

Functions of the Data Menu:

Coord Data: Display the View Coordinate dialog. You can view, modify and delete the coordinate data.

X-Sect: On the right shows the transect data as shown in Figure 2-3. Choose different Occupied Point, the Coordinate, Back Sight Point Coordinate, Total Station Height, Horizontal Angle, Slope Distance and Zenith of the selected Occupied Point will be shown. You can modify and save the information.

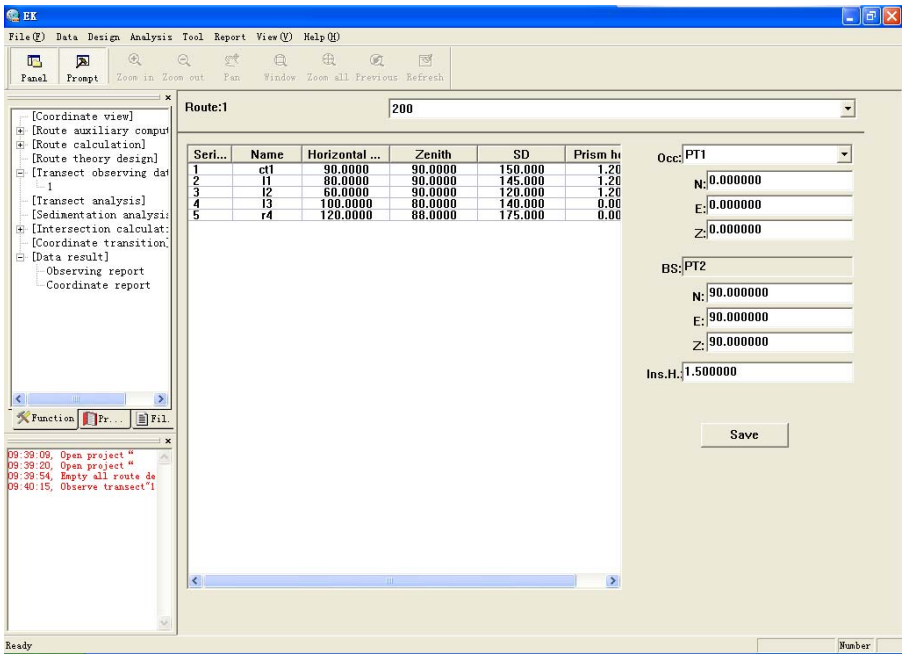


Figure 2-3: Transect Data Menu

2.3 Design

Click Design in the menu bar. The list of items appears as shown in Figure 2-4:

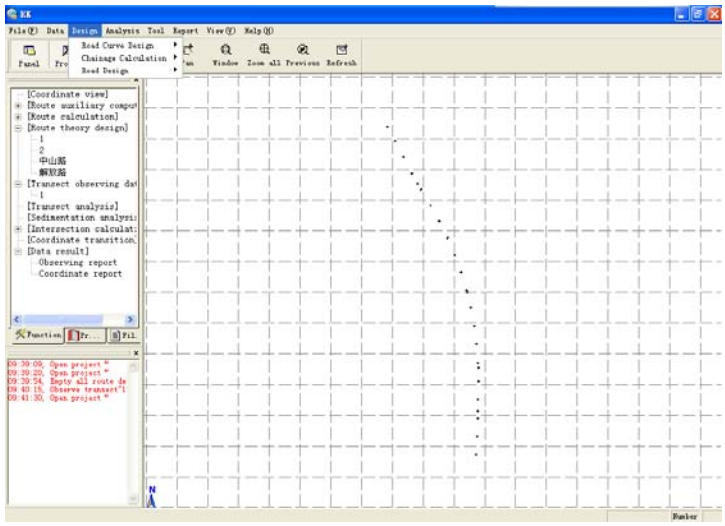


Figure 2-4: Design Menu

Functions of the Design Menu:

Road Curve Design: Curve Calculation. It can calculate these linetypes: Single cross plane curve, Convexity plane curve, Tangent base line plane curve, Complex base line plane curve, S type plane curve, Egg type plane curve. The calculation result can be

exported into an EXCEL file. Road Curve Design is corresponding to Route calculation in the control panel. You'll get more details about these commands in later sections.

Chainage Calculation: Based on the Number of the starting Stake, Curve Parameter, Curve Start Point, etc, input the space between the stakes, the program will work out each coordinates of the stakes. The result can be exported into an EXCEL file. Chainage Calculation is same as the Chainage Calculation in the control panel. You'll get more information in later sections.

Road Design: Create new lines or clear the old lines. This function includes Horizontal alignment design, Transect design and Road Calculation, etc. You'll get more information in later sections.

2.4 Analysis

Click Analysis in the menu bar. The list of items appears as shown in Figure 2-5:

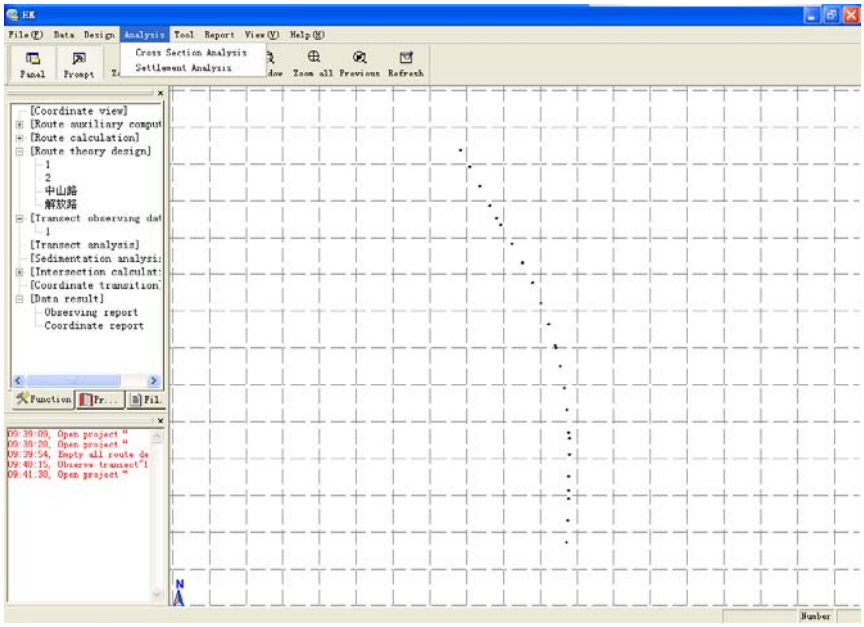


Figure 2-5 Analysis Menus

Functions of this Menu:

Cross Section Analysis: Compare the transect design and transect survey result. Select the line which you want analysis first, then choose transect design (display as red line) then choose transect survey result (display as blue line); the compared result can be printed out, as shown in Figure 2-6.

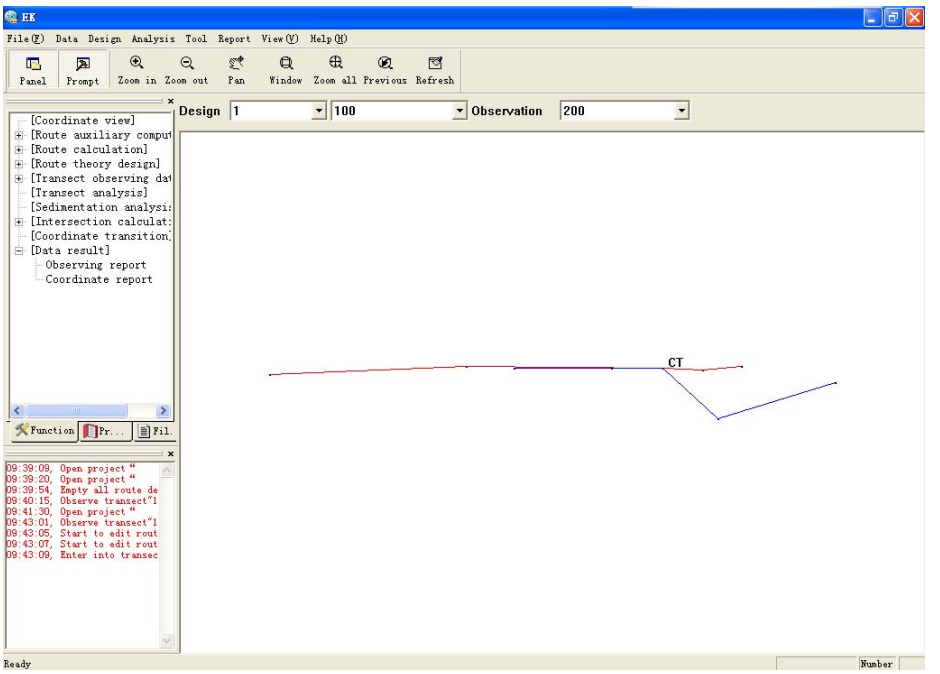


Figure 2-6: Cross Section Analysis

Sedigraph: Display the Settlement Curve, Point Position and Point Movement Curve. Click Sedigraph, the system shows "None Settlement Data imported, import it now?" Click "OK" to show "Open" dialog, User can now import Settlement Data (*.txt format, user can import several data files at the same time). After importing, user can choose Sedigraph, Displacement C and Point variation; the result can be printed out, as shown in Figure 2-6:

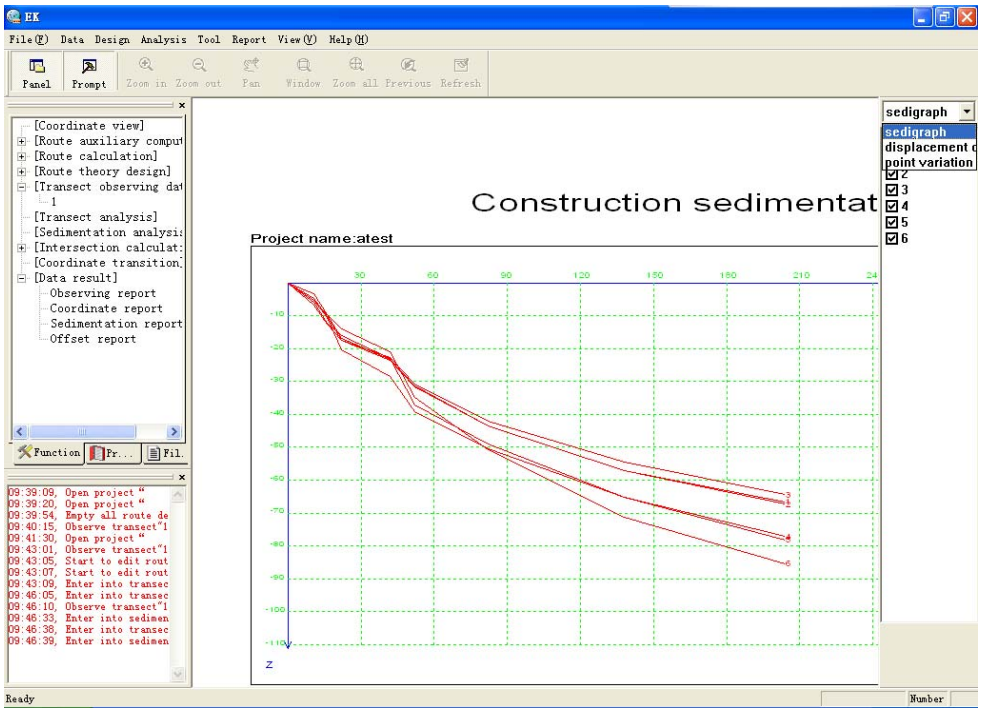


Figure 2-6: Sedigraph

On the right the six numbers: 1, 2, 3, 4, 5, 6 means six observation points. Figure 2-6 shows six settlement curves at the same time, if user only wants to display one of these curves, just remove the "√" in front of other numbers.

Choose Displacement C, The View Area will display the first Displacement Curve as default, as shown in Figure 2-7. The result can be printed out.

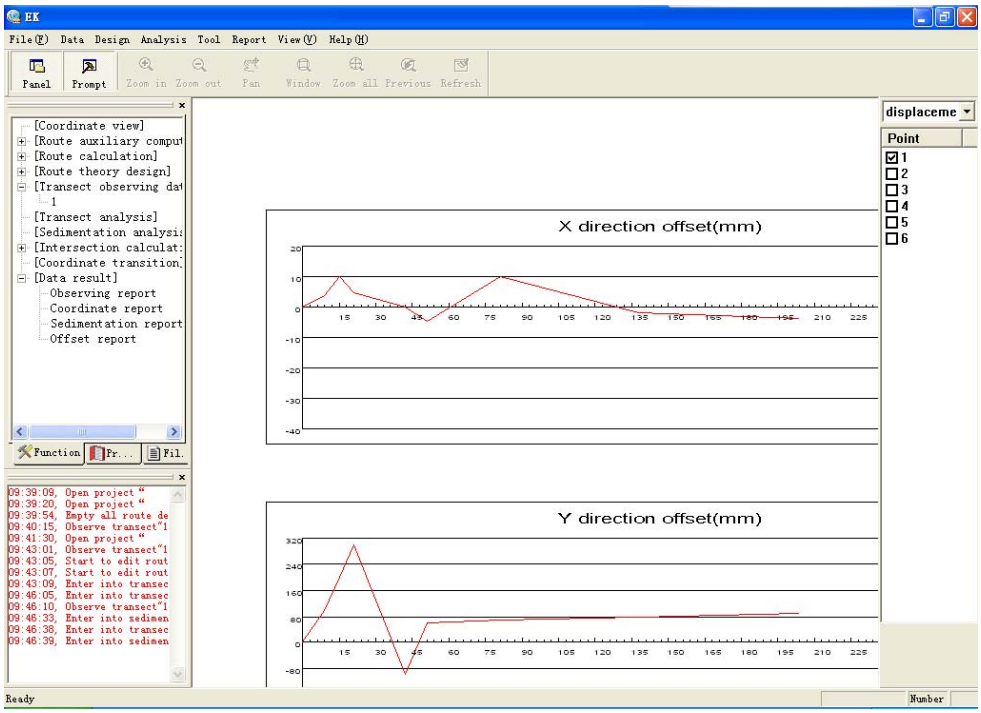


Figure 2-7: Displacement Curve

Choose Point variation, The View Area will display the first Point Variation Curve as default, as shown in Figure 2-7. The result can be printed out.

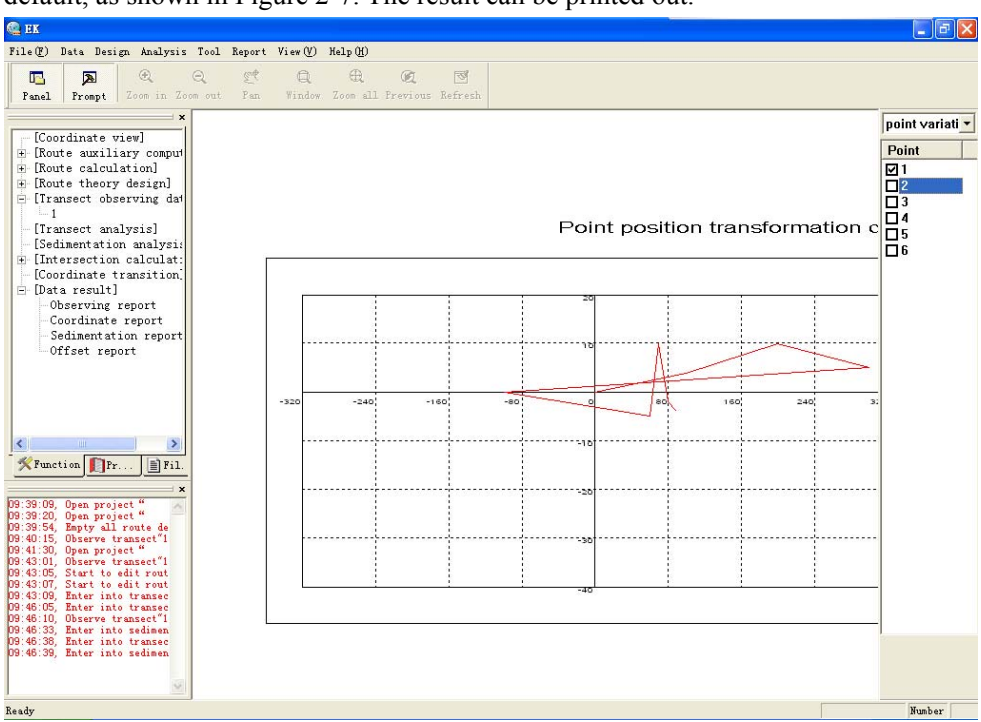


Figure 2-8: Point Variation

2.5 Tool

Click Tool in the menu bar. The list of items appears as shown in Figure 2-9:

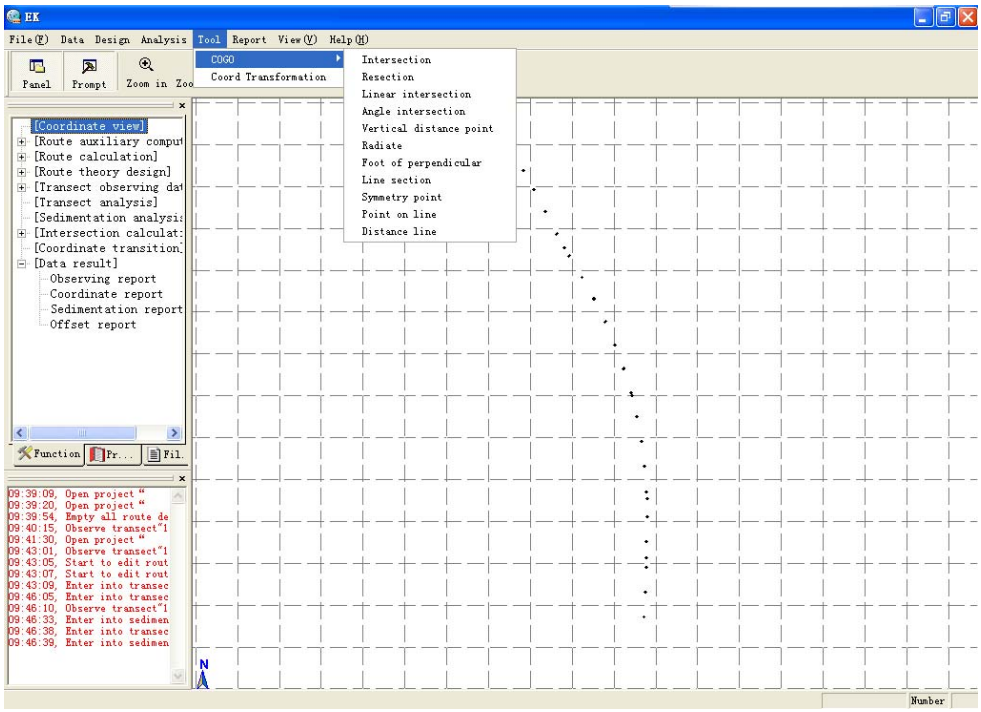


Figure 2-9: Tool Menu

Functions of the Tool Menu:

COGO: According to some geometry theory and calculating steps, use some known points or lines to calculate unknown point or parameter. This command has pull-down choices, such as Intersection, Resection, Linear Intersection, Angle Intersection, Vertical Distance Point etc. More about these commands will be introduced later.

Coordinate Transformation: Transform current coordinate system to another coordinate system.

2.6 Report

Click Report in the menu bar. The list of items appears as shown in Figure 2-10:

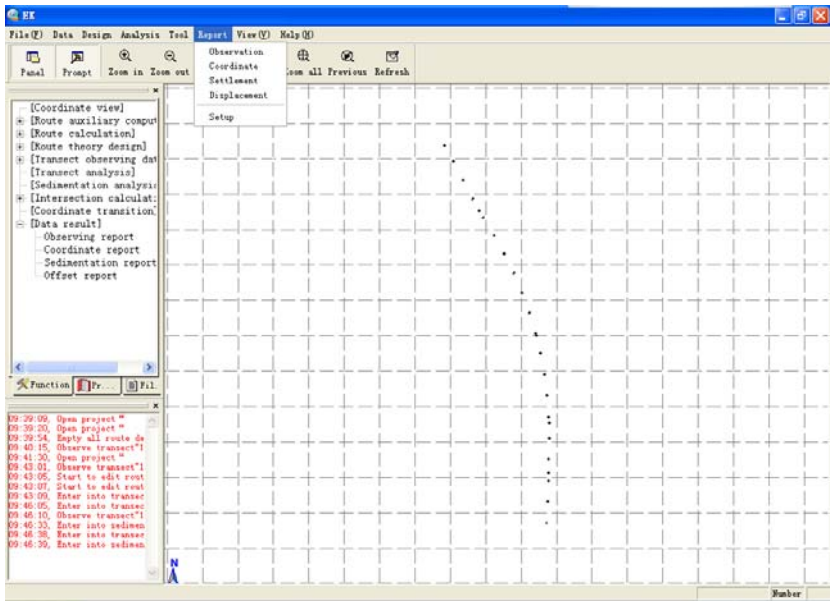


Figure 2-10: Report Menu

Functions of the Tool Menu:

Observation: Display the Observation Report in the View Port, including Name of Survey Station, Collimating Direction, Right and Left Horizontal Angle, Zenith Distance, Slope Distance, etc. The Report will be automatically divided into several pages and can be printed out. As shown in Figure 2-11.

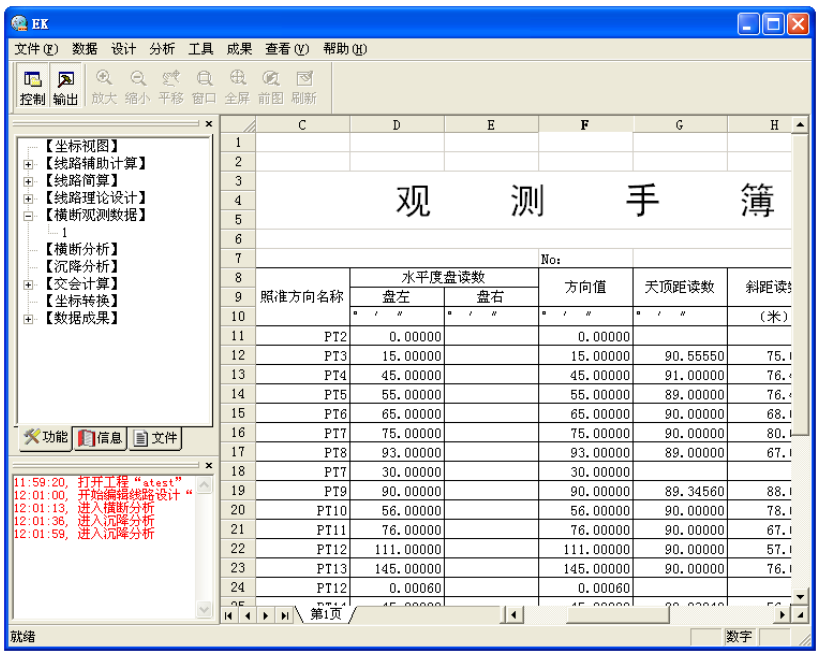


Figure 2-11: Observation Report

Coordinate: Display the Coordinate Report in the View Port, including Point Name, Point Code, NEZ Coordinate, etc. The Report will be automatically divided into several pages and can be printed out. As shown in Figure 2-12.

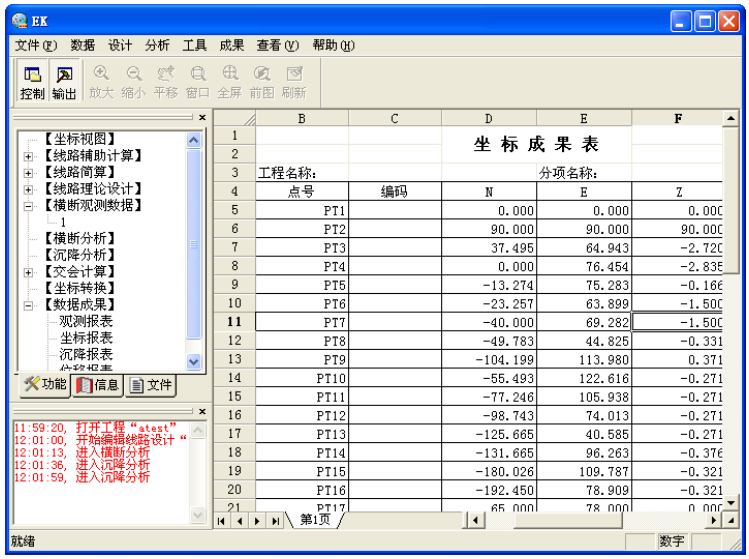


Figure 2-12: Coordinate Report

Settlement: Display the Settlement Report in the View Port (Import the Settlement Data first). The Settlement Report will be displayed by stages, including Elevation, Settlement of Current period and Accumulated Settlement. The Report will be automatically divided into several pages and every page is divided into four stages. The Report can be printed out, as shown in Figure 2-13.

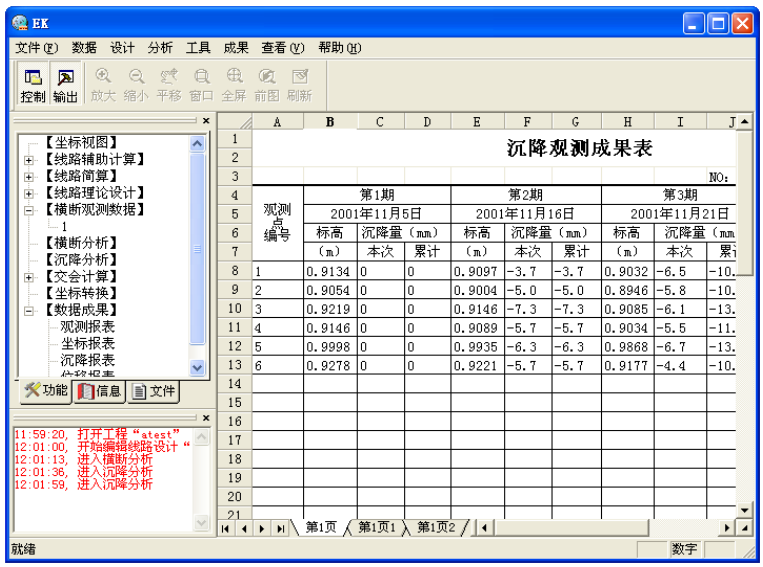


Figure 2-13: Settlement Report

Displacement: Display the Displacement Report in the View Port (Import the Settlement Data first). The Displacement Report will be displayed by stages, every stage includes Coordinate, Current Displacement and Accumulate Displacement. The Report will be automatically divided into several pages and every page will be divided into four stages. The Report can be printed out, as shown in Figure 2-14.

Figure 2-14: Displacement Report

Setup: Setup the path of Report Template and exported Rows (The Observation Report set 22 rows as default, The Coordinate Report set 45 rows as default), as shown in Figure 2-15. The Report can't be displayed without a right Template Path.

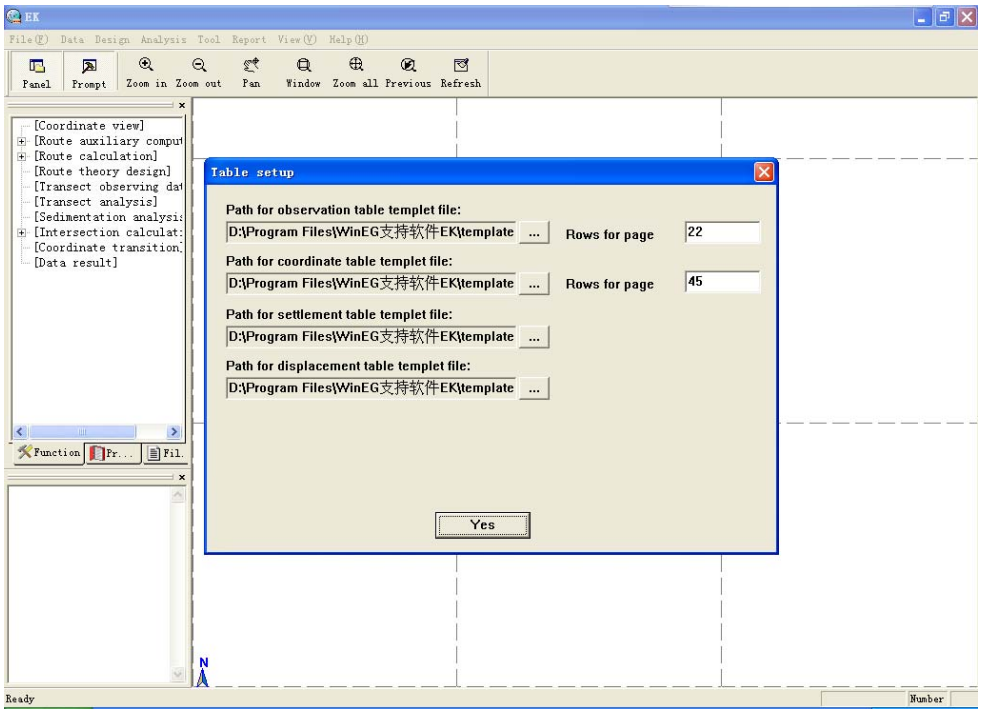


Figure 2-15 Setup

2.7 View

Click View in the menu bar. The list of items appears as shown in Figure 2-16:

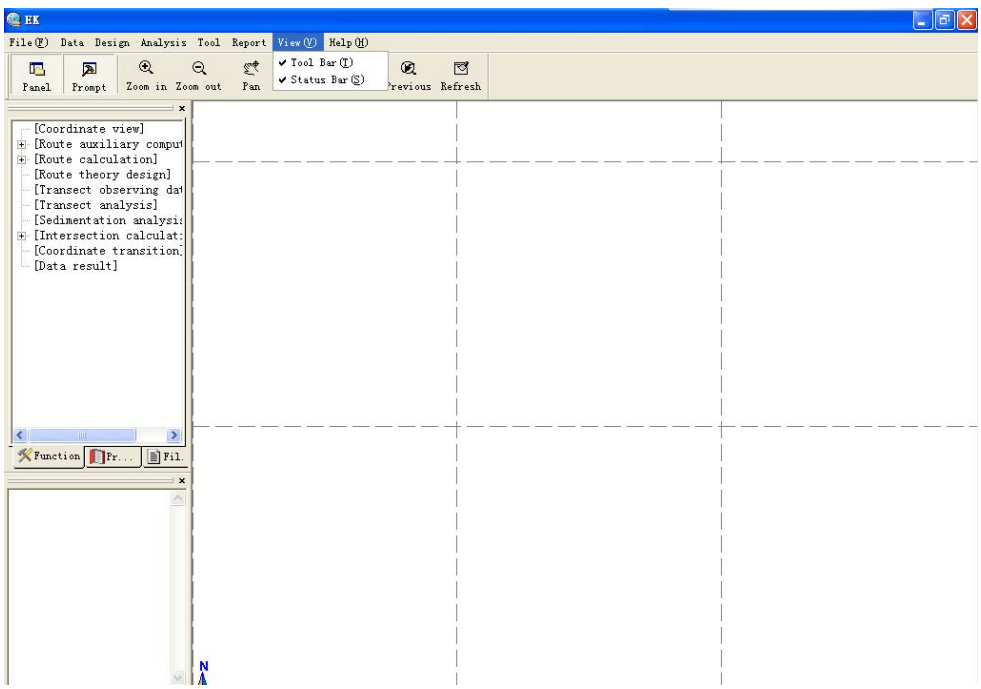


Figure 2-16 View Menu

Functions of the View Menu:

Tool Bar: Open or Close the Tool Bar.

Status Bar: Open or Close the Status Prompt.

2.8 Help

Click Help in the menu bar. The list of items appears as shown in Figure 2-17:

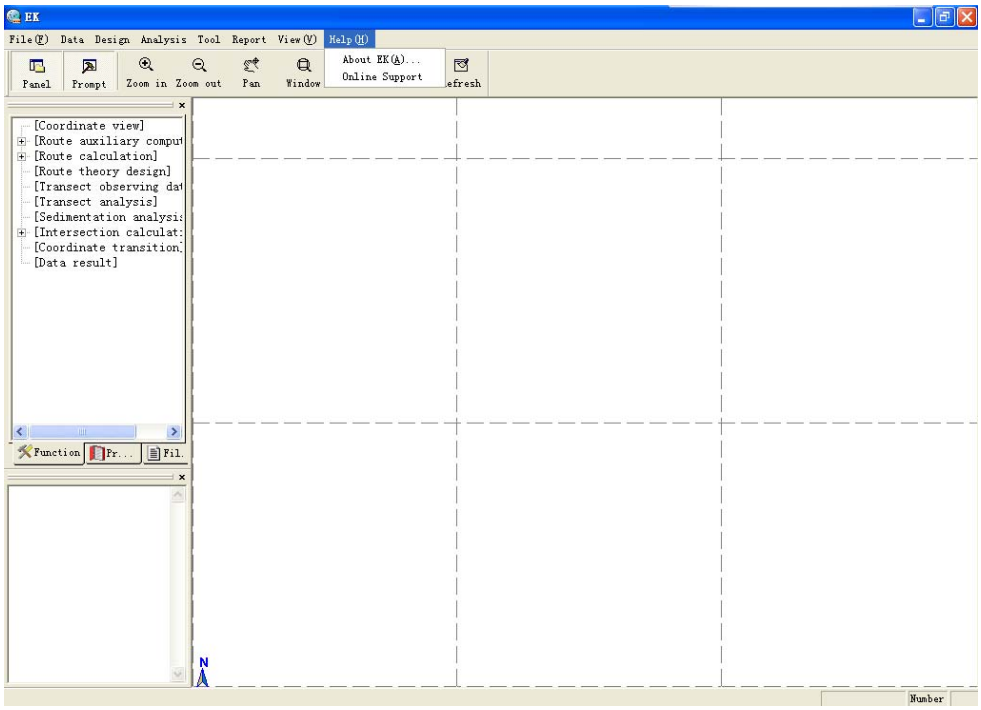


Figure 2-17 Help Menu

Functions of the Help Menu:

About EK: You can view information about EK. As shown in Figure 2-18. Click OK to exit.

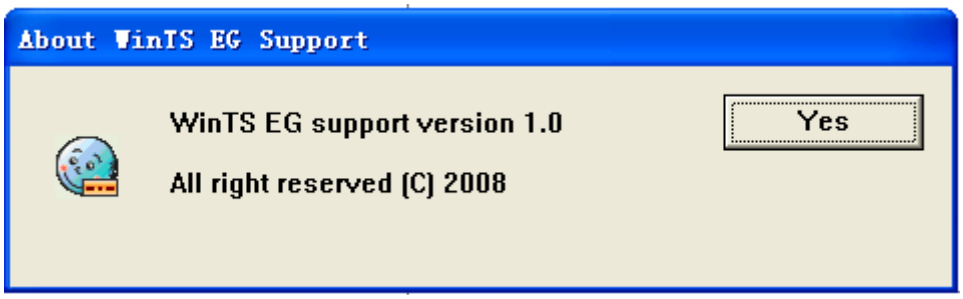


Figure 2-18 About EK

Online Support: Enter the http://www.southsurvey.com to get help.

2.9 Toolbar

Functions of the Tool Bar:

	Open or Close the Control panel		Open or Close the Prompt panel
	Zoom In		Zoom Out
	Pan		Zoom Window
	Zoom all		Previous
	Refresh		

2.10 Control Panel

Functions of the Tool Bar, as shown in Figure 2-19

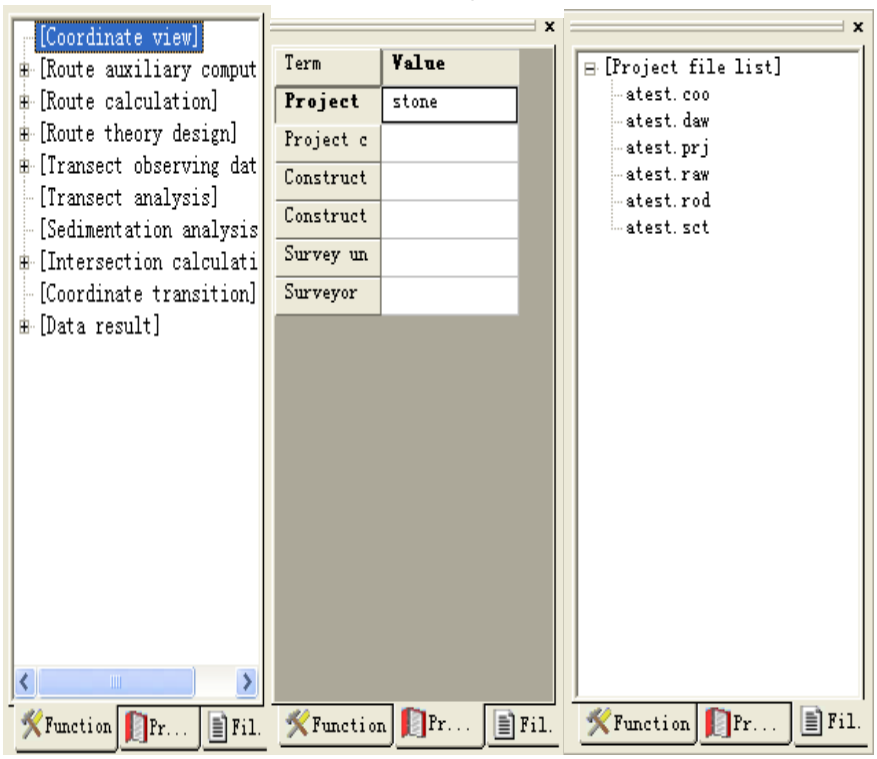


Figure 2-19 Control Panel

Function: Corresponding to the functions of Design, Analysis, Tool and Report menu.

Property: Check the project information in this panel, double click on the subject which you want to modify.

File list: Check the file information of current project, Click on the file which you want to check, the result will be displayed in the View Area. You'll get more information about file format in later sections.

2.11 Information Output Area

Display the operations you have done at different time. As shown in Figure 2-20

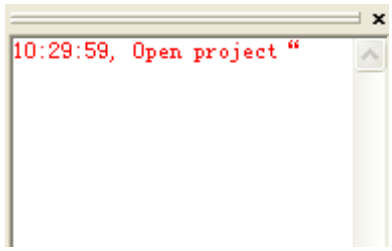


Figure 2-19: Information Output Area

3 Road auxiliary computation

3.1 Single intersection plane curve

The calculation of single crosspoint plane curve is based on two or three of Option, Off angle, External spur, Tangent, Tangent vertical dist., Normal vertical dist. to calculate the off angle of curve, external distance, radius of circle curve, circle curve, tangent, length of transition curve and length of curve etc. Interface as shown in figures 3-1.

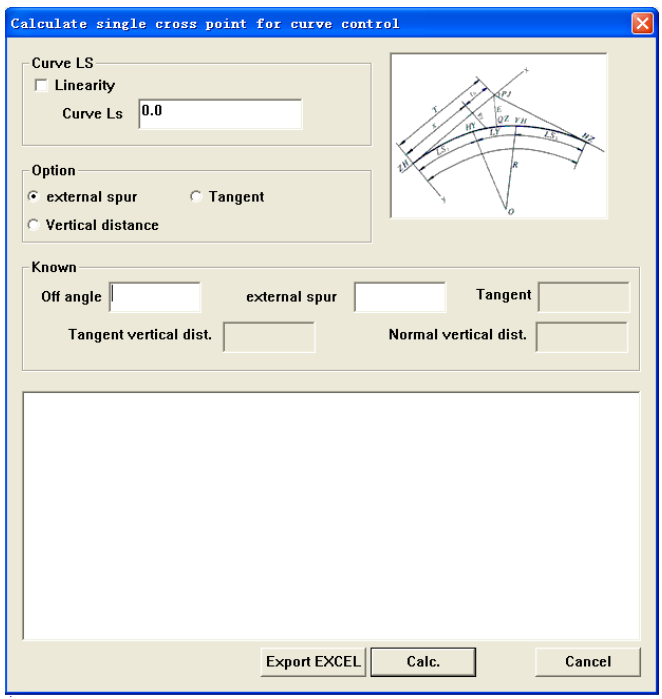


Figure 3-1 Single crosspoint for curve

Input transition curve length first. If the length is known, input to the dialog box directly; If it is unknown, choose Linearity, after choosing Linearity, textbox of transition curve become gray, according to other known factors the program will calculate the best transition curve length. The following example is supposing that the length of transition curve is known.

Choose external spur in Option and input off angle and external spur, other dialog boxes become gray. The unit of off angle is degree, minute, second, as 16°10′35.1″, input 16.10351; the unit of external spur is meter. After inputting the data, click Calc., the result is displayed, as shown in figure 3-2:

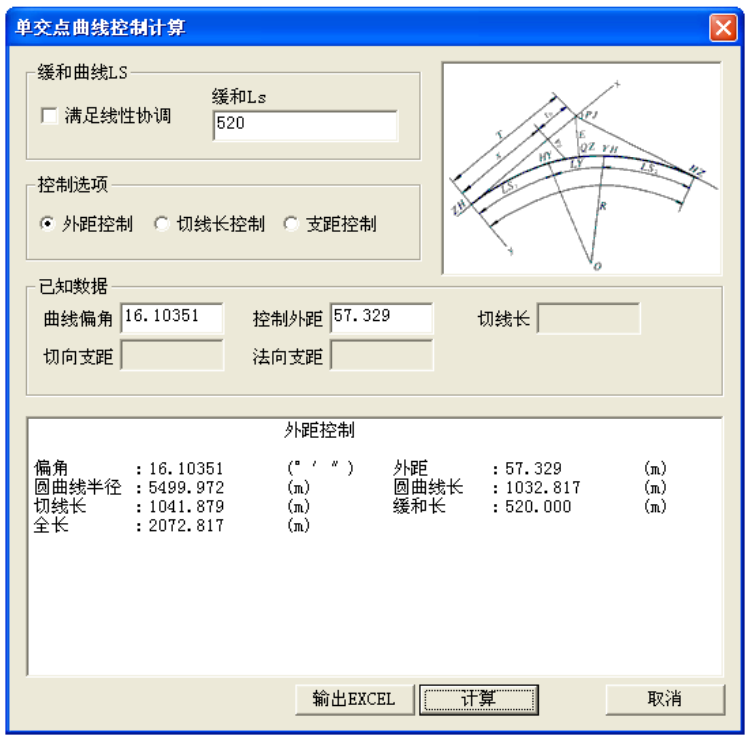


Figure 3-2 Single crosspoint for curve——external spur

Choose Tangent in Option and input off angle and tangent, other dialog boxes become gray. After inputting known data, click Calc., then the result is displayed, as shown in figure 3-3:

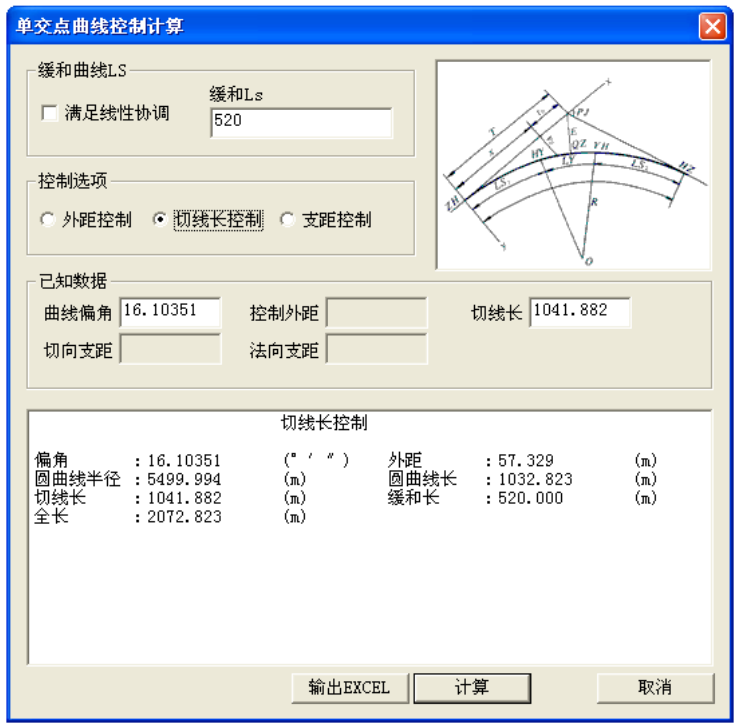


Figure 3-3 Single crosspoint for curve——Tangent

Choose Vertical distance in Option and input Off angle, Tangent vertical dist. and Normal vertical dist., other dialog boxes become gray. After inputting the known data, click Calc., the result is displayed, as shown in figure 3-4:

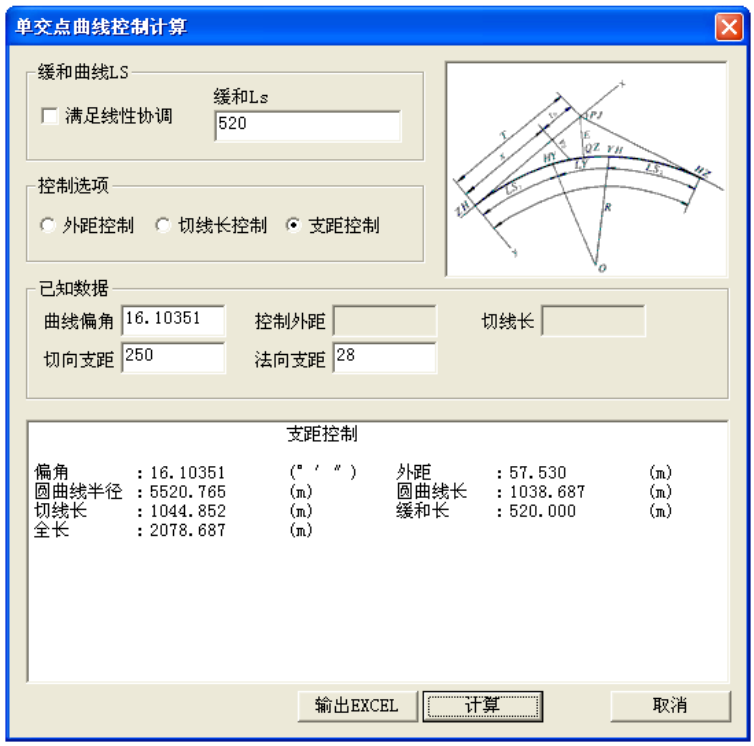


Figure 3-4 Single crosspoint for curve ——vertical distance

If you want to save the result, please click Export EXCEL, then input the name and save the file. If you want to cancel, click cancel to quit the current interface.

3.2 Convex plane curve

Convexity plane curve is a curve combined by two transition curves which have no circle curve to join up. According to some known conditions such as Option, external spur and tangent, the calculation of Convexity curve is to calculate off angle, tangent, radius of circle curve, transition curve and curve length. The interface of Convexity curve is shown as figure 3-5.

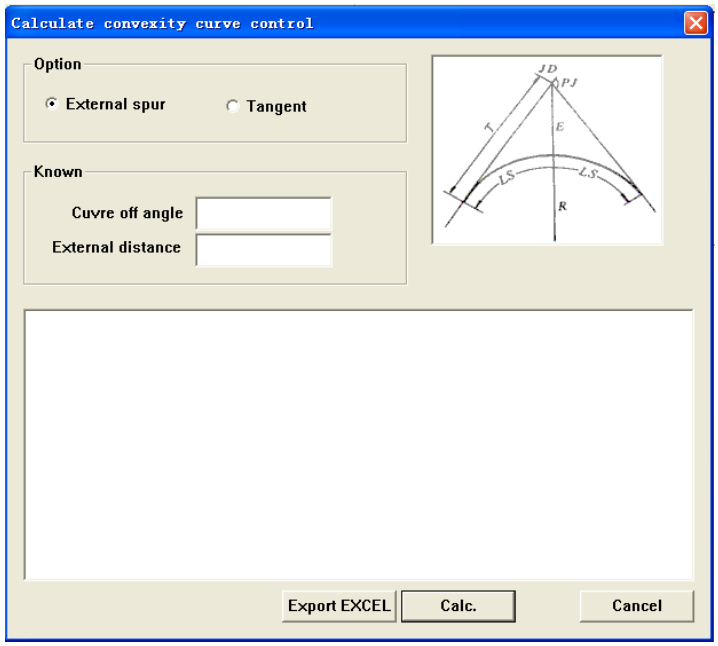


Figure 3-5 Convexity curve

Choose external spur in Option, input Curve off angle and External distance, then click Calc., the result will be displayed, as shown in figure 3-6:

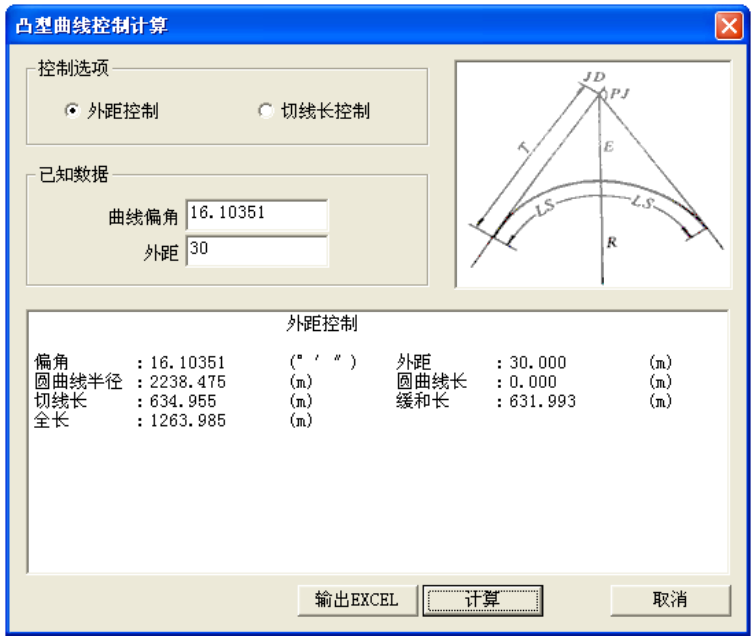


Figure 3-6 Convexity curve——external spur

Choose tangent in Option, input Curve off angle and External distance, then click Calc., the result will be displayed, as shown in figure 3-7:

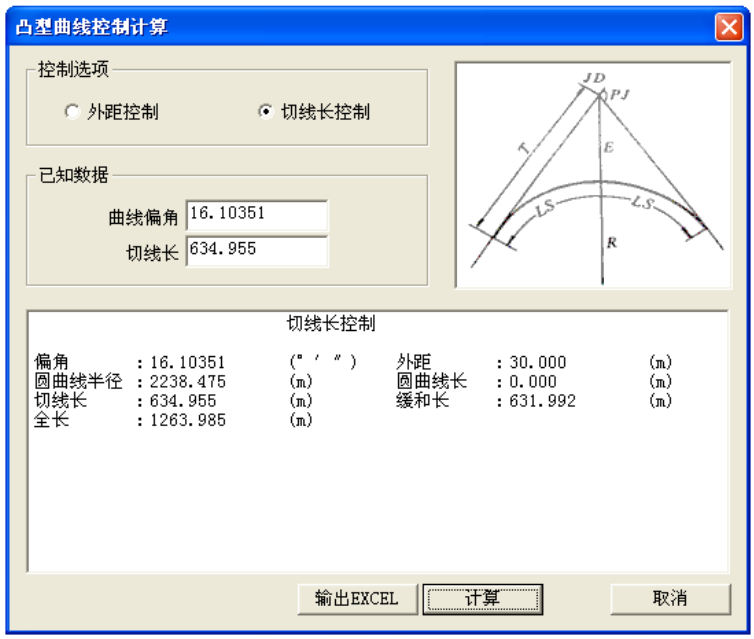


图 3-7　Convexity curve——tangent

If you want to save the result, pleas click Export EXCEL, then input the name and save the file. If you want to cancel, click cancel to quit the current interface.

3.3 Baseline tangent plane curve

If the crosspoint can't be set because of the terrain or some obstacles, you can choose crosspoints of two circles to set a reference line and to replace a crosspoint laydown curve, this is called double crosspoints plane curve. If the radius is tangent to reference line, it forms the tangency base line plane curve. According to Curve LS, Off JA, Base line and Off JB, the calculation of tangency base line plane curve calculates out radius of circular curve, length of circular curve, former tangent, later tangent and overall length. The interface of Tangency base line plane curve is as shown in figure 3-8.

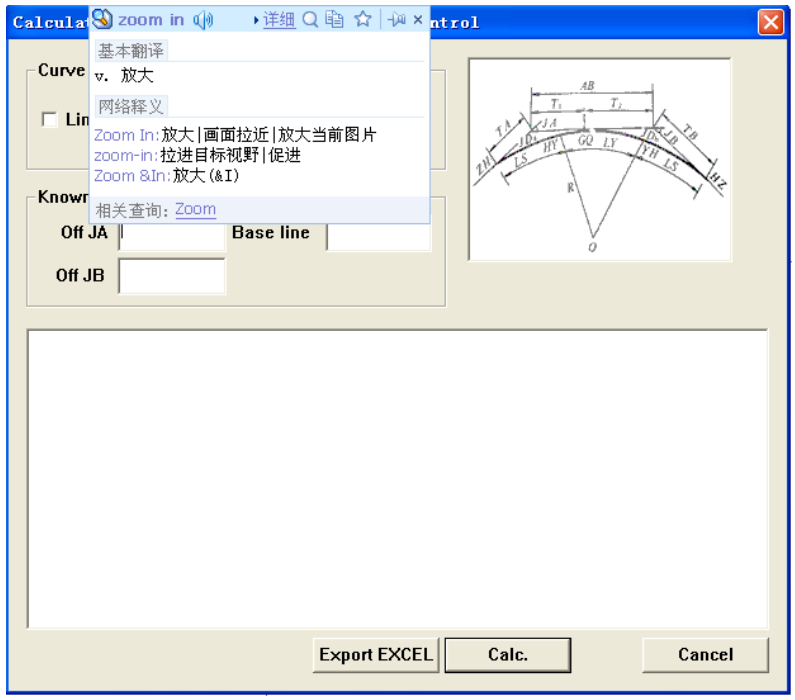


Figure 3-8 tangency base line plane curve

Choose Linearity, Curve LS textbox become gray, according to other known factors the program will calculate the best transition curve. Take curve LS for example, input curve LS, off JA, base line, off JB then click Calc., the result will be displayed, as shown in figure 3-9:

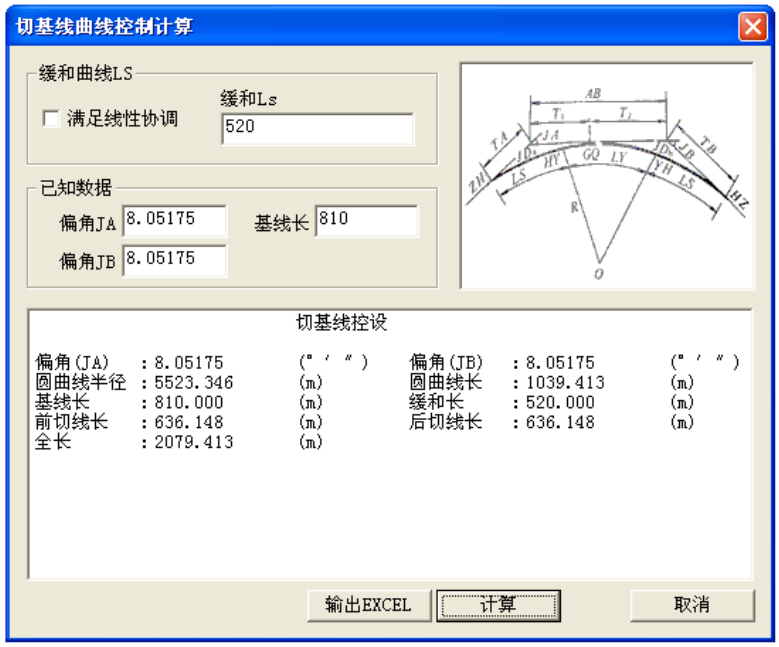


图 3-9 tangency base line for curve

To save the result, click Export EXCEL, then input the name and save the file, if not, click Cancel to quit current interface.

3.4 Complex curve

Circle curve is a plane curve which is combined by two circular curves with different radiuses but same direction. According to off JA, former curve, off JB, Later curve, Baseline and Former radius, the calculation of complex curve calculates out radius of later circular curve, length of former circular curve, later circular curve, former tangent, later tangent and overall length. Complex curve is shown as figure 3-10.

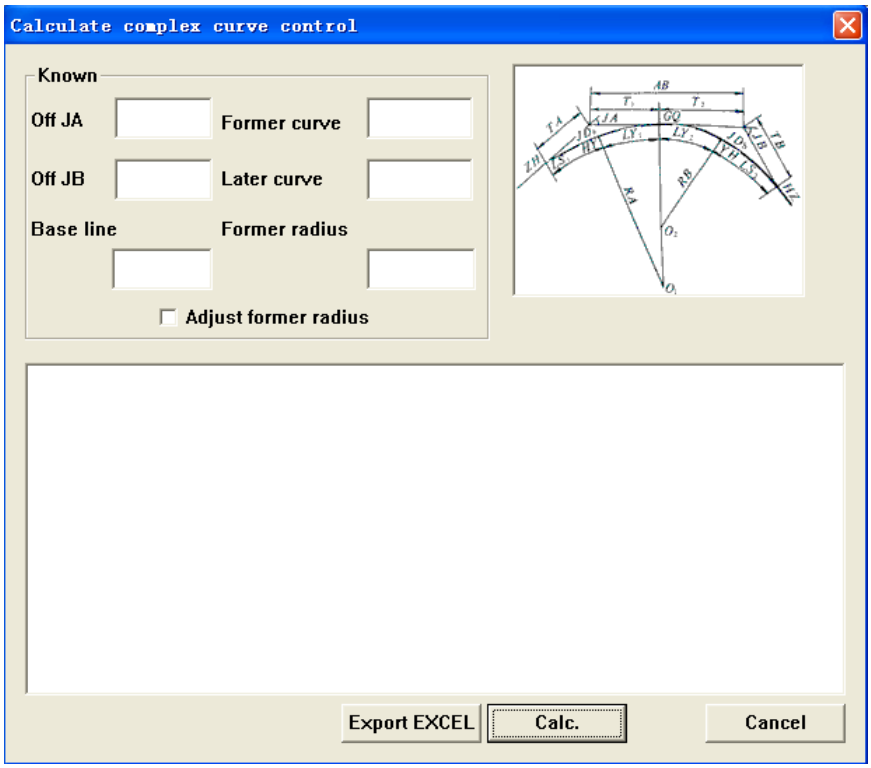


Figure 3-10 Complex curve

After inputting off JA, former curve, off JB, Later curve, Baseline and Former radius, click Calc., the result will be displayed. If select Adjust former radius, the best radius of former circle will be calculated, if not, the calculation will use the user input value. As shown in figure 3-11:

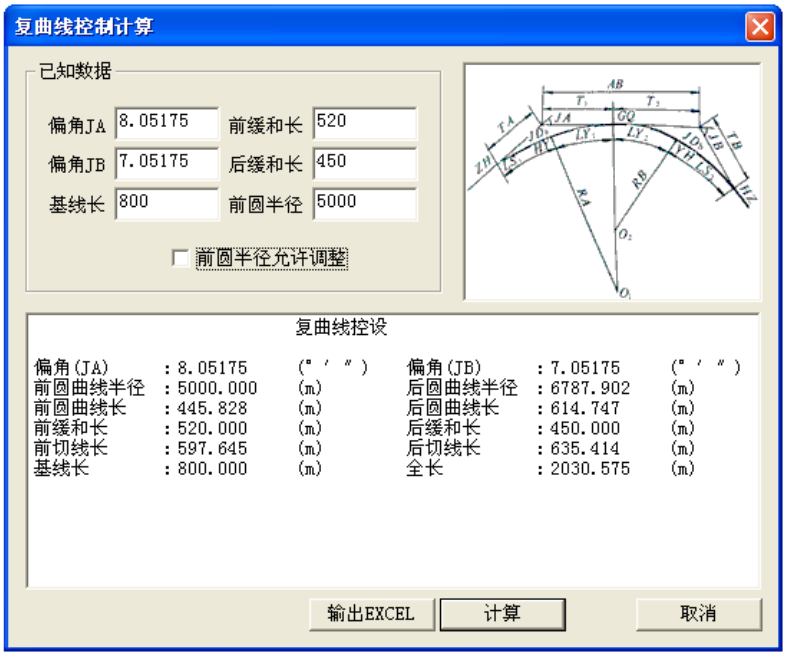


图 3-11 Complex curve

If you want to save the result, click Export EXCEL, then input the name and save the file. If not, click Cancel to quit current interface.

3.5 S-shape plane curve

Circle curve is a plane curve which is combined by two circular curves with different radiuses and opposite direction. According to Off JA, Former curve, Off JB, Later curve, Intersection distance and Former radius, the calculation of S curve calculates out radius of later circular curve, length former circular curve, later circular curve, former tangent, later tangent and overall length. S curve is shown as figure 3-12.

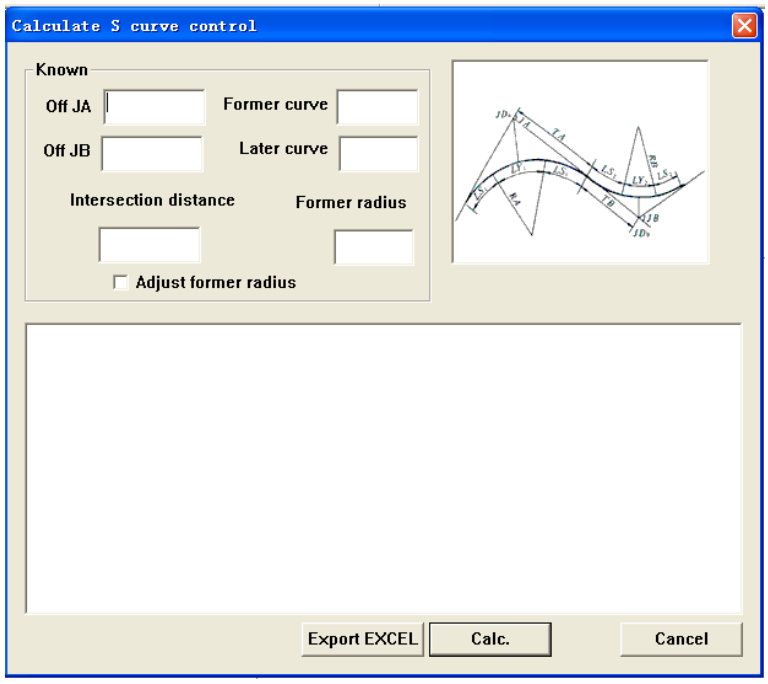


Figure 3-12 S curve

Input Off JA, Former curve, Off JB, Later curve, Intersection distance and Former radius then click Calc., the result is displayed. If choose Adjust former radius, the best former circular radius will be calculated, if not, the calculation will use the user input value. As shown in figure 3-13:

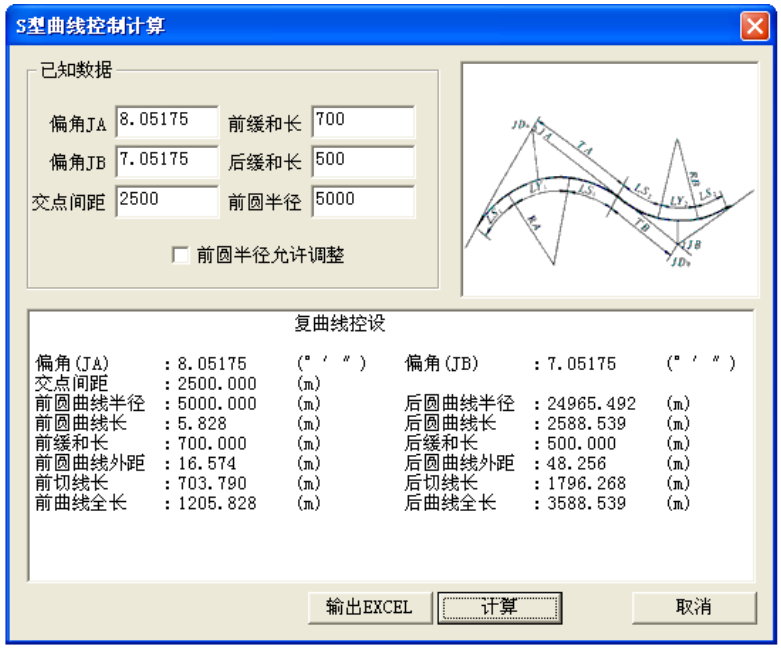


Figure 3-13 S curve

If you want to save the result, click Export EXCEL, then input the name and save the file, if not, click Cancel to quit current interface.

3.6 Egg-shape plane curve

Insert a transition curve into two circular curves to make curvature gradually change, this is oviform plane curve. According to Off JA, Former curve, Off JB, Later curve, Baseline and Former radius, the calculation of oviform plane curve calculates out radius of later circular curve, former circular curve length, later circular curve, middle transition curve, former tangent, later tangent and overall length. Oviform for curve is shown as figure 3-14.

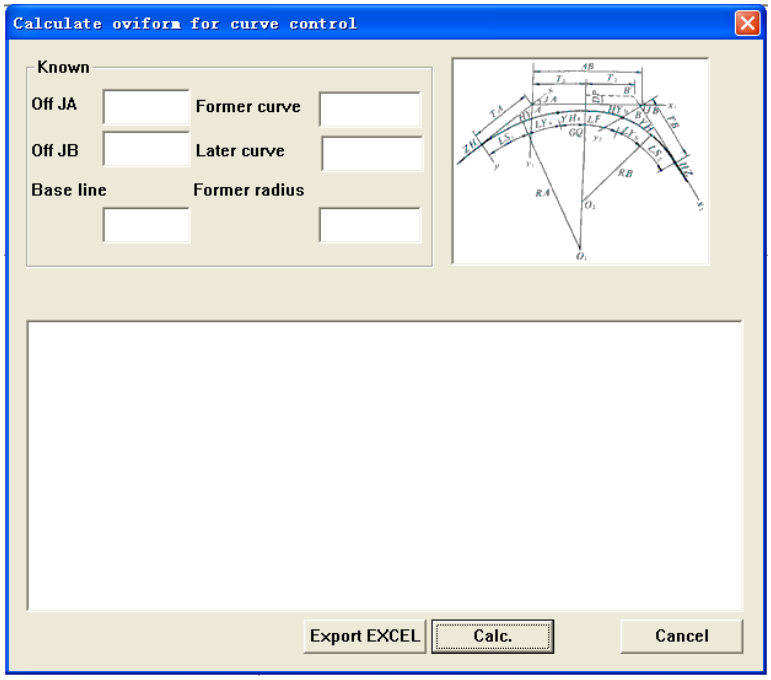


Figure 3-14 oviform for curve

Input Off JA, Former curve, off JB, Off JB, Later curve, Baseline and Former radius, then click Calc., the result will be displayed. As shown in figure 3-15:

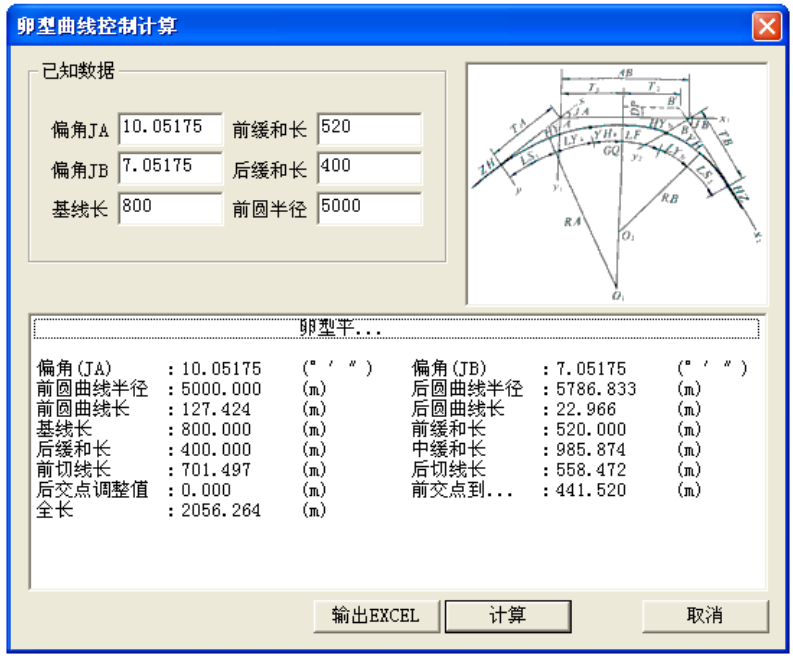


Figure 3-15 oviform for curve

If you want to save the result, click Export EXCEL, then input the name and save the file, if not, click Cancel to quit current interface.

3.7 Over width & over height

Widen and superelevation is based on Raw data, Widen and Superelevation to calculate superelevation value of a certain middle stake's outside roadbed, of a road's middle line, or of an inside roadbed. Raw data includes: ZH chainage, HZ chainage, Curved width, SL curve, Curved SL slope%, Crown slope%, Shoulder slope%, Shoulder width and Road width; Widen: Line scale, High order parabola; Superelevation: Centre shaft rotation, Inside axis rotation. The interface is shown as figure 3-16.

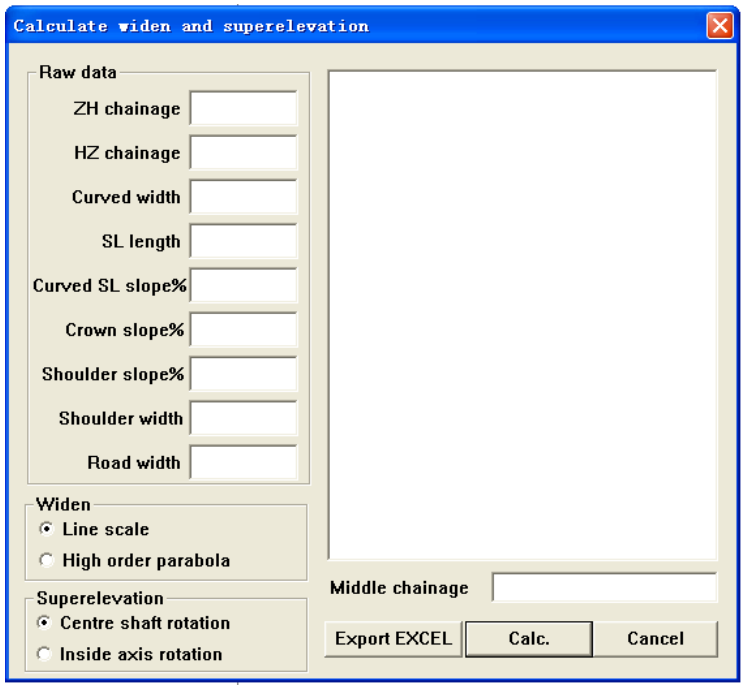


Figure 3-16 widen and superelevation

Input Raw data, suppose Widen as High order parabola, Superelevation as Centre shaft rotation, then input Middle chainage, click Calc., the result will be displayed, as shown in figure 3-17:

Figure 3-17 widen and superelevation

If to save the result, click Export EXCEL, then input the name and save the file, if not, click Cancel to quit current interface.

4 Road chainage calculation

4.1 Single intersection plane curve

According to chainage, increase and other known factors, Lay single crosspoint plane curve calculates chainage coordinate. The interface is shown as figure 4-1.

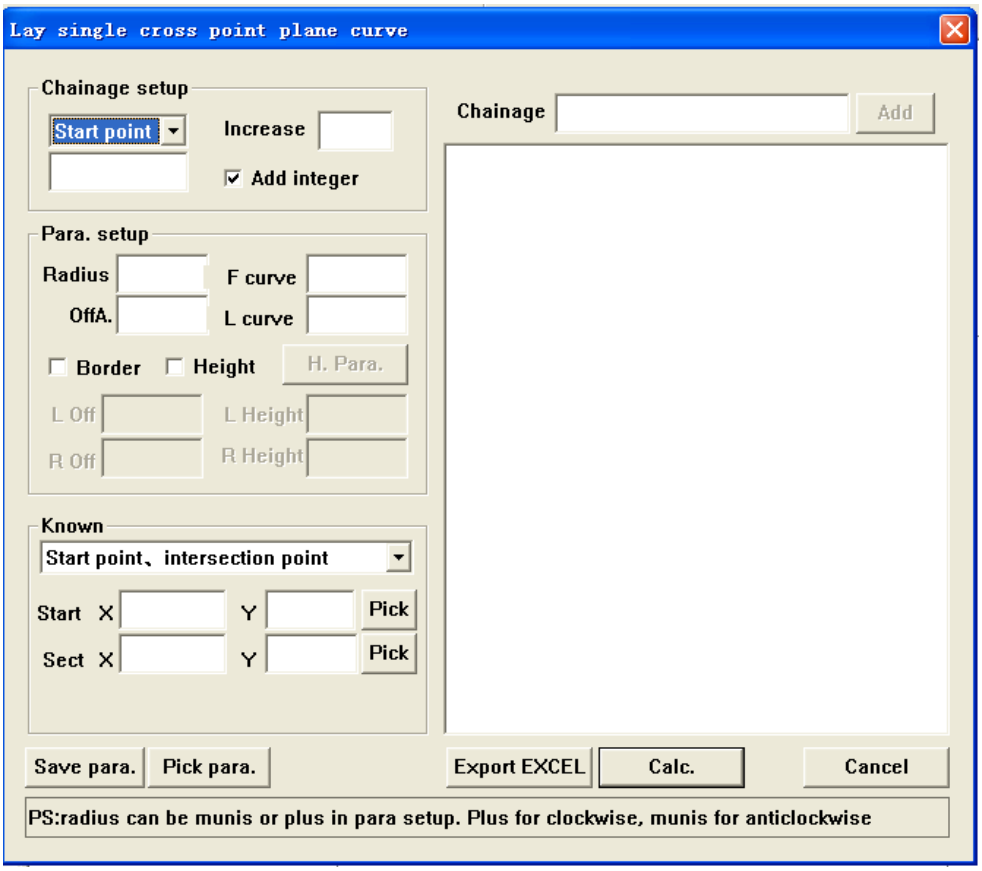


Figure 4-1 lay single crosspoint plane curve

Chainage setup: User can setup chainage by intersection point chainage or start point chainage; Add integer: According to the start point and increasing space to insert chainage, the value of chainage is an integer.

Para. setup: User must input radius, offA., F curve and L curve of the curve. If you want to calculate border, please choose border to activate L off and R off dialog box and input the value. If you want to calculate elevation, please choose Height to

activate L height and R height dialog box as well as H.Para. button, click H.Para. as shown in figure 4-2.

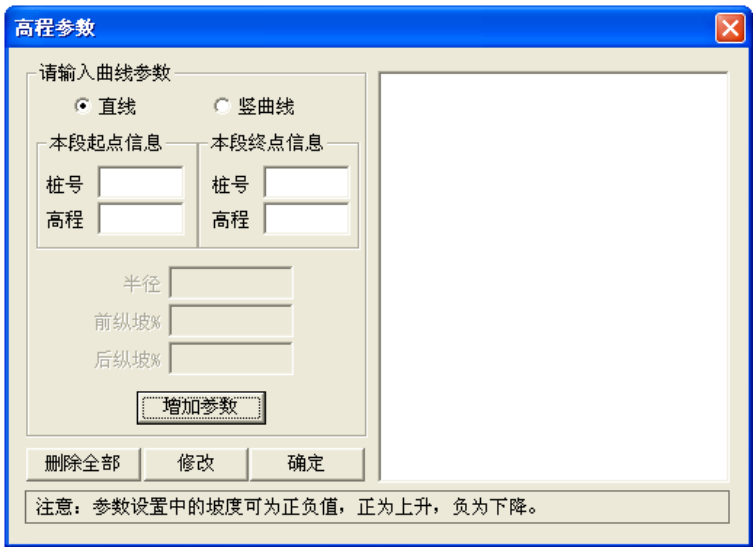


Figure 4-2 H.Para.

First user has to input information of start point and end point of this segment. If the beginning segment is a line, input the chainage and elevation of the start and end point of this straightline. If the beginning is a curve, input chainage and elevation of start point, and chainage, radius, former longitudinal slope% and later longitudinal slope% of end point, then click add para.. Del all is used to delete all information in the dialog box on the right. If you want to modify the linetype of a segment, select the listed items of this segment in the list box on the right, click modify, after modifying click OK. After adding all factors, click Yes to quit.

NOTE: In parameter setup, value for slope can be plus or minus, plus to ascend, minus to descend.

Known factors: known section start point, known section end point, known section azimuth between start point and section point and known section azimuth between section point and end point etc. User can input coordinates by manual or automatic. Click pick, as shown in figure 4-3, double click to choose, after that browse coordinate close.

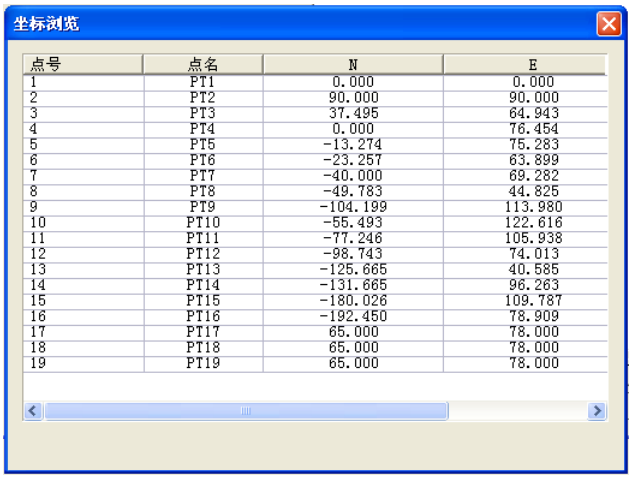


Figure 4-3 browse coordinate

Save para.: save all the parameter to the file, click save to save, the default name is "Untitled" and the format is *txt; If you want to use the same parameter click pick para. to open the file.

Note: In parameter setup, value for slope can be plus or minus, plus for right in forward direction, minus for left in forward direction.

After setting parameter, click Calc., the result is displayed in dialog box on the right, including curve factor, chainage and coordinate of key points (ZH, HY, QZ, YH, HZ) and of each inserted chainage. This software has Add chainage function, input the chainage to be added Add, then calculated information of of the added chainage will be displayed in the list box. As shown in figure 4-4.

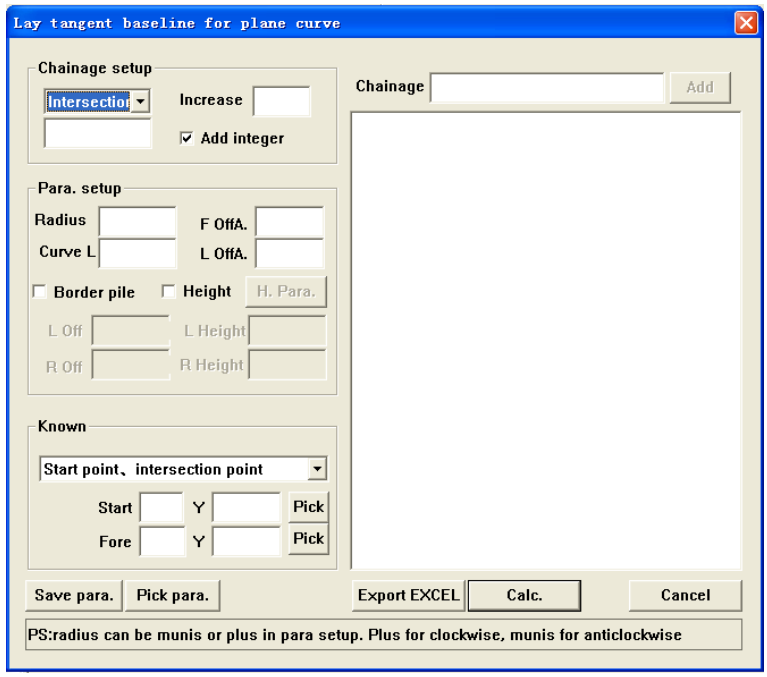
Export EXCEL: export result to EXCEL.

Cancel: Quit the dialog box.

Figure 4-4 Lay single crosspoint plane curve

4.2 Baseline tangent plane curve

According to Chainage, Increase and other known factors, this function can calculate chainage coordinate. The interface is as follow:.



Baseline tangent plane curve

Chainage setup: User can setup chainage by Intersection point chainage or Start point Chainage;

Add integer: Make the value of start point chainage, insert point chainage and increment to be integral.

Para. setup: You have to input curve Radius, F offA, L offA and Curve L. If you want to calculate border, please choose Border to activate L off and R off dialog box and input the value. If you want to calculate elevation, please choose Height to activate L height and R height dialog box, at the same time, H.para. also is activated. Click H.para..

Known factor, Save pare., Pick para., Calc., Add, Export EXCEL are same as lay single intersection plane curve. As following figure:

Baseline tangent plane curve

You can move scroll bar up, down, left or right to view the information, click Cancel to escape.

4.3 Complex curve

According to chainage, increase and other known factors, this function can calculate chainage coordinate. Interface is as following figure:

Complex curve

The differences between complex curve and single intersection plane curve are F radius, F offA, L radius, L offA, F curve, L curve must be input in Para. setup. Others are same as single intersection plane curve. Example for calculation with complex curve is as following graph:

PS: Former radius and later radius must be the same plus-minus.

Complex curve

You can move scroll bar up, down, left and right to view the information, click Cancel to quite.

4.4 S-shape plane curve

According to Chainage, Increase and other known factor, this function calculates chainage coordinate. Interface is as following figure:

S-shape plane curve

From interface S-shape plane curve is almost the same as single intersection plane curve, but a little different, the former radius and later radius must be opposite. S-shape plane curve is as follows:

S-shape plane curve

User can move scroll bar to up, down, left and right to go over the information, click Cancel to escape.

4.5 Egg-shape plane curve

According to Chainage, increase and other known factor, this function can calculate chainage coordinate. Interface is as following figure:

Egg-shape plane curve

The difference between Egg-shape plane curve and single intersection plane curve are that F radius, F offA, L radius, L offA, F curve, L curve must be input in Para. setup. Others are same as single intersection plane curve, egg-shape plane curve is as following figure:

Egg-shape plane curve

You can move scroll bar to up, down, left and right to go over the information, click Cancel to escape.

4.6 Vertical curve

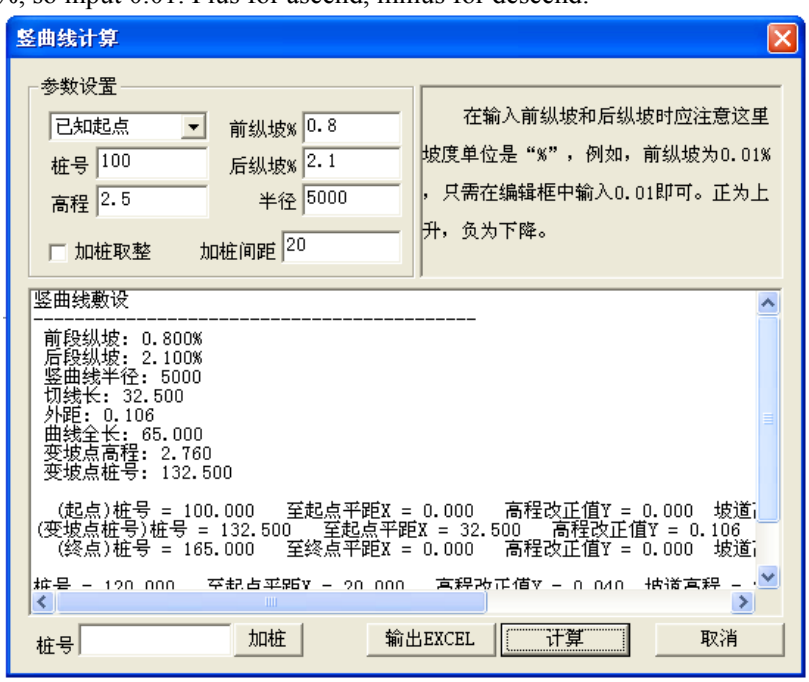
According to Elevation, Radius, F slope%, L slope% and Increase of Start point or Knick point to calculate chainage, HD to start point, slope elevation and vertical curve elevation..

Add integer: Make the value of start point chainage, chainage, increment to be in tegral. Interface is as following figure:

Vertical curve

After input parameter, click Calc, result lists in the list box. If you want to calculate chainage, input the value in Chainage, and then click Add. Shown as following figure:

PS: The unit for former slope and later slope is “%”, for example, former slope is 0.01%, so input 0.01. Plus for ascend, minus for descend.

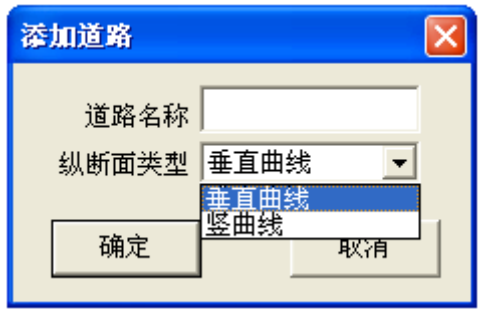


Vertical curve

User can move scroll bar to up, down, left and right to go over the information, click Cancel to quite.

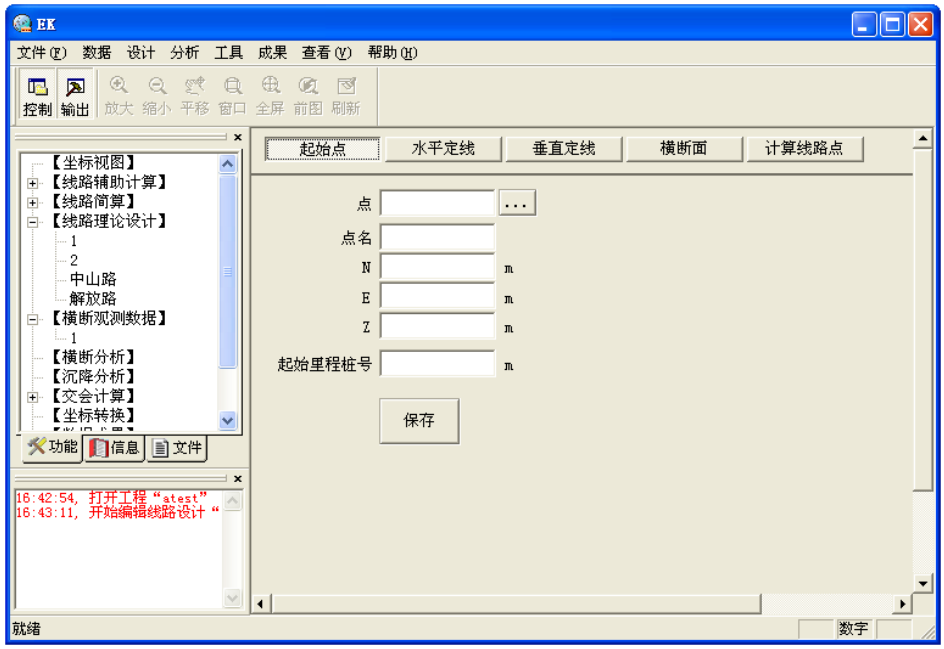
5 Road theory design

Click Design——Road Design——Add, it displays “Add road” figure:



Add road

Take Road name as “zhongshan road”, choose vertical in V-sect type, click “Yes”, “zhongshan road” display in the subdirectory of Road theory design, and as follows figure 5-2. If there is no road name, system prompts you to input the name, click Cancel to quite. If already exist road name, double click road theory design, chose road will be open.



Road theory design

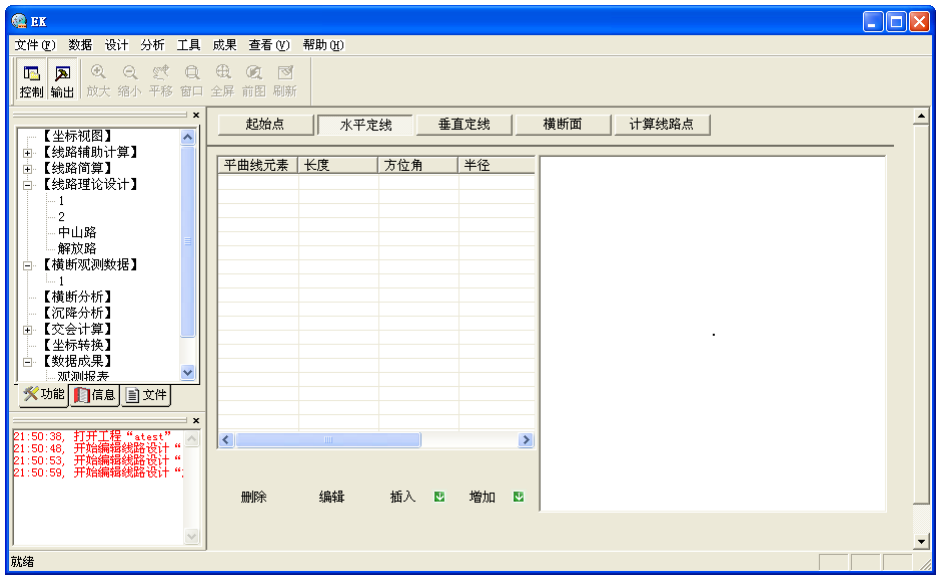
5.1 Start point

Start point can be input manually or by clicking ..., Start chainage must be input manually. Click save to save, after inputting.

PS: No matter manual input or automatic input, you must click “Save” after input. The default value: N=0;E=0;Z=0;start chainage=0.

5.2 Horizontal alignment

Horizontal alignment elements contain: chainage of intersection, elevation ,length(radius).



Horizontal alignment

Add: Add more of blank line used for inputting horizon alignment elements.

Insert: Insert blank line into appointed position, used for inputting horizon alignment elements.

Delete: Delete horizon alignment elements at appointed position.

Edit: Modify the appointed horizontal alignment elements.

Click Add, then an interface will pop up. Choose line in horizon alignment element. As follows figure 5-3. In “input line”, length: 712.017 m, azimuth: 1.4916 (degree), click Yes to save the data. Click Cancel to quite.

Input line

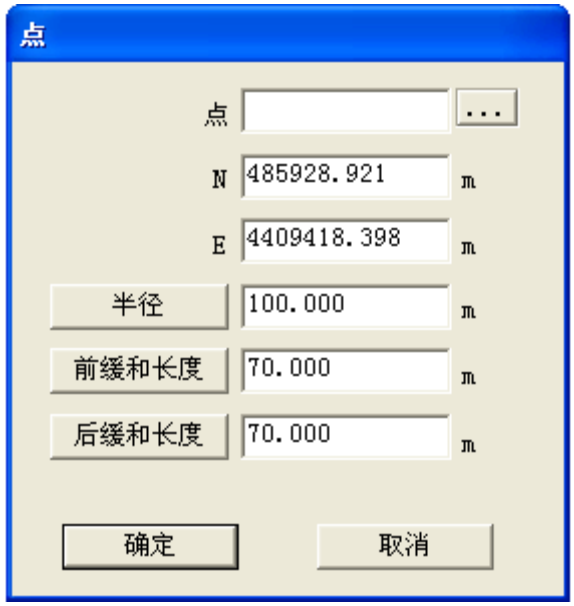
Choose transition curve in “horizon alignment element”, figure 5-4 “input transition curve”, Radius: 5500 m, length: 700 m, choose left in Rotate, click Yes to save, click Cancel to escape.

Input transition curve

Choose circle curve in “horizon alignment element”, figure 5-5 “input circle curve”, circle radius: 5500 m, circle length: 700 m, choose left in Rotate, click Yes to save, click Cancel to quite .

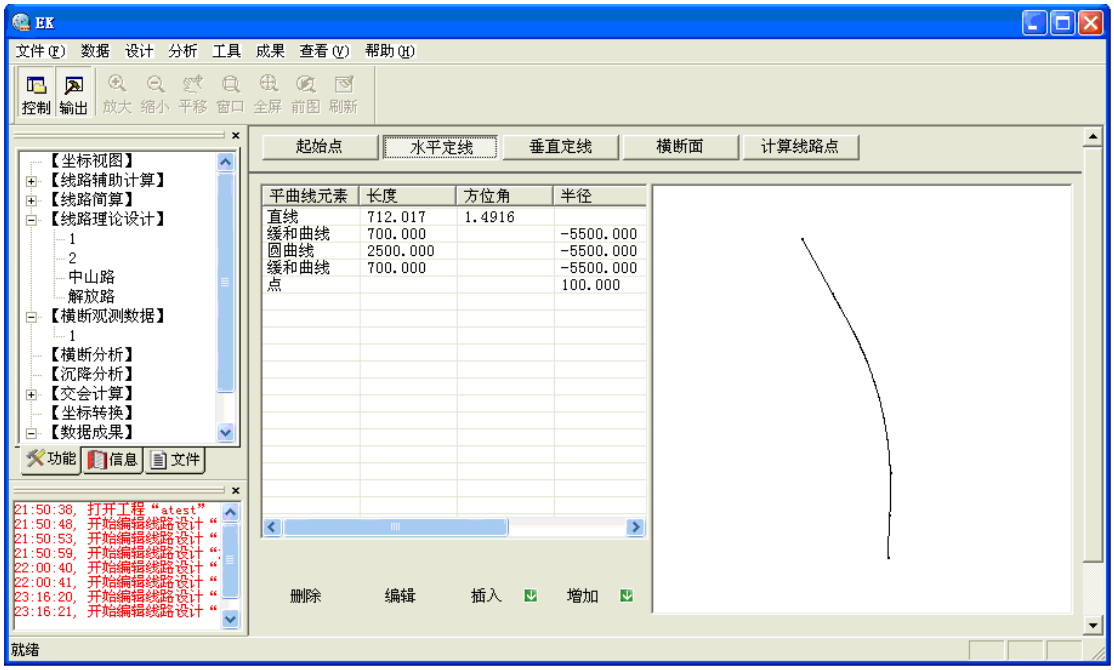
Input circle curve

Choose point in “horizon alignment element”, figure 5-6 “input point”. Two ways to input point element manual and …. Radius: 100 m, F curve length: 70 m, L curve length: 70 m. click Yes to save the data. Click cancel to quite.



Input point

4 kinds of horizontal element are showed in figure “Horizon alignment data”. When choose one element in the list box, it shows chainage and azimuth, and chosen curve with red line at the right side. You can click Edit, Del, Insert to edit the data.

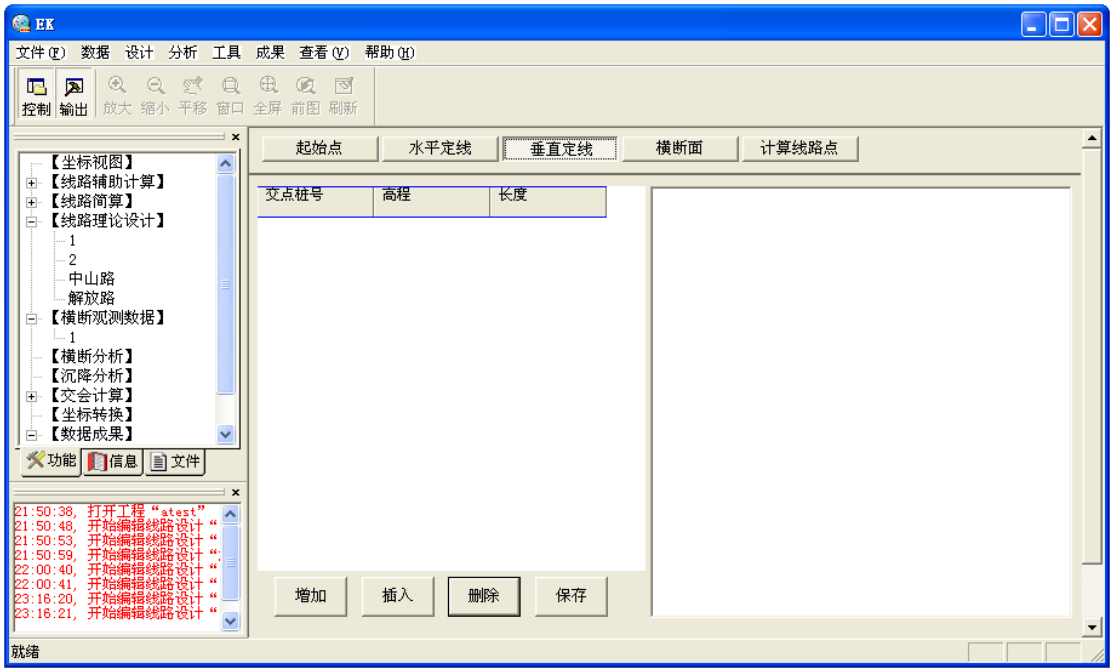


Horizontal alignment data

5.3 Vertical alignment

After completing adding information of horizontal alignment elements, you can start

to input “Vertical alignment” information. Click Vertical alignment button, graph shown as below:



Vertical alignment

Vertical alignment elements contain: chainage of intersection, elevation, length (radius).

Add: Add more of blank line used for inputting vertical alignment elements.

Insert: Insert blank line into appointed position, used for inputting vertical alignment elements.

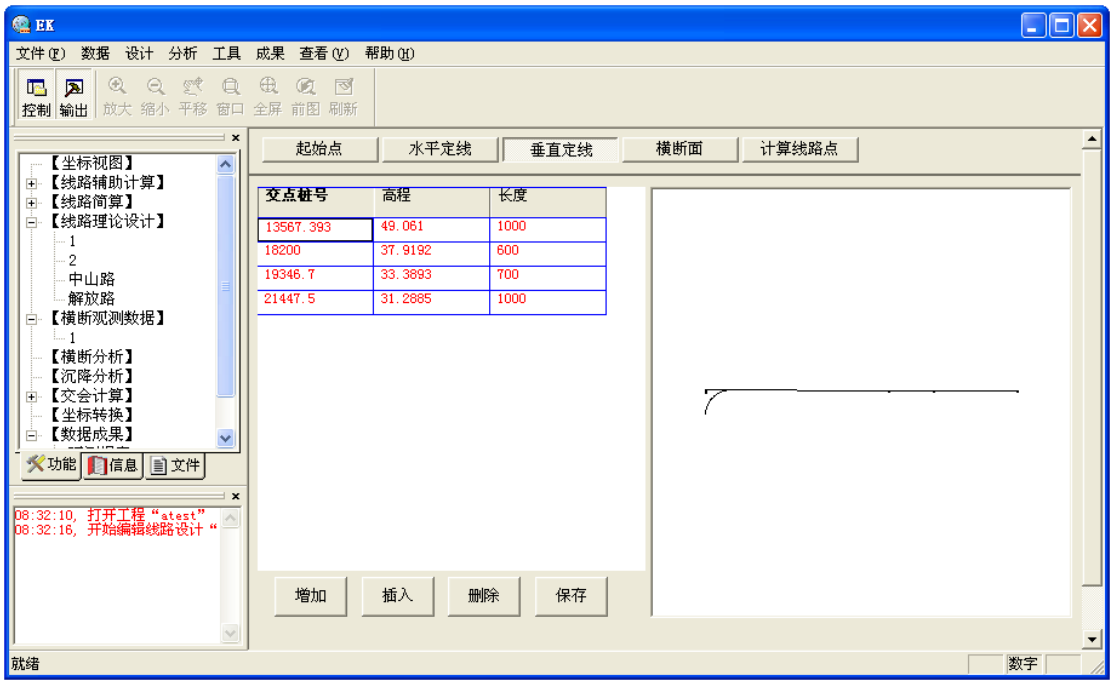
Delete: Delete vertical alignment elements at appointed position.

Save: Record the input vertical alignment elements. After modifying vertical alignment elements, please save before starting other process.

Click Add, then a blank line exists in the list. Input vertical alignment element data, according to the list below.

Chainage	Elev.	Length
13567.393	49.061	1000
18200	37.9192	600
19346.7	33.3893	700
21447.5	31.2885	1000

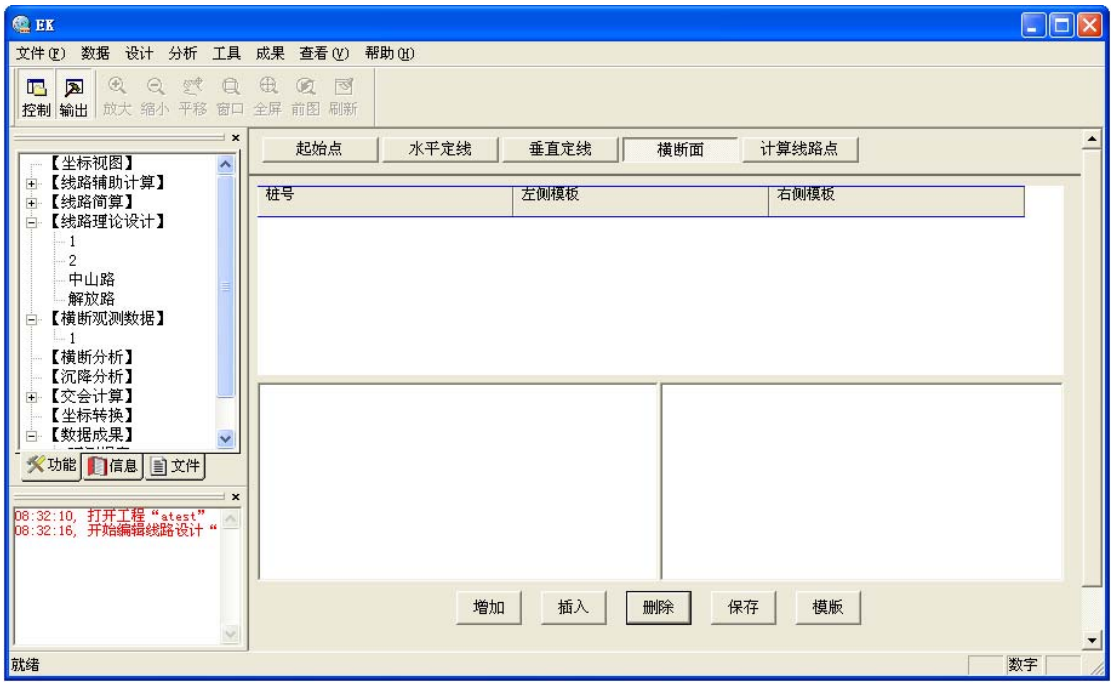
Check the inputting and click Save. And then defining vertical alignment is completed, as graph 5-9 shown:



Vertical alignment element data

5.4 Transect

After completing adding information of vertical alignment elements, you can start to input "Transect" information. Click "Transect" button, graph will show as below:



Transect information

Add: Add more of blank lines used for inputting transect information.

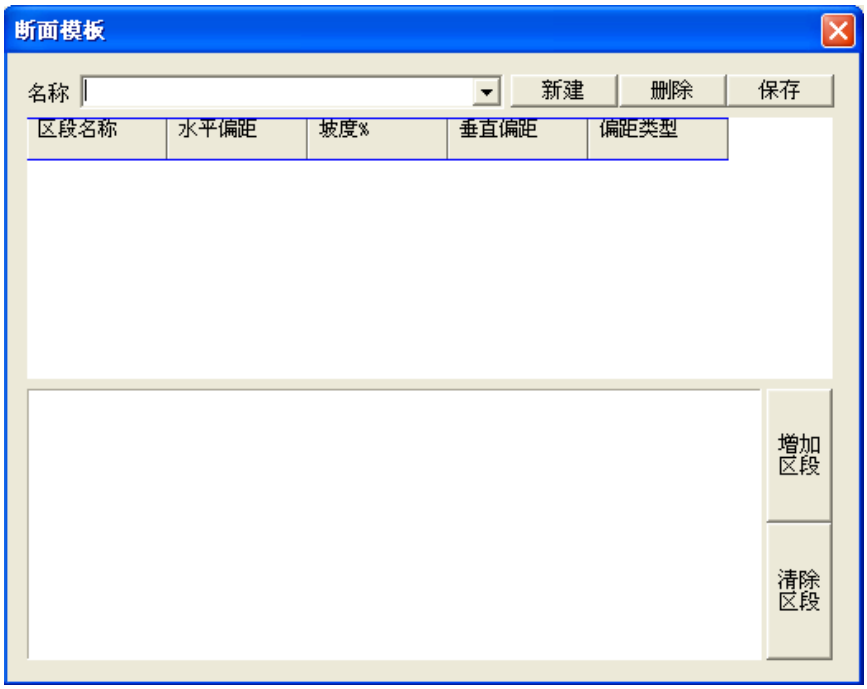
Insert: Insert blank lines into appointed position, used for inputting transect information.

Delete: Delete transects information at appointed position.

Save: Record the input transects information. After modifying transect information, please save before starting other process.

Templet: Add new template, view original template or modify existed template. Make sure that checking that if the template is existed or not before editing. Define new template if there is no template.

Click Templet, graph as below will show. Template data include: Section name, H offset, slope%, V offset, offset type.



Transect templates

New: Create new transect template, according to input template name.

Delete: Delete the template chose or has input name.

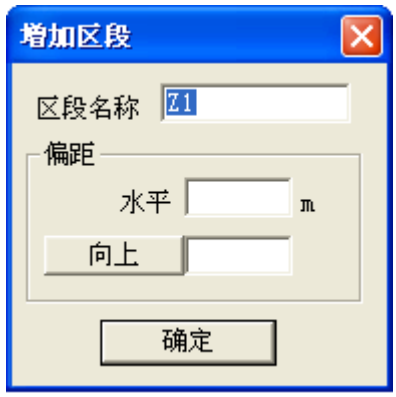
Save: Save new or modified transect template data.

Add section: Add new section of transect template.

Delete section: Delete chose section of transect template.

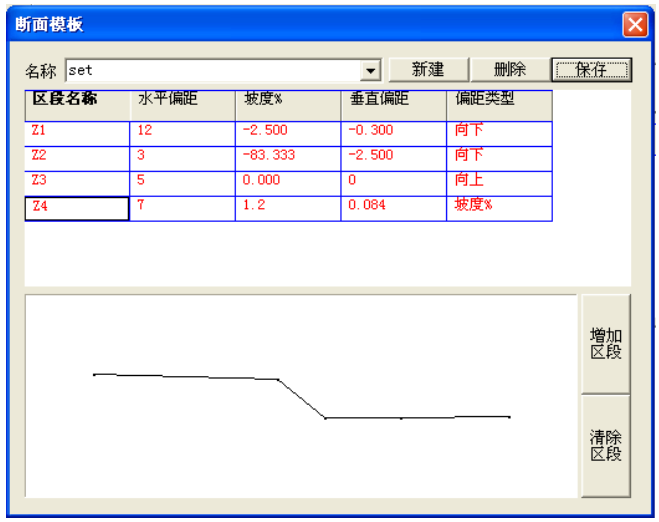
Input at template Name, set, then click Add section, graph 5-12 will show as below. Input section name (Default Z1), rest is empty. Input by sequence horizontal offset: 12, vertical offset (Slope %): 0.3, click Upward button, button will switch from “Upward”,

"Downward" and "Gradient%".



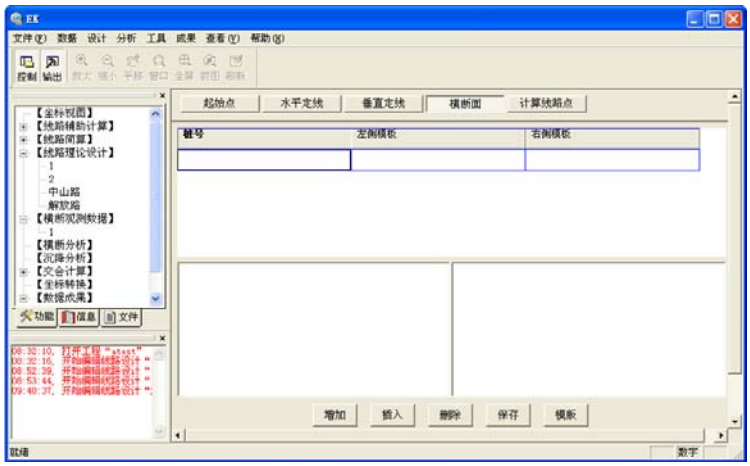
Add section

Click Yes, then Z1 section will be added, click X to cancel adding section. Repeat the steps above and add the new sections as below: Section name, Z2, Horizontal offset, 3, Vertical offset, 2.5, Offset type, down. Section name, Z3, Horizontal offset, 5, Vertical offset, 0, Offset type, up. Section name, Z4, Horizontal offset, 7, Vertical offset, 1.2, Offset type, slope%. Click Save at last to complete the data inputting for template name. That will show like graph below. Click X to go back to transect main interface.



Inputting data of transect template

In interface "transect information", click Add, graph will show as below. Click once only when you need to input chainage.

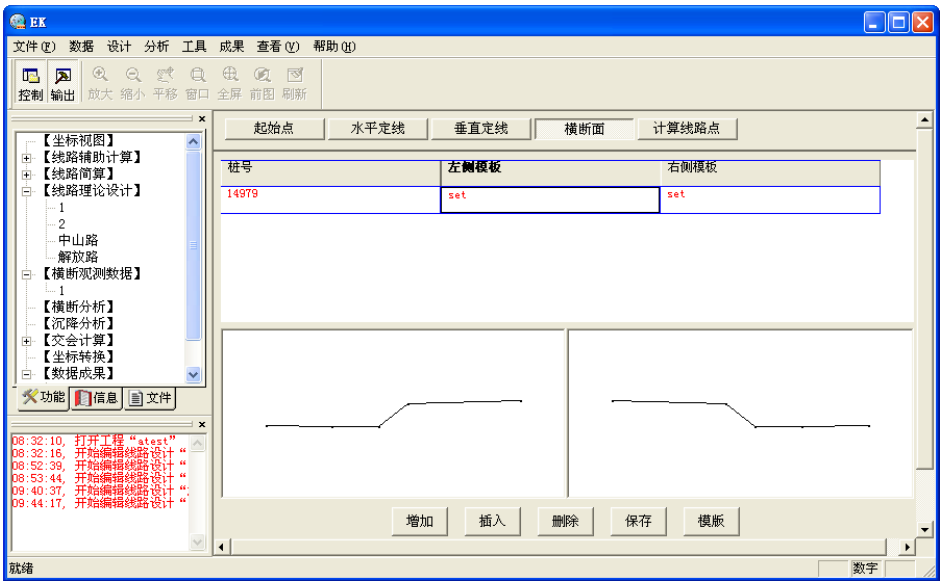


Add transect

Click the blank line on left template or right template, interface for choosing transect template will appear, as shown on graph below:

Choosing transect template

Select “Set” template from the template name list in “Choosing transect template” interface. Interface after completing data will show like this graph below “Transect template data”. Click Save to save the transect data.



Transect template data

Caution: Template of leftside and rightside can be different and also can be same. If they are different, choose different templates in "Choosing transect template" interface.

5.5 Calculate road point

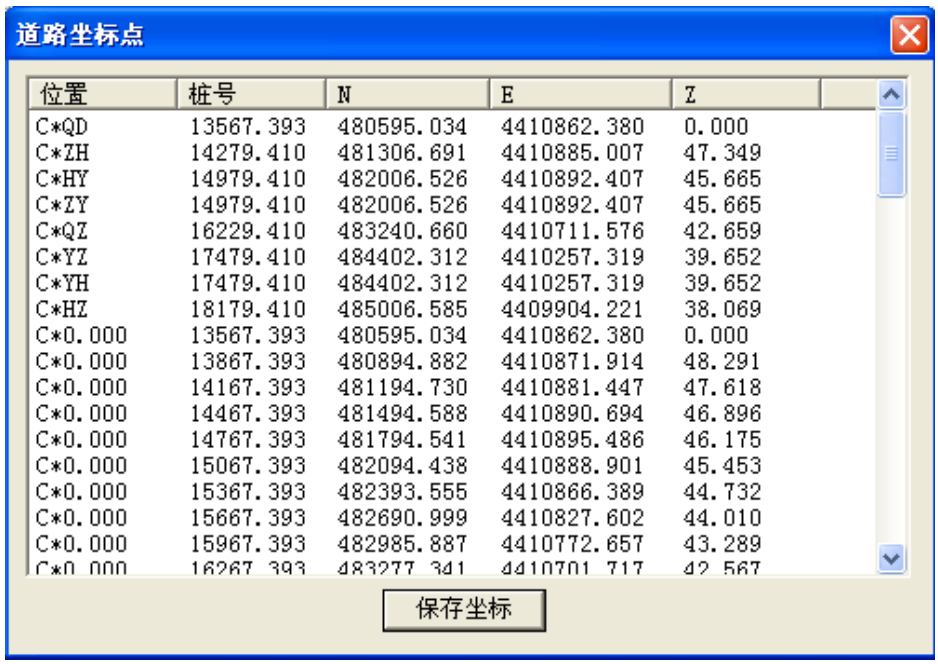
After completing adding the transect information, we can go to calculation of road points, click "Calculate road point" button, graph will show as below:

Calculate road point

Road point include: Middle Pt, Left Pt, Right Pt and transition point, etc.

Choose Middle Pt, Right Pt, input the distance to middle line, 5, unit is meter; Left Pt, input distance to middle line, 7, unit is meter, Transition Pt, input the distance between chainage, 100, unit is meter. Click Calc., system will calculate out that 100 road points, between which the distance is 100, all of which are on road middle line. Results will be showed as below:

Caution: Distance between chainage is less than 10 meter.



Road coordinate points

6 COGO

In EK software, Cogo contains forward intersection, resection, linear intersection, angle intersection, radiate, foot of perpendicular, distance line, lines intersection, point on line, symmetrical point, etc eleven coordinate calculating function.

Each coordinate calculating function has simple picture to instruct. System supplies manually inputting and selecting from coordinate list two types methods to input point number at every place where to input point number. Software will notice you, if there is no intersection.

6.1 Forward intersection

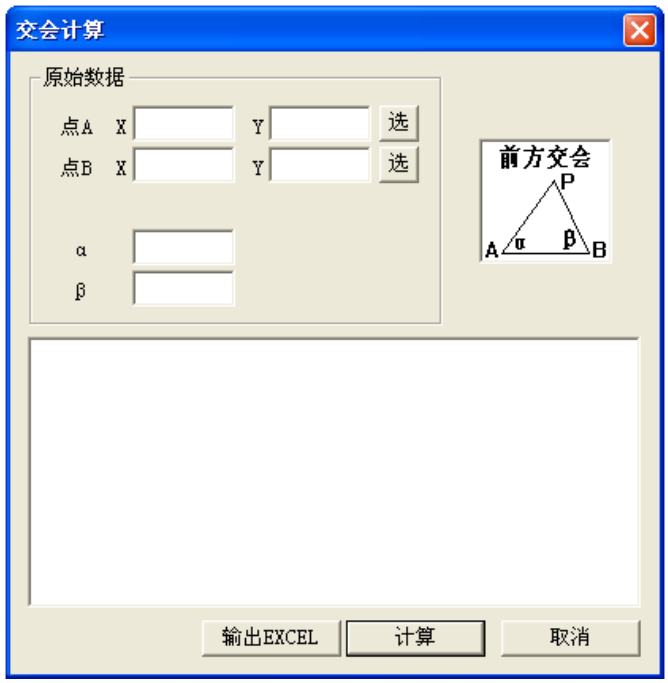
According to forward intersection, we have point 1, point 2, both of them are known

points. Set occupation at these two points and get value of ∠1, ∠2, to calculate unknown point P. The mathematical model as below:

$$xP=\frac{x1\times ctg\angle 2+x2\times ctg\angle 1-y1+y2}{ctg\angle 1+ctg\angle 2}$$

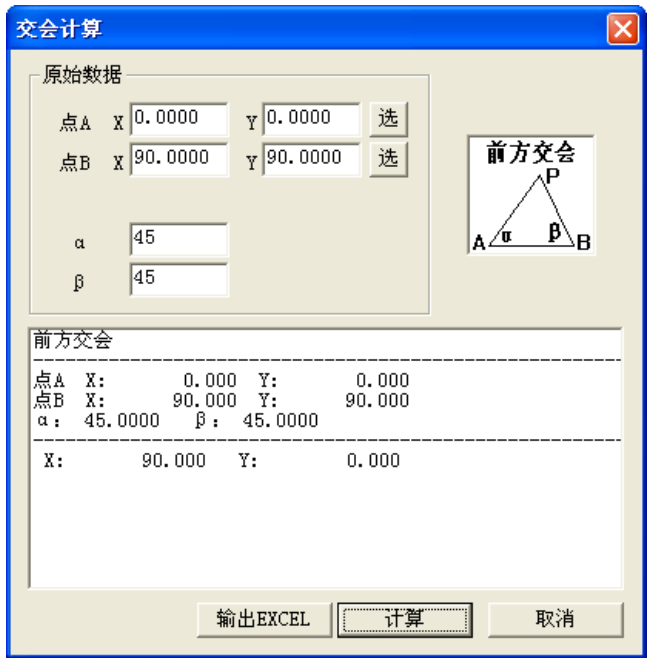
$$yP=\frac{y1\times ctg\angle 2+y2\times ctg\angle 1-x1+x2}{ctg\angle 1+ctg\angle 2}.$$

As shown in graph 6-1 “Forward intersection”, Point A, B are known points, you can input manually, and also can select them from coordinates list.



Forward intersection

Suppose that coordinate of A is 0,0, coordinate of B is 90,90, both of α、β are 45. Click Calc. button, calculation results will display in list, as shown below with graph 6-2:



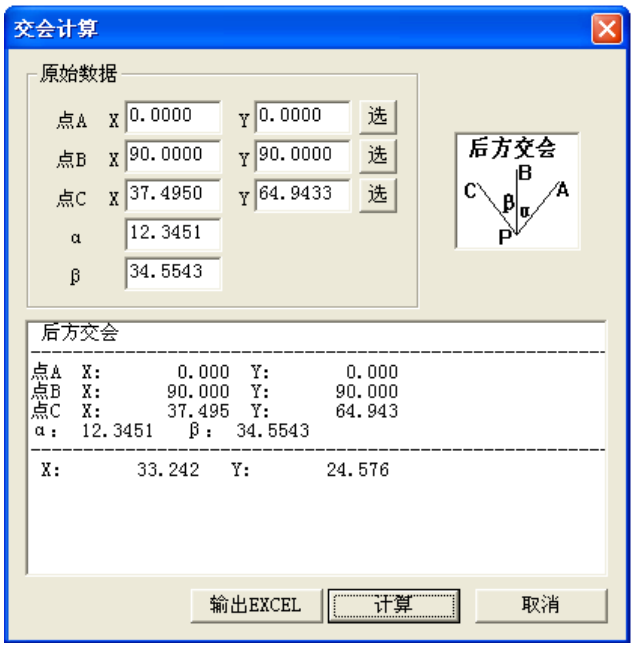
Forward intersection calculation

Click Export EXCEL, name the saved file and click Yes, calculation results will be saved into EXCEL file.

6.2 Resection

In resection, points A, B, C are known, angle α, β can be measured, with all the conditions above to calculate the coordinate of point P. Point P can not appear on the circum circle of A, B, C or near it.

Suppose that coordinate of point A is 0,0, point B is 90,90, point C is 37.495,64.9433, α、β are 12.3451, 34.5543 respectively. Click Calc. button, results will show in list. Shown as graph 6-3.



Graph 6-3 Resection calculation

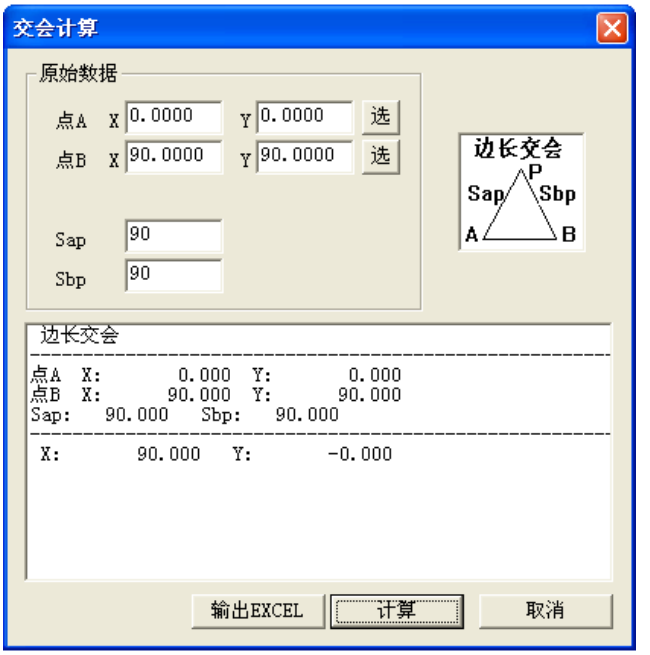
Click Export EXCEL, name the saved file and click Yes, calculation results will be saved into EXCEL file.

6.3 Linear intersection

With Linear intersection, you should set station at point A, B both of which are known, with all the conditions above to calculate the coordinate of point P.

In raw data input, suppose that coordinate A is 0, 0, B is 90.90, length of PA is 90 meters, length of PB is 90 meters. Click Calc. button, results will show in the list, as shown below:

Caution: In Linear intersection, the intersection point will be the left side of forwarding direction.



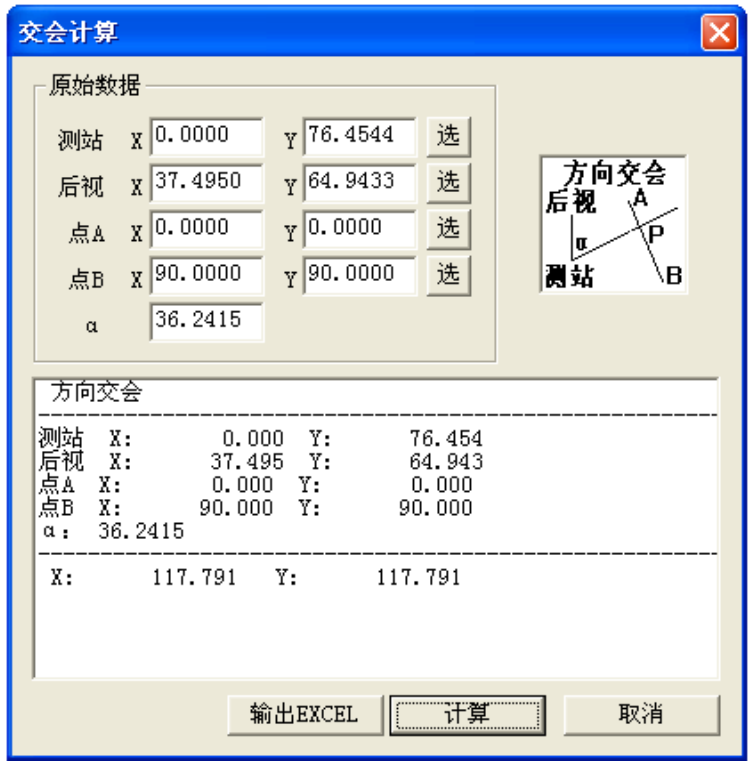
Graph 6-4 Linear intersection calculation

Click Export EXCEL, name the saved file and click Yes, calculation results will be saved into EXCEL file.

6.4 Angle intersection

Angle intersection is to use known directions of two lines to determine the unknown coordinate of point. In practical surveying, looking for the place for setting station is always a problem. This function is made to deal with this kind of problem. Known coordinates of point A, point B, point P is a intersection of line AB and a line that cross through station, with all the conditions above to get the coordinate of point P.

In the process of raw data inputting, suppose that coordinate of station is 0, 76.4544. Coordinate of backsight is 37.4950,64.9433. Coordinate of point A is 0,0. Point B is 90,90. α is 36.2415, click Calc., results will show in the below list. As graph 6-5 shown:



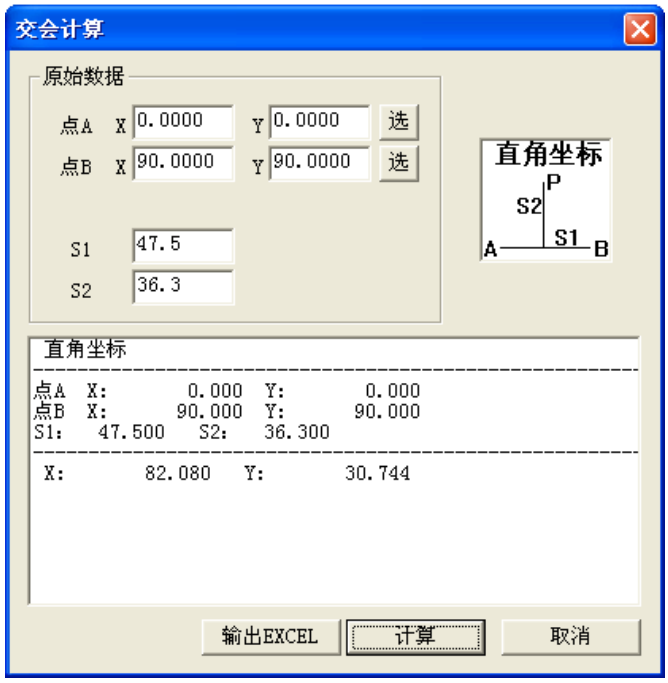
Graph 6-5 Angle intersection calculation

Click Export EXCEL, name the saved file and click Yes, calculation results will be saved into EXCEL file.

6.5 Vertical distance point

Point A and point B are knew, the distance from point B to foot of it is S1 and the distance from point P to the line crosses through point A and B is S2, with all the conditions above to calculate the coordinate of point P.

Suppose that coordinate of point A is 0, 0, B is 90, 90, S1 is 47.5 meters, S2 is 36.3 meters, click Calc. button, results will show in the list:



Graph 6-6 Vertical distance point calculation

Click Export EXCEL, name the saved file and click Yes, calculation results will be saved into EXCEL file.

6.6 Radiation

点 A、点 B 为已知控制点,在点 A 设站,以 B 点为起始方向,观测了水平角 α 和距离 S,计算 P 点的坐标.

在原始数据输入中假设 A 点坐标为 0,0;B 点坐标为 90,90; α 为 36.4215,度分秒;距离为 73.3 米, 点击计算按钮,计算结果显示在列表框中,如图 6-7 极坐标计算:

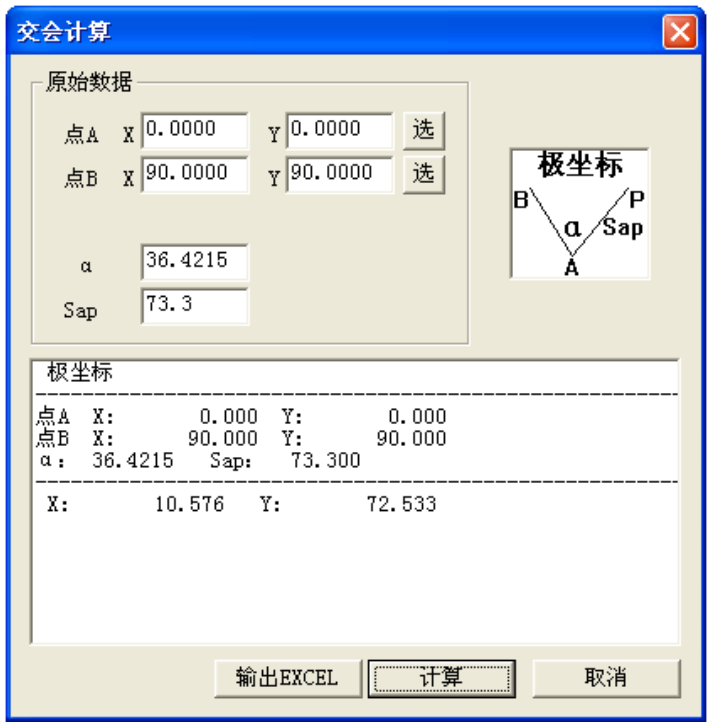


图 6-7 极坐标计算

Click Export EXCEL, name the saved file and click Yes, calculation results will be saved into EXCEL file.

6.7 Foot of perpendicular

Point A, B, C are known points, with these conditions to calculate the foot P of the line which connects Point C and line AB in shortest distance.

Suppose that coordinate of point A is 0, 0, B is 90, 90, C is 37.495, 64.943, click Calc., results will show in the list below:

Graph 6-8 Foot of perpendicular

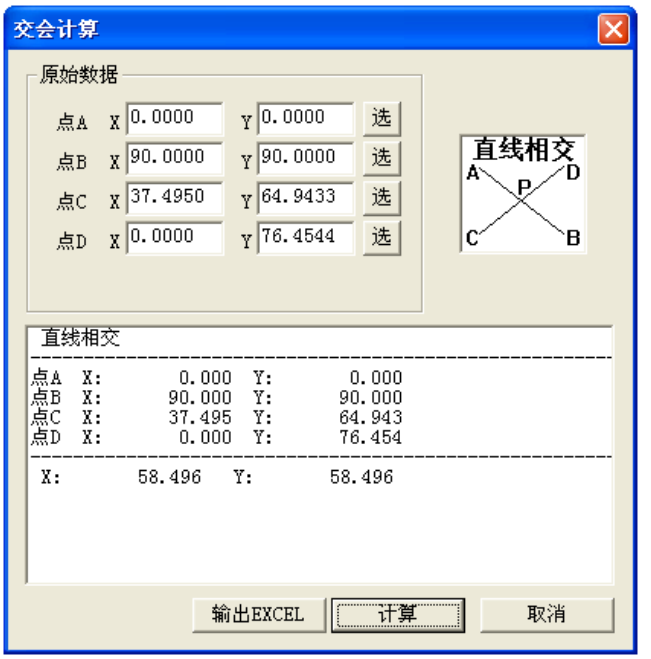
Click Export EXCEL, name the saved file and click Yes, calculation results will be saved into EXCEL file.

6.8 Lines intersection

Point A, B, C, D are known points, with these conditions to calculate the intersection P of line AB and line CD.

Suppose that coordinate of point A is 0, 0, B is 90, 90, C is 37.495, 64.943, D is 0, 76.454, click Calc., results will show in the list below:

Caution: Each line points you input will be check by system automatically to see that if the lines you input are parallel, if they are, system will notice you that "calculating failed, please check your data again".



Graph 6-9 Lines intersection

Click Export EXCEL, name the saved file and click Yes, calculation results will be saved into EXCEL file.

6.9 Symmetry point

Point A, B, C are known points, line AB is a known line, to calculate the symmetrical point of C.

Suppose that coordinate of point A is 0, 0, B is 90, 90, C is 37.495, 64.943, click Calc., results will show in the list below:

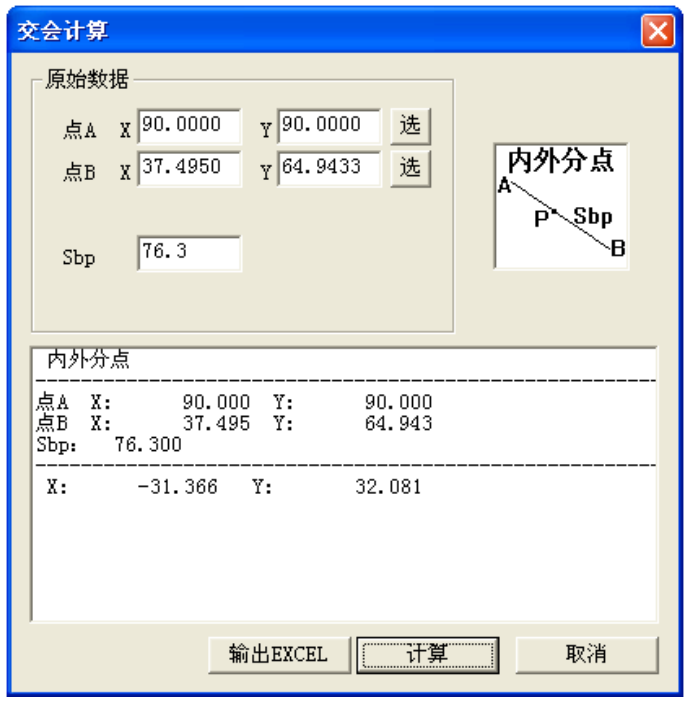
Graph 6-10 Symmetrical point

Click Export EXCEL, name the saved file and click Yes, calculation results will be saved into EXCEL file.

6.10 Point on line

Point A, B are known points, line AB is a known line, point p is on line AB or on the extension line of line AB. S is the distance between point B and point P, to calculate the coordinate of point P.

Suppose that coordinate of point A is 90, 90, B is 37.495, 64.9433, Sbp is 76.3 meters, click Calc., results will show in the list below:



Graph 6-11 Point on line

Click Export EXCEL, name the saved file and click Yes, calculation results will be saved into EXCEL file**.**

6.11 Distance line

Points A, B, C are known points, line AB is known line, distance S is knew, to calculate point located on line AB and from which to C, the distance is S.

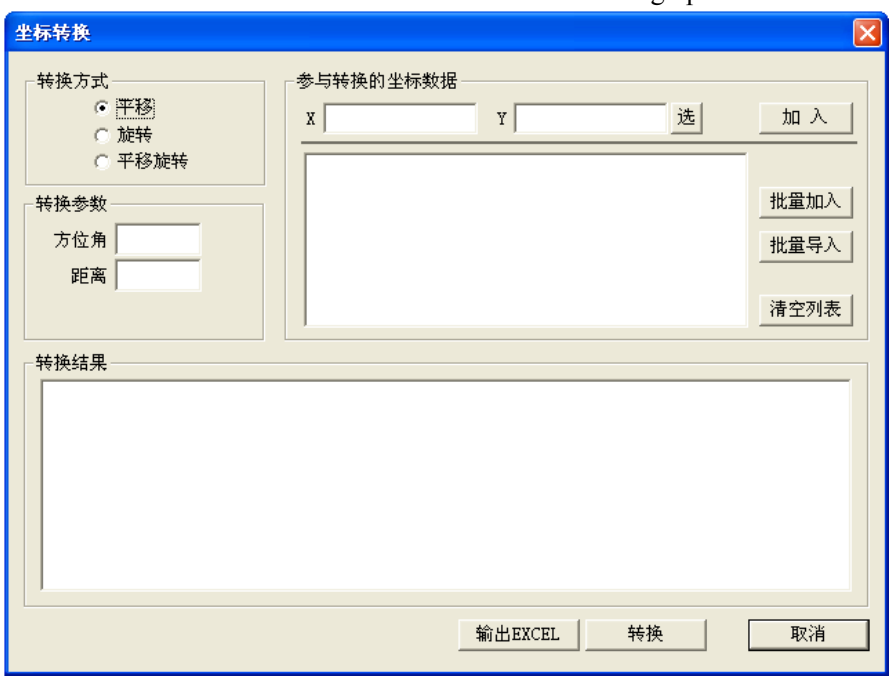
Suppose that coordinate of point A is 0, 0, B is 90, 90, C is 37.495, 64.943, Scp is 43.27 meters, click Calc., results will show in the list below:

Caution: According to the limitation of known conditions, this method would produce two intersections, our software will judge by choosing the one which is farthest from first point. When operator needs to get another point, you can change the sequence of point A and B.

Graph 6-12 Distance line

6.12 Coordinate transformation

Coordinate transformation is to transform the known coordinate to other kinds of coordinate system by moving, rotating, according to some known transformation parameters. Main interface of coordinate transformation is as graph 6-13 below:



Graph 6-13 Coordinate transformation

Transform: Pan, Rotation and Parallel rotation

Parameter: When transform type is Pan, parameter are azimuth and distance. When transform type is rotation, parameter are rotation angle and basic point. When transform type is parallel rotation, parameter is rotation angle and origin point.

Pick: Open coordinate view window to add coordinates.

Add:Add the coordinates to list as the data before transforming.

Batch add: add all the data recorded in system to list.

Batch import: Open appointed files and add all the data in the file to list.

Delete list: Clean out the data existed in list.

Export EXCEL: Save the results into EXCEL file.

Transform: Transform according to raw data and transformation parameter.

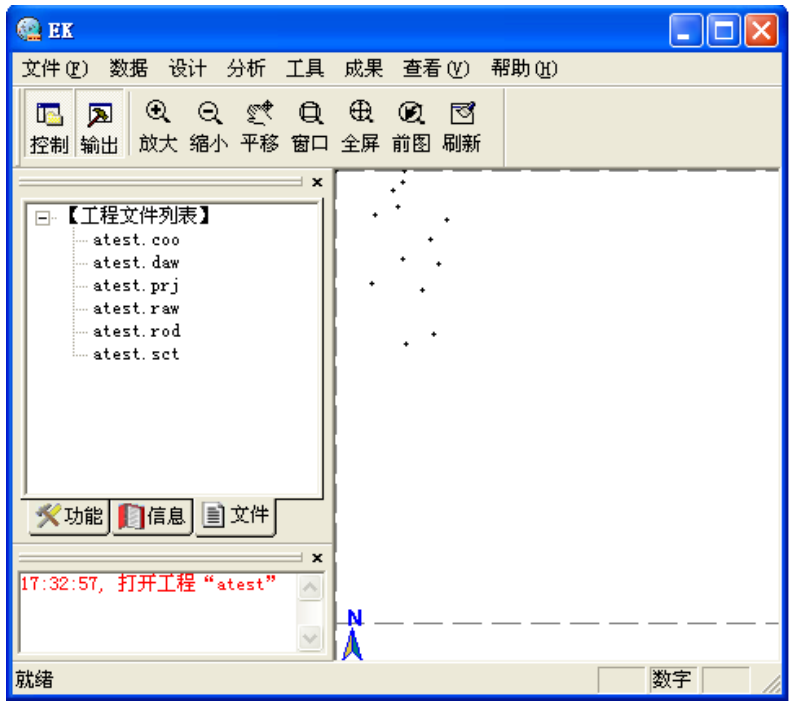
Cancel: Quit dialog box of coordinate transformation

For example, select “Parallel rotation” from transform type list. Corresponding parameter will change to rotating angle, origin△X, origin△Y. Input 35.2457 as rotating angle, 153.24 as origin△X, 72.51 as origin△Y. Click Batch add to add the coordinate file to list, then click Transform button, results will display in list of Results list box. Shown as below:

Graph 6-14 Coordinate transformation——Parallel rotation

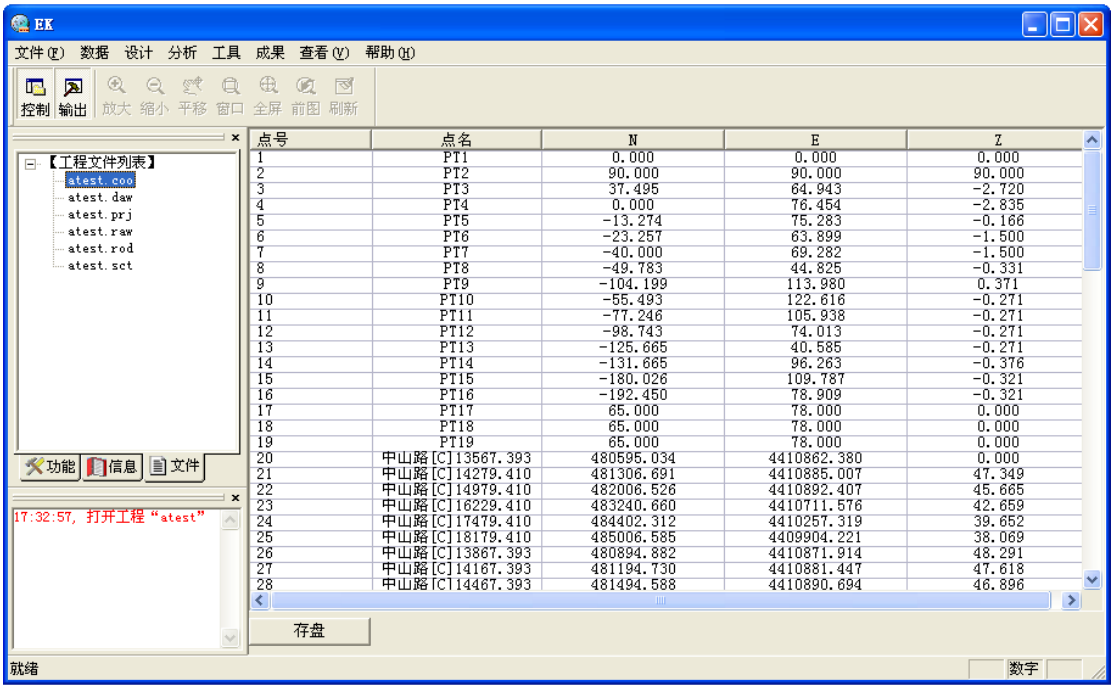
7 System file

Click File option in control area, “Project file list” will show as graph 7-1 below:



Graph 7-1 Project file list

The file suffix of which is *.coo, is coordinate file. That includes point No., point name and coordinates X, Y, Z. While you select “atest.coo” file, all the coordinate file will display in the right area. Shown as graph below:

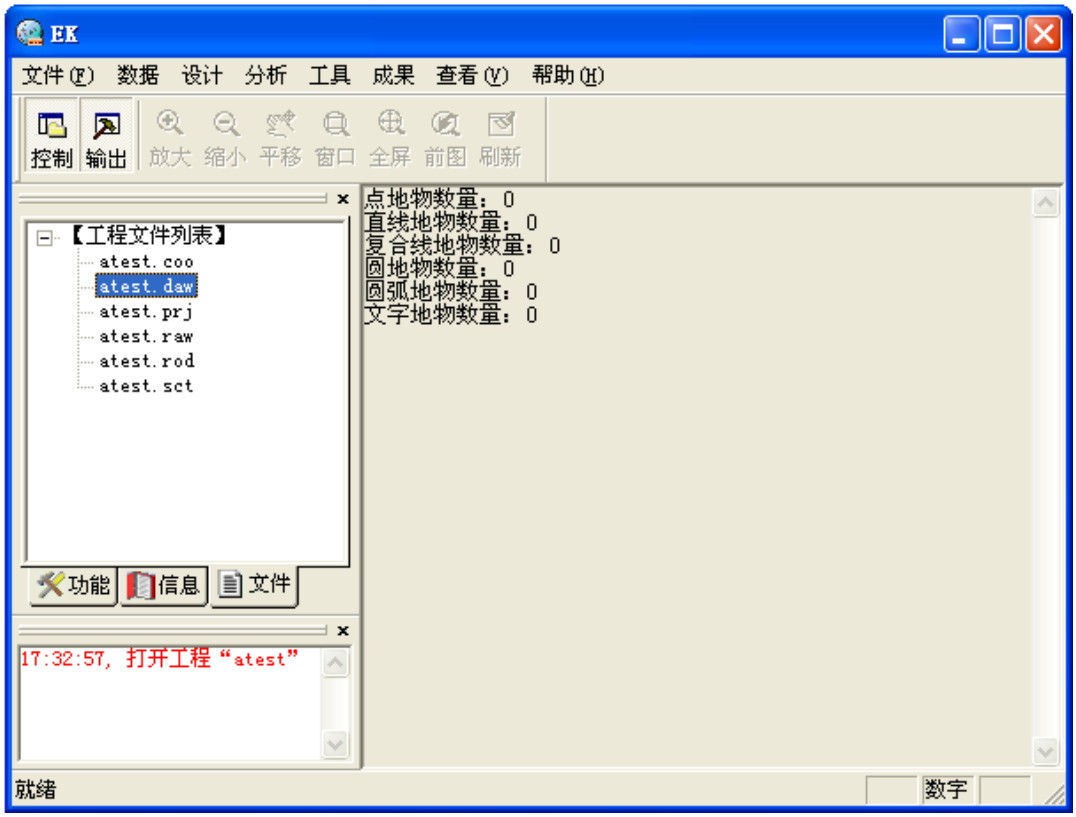


点号	点名	N	E	Z
1	PT1	0.000	0.000	0.000
2	PT2	90.000	90.000	90.000
3	PT3	37.495	64.943	-2.720
4	PT4	0.000	76.454	-2.835
5	PT5	-13.274	75.283	-0.166
6	PT6	-23.257	63.899	-1.500
7	PT7	-40.000	69.282	-1.500
8	PT8	-49.783	44.825	-0.331
9	PT9	-104.199	113.980	0.371
10	PT10	-55.493	122.616	-0.271
11	PT11	-77.246	105.938	-0.271
12	PT12	-98.743	74.013	-0.271
13	PT13	-125.665	40.585	-0.271
14	PT14	-131.665	96.263	-0.376
15	PT15	-180.026	109.787	-0.321
16	PT16	-192.450	78.909	-0.321
17	PT17	65.000	78.000	0.000
18	PT18	65.000	78.000	0.000
19	PT19	65.000	78.000	0.000
20	中山路[C]13567.393	480595.034	4410862.380	0.000
21	中山路[C]14279.410	481306.691	4410885.007	47.349
22	中山路[C]14979.410	482006.526	4410892.407	45.665
23	中山路[C]16229.410	483240.660	4410711.576	42.659
24	中山路[C]17479.410	484402.312	4410257.319	39.652
25	中山路[C]18179.410	485006.585	4409904.221	38.069
26	中山路[C]13867.393	480894.882	4410871.914	48.291
27	中山路[C]14167.393	481194.730	4410881.447	47.618
28	中山路[C]14467.393	481494.588	4410890.694	46.896

Graph 7-2 *coo file

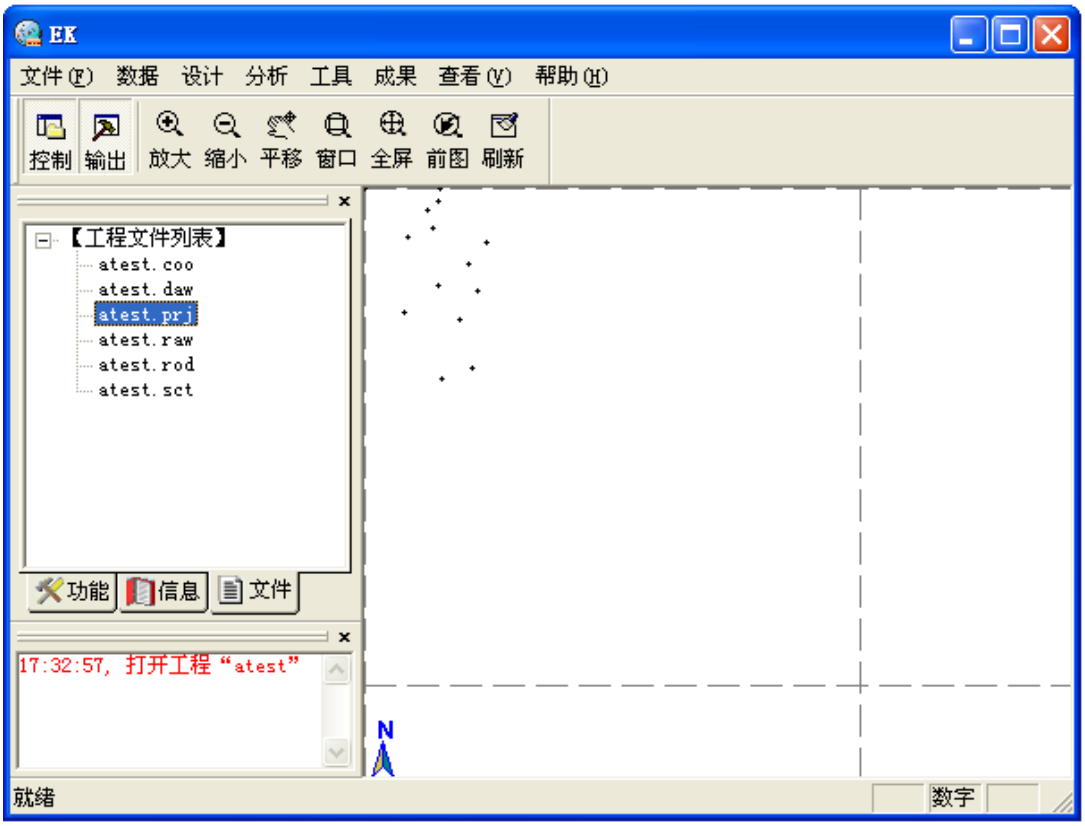
Customer can modify the coordinates when the file is open. Click twice the data you need to modify, then you will be allowed to edit. Notice that Pt No. and Pt name can not be modified. Click Save after modifying.

The file suffix of which is *.daw is used for saving information of ground object. While you select "atest.daw" file, all the information included in the file can be displayed at right area of window. You can check the information shown as below:



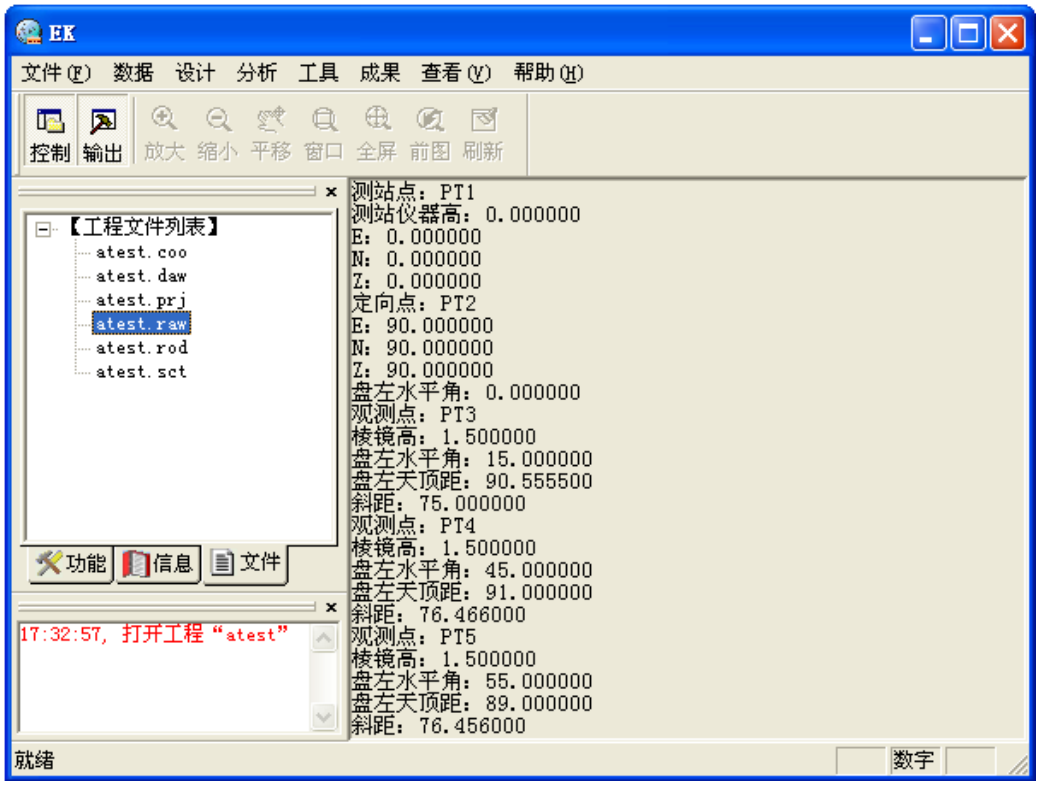
Graph 7-3*daw file

The file suffix of which is *.prj is graphics file. While you select “atest.prj” file, graph will display at right area of window. Shown as below:



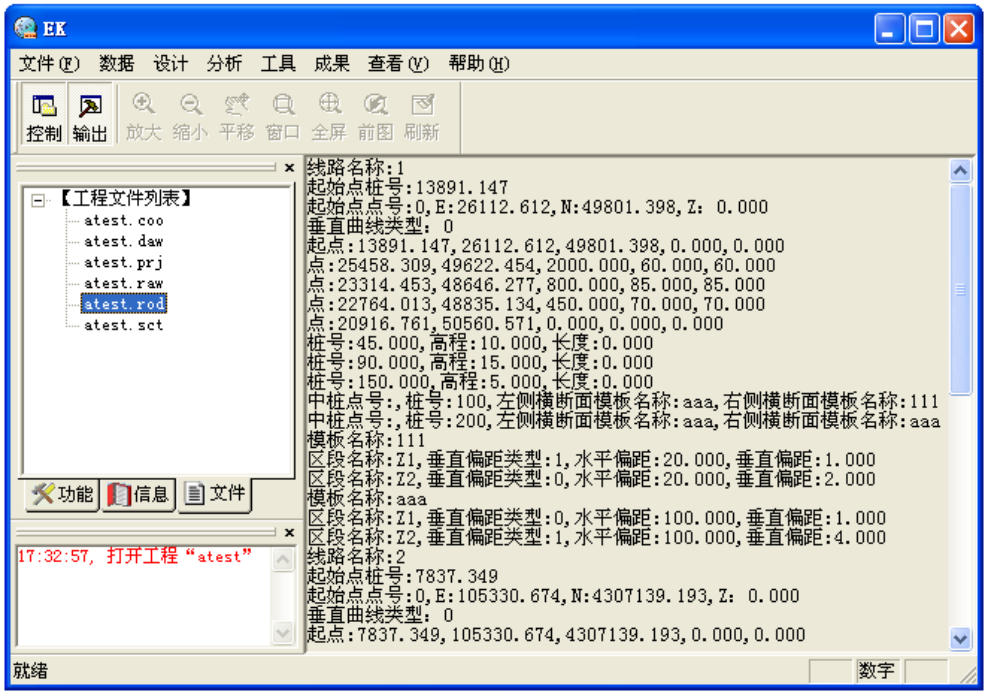
Graph 7-3*prj file

The file suffix of which is *.prj is used for recording raw data which includes information of station point, backsight point and horizontal angle, zenith, SD, prism height of each observing point. While you select "atest.raw" file, file contents will display at right area of the window. Customer can view the information as below:



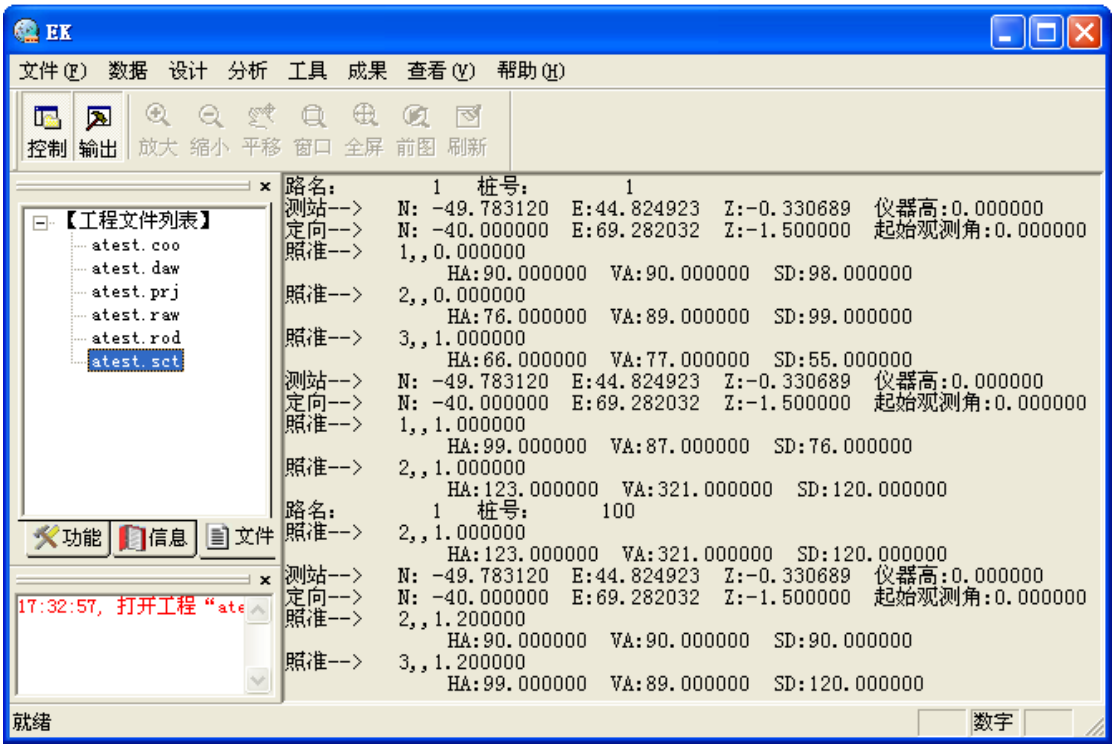
Graph 7-4*.raw file

The file suffix of which is *.rod is used for recording information of horizontal alignment, vertical alignment and transect template. While you select "atest.rod" file, file contents will display at right area of window. Customer can view the information as below:



Graph 7-5*.rod file

File suffix which is *.sct is main information of recorded station, orientation point and sight point. While you select "atest.sct" file, file contents will display in right area. The information you can view is as below:



Graph 7-6*.sct file

Appendix A:File forms of EK

*.dat Coordinate data file

Form of coordinate data file as below:

Point 1 name,Point 1 code,Point 1 Y（East）coordinate,Point 1 X（North）coordinate,Point 1 Elevation

…

Point N name,Point N code,Point N Y（East）coordinate,Point N X（North）coordinate,Point N Elevation

Instruction:

Each line in file indicates one point; Unit of coordinate Y, X, Z of every point is meter; comma can not be contained in code.

*.rod Road data file
Data file form is as below:
[HEADER]
ROADNAME,road1
VALTYPE,0
[END]

[ALIGN]
START,300.000,488342.493,2552134.180
STRAIGHT,30.0000,500.00000000000
ARC,-2000.000,500.000000
SPIRAL,-2500.000,300.000000
Pt,489996.699,2558932.226,3500.000,300.000,300.000
[END]

[VLIGN]
400.000,40.000,60.000
500.000,35.000,50.000
600.000,25.000,70.000
700.000,30.000,60.000
[END]

[SECT]
400,sect1,sect1
[END]

[TEMPLATE]
TEMPLATENAME,sect1,3
ZONE,Z1,1,12.000,0.300
ZONE,Z2,1,3.000,2.500
ZONE,Z3,0,5.000,0.000
[END]

Instruction:
[HEADER]Road information
ROADNAME, Road name
VALTYPE, Vertical curve type（0,vertical curve;1,erect curve）

[END]Road information is over

[ALIGN]Horizontal alignment
START, Start chainage,East coordinate,North coordinate（Only one start point data is allowed）
STRAIGHT, azimuth, length（straight segment）
ARC, radius, arc length（Arc section）
SPIRAL, radius,transition length（transition curve section）
Pt, coordinate east,coordinate north,radius,last transition length,next transition length（point）
[END]Horizontal alignment is over

[VLIGN] vertical alignment
chainage, elevation（gradient）,length
[END] vertical alignment is over

[SECT] transect
chainage,transect model name of road leftside, transect model name of road rightside
[END] transect is over

[TEMPLATE] transect template
TEMPLATENAME, template name, section number
ZONE, section name 1,offset type,horizontal offset,vertical offset
……
ZONE, section name N,offset type,horizontal offset,vertical offset
[END] transect template is over