PART I	•••••	••••••1
Foreword	••••• 错误!	未定义书签。
1 Introduction of WinEG2007…	•••••	2
1.1 Interface		2
1.2 Pull-Down Menu ·····		2
2 Meas→X-sect······	•••••	9
2.1 New Project		9
2.2 Input Control Point		9
2.3 Occ & BS Set		
2.4 Meas→X-sect······		
3 Meas→REM ······	•••••	
4 Meas→Coord······	•••••	
5 Edit→Coord Data	•••••	
6 Edit→Alignment Data	•••••	
6.1 Edit→Alignment Data		
6.2 Add Road ·····		
6.3 Edit the Start Point of the Road	••••••	
6.4 Edit Horizontal Alignment		
6.5 Edit Vertical Alignment Data		
6.6 Edit Transect		28
6.7 Calculate the Road Point		

7 S.O.→Radiate	
7.1 File→Import·····	
7.2 Meas→Occ & BS	
7.3 S.O.→Radiate·····	
8 S.O.→Point	
8.1 File→Coord Import·····	
8.2 Meas→Occ& BS Set ·····	
8.3 S.O.→Point	
9 S.O.→Line→line segment······	
10 S.O.→Line→Arc······	
11 S.O.→Plane→Slope	
12 S.O.→Plane→3 Pts plane	
13 S.O.→Plane→Arc plane	50
14 S.O. $\rightarrow$ Road ······	53
15 Function Introduction	
15.1 File Menu	
15.2 Meas Menu	60
15.3 Edit menu·····	70
15.4 S.O. menu	76
15.5 Tool menu	•••••81
15.6 Setting menu ·····	97

16 Appendix A: File forms for Engineering Genius 103
17 Appendix B: Upgrade and install WinEG2007 106
PART II 109
1 Introduction 109
2 Function Introduce 110
2.1 File 110
2.2 Data 111
2.3 Design 112
2.4 Analysis113
2.5 Tool117
2.6 Report
2.7 View12
2.8 Help122
2.9 Toolbar122
2.10 Control Panel······123
2.11 Information Output Area124
3 Route auxiliary computation 124
3.1 Single cross point for curve124
3.2 Convexity curve12
3.3 Tangency base line for curve129
3.4 Complex curve13
3.5 S curve132
3.6 Oviform for curve134

3.7 Widen and superelevation 135
4 Route calculation 137
4.1 Lay single cross point plane curve137
4.2 Cut baseline plane curve140
4.3 Complex curve141
4.4 S-type plane curve143
4.5 Egg-type plane curve145
4.6 Vertical curve146
5 Route theory design 148
5.1 Start point 149
5.2 Horizon alignment149
T5.3 Vertical alignment151
T5.4 Transect153
5.5 Calculate road point157
6 Intersection calculation 158
6.1 Forward intersection158
6.2 Resection160
6.3 Linear intersection161
6.4 Angle intersection 162
6.5 Vertical distance point163
6.6 Radiate164
6.7 Foot of perpendicular165
6.8 Lines intersection166
6.9 Symmetry point167
6.10 Point on line 168

6.11 Distance line	
6.12 Coordinate transformation	170
7 System file	
Appendix :File forms of EK	

# 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.

All copyrights of the manual are reserved by our company. In the scope of copyright protection, reproduction, adaptation will be prohibited without the written consent of company.

#### **Registered trademarks**

AutoCAD, WinCE is registered trademarks. All those trademarks are the property of their respective owners.

### **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:**

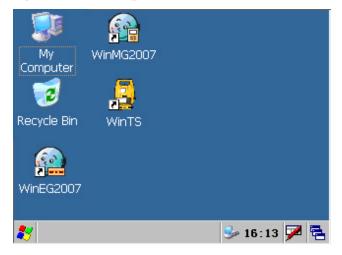
	name	Unit
1	WinEG2007 manual	1
2	Total Station Communication Cable	1

# **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.

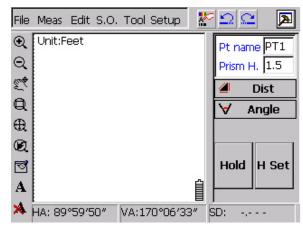


Win Total Station Interface

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 Meas Edit S.O.	Tool Setup	<b>*</b>	20	$\mathbf{\lambda}$
New			Dharas	- DT1
Open			Pt nam	
Save			Prism H	1. 1.5
Save as			∕	Dist
Import 🕨			¥ /	\ngle
Export				
Exit				
			Hold	H Set
A				
メ HA: 89°59′50″	VA:170°06′32	2″ 9	6D:	

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.

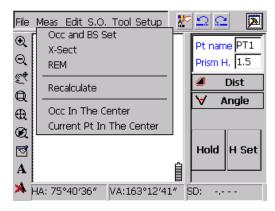
Import: Input the coordinated point into the current graphic file. There are two different ways of import: Manual Entry and Auto Import.

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.

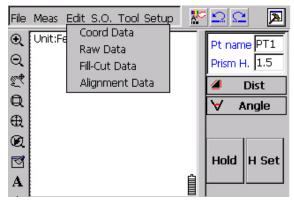
Recalculate: According to the raw data, we recalculate the current graphic file.

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:

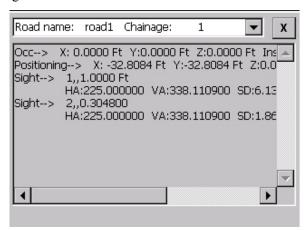
Coord Data: By clicking this item, you can browse, delete, and edit the coordinate data, see the following figure.

Browse	Browse coord data 🛛 🗙								
Pt	Pt N	N	E	Z					
1 2 3 4	22[C	3.2808 331.3648 469.4014 480.5278	6.5617 6.5617 -68.8480 -225.7459	9.8425					
•									
				Delete					

							_
Position Occ>	ing> X: 3.2	X: 331 2808 Ft	.3648 F Y:6.56	t Y:6. 17 Ft	Z:9.842 5617 Ft Z:9.842 5617 Ft	Z:-32 5 Ft I	28 ns
							7

**Caution**: You can adjust the width of the list to see the whole information. Raw Data: You can browse the raw data here.

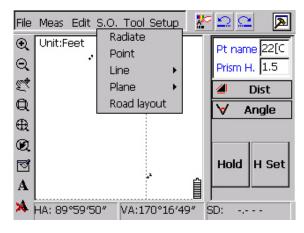
Fill-Cut Data: By clicking this command, you can browse the Occ Pt and BS Pt, but the data is unchangeable.



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:





The items of this menu are as follows

<u>Radiate</u>: setout points with the distance and angle that exist between station and setout point.

Point: Layout points.

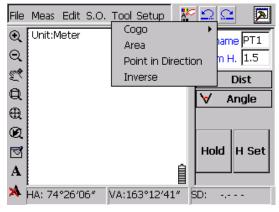
Line: Layout line, curve and arc.

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

Road Layout: Layout roads.

### Tool

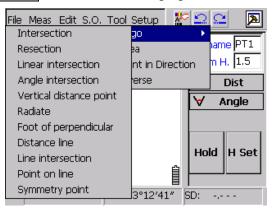
Click, Tool, you will get the following figure:



Tool

The items of this menu are as follows:

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



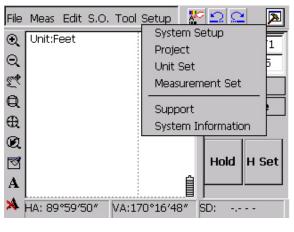
COGO

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:





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.



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

	nam ism H		
		Dist	
	Å	ngl	е
н	old	ня	iet
SD:	-,-		

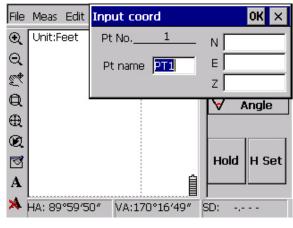
# 2. Meas→X-sect

# 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.





Click File  $\rightarrow$  Import  $\rightarrow$  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	Х	Y	Z
1	Pt1	100	200	22
2	Pt2	200	200	22
3	Pt3	300	80	21
4	Pt4	250	40	20

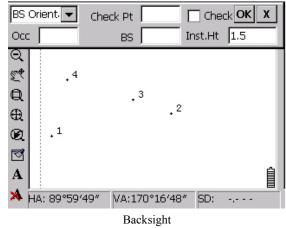
After inputting, Click ( you can see the following figure with four control points:

File	Meas	Edit	S.O.	Tool	Seti	цр	*~	2	2	$\mathbf{\lambda}$
Q	Unit:F	eet						Pt na	me	PT5
Q								Prism		
0 % Q		۰4						4	D	ist
Q				•	3			V	An	igle
€						• 2				
Ø	•1									
3								Hold	I   F	l Set
Α							Î			
×	HA: 89	°59′4	19″	VA:1	70°1	6′48		BD: ·		-

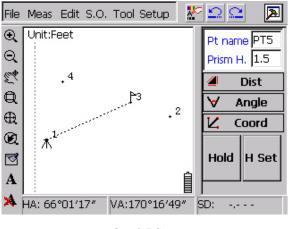
Control points

# 2.3 Occ & BS Set

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



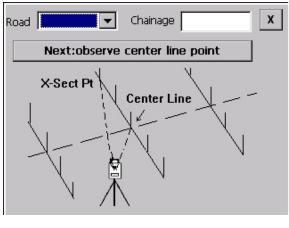
Input the Occ, BS, and inst. Ht then aim the BS point and click the  $\boxed{}$  key. Then you can see an Occ point  $\stackrel{\bigstar}{\uparrow}$  and a BS point  $\stackrel{\bigstar}{\uparrow}$  on the screen. See the following figure.



Occ & BS set

#### 2.4 Meas→X-sect

Click Meas  $\rightarrow$  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  $\overrightarrow{\text{Edit}} \rightarrow \overrightarrow{\text{Alignment}}$  to know how to define a road. Input chainage, click Next: obverse center line point, you will get the following figure: "middle chainage".

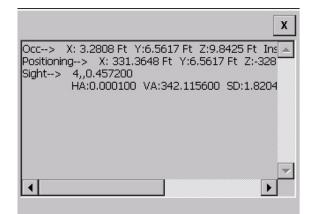
<sub>[</sub> Mid chainage measurer	nent	
Code 1	P.Ht	
HA: 0°00′01″	E:	
VA:170°16′48″	N:	
SD:	Z:	
Browse Resetup	Meas.	
Last step:transect set X		
Next step:transect (	point measurement	

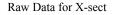
#### Middle Chainage

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.

Mid chainage measurement			
Code 2	P.Ht 1.5		
HA: 0°00′01″	E:6.5617 Ft		
VA:342°11′56″	N:1.4558 Ft		
SD:5.9698 Ft	Z:10.6053 Ft		
Browse Resetup	Meas.		
Last step:transect set X			
Next step:transect point measurement			

Middle Chainage





Transect point measurement		
Code 2	P.Ht 1.5	
HA: 0°00′00″	E:6.5617 Ft	
VA:342°11′56″	N:1.4542 Ft	
SD:5.9751 Ft	Z:10.6103 Ft	
Browse	Meas.	
Last step:Mid chainage measurement X		
Save transect point measurement		

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 point measurement			
Code 2	P.Ht 1.5		
HA: 0°00′00″	E:6.5617 Ft		
VA:342°11′56″	N:1.4542 Ft		
SD:5.9751 Ft	Z:10.6103 Ft		
Browse	Meas.		
Last step:Mid chainage measurement X			
Save transect point measurement			

#### Transect Data

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

WinEG	ок 🗙
Code of transect chainage can not	



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

Notice	$\times$
The point was measured before want to cover it?	9,
Yes No	

Prompt Dialog Box 2

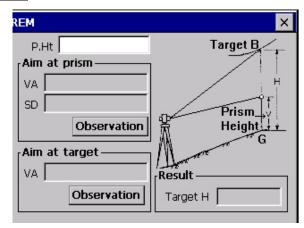
Click "Yes" button, the existing data will be covered, click "No" button, it will turn back to the **Meas.** interface, you can change the code and save it.

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

# 3. Meas→REM

### Meas→REM

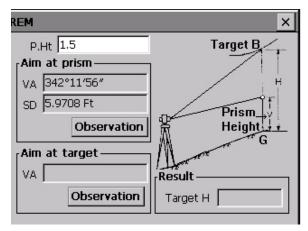
Click: Meas  $\rightarrow$  REM, see the following figure: "REM"



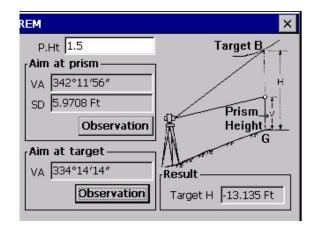
REM

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".



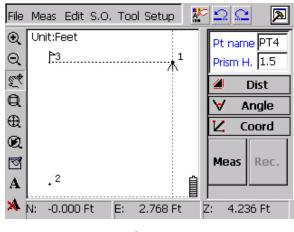
Observation Data with Prism





# 4. Meas→Coord

# **Setting Occupied Point**

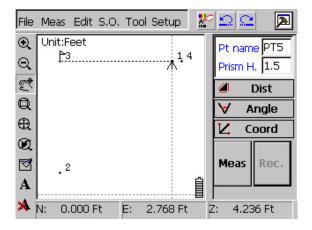




As the figure shown above, input the point number: Pt4, P.Ht: 1.5, aim to the prism. Choose **Coord** and click mesa, the system will work out angle, distance as the following figure shows:

File	Meas Edit S.O. Tool Setup 🛛 🐰	<u>2</u> 🔁 🔊
Q	PT1 PPT3	Pt name PT4
Q	<b>A</b>	Prism H. 1.5
et Q		🖉 Dist
1000		∀ Angle
æ		🖌 Coord
Q		
3	PT2	Meas Rec.
A		
×	N: -0.000 Ft E: 2.768 Ft	Z: 4.236 Ft

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"

Browse	e coord	data			×
Pt	Pt N	N	E	Z	Т
1 2 3	PT1	0.0000	0.0000	0.0000	
2	PT2 PT3	-32.8084 0.0000	-32.8084 -32.8084	0.0000 0.0000	
•					
				Delete	

#### 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

Browse coord data			×		
Pt	Pt N	N	E	Z	Т
1	PT1	0.0000	0.0000	0.0000	_
2 3	PT2	-32.8084	-32.8084	0.0000	
3	PT3	0.0000	-32.8084	0.0000	
•					►
				Delet	e

Delete Coord Data

Browse coord	Coordinate edit	ОК 🗙
Pt Pt N 1 PT1	Pt No. <u>3</u>	N 0.0000
1 PT1 2 PT2 3 PT3	Pt name PT3	E -32.8084 Z 0.0000
		Delete

### 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	×
Road name	
Del Edit	Add Import Export

#### 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".

Road da	ita	×
Road n	name	
	Road add	
	Road name V-Sect type Perpendicular c 💌	-
	Yes Cancel	
Del	Edit Add Import Exp	ort
Der		or
	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.

Road da	ita	×
Road n	iame	
	Road add	- 1
	Road name V-Sect type Perpendicular c 🖵 Perpendicular curve	-
	Yes Vertical curve	
		_
Del	Edit Add Import Exp	port

V-Sect Type

Edit road:road1		×
Start point Horizonta	al alignment   Ve	rtical alignme 💶 🕨
Pt No. 0		Add Pt.
Pt name		
N	Ft	
E	Ft	
z	Ft	
Start chainage of mil	leage	Save
	Ft	

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"

Browse coord data					×
Pt	Pt N	N	E	Z	Τ
1 2	PT1	0.0000	0.0000	0.0000	
2	PT2	-32.8084	-32.8084	0.0000	
3	PT3	0.0000	-32.8084	0.0000	
•					
				Delete	1
				-	

Select the Start Point

Edit road:road1	×
Start point Horizontal alignment V	ertical alignme 💶 🕨
Start chainage of mileage	m
N	m
E	m
z	m
Select from list Add Pt.	Save

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.

Edit road:road1	×
Start point Horizontal alignment Vertical a	alignme 💶 🕨
Plane curv Distance Az	
Chainage:300.0000 Ft,Azimuth:0°00′00″	
Del Edit Insert 🛚	Add 関

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  $\overrightarrow{OK}$ , save the data and turn back to the interface: "Horizontal alignment inputting". Click  $\overrightarrow{X}$ , 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.

Edit road:road1	×
Start point Horizontal alignment Vertical a	alignme 🔳 🕨
Plane curv Distance Az	
	Line
Chainage:300.0000 Ft,Azimuth:0°00′00″	Arc
Del 🛛 Edit 🔹 Insert 🗳	Cruve
	Point

Choose Element of Horizontal Alignment

Edit road	Straight line	OK ×
Start poir Plane cu	Length 500	Ft
	Azimuth 30	dms
Chainage:	300.0000 Ft,Azimuth:0°00′00″	
Del	Edit Insert 🗳	Add 関

Input Line

In the interface: "Choose Horizontal Alignment Data" click Are, 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".

Edit road:roa	Circular cu	irve	ок 🗙
Start point	Radius	2000	Ft
Plane curv	Length	500	Ft
	Azimuth	9.1440	dms
	Turn	Left 💌	
•			
Chainage:600	.0000 Ft,Azii	muth:9°14′40″	
Del	Edit	Insert 💵 🗌	Add 関

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".

Edit road:r	Transition curve	OK ×
Start point	Radius 2500	 Ft
Plane curv Line	Length 300	Ft
Circular cur	Azimuth 354.5513	dms
	Turn Left 🗨	
		1
Chainage:1:	100.0000 Ft,Azimuth:354°55′13	3″
Del	Edit Insert 🗳	Add 💵

#### 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 <u>Select from list</u> 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".

Point	0	К×
N -32.808	m	
E -32.808	m	
Radius 3500	m	
Former transition curve length		
300	m	
Latter transition curve length		
300	m	
Select from	list Add Pt	t

Input Point

Browse coord data				×	
Pt	Pt N	N	E	Z	Т
1	PT1	0.0000	0.0000	0.0000	_
2	PT2	-32.8084	-32.8084	0.0000	
3	PT3	0.0000	-32.8084	0.0000	
•				Delete	•

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.

Edit road:road1 🛛 🛛 🗙					
Start point H	lorizontal alignr	Vertical alignme 💶 🕨			
Plane curv Line Circular cur Transition		Az 9.			
Chainage:2526.3878 Ft,Azimuth:183°05′09″					
Del	Edit	Inse	ert 🖸 🛛 Add 💟		

Data of HAL

#### 6.5 Edit Vertical Alignment Data

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

Edit road:road1			×
Horizontal alignme	nt Verti	cal alignment	Insect 🔳 🕨
Intersection Elev	ation	Distance	Add
			Insert
			Del
			Save

Data of VAL

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

Edit road:roa	ad1		×
Horizontal alig	inment Vert	ical alignment	Insect 💶
Intersectic	Elevation	Distance	Add
		1	Insert
			Del
			Save

Add Vertical data

Edit road:roa	×		
Horizontal alig	inment Verti	cal alignment	Insect 🔳 🕨
Intersectic	Elevation	Distance	Add
			Insert
			Del
			Save

Vertical alignment data inputting

After you input all the data, click <u>Save</u>. You will get the following figure. "Data of vertical alignment".

Edit road:road1 X				
Horizontal alignment Vertical alignment			Inse	ect 🔸
Intersection	Elevation	Distance		
400	40	60		Add
500	35	50		
600	25	70		Insert
700	30	60	-	
				Del
			•	
				Save
1				

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".

Edit road:ro	oad1		×
Horizontal al	ignment   Ve	ertical alignment	Insect 🔸
Chainage	Left side m	Right side r	Add
			Insert
			Del
			Save
			Template

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 t	emplate				×
Femplate r	name 📃	• • N	lew I	Del	Save
Section r	Horizonta	Gradient	Verticle o	: Distar	nce
				Add s	ection
				Del s	ection

Section template

Section template		×
Template name 316 💌 New 🛛	)el Save	,
Section r Horizonta Gradient <sup>(</sup> Verticle c	Distance	٦
	Add sectio	n
	Del sectio	n

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

Section t	emplate	×
Template r	Section add OK X	Save
Section r		ance
	Section name Z1	
	Offset —	
	Level Ft	
		section
	Dei	section

Vertical offset: 2.5 Gradient%: 0.3; Select Up; see the following figure" Z1 section".

Add section

Section t	emplate		×
Template r Section r	Section add	OK ×	Save
000000000	Section name Z1		
	Offset —		
	Level 12	Ft	
	Down 🖵 0.3		
			section
		De	l section



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 t	emplate				×	
Template r	name 1	• N	lew D	el Sav	/e	
Section	Horizonta	Gradient	Verticle c	Distance		
Z1	12	-2.500	-0.300	Downwar		
			-			
				Add sect	ion	
			<b></b>			
				Del secti	on	
	Section 1					

Section template					×
Template r	name 1	▼ N	lew D	el Sav	re
Section	Horizonta	Gradient	Verticle c	Distance	
Z1	12	-2.500	-0.300	Downwar	
				Add secti	ion
			•	Del secti	on

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".

Edit road:ro	oad1		×
Horizontal al	ignment   Ve	ertical alignme	nt Insect 💶
Chainage	Left side m	Right side r	Add
			Insert
			Del
			Save
			Template

Add transect

Edit road:road1		×
Select X-Sect t	emplate	ок 🗙
Template name:		

Select template

Edit road:ro	oad1			×
Horizontal al	ignment   Ve	rtical alignme	nt Ir	nsect 🚺
Chainage	Left side m	Right side		Add
400	1	1		
				Insert
				Del
				Save
			-	Template

Transect data.

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

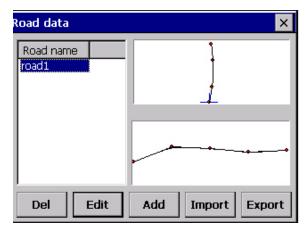
Edit road:road1	×
Insect Calculate the road points	+ >
<sub>[</sub> Road Point ————	
Left Pt To middle line	Ft Ft
Profix Pt name road1	Calc.

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 <u>Calc.</u>; 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 $\rightarrow$ X-sect $\rightarrow$ Occ & BS.

### 7.3 S.O.→Radiation

Click S.O.  $\rightarrow$  Radiate menu, you will get the following figure: "Radiate":

S.O. Pick P.Ht S.O. X		
rInformation ———		
HA:225°00'00"	Angle diff:	
VA:334°14′15″	Dist. diff:	
SD:	H diff:	
Right:	N:	
Forward:	E:	
Up:	Z:	



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

S.O. Pick	P.H	it 📃	S.O. X
HA From View VA Add SD:		Angle diff: Dist. diff: H diff:	
Right: Forward: Up:		N: E: Z:	

**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  $2^{nd}$  area of information display area at downside of the screen. As picture showed "Setout 1":

**Interface instruction**: in graph "Setout 1": "1<sup>st</sup> area" is for Occ information, displaying azimuth, zenith and SD; "2<sup>nd</sup> 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; "4<sup>th</sup> area" is for coordinate display which include showing northing coordinate, easting coordinate and elevation in real time.

	Ht S.O. X
Information ———	
HA:225°00'01"	Angle diff:315°00′01″
VA:334°14′15″	Dist. diff:
SD:	H diff: (2)
Right:	N:
Forward:	E:
Up:	Z:
3	4

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":

S.O. 3 Pick P.ł	Ht 1.5 S.O. X	
[Information ———		
HA:225°00'00"	Angle diff:315°00′00″	
VA:334°14′15″	Dist.diff:34.8207Ft	
SD:6.3685 Ft	Ele. diff:2.7355Ft	
Right:23.1989Ft	N:1.9573 Ft	
Forward:-25.9672Ft	E:1.9573 Ft	
Up:-2.7355Ft	Z:4.2355 Ft	

Setout 2

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

## 8. S.O.→Point

#### 8.1 File→Coord Import

See Meas  $\rightarrow$  X-sect  $\rightarrow$  Input the Control Point for details.

#### 8.2 Meas→Occ& BS Set

See Meas  $\rightarrow$  X-sect  $\rightarrow$  Occ & BS Set for details.

#### 8.3 S.O.→Point

Click S.O.  $\rightarrow$  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.

Type Point	P.Ht
HA:225°00′01″	VA:334°14′15″
rResult	
SD:	Angle diff:233°20′40″
HD:	HD diff:
H diff:	SD diff:
Forward:	N:
Right:	E:
Up:	Z:
Des	ign Meas. Close

Point setout

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

Input coord	Input coord 🛛 🗙
N 500	N 500
E 50	E 50
Z O Pick	Z O Pick
OK Cancel	List Add coordinate:
Input coord of designed Pt	Select setout Pt

Input coord of designed 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.

Type Point 💌	P.Ht 1
HA:225°00′01″	VA:334°14′14″
rResult — — — — — — — — — — — — — — — — — — —	1
SD:6.3704 Ft	Angle diff:219°17′22″
HD:6.3704 Ft	HD diff:500.3539Ft
Ele. diff:5.7372Ft	SD diff:500.3599 Ft
Forward:386.1383Ft	N:1.9579 Ft
Right:318.1999Ft	E:1.9579 Ft
Up:-2.4564Ft	Z:2.4564 Ft
De	sign Meas. Close

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.	. <mark>→</mark> Line	$\rightarrow$ Poly Line	, you will get the	e following dialog.
------------	-----------------------	-------------------------	--------------------	---------------------

Type Section 💌	P.Ht
HA:225°00'01"	VA:334°14′15″
<sub>[</sub> Result ————	
SD:	Start-foot HD:
HD:	Start-foot SD:
H diff:	Foot height:
Pt-slope HD:	N:
Pt-slope SD:	E:
Pt-slope Dist.	Z:
Des	ign Meas. Close

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.

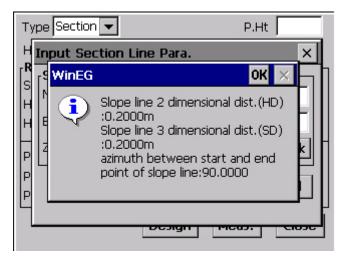
Designed value: click "Design", you will get the following dialog, see figure "Input line design parameter."

Type Section 💌	P.Ht
H Input Section Line Pa	ra. 🗙
Strat point	End point
N 0.0000	N 0.0000
н Е 0.3	E 0.5
P Z 0.0000 Pick	Z 0.0000 Pick
P Information	OK Cancel
000	

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

Type Section 💌	P.Ht 1
HA:225°00′01″	VA:334°14′15″
rResult — — — — — — — — — — — — — — — — — — —	
SD:6.3714 Ft	Start-foot HD:Overflow
HD:6.3714 Ft	Start-foot SD:Overflow
Ele. diff:5.7381Ft	Foot height:Overflow
Pt-slope HD:Overflow	N:1.9582 Ft
Pt-slope HD:Overflow	E:1.9582 Ft
Pt-slope Dist.Overflow	Z:2.4573 Ft
Des	ign Meas. Close

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.  $\rightarrow$  Line  $\rightarrow$  Arc, you will get the following dialog:

Type <b>Eircular 💌</b>	P.Ht
HA:225°00'01"	VA:334°14′15″
Result —	
SD:	Start-foot curve:
HD:	
H diff:	Pt-slope HD:
FootN:	N:
	E:
FootE:	Z:
Desi	ign Meas. Close

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.

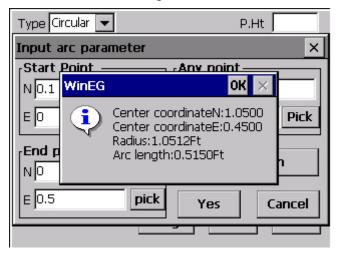
**Designed value:** Click "Design", you will get the following dialog. See figure "Input arc parameter":

Type Circular 💌	P.Ht
Input arc parameter	×
Start Point ———	Any point
N 0.1	NO
E D Pick	E 0.4 Pick
Find point	Information
E 0.5 pick	Yes Cancel

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 $\rightarrow$ Measuring"; until each index meets the precision requirement of setout, the line arc setting out is finished.

**Close:** to quit the arc setout interface.

Type Circular 💌	P.Ht 1
HA:225°00'00"	VA:334°14′13″
Result —	
SD:6.3678 Ft	Can not calculate with
HD:6.3678 Ft Ele. diff:5.7348Ft	Pt-slope HD:
FootN:	N:1.9571 Ft
	E:1.9571 Ft
FootE:	Z:2.4540 Ft
[	Design Meas. Close

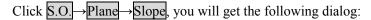
Calculated result of arc setout

## 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



Type Slope 💌	P.Ht
HA:225°00'00"	VA:334°14'13"
rResult — — — — — — — — — — — — — — — — — — —	
SD:	Start-foot HD:
HD:	
H diff:	Pt-slope HD:
Pt-plane HD	N:
Pt-plane VD	E:
Pt-plane Perp.D	Z:
Des	ign Meas. Close



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

True Clopo	0.14
Input Design of Slope	Para. 🗙
Start point ———	TEnd point ———
s N 0.0000	N1
H E 0.0000 Pick	E 1 Pick
F Slope line H 2	Grade: 1: 3
F F On the right side	🔿 On the left side
Information	OK Cancel

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.

Translationo	_		
Input Design of Slope Para. ×			
Start poi	nt	End poin	t
		lla de	
WinEG			ок 🗙 🚽
	Slope line ler azimuth betv point of slope	veen start a	nd end 🗖
F On the	right side	O On the	lett side
Informat	tion	ОК	Cancel

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.

Type	Slope 💌	P.Ht 1
	)5°50′38″	VA:125°23'09"
[Resu	lt	
SD:0.1	7283 Ft	Start-foot HD:-0.5609 Ft
HD:0.	7283 Ft	
Ele. d	iff:0.4218Ft	Pt-slope HD:-0.1948 Ft
Point	is on the other side	N:-0.5344 Ft
		E:-0.2589 Ft
		Z:-3.7026 Ft
Design Meas. Close		

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.  $\rightarrow$  Plane  $\rightarrow$  3 Pts plane, you will get the following dialog:

Type Plane w 💌	P.Ht
HA:223°46'18"	VA:338°11′09″
rResult —	
SD:	Gradient: 1:
HD:	
H diff:	
Pt-plane HD	N:
Pt-plane VD	E:
Pt-plane Perp.D	Z:
	Design Meas. Close



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

T	TInput plane parameter			
Н	Pt 1	Pt 2		
R SI	N 0.0000	N 1.0000		
н	E 0.0000	E 2.0000		
н	Z 1.0000 Pick	Z 9.8425 Pick		
P	Pt 3			
P	N 0.0000			
P	E 0.0000	Yes		
	Z 0.0000 Pick	Cancel		

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.

Type Plane w	P.Ht 1.5	
HA: 43°15′18″	VA:189°43′26″	
rResult — — — — — — — — — — — — — — — — — — —		
SD:0.0963 m	Gradient: 1:1.91	
HD:0.0163 m		
H diff:-0.0949 m		
Pt-plane HD-0.0918 m	N:-0.0118 m	
Pt-plane VD-0.0949 m	E:-0.0111 m	
Pt-plane Perp.D1.0111 m	Z:-0.0949 m	
Design Meas. Close		

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.  $\rightarrow$  Plane  $\rightarrow$  Arc plane, you will get the following dialog:

Type Arc-Plar 💌	P.Ht
HA:223°46'18"	VA:338°11′09″
rResult —	]
SD:	Start-foot curve:
HD:	
H diff:	Pt-slope HD:
Pt-plane HD	N:
Pt-plane VD	E:
Pt-plane Perp.D	Z:
Des	ign Meas. Close

Arc plane Setout

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

Input Arc Slope Para.	×
Start point	Any point
N <mark>D.0000</mark>	N 1.0000
E0.0000 Pick	E 1.0000 Pick
End point	Elevation 0.000
N2.0000	Ratio of slope 1: 0.000
E 9.8425 Pick	Outside O Inside
Information	OK Cancel

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.

Input Arc Slo	pe Para. X		
Start point-	Any point		
N0.9999	NU1 0000		
WinEG	OK × Pick		
	Center coordinateN:-5.1763		
Fend 🖓	Center coordinateE:6.1763		
N2.0	Radius:8.0585Ft		
	.000		
Information OK Cancel			

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.

Type Arc-Plar 💌	P.Ht 1.5	
HA: 43°15′18″	VA:189°43′26″	
rResult — — — — — — — — — — — — — — — — — — —		
SD:0.0963 m	Gradient: 1:1.91	
HD:0.0163 m		
H diff:-0.0949 m		
Pt-plane HD-0.0918 m	N:-0.0118 m	
Pt-plane VD-0.0949 m	E:-0.0111 m	
Pt-plane Perp.D1.0111 m	Z:-0.0949 m	
Design Meas. Close		

Calculated result of arc plane setout

# 14. S.O. $\rightarrow$ Road

Principle: define a road with designed road data.

#### S.O.→Road

Click S.O.  $\rightarrow$  Road, you will get the following dialog:

Road layout	×
	Road 💌 💌 New
	Chainage 🥅 Ft
	Right 0 Ft
	HA:223°46'18"
	VA:338°11′09″
	Information
	View Pt position
	Layout

Road Setout

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



Selecting road

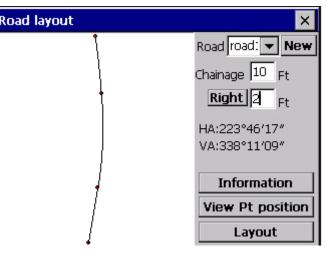
After selecting, plane map of road would be drawn on the screen as shown below:

(2) Input Setout chainage in chainage edit box

(3) Select leftside or rightside of the midline. If leftside is selected. Click <u>Right</u>, 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.

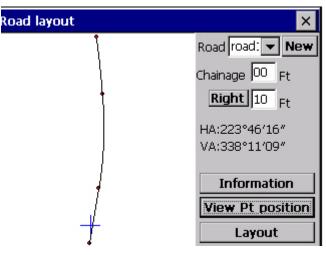
- (5) Click Layout point position, as picture shown below:
- (6) Click Layout, as picture shown below:





Road layout info.	×
Overall length:1100.0000Ft	
Coord of design layout point:	
N=100.3077	
E=6.1946	
Z=36.6250	
No transect model at layout point or over the transect model, elevation is subject to midchainage elevation of this chainage!	

Road Setout information



Layout point position

Chainage:400.000C	P.Ht	S.O. X
[Information ——		
HA:223°46'16"	Angle diff:220°14	'14"
VA:338°11′09″	Dist. diff:	
SD:	H diff:	
Right:	N:	
Forward:	E:	
Up:	Z:	

Road point setout

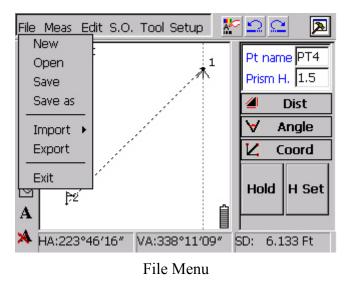
(7) Click S.O. in road Setout. Carry out measuring of distance and angle, calculate and show the difference between the designed chainage and real-measured point according to the input designed data. See figure "Calculated result of road setout". Repeat the operation of "moving prism—Measuring", until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

Chainage:400.000C	P.Ht 1	S.O. X
[Information ———		
HA:223°46'16"	Angle diff:220°14	4′14″
VA:338°11′09″	Dist.diff:98.7699	Ft 📗
SD:6.1332 Ft	Ele. diff:-32.9309	9Ft
Right:64.9176Ft	N:1.6458 Ft	
Forward: 74.4393Ft	E:1.5766 Ft	
Up:32.9309Ft	Z:4.6941 Ft	

Calculated result of road Setout

## **15. Function Introduction**

### 15.1 File Menu



## 1. New Project

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

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

Project name Project code		 	Executive Survey co			
Construction c	ю.		Survey cr			
Project na	Sav	Saving position				
5.exe 5 5.123 4 111111 1231 123		outhDisk\W outhDisk\W outhDisk\W outhDisk\W outhDisk\W	inEG\5.exe inEG\5.123 inEG\4\4.p inEG\1111: inEG\1231' inEG\123\:	rj I\5.12 rj \1231	2 L L.prj	•
Open					Exit	

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  $\rightarrow$  Save, the system will save the project in your selected file route, with the format of \*.prj. See figure "Save file":

File	Me	as Edit S.O. To	ol Setup	<b>*</b> ~	20	Þ
Q	Uni	t:Feet			Pt nam	e PT4
Q		• "			Prism H	
0 0 0		Save as			×	ist
		Project name			_	ngle
æ					_	ord
Ø		Yse		Car	ncel	
3		Þź			Hold	H Set
A		•				

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  $\rightarrow$  Save as, you will get the "Save as" dialog. Save it with a proper file name.

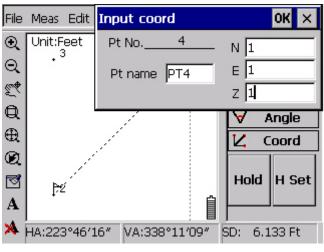
Note: When saving the file with another name, the project must be saved into the

"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  $\rightarrow$  Import  $\rightarrow$  Manual Entry, you will get the following dialog, input the Pt name and coordinates and then click  $\overrightarrow{OK}$ , 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  $\times$  to quit Input Coord



Input Coord

Click File  $\rightarrow$  Import  $\rightarrow$  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 🗈 🥂 📰					0	К	×		
🔍 \SouthDisk \									
🔁 Application Da	ta 🤅	🖻 Pro	ogram	IS			ĉ	) W	'inM(
🗁 Desktop		🖻 Re	cent				C	W	'inT9
Favorites My Document:	Input	Pan	el				Î		
Program Files	Esc 1	[2]3	3[4].	5[6	[7]	8	9	0	- [=
	Tab] C	ı[w]	e∐r	<u>[t</u> ]	УI	u∐	i	0	p∐q
		a s	<u> d </u> 1		[h]	j	<u>k</u>	Ļ	ĿЦ
Name: 1.dat	Shift	ZX	C	۷ļb	ļn	ļm	1÷	Ŀ	ЦĻ
- ,	[Ctl]ái	ül,	$\mathbf{M}$		_	_		ΨĮ	<u>† +</u>

Open coord data

#### 6. Export

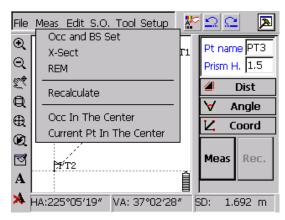
Function: Export coord data file to create CASS coord data file (\*.dat)

**Operation:** Click File  $\rightarrow$  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.

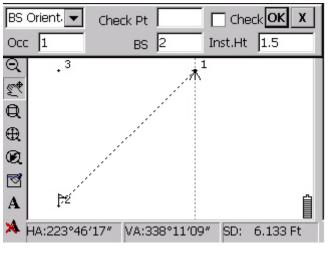
There are 2 ways to set the Occ & BS points: BS Orientation and Azimuth Orientation.

## **BS Orientation:**

Click: Meas  $\rightarrow$  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.

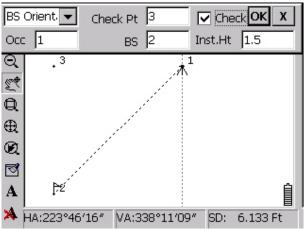
During orientation, the Inst. Ht is default as 1.5m, use steel tape to measure the Inst. Ht. accurately, and input this accurate value to the Inst. Ht item.

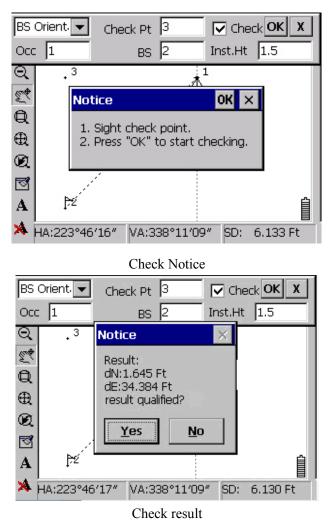
After inputting, rotate the telescope to sight the orientation Pt precisely, click  $\sqrt{1}$  to finish Occ & BS orientation. System will prompt: "Occ has been set successfully.....", and then an Occ symbol shows at the occupied point, and a dotted line appears to connect occupied point and orientation 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  $\boxed{N}$  before Check, system prompts "1. Sight check point. 2. Press "OK" to start checking. See figure "Check Notice". Press  $\boxed{OK}$  to return to check result, see figure Check result. If the check result is disqualified, click  $\boxed{No}$ , 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  $\boxed{Yes}$  to finish Occ Pt checking.





Check Occ Pt

#### **Azimuth Orientation:**

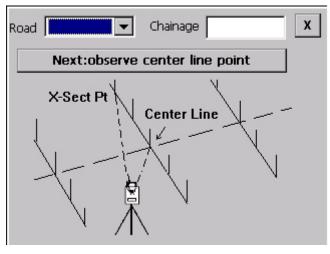
In the Occ Pt checking box select Azimuth Orientation, see figure "Azimuth Orientation", the BS changed into Azimuth, which requires to input BS azimuth as per the format of "degree, minute, second" manually. Other operations are same as BS Orientation.



Azimuth Orientation

### 2. X-Sect

After setting Occ, click Meas  $\rightarrow$  X-Sect, as graph 'X-Sect':



X-Sect

Setting occupied point before measuring transect. After that, click Meas $\rightarrow$ 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":

	Mid chainage measurement					
	Code 1		P.Ht			
	HA: 0°00′01″		E:			
	VA:170°16′4	8″	N:			
	SD:		Z:			
	Browse	Resetup		Meas.		
[	Last step:transect set X					
	Next step:transect point measurement					

#### 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":

Mid chainage measurement				
Code 2	P.Ht 1.5			
HA: 0°00′01″	E:6.5617 Ft			
VA:342°11′56″	N:1.4558 Ft			
SD:5.9698 Ft	Z:10.6053 Ft			
Browse Resetup		Meas.		
Last step:transect set X				
Next step:transect point measurement				

#### 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.

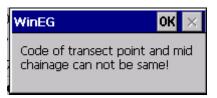
Transect point measurement				
Code 2	P.Ht 1.5			
HA: 0°00′00″	E:6.5617 Ft			
VA:342°11′56″	N:1.4542 Ft			
SD:5.9751 Ft	Z:10.6103 Ft			
Browse Meas.				
Last step:Mid chainage measurement X				
Save transect point measurement				

#### 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	$\times$
The point was m want to cover it?	
Yes	No

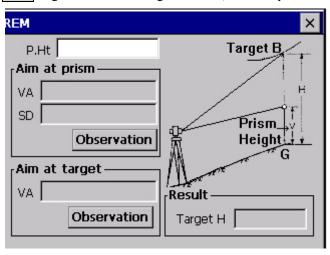
Notice 2

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  $\rightarrow$  REM to get into remote height window, show as picture "REM":



REM

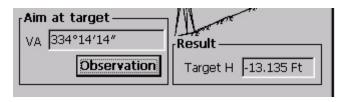
In REM dialogue box, default prism height is empty; user can change the prism height.

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":

rAim at prism			
VA 342°11′56″			
SD 5.9708 Ft			
Observation			

### 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":



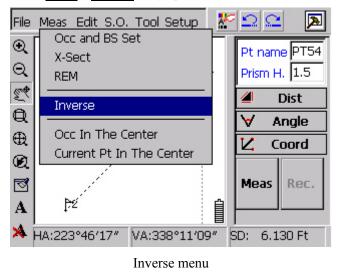
Calculation results

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

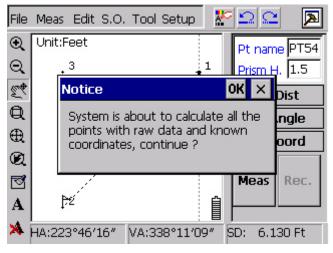
### 4. Coordinate recalculation

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:



Dialogue box showing as below will pop up:

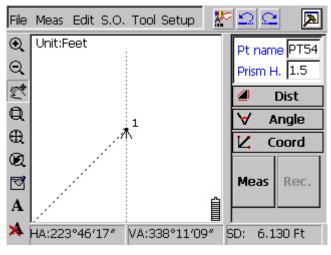


Coordinate recalculation notice

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  $Meas \rightarrow Occ$  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

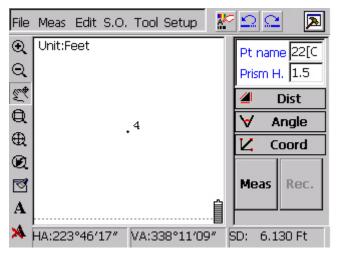
# 6. Centering point

This function could make the last measured point centered and shown on screen. Click menus in turn: Meas  $\rightarrow$  Current Pt in The Center, as picture shown below:

File	Meas Edit S.O. Tool Setup	*	20	
Q	Occ and BS Set		Pt nam	ne PT3
Q	X-Sect			
	REM		Prism H	4, j1.5
19	Recalculate		∕	Dist
Q			V /	Angle
æ	Occ In The Center		V C	ioord
Q	Current Pt In The Center			
-		1		<b>D</b>
3			Meas	Rec.
$ \mathbf{A} $		Ê		
⋊	: HA:233°01′47″ VA: 37°02′34	<u>ا</u>	) GD: 1.	692 m

Centering point menu

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



Center and display point

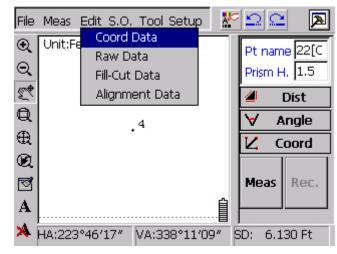
### 15.3 Edit menu

File	Meas	Edit S.O. Tool Setup		20	
Q	Unit:Fe			Pt nam	ne PT1
Q		Raw Data			
-		Fill-Cut Data		Prism H	1, [1,5
Q		Alignment Data		4	Dist
Q				$\forall$	Angle
Ð					
Q					
3				Hold	H Set
A					
×	, HA: 89°	°59′50″ VA:170°06′	_	i 6D:	

Edit menu

## 15.3.1 Coordinate data

Click Edit $\rightarrow$ 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:

Browse coord data					×
Pt	Pt N	N	E	Z	Τ
1	22[C	3.2808	6.5617	9.8425	
2 3	22[C	331.3648	6.5617		
	22[C	469.4014	-68.8480		
4	22[C	480.5278	-225.7459		
•					•
				Delete	

#### 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:

Browse coord	Coordinate edit	ок 🗙
Pt Pt N	Pt No. 2	N 331.3648
1 22[C 2 22[C 3 22[C	Pt name 2.084Ft	E 6.5617
3 22[C 4 22[C		Z
<b>                                     </b>		
		Delete

#### 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":

Browse raw data 🛛 🗙
Occ> X: 0.0000 Ft Y:0.0000 Ft Z:0.0000 Ft Ins Positioning> X: 0.0000 Ft Y:0.0000 Ft Z:0.0000 Sight> PT4,,1.5000 Ft HA:270.000000 VA:334.141400 SD:6.36 Sight> PT5,,1.5000 Ft HA:217.350200 VA:334.141400 SD:6.48 Occ> X: 0.0000 Ft Y:0.0000 Ft Z:0.0000 Ft Ins Positioning> X: -32.8084 Ft Y:-32.8084 Ft Z:0.0 Occ> X: 0.0000 Ft Y:0.0000 Ft Z:0.0000 Ft Ins Positioning> X: -32.8084 Ft Y:-32.8084 Ft Z:0.0

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:

Browse raw data	×
No raw data	A
	P
1	

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.

Road name:	road1 Chainage	: 1	<b>–</b> X
Positioning> Sight> 1,,1	0000 Ft Y:0.000 X: -32.8084 Ft .0000 Ft	Y:-32.8084	Ft Z:0.0
Sight> 2,,0	225.000000 VA: .304800 225.000000 VA:		
•			▼ ▶

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

Transect observing data

### 15.3.4 Alignment Data

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

Road data		×
Road name road1		
Del Ec	lit Add	Import Export

Road design

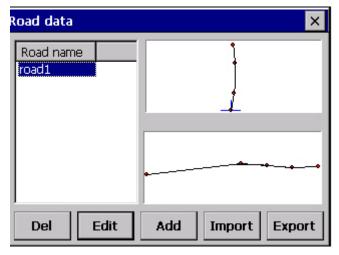
In road design window, functions of four icon downside from left to right are: Del.: delete the road design data user selects. Edit: edit and modify the horizontal and vertical alignment of road user selects. Add: add one road alignment data. Import: input road design data from files. (Suffix of road 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

Save As 💼 📥		ок 🗙
🔍 \SouthDisk\		
C Application Data	🗁 Programs	🗁 WinM(
🗁 Desktop	Recent	🗁 WinT9
Favorites	Input Panel	
C My Documents	Esc 1 2 3 4 5	5[6]7[8]9]
	Tabqwer	[t]y]u[i](
	CAP a s d f Shift z x c	g h j k  V b n m ,
Name: 1	Ctiláü] ` ] \ ]	, ToTuTuTi

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.

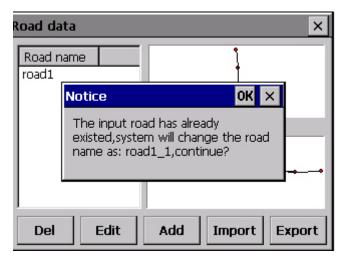
## Import road design data:

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

Open 🗈 🔺 🧮		ок 🗙
🔍 \SouthDisk\		
<ul> <li>Application Data</li> <li>Desktop</li> <li>Favorites</li> <li>My Documents</li> <li>Program Files</li> </ul>	Programs Recent StartUp System WinEG	🗁 WinMo 🗁 WinTs
Name:	Type: Road F	ile (*.rod)

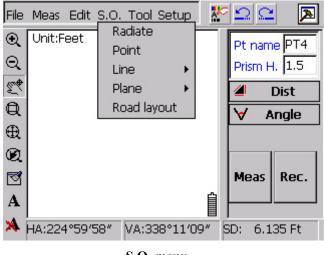
Open file

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.  $\overrightarrow{OK}$  Continue,  $\overleftarrow{X}$  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.

S.O. Pick P.I	Ht S.O. X
Information	
HA:225°00'00"	Angle diff:
VA:338°11′09″	Dist. diff:
SD:	H diff:
Right:	N:
Forward:	E:
Up:	Z:

### **Radiate Setout**

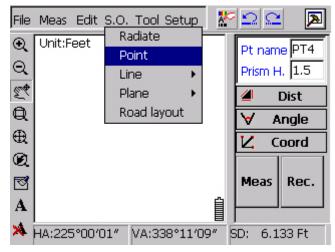
Click Select at rightside of Setout point input box, Setout point choosing dialogue box would pop up under the Setout point input box, as below:

s.o.	Pick	P
<sub>[</sub> Inf	From List	
HA	From View	
VA	Add	
1 000		

Refer to "S.O.  $\rightarrow$  Radiate" to know more about details.

# 15.4.2 Setout point

Click S.O.  $\rightarrow$  Point. As picture "Setout point menu" showed. Refer to "S.O.  $\rightarrow$  Point" to know more about details.



Setout point menu

# 15.4.3 Setout line

Click S.O.  $\rightarrow$  Line. As picture "Setout line menu" shows.

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

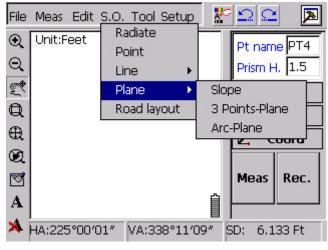
File (O	Meas Edit Unit:Feet	S.O. Tool Setup Radiate Point Line ▶		Pt nam	
₹ 0		Plane 🕨	Arc		Dist
Q	R	Road layout		V A	ngle
æ				K c	oord
Q					
				Meas	Rec.
3				meas	Rec.
⊠ A				меаз	

Setout line menu

### 15.4.4 Setout plane

Click S.O.  $\rightarrow$  Plane. As picture "Setout plane menu" showed.

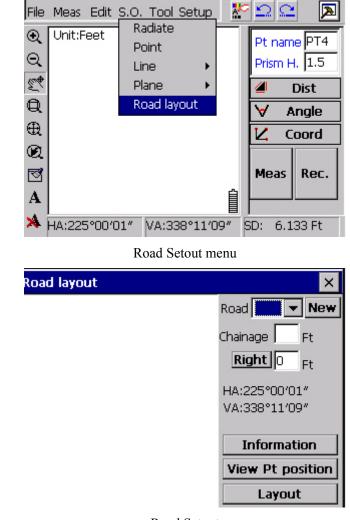
Refer to "S.O. $\rightarrow$ Plane $\rightarrow$ Slope", "S.O. $\rightarrow$ Plane $\rightarrow$ 3 points-plane", "S.O. $\rightarrow$ Plane $\rightarrow$ Arc plane" to know more about details.



Setout plane menu

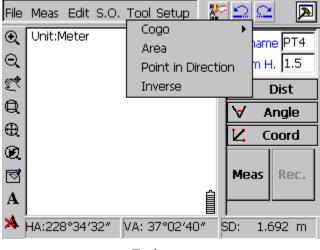
#### 15.4.5 Road design

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



Road Setout Refer to  $S.O. \rightarrow Road$  layout to know more details about Setout.

## 15.5 Tool menu



Tool menu

## 15.5.1 COGO

File Meas Edit S.O. Tool	Setup 🛛 💒	2	<u> </u>
Intersection	30	•	
Resection	ea		name PT4
Linear intersection	nt in Directio	n	m H.  1.5
Angle intersection	rerse		Dist
Vertical distance point		$\overline{\nabla}$	Angle
Radiate		÷	
Foot of perpendicular		Ľ.	Coord
Distance line			
Line intersection		Me	as Rec.
Point on line			
Symmetry point	7°02′40″	, 5D:	1.692 m

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.

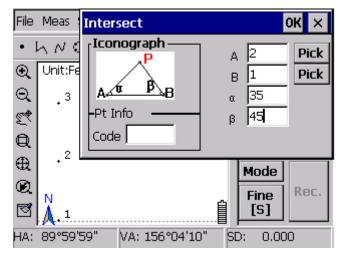
#### **Forward intersection**

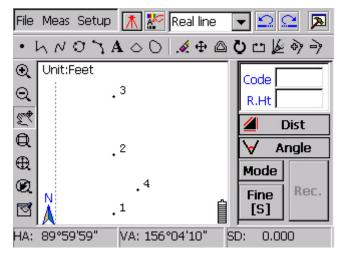
According to forward intersection, we have point 1, point 2, both of them are known points. Set occupation at these two points and get value of  $\angle 1$ ,  $\angle 2$ , to calculate unknown point P. The mathematical model as below:

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

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.



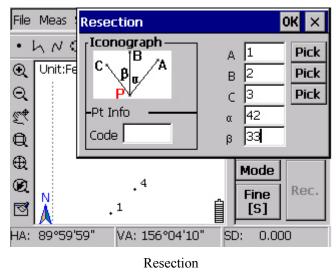


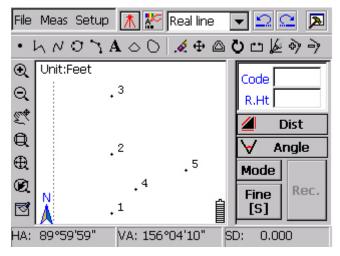
Forward intersection

Forward intersection results

### Resection

According to resection, we need three known points 1, 2, 3, two known angles  $\alpha \beta$ , 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'.





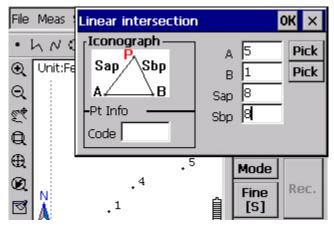
Resection results

### Linear intersection

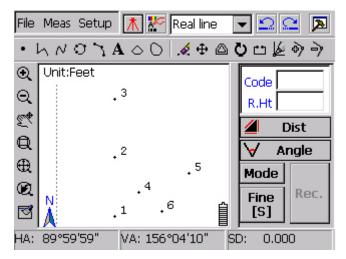
According to linear intersection, we need to set occupation at point P, get two distances from point P to point 6 and to point 1, to calculate coordinate of point P.

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  $\overrightarrow{OK}$ , 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.



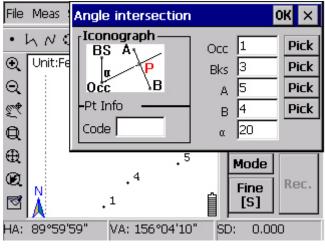
Linear intersection



Linear intersection results

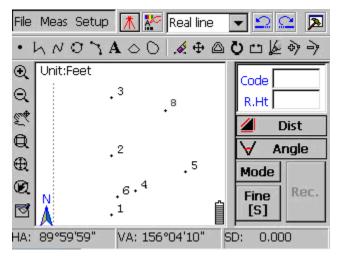
### Angle intersection

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

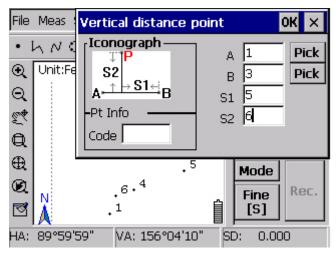
As picture 'Angle intersection shows points 4, 6 are known, Point 1 is occupation point, point 3 is back point. Input turn angle  $\alpha$  and click  $\overrightarrow{OK}$  to calculate point P. Dialogue box will show intersection number as 8 points position will be shown on screen. New point number 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

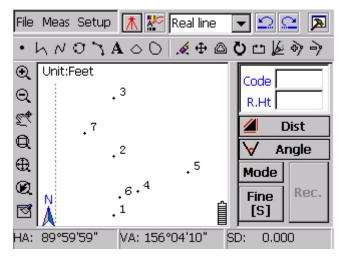
### Vertical distance point

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'.

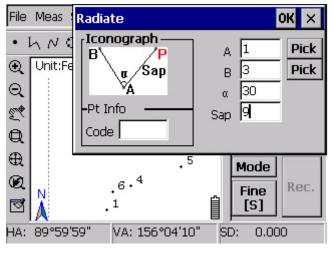


Vertical distance point results

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.

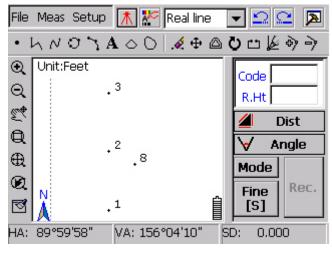
#### Radiate

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  $\alpha$ , click  $\overrightarrow{OK}$ , 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'.

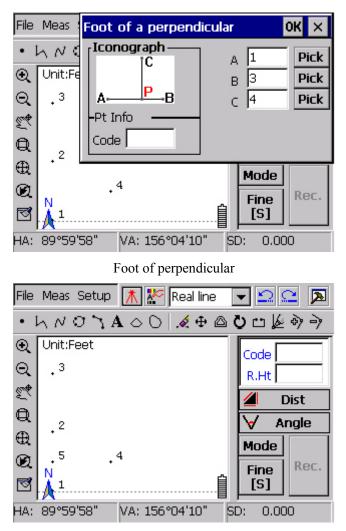


Radiate results

#### 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  $\overrightarrow{OK}$ , 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'.

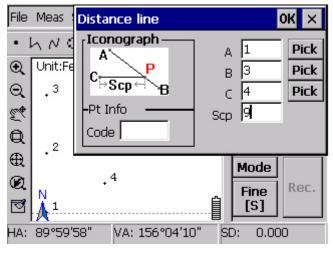


Foot of perpendicular results

### **Distance line**

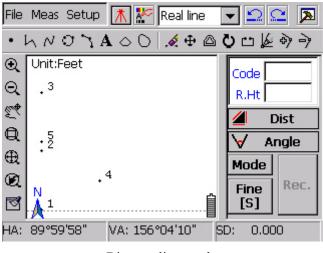
Point A, B, C are all known points, AB is a straight line, S is a distance needed to join calculation, to get the point which is on AB line and the distance from which to point C is S.

As 'Distance line' show, a straight pass through point 1 and 2. Input distance from unknown point to point 5, click  $\overrightarrow{OK}$  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.

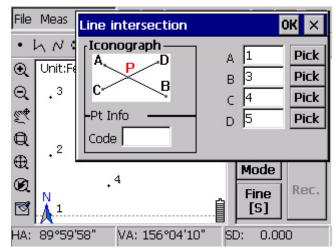


Distance line results

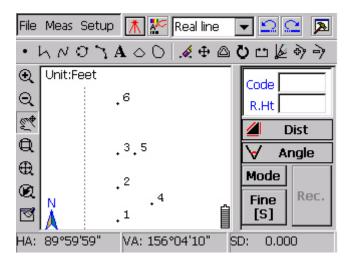
### **Lines intersection**

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

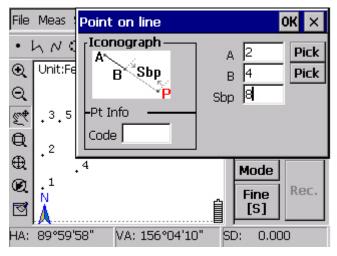


Lines intersection results

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

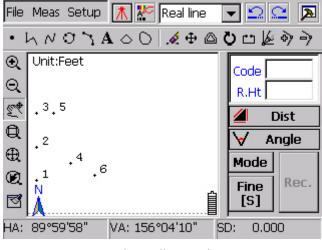
Point A and B are known points, a straight line passes through point A and B, P is inside point or outside point on line, S is distance from B to P, to calculate coordinate of inside point, outside point P.



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.



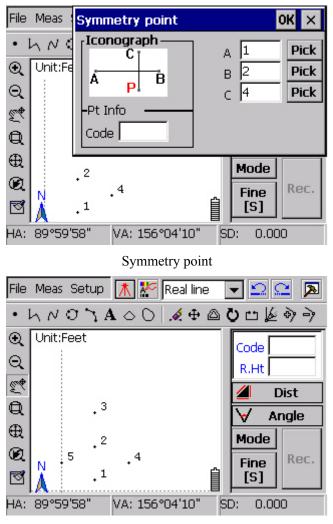
Point on line results

## 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 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:

File M	Area	×
QŪ	Pt No. 3 Pick Add	Calc.
Q	1(PT1): 0.000 0.000 2(PT2): -32,808 -32,808	Up
£₹	2(PT2): -32.808 -32.808 3(PT3): 0.000 -32.808	Down
Q	Area:	Ft.SQ
⊕.		
$\odot$		
3		
A		
メ HA	:225°00′03″ VA:338°11′09″ SD: 6.3	133 Ft

### 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  $\boxed{\text{Tool}} \rightarrow \boxed{\text{Point in Direction}}$ , showed as graph below:

File	Me	Coord calcu	ilate			ОК 🗙
Q	Ur	Pick N		Result		
Q		E		Pt nam	е РТ	
0 % Q		Azimuth				a V
		но 🗌		E		е
æ						
Q						
3						
A						
×	HA:	225°00′02″	VA:338°1	L1′10″	SD:	6.133 Ft

### 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:

File	Me	Coord c	alculate		ок 🗙
Q	Ur	Pick N	0.000	Result	
Q		E	-32.808	Pt name 3	S
<u>r</u> ¢		Azimuth	180	N -2.000	a    V
Q		HD	2	E -32.808	е
Ð					_
Q					
3			.2		
A			•		
×	HA:	225°00′0	2″ VA:338°	, 11′09″ SD: 6.	133 Ft

Calculation result

Click to save coordinate, as picture shown below:

File	Me	Coord c	alculate		OK ×
Q	Ur	Pick N	0.000	Result	
Q		E	-32.808	Pt name  3	S
0 10		Azimuth	180	N -2.000	a V
Q		HD	2	E -32.808	е
æ		_			_
Q					
3			• <sup>2</sup>		
Α					
×	HA:	225°00′0	2″ VA:338	3°11′09″ SD: 6.3	133 Ft

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			OK ×
N Pick	BS Pick	Target	Pick
Azimuth	Angle	но Г	
ଅ ଅ A		Meas	Rec.
A HA:263°04'33"		] SD: 1.6	592 m

Inverse

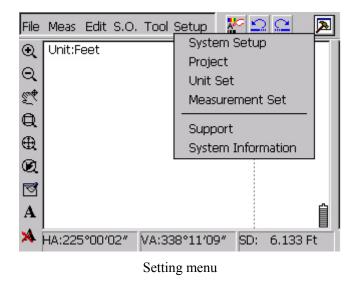
Steps: Click  $\boxed{\text{Tool}} \rightarrow \boxed{\text{Inverse}}$ . Input Occ, BS points, known point and click Calculate to get horizontal distance and angle. Shown as the picture below:

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

Inv	erse		ок 🗙
N E	Occ 0.000 Pick 0.000	BS -32.808 Pick -32.808	Target           -2.000         Pick           -32.808         -32.808
r <b>Re</b> : Azim		Angle 41.3041	HD 32.869
छ र A	• <sup>2</sup>		Ê
×	, HA:225°00′02″	VA:338°11′10″	SD: 6.133 Ft

Calculation result

## 15.6 Setup menu



# 15.6.1 System Setup

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

System set	ок 🗙
Range 5 ▼ Pixel ✓ Endpoint Nearest Point	Coord Info Pt No. 💌 Select Mode Pt No. 💌
Scale 1000 V Norm 50 X 50 V	<ul> <li>Power</li> <li>North Arrow</li> <li>Quick Draw Mode</li> <li>Dist Unit</li> </ul>

Graph settings

Screen capture: The accuracy arrange of screen capture is about  $1 \sim 10$  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  $50 \times 50 \times 40$  different subdivisions to select. The system default drawing scale is: 1:1000, man subdivision is:  $50 \times 50$ .

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 <u>Setup</u> $\rightarrow$ <u>Project</u>, System info dialogue box would pop up, as picture shown "Project information"

Project name	66	Executive co.	
Project code		Survey co.	
Construction co.		Survey crew	
Save			Exit

### System information

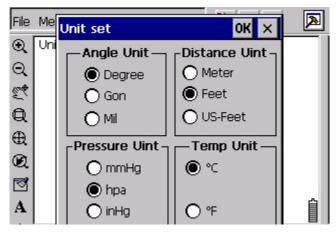
Saving path, project file name, file version and creating date of project file would be included in system info dialogue box.

#### 15.6.3 Setup unit

Click these two options in turn Setup $\rightarrow$ 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

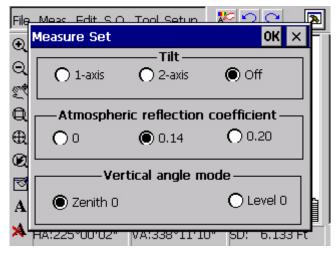
Unit setting	options
--------------	---------

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	°C/ °F	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  $\rightarrow$  Measurement Set, "Measurement Set" dialog box will be shown as below:

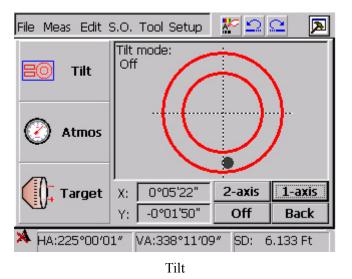


Measurement setting

### **Measurement settings:**

Menu	Selecting	Contents
	Item	
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:



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·cosα

 $H=S\cdot sin\alpha$ 

In formula: K=0.14 ······Atmosphere Refraction Modulus

Re=6370 km ..... The Earth Curvature Radius

A  $(or\beta)$  ... 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, 500.0000000000
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

File Yiew Iools Help Sync Stop Details Explore Options WindowsCE Connected Synchronized Information Type Status	🔕 Ticrosoft A		
Connected Synchronized	0 0 1		
Synchronized	WindowsCE		
Information Type Status	Synchronized	1	
	Information Type	Status	

#### 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

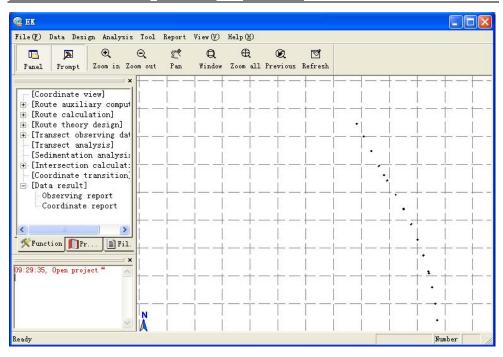


Figure 1-1: Arrangement of the elements in the EK window

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:

File(F) Data Design Analysis	Tool	Report	View(V)	Help(H)					
New (M)         Ctrl+N           Open (Q)         Ctrl+O           Save (S)         Ctrl+S           Save as (A)         Save as (A)	ut	₽¶ Pan	Q Window	€ Zoom all	Q Previous	S Refresh			
Coord Input Coord Output	•	- [	-	-+-	-+-	-		+-+	+
<b>Export settlement data</b> Import settlement data Export to EXCEL		- [		· — 十 -		-			
Print (P) Ctrl+P Print Preview (V) Print Setup (K)								; 	
Exit (2)		-     -	 -	· — + -   · — + -	- +   - +	-    -       -    -	   	+-+   +	 
19:29:35, Open project "	 	   		· — + -	- <del> </del>	 			•   •   •
×	N	-		· — 🕂 -	-+	-  -  - 		$\frac{1}{1}$	•+

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)

<u>Coord Input</u>: 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:

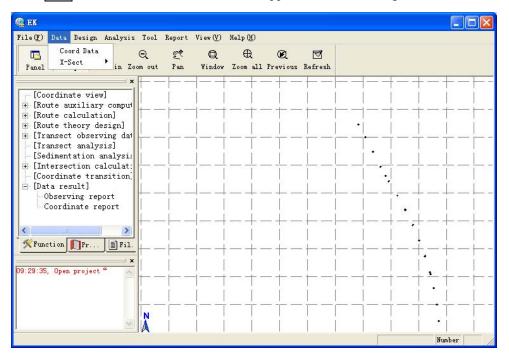


Figure 2-2: Data Menu

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.

ek 🦉								
File(F) Data Design Analysis	Tool Repor		Help(H)	75				
Panel Prompt Zoon in Zoo			v Zoon all Previou					
[Coordinate view] [Route auxiliary compute	Route:1		ſ	200				•
<ul> <li>Boute calculation</li> <li>Boute cherry design]</li> <li>[Transect observing dat</li> <li>[Transect malyzis]</li> <li>[Sedimentation calculation calculation calculation calculation calculation conductor transitions</li> <li>[Data result]</li> <li>Observing report</li> <li>Coordinate report</li> <li>Coordinate report</li> <li>* X</li> <li>Prescient Project "</li> <li>* 393 00, Open project "</li> <li>* 393 04, Open project "</li> <li>* 393 05, Open project "</li> <li>* 393 05, Open project "</li> <li>* 40.15, Observe transect 1</li> </ul>	Seri 1 2 3 4 5 	Name ct1 11 12 13 13 r4	Horizontal 90.0000 80.0000 60.0000 100.0000 120.0000 120.0000	Zenith 90,0000 90,0000 90,0000 80,0000 88,0000	SD 150,000 145,000 120,000 120,000 175,000	Prism hı 1.20 1.20 1.20 0.00 0.00	Occ: PT1 N: 0.00000 Z: 0.00000 BS: PT2 N: 90.00000 Z: 90.00000 Z: 90.00000 Ins.H. 1.500000 Save	
ady								Number

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:

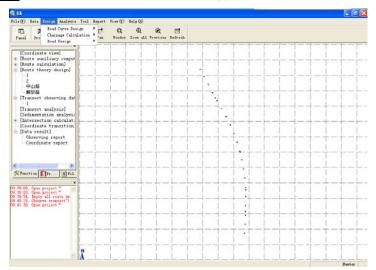


Figure 2-4: Design Menu

Functions of the Design Menu:

<u>Road Curve Design</u>: 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. <u>Road Curve Design</u> is corresponding to <u>Route</u> calculation in the control panel. You'll get more details about these commands in later sections.

<u>Chainage Calculation</u>: 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. <u>Chainage Calculation</u> is same as the <u>Chainage Calculation</u> 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:

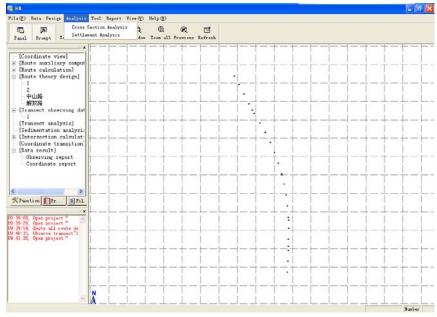


Figure 2-5 Analysis Menus

Functions of this Menu:

<u>Cross Section Analysis</u>: 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.

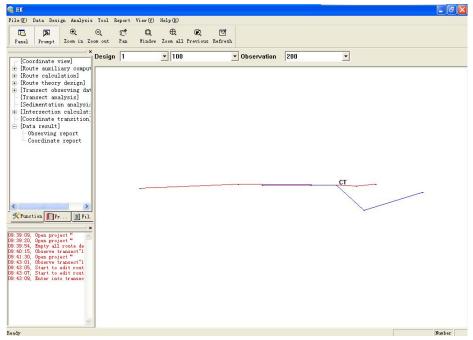


Figure 2-6: Cross Section Analysis

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:

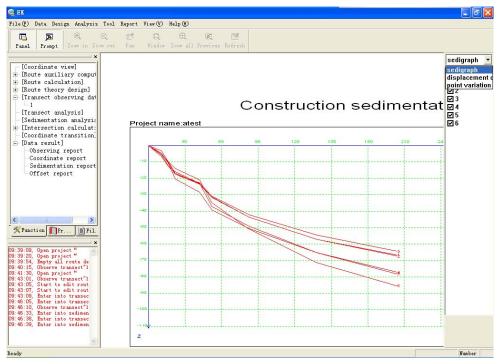
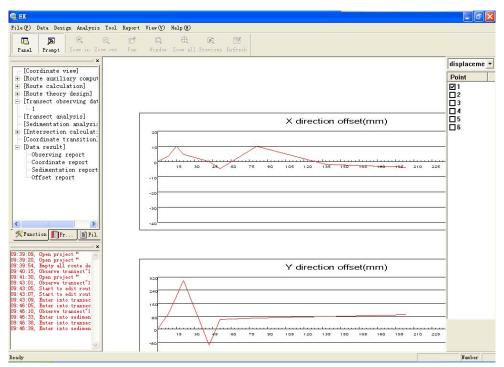


Figure 2-6: Sedigraph

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 " $\sqrt{}$ " 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.





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.

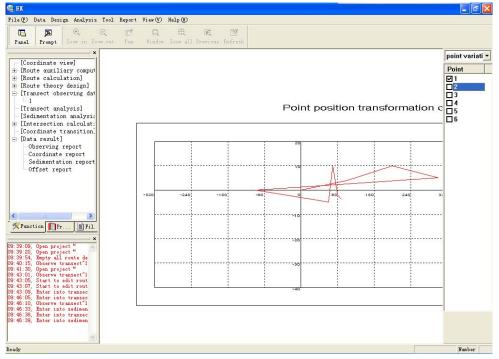


Figure 2-8: Point Variation

#### **2.5 Tool**

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

Condition Analysis     Tool Report Vier(V) Malp(V)       Panal     Prosp.     Condition Transformation       Panal     Prosp.     Condition Transformation       Bits Bestion     Linear intersection       Image: State St	ek .	
Panel       Prospt       Zoom in Zoo       Intersection         Resection       Resection       Resection         Intersection       Resection       Resection         Prospt       Zoom in Zoo       Prospt         (Coordinate vise)       Prospt       Prospt         (Rotte auxiliary computed intersection       Resister         (Rotte calculation)       Prospt       Point calculate         (Financet malyzic)       Speatry point       Point calculate         (Schartation malyzic)       Speatry point       Point calculate         (Coordinate report       Speatry point       Point calculate         (Coordinate report       Software report       Software report         (Coordinate report       Software report       Software report         (Software report       Software report       Soft		Help (H)
Pr. Pr.     Pr.	Panel     Prospit     Q     Coord Transformatio       Coordinate view]     X     Coord Transformatio       Coordinate view]     Route calculation]     X       Route calculation]     Route calculation]       Classification]     Coordinate view]       Coordinate view]     Coordinate view]       Coordinate view]     Coordinate view]       Coordinate view]     Coordinate view]       Coordinate view]     Coordinate view]       Coordinate transition     Coordinate report       Observing report     Coordinate report       Sediment ation report     Sediment ation report	Intersection     Resection       Linear intersection     Angle intersection       Kaiate     Intersection       Roatical distance point     Intersection       Intersection     Intersection       Symmetry point     Intersection
→ <u>→ → → → → → → → → → → → → → → → → → </u>	Pr.         P1           132 00, Open project "         132 00, Open project "           132 00, Open project "         143 0, Open project "           143 0, Open project "         143 0, Open project "           143 0, Open project "         143 0, Open project "           143 0, Open project "         143 0, Open project "           143 0, Open project "         143 0, Open project "           140 0, Diserve transce'1         143 0, Open project "           140 0, Diserve transce'1         143 0, Diserve transce           140 0, Diserve transce         143 0, Diserve transce	

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:

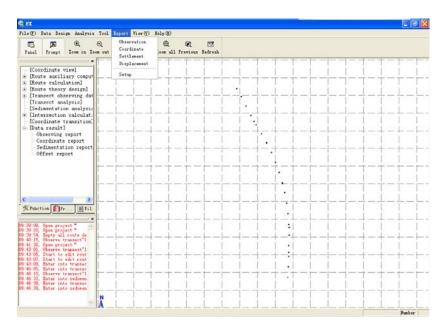


Figure 2-10: Report Menu

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.

🚳 EK							
文件(2) 数据 设计 分析 工具	成果	查看(V) 帮助	(H)				
Image: Constraint of the state o	- ① 全屏	<ul> <li></li></ul>					
:		С	D	E	F	G	H 🔺
【坐标视图】	1						
□ 【线路辅助计算】	2						
■【线路简算】	3		70	<b>اتار</b>	1 -	T	A.4.
正 【线路理论设计】     白 【横断观测数据】	4		观	测		<del>,</del>	簿
- 1	5				-	-	
【横断分析】	6						
【沉降分析】	7		水平度	10.25 ¥6	No:		
■ 【交会计算】	9	照准方向名称	盘左	盘 味致 盘右	方向值	天顶距读数	斜距读
【坐标转换】 王【数据成果】	10	開催力回省称		· 通句 • / 》	• / #	• / //	(米)
⊡─【数据成果】	11	PT2	0.00000		0.00000		<u>(</u> (1))
	12	PT2 PT3	15.00000		15.00000	90.55550	75.1
	13	PT4	45.00000		45.00000	91.00000	76.4
	14	PT5	55,00000		55,00000	89,00000	76.4
	15	PT6	65.00000		65.00000	90.00000	68.1
	16	PT7	75.00000		75.00000	90.00000	80.
	17	PT8	93.00000		93.00000	89.00000	67.1
×	18	PT7	30.00000		30.00000		
11:59:20, 打开工程"atest" 12:01:00, 开始编辑线路设计"	19	PT9	90.00000		90.00000	89.34560	88.
12:01:13,进入横断分析 12:01:36,进入沉降分析	20	PT10	56.00000		56.00000	90.00000	78.
12:01:36,进入沉降分析 12:01:59,进入沉降分析	21	PT11	76.00000		76.00000	90.00000	67.
	22	PT12	111.00000		111.00000	90.00000	57.1
	23	PT13	145.00000		145.00000	90.00000	76.1
	24	PT12	0.00060		0.00060		
✓	14 4	▶ ▶ \ 第1页	/ AE 000000	•	45,00000	0 00040	÷ 4
就绪							数字

Figure 2-11: Observation Report

<u>Coordinate</u>: 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.

🚳 ek						
文件(E) 数据 设计 分析 工具	成果	查看(V) 帮助(H	)			
国家         日、日、日、日、日、日、日、日、日、日、日、日、日、日、日、日、日、日、日、		<b>政 団</b> 前图 刷新				
×		В	С	D	E	F
【坐标视图】 ▲ ① 【线路辅助计算】 ▲	1 2			坐标原	氐 果 表	
■【线路简算】	3	工程名称:			分项名称:	
■ 【线路理论设计】	4	点号	编码	N	E	Z
□ 【横断观测数据】	5	PT1		0.000	0.000	0.000
	6	PT2		90.000	90.000	90.000
【沉降分析】	7	PT3		37.495	64.943	-2.720
□ 【交会计算】	8	PT4		0.000	76.454	-2.835
【坐标转换】	9	PT5		-13.274	75.283	-0.166
□【数据成果】	10	PT6		-23.257	63.899	-1.500
- 观测报表 - 坐标报表	11	PT7		-40.000	69.282	-1.500
沉降报表	12	PT8		-49.783	44.825	-0.331
▲ 秋枢主 🞽	13	PT9		-104.199	113.980	0.371
≪功能 []信息 ] 〕文件]	19	PT10 PT11		-55.493	122.616 105.938	-0.271
×	16	PT11 PT12		-98.743	74.013	-0.271
11:59:20, 打开工程 "atest" _ 🔨	17	PT13		-125.665	40.585	-0.271
12:01:00, 开始编辑线路设计 "一 12:01:13, 进入横断分析	18	PT14		-131,665	96.263	-0.376
12:01:36,进入沉降分析	19	PT15		-180.026	109.787	-0.321
12:01:59,进入沉降分析	20	PT16		-192.450	78.909	-0.321
V	21 I4 ◀	PT17 ▶ N 第1页		65 000	78 000	100 0 ▲
就绪						数字

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.

🚳 ek												×
文件(22) 数据 设计 分析 工!	し 成果	查看仪	□ 帮助 04	)								
□□ □ ② ④ ○ 〔 〔 控制 输出 前大 缩小 平移 窗		🔍 🖸 前图 刷										
	×	A	В	С	D	E	F	G	H	I	J	P
<ul> <li>【坐标视图】</li> <li>▲</li> <li>【线路辅助计算】</li> </ul>	1 2						沉降	观测周	成果表			
王 【线路简算】	3										NO:	
由 【线路理论设计】	4			第1期			第2期			第3期		
□ 【横断观测数据】	5	观测		年11月			年11月:			1年11月:		
【横断分析】	6	编号	标高	沉降量		标高	沉降量		标高	沉降量		
【沉降分析】	7		(m)	本次	累计	(m)	本次	累计	(m)	本次	累	i
□ 【交会计算】	8	1	0.9134	0	0	0.9097	-3.7	-3.7	0.9032	-6.5	-10.	
【坐标转换】	9	2	0.9054	0	0	0.9004	-5.0	-5.0	0.8946	-5.8	-10.	-0
白【数据成果】	10	3	0.9219	0	0	0.9146	-7.3	-7.3	0.9085	-6.1	-13.	-0
一观测报表	11	4		0	0	0.9089	-5.7	-5.7	0.9034	-5.5	-11.	-0
- 坐标报表	12	5	0.9998	0	0	0.9935	-6.3	-6.3	0.9868	-6.7	-13.	-0
- 沉降报表	13	6	0.9278	0	0	0.9221	-5.7	-5.7	0.9177	-4.4	-10.	4
🛠 功能 📗 信息 📄 文件	14											•
	× 16											1
11:59:20, 打开工程"atest" 12:01:00, 开始编辑线路设计" 12:01:13, 进入横断分析	17											1
12:01:00,开始编辑线路设计" - 12:01:13,进入横断分析	18											1
12:01:36,进入沉降分析	19											-
12:01:59,进入沉降分析	20											•
	21	F H	第1页 🖌	第1页1	) 第1页	2/1			1	1	•	ſ
沈绪		\								数字	_	ľ

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.

文件(21) 数据 设计 分析 工具	し 成果	查看	(V) 帮助(	<u>H</u> )							
□□ <b>□ □ ④ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</b>		<b>愛</b> 前图 4	<b>図</b> 利新								
	<	A	В	С	D	E	F	G	Н	I	
□【线路辅助计算】 ▲	1 2						位移	观测周	成果表		
🖃 【线路理论设计】 📃	3										N
□ 【横断观测数据】	4			第1期			第2期			第3期	
┃   1 【横断分析】	5	观测		1年11月8			年11月1			年11月:	
	6	点 编号	坐标	位移量		坐标	位移量		坐标	位移量	<u>t (</u>
■【交会计算】	7		(m)	本次	累计	(m)	本次	累计	(m)	本次	
□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□	8	_	254.153		0	254.253	100.0	100.0	254.353		21-
□□【数据成果】	9	1	756.115	-	0	756.119	4.0	4.0	756.125		11
观测报表	10		254.253	-	0	254.353	100.0	100.0	254.453		21
坐标报表	11	2	756.215		0	756.315	100.0	100.0	756.415		21
	12	-	254.353	-	0	254.453	100.0	100.0	254.553		21
	13	3	756.315	-	0	756.415	100.0	100.0	756.515		21
🔨 功能 🚺 信息 📄 文件	14	-	254.453	-	0	254.553	100.0	100.0	254.653		21
	15	4	756.415	-	0	756.515	100.0	100.0	756.615		21
	10	_	254.553	-	0	254.653	100.0	100.0	254.753		21
12:01:00,开始编辑线路设计"一	17	5	756.515	-	0	756.615	100.0	100.0	756.715		21
12:01:13,进入横断分析 12:01:36,进入沉降分析	18		254.653	-	0	254.753	100.0	100.0	254.853		21
12:01:59,进入沉降分析	19	6	756.615	U	0	756.715	100.0	100.0	756.815	100.0	21
	20										
~		► H	第1页 🤇	第1页1	) 第1页2	2/1	1	1			• •
就绪										数字 🗌	

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.

C EK	đΧ
File (2) Data Design Analysis Tool Report View (V) Help (D)	
D     D     D     D       Panel     Prompt     Zoom in Zoom out     Pan     Window     Zoom all Previous Refresh	
x .	
[Coordinate view] ⊕ [Route auxiliary comput ⊕ [Route calculation]	
Route theory design Table setup	
[Transect observing dat [Transect analysis]	
- [Sedimentation analysi: Path for observation table templet file:	
- [Coordinate transition]	
[Data result] Path for coordinate table templet file: D:\Program Files\WinEG支持软件EK\template Rows for page 45	
Path for settlement table templet file: D:\Program Files\WinEG支持软件EK\template	
Path for displacement table templet file: D:\Program Files\WinEG支持软件EK\template	
D.(Program Pressivanco × 1974) TExtemplate	
KPunction Pr Fil.	
x	
Yes	
N	
Ready Kun	ber

Figure 2-15 Setup

#### **2.7 View**

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

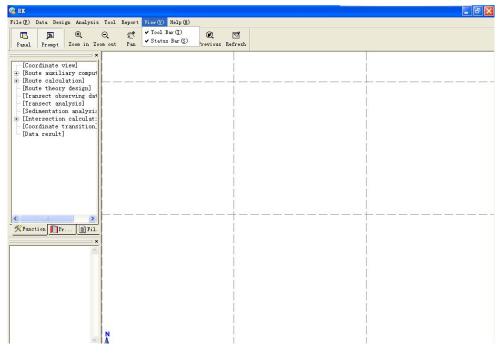


Figure 2-16 View Menu

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:

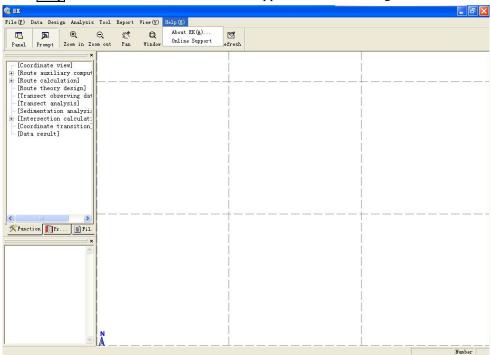


Figure 2-17 Help Menu

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 <u>http://www.southsurvey.com</u> to get help.

#### 2.9 Toolbar

Functions of the Tool Bar:

	Open or Close the Control panel	A	Open or Close the Prompt panel
€.	Zoom In	Q	Zoom Out
<u></u>	Pan	Q	Zoom Window
€	Zoom all	Ø.	Previous
3	Refresh		

#### 2.10 Control Panel

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

- [Coordinate view]		×	×
Route auxiliary comput	Term	Value	😑 [Project file list]
# [Route calculation]	Project	stone	-atest.coo
🗷 [Route theory design]	Project c		atest. daw atest. prj
ITransect observing dat	Construct		atest.raw
[Transect analysis]	Construct		atest.rod
[Sedimentation analysis	Survey un		atest. sct
Intersection calculati			
	Surveyor		
H-[Data result]			
KFunction Pr EFil.	Function	n Pr Fil.	KFunction Pr 📄 Fil.

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

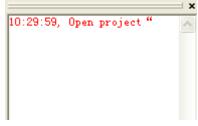


Figure 2-19: Information Output Area

### **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.

alculate single cross poi	int for curve control	E
Curve LS Linearity Curve Ls 0.0 Option © external spur © Tar © Vertical distance	ngent	
Known Off angle Tangent vertical dist.	external spur Tangent Normal vertical dist.	

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:

单交点曲线控制计算
缓和曲线LS 运 满足线性协调 520
控制选项 · 外距控制 · 切线长控制 · 支距控制
已知数据
曲线偏角 16.10351 控制外距 57.329 切线长
切向支距 法向支距
外距控制
偏角 :16.10351 (°′″)外距 :57.329 (m.) 圆曲线半径 :5499.972 (m.)
新出EXCEL [

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:

单交点曲线控制计算	X
緩和曲线LS 「満足线性协调 520 第22 yu	
控制选项 C 外距控制 ・ 切线长控制 C 支距控制	
□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□	
曲线偏角 16.10351 控制外距 切线长 1041.882	
切向支距	
切线长控制	_
偏角 :16.10351 (°´´) 外距 :57.329 (m) 圆曲线半径 :5499.994 (m) 圆曲线长 :1032.823 (m) 切线长 :1041.882 (m) 缓和长 :520.000 (m)	
切线长 :1041.882 (m) 緩和长 :520.000 (m) 全长 :2072.823 (m)	
輸出EXCEL 计算 取消	

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:

单交点曲线控制计算
緩和曲线LS         緩和Ls           「満足线性协调」         520
控制选项 ○ 外距控制 ○ 切线长控制 · 支距控制
已知数据     16.10351     控制外距     切线长       切向支距     250     法向支距     28
備角 :16.10351 (°´´) 外距 :57.530 (m) 圆曲线半径 :5520.765 (m) 圆曲线长 :1038.687 (m) 切线长 :1044.852 (m) 缓和长 :520.000 (m) 全长 :2078.687 (m)
输出EXCEL 页消

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.

Calculate convexity curve control	
Option © External spur © Tangent	
Known Cuvre off angle External distance	
Export EXCEL Calc. Cancel	

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:

凸型曲线控制计算	
控制选项 ・ 外距控制 ・ 切线长控制 已知数据 曲线偏角 16.10351 外距 30	-2.5-
外距控制 備角 :16.10351 (*´´) 外距 :30.000 図曲线半径 :2238.475 (m) 図曲线长 :0.000 切线长 :634.955 (m) 緩和长 :631.993 全长 :1263.985 (m)	(m) (m) (m)
输出EXCEL【【计算】】	取消

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:

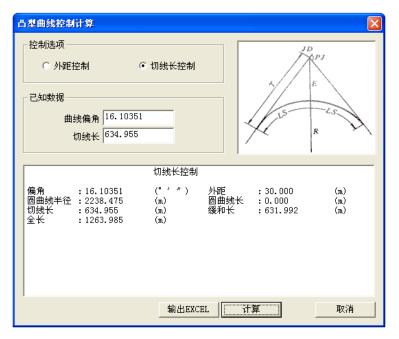


图 3-7 Convexity curve—tangent

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.

Calculat 🕙 zoom in 📢 🔹 → <u>详細</u> C	Q 🛍 ☆ 🖓 × <mark>atrol 🛛 🗙 🗙 🗙 🗙 🗙</mark>
基本翻译           ♥. 放大           网络释义           Zoom In:放大  画面拉近   放大           zoom an:放大 (▲I)	当前图片
Knowr 相关查询: <u>Zoom</u> Off JA Base line	
	Export EXCEL Calc. Cancel

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:

切基线曲线控制计算				
	和Ls 20		AB TI TI IA I ID HY GO LY	
已知数据 偏角JA 8.05175	基线长 810	211	R	1-10 15 Hay
偏角JB 8.05175			V	
	切基线控设			
偏角(JA) :8.05175 圆曲线半径 :5523.346 基线长 :810.000 前切线长 :636.148 全长 :2079.413	(* ' * ) (m) (m) (m) (m)	偏角(JB) 偏曲线长 緩和长 后切线长	: 8.05175 : 1039.413 : 520.000 : 636.148	(* ' ″ ) (m) (m) (m)
	输出EXCE	L I II	算	取消

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.

Calculate complex curve cont	rol		X
Known		AB	
Off JA Former curv	e	$\frac{T_i}{10} \frac{T_i}{10} \frac{T_i}{10$	Xalita
Off JB Later curve		111 tar na p	X
Base line Former radi	us		
🗌 Adjust former ra	dius		
	Export EXCEL	Calc.	Cancel

#### 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:

复曲线控制计算 一已知数据		
偏角JA <sup>8.05175</sup> 偏角JB <sup>7.05175</sup> 基线长 <sup>800</sup>	前缓和长 520 后缓和长 450 前圆半径 5000	
	圆半径允许调整 复曲线控设	
偏角(JA) : 8.05 前圆曲线半径 : 5000 前圆曲线长 : 445. 前缓和长 : 520. 前切线长 : 597. 基线长 : 800.	.000 (m)	: 7.05175 (° ' " ) : 6787.902 (m) : 614.747 (m) : 450.000 (m) : 635.414 (m) : 2030.575 (m)
	輸出EXCEL 计算	取消

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.

Calculate S curve control	
Known Off JA Former curv Off JB Later curv Intersection distance For Adjust former radius	
E	xport EXCEL Calc. Cancel

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:

S型曲线控制计算		X
己知数据		
偏角JA 8.05175 偏角JB 7.05175 交点间距 2500	前緩和长 700 后緩和长 500 前圆半径 5000 圆半径允许调整	AST LY USA
	复曲线控设	
偏角(JA) :8.05 交点间距 :2500 前圆曲线半径 :5000 前圆曲线长 :5.82 前缀和长 :700. 前圆曲线外距 :16.5 前切线长 :703. 前曲线全长 :1205	.000 (m) 1.000 (m) 后圆曲线半径 :24965.49 18 (m) 后圆曲线长 :2588.539 000 (m) 后缓和长 :500.000 174 (m) 后圆曲线外距 :48.256 790 (m) 后切线长 :1796.268	(m) (m) (m) (m) (m)
	输出EXCEL 计算	取消

#### 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.

Calculate ovifor	for curve control
Known	
Off JA	
Off JB	Later curve
Base line	Former radius
	Δ.
	Export EXCEL Calc. Cancel

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:

卵型曲线控制计算			
- 已知数据			
偏角JA 10.05175	前缓和长 520	The second secon	
偏角JB 7.05175	后缓和长 400	AND THE REAL OF TH	
基线长 800	前圆半径 5000	RA D RB	
	12 10 Vali, Vali	Ö,	
	卵型平		
偏角(JA) :10.0 前圆曲线半径 :5000		(JB) :7.05175 (゜′″) 曲线半径 :5786.833 (m)	
前圆曲线长 : 127. 基线长 : 800.	424 (m) 后圆	曲线长 :22.966 (m)	
后缓和长 :400.	000 (m) 中緩;	和长 :985.874 (m)	
前切线长 :701. 后交点调整值 :0.00		线长 :558.472 (m) 点到 :441.520 (m)	
全长 : 2056			
1	tê di miranî - [[		
输出EXCEL 计算 取消 取消			

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 <u>Raw data</u>, <u>Widen</u> and <u>Superelevation</u> 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: <u>ZH chainage</u>, <u>HZ chainage</u>, <u>Curved width</u>, <u>SL curve</u>, <u>Curved SL slope%</u>, <u>Crown slope%</u>, <u>Shoulder slope%</u>, <u>Shoulder width</u> and <u>Road width</u>; Widen: <u>Line scale</u>, <u>High order parabola</u>; Superelevation: <u>Centre shaft rotation</u>, <u>Inside axis rotation</u>. The interface is shown as figure 3-16.

Calculate widen and superele	vation 🔀
Raw data	
ZH chainage	
HZ chainage	
Curved width	
SL length	
Curved SL slope%	
Crown slope%	
Shoulder slope%	
Shoulder width	
Road width	
Widen	
• Line scale	
C High order parabola	·
Superelevation	Middle chainage
<ul> <li>Centre shaft rotation</li> </ul>	Export EXCEL Calc. Cancel
C Inside axis rotation	

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:

加寬超高计算	
┌ 原始数据	加宽超高
直缓点桩号 100	
緩直点桩号 620	/ · 缓宜点桩号 = 620   弯道最大加宽 = 2
弯道最大加宽 2	超高缓和段长 = 520 弯道超高坡度 = 0.5%
超高缓和段长 520	路拱横坡 = 1% 路 <u>肩横</u> 坡 = 0.5%
弯道超高坡度% 0.5	路面宽 = 2 路肩宽 = 10
路拱横坡% 1	中桩桩号 = 400.000 加宽方式: 直线比例
路肩横坡% 0.5	超高方式: 白线记M 超高方式: 中轴旋转 加宽值 = 0.846
路肩宽 2	路基外侧超高值 = 0.020 路中线超高值 = 0.060
路面宽 10	路基內侧超高值 = -0.058
<ul> <li>● 直线比例 ○ 高次抛物线</li> </ul>	
	中桩桩号 ↓400
<ul> <li>● 中轴旋转</li> <li>○ 内边轴旋转</li> </ul>	输出EXCEL 计算 取消

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.

Lay single cross point plane curve	$\mathbf{X}$	
Chainage setup Start point  Increase  Add integer	Chainage Add	
Para. setup Radius F curve		
□ Border □ Height H. Para.		
R Off R Height		
Known Start point, intersection point		
Start X   Y   Pick     Sect X   Y   Pick		
Save para. Pick para.	Export EXCEL Calc. Cancel	
PS:radius can be munis or plus in para setup. Plus for clockwise, munis for anticlockwise		

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.

高程参数		
「请输入曲线参数一		
• 直线	○ 竖曲线	
┌本段起点信息──	本段终点信息	
桩号	桩号	
高程	高程	
	, , , , , , , , , , , , , , , , , , ,	
半径		
前纵坡%		
后纵坡%		
增加	<b>□参数</b>	
─────────────────────────────────────		
	···X ··· ··· ··· ··· ··· ····	
注意:参数设置中(	的坡度可为正负值,正	为上升,负为下降。

#### 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.

点号	点名	N	E
1	PT1	0.000	0.000
2 3	PT2	90.000	90.000
3	PT3	37.495	64.943
4	PT4	0.000	76.454
5	PT5	-13.274	75.283
6	PT6	-23.257	63.899
7	PT7	-40.000	69.282
8	PT8	-49.783	44.825
9	PT9	-104.199	113.980
10	PT10	-55.493	122.616
11	PT11	-77.246	105.938
12	PT12	-98.743	74.013
13	PT13	-125.665	40.585
14	PT14	-131.665	96.263
15	PT15	-180.026	109.787
16	PT16	-192.450	78.909
17	PT17	65.000	78.000
18	PT18	65.000	78.000
19	PT19	65.000	78.000
٢			

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.

单交点平曲线敷设	×
社会校告       」         超点桩号       」         100.587       」         加油取整         参数设置         半径       6505         備角       16.10351         后緩和       520         「       边桩         「       高程参数         左偏距       高程参数         左偏距       一         七高差       二         石嶋距       「         石嶋距       「         七山奈件       三         起点       ×         約5.8913       Y         10956.8913       Y         500       三	<b>社 500.2544 1加班 单</b> 文点平曲线敷设(长度单位: m) <b>痛</b> : 16.10351(* * * )     /9.00     /9.
────────────────────────────────────	輸出EXCEL         计算         取消           方向左转为负,右转为正。

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:.

Lay tangent baseline for plane curve	9	×
Chainage setup Intersectior → Increase ✓ Add integer	Chainage	Add
Para. setup Radius F OffA.		
Curve L L OffA. L OffA. Border pile Height H. Para.		
L Off L Height R Off R Height		
Known Start point, intersection point		
Start     Y     Pick       Fore     Y     Pick		
Save para. Pick para.	Export EXCEL Calc. Ca	ncel
PS:radius can be munis or plus in para set	tup. Plus for clockwise, munis for anticlockwise	;

#### **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:

切基线平曲线敷设	
桩号设置       起点桩号 ▼       1       200.45	桩号 600 加桩 切基线平曲线敷设(长度单位: m) ^ 前偏角: 8.05175 (° / ″) 后偏角: 9.10435 (° / ″)
参数设置         半径       5500       前偏角       8.05175         緩和长       520       后偏角       9.10435         び 边桩       □ 高程       高程参数         左偏距       5       左高差         石偏距       7       石高差	后偏角: 9.10435 (° ′ ″) 因曲线半径: 5500.000 缓和长: 520.000 前切线长: 634.437 后切线长: 688.815 因曲线长: 1137.508 曲线全长: 2177.508 主点桩号及坐标
已知条件 已知起点、前交点 起点X <sup>37806.776</sup> Y .6107.023 选 前交点X <sup>3097.9954</sup> Y <sup>504.8214</sup> 选	桩号 = 200.450 X = 87806.776 Y = 516 桩号 = 500.450 X = 87519.180 Y = 516 桩号 = 600.000 X = 87423.746 Y = 516; 桩号 = 800.450 X = 87231.584 Y = 516; 桩号 = K1+100.450 X = 8643.988 Y = ! 桩号 = K1+400.450 X = 86656.392 Y = !
保留参数 提取参数 注意:参数设置中的半径可以为负,前进	输出EXCEL 计算 取消

# 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:

夏曲线敷设	E Contraction of the second
桩号设置       起点桩号 ▼       插桩间距       ✓       ✓       ✓	<b>桩号</b> 加桩
- 参数设置	
前半径前偏角	
后半径	
前缓和    后缓和	
□ 边桩 □ 高程 高程参数	
左偏距	
右偏距	
已知起点、前交点	
起点X X 选	
前交点X Y 选	
保留参数 提取参数	输出EXCEL 计算 取消

# Complex curve

The differences between complex curve and single intersection plane curve are  $\mathbf{F}$  radius,  $\mathbf{F}$  offA,  $\mathbf{L}$  radius,  $\mathbf{L}$  offA,  $\mathbf{F}$  curve,  $\mathbf{L}$  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.

复曲线敷设	
<ul> <li>桩号设置</li> <li>起点桩号 ▼</li> <li>100.45</li> <li>加桩取整</li> <li>参数设置</li> <li>前半径 5000</li> <li>前偏角 8.05175</li> <li>后半径 6700</li> <li>后偏角 7.05175</li> <li>前缓和 520</li> <li>后缓和 450</li> <li>「 边桩 「 高程</li> <li>高程参数</li> <li>左高差</li> <li>右偏距 7</li> <li>右高差</li> </ul>	推号 500     加班     前偏角: 8.05175 (° / ")     后偏角: 7.05175 (° / ")     后偏角: 7.05175 (° / ")     而回曲线半径: 5000.000     后圆曲线半径: 6700.000     前圆曲线半径: 6700.000     前切线长: 597.645     后切线长: 629.838     前回曲线长: 645.828     后回曲线长: 645.828     后回曲线长: 603.873     曲线全长: 2019.701     过去症世号及坐标
已知条件 已知起点、前交点 起点x <sup>3</sup> 7806.776 Y 6107.023 选 前交点x <sup>3</sup> 097.9954 Y <sup>5</sup> 504.8214 选	桩号 = 100.450 X = 87806.776 Y = 516 桩号 = 400.450 X = 87519.180 Y = 516 桩号 = 500.000 X = 87423.746 Y = 516: 桩号 = 700.450 X = 87231.584 Y = 516: 桩号 = K1+0.450 X = 86943.988 Y = 511 林号 = K1+300.450 X = 86656.392 Y = 1♥
保留参数 │ 提取参数 │ 注意:参数设置中的半径可以为负,前进力	輸出EXCEL 计算 取消 防向左转为负,右转为正。

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型平曲线敷设	
<ul> <li>桩号设置</li> <li>起点桩号 ▼ 插桩间距</li> <li>✓ 加桩取整</li> </ul>	<b>桩号</b> 加桩
前半径前偏角	
后半径后偏角	
前缓和    后缓和	
□ 边桩 □ 高程 高程参数	
左偏距	
右偏距	
己知条件	
已知起点、前交点	
<sub>起点X</sub> Y 选	
前交点X Y 选	
保留参数 提取参数	輸出EXCEL 计算 取消
│	

# 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型平曲线敷设	
桩号设置       插桩间距 300         100.45       山桩取整         参数设置       前半径 5000         前半径 5000       前偏角 8.05175         后半径 -6700       后偏角 7.05175         前緩和 520       后緩和 450         ✓ 边桩       高程         左偏距       五病差         右病差       石病差	桩号     加桩     S型平曲线敷设     前偏角: 8.05175 (° / *)     后偏角: 7.05175 (° / *)     后偏角: 7.05175 (° / *)     前周曲线半径: 5000.000     后圆曲线半径: 5000.000     后圆曲线半径: -6700.000     前缓和长: 520.000     后缀和长: 450.000     前切线长: 613.661     后切线长: 613.661     后切线长: 613.661     后切线长: 613.873     前曲线急长: 1278.873     前曲线急长: 1278.873
已知条件 已知起点、前交点 起点X <sup>87806.77t</sup> Y <sup>516107.05</sup> 选 前交点X <sup>8097.995t</sup> Y <sup>517504.85</sup> 选	(HTA) 桩号 = KT9+727.825 X = 8191.624 (QZA) 桩号 = KT9+820.739 X = 8098.800 (YHA) 桩号 = KT9+813.653 X = 8006.068 (HTA) 桩号 = K80+433.653 X = 7041.929 (QZB) 桩号 = K81+73.090 X = 6853.045 (YHB) 桩号 = K81+262.526 X = 6663.830
保留参数 提取参数 注意:参数设置中的半径可以为负,前进	输出EXCEL T算 取消 方向左转为负,右转为正。

# 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:

卵型平曲线敷设	X
桩号设置 起点桩号 ▼ 插桩间距 ▼ 加桩取整	<b>桩号</b> 加柱
-参数设置	
前半径	
后半径 后偏角	
前緩和中緩和	
后缓和	
□ 边桩 □ 高程 高程参数	
左偏距 左高差	
右偏距    右高差	
己知条件	
已知起点、前交点	
Leix Y 选	
前交点X Y 选	
保留参数 提取参数	输出EXCEL 计算 取消

#### 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:

- 桩号设置   起点桩号 <u>▼</u> 插桩间距 <sup>300</sup>   100.45	
参数设置         前半径 5000         前偏角 10.05175           后半径 6700         后偏角 7.05175	前切线长: 701.497 后切线长: 640.035 前圆曲线长: 120.361 后圆曲线长: 103.873 前曲线全长: 2194.234
前緩和 520 中緩和 1000 后緩和 450 ☑ 边桩 □ 高程 高程参数	主点桩号及坐标 (ZHA)桩号 = K79+119.989 X = 8799.384 (HYA)桩号 = K79+639.989 X = 8279.447 (QZA)桩号 = K79+700.170 X = 8219.316 (YHA)桩号 = K79+760.350 X = 8159.219
左偏距     5     左高差       右偏距     7     右高差	(HLB) 他亏 = K81+314.223 X = 6637.676
已知条件 已知起点、前交点 起点X <sup>87806.77ℓ</sup> Y <sup>516107.0℃</sup> 选	桩号 = 100.450 X = 87806.776 Y = 516 桩号 = 400.450 X = 87506.822 Y = 516 桩号 = 500.000 X = 87407.287 Y = 516 桩号 = 700.450 X = 87206.868 Y = 516 桩号 = K1+60.450 X = 86906.914 Y = 511 桩号 = K1+300.450 X = 86606.960 Y = 1 桩号 = K1+600.450 X = 86307.007 Y = 1
起点X 8097.9954 Y 517504.85 迭 前交点X 8097.9954 Y 517504.85 迭	社号 = K1+300.450 X = 86606.960 Y = 桩号 = K1+300.450 Y = 86307.007 Y = 輸出EXCEL 计算 取消

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:

竖曲线计算	
参数设置         □知起点       」         桩号       100         后纵坡%       」         高程       2.5         半径       」         加桩取整       加桩间距	在输入前纵坡和后纵坡时应注意这里 坡度单位是"%",例如,前纵坡为0.01% ,只需在编辑框中输入0.01即可。正为上 升,负为下降。
桩号 加桩 输出	LEXCEL 计算 取消

Vertical curve

After input parameter, click <u>Calc.</u>, result lists in the list box. If you want to calculate chainage, input the value in <u>Chainage</u>, and then click <u>Add</u>. 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.

Sem 19 名字 19 A     1
参数设置 <ul> <li></li></ul>
竖曲线敷设
前段纵坡: 0.800% 后段纵坡: 2.100% 竖曲线半径: 5000 切线长: 32.500 外距: 0.106 曲线全长: 65.000 变坡点高程: 2.760 变坡点桩号: 132.500
(起点)桩号 = 100.000 至起点平距X = 0.000 高程改正值Y = 0.000 坡道; (变坡点桩号)桩号 = 132.500 至起点平距X = 32.500 高程改正值Y = 0.106 (终点)桩号 = 165.000 至终点平距X = 0.000 高程改正值Y = 0.000 坡道;
##号 - 120 000 至記占平昭¥ - 20 000 高程改正借▼ - 0 040 博道高程 - · ▼
加桩         输出EXCEL         计算         取消

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



#### 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).

🔍 ek					
文件(27) 数据 设计 分析 工具		<u></u> መር መ			
□□ ▶ ④ ④ ○ ◎ ♥ □ 控制 輸出 放大 缩小 平移 窗口	<ul> <li>①</li> <li>①</li> <li>①</li> <li>全屏 前图 刷新</li> </ul>				
★ 【坐标视图】	起始点	水平定线	£直定线	橫断面 计算线路点	<u> </u>
<ul> <li>■ 【线路辅助计算】</li> <li>■ 【线路简算】</li> </ul>	平曲线元素   长	度 方位角	半径		
<ul> <li>□ 【线路理论设计】</li> <li>□ 1</li> </ul>					
2 中山路					
● 解放路 □ 【横断观测数据】					
<ul> <li>【沉降分析】</li> <li>■【交会计算】</li> </ul>					
<ul> <li>【坐标转换】</li> <li>【数据成果】</li> <li>□ 【数据成果】</li> </ul>					
≪功能 ◎ 信息 ◎ 文件					
	<		>		
21:50:38,打开工程"atest" 21:50:48,开始编辑线路设计" 21:50:53,开始编辑线路设计" 21:50:59,开始编辑线路设计"	,				
	删除	编辑 插入 🛚	増加 🖸		
					<b>-</b>
就绪	,				

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.

直线	
长度 712.017	m
方位角 1.4916	dms
确定	取消

#### 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.

缀	和曲线			
	半径	5500.000		_
	 长度	700.000		m m
				dns
		向左 ▼		(LIIILE)
	1440			
	确定		取消	

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

圆曲线		
半径	5500.000	m
长度	2500.000	m
方位角		dms
转动	向左 💌	
确定		

#### 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.

点		
点		
N	485928.921	m
E	4409418.398	m
半径	100.000	m
前缓和长度	70.000	m
后缓和长度	70.000	m
	_	
确定		

#### 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.

🚳 EK						
文件(27) 数据 设计 分析 工具	成果 査看(⊻)	帮助 (H)				
回         回         Q         Q         2         2         2         2         2	<ul> <li>①</li> <li>②</li> <li>③</li> <li>②</li> <li>③</li> <li>④</li> <li>③</li> <li>④</li> <li>④</li></ul>					
—————————————————————————————————————	起始点	水平定	线 重1	<u> </u> 定线	横断面 计算线路点	<u> </u>
<ul><li>■【线路辅助计算】</li><li>■【线路简算】</li></ul>		长度	方位角	半径		
<ul> <li>□ 【线路理论设计】</li> <li>□ 1</li> <li>□ 2</li> <li>□ 中山路</li> <li>●解放路</li> <li>□ 【横断观测数据】</li> </ul>	缓和曲线 圆曲线	712.017 700.000 2500.000 700.000	1.4916	-5500.000 -5500.000 -5500.000 100.000		
<ul> <li>↓ 1</li> <li>【横断分析】</li> <li>【沉降分析】</li> <li>□ 【交会计算】</li> <li>□ 【公标转换】</li> <li>□ 【数据成果】</li> </ul>						
✓功能 ☐信息 直文件						
★ 21:50:36,打开工程"atest" 21:50:48,开始编辑线路设计" 21:50:53,开始编辑线路设计" 21:50:59,开始编辑线路设计" 22:00:40,开始编辑线路设计" 22:00:41,开始编辑线路设计" 23:16:20,开始编辑线路设计" 23:16:21,开始编辑线路设计"	★	编辑	插入 🖸	→ 単加 型		
23:16:20, 开始编辑线路设计" 23:16:21, 开始编辑线路设计" 就绪		치배 <b>구</b> 와	JULIX M	авли 🔽		

## 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:

🚳 ek		
文件(27) 数据 设计 分析 工具	成果 查看 (Y) 帮助 (H)	
□         ▶         ●		
	起始点 水平定线 垂直定线 横断面 计算线路点	<b>^</b>
<ul> <li>【线路辅助计算】</li> <li>【线路简算】</li> <li>【线路理论设计】</li> </ul>	交点桩号高程长度	
2 - 中山路 - 解放路		
1 【横断分析】 【沉降分析】		
<ul> <li>■ 【交会计算】</li> <li>■ 【坐标转换】</li> <li>■ 【数据成果】</li> </ul>		
21:50:38,打开工程"atest" 21:50:48,开始编辑线路设计" 21:50:53,开始编辑线路设计" 21:50:59,开始编辑线路设计" 22:00:40,开始编辑线路设计" 22:00:41,开始编辑线路设计" 23:16:20,开始编辑线路设计" 23:16:21,开始编辑线路设计"		
22:00:41,开始编辑线路设计" 23:16:20,开始编辑线路设计" 23:16:21,开始编辑线路设计"	增加 插入 删除 保存	-
就绪		

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:

🚳 ek					
文件(22) 数据 设计 分析 工具	成果 查看(V) 帮	帮助(任)			
□         □         ○	<ul> <li>①</li> <li>①</li> <li>①</li> <li>(</li> <li>(</li></ul>				
★ 【坐标视图】 ▲	起始点	水平定线	垂直定线	横断面    计算线路点	<u>*</u>
□ 【线路辅助计算】 □ 【线路简算】	交点桩号	高程	长度		
□【线路理论设计】 1	13567.393 18200	49.061 37.9192	1000		
2	19346. 7	33, 3893	700		
解放路 □ 【横断观测数据】	21447.5	31.2885	1000		
□ 【積断%別数据】 □ 1 【荷断分析】 【次降分析】 □ 【交会计算】 □ 【坐标转换】 □ 【数据成果】 ▼ 功能 □ 信息 ■ 文件 08:32:10, 打开工程 "atest" 08:32:16, 开始编辑线路设计"	增加	插入 删	涂 保存		-
				1	
」					

# 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:

🔍 EK	
文件(正) 数据设计分析 工具	成果 查看 (1) 帮助 (1)
回         回         ①         ②         ②         ②         ②         ②         ②         ②         ②         ②         ②         ③         ④         ③         ④         ④         ④         ④         ④         ④         ④         ④         ④         ④         ④         ④         ④         ④         ④         ④         ④         ●	<ul> <li>① 図</li> <li>全屏前图 刷新</li> </ul>
····································	
<ul><li>■【线路辅助计算】</li><li>■【线路简算】</li></ul>	桩号 左侧模板 右侧模板
□ 【线路理论设计】 1	
— 2 — 中山路	
解放路 曰【横断观测数据】	
□□【⑦碑⑦初】 □□【交会计算】	
🖻 【数据成果】 🛛 👽	
────────────────────────────────────	
× 08:32:10,打开工程"stest" 08:32:16,开始编辑线路设计"	
	増加 插入 删除 保存 模版 一
×	
就绪	数字

## 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%".

増加区段 🛛 🔀	
水平 m <u> 向上</u>	
确定	

# 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.

a称 set					保存
区段名称	水平偏距	坡度%	垂直偏距	偏距类型	
Z1	12	-2,500	-0.300	向下	
Z2	3	-83, 333	-2,500	向下	
Z3	5	0.000	0	向上	1
Z4	7	1.2	0.084	坡度%	1
	_				増加 区段
			·		

# 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.

19 (1993年) 第六 第六 平林 官口 小	电效 回				
【坐标视题】 ^ 【线路辅助计算】 【线路辅助计算】 【线路简算】 【线路理论说计】	起始点	水平定线	● 重定线 材	计算统结点 石间模板	
1 中山路 解放路 【横桁观测蚊报】					
【横断分析】					
【坐标转换】					
【交会计算】					

Add transect

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

橫断面模板	选择	
模板名称:	set	▼ 确定
	set	
-		
	\	

# 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.

🚳 ek			
文件 (2) 数据报设计分析工具 口 图 图 ④ ④ ④ ① 控制输出前大缩小平移窗口	₩ Ø ₫		
× 【坐标视图】	起始点 水平定线	垂直定线  横断面	计算线路点
<ul> <li>■【线路辅助计算】</li> <li>■【线路简算】</li> </ul>	桩号	左侧模板	右侧模板
□-【线路理论设计】 1	14979	set	set
… 2 … 中山路 … 解放路			
□ 【横断观测数据】 □ 1			
【横断分析】 【沉降分析】			
<ul> <li>□ 【交会计算】</li> <li>□ 【坐标转换】</li> <li>□ 【数据成果】</li> </ul>			
□<     【数据成果】     ▲       ※功能     □     「信息」     〕			
× 08:32:10, 打开工程 " <u>stest</u> " ∧			<u> </u>
08:32:10, 打开工程"atest" 08:32:16, 开始编辑线路设计" 08:52:39, 开始编辑线路设计" 08:53:44, 开始编辑线路设计" 08:40:37, 开始编辑线路设计"" 08:44:17, 开始编辑线路设计"			
109:40:37,开始编辑线路设计": 09:44:17,开始编辑线路设计"	増加	插入   删除   保存	模版
~			
就绪	<u>, , , , , , , , , , , , , , , , , , , </u>		数字 ///

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:

🚳 EK	
文件(E)数据设计分析工具成果查看(Y)帮助(B)         回入       Q       Q       (C)       (C)         控制输出       放大缩小平移窗口全屏前图刷新	
工     ×     起始点     水平定线     垂直定线     横断面       ①     【线路辅助计算】     •     ·     ·     ·     ·       ①     【线路简算】     ·     ·     ·     ·     ·	│ 计算线路点 _
□     【线路理论设计】     □     □     中北点       □     □     □     □     □       □     □     □     □       □     □     □     □       □     【横断观测数据】     □     □	
↓     ↓<	计算
08:32:10, 打开工程"stert" 08:32:16, 开始编辑线路设计" 08:52:39, 开始编辑线路设计" 08:53:44, 开始编辑线路设计" ✓	▼ ▶ 数字

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:

					_
首路坐标点					<b>≥</b>
(L. 99)					
位置	桩号	N	E	Z	<u>^</u>
C*QD	13567.393	480595.034	4410862.380	0.000	
C*ZH	14279.410	481306.691	4410885.007	47.349	
C*HY	14979.410	482006.526	4410892.407	45.665	
C*ZY	14979.410	482006.526	4410892.407	45.665	
C*QZ	16229.410	483240.660	4410711.576	42.659	
C*YZ	17479.410	484402.312	4410257.319	39.652	
C*YH	17479.410	484402.312	4410257.319	39.652	
C*HZ	18179.410	485006.585	4409904.221	38.069	
C*0.000	13567.393	480595.034	4410862.380	0.000	
C*0.000	13867.393	480894.882	4410871.914	48.291	
C*0.000	14167.393	481194.730	4410881.447	47.618	
C*0.000	14467.393	481494.588	4410890.694	46.896	
C*0.000	14767.393	481794.541	4410895.486	46.175	
C*0.000	15067.393	482094.438	4410888.901	45.453	
C*0.000	15367.393	482393.555	4410866.389	44.732	
C*0.000	15667.393	482690.999	4410827.602	44.010	
C*0.000	15967.393	482985.887	4410772.657	43.289	1
C*0_000	16267 393	483277 341	4410701 717	42 567	×
		保存坐	标		
		休住王	-4212		

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  $\angle 1$ ,  $\angle 2$ , 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.

交会计算	
「原始對	校据
点A	x y 选
点B	x x 法 前方交会 
α	A a B B
β	
,	輸出EXCEL 计算 取消

Forward intersection

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

交会计算	×
原始数据 点A X 0.0000 Y 0.0000 迭 点B X 90.0000 Y 90.0000 选 α 45 β 45	前方交会 A T B B
前方交会 	
輸出EXCEL	算正正

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  $\alpha$ ,  $\beta$  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,  $\alpha_{s}$   $\beta$  are 12.3451, 34.5543 respectively. Click Calc. button, results will show in list. Shown as graph 6-3.

交会计算	
「原始数据	
点A X	0.0000 Y 0.0000 选
	90.0000 Y 90.0000 选 后方交会 B
点C X	37.4950 Y 64.9433 选 С р Л А
α	12. 3451 P
β	34. 5543
后方交会	
点A X: 点B X: 点C X: α: 12.3	0.000 Y: 0.000 90.000 Y: 90.000 37.495 Y: 64.943 451 β: 34.5543
X:	33.242 Y: 24.576
	输出EXCEL 取消

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.

交会计算	×
┌ 原始数据	]
点A X 0.0000 Y 0.0000 选	
点B X 90.0000 Y 90.0000 选	边长交会 △P
Sap 90	Sap Sbp
Sbp 90	
边长交会	
点A X: 0.000 Y: 0.000 点B X: 90.000 Y: 90.000 Sap: 90.000 Sbp: 90.000	
X: 90.000 Y: -0.000	
输出EXCEL	取消

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.  $\alpha$  is 36.2415, click Calc., results will show in the below list. As graph 6-5 shown:

<mark>交会计算</mark> ┌原始数据·				×
后视 X 点A X 点B X α	0.0000 37.4950 0.0000 90.0000 36.2415	γ 76.4544 γ 64.9433 γ 0.0000 γ 90.0000	选 选 选	方向交会 后视 B 開站 B
方向交会 	0.00 37.49 0.000 90.000 415 	95 Y: 6 D Y: 0 D Y: 90	(6.454 (4.943 ).000 ).000 ).000	
		〕出EXCEL	计算	

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:

交会计算	×
原始数据 点A X 0.0000 Y 0.0000 选 点B X 90.0000 Y 90.0000 选 S1 47.5 S2 36.3	
X: 82.080 Y: 30.744	
輸出EXCEL [ 订算 取消	

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:

Ż	经会计算 🛛 🔀
	原始数据
	点A X 0.0000 Y 0.0000 选
	点B X 90.0000 Y 90.0000 选 极坐标 B / P
	a Sap
	α 36.4215
	Sap (3.3
	极坐标
	点A X: 0.000 Y: 0.000 点B X: 90.000 Y: 90.000 α: 36.4215 Sap: 73.300
	X: 10.576 Y: 72.533
	輸出EXCEL 取消

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:

交会计算	
原始数据	
点A X 0.00	1000 y 0.0000 选
点B X 90.0	0000 y 90.0000 选 求垂足
点C X 37.4	4950 y 64.9433 选
	A B
   求垂足	
 点A X: 点B X: 点C X:	0.000 Y: 0.000 90.000 Y: 90.000 37.495 Y: 64.943
X: 51.	.219 Y: 51.219
]	
	輸出EXCEL 订算 取消

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".

原始	数据						
点	A X	0.0000	Y 0.000	0	选		
点	в Х	90.0000	y 90.00	000	选	自語	线相交
点	с х	37.4950	y 64.94	133	选		火 _
点	D X	0.0000	Y 76.45	544	选	c	В
点A 点B 点D	相交 X: X: X: X: X: X:	0.00( 90.00( 37.49( 0.00(	) Y: 5 Y:	90. 64.	000 000 943 454		
点D  X:		58.496	Ÿ:	58.4	196		

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:

点B X	0.0000 y 0.0000 选 90.0000 y 90.0000 选 37.4950 y 64.9433 选	▼
点A X: 点B X: 点C X:	0.000 Y: 0.000 90.000 Y: 90.000 37.495 Y: 64.943	
X:	64.943 Y: 37.495	
	输出EXCEL 计算	取消

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:

र्र्ट्टनेड़
原始数据
点A X 90.0000 Y 90.0000 选
点B X 37.4950 Y 64.9433 选 内外分点
Sbp 76.3
内外分点
点A X: 90.000 Y: 90.000 点B X: 37.495 Y: 64.943 Sbp: 76.300
X: -31.366 Y: 32.081
輸出EXCEL 订算 取消

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.

交会计算	
原始数据	
点A X 0.000 点B X 90.00 点C X 37.49	00 y 90.0000 选 距离直线
点C X 37.49 Sep 43.27	с <u>Scp</u> В
 距离直线	
「点B X: 90	0.000 Y: 0.000 0.000 Y: 90.000 7.495 Y: 64.943
X: 78.5	35 Y: 78.565
,	输出EXCEL T算 取消

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:

方位角 批量导入 距离 清空列表	转换参数     批量加入       方位角     批量导入       距离     清空列表	转换参数		批量导入
转换结果	转换结果	转换结果		

Graph 6-13 Coordinate transformation

Transform: Pan, Rotation and Parallel rotation

ParameterWhen transform type is Pan, parameter are azimuth and distance. When<br/>transform type is rotation, parameter are rotation angle and basic point. When<br/>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 importOpen appointed files and add all the data in the file to list.Delete list:Clean out the data existed in list.Export EXCELSave the results into EXCEL file.Transform:Transform according to raw data and transformation parameter.

Cancel: Quit dialog box of coordinate transformation

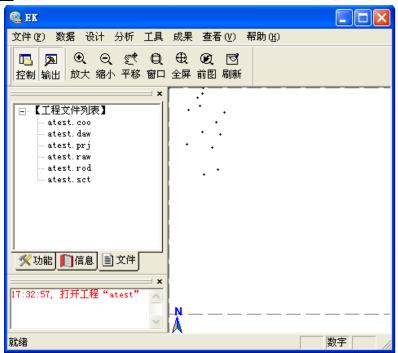
For example, select "Parallel rotation" from transform type list. Corresponding parameter will change to rotating angle,  $\operatorname{origin} \Delta X$ ,  $\operatorname{origin} \Delta Y$ . Input 35.2457 as rotating angle, 153.24 as  $\operatorname{origin} \Delta X$ , 72.51 as  $\operatorname{origin} \Delta Y$ . 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:

转换方式	参与转换的坐标数据 X X X X	加入
<ul> <li>○ 平移旋转</li> <li>转换参数</li> <li>旋转角 35.2457</li> <li>原点 △X 153.24</li> <li>原点 △Y 72.51</li> </ul>	$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	<ul> <li>批量加入     <li>批量与入     <li>清空列表     </li> </li></li></ul>
转换结果           X = 153.240 Y = 72.510           X = 174.432 Y = 198.013           X = 146.162 Y = 147.165           X = 198.934 Y = 134.818           X = 98.795 Y = 126.171           X = 97.256 Y = 111.108           X = 80.492 Y = 105.792           X = 86.692 Y = 80.191           X = 2.269 Y = 105.016           X = 36.958 Y = 140.280           X = 20.977 Y = 75.606		

Graph 6-14 Coordinate transformation—Parallel rotation

# 7 System file

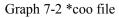
Click File option in control area, "Project file list" will show as graph 7-1 below:



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:

Image: Sec of the sec	💁 EK						
T 程文件列表     T 目 1 0,000 0,000 0,000     S 0,00     S	<b>B Q Q C</b>	a a s	帮助 (出)				
【工程文件列表】     1	×	点号	点名	N	E	Z	
17:32:57, 打开工程 "atest"         23         中山路[C]16229,410         483240.660         4410711.576         42.659           17:32:57, 打开工程 "atest"         24         中山路[C]17479.410         4834402.312         4410257.319         39.652           25         甲山路[C]18179.410         4854056.585         4409904.221         38.069           26         甲山路[C]13867.393         480894.882         4410871.914         48.291           27         甲山路[C]1467.393         48194.730         4410881.447         47.618           28         甲山路[C]14467.393         481494.588         4410890.694         46.896	atest.daw atest.ray atest.raw atest.rod atest.sct	3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	PT3           PT4           PT5           PT6           PT7           PT8           PT9           PT10           PT11           PT12           PT13           PT14           PT15           PT16           PT17           PT18           PT18           PT19           中山路(C)13267.393	$\begin{array}{c} 37, 495\\ 0, 000\\ -13, 274\\ -23, 257\\ -40, 000\\ -49, 783\\ -104, 199\\ -55, 493\\ -77, 246\\ -98, 743\\ -125, 665\\ -131, 665\\ -131, 665\\ -180, 026\\ -192, 450\\ 65, 000\\ 65, 000\\ 65, 000\\ 65, 000\\ 481306, 691\\ \end{array}$	64, 943 76, 454 75, 283 63, 899 69, 282 44, 825 113, 980 122, 616 105, 938 74, 013 40, 585 96, 263 109, 787 78, 909 78, 000 78, 000 78, 000 78, 000 4410862, 380	-2.720 -2.835 -0.168 -1.500 -1.500 -0.331 -0.271 -0.271 -0.271 -0.271 -0.271 -0.376 -0.321 -0.321 0.000 0.000 0.000 0.000 47.349	
		23 24 25 26 27 28	中山路[C]16229.410 中山路[C]17479.410 中山路[C]18179.410 中山路[C]13867.393 中山路[C]14167.393	483240.660 484402.312 485006.585 480894.882 481194.730 481494.588	4410711.576 4410257.319 4409904.221 4410871.914 4410881.447	42.659 39.652 38.069 48.291 47.618	>



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:

🚳 ek	
文件 健) 数据设计分析 工具 成果 查看 (⊻) 帮助 0£)	
□     ▶     ●     ●     ●     ●     ●     ●     ●       控制     輸出     放大     縮小     平移     窗口     全屏     前图     刷新	
▲ 本          □       【工程文件列表】         □       atest. coo         □       atest. daw         □       atest. raw         □       atest. raw         □       atest. raw         □       atest. sct	
★ 30HB 目 1 mb 目 2 ml ¥ 17:32:57, 打开工程 "atest"	×
	数字

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:

🚳 ek	
文件(22) 数据设计分析 工具成果 查看(2) 帮助(31)	
□□ ▶ ④ ④ 〔 ♥ ❶ ⊕ ⑨ [1] 控制 輸出 放大 缩小 平移 窗口 全屏 前图 刷新	
エーマンド     ・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・	
atest. raw atest. raw atest. rod atest. sct 	
x 17:32:57, 打开工程 "atest" ▲	
▶ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	数字

# 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:

ek ek	
文件 (2) 数据设计分析 工具 成果 查看 (2) 帮助 (3)	
□     ▶     ♀     ♀     ♀     ♀     ♀     ♀     ♀     ♀       控制     輸出     放大     縮小     平移     窗口     全屏前图     刷新	
<ul> <li>▲ 【工程文件列表】</li> <li>▲ atest. coo</li> <li>▲ atest. coo</li> <li>▲ atest. daw</li> <li>▲ atest. rod</li> <li>▲ atest. rod</li> <li>▲ atest. rod</li> <li>▲ atest. sct</li> <li>※ 功能 〕信息 〕文件</li> <li>※ 功能 〕信息 〕文件</li> <li>※ 功能 〕信息 〕文件</li> <li>※ 功能 〕信息 〕文件</li> <li>※ 功能 〕17:32:57, 打开工程 "atest"</li> </ul>	
★镜高: 1.500000 盘左水平角: 55.000000 盘左天顶距: 89.000000 斜距: 76.456000	
就绪	数字 //

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:

🚳 EK		×
文件(27) 数据设计分析 工具	成果 查看 (V) 帮助 (H)	
□         □         ●	<ul> <li>① 図</li> <li>全屏前图刷新</li> </ul>	
□【工程文件列表】 	战路名称:1 2站点桩号:13891.147 2站点点号:0,E:26112.612,N:49801.398,Z: 0.000 重直曲线类型:0 2点:13891.147,26112.612,49801.398,0.000,0.000 5:25458.309,49622.454,2000.000,60.000,60.000 5:25458.309,49622.454,2000.000,85.000 5:22764.013,48355.134,450.000,70.000,70.000 5:220916.761,50560.571,0.000,0.000,0.000 E号:45.000,高程:15.000,长度:0.000 E号:45.000,高程:15.000,长度:0.000 E号:90.000,高程:5.000,长度:0.000 P桩点号:,桩号:100,左侧横断面模板名称:aaa,右侧横断面模板名称:111 P桩点号:,桩号:200,左侧横断面模板名称:aaa,右侧横断面模板名称:aaa 模板名称:11,垂直偏距类型:1,水平偏距:20.000,垂直偏距:1.000 Z段名称:Z1,垂直偏距类型:0,水平偏距:20.000,垂直偏距:2.000 模板名称:aaa Z段名称:Z1,垂直偏距类型:0,水平偏距:100.000,垂直偏距:1.000 Z段名称:Z2,垂直偏距类型:0,水平偏距:100.000,垂直偏距:1.000	
	38名称:2 短治点桩号:7837.349 電治点点号:0,E:105330.674,N:4307139.193,Z: 0.000 重直曲线类型: 0 显点:7837.349,105330.674,4307139.193,0.000,0.000	~
就绪	数字	

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:

🚳 ek		
文件(22) 数据 设计 分析	工具成果	查看 (Y) 帮助 (H)
□ ▶ ② ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○		<ul> <li></li></ul>
× □ 【工程文件列表】 □ atest.coo □ atest.daw □ atest.raw □ atest.rod □ atest.sct		1 桩号: 1 N: -49.783120 E:44.824923 Z:-0.330689 仪器高:0.000000 N: -40.000000 E:69.282032 Z:-1.500000 起始观测角:0.000000 HA:90.000000 VA:90.000000 SD:98.000000 2,0.000000 VA:90.000000 SD:99.000000 3,1.000000 VA:89.000000 SD:99.000000 HA:66.000000 VA:77.000000 SD:55.000000 N: -49.783120 E:44.824923 Z:-0.330689 仪器高:0.000000 N: -40.000000 E:69.282032 Z:-1.500000 起始观测角:0.000000 1,1.000000 HA:99.000000 VA:87.000000 SD:76.000000 2,1.000000 HA:123.000000 VA:321.000000 SD:120.000000 1 桩号: 100 2,1.000000
▲ 2018日 ■ ★ 117:32:57,打开工程 "ate	- mark -	HA:123.000000 VA:321.000000 SD:120.000000 N: -49.783120 E:44.824923 Z:-0.330689 仪器高:0.000000 N: -40.000000 E:69.282032 Z:-1.500000 起始观测角:0.000000 2,,1.200000 HA:90.000000 VA:90.000000 SD:90.000000 3,,1.200000 HA:99.000000 VA:89.000000 SD:120.000000
就绪	-	数字

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,30.0000,500.0000000000 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