

# CEASER™

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*Field*

Profiles

Earthworks Check

Staking

Batterboards

GIS Logging

Polars

Elevations

Developed By:



Tachy  
Surveying

Routines

Earthworks

Surveying

And

Engineering

Civil

## *Index*

<b>CHAPTER 1: Introduction.....</b>	<b>7</b>
1.1.00 Introduction: .....	8
1.1.01 Hardware Requirements: .....	9
1.1.02 Program Principals: .....	9
1.1.03 Installation: .....	9
1.1.04 Starting the Program: .....	13
1.2.00 Open a Site: .....	16
1.2.01 Create a New Site: .....	17
1.2.02 Erase a Site: .....	18
1.2.03 Open a Job: .....	19
1.2.04 Create a New Job: .....	20
1.2.05 Erase a Job: .....	22
1.3.00 Copy Job To Job: .....	23
1.3.01 Import Job Data: .....	24
1.3.02 Export Job Data: .....	32
1.4.00 List: .....	34
1.5.00 Erase Data: .....	35
1.6.00 Parameters: .....	36
1.6.01 Setup System: .....	37
1.6.02 Setting Out: .....	43
1.6.03 Elevations: .....	44
1.6.04 Defaults: .....	46
1.7.00 Info: .....	47
1.7.01 Registration: .....	47
 <b>CHAPTER 2: DESIGN .....</b>	 <b>50</b>
2.1.00 Introduction: .....	51
2.2.00 Horizontal Pi's: .....	54
2.2.01 Alignment Points: .....	57
2.2.02 Vertical Alignments: .....	59
2.3.00 Surface Parameters: .....	62
2.3.01 Crossfalls: .....	64
2.3.02 Design Surface: .....	66
2.3.03 Edge Shift: .....	68
2.3.04 Shoulders: .....	70
2.3.05 Median: .....	72

2.4.00 Offsets:.....	73
2.4.01 Stake Offsets:.....	74
2.4.02 Gradeline Offsets: .....	76
2.5.00 Batters:.....	79
2.6.00 Tin Model: .....	83
2.6.01 Import Pts: .....	84
2.6.02 Edit\Add: .....	85
2.6.03 List: .....	86
2.6.04 Plot:.....	87
2.7.00 Strings:.....	88
2.7.01 Edit: .....	90
2.7.02 List: .....	92
2.7.03 Plot:.....	93
2.8.00 Terrace: .....	94
2.8.01 Import Pts: .....	95
2.8.02 Define: .....	95
2.8.03 List: .....	96
2.8.04 Plot:.....	97
2.8.05 List Design:.....	98
2.9.00 Coordinates:.....	100
2.9.01 Import Pts: .....	101
2.9.02 Edit\Add: .....	102
2.9.03 List: .....	104
2.9.04 Plot:.....	105
2.10.00 Code:.....	106
2.11.00 Gen: .....	107
2.11.01 Copy: .....	107
2.11.02 Import: .....	109
2.11.03 Export: .....	112
2.11.04 List: .....	114
2.11.05 Erase Design:.....	115
2.12.00 Rpts:.....	116
<b>CHAPTER 3: Field .....</b>	<b>117</b>
3.1.00 Introduction: .....	118
3.2.00 Fix:.....	119
3.2.01 Collimation: .....	121

3.2.02 Backsight: .....	122
3.2.03 Foresight: .....	123
3.3.00 Unknown Coords: .....	126
3.3.01 Known Coords: .....	130
3.3.02 Manual: .....	131
3.3.03 Coordinate File: .....	132
3.3.04 Stake + Offset: .....	134
3.3.05 Orient: .....	136
3.3.06 Coords: .....	137
3.3.07 Stake + Offset: .....	138
3.3.08 Set: .....	140
3.3.09 Stn Hgt: .....	141
3.3.10 Polar Fix: .....	142
3.4.00 Setup Base: .....	144
3.4.01 Setup Rover: .....	146
3.4.02 Calibration: .....	147
3.4.03 Fix A Point: .....	148
3.4.04 Satellites: .....	149
3.5.00 Setout: .....	150
3.5.01 Restrictions for Horizontal Alignment Computations: .....	151
3.5.02 Batterboards: .....	152
3.5.03 Earthworks: .....	156
3.6.00 Design Input: .....	159
3.6.01 Surface Width: .....	160
3.6.02 Surface: .....	163
3.6.03 Full Design: .....	165
3.6.04 Surface Width: .....	168
3.6.05 Edge Shift: .....	173
3.6.06 Shoulder: .....	177
3.6.07 Appendage: .....	182
3.7.00 General: .....	186
3.7.01 Stake + Offset: .....	187
3.7.02 Pivot Point: .....	190
3.7.03 Radial: .....	191
3.7.04 Polar Join: .....	194
3.7.05 Pnt & Grade: .....	195
3.7.06 Geo String: .....	196



3.8.00 Checks: .....	198
3.8.01 SV/Offset To YXZ: .....	199
3.8.02 YXZ To SV/Offset: .....	201
3.8.03 Polar To SV/Offset: .....	202
3.8.04 Asbuild: .....	203
3.8.05 Check A Point:.....	205
3.9.00 Coordinates:.....	207
3.9.01 Manual: .....	208
3.9.02 Coord File: .....	209
3.9.03 Find Point: .....	212
3.9.04 Plot:.....	213
3.10.00 String: .....	215
3.10.01 Define By Polar: .....	217
3.10.02 Define By Coords: .....	219
3.10.03 Load A String: .....	220
3.10.04 Setout String: .....	222
3.10.05 Check String: .....	224
3.10.06 Plot Strings: .....	226
3.10.07 List: .....	227
3.11.00 Terrace: .....	228
3.11.01 Setout: .....	229
3.11.02 Plot:.....	230
3.12.00 Rehabilitation: .....	231
3.12.01 Surface: .....	233
3.12.02 List: .....	234
3.13.00 Elevations: .....	236
3.14.00 Surface: .....	238
3.14.01 Surface Width: .....	239
3.14.02 Edge Shift: .....	241
3.14.03 Shoulder:.....	242
3.15.00 Coordinates:.....	244
3.15.01 Manual: .....	245
3.15.02 Coord File: .....	246
3.16.00 Tin Model: .....	247
3.16.01 Setout: .....	249
3.16.02 Plot:.....	251
3.17.00 Layer Checks: .....	252

3.17.01 Dips:.....	254
3.17.02 Fixed: .....	257
3.17.03 Random:.....	259
3.18.00 Levelling: .....	262
3.18.01 Collimation: .....	263
3.18.02 Backsight: .....	264
3.18.03 Intermediate: .....	265
3.18.04 Foresight: .....	266
3.18.05 Fieldbook: .....	268
3.19.00 Line Level:.....	270
3.19.01 Level Run: .....	271
3.19.02 List: .....	272
3.20.00 Heighting: .....	273
3.20.01 Trig: .....	274
3.20.02 Remote:.....	275
3.21.00 Topo:.....	276
3.21.01 Log:.....	277
3.21.02 List: .....	278
3.21.03 Plot:.....	279
3.22.00 Gen: .....	280
3.22.01 Area: .....	280
3.22.02 List: .....	281
3.22.03 Plot:.....	282
3.23.00 Rpts:.....	283
3.24.00 Parameters: .....	284
3.24.01 Setup System: .....	285
3.24.02 Setting Out: .....	291
3.24.03 Elevations: .....	292
3.24.04 Defaults:.....	294
<b>CHAPTER 4: Stock .....</b>	<b>295</b>
4.1.00 Introduction: .....	296
4.2.00 Import: .....	298
4.2.01 Open: .....	300
4.2.02 List: .....	301
4.2.03 Swap: .....	302
4.2.04 Erase: .....	303

4.2.05 Plot:.....	304
4.2.06 Boundary: .....	305
4.3.00 Plane Area: .....	306
4.3.01 Slope Area: .....	306
4.3.02 Volume: .....	307
<b>CHAPTER 5: COGO .....</b>	<b>308</b>
5.1.00 Introduction: .....	309
5.2.00 Cogo 1: .....	311
5.2.01 Coords:.....	312
5.2.02 Edit\Add: .....	313
5.2.03 List: .....	314
5.2.04 Plot:.....	315
5.3.00 Join: .....	316
5.3.01 Polar:.....	318
5.4.00 Area: .....	320
5.4.01 List Calcs: .....	322
5.5.00 Cogo 2: .....	323
5.5.01 Arc Calculations: .....	324
5.5.02 Arc Passing 2 Points:.....	325
5.5.03 Arc Passing 3 Points: .....	325
5.5.04 Pts On Line: .....	326
5.5.05 Pts On Arc - Increment\Number:.....	328
5.5.06 Angle: .....	329
5.6.00 Cogo 3: .....	330
5.6.01 Convert Units:.....	331
5.7.00 Transformation: .....	333
5.8.00 Solve Triangle: .....	334
<b>CHAPTER 6: UTILITIES .....</b>	<b>335</b>
6.0.00 Cal:.....	336
6.1.00 Editor: .....	338

## **CHAPTER 1: Introduction**

### **1.1.00 Introduction:**

**Ceaser<sub>field</sub>** is a Windows Mobile based program, which has been developed to assist the Engineering and Topographical surveyor through all phases of a surveying project. It releases the surveyor from all pre-calculations necessary to set out any phase of a project that can be defined by Geometric Parameters, Tin Models, Strings, Platforms, Arcs, Tubes, Tunnels or Coordinates. The surveyor can set up anywhere on the project, observe a minimum of two known reference points, and immediately setout or check anything on the project, without having to set anything on the instrument nor do any calculations. The surveyor can on the fly change from a Level to a Total Station to a GPS, while busy with a Job.

**Ceaser<sub>field</sub>** can accommodate any project that can be defined by Geometric Parameters, Strings, Coordinates or Tin Models. Geometric Parameters will include horizontal and vertical alignments, design widths, batters, widenings, sidedrains, alignment points, etc.

Projects having such parameters are:

- Roads
- Railways
- Dams
- Airport Runways
- Golf Courses
- Canals...etc.



All data can be transferred between **Ceaser<sub>field</sub>** and **Ceaser<sub>office</sub>**, which is a PC based design and construction package, operating in Windows XP, Vista or Windows7.

**Ceaser<sub>field</sub>** will be referred to as **Ceaser** from here on.

**Ceaser** has mainly been developed to work with a Total Station or a GPS, but it can also be setup to work in manual mode, in which case all data has to be entered via the Pocket PC's keyboard into **Ceaser**. When **Ceaser** is used on a Total Station or a GPS, all data transferred between the Pocket PC and the Total Station is done electronically, thereby eliminating the risk of error that is associated with manual operations and thereby also increasing the productivity of the surveyor.

When using a surveying instrument, such as a Total Station or a GPS, the surveyor is not bounded anymore to the stakeline and offset method of surveying. **Ceaser** uses dynamic surveying principals and it is now possible to setup the instrument anywhere on site and setout any point required without having to calculate any setting out data.

**With CEASER, the surveyor never has to do any calculations!**

### **1.1.01 Hardware Requirements:**

In order for this program to function, you need the following hardware:

- A Handheld Pocket PC with Windows CE or Windows Mobile installed on the device and the .NET 3.5 compact Framework.
- A built in serial port or Bluetooth.
- Optional: A solid state disc with a minimum capacity of 256Mb where the program and data is stored on. The SD discs are relatively inexpensive and the bigger you can afford one the better.

### **1.1.02 Program Principals:**

**Ceaser** consists of seven modules, namely:

- Main - here you will open Jobs, copy data, export data, etc.
- Design - enter\import the geometric design of a Job, Tin Model, Terrace, Coordinates, etc.
- Field - this you will use to fix your position in the field, setout profiles, Topo survey, etc.
- Scan - monitoring surfaces.
- Stock - stockpile\pit volumes
- Cogo - joins, polar, conversions, etc.
- Cal - a survey calculator.

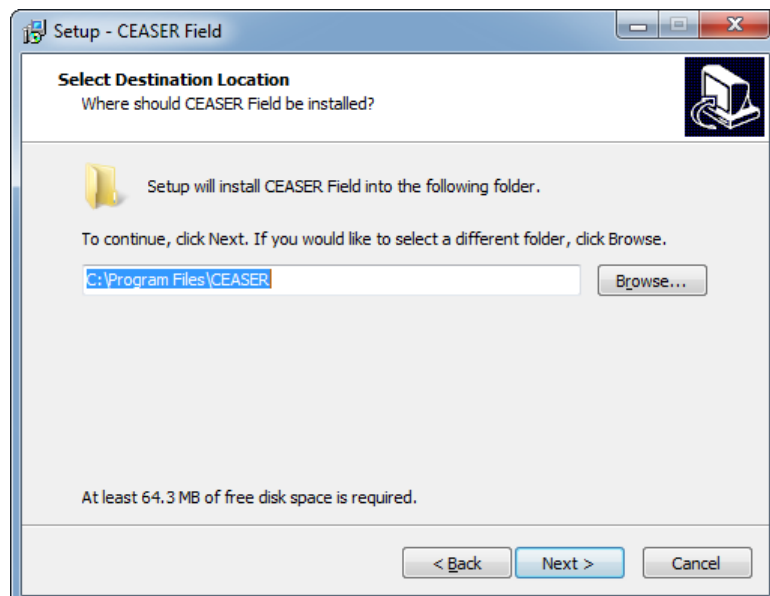
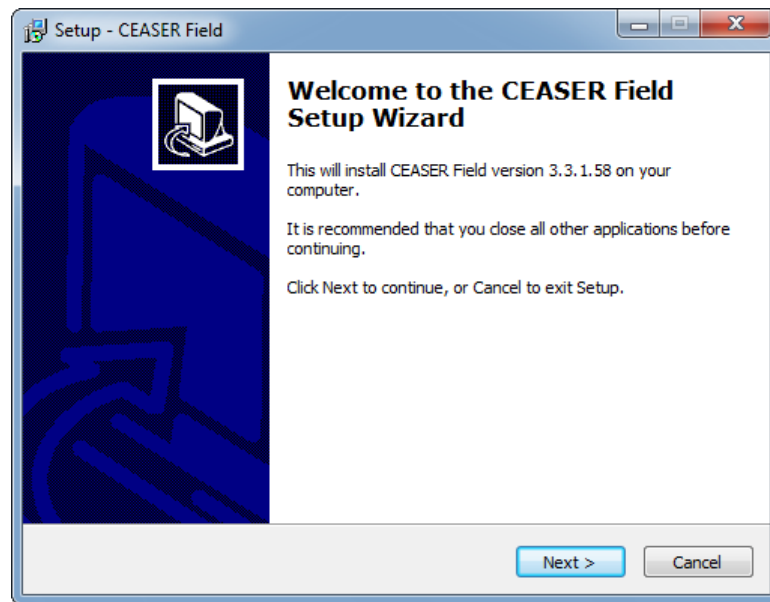
None of the modules, except for the Stock module can be accessed unless a Site and a Job has been opened or created.

Additional modules will become later available as the program develops.

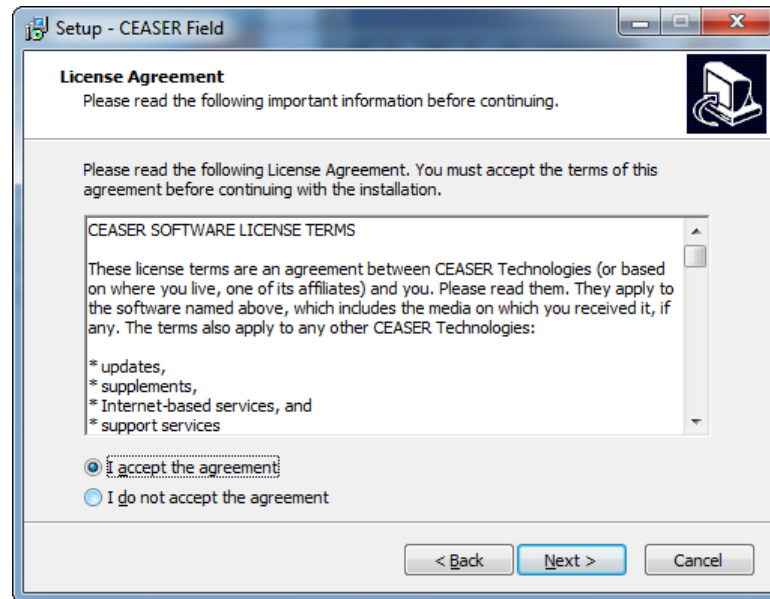
### **1.1.03 Installation:**

To install the program on your Workabout, proceed as follows:

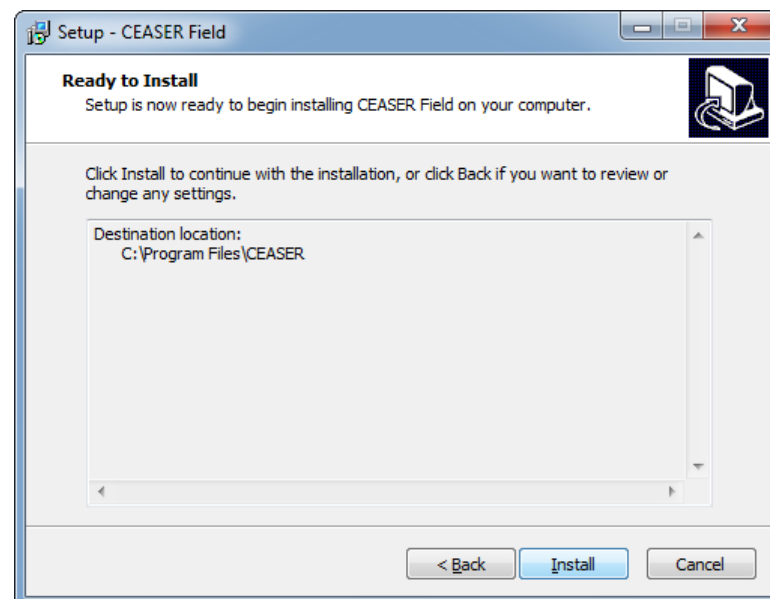
- Connect the Handheld Unit to your PC with a USB cable.
- Switch your Handheld on.
- Make sure that Microsoft Sync is running. If you do not have Microsoft Sync, you can download it from their website.
- Double click on the “Ceaser.exe” program that was supplied to you or that you downloaded from the Website.
- Follow the instructions onscreen.



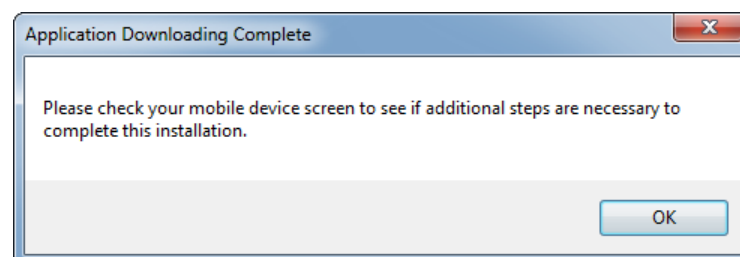
- Click on the <Next> button.



- Accept the agreement and click on the <Next> button.
- Next, the program will be installed.

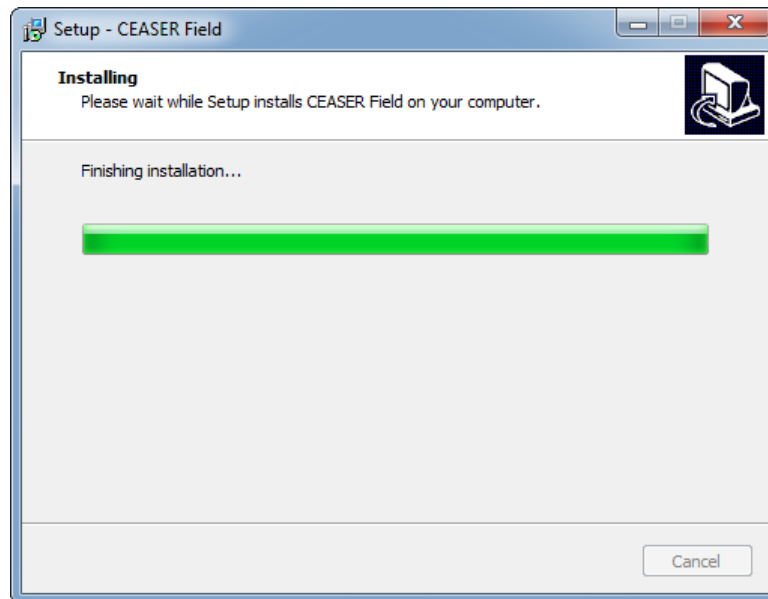


- Accept the default installation folder and click on the <Install> button.

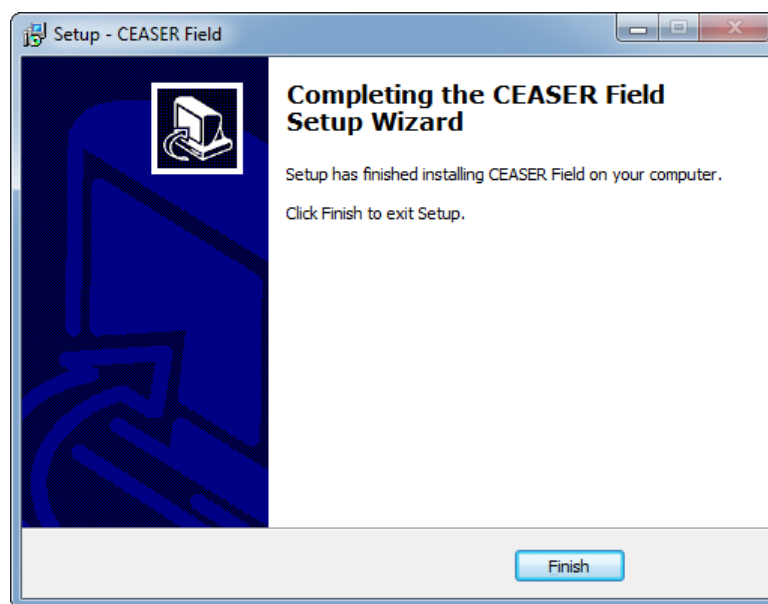


- Have a look on your Handheld if there are any additional actions to be taken.





- The program is finishing the installation.



- The program has been installed on the Unit and a shortcut icon will be displayed on your Handheld.

#### **1.1.04 Starting the Program:**

To start the program, proceed as follows:

- Double click with your stylus on the "**CEASER**" icon.

On the startup screen, the version number of the program will be displayed. Each program will have a unique serial number, which is linked to a database, indicating when, where and who brought the program.



Tap on <**Continue**> to display the main menu:



The above screen is the top-level menu in **Ceaser**. From here all other menus and routines are controlled.

The icons point to different modules:



Open existing Jobs.



Setup your setting out Parameters.



Here you will enter all the design data of your Job.



Use this module to do all your work in the field.



A Scanning module.



Determine stockpile volumes in the field.



This module contains all your COGO calculations.



A Calculator. This works on the same logic as the HP calculator.

Before any function in this program can be used, basic requirements are needed to give the surveyor any meaningful results, which are:

- First a Site must be created or an existing one opened. Say you have a couple of projects in Cape Town, some in Durban and some in Windhoek. You would then have three different Sites. Under each Site you would then have the different Jobs associated to the specific Site.
- Next a Job must be created or an existing one opened. If no Job has been opened, the program will not let you use any of the other routines on the menu. For every road, dam, canal, etc. a different Job must be created.

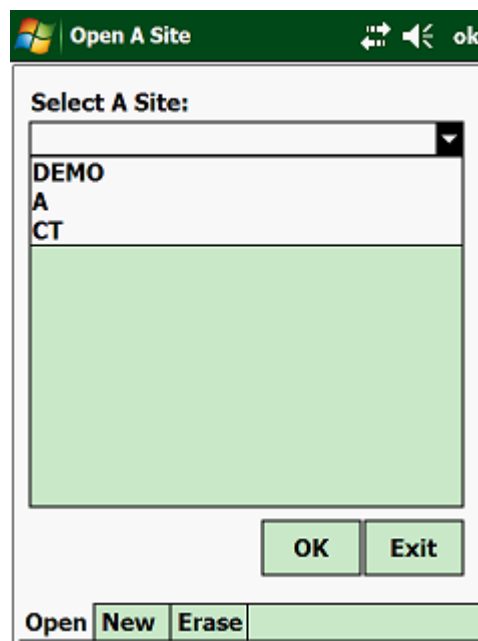
- You must let the program know what instruments you are using - i.e. a Total Station, an EDM, level and staff, etc. These are global setups and apply to all Sites and Jobs.
- The Job parameters must be entered into the program, if you are going to do any setting out or level settings. Setting out and elevation parameters are global constants, i.e. they apply to all the different Sites.
- There are 4 minimum design parameters that must be entered, i.e. Alignment Points, Vertical Alignment, Design Widths and Crossfalls. Without these no setting out work can be done. This applies to the geometric section of the program only. Topo surveys, coordinate setting out, etc. are excluded from this.

**1.2.00 Open a Site:**

Use this function to open an existing Site. On the menu tap on “Work”, then “Open Site”:



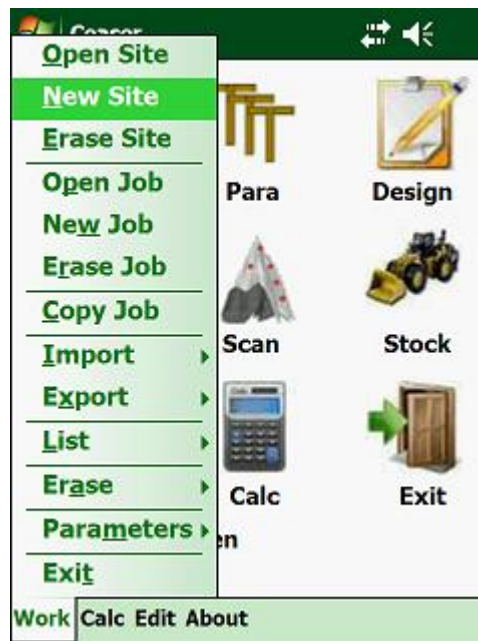
From the menu, select the Site name that you want to use.



Once you have selected your Site, tap on the <OK> button.

### 1.2.01 Create a New Site:

If no Site exists, you will have to create a new one. Tap on “Work” to display the following:



You will notice that on certain Units part of the pulldown menu will be hidden. To display these tap on the arrow at the bottom or top on the pulldown menu to scroll through the menu. From the displayed menu, tap on “New Site”, which will display the following input Window:

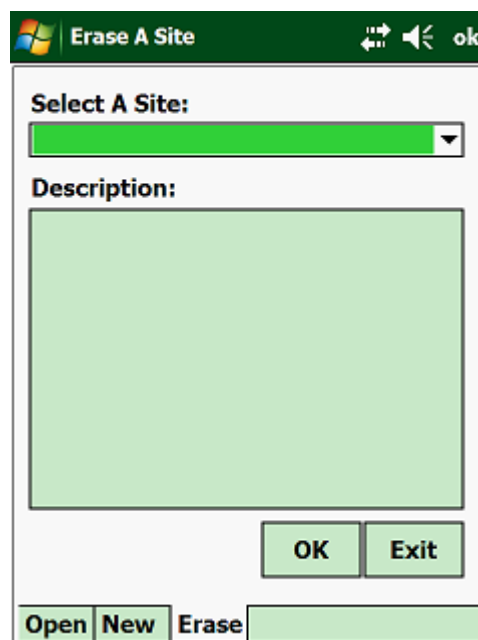
- New Site      - enter the name of the new Site. Enter a name that will remind you of the Site.
- Description    - enter a description of the Site.

### 1.2.02 Erase a Site:

Once a Site becomes redundant or is no longer required, you can erase the Site to release the memory on your device for other Sites and Jobs. On the menu tap on “Erase Site”:



Select the Site that you want to erase and tap the <OK> button.



**WARNING: ERASING A SITE ALSO ERASES ALL THE JOBS ASSOCIATED WITH THAT SITE AND THERE ARE NO UNDO FUNCTIONS!**

### **1.2.03 Open a Job:**

When working on a big project, it is very likely that you will have more than one Job stored on your Unit. With this function, you can toggle between the different Jobs that have already been created. Although the Unit can work on multiple Jobs, you can only have one Job open at a time. As soon as you open a new Job, the program will automatically close the previous Job.

To access this routine, use your arrows to highlight “Open Job” and press the <Enter> key.



The following screen will be displayed:

A screenshot of the 'Open A Job' dialog box. The dialog box has a green title bar with the text 'Open A Job' and a green 'ok' button. The main area is white with a green border. It contains a 'Job:' label followed by a dropdown menu showing 'ROADA'. Below this is a 'Surveyor:' label followed by an empty text box. Underneath is a 'Description:' label followed by a large empty text area. At the bottom right, there are two buttons: 'OK' and 'Exit'. At the bottom left, there is a status bar with the text 'Open New Erase'.



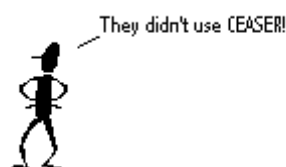
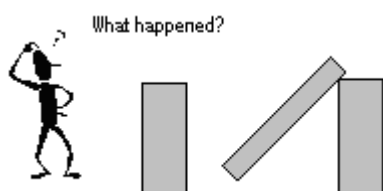
- Job - enter the name of the Job that you want to open. If you cannot remember what Jobs are available, tap on the arrow on the right and a pulldown list will appear with all the Jobs available. Tap on the Job that you want to open.

Once you have selected the Job that you want to work with, the program will display the following:

- Surveyor - this is the name of the surveyor.
- Job Description - a description of the Job that you opened.

The above information cannot be altered here.

Tap on <OK> to open the Job.



#### **1.2.04 Create a New Job:**

Before any design entry, setting out or Topo surveys can be done, a Job must first be created or opened. Tap "Job" on the main menu.

A dropdown menu will appear:



Next tap on “New Job” to create a new Job:

**Create A New Job**

**New Job:**

**Surveyor:**

**Description:**

**OK** **Exit**

**Open** **New** **Erase**

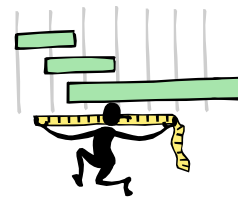
The cursor will be flashing at “New Job Name”; here you must enter a name for the new Job. The maximum number of characters that you can use is 250 and the first character in the name must be an alpha character.

**Note:**

**A Job must first be created or opened before CEASER can be used!**

**Use only alpha or numeric characters in your Job name!  
Do not use characters like @#\$\$%^&\* .....etc!**

**The project name can only be a maximum length of 250 characters!**

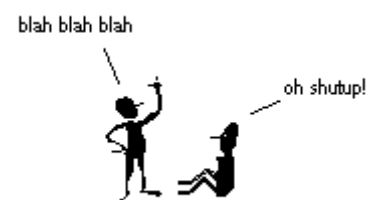


### 1.2.05 Erase a Job:

When a Job becomes redundant, it is necessary to erase that Job, to make space for new Jobs. Tap on “Job” and on the pulldown menu tap on “Erase Job”.



The following screen will then be shown:



- Job - enter the name of the Job that you want to erase, else tap on the Job that you want to erase.

Before the program actually erases the selected Job, you will have to confirm your selection made.

**WARNING: ERASING A JOB HAVE NO UNDO FUNCTION!**

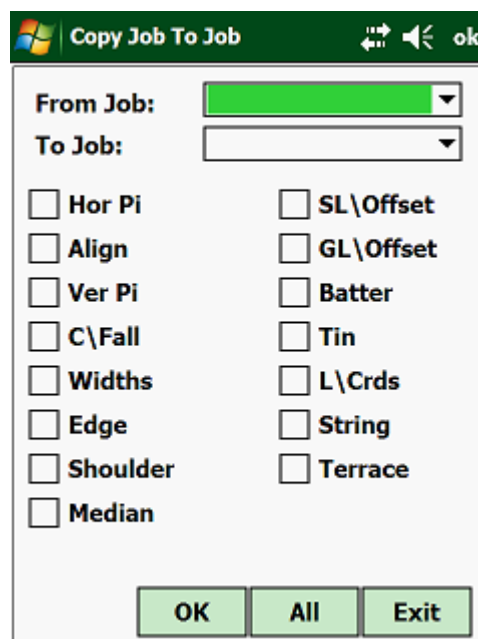
### 1.3.00 Copy Job To Job:

If you are working with Jobs that have the same widths, crossfalls, etc. then instead of entering the data over and over again for each Job, you can use this function to copy the common parameters which are the same for each Job to each other Job.

Tap on “Work” and then on “Copy Job To Job”



This will display the following screen:



Be aware that this function will override any existing data in the Job that is being copied to.

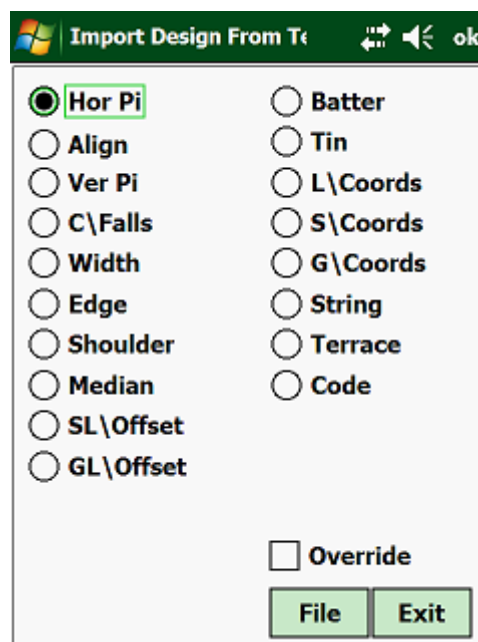
### 1.3.01 Import Job Data:

Here you can import design parameters from a comma, tab or space delimited text file. Tap on “Work”, then on “Import Job Data”. This will give you two options to import from:

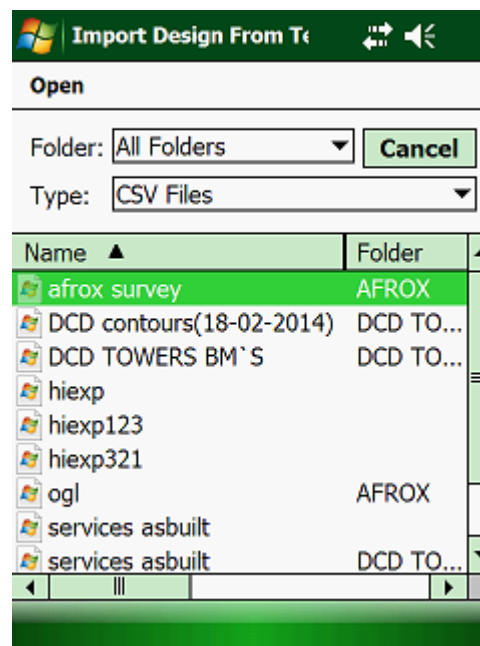


- Text Files
- Roadmaker

Next select the type of design parameter that you need to import. If you select to import from a text file, then only one selection can be made at a time.



Next tap on “File”, which will display the following:



Select the file that you want to import and tap on the <OK> button, which will return you to the previous screen. Next tap on “Import” and the program will import the data for you.

Note that if you check “Override”, the program will erase the existing data in the file, before importing the new data else it will add the imported data to the existing file.

When importing from text files, make sure that the files are in the following sequence:

- Horizontal Pi's - Start Stake; Y Coord of Pi; X Coord of Pi; Radius; Transition In; Transition Out.
- Alignment Points- Start Stake; Y Coord of Point; X Coord of Point; Radius (-ve or +ve); Length of Transition; Stake of Point.
- Vertical Pi's - Stake of VPi; Level of VPi; Length of Curve, Symmetrical/Asymmetrical, Type
- Crossfalls - Stake; Left Crossfall; Right Crossfall.
- Design Widths - Stake; Left Width; Right Width.
- Edge Shifts - Stake; Left Relative Width; Left Relative Height; Right Relative Width; Right Relative Height.
- Shoulders - Stake; Left Width; Left Grade; Right Width; Right Grade.
- Stake Offsets - Stake; Offset.
- Grade Offsets - Stake; Offset
- Batterboards - Side; Condition; Stake; Set; Test Height; Type; Batter; Appendage Width; Appendage Height.
- Strings - Y Coord; X Coord; Z Coord; Y Coord 1; X Coord 1; Z Coord 1; Start Stake; Grade; Radius.
- Tin Model - Y Coord; X Coord; Z Coord; Y Coord 1; X Coord 1; Z Coord 1; Y Coord 2; X Coord 2; Z Coord 3.
- Coordinates - Name; Y Coord; X Coord; Z Coord.

With the Roadmaker option, your screen is as follows:  
These are the formats of the different files:

#### Hor Pi (Horizontal Point of Intersections)

*1,50478.171,-32155.301,2494333.696,0.000,0.000,0.000  
2,50478.171,-32533.590,2494184.131,400.000,150.000,80.000*

- 1st column - sequential id of the horizontal pi's (1, 2,...) - this is optional
- 2nd column - start stake value of your Job (50478.171)
- 3rd column - the Y coordinate (-32155.301,-32533.590)
- 4th column - the X coordinate (2494333.696, 2494184.131)
- 5th column - the circular radius at the Pi (0.000, 400.000)
- 6th column - the length of the ingoing transition (0.000, 150.000)
- 7th column - the length of the outgoing transition (0.000, 80.000)

#### Align (Alignment Points)

*1,50478.171,-32155.301,2494333.696,0.000,0.000,0,50478.171  
2,50478.171,-32333.392,2494271.982,600.000,0.000,1,50644.019*

- 1st column - sequential id of the alignment point (1, 2,...) – this is optional
- 2nd column - starting stake value (50478.171)
- 3rd column - the Y coordinate (-32155.301,-32333.392)
- 4th column - the X coordinate (2494333.696, 2494271.982)
- 5th column - the circular radius of the circular curve (0.000, 600.000)
- 6th column - the length of the transition curve (0.000, 0.000)
- 7th column - the code of the alignment point (0, 1)
- 8th column - the stake value (50478.171, 50644.019)

#### Ver Pi (Vertical Point of Intersection)

*50478.171,402.428,0.000,0.000,0  
50786.038,373.415,172.530,0.000,0*

- 1st column - starting stake value (50478.171, 50786.038)
- 2nd column - the elevation of the vertical pi (402.428, 373.415)
- 3rd column - the total length of the vertical curve (0.000, 172.530)
- 4th column - "0" if the vertical curve is symmetrical, else enter the second length of the asymmetrical curve (0.000, 0.000)
- 5th column - 0 for Parabolic, 1 for cubical and 2 for circular (0, 0)

#### Crossfalls (Also known as Superelevation)

*50478.171,-2.000,2.000  
50665.000,6.300,-6.300*

- 1st column - the stake value from where the crossfalls apply (50478.171, 50665.000)
- 2nd column - the left-hand side crossfall as a percentage value starting from the centreline (-2.000, 6.300)
- 3rd column - the right-hand side crossfall as a percentage value starting from the centreline (2.000,-6.300)

### Width

*50478.171,3.500,7.500*  
*50575.000,9.200,7.700*

- 1st column - the stake value from where the widths entered apply (50478.171, 50575.000)
- 2nd column - the left side as an absolute value in meters (3.500, 9.200)
- 3rd column - the right side as an absolute value in meters (7.500, 7.700)

### Edge

*50478.173,5.000,0.500,10.000,0.400*  
*50478.433,2.000,0.300,4.000,0.400*

- 1st column - the stake value from where the outer edge shift applies (50478.171, 50665.000)
- 2nd column - the relative width of the left edge shift (5.000, 2.000)
- 3rd column - the relative height of the left edge shift (0.500, 0.300)
- 4th column - the relative width of the right edge shift (10.000, 4.000)
- 5th column - the relative height of the right edge shift (0.400, 0.400)

### Shoulder

*50478.371,2.000,-2.000,5.000,-2.000*  
*50478.674,4.000,-2.000,5.000,-3.000*

- 1st column - the stake value from where the shoulder widths apply (50478.371, 50478.674)
- 2nd column - the relative width of the shoulder on the LHS (2.000, 4.000)
- 3rd column - the crossfall of the shoulder as a percentage value on the LHS (-2.000, -2.000)
- 4th column - the relative width of the shoulder on the RHS (5.000,5.000)
- 5th column - the crossfall of the shoulder as a percentage value on the RHS (-2.000, -3.000)

### Median

*50476.571,10.000,-1.000*  
*50478.327,12.000,-2.000*



- 1st column - the stake value from where the Median applies (50476.571, 50478.327)
- 2nd column - the horizontal offset from the SBP to the center of the Median (10.000, 12.000)
- 3rd column - the relative depth from the SBP to the Median (-1.000, -2.000)

#### Stakeline Offsets

*50478.171,3.000*  
*50478.745,6.000*

- 1st column - the stake value from where the stakeline offset applies (50478.171, 50478.745)
- 2nd column - the horizontal offset of the gradeline (vertical alignment) from the horizontal alignment (3.000, 6.000)

#### Gradeline Offsets

*50476.543,6.000,4.000*  
*50477.223,7.000,3.000*

- 1st column - the stake value from where the design offset applies (50476.543, 50477.223)
- 2nd column - the horizontal distance from the gradeline to the point of rotation (6.000, 7.000)
- 3rd column - the vertical distance from the gradeline to the point of rotation (4.000, 3.000)

#### Batter

*Left,Cut,50478.171,1,0.400,Fixed Batter,0.400,0.200,0.300,1,0*  
*Right,Fill,50478.171,1,0.500,Fixed Batter,0.400,0.300,0.600,1,0*

- 1st column - the batter parameters for the left side or for the right side of the Job (Left, Right)
- 2nd column - the cut parameters or the fill parameters (Cut, Fill)
- 3rd column - the stake value from where the batters applies (50478.171, 50478.171)
- 4th column - set - up to 5 different sets of batter criteria (1, 1)
- 5th column - the height of the fill or the depth of the cutting up to which the design parameters for a specific "Set" has to apply to (0.400, 0.500)
- 6th column - the batter can either be a "Fixed Batter" (i.e. 1:2, 1:1.5, etc.) or you can have a "Fixed Width" batter (Fixed Batter, Fixed Batter)
- 7th column - the slope of the batter as 1:X, which refers to one unit vertically and X units horizontal (0.400, 0.400)
- 8th column - the total width of the appendage data (0.200, 0.300)

- 9th column - the total height of the appendage feature in relation to the shoulder breakpoint (0.300, 0.600)  
10th column - layer – always 1 (1, 1)  
11th column - 0 for not combined batter data and 1 for combined batter data (0, 0)

### Tin Model (Digital terrain Model)

*1,745954.221,9080710.702,1196.526,745963.867,9080707.138,1195.906,745953.728,9080699.853,1196.939*  
*2,745954.221,9080710.702,1196.526,745953.728,9080699.853,1196.939,745943.935,9080703.500,1197.741*

- 1st column - sequential id of the tin record (1, 2 ,...)  
2nd column - the Y coordinate of the first vertex of the triangle (745954.221, 745954.221)  
3rd column - the X coordinate of the first vertex of the triangle (9080710.702, 9080710.702)  
4th column - the Z coordinate of the first vertex of the triangle (1196.526, 1196.526)  
5th column - the Y coordinate of the second vertex of the triangle (745963.867, 745953.728)  
6th column - the X coordinate of the second vertex of the triangle (9080707.138, 9080699.853)  
7th column - the Z coordinate of the second vertex of the triangle (1195.906, 1196.939)  
8th column - the Y coordinate of the 3rd vertex of the triangle (745953.728, 745943.935)  
9th column - the X coordinate of the 3rd vertex of the triangle (9080699.853, 9080703.500)  
10th column - the Z coordinate of the 3rd vertex of the triangle (1196.939, 1197.741)

### Local / Site / Global Coordinates

*a1,100,105,30,description1*  
*a2,106,103,32,description2*

- 1st column - the name of the coordinate (100, 106)  
2nd column - the Y coordinate (105, 103)  
3rd column - the X coordinate (30, 32)  
4th column - the description of the coordinate (description1, description2) – the description is optional

### Strings

*string1,100.000,105.000,30.000,106.000,103.000,32.000,0.000,31.623,0.000*  
*string2,40.000,35.000,2.000,43.000,34.000,5.000,0.000,94.868,0.000*

- 1st column - the name of the string (string1, string2)
- 2nd column - the Y coordinate of the first point of the string (100.000, 40.000)
- 3rd column - the X coordinate of the first point of the string (105.000, 35.000)
- 4th column - the Z coordinate of the first point of the string (30.000, 2.000)
- 5th column - the Y coordinate of the second point of the string (106.000, 43.000)
- 6th column - the X coordinate of the second point of the string (103.000, 34.000)
- 7th column - the Z coordinate of the second point of the string (32.000, 5.000)
- 8th column - the start stake of the string (0.000, 0.000)
- 9th column - the grade between the 2 points (31.623, 94.868)
- 10th column - the radius of the string (0.000, 0.000)

#### Terrace (Platform)

*a1,100,105,30,0,0,0,0,0,0*  
*a2,106,103,32,0,0,0,0,0,0*

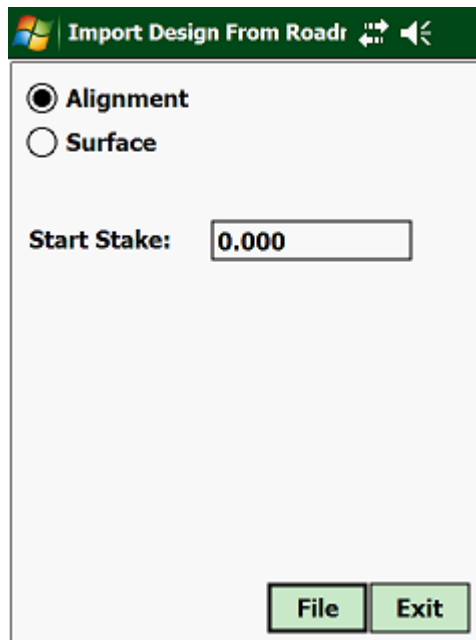
- 1st column - the name of the point (a1, a2)
- 2nd column - the Y coordinate of the point of the terrace (100, 106)
- 3rd column - the X coordinate of the point of the terrace (105, 103)
- 4th column - the Z coordinate of the point of the terrace (30, 32)
- 5th column - for internal use – leave empty
- 6th column - for internal use – leave empty
- 7th column - for internal use – leave empty
- 8th column - always put 0 (0, 0)

#### Codes

*tree,0,topo*  
*rock,0,houses*

- 1st column - the name of the feature (tree, rock)
- 2nd column - always put 0
- 3rd column - the name of the layer (topo, houses)

With the Roadmaker option, your screen is as follows:



Roadmaker stores its design information in two files:

- PID - in this file the Horizontal Alignment data is stored.
- PR3 - this file keeps the vertical Alignment, Widths, Crossfalls, Kerbs, etc.

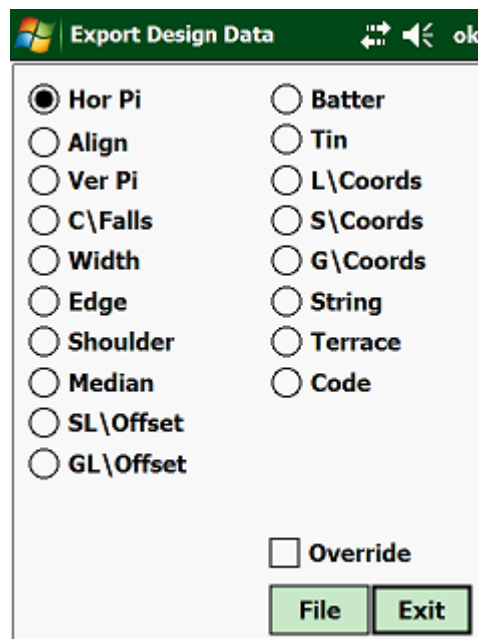
**Note: the current version of the program does not read the start stake value of the Horizontal Alignment (PID) file and you will have to enter that value. The default is 0.000, but from the drawing you will be able to determine the start stake value.**

### 1.3.02 Export Job Data:

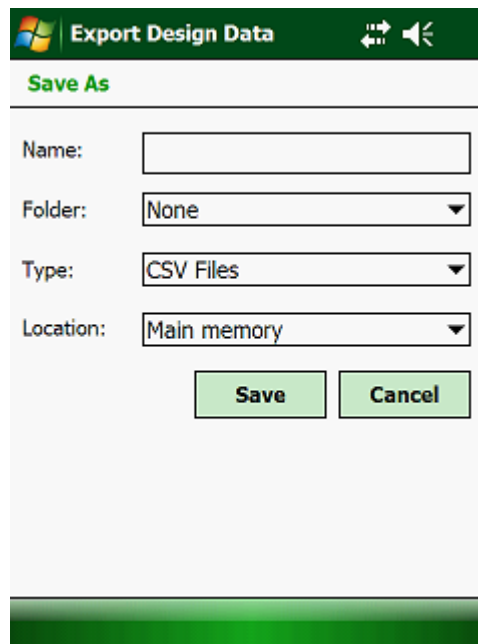
This option lets you export your Design or Field data to a “CSV file. From the pulldown menu, select “Export Job Data” and select then either “Design” or “Field”.



Next select which files you want to download. Remember that the program will not export the data to the PC. All that the program does is to convert the information in the database to the selected file format. You will still have to connect with Microsoft Sync and drag the files across to your PC (Copy and Paste).



Next select or type in a new name of the file where the data has to be stored:



The image shows a dialog box titled "Export Design Data" with a green header bar. Below the header, the text "Save As" is displayed in green. The dialog contains four input fields: "Name:" with an empty text box, "Folder:" with a dropdown menu showing "None", "Type:" with a dropdown menu showing "CSV Files", and "Location:" with a dropdown menu showing "Main memory". At the bottom right, there are two buttons: "Save" and "Cancel".

Here you tap on <Save>, which will store the converted data in the selected file.

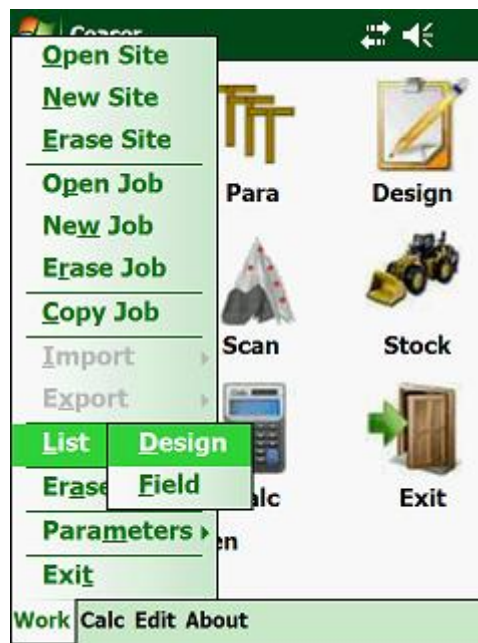
The above works exactly the same if you want to export any of your “Field” data.



**1.4.00 List:**

With this routine, you can list all the data content of a selected Job. Tap on “List”, which will give you the following options:

- Design Data
- Field Data



Select the required Database which will display the following:

The screenshot shows the 'List Design Data' window. It contains a table with two columns: 'Item' and 'Data'. The table lists various design data items and their corresponding values, all of which are currently set to 0. At the bottom of the window, there are 'Export' and 'Exit' buttons.

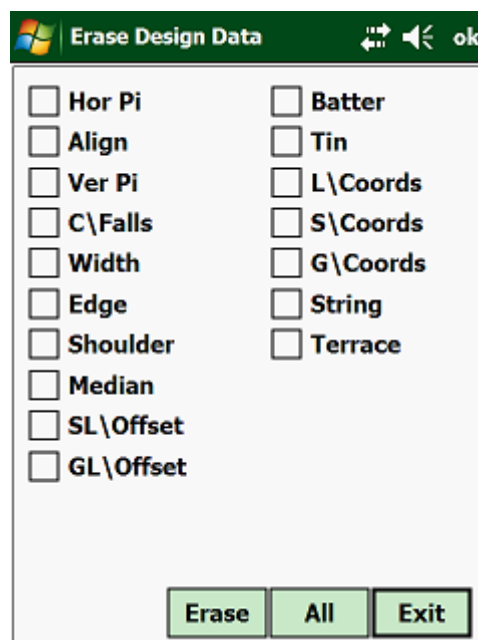
Item	Data
Horizontal P'i's	0
Alignment Points	0
Vertical P'i's	0
Crossfall	0
Surface	0
Edge Shift	0
Shoulder	0
Stake Offset	0
Grade Offset	0
Batters	0
TIN Model	0
Strings	0

### 1.5.00 Erase Data:

Here you can erase data that is not required anymore. You must remember that here you cannot delete the entire Job, but only selected design, field or office data. Field data is the information that gets recorded while you are busy surveying in the field. Tap with your stylus on “Erase Data”:



Select which type of data you want to erase and tap on it.



Select the required Database and click the files that you want to erase. Once you have selected all, tap on <Erase> and the program will erase the selected data. The same method is used for the field files.



**1.6.00 Parameters:**

This routine can be used to change the survey parameters of the Job that is open - i.e. if you want to use a different instrument, change the offsets of your profile pegs, etc.

To access this routine, tab on “Parameters”:

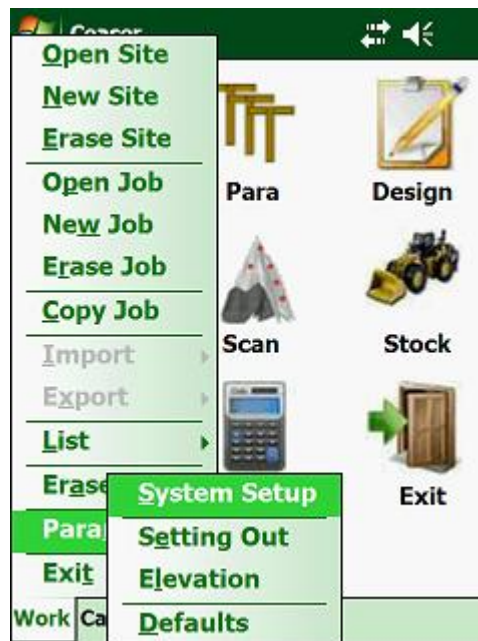


This will give you the following options:

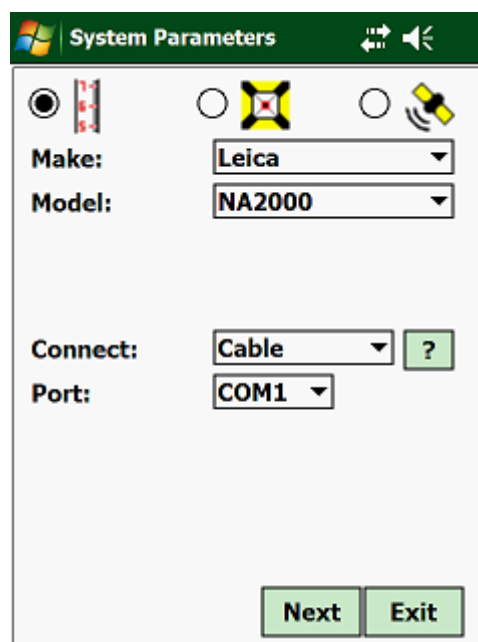
- Setup System
  - this lets you change the mode in which you want to survey, the type of instrument that you are working with, change the coordinate system, etc.
- Setting Out
  - here you change the position and travel of your pegs relative to the design of the Job.
- Elevations
  - this will control how the elevations must be relative to the design levels.
- Defaults
  - here you can set the default Batter Slopes and Stake Value increments.

**1.6.01 Setup System:**

To change the system parameters, tab on “Setup System”:



Next you will need to enter or change the Job parameters:



First select which type of instrument you want to set, i.e. Level, Total Station or GPS.

Next:

- **Make** - if you are working with a Total Station, then you must select the make of the instrument that you are working with - i.e. Geodimeter, Nikon, Leica, etc.
- **Model** - select which model of the selected instrument types you are using.
- **Mode** - toggle between “Fine” which is to millimetre accuracy or “Coarse”, which is to centimetre accuracy.

**System Parameters**

☐ ☒ ☐

**Make:** Leica

**Model:** TC400

**Mode:** [Green Box]

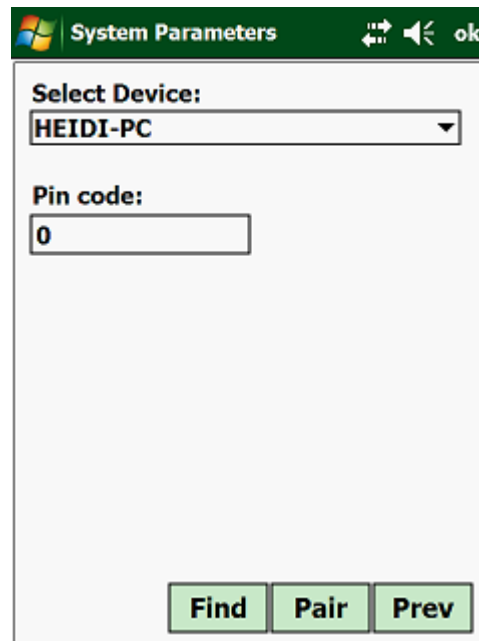
**Connect:** Cable ?

**Port:** COM1

Next Exit

Next select how the PDA is connected to the instrument. Here you have 2 options:

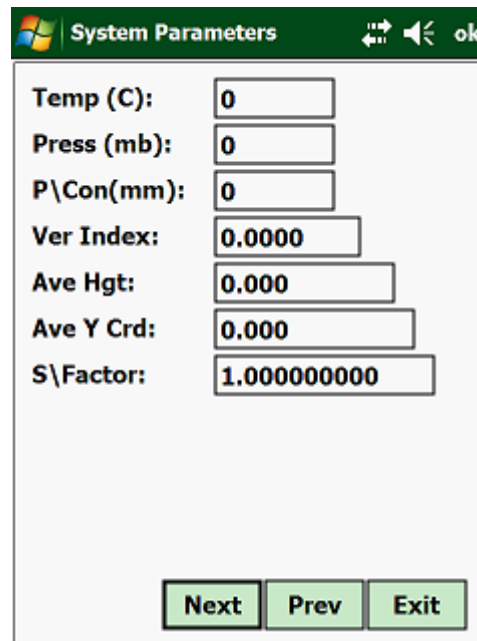
- Cable - select the Port to which the cable is connected.
- Bluetooth - here you will have to “Find” your instrument and then the program will “Pair” to your instrument.



Once the program has picked up your Instrument, you need to click on the “Pair” button. Most Instruments do not need a “Pin Code”, but if the “Pairing” is unsuccessful then you mostly likely need a Pin Code.



Next:

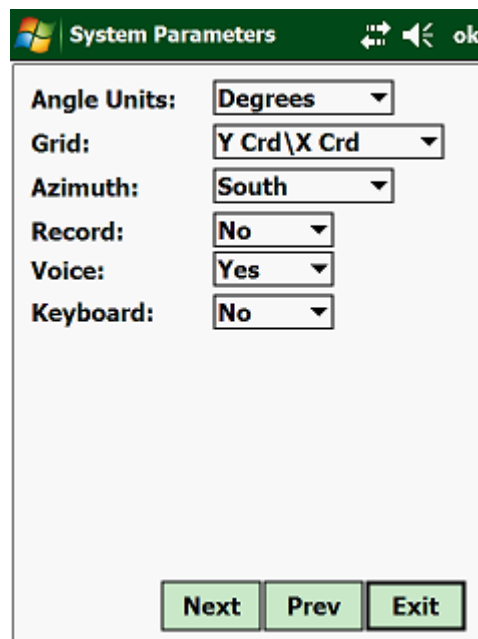


Parameter	Value
Temp (C):	0
Press (mb):	0
P\Con(mm):	0
Ver Index:	0.0000
Ave Hgt:	0.000
Ave Y Crd:	0.000
S\Factor:	1.000000000

- Temp (C) - enter the temperature in Celsius
- Press (mb) - enter the pressure in millibars
- P\Con (mm) - enter the prism offset in millimeters
- Ver Index - enter the vertical index error of your instrument. The vertical index error can be determined by reading the vertical angle to some distant target in face left and face right. The sum of the two readings must be 360°. Half the difference between the sum of the two angles and 360° will be your index error. The program will correct all your vertical angle observations by this error.
- Ave Hgt - enter the average height above mean sea level of the area that you are going to work in.
- Ave Y Crd - enter the average Y coordinate of the area that you are going to work in.

From the above information the program will calculate a scale factor correction, which will be applied to all the distance observations. The value that the program has calculated can be overridden, by allowing you to enter your own scale factor.

Next:



**System Parameters**

Angle Units: Degrees

Grid: Y Crd\X Crd

Azimuth: South

Record: No

Voice: Yes

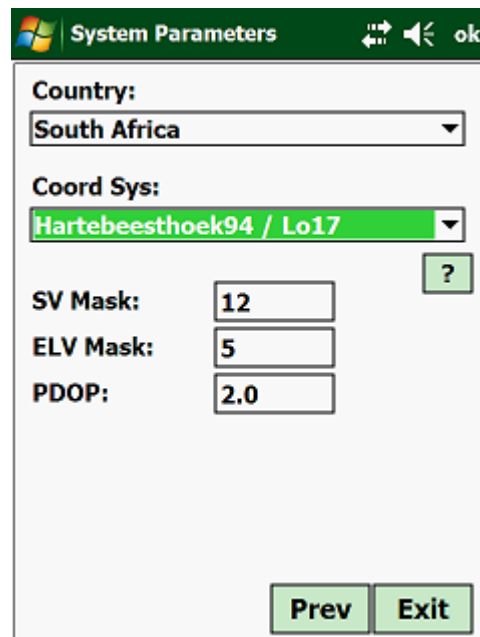
Keyboard: No

Next Prev Exit

- Angle Units
  - select the angle units that you are working with.
- Grid
  - select the coordinate system that you are going to use.
- Azimuth
  - select whether your zero bearing is North or South.
- Record
  - if you select "yes", then all your observations will be stored automatically.
- Voice
  - if set on "Yes", you will get voice messages from the program after actions have been taken.
- Keyboard
  - if your Handheld unit does not have a keyboard, then you can activate the virtual keyboard with this setting.

Next:

The following information is only required if you work with a GPS system.



- Country - select the Country that you are working in.
- Coord Sys - select the coordinate system.
- SV Mask - enter the minimum number of Satellites that you want to work with. Generally the more Satellites you have the more accurate is your position.
- ELV Mask - this is the minimum angle below which you do not want to use the Satellites. Satellites very close to the Horizon do not yield good results.
- PDOP - enter the maximum PDOP that you want to work with. The lower the PDOP the more accurate your fix is.

Once you have completed the above, tap on “Exit” to return to the main menu.

You can at any stage while in the above input screens, tap the “Exit” button to return to the main menu.

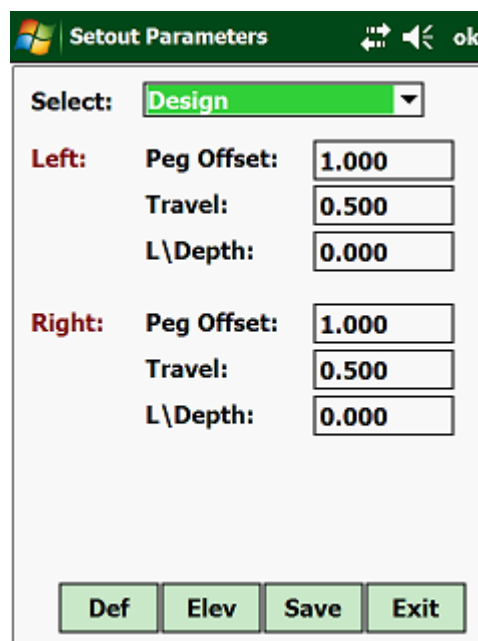


### **1.6.02 Setting Out:**

Under the “Setting Out” option, you can define the offsets, travels and layer depths in the setting out routines:



Next:



Here you will have to select the type of setting out, of which you want to change the parameters:

- Batterboards
- Full



- Design
- Edge
- Shoulder
- Appendage
- Stake & Offset
- Pivot Point
- Manual
- Coordinates
- Strings

Once you have selected the above, you will have to enter the following:

- Peg Offset - Enter the offset of the pole from the relevant surface
- Travel - Enter the travel - i.e. the distance of the placed level above the design level.
- L\Depth - Enter the depth of the layer to which the level must be calculated. Normally this stays at “0”, which is the default and the Foreman or Supervisor changes the dip stick to suit what needs to be constructed.

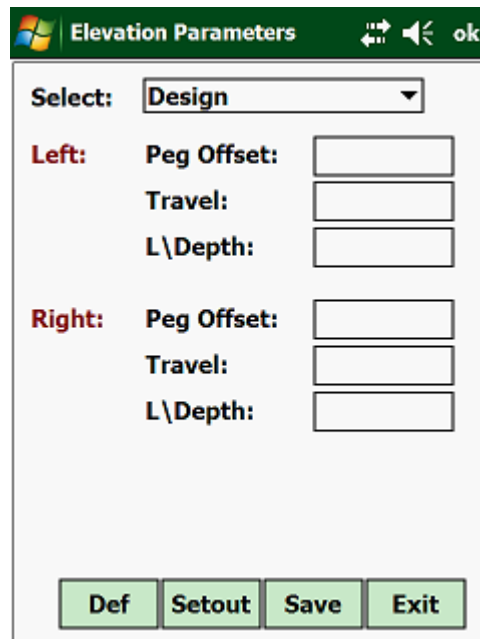
This will also have to be entered for the right side.

### **1.6.03 Elevations:**

This selection will be used to define the parameters for all the elevation options:



Next:



To access this routine, highlight “Elevations” and press the <Enter> key:

Here you will have to select the type of elevation placing, of which you want to change the parameters:

- Full
- Design
- Edge
- Shoulder
- Appendage
- Manual
- Coord
- Tin Model



Once you have entered the above, you will have to enter the following:

- |            |   |  |
|------------|---|--|
| Peg Offset | - | Enter the offset of the pole from the relevant surface   |
| Travel     | - | Enter the travel - i.e. the distance of the placed level above the design level.   |
| L\Depth    | - | Enter the depth of the layer to which the level must be calculated. Normally this stays at “0”, which is the default and the Foreman or Supervisor changes the dip stick to suit what needs to be constructed. |

**1.6.04 Defaults:**

This option lets you enter default values for your Job.



Next:

The screenshot shows the 'Default Parameters' dialog box. It has a title bar with the Windows logo, the text 'Default Parameters', and icons for help, back, and 'ok'. The main area contains three input fields: 'Stake Incr:' with the value '20.000', 'Cut Slope:' with the value '2.000', and 'Fill Slope:' with the value '2.000'. At the bottom, there are four buttons: 'Elev', 'Setout', 'Save', and 'Exit'.

Here you will then be given the opportunity to enter a default Stake Value increment, Cut Slope and Fill Slope Batter.

### 1.7.00 Info:

This displays the “Info” page.

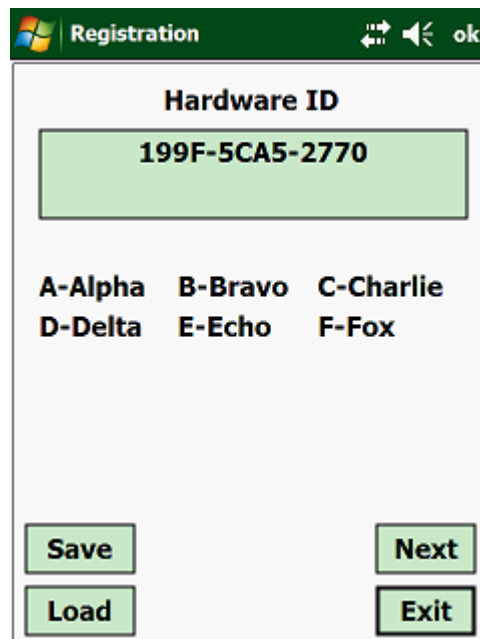


### 1.7.01 Registration:

Here you will register your software.



Next:



**Registration** [Icons] ok

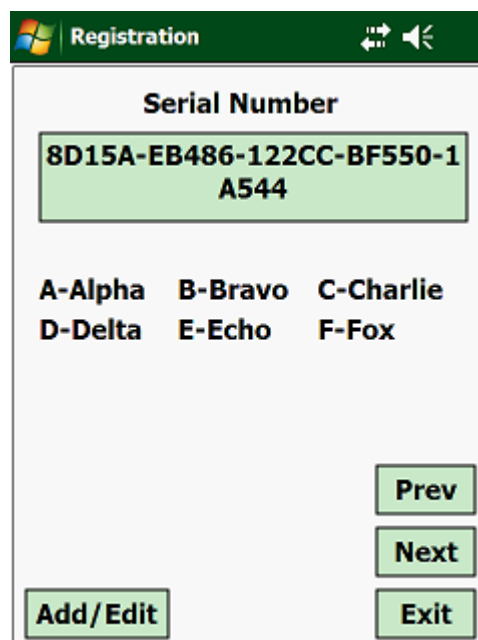
**Hardware ID**

199F-5CA5-2770

A-Alpha   B-Bravo   C-Charlie  
D-Delta   E-Echo   F-Fox

Save   Next  
Load   Exit

Next:



**Registration** [Icons]

**Serial Number**

8D15A-EB486-122CC-BF550-1  
A544

A-Alpha   B-Bravo   C-Charlie  
D-Delta   E-Echo   F-Fox

Prev  
Next  
Add/Edit   Exit

This number will be given to you. Click on the <Add/Edit> button and enter the number on the virtual keyboard.

The 'Start' window features a title bar with the Windows logo and 'Start' text. Below the title bar is a virtual keyboard interface. At the top, there are three input fields containing the serial numbers '8D15A', 'EB486', and '122CC'. Below these are two more input fields containing 'BF550' and '1A544'. The keyboard itself consists of a grid of buttons: a row of letters A, B, C, D; a row of numbers 7, 8, 9, and a button labeled 'E'; a row of numbers 4, 5, 6, and a button labeled 'F'; a row of numbers 1, 2, 3, and a yellow button labeled 'Cls'; and a bottom row with numbers 0, a yellow button labeled '<--', a yellow button labeled 'Esc', and a yellow button labeled 'Ok'.

Once you have entered the Serial number, click on the <OK> button.

Next:

The 'Registration' window has a title bar with the Windows logo and 'Registration' text. The main content area contains a table with two columns: 'Activation' and 'Expire'. The table has five rows of data, all with a green background. Below the table, there are four buttons arranged in a 2x2 grid: 'Remove' and 'Prev' in the top row, and 'Add' and 'Exit' in the bottom row.

Activation	Expire
Scan	Permanent
Stock	Permanent
Level	Permanent
GPS	Permanent
TS	Permanent

Depending on which licences you have brought, you will be given the appropriate licence number for the different modules and types of Instruments. Use the <Add> button to enter your licence numbers.

## **CHAPTER 2: DESIGN**

### **2.1.00 Introduction:**

**Ceaser** works on the "coat hanger" system to define the parameters of a Job. Each Job will have a horizontal as well as a vertical alignment, onto which the surface parameters will be "hooked" on to define the design of the Job. **Ceaser** can theoretically be used on any civil project that can be defined by geometric parameters.

An alternative is to define the project as a Tin (triangles) model, which can either be entered via the keyboard or the model can be imported from the PC, which was created on **Ceaser**\_office. In this section the required design information, which the program needs to be able to compute setting out and elevation data, will be discussed. The design information can consist of the following:

- Alignment Points
- Design surface
- Offsets
- Batters
- Tin Model
- Strings
- Terraces
- Coordinates
- Topo Codes

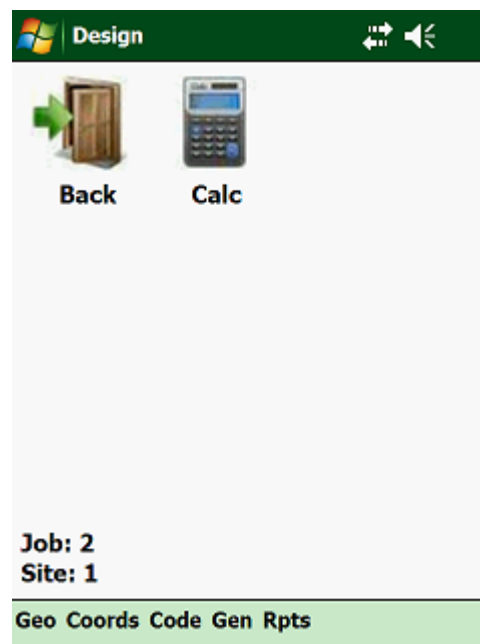


Tap on the  icon:





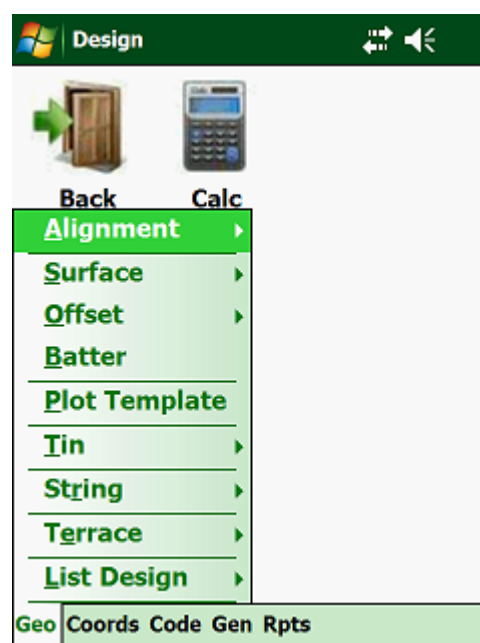
This will display the following screen for the “Design” module:



Options available:

- Geo - this you will use for all your geometric parameter, Tin Model, Strings and Terrace input.
- Coord - add Global, Site or Local coordinates.
- Code - add Codes to be used with Topo Surveying.
- Gen - import, export, erase and list design data.
- Rpts - generate reports from your Design input.

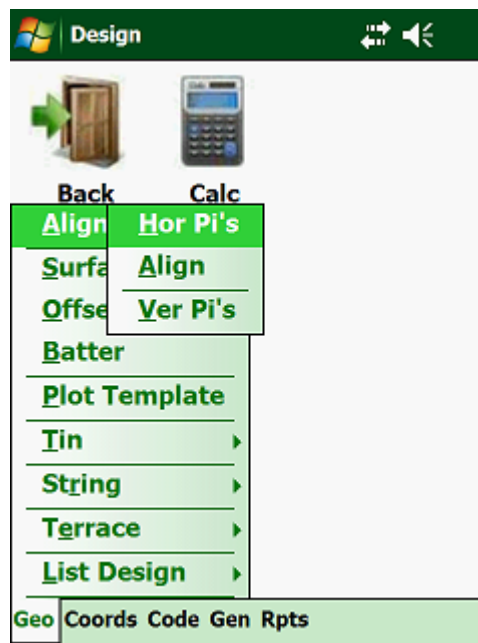
Tapping on “Geo” will give you the following:



Here you have the following design options:

- Alignment - Horizontal Pi's, Alignment Points, Vertical Pi's.
- Surface - Crossfalls, Surface Widths, Outer Edge Shifts, Shoulder Widths.
- Offset - Stakeline Offsets, Design Offsets.
- Batter - Batter and Appendage Data for Cut and Fill conditions.
- Plot Template - See a graphical Plot of your Geometric design.
- Tin - Triangles that represent surface models.
- String - Lets you define Strings.
- Terrace - Enter Terrace designs.
- List Design - This gives you a summary list of each selected design.

To access the Alignments, tap on “Alignment”, which will display the following options:

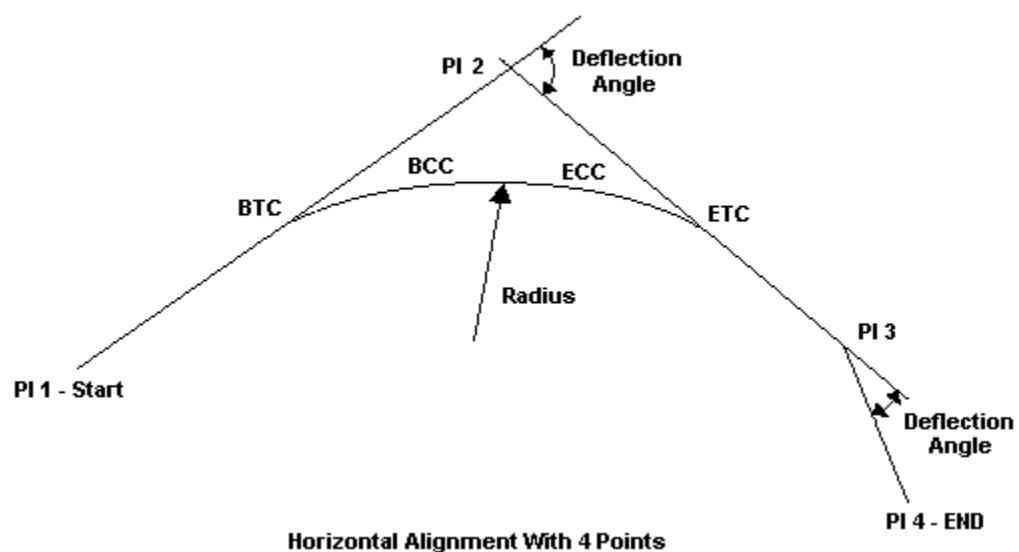
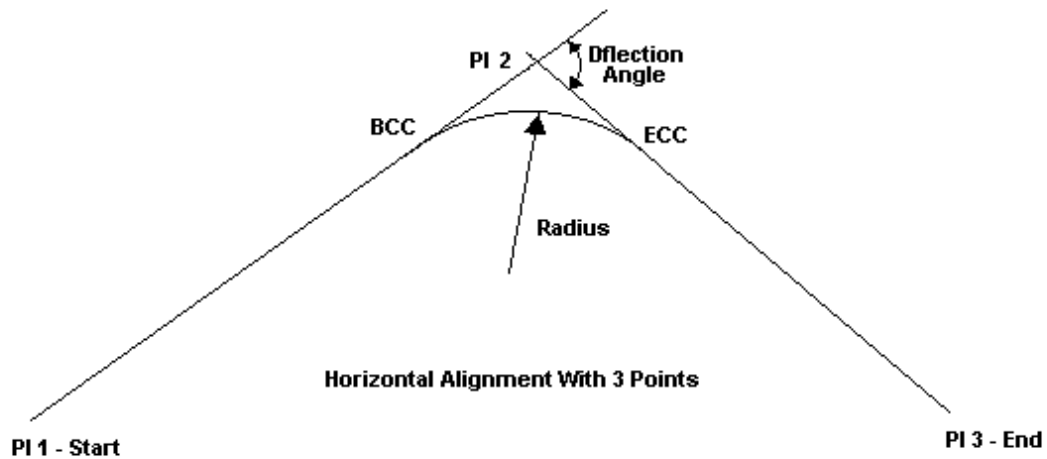


The Alignment consists of the following subroutines:

- Hor Pi's - add the horizontal alignment using Pi's.
- Align Pts - define the horizontal alignment using BC's, EC's and radius.
- Ver Pi's - add the vertical alignment.

## **2.2.00 Horizontal Pi's:**

Pi stands for Point of Intersection and this defines the horizontal alignment of the Job. A maximum of 500 horizontal Pi's with transition spirals for run-in and run-out can be entered per project, including the start and end points. A Pi is the point that defines the intersection of two straights on the horizontal alignment.



To access this routine tap on “Hor Pi’s”:



This will display the following window:

A screenshot of the 'Horizontal Pi's' input window. The title bar is green with the Windows logo, the text 'Horizontal Pi's', and navigation icons, followed by an 'ok' button. The window contains several input fields: 'Start Stake:' with an empty text box; 'Pi No:' with a dropdown menu showing '1' and a green button with a question mark; 'Y Coord:' with a text box containing '1000.000'; 'X Coord:' with a text box containing '1000.000'; 'Radius:' with a text box containing '0.000'; 'Trans In:' with a text box containing '0.000'; and 'Trans Out:' with a text box containing '0.000'. At the bottom, there are four green buttons: 'Erase', 'Insert', 'Save', and 'Exit'.

Firstly enter the stake value of the first Pi point where the Job starts. Next tap on “Pi No” and select the Pi number from the list.

Once the Y and X coordinates have been entered of the first Pi, the coordinates of all subsequent Pi's will be requested.

You will notice that **Ceaser** does not request the stake value of the Pi's after the first Pi has been entered. This is because the program will calculate the stake values of all

the BTC's, BCC's, ECC's and ETC's based on the relevant radiuses and transition lengths entered at each Pi.

**Note:**

If the stake values calculated are not correct due to a Lo change, short chain, etc. then it is advisable to enter your horizontal alignment under the Alignment Points, as here you have the option of overriding the stake values calculated by the program.

- Radius - Enter the circular radius at the Pi - this will only be applicable from the second Pi onwards, but excluding the last point.
- Trans In - Enter the length of the ingoing transition.
- Trans Out - Enter the length of the outgoing transition.

The lengths of the two transition curves can differ from each other.

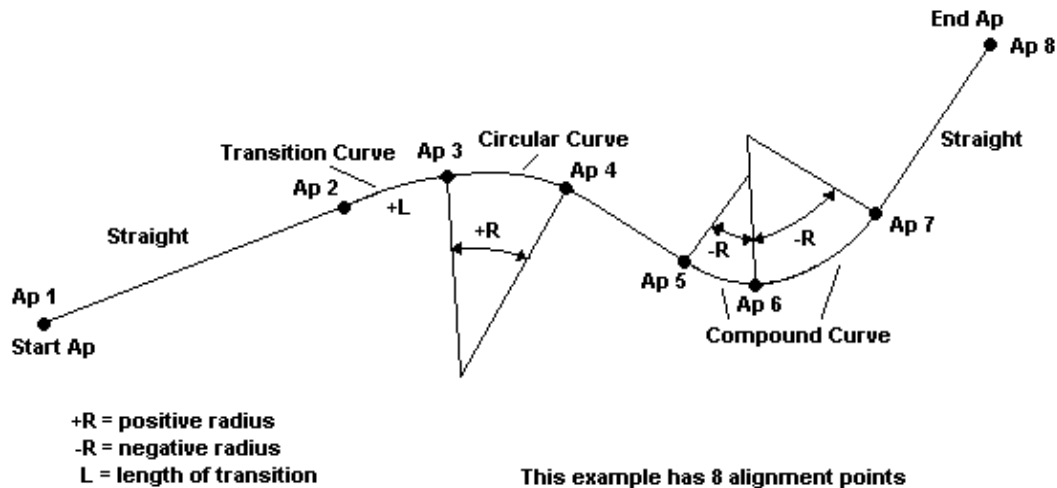
While the program is processing the input data, it will check for overlapping curves. If any of the curves are overlapping, the processing will be terminated and the horizontal alignment will have to be corrected where the overlap occurs. The program will warn you at which Pi the curve is overlapping.

At the bottom of the screen you have the following options:

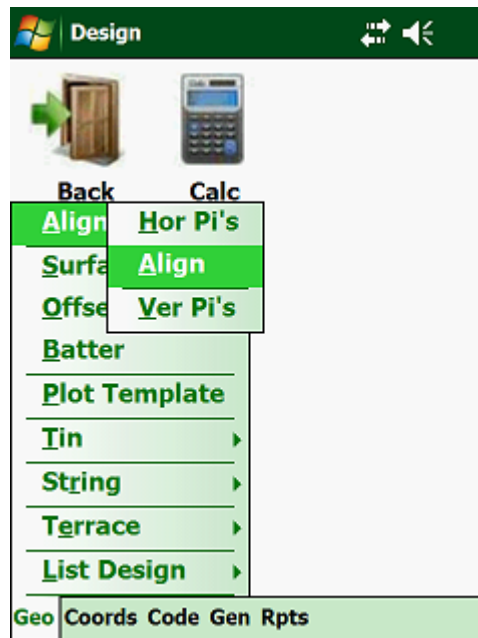
- Exit - go to the main screen of the "Design" module.
- Save - save the data entered in the database.
- Insert - insert a new record before the one displayed.
- Erase - erase the displayed record.

### 2.2.01 Alignment Points:

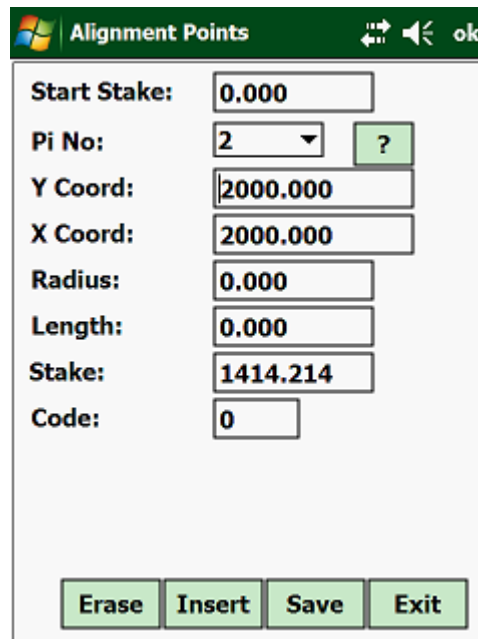
This option allows for virtually any type of horizontal alignment to be entered and processed by the program. What is entered here are the BCC's, ECC's, BTC's, etc. positions and their relevant parameters to form a horizontal alignment. A typical application where one would use alignment points will be on compound curves, as the processing of horizontal Pi's does not support computation of compound curves.



To access the Alignment routine, tap on “Align Pts”



The following screen will become available:



Alignment Points

Start Stake: 0.000

Pi No: 2 ?

Y Coord: 2000.000

X Coord: 2000.000

Radius: 0.000

Length: 0.000

Stake: 1414.214

Code: 0

Erase Insert Save Exit

- Start SV - Enter the stake value at the start of the alignment points.

At the first alignment point, you will be asked to enter a starting stake value. For all the following alignment points, the stake value will be calculated after entering the coordinates of the alignment point, the radius at the alignment point and the code. You have the option of overriding the calculated stake value.

- Radius - enter the radius of the circular curve or in the case of a transition curve the radius at the point where the properties of the transition curve is the same as a circular curve - i.e. the radius of the transition curve is not infinity anymore.
- Length - enter the length of the transition curve, if there is any.
- Code - enter the code of the alignment point entered. Bends is "0", "1" is for Transition in, "2" is for Circular Curves and "3" is for Transition out.
- Stake - the program will calculate a Stake value using the entered data. This value can be overridden should there be a long or short chain in the Job.

When entering the data for the alignment points, keep to the following conventions:

- **Radius:**
  - The radius for bends is "0"
  - The radius for a left-hand curve is always negative
  - The radius for a right-hand curve is always positive.

The length of the transition or radius is entered at the end of the curve, - i.e. on a circular curve the radius will be entered at the ECC.

**Codes:**

- The code for straights is "0".
- The code for circular curves is "2".
- The code for a lead in transitions is "1" - i.e. the first transition
- The code for a trailing transition is "3" - i.e. the second transition.

**Note:**

To accommodate non-geometrical alignments (i.e. stake values that do not match the coordinates given or Lo-coordinates and surface stake values), enter the actual stake values for the BCC's, ECC's, etc. A factor between the actual and the entered distance will be calculated and applied for the section of the last two alignment points.

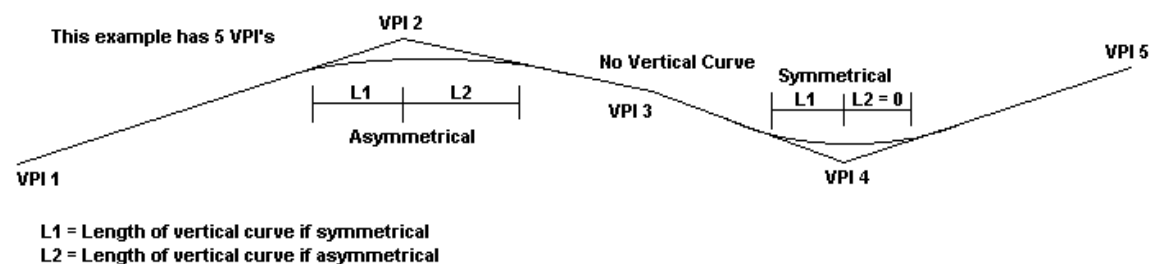
While the program is processing the input data, it will check for overlapping curves, as well as curves that do not fit. If any of the curves are overlapping or do not fit, the processing will be terminated and the horizontal alignment will have to be entered again. The program will warn you at which Alignment Point the curves are overlapping.

At the bottom of the screen you have the following options:

- Exit - go to the main screen of the "Design" module.
- Save - save the data entered in the database.
- Insert - insert a new record before the one displayed.
- Erase - erase the displayed record.

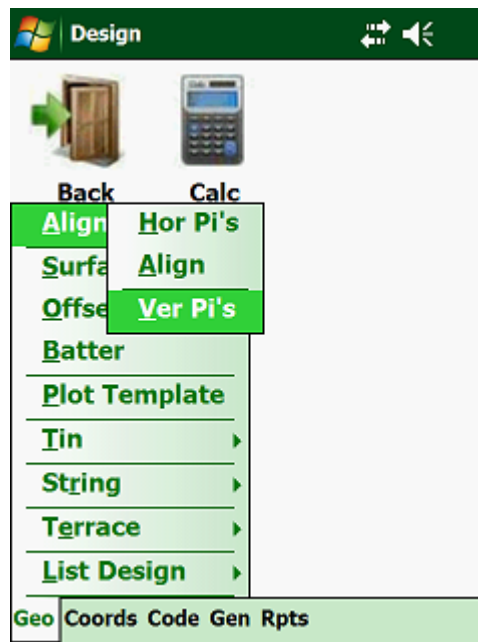
**2.2.02 Vertical Alignments:**

The vertical alignment consists of the parameters that control the elevation at each specific point of the Job. The vertical alignment computations support parabolic, cubical functions and circular curves.





To access the Vertical Alignment routine, tap on “Ver Pi’s”.



This will display the following screen:

A screenshot of the 'Vertical Pi's' input screen in the CEASER<sub>field</sub> application. The screen has a green header bar with the title 'Vertical Pi's' and navigation icons. Below the header, there are several input fields: 'Select' (a dropdown menu showing '0.000'), 'VPI Stake' (a text box with '2400.000'), 'VPI Level' (a text box with '102.154'), 'Length 1' (a text box with '0.000'), 'Length 2' (a text box with '0.000'), and 'Curve Type' (a dropdown menu showing 'Parabolic'). At the bottom of the screen, there are four buttons: 'Erase', 'Insert', 'Save', and 'Exit'.

Next the following must be entered:

- Stake - Enter the Stake Value of the relevant vertical Pi.
- VPI Level - Enter the elevation of the vertical Pi.
- Length1 - Enter the total length of the vertical curve under "Length 1" if the curve is symmetrical, else if the curve is asymmetrical, enter the first length under "Length 1".
- Length2 - Enter "0" if the vertical curve is symmetrical, else enter the second length of the asymmetrical curve under "Length 2".

- Curve Type - vertical curve types are: parabolic, cubical and circular.

**Note:**

- Both the entries for Length1 and Length2 are necessary, if the vertical curve is asymmetrical.
- For symmetrical curves, enter the length of the vertical curve in Length1 and for Length2 enter "0"
- If Length1 is entered as "0" and Length2 is not "0", the program will consider no vertical curve.
- If a length of vertical curve is entered for the first and last vertical Pi, no computations will take place within the limits of those vertical curves.

While the program is processing the input data, it will check for overlapping vertical curves. If any of the vertical curves are overlapping, the processing will be terminated and the input will have to be corrected. The program will warn you at which Vertical Pi the curves are overlapping.

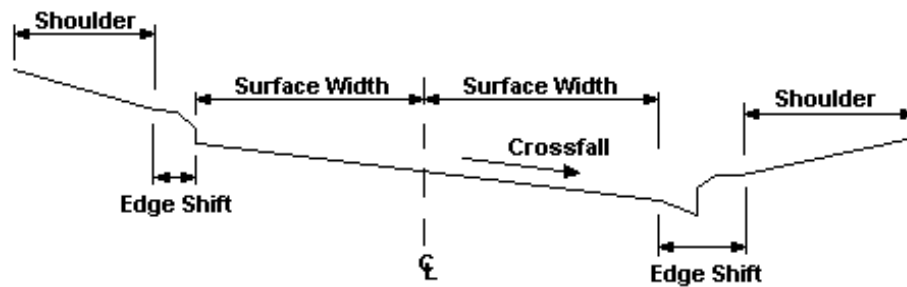
At the bottom of the screen you have the following options:

- Exit - go to the main screen of the "Design" module.
- Save - save the data entered in the database.
- Insert - insert a new record before the one displayed.
- Erase - erase the displayed record.

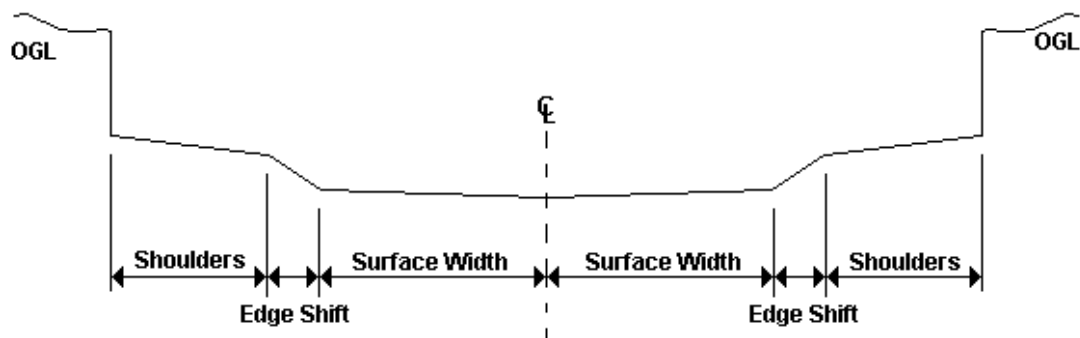
### **2.3.00 Surface Parameters:**

Surface parameters are design parameters that define the widths and crossfalls of the Job. Routines that are available include:

- Crossfalls
- Surface Widths
- Edge Shifts
- Shoulder Widths
- Median



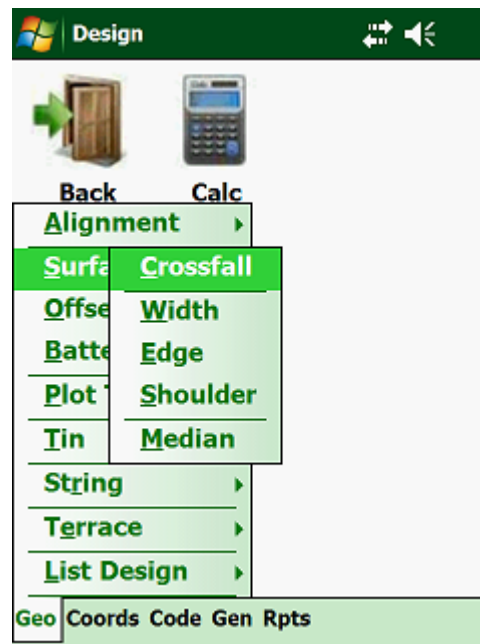
**Surface Design Input Sequence**



As can be seen from the above figures, it is possible to enter most shapes of surfaces that define a Job.

In the top figure, is a typically cross-section of a road and in the bottom figure is a cross- section of a canal.

These routines can be accessed by tapping on “Data”, which will display the following menu:

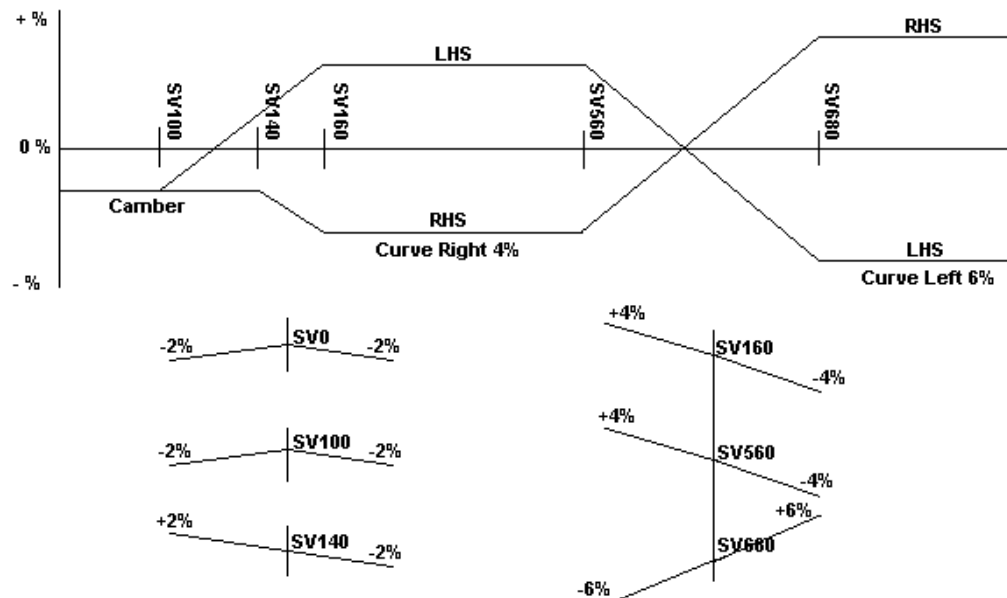


Here you have:

- Crossfalls - defines how the surface of your Job slopes (Superelevation).
- Design Width - that's the width of your surface.
- Edge Shift - this is an additional width tied to your Design Width.
- Shoulder - another width definition that ties into your Edge Shift.
- Median - this is the last design entity before the Cut or Fill side slopes. On dual carriageway roads you will normally find a stormwater channel between the two carriageways which can be accommodated here by the program.

### 2.3.01 Crossfalls:

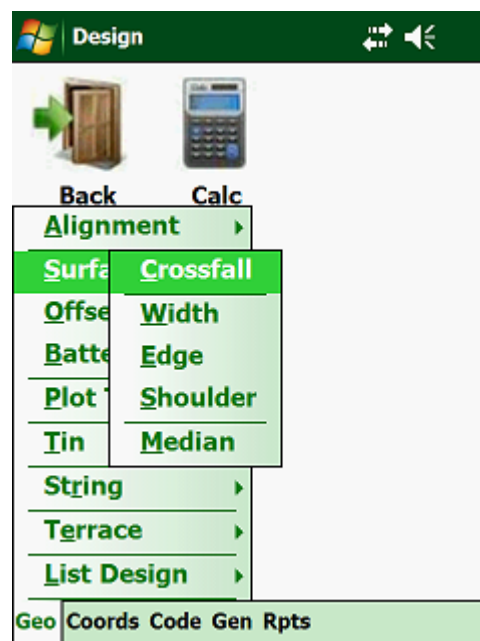
Crossfalls (Superelevation) are the parameters that define the slope of the design surface of the Job. The design width and the shoulder width can each have their own crossfalls. Basically any type of crossfalls can be accommodated with this program.



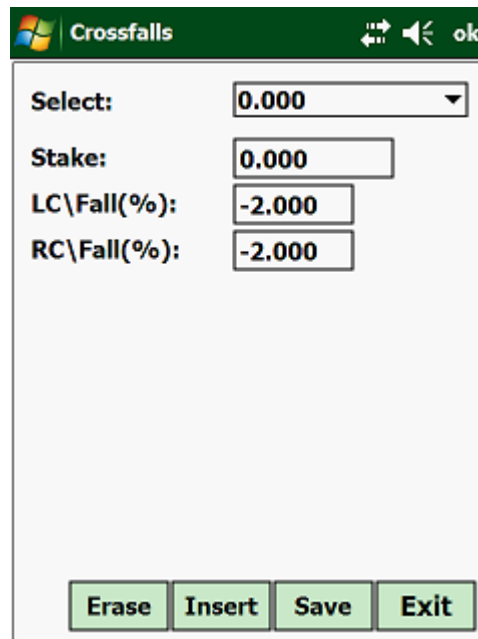
In this example crossfalls would have been entered at the above stakes

The sign (plus or minus) of the crossfalls is always determined from the centerline outwards. The crossfalls must be entered as a percentage value.

Tap on "Crossfalls":



This will display the next input window:



The screenshot shows a software window titled "Crossfalls". It has a standard Windows-style title bar with a logo on the left and "ok" on the right. The main area contains four input fields arranged vertically. The first is a dropdown menu labeled "Select:" with "0.000" selected. The second is a text box labeled "Stake:" containing "0.000". The third is a text box labeled "LC\Fall(%):" containing "-2.000". The fourth is a text box labeled "RC\Fall(%):" containing "-2.000". At the bottom of the window, there are four buttons: "Erase", "Insert", "Save", and "Exit".

- Stake - Enter the stake value from where the crossfalls are to apply. If only one crossfall is entered, it will apply for the whole Job.
- Lc\Fall - Enter the left-hand side crossfall as a percentage value starting from the centerline. If the slope falls away from the centerline, enter the crossfall as a negative percentage value and if the slope rises above the centerline, enter the crossfall as a positive percentage value.
- Rc\Fall - Enter the right-hand side crossfall as a percentage value starting from the centerline. If the slope falls away from the centerline, enter the crossfall as a negative percentage value and if the slope rises above the centerline, enter the crossfall as a positive percentage value.

This information you enter at all the stake values where there is an abrupt change of crossfall.

**Note:**

- Crossfalls between different stake values are linearly interpolated for both the left-hand side and the right-hand side of the Job.
- The slope must be entered as a percentage value starting from the centerline.
- Falling slopes are negative and rising slopes are positive.

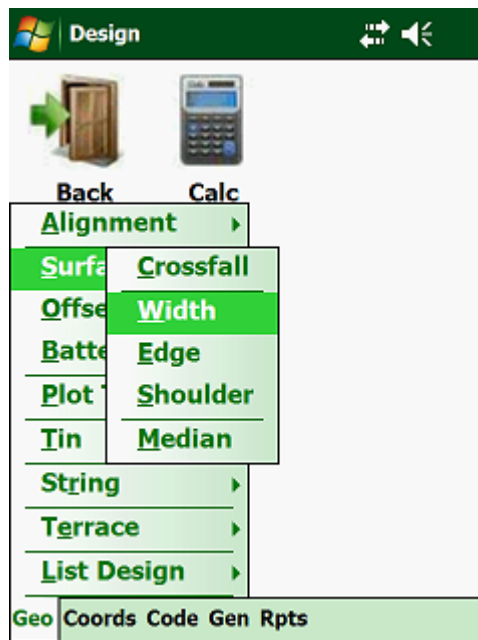
At the bottom of the screen you have the following options:

- Exit - go to the main screen of the “Design” module.
- Save - save the data entered in the database.
- Insert - insert a new record before the one displayed.
- Erase - erase the displayed record.

### **2.3.02 Design Surface:**

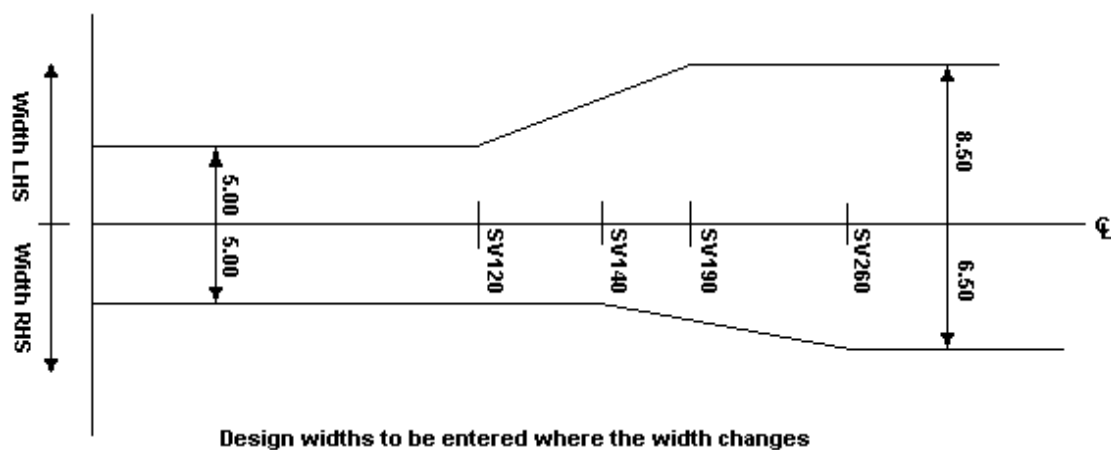
The design surface width defines the main width of the design shape, such as road widths, canal widths, earthwall dam widths, etc.

Tap on “Surface Width”:



Next the following screen will be displayed:

- Stake - Enter the stake value from where the widths entered are to apply. If only 1 width is entered, then this width will be applied to the entire Job.
- Left Width - Enter the left side as an absolute value in meters.
- Right Width - Enter the right side as an absolute value in meters.



At the bottom of the screen you have the following options:

- Exit - go to the main screen of the “Design” module.
- Save - save the data entered in the database.
- Insert - insert a new record before the one displayed.
- Erase - erase the displayed record.



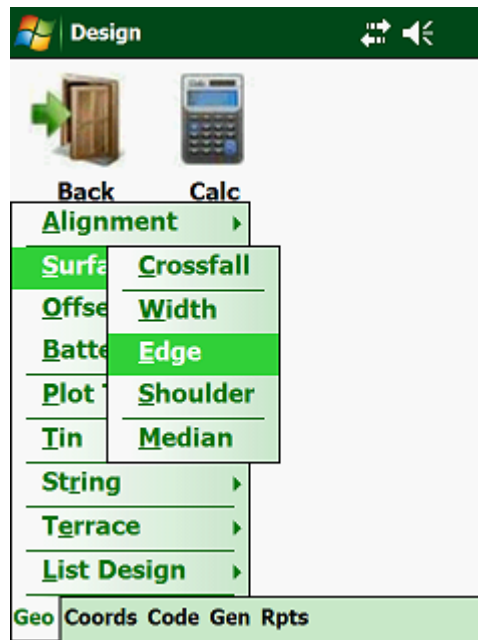
**Note:**

- Different widths for the left-hand side and the right-hand side for individual stake values may be entered.
- For each width entered, a width for both sides must be specified.
- Widths between different stake values are linearly interpolated for the left-hand side and the right-hand side.

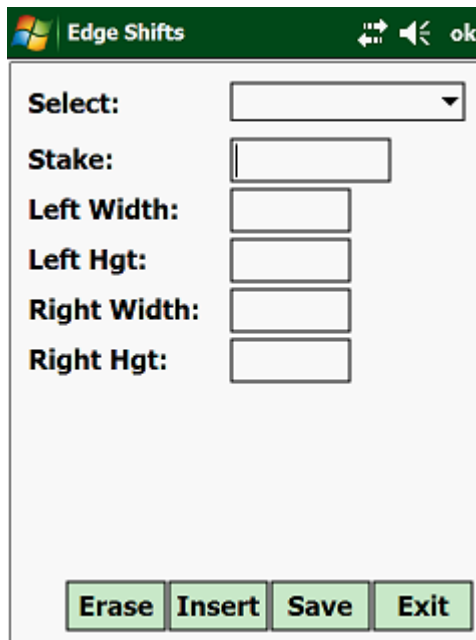
**2.3.03 Edge Shift:**

The edge shift is an additional widening or step, which adds to the edge of the design surface. You could use this to define the kerbline next to the road or even to accommodate a retaining wall.

To access this routine tap on "Edge Shift":



Which will show you the following:



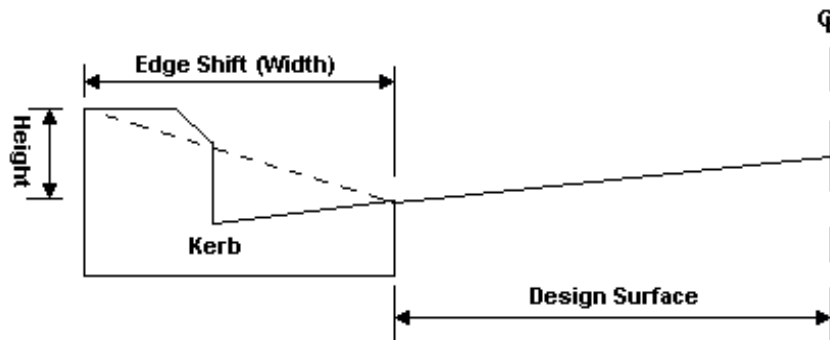
The screenshot shows a software window titled "Edge Shifts". It features a green header bar with a Windows logo, the title "Edge Shifts", and icons for help, volume, and an "ok" button. The main content area is white and contains several input fields: a dropdown menu for "Select:", and text boxes for "Stake:", "Left Width:", "Left Hgt:", "Right Width:", and "Right Hgt:". At the bottom of the window, there are four green buttons labeled "Erase", "Insert", "Save", and "Exit".

The input menu for the edge shift is as follows:

- Stake Value - Enter the stake value from where the outer edge shift is to apply. If only 1 edge shift is specified, then this will be applied to the entire Job.
- Left Width - Enter the relative width of the left edge shift.
- Left Hgt - Enter the relative height of the left edge shift.
- Right Width - Enter the relative width of the right edge shift.
- Right Hgt - Enter the relative height of the right edge shift.

At the bottom of the screen you have the following options:

- Exit - go to the main screen of the “Design” module.
- Save - save the data entered in the database.
- Insert - insert a new record before the one displayed.
- Erase - erase the displayed record.



Example where edge shift could be used

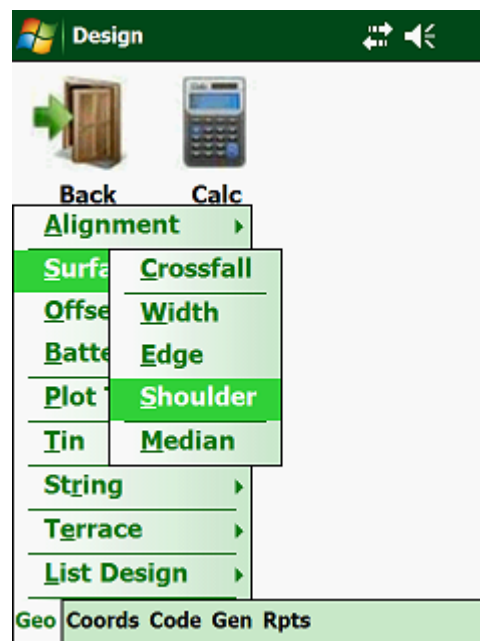
**Note:**

- For each stake value entered, the data for the left side and the right side must be specified.
- The data is linearly interpolated between the different stake values for the left side and the right side.

### **2.3.04 Shoulders:**

The shoulders represent an addition to the normal design width or an addition to the normal design width plus the edge shift. You could use this routine to define the sidewalk next to the kerbline.

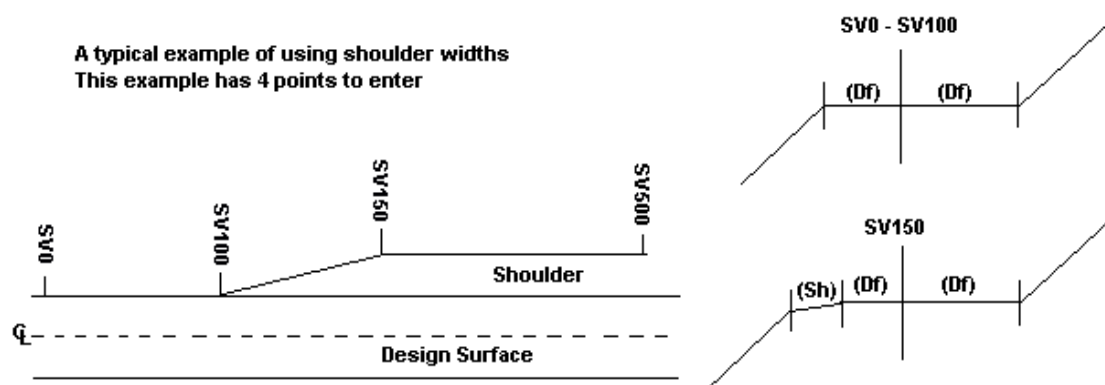
To access this routine tap on “Shoulder”:



This will show you:

The input menu for the shoulder widths is as follows:

- Stake Value - Enter the stake value from where the shoulder widths are to apply. If only 1 shoulder width is specified, this will be applied to the entire Job.
- Left Width - enter the relative width of the shoulder on the LHS.
- L\Slope (%) - enter the crossfall of the shoulder as a percentage value on the LHS.
- Right Width - enter the relative width of the shoulder on the RHS.
- R\Slope (%) - enter the crossfall of the the shoulder as a percentage value on the RHS.



At the bottom of the screen you have the following options:

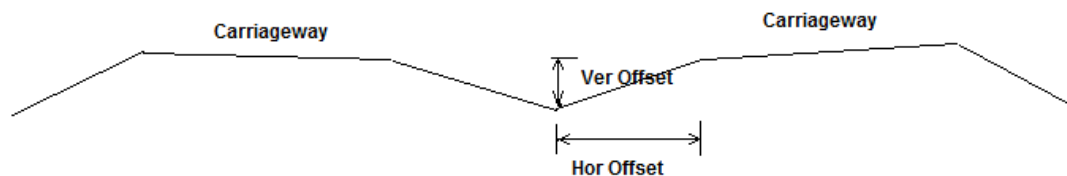
- Exit - go to the main screen of the “Design” module.
- Save - save the data entered in the database.
- Insert - insert a new record before the one displayed.
- Erase - erase the displayed record.

**Note:**

- Shoulder width and crossfalls between different stake values are linearly interpolated for both side of the Job.
- The slope must be entered as a percentage value relative to the edge of the design width or the edge of the outer edge shift.
- Falling slopes are negative and rising slopes are positive.
- For each stake value entered the data for the left-hand side and the right-hand side must be specified.

**2.3.05 Median:**

Normally on a dual carriageway, you will find a Stormwater Drain that is defined by an offset and relative height to the SBP (Shoulder Break Point).



The input menu for the Median is as follows:

- Stake Value - Enter the stake value from where the Median is to apply. If only Median is specified, this will be applied to the entire Job.
- Hor Offset - enter the horizontal offset from the SBP to the center of the Median.
- Ver Offset - enter the relative depth from the SBP to the Median.

At the bottom of the screen you have the following options:

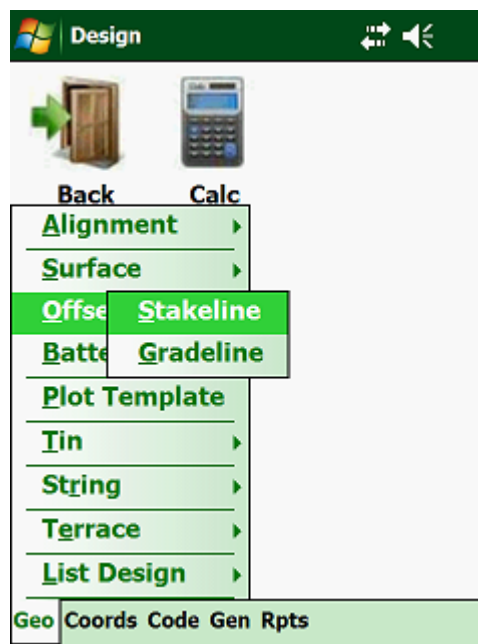
- Exit - go to the main screen of the “Design” module.
- Save - save the data entered in the database.
- Insert - insert a new record before the one displayed.
- Erase - erase the displayed record.

### **2.4.00 Offsets:**

Offsets are variables that can be entered into the program to accommodate designs that are at an offset from the horizontal and vertical alignment. This can be where the vertical alignment (gradeline) is at an offset from the stakeline, such as on a dual carriageway.

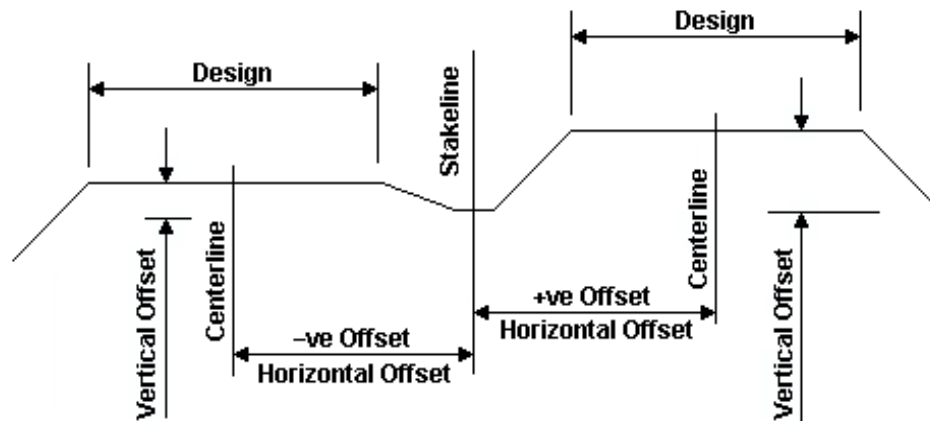
The stakeline is defined by your horizontal alignment. If the centerline of the design is to the left of the stakeline, then the offset is entered as a negative value and if the design is to the right of the stakeline, then the offset is entered as a positive value.

To access these routines, use the arrows on the Handheld unit until the pull down menu under "Geo" is activated. Once the pull down menu has been opened, use your up and down arrows to highlight "Offsets" and press the <Enter> key.



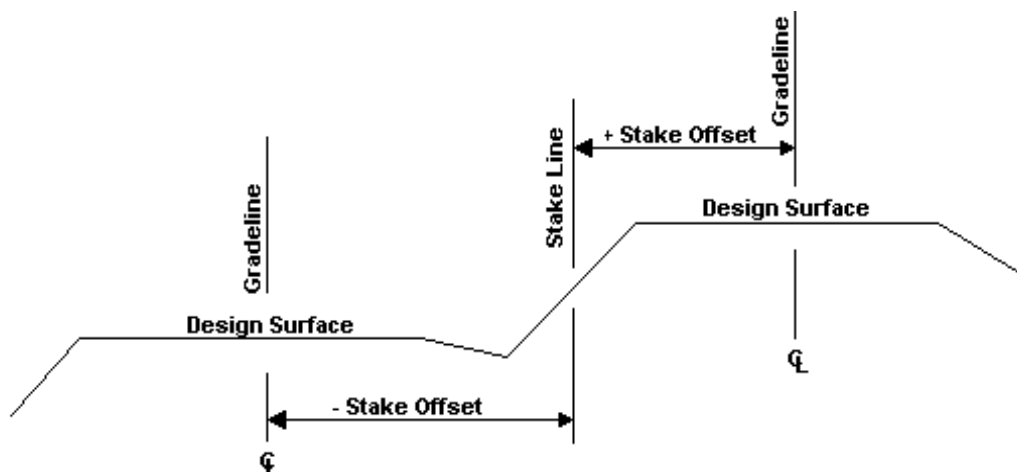
There are two types of offsets that can be accommodated by the program:

- Stakeline Offsets
- Gradeline Offsets



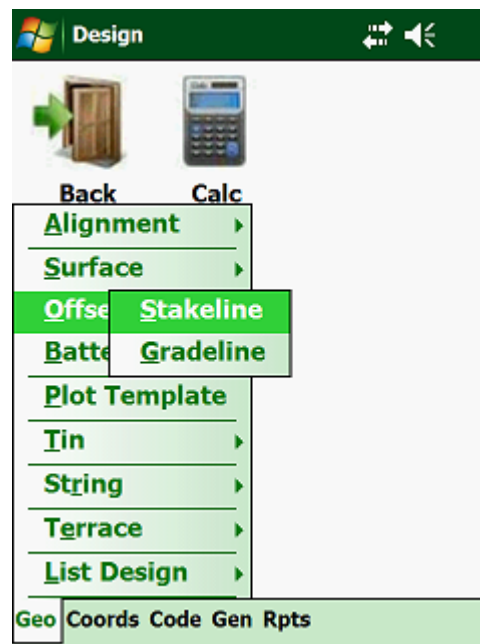
#### 2.4.01 Stake Offsets:

The stake offset is the horizontal distance between the stake line and the gradeline, where the vertical alignment is defined. One application of this would be on dual carriageways, where the stake line is usually situated between the two carriageways.



**Ceaser** can only accommodate one carriageway at a time, which means that in a situation like above, you will have to open two Jobs; one for each carriageway.

Tap on “Stakeline”:



The following screen will then be shown:

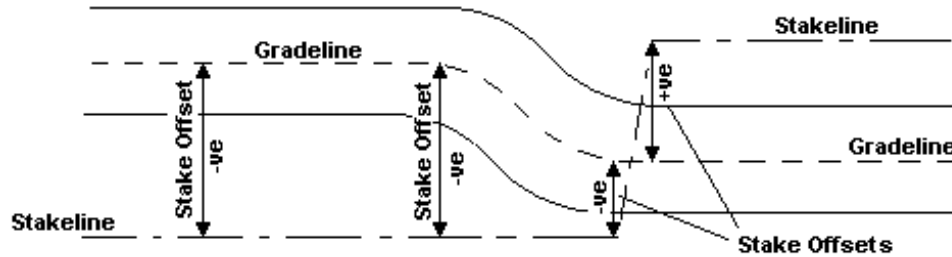
A screenshot of the 'Stakeline Offsets' screen. It features input fields for 'Select:', 'Stake:', and 'Hor Offset:'. At the bottom, there are buttons for 'Erase', 'Insert', 'Save', and 'Exit'.

Next will be the screen to enter the stakeline offsets:

- Stake Value - Enter the stake value from where the stakeline offset is to apply.
- Hor Offset - Enter the horizontal offset of the gradeline (vertical alignment) from the horizontal alignment (stakeline). If the gradeline is to the left of the stakeline, then enter the offset



as a negative value and if the gradeline is to the right of the stakeline, then enter the offset as a positive value. If only 1 offset is entered, then this offset will be applied to the entire Job.



**This example shows 4 stake offsets to enter**

At the bottom of the screen you have the following options:

- Exit - go to the main screen of the “Design” module.
- Save - save the data entered in the database.
- Insert - insert a new record before the one displayed.
- Erase - erase the displayed record.

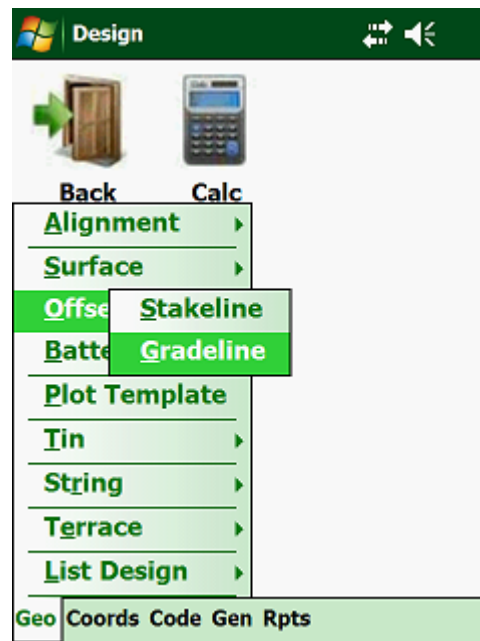
**Note:**

- If the gradeline is to the left of the stakeline, the stake offset is negative and if the gradeline is to the right of the stakeline, the stake offset is positive.
- Stake offsets entered for different stake values are linearly interpolated.

#### **2.4.02 Gradeline Offsets:**

The design offsets are the shifts between the gradeline and the point of rotation about which the crossfalls rotate. Design offsets are mainly used to accommodate dual carriageways, which usually have a Horizontal and Vertical Alignment. They can also be used to shift the vertical alignment or gradeline up and down.

Tap on “Geo”, “Offsets” and then on “Gradeline”.

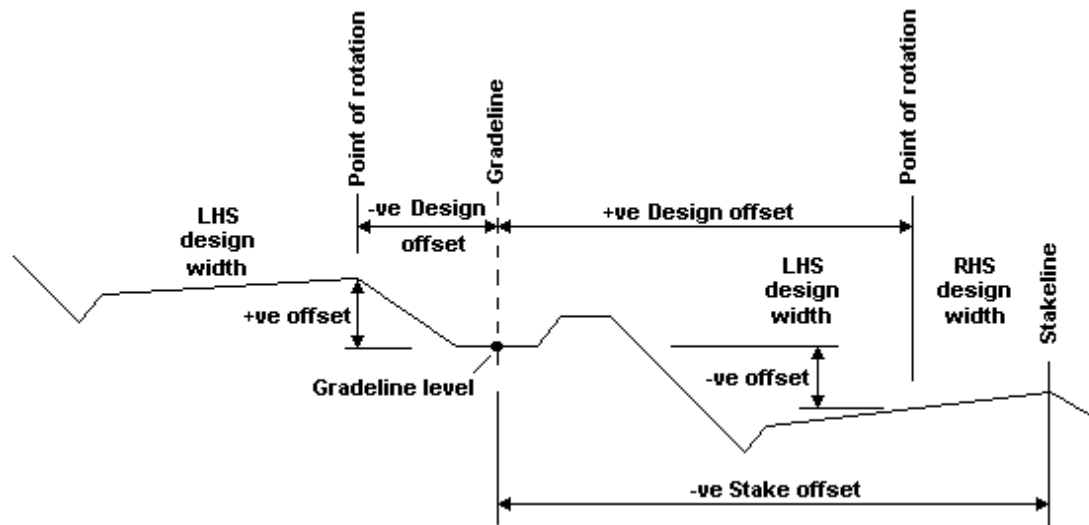


This will display the next input window:

A screenshot of the "Gradeline Offsets" input window. The window has a title bar with the CEASER logo, the text "Gradeline Offsets", and navigation arrows, a speaker icon, and an "ok" button. The main area contains four input fields: "Select:" with a dropdown arrow, "Stake:" with a text box, "Hor Offset:" with a text box, and "Ver Offset:" with a text box. At the bottom of the window, there are four buttons: "Erase", "Insert", "Save", and "Exit".

- Stake Value - Enter the stake value from where the design offset is to apply. If only 1 design offset is entered, then this will be applied to the entire Job.
- Hor Offset - Enter the horizontal distance from the gradeline to the point of rotation. If the point of rotation is to the left of the gradeline then the horizontal offset is negative and if the point of rotation is to the right of the gradeline, then the horizontal offset is positive.
- Ver Offset - Enter the vertical distance from the gradeline to the point of rotation. If the point of rotation is above the gradeline, then

the offset is positive and if the point of rotation is below the gradeline, then the vertical offset is negative.



At the bottom of the screen you have the following options:

- Exit - go to the main screen of the “Design” module.
- Save - save the data entered in the database.
- Insert - insert a new record before the one displayed.
- Erase - erase the displayed record.

**Note:**

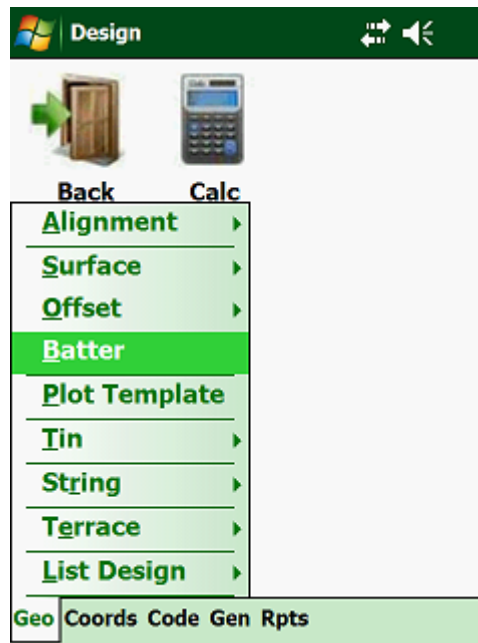
- If the point of rotation is to the left of the gradeline, then the horizontal offset is negative and if the point of rotation is to the right of the gradeline, then the horizontal offset is positive.
- If the point of rotation is above the gradeline, then the vertical offset is positive and if the point of rotation is below the gradeline, then the vertical offset is negative.
- All data between the different stake values are linearly interpolated.

### **2.5.00 Batters:**

Batter data is used to define the outer edge of the appendage point as well as the slope of the batter. Appendage data, is the information that defines the features adjacent to the outer edge of the Job. These features can include side drains, additional widenings, retaining walls, etc.

Batters are the last design features in **Ceaser** that intersect with the ground level.

Tap on “Geo” and then on “Batters”.



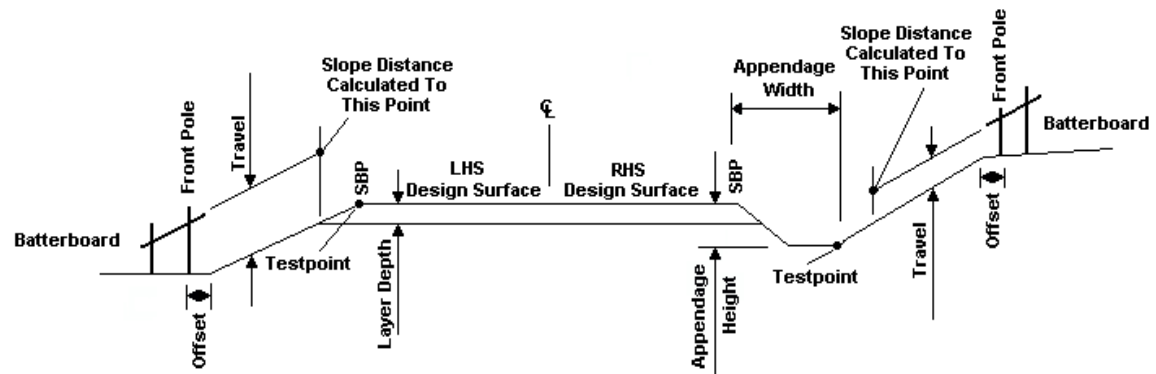
The following screen will then be displayed:

- Side - from the dropdown box select whether you want to enter the batter parameters for the left side or for the hand side of the Job. Also here you must enter the batter data for both sides of the Job.
- Condition - from the dropdown box, select whether you want to enter the cut parameters or the fill parameters. Even if there are no fill or no cut conditions on site, you must still enter the parameters for both cut and fill conditions.
- Set - you can up to 5 different sets of batter criteria.
- Side - from the dropdown box select whether you want to enter the batter parameters for the left side or for the hand side of the Job. Also here you must enter the batter data for both sides of the Job.
- Stake - Enter the stake value from where the batters are to apply. If only 1 set of data is entered, then this information will be applied to the entire Job. You need to tap on the “New” to enter new Batter parameters.
- Test hgt - enter the height of the fill or the depth of the cutting up to which the design parameters for a specific “Set” has to apply.
- Type - the batter can either be a “Fixed Batter” (i.e. 1:2, 1:1.5, etc.) or you can have a “Fixed Width” batter, where the offset from the toe to the shoulder breakpoint is at a fixed width.
- Batter(1:X) - Enter the slope of the batter as 1:X, which refers to one unit vertically and X units horizontal. If a fixed Batter has been selected then the distance from the Shoulder Break Point (SBP) to the Toe has to be entered.
- App Width - Enter the total width of the appendage data - i.e. the width up to the outer edge of the additional features adjacent to the Job.
- App Height- Enter the total height of the appendage feature in relation to the shoulder breakpoint - i.e. the height above or below of the outer edge of the additional features adjacent to the Job, in relation to the edge of the Job. If the outer edge of the appendage data is below the shoulder breakpoint, then enter the appendage height as negative and if the appendage data is above the shoulder breakpoint, then enter the appendage data as positive.

To have combined Batters, you need to tap the “Comb” box. See the end of this section for an explanation on combined Batters.

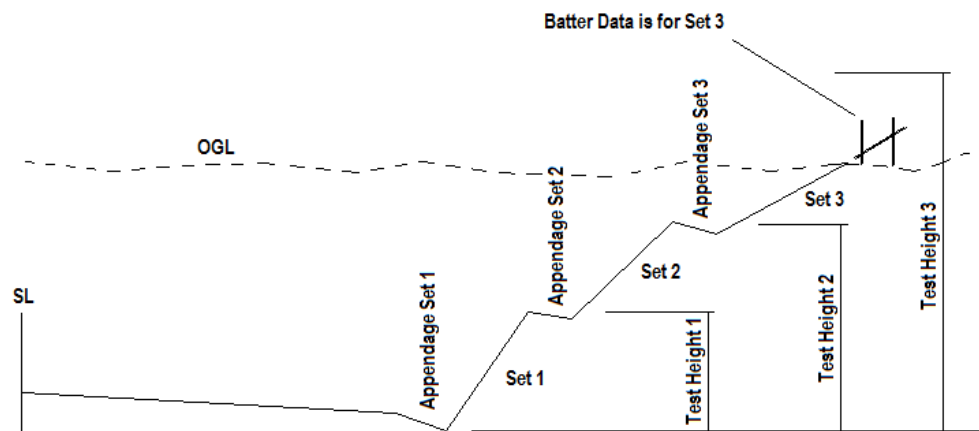
At the bottom of the screen you have the following options:

- Exit - go to the main screen of the “Design” module.
- Save - save the data entered in the database.
- Insert - insert a new record before the one displayed.
- Erase - erase the displayed record.

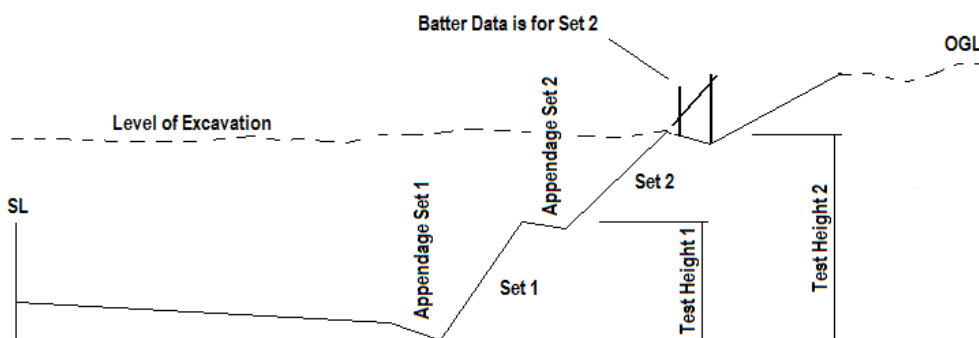
**Note:**

- Batter data must always be defined for CUT and FILL conditions, as well as for the LHS and the RHS. Although the Job may only be in a cut or fill condition, you must enter for both conditions.
- The batter slope has to be entered as 1:X, which refers to one unit vertically and X number of units horizontally.
- The entered width and height for the appendage has to be entered relative to the shoulder breakpoint. The shoulder breakpoint (SBP) is the furthest point of all surfaces added. Surfaces added are: design width + edge shift + shoulder width. Enter "E" if the appendage slope has to be an extension of your Surface width.
- The layer depth is always subtracted from the elevation of the shoulder breakpoint and intersects horizontal with the batter. The depth of the layers will only affect the length of the batter slope distances.
- The testpoint, is the point at which the program decides whether to apply a cut situation or a fill situation. If the testpoint is below the ground line, then it is in a cut condition and if the testpoint is above the ground line it is in a fill condition.
- All data between the different stake values are linearly interpolated, except for the offsets and the travelers.

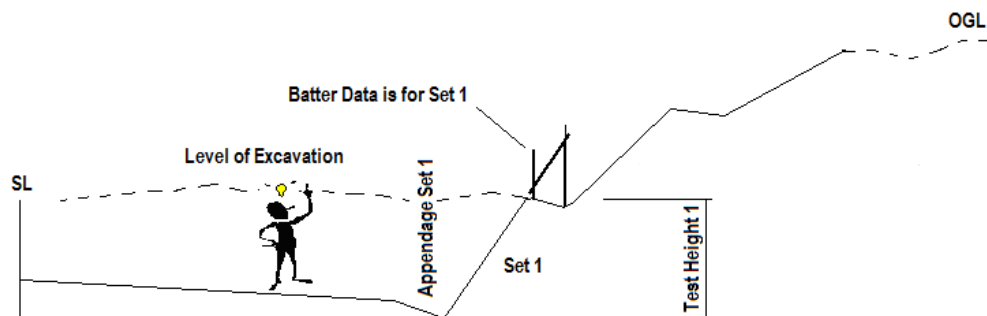
Combined Batters are used in situations where more than one Batter slope is used in the same cross-section, depending on the height of the fill or depth of the cutting.



Start of Cutting with a Combined Batter.



Cutting has progressed through Set 3 and the parameters of Set 2 is now used.

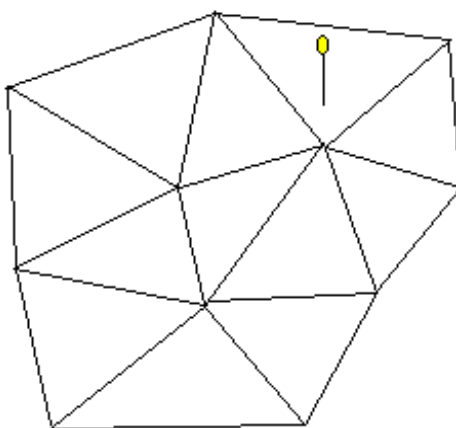


Cutting has progressed through Set 2 and the parameters of Set 1 is now used.

### 2.6.00 Tin Model:

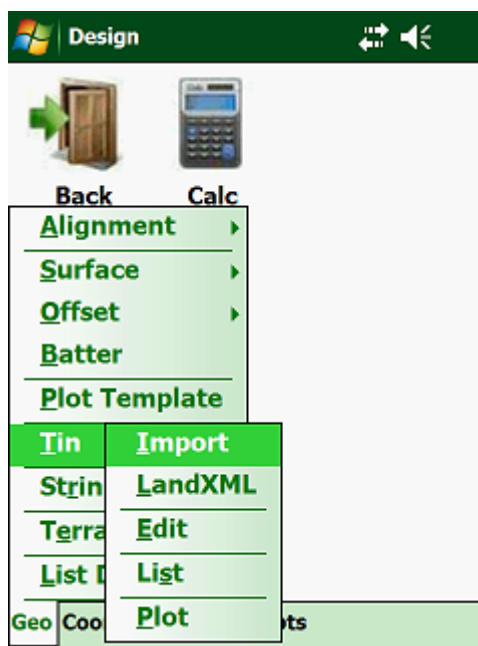
It is sometimes impossible to define the project that you must control by geometric parameters. Projects that include these conditions could be golf courses, landscaping, etc. In these cases it is possible to triangulate the project in **CEASER\_office** and export it to **Ceaser**. It will then be possible to hold the prism anywhere on site and the program will give the design level, ground level and the distance (cut or fill) that must be moved to reach the final design level.

Program will locate in which triangle the prism is located and calculate the design level



The program will give you the design level, actual level and the difference to cut or fill

Once you have set out the peg and placed the level on the peg, you have the option of storing the coordinates, ground level and the design level. This data can then be downloaded to **CEASER\_office** to calculate cut and fill volumes.

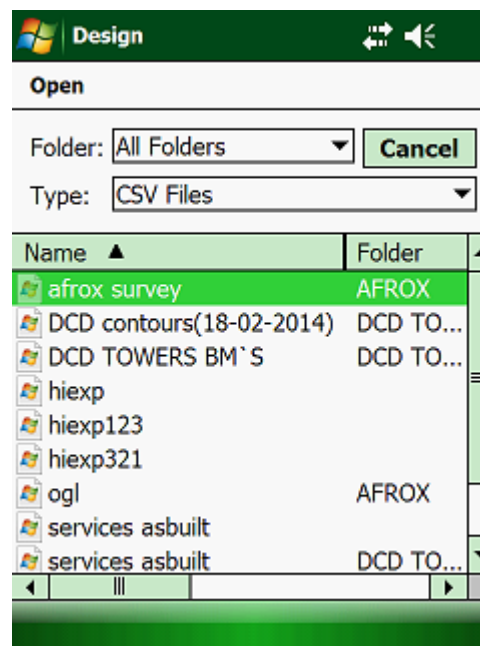




### **2.6.01 Import Pts:**

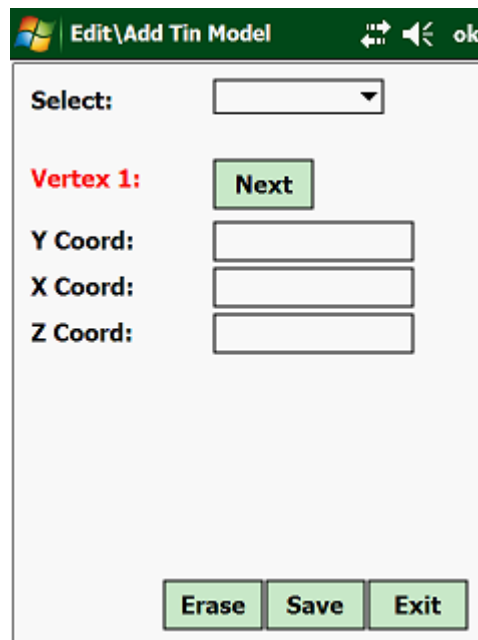
This option lets you import a Tin Model from a text file. The file must define the three vertices of each triangle that make up the model. The format must be: Y1, X1, Z1, Y2, X2, Z2, Y3, X3, Z3. The imported model will override the existing model if you have one for the loaded Job.

Tap on “Tin” and then on “Import Pts”:



**2.6.02 Edit\Add:**

With this function you can add the 3 vertices of each triangle in your Tin model:

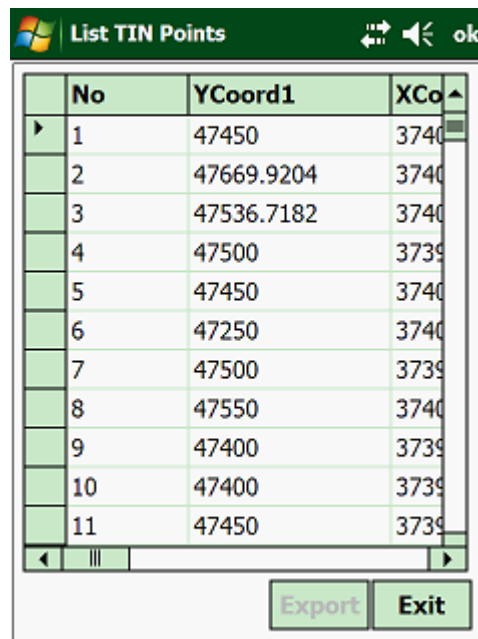


The screenshot shows a software dialog box titled "Edit\Add Tin Model". It features a standard Windows-style title bar with a logo, the title text, and icons for help, back, and OK. The main area contains a "Select:" dropdown menu. Below this, the text "Vertex 1:" is displayed in red, followed by a green "Next" button. Underneath are three empty input fields labeled "Y Coord:", "X Coord:", and "Z Coord:". At the bottom of the dialog are three green buttons labeled "Erase", "Save", and "Exit".

Enter the coordinates for the first vertex and tap on the “Next” button. Do this for all three vertices and tap then on the <Save> button. Repeat this for all the triangles that make up the Tin model.

**2.6.03 List:**

This will list the Tin Model that have you linked to the Job:

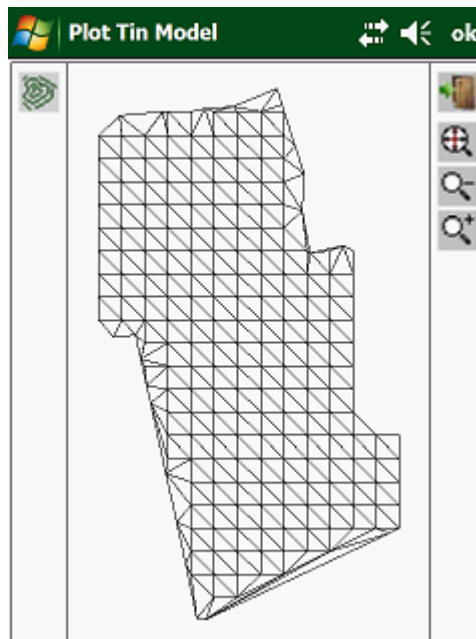


No	YCoord1	XCo
1	47450	3740
2	47669.9204	3740
3	47536.7182	3740
4	47500	3739
5	47450	3740
6	47250	3740
7	47500	3739
8	47550	3740
9	47400	3739
10	47400	3739
11	47450	3739

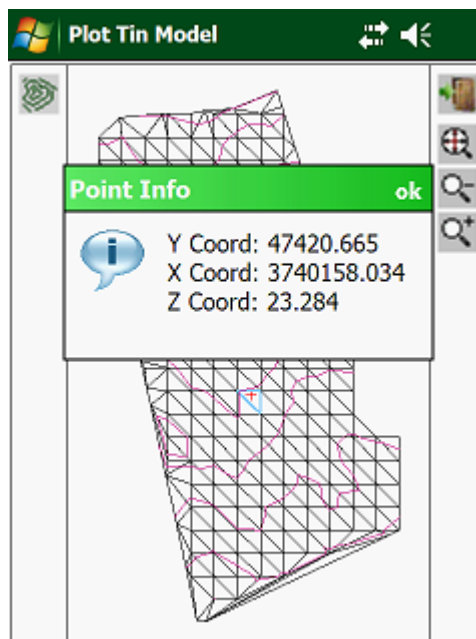
Export Exit

#### **2.6.04 Plot:**

This will plot the Tin Model.

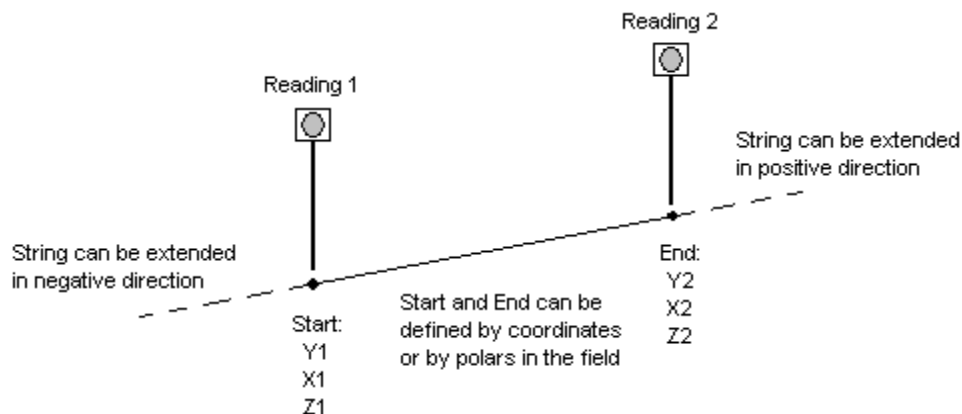
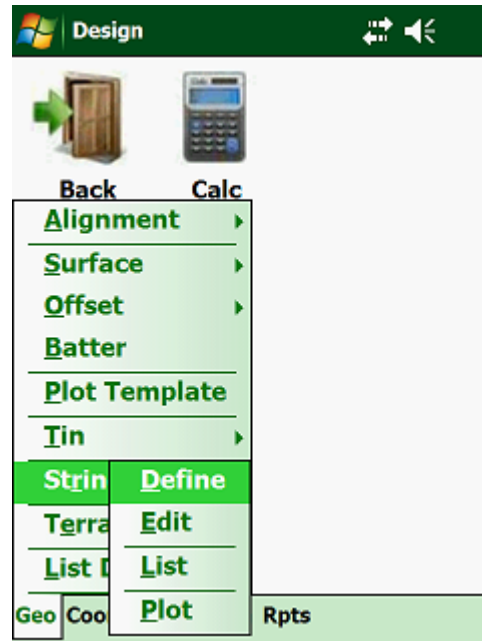


By tapping in a triangle, the program will display the coordinates (Y, X and Z).

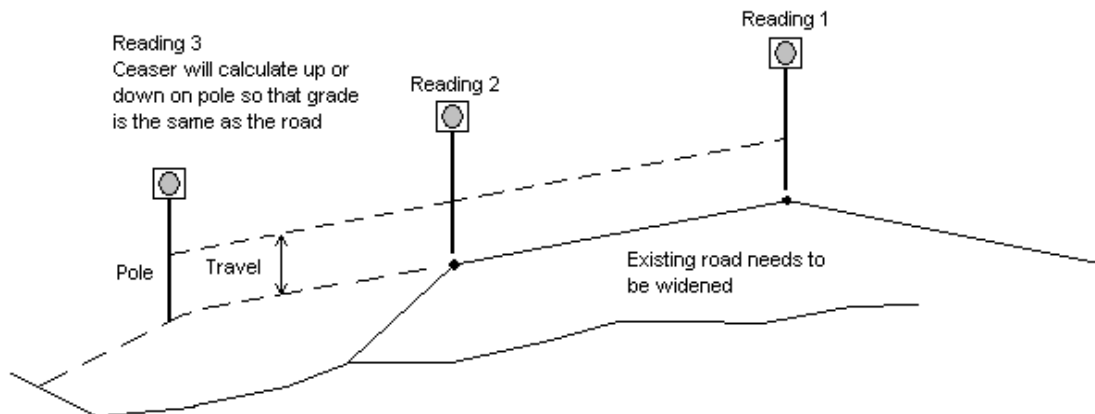


## 2.7.00 Strings:

A string is a line that is defined by two points; Y, X and Z at the start and Y, X and Z at the end. This string can either be a straight line between the two points or it can have a circular curve. The string is also not confined between these two points, but can be extended either way.



One example where you could use strings would be on an existing road which needs to be widened, but for which there is no design data available. Here you would first knock in the pegs at a predetermined distance from the edge of the road at any interval required. Then you will take a reading on the center of the road and then on the edge of the road. Next hold the prism on top of the pole and read the prism. The program will then calculate the distance up or down from the peg, such that it has the same grade as the road.



Here one can recall the two points of your string from either the “Local”, “Site” or “Global” coordinate file.

The program will display you the following:

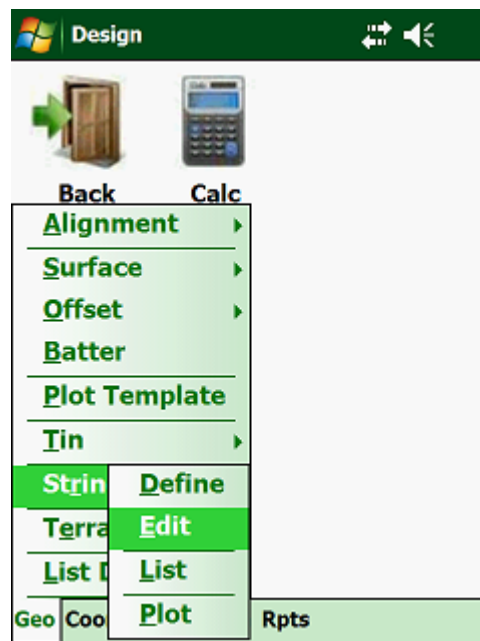
- **Start Stake** - the default is zero, but you can change it to whatever value you want.
- **Grade%** - this is the grade between the 2 points. This can be changed, in which case the program will use the Z value of the starting point and calculate the heights along the String using the entered grade value.
- **Radius** - as default the program assumes a straight line between the 2 points, but you can enter a radius to have a curved String. If

the centre of the curve sits to the left of the String, enter the radius as a negative value and if the centre of the curve sits to the right of the String, enter the radius as a positive number.

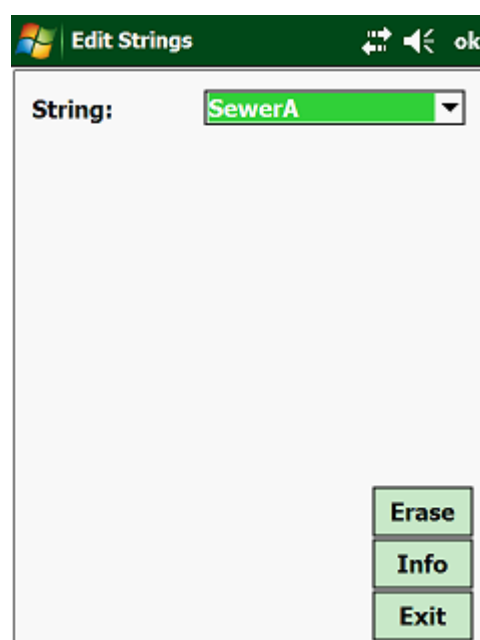
- Name - enter a name for the String.

### **2.7.01 Edit:**

This option lets you edit the existing Strings associated to the Job. Tap on “Geo”, “Strings” and then on “Edit”:



Next:



From the list select the String that you want to erase or if you want to change the parameters of the String tap on “Info”.

Tapping on “Info” will display the following screen:

The screenshot shows a software interface titled "Edit Strings". It contains several input fields for numerical values, organized into two groups. The first group includes YCrds, XCrd, and ZCrds with values 1000.000, 1000.000, and 100.000 respectively. The second group includes YCrds, XCrd, and ZCrds with values 2000.000, 2000.000, and 145.000 respectively. Below these are fields for Start Stake (0.000), Grade(%) (3.182), and Radius (0.000). At the bottom, there are four buttons: Prev, Data, Save, and Exit.

YCrds:	1000.000
XCrd:	1000.000
ZCrds:	100.000
YCrds:	2000.000
XCrd:	2000.000
ZCrds:	145.000
Start Stake:	0.000
Grade(%):	3.182
Radius:	0.000

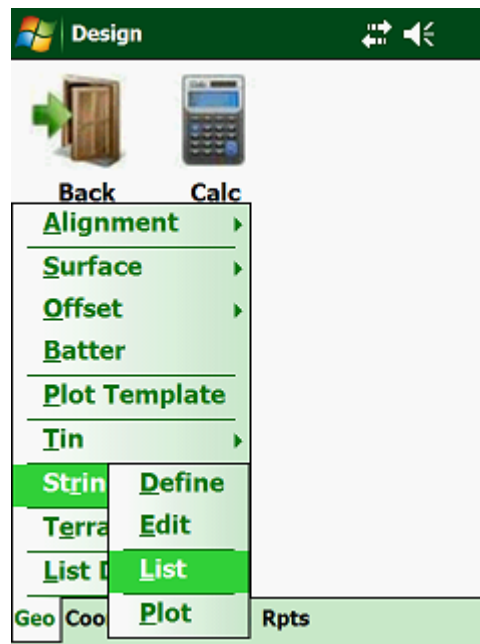
Prev Data Save Exit

Once you have made your changes, tap on the <Save> button.

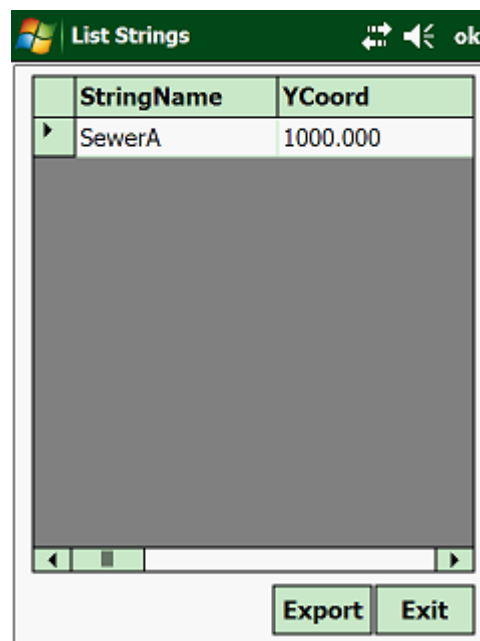


**2.7.02 List:**

This routine will list all the Strings that are associated with the loaded Job. Tap on “Geo”, “String” and then on “List”.

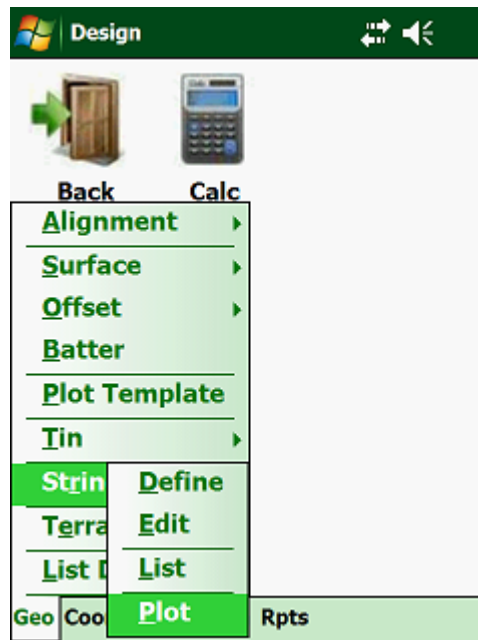


Next:

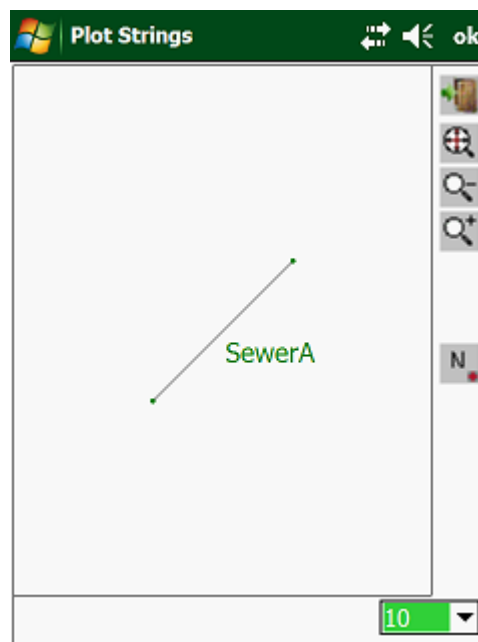


### 2.7.03 Plot:

This will plot all the Strings associated with the loaded Job. Tap on “Geo”, “String” and then on “Plot”.

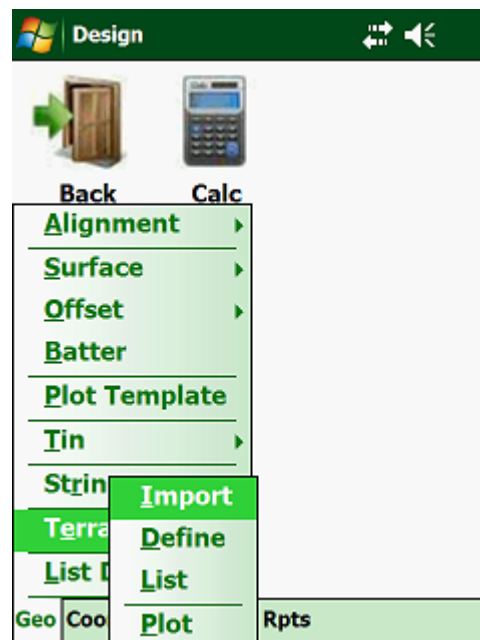
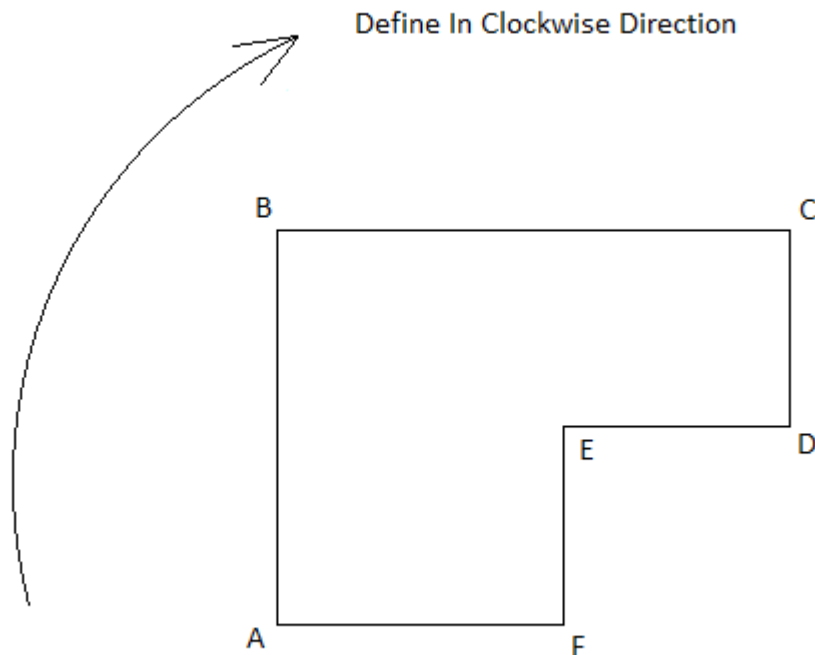


Next:



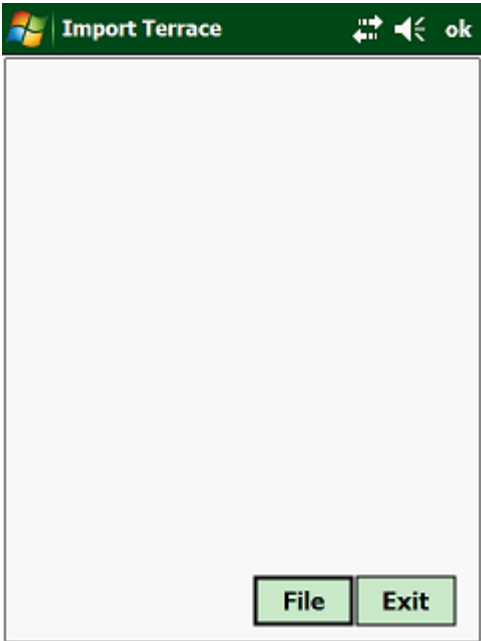
**2.8.00 Terrace:**

Use this routine to define your Terraces. You can enter the coordinates (Y, X & Z) of the corners of the Terrace or you import them from a Text file. Remember that the Terrace has to be defined in a clockwise direction.



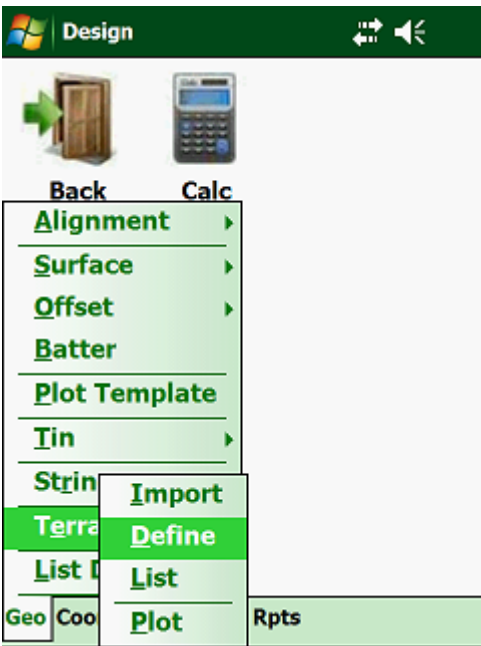
**2.8.01 Import Pts:**

Here you can import the corners of the Terrace from a Text file. The format should be Name, Y Coord, X Coord and Z Coord. If the name is not available, then the program will sequentially number them.

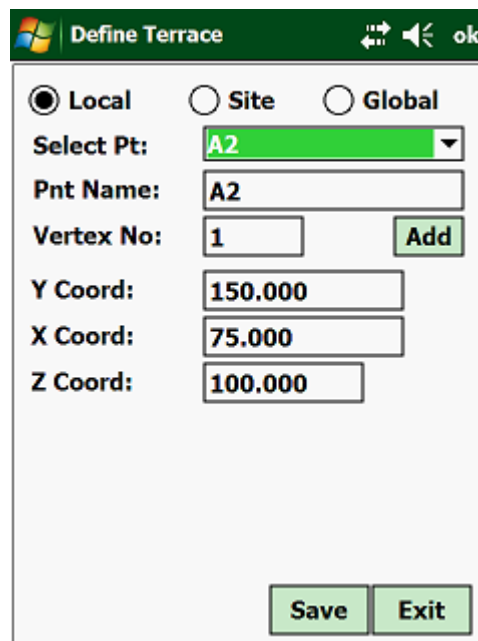


**2.8.02 Define:**

Here you can manually enter the coordinates of the corners of the Terrace.



Next:

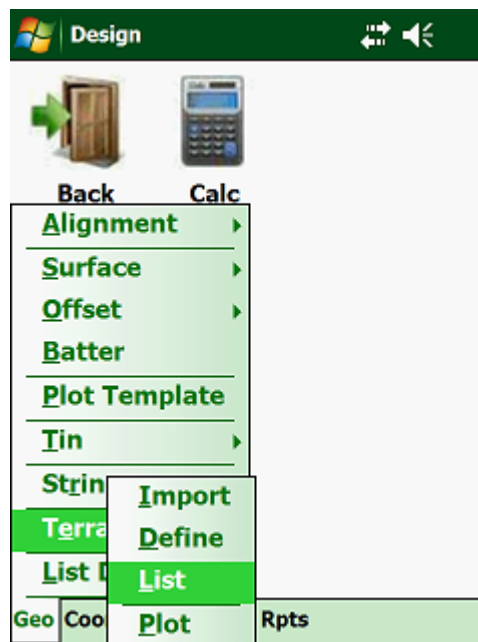


The 'Define Terrace' dialog box is shown. It has a title bar with a Windows logo, the text 'Define Terrace', and icons for help, undo, and 'ok'. Inside, there are three radio buttons: 'Local' (selected), 'Site', and 'Global'. Below them are input fields: 'Select Pt:' with a dropdown menu showing 'A2', 'Pnt Name:' with a text box containing 'A2', 'Vertex No:' with a text box containing '1' and an 'Add' button, 'Y Coord:' with a text box containing '150.000', 'X Coord:' with a text box containing '75.000', and 'Z Coord:' with a text box containing '100.000'. At the bottom right are 'Save' and 'Exit' buttons.

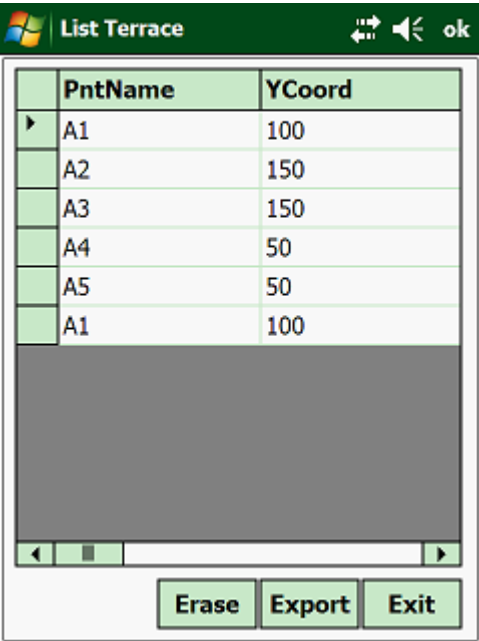
Remember to enter the coordinates in a clockwise direction.

### 2.8.03 List:

This will list the coordinates of your Platform.



Next:

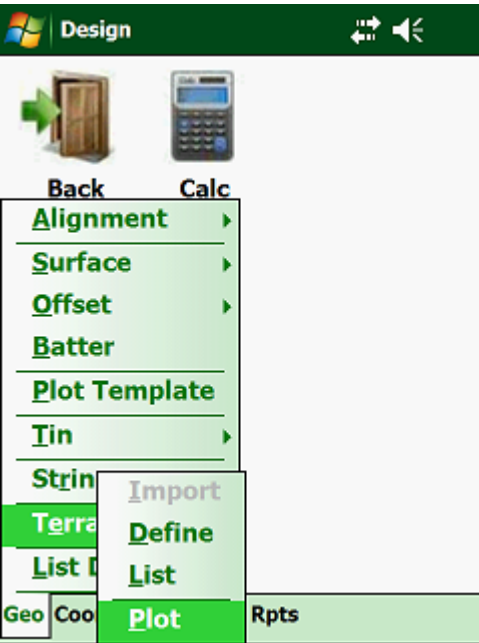


	PntName	YCoord
▶	A1	100
	A2	150
	A3	150
	A4	50
	A5	50
	A1	100

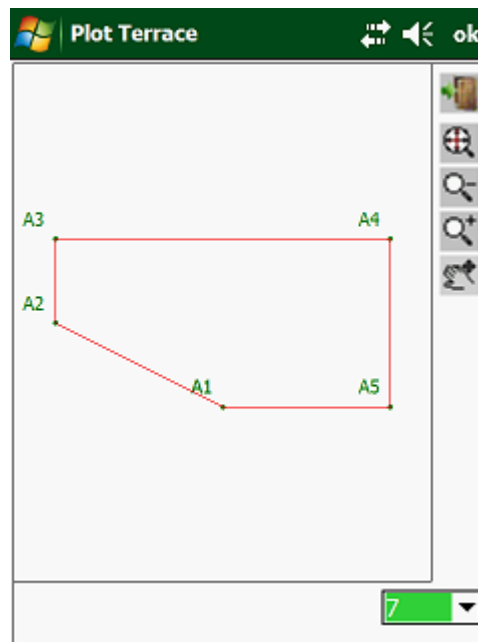
EraseExportExit

**2.8.04 Plot:**

This will plot your platform.



Next:

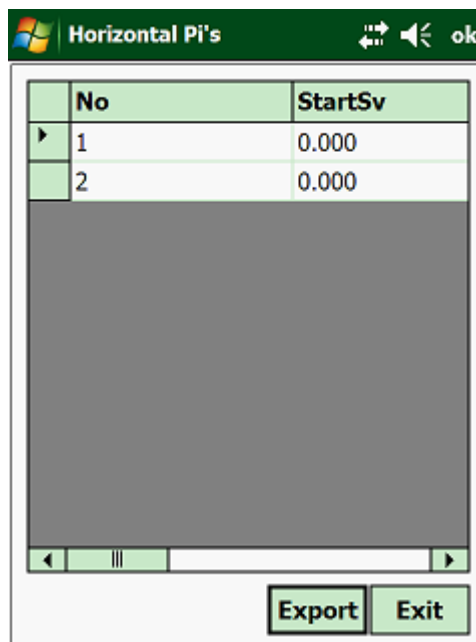


### **2.8.05 List Design:**

This will display all the stored design data in a spreadsheet format.



Next:



	No	StartSv
▶	1	0.000
	2	0.000

Export Exit

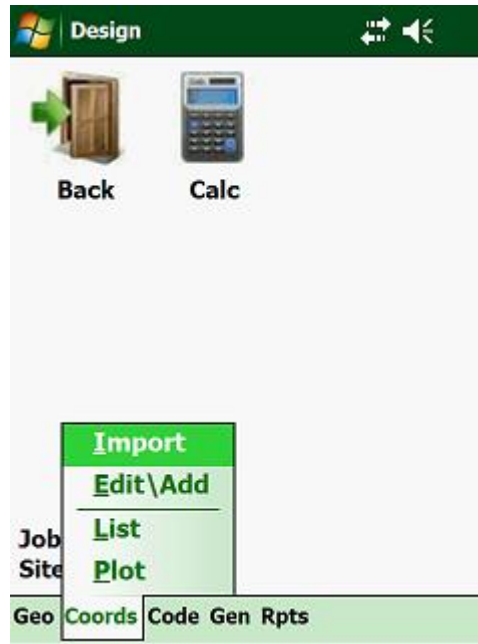
The display is similar for the different design parameters.



### **2.9.00 Coordinates:**

The coordinate file is a reference file that exists on your Handheld and keeps a record of all the coordinates stored during the operation of **Ceaser**. There are three types of coordinate files – Local, Site and Global. The coordinates in the Local file can only be accessed by the loaded Job. The coordinates in the Site file can be accessed by all the Jobs under a specified Site. The coordinates in the Global file can be accessed by all the Jobs.

To access these routines, tap on “Coord”:

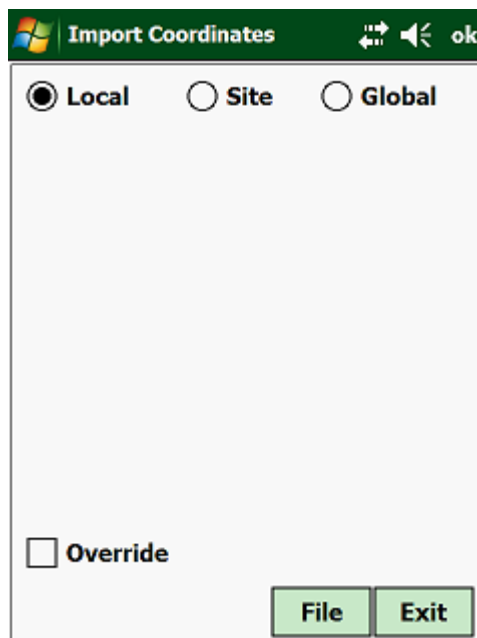


Here you have the following options:

- Import Pts - import coordinates from a Text file.
- Edit\Add - edit, add or delete coordinates.
- List - list the coordinates in a tabular format.
- Plot - plot the coordinates on the screen.

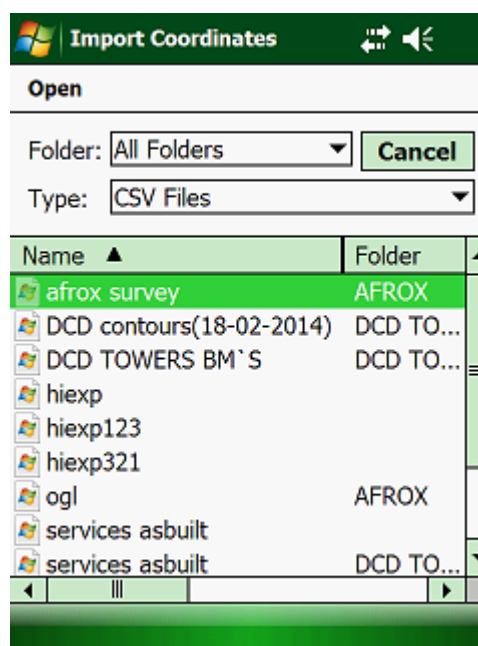
### **2.9.01 Import Pts:**

Here you can import coordinates from a Text file. The format of the file must be: Name, Y, X and Z.



Select whether the imported points are to be stored in the Local, Site or Global file. If you want the imported points to override the existing points, then tap on The “Override” box.

Next tap on “File”:



Select the file to import.

### **2.9.02 Edit\Add:**

Tap on “Edit\Add”:



Next will be shown the following screen:

A screenshot of the 'Edit\Add Coords' screen. It features radio buttons for Local (selected), Site, and Global coordinates. Fields for Select Pt, Pt Name, Y Coord, X Coord, and Z Coord are present, along with a Description text area. At the bottom are buttons for Erase, Copy, Save, and Exit.

At the top of the screen you can either select “Local”, “Site” or “Global” coordinates.

Local coordinates are unique to each Job. Every Job that you have, has its own coordinate file, where there are coordinates stored that can only be accessed by that specific Job which has been opened.

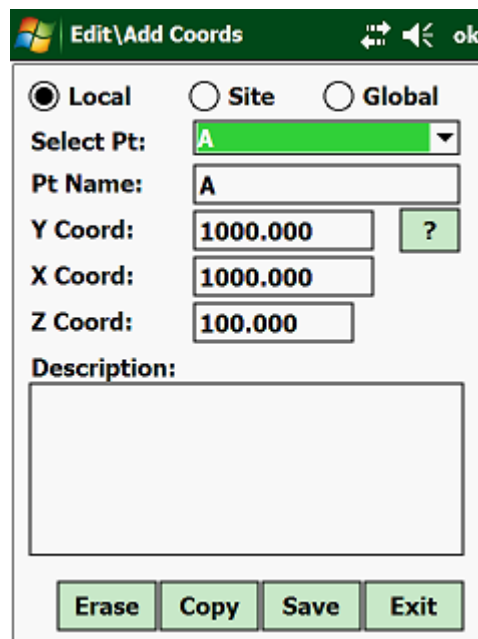
Site coordinates can be accessed by every Job related to the opened Site.

Global coordinates are available to every Site and Job. Every Job that you have can access the coordinates that you have stored in the global coordinate file.

Input required:

- **Point Name** - enter the name of the coordinate point. A maximum of 256 characters can be entered. If the name already exists in the file, then the data will be retrieved and the Y, X and Z coordinates will be displayed.

The program will then display the coordinates of the selected point.



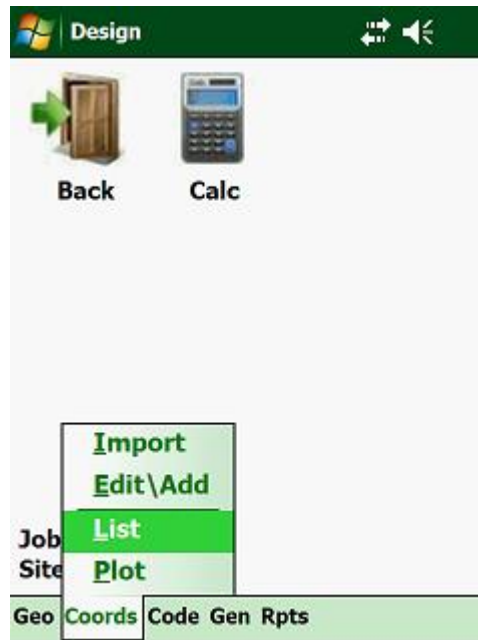
- **Y Coord** - the Y coordinate of the point retrieved will be displayed. This value can be amended. If the point does not exist, then the field will be empty and you must enter the correct Y coordinate of the new point.
- **X Coord** - the X coordinate of the point retrieved will be displayed. This value can be amended. If the point does not exist, then the field will be empty and you must enter the correct X coordinate of the new point.
- **Z Coord** - the Z coordinate (elevation) of the point retrieved will be displayed. This value can be amended.
- **Description** - here you can enter a description of the point up to 256 characters long, i.e. 20mm steel peg, etc.

At the bottom of the screen you have the following options:

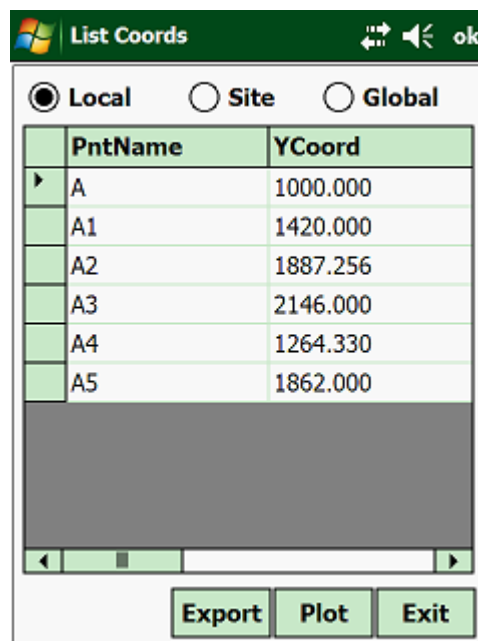
- **Exit** - go to the main screen of the “Design” module.
- **Save** - save the data entered in the database.
- **Copy** - copy the selected coordinate across the different files.
- **Erase** - erase the displayed record.

### 2.9.03 List:

This will display your coordinates in a tabular format. Tap on “Coord” and then on “List”:



This will display the following:

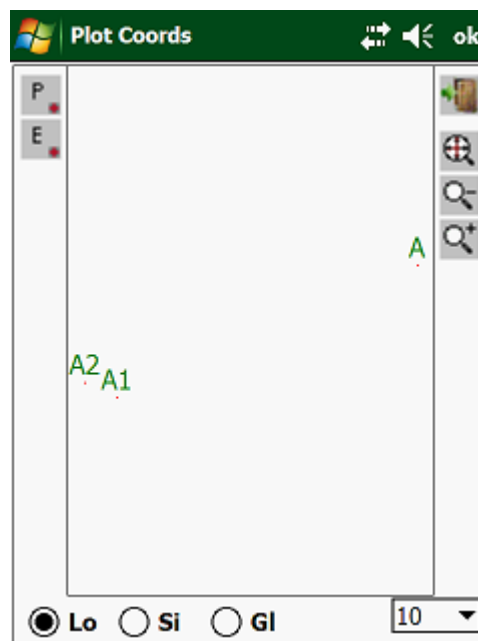


**2.9.04 Plot:**

This routine lets you plot your points on the screen. Tap on “Coord” and then on “Plot”:



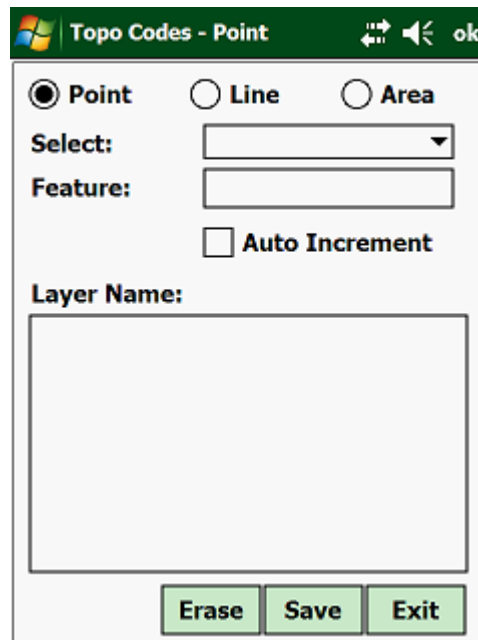
This will display the next:



- Lo - plot Local Coordinates.
- Si - plot Site Coordinates.
- Gl - plot Global Coordinates.

**2.10.00 Code:**

Here you can enter Point, Line or Area codes which you can use with your Topo or GIS surveys. With Topo surveys you will only use point codes, whereas with GIS you will use all 3 types of codes.



Data that needs to be entered:

- Code - enter a code.
- Increment - click on the box to automatically increment your code by one, i.e. River1, River2, River3, etc.
- Layer name - this can be useful if you want to group certain codes together on one layer.

**2.11.00 Gen:**

Here you have the following routines:



- Copy - copy design data from one Job to another Job.
- Import - import design data from a Text file, Roadmaker or LandXML.
- Export - export your design data to a text file.
- List - this will give a tabular display of the content of your design files.
- Erase - erase your design information.

**2.11.01 Copy:**

If you are working with Jobs that have the same widths, crossfalls, etc. then instead of entering the data over and over again for each Job, you can use this function to copy the common parameters which are the same for each Job to each other Job.



Tap on “Gen” and then on “Copy Job To Job”



This will display the following screen:



Be aware that this function will override any existing data in the Job that is being copied to.

### 2.11.02 Import:

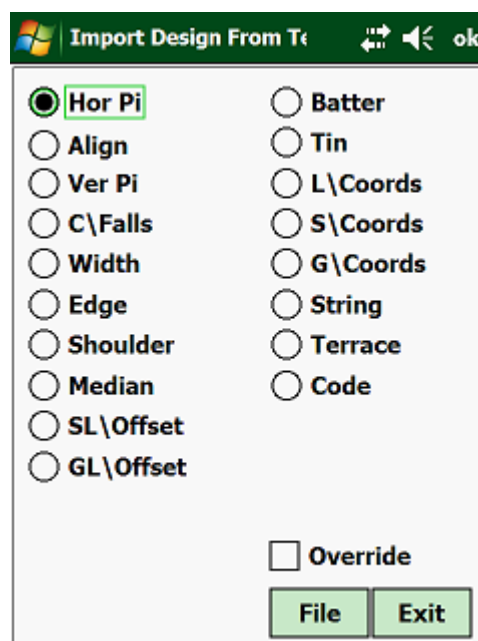
Here you can import design parameters from a comma, tab or space delimited text file or from Road Maker. Tap on “Job”, then on “Import Job Data”. This will give you three options to import from:



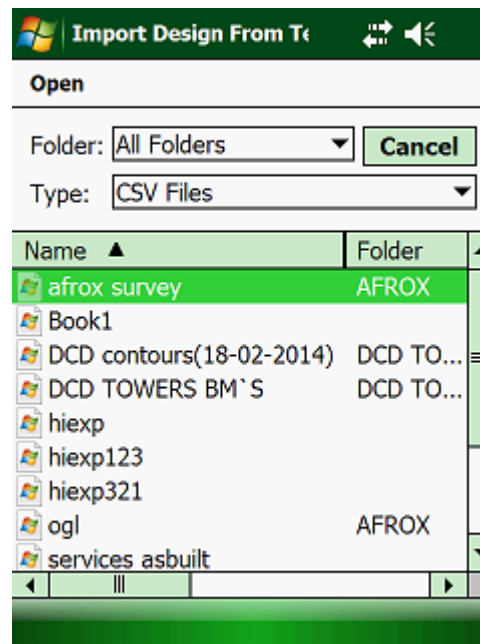
Here you have two options:

- From a text file
- From Road Maker (Model Maker's road program)

Next select the type of design parameter that you need to import.



Next tap on “File”, which will display the following:



Select the file that you want to import and tap on the <OK> button, which will return you to the previous screen. Next tap on “Import” and the program will import the data for you.

Note that if you click “Override”, the program will erase the existing data in the file, before importing the new data else it will add the imported data to the existing file.

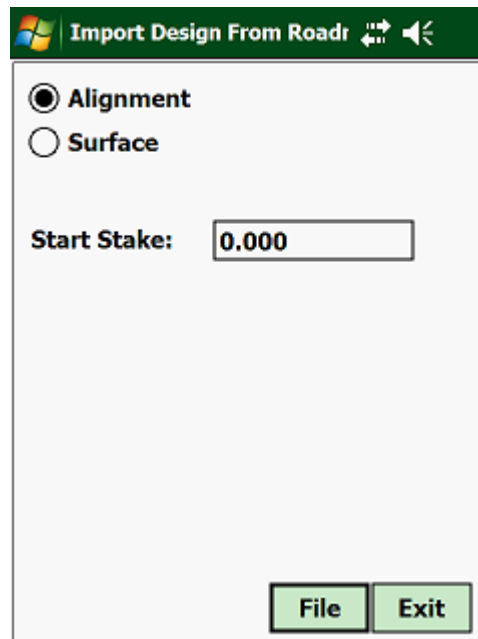
If you are importing data from either Road Maker or Civil Designer, then you will not have the option of selecting which type of data must be copied across. Instead the program will copy the entire Job data over.

When importing from text files, make sure that the files are in the following sequence:

- Horizontal Pi's - Start Stake; Y Coord of Pi; X Coord of Pi; Radius; Transition In; Transition Out.
- Alignment Points- Start Stake; Y Coord of Point; X Coord of Point; Radius (-ve or +ve); Length of Transition; Stake of Point.
- Vertical Pi's - Stake of VPi; Level of VPi; Length of Curve.
- Crossfalls - Stake; Left Crossfall; Right Crossfall.
- Design Widths - Stake; Left Width; Right Width.
- Edge Shifts - Stake; Left Relative Width; Left Relative Height; Right Relative Width; Right Relative Height.
- Shoulders - Stake; Left Width; Left Grade; Right Width; Right Grade.
- Stake Offsets - Stake; Offset.
- Grade Offsets - Stake; Offset
- Batterboards - Side; Condition; Stake; Set; Test Height; Type; Batter; Appendage Width; Appendage Height.

- Strings - Y Coord; X Coord; Z Coord; Y Coord 1; X Coord 1; Z Coord 1; Start Stake; Grade; Radius.
- Tin Model - Y Coord; X Coord; Z Coord; Y Coord 1; X Coord 1; Z Coord 1; Y Coord 2; X Coord 2; Z Coord 3.
- Coordinates - Name; Y Coord; X Coord; Z Coord.

With the Roadmaker option, your screen is as follows:



Roadmaker stores its design information in two files:

- PID - in this file the Horizontal Alignment data is stored.
- PR3 - this file keeps the vertical Alignment, Widths, Crossfalls, Kerbs, etc.

**Note: the current version of the program does not read the start stake value of the Horizontal Alignment (PID) file and you will have to enter that value. The default is 0.000, but from the drawing you will be able to determine the start stake value.**

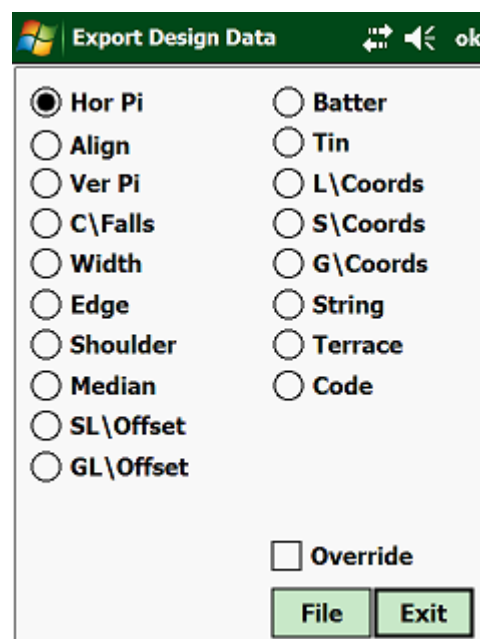


**2.11.03 Export:**

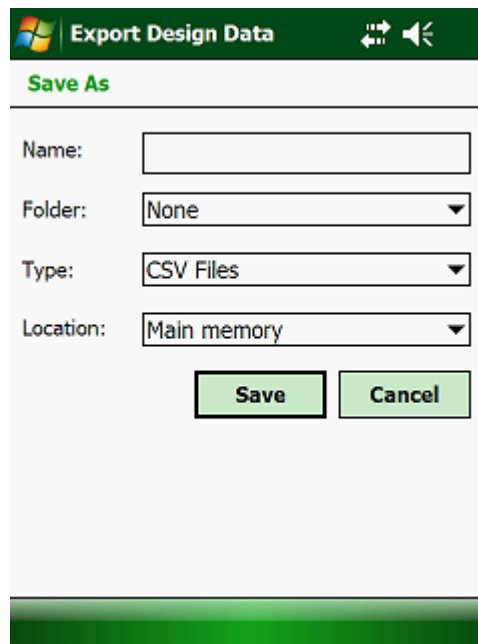
This option lets you export your design or your field data to a tab delimited text file. From the pulldown menu, select “Export Job Data” and select then either “Design Data” or “Field Data”.



Next select which file you want to download. Remember that the program will not export the data to the PC. All that the program does is to convert the information in the database to a text format. You will still have to connect with Microsoft Sync and drag the files across to your PC.

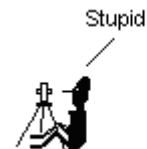


Next select or type in a new name of the file where the data has to be stored:



The image shows a dialog box titled "Export Design Data" with a Windows logo icon on the left and two icons (a double-headed arrow and a speaker) on the right. Below the title bar, the text "Save As" is displayed in green. The dialog contains four labeled input fields: "Name:" with an empty text box, "Folder:" with a dropdown menu showing "None", "Type:" with a dropdown menu showing "CSV Files", and "Location:" with a dropdown menu showing "Main memory". At the bottom of the dialog are two buttons: "Save" and "Cancel".

Once this has been done, click on <OK>, which will return you to the previous menu. Here you tap on “Export”, which will store the converted data in the selected file.



**2.11.04 List:**

With this routine, you can list all the data content of a selected Job. Tap on “List”, which will give you the following:



Select the required Job and tap on <OK>, which will display the following:

Item	Data
Horizontal Pi's	2
Alignment Points	2
Vertical Pi's	1
Crossfall	1
Surface	1
Edge Shift	1
Shoulder	1
Stake Offset	0
Grade Offset	0
Batters	0
TIN Model	1
Strings	1

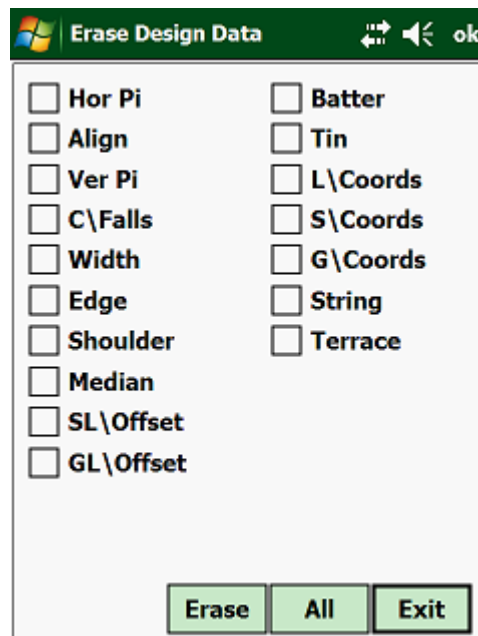
Export Exit

**2.11.05 Erase Design:**

Here you can erase data that is not required anymore. You must remember that here you cannot delete the entire Job, but only selected design data or field data. Field data is the information that gets recorded while you are busy surveying in the field. Tap with your stylus on “Erase”:



Select which type of data you want to erase and tap on it.



Once you have selected all, tap on “Erase” and the program will erase the selected data.

**There Is No “Undo” Option For Erased Data!**

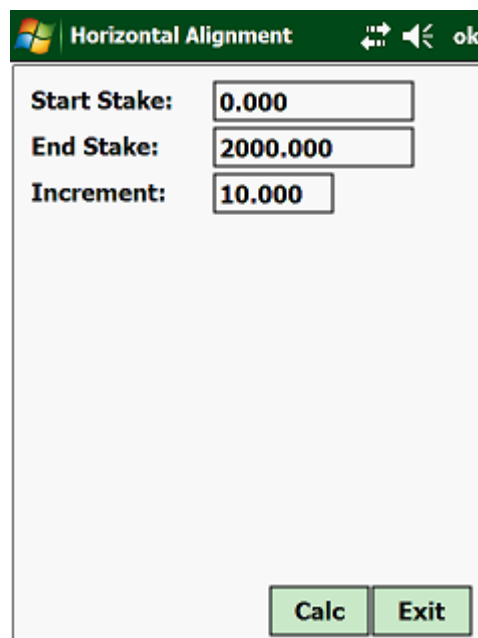


**2.12.00 Rpts:**

Use this function to check your design input of your Geometric Parameters against the drawings from which you have extracted the design.



Next:



Enter your required variables to calculate the range that you want to check.

## **CHAPTER 3: Field**

**3.1.00 Introduction:**

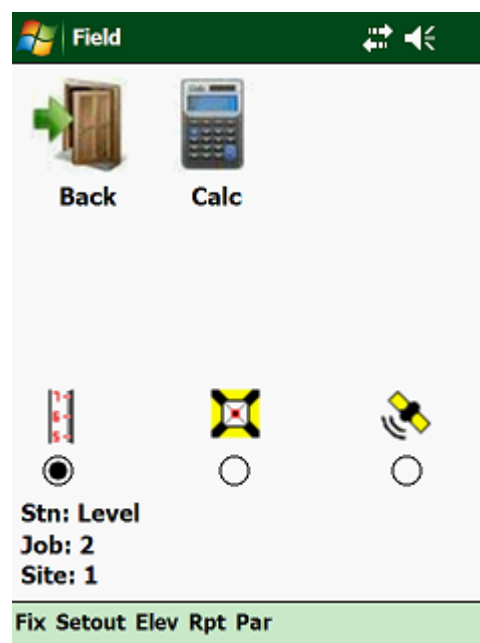
The “Field” module is the one that you will use to do all your setting out works, fix your position in the field, log Topo shots, etc.



Tap on



the icon and the next will be displayed:



At the top of the screen you have your exit and calculator icons. At the bottom of the screen you can tap on the type of instrument you are using. Tapping on the icons, will indicate the setup parameters of each instrument.

### **3.2.00 Fix:**

Before any setting out can be done, where coordinates are involved, it is necessary that you first determine where your instrument is set up. If you are using an instrument other than a level, then you will not be able to do any of the setting out, elevation or logging routines, unless you have fixed your position in the field.

#### **CEASER NEEDS TO KNOW WHERE YOU ARE !**

If adequate observations have been taken, the program will perform a least squares adjustment on the observation results.

Standard deviations and residuals for Y, X, Z and orientation corrections are computed and displayed.

The trig heightening for a station is a weighted mean.

The orientation correction is a mean of all the single corrections calculated.

The following routines support a Total Station connected to **Ceaser**:

- Eccentric setup
- Trilateration
- Resection
- Free Positioning
- Orientation and trig heightening
- Polar Fix

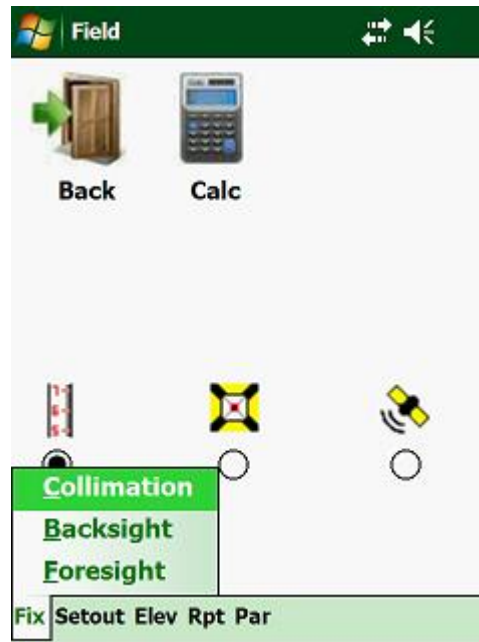
Instruments supporting dual communication will be orientated if "Orientation" is checked. If your instrument does not support dual communication capabilities, then all horizontal angles will be adjusted by the correction calculated – i.e. the bearings displayed will be false bearings.

No trig-height will be calculated if any of the following conditions apply:

- Z coordinate of the station     = 0
- Vertical direction                = 0
- Distance measured               = 0

All routines necessary to calculate your position in the field is found under the “Fix” option on the program.

These routines can be accessed by pressing the right or left arrow on the Handheld, until the pull down menu under "Fix" is activated .



#### For a Level:

- Collimation - lets you enter the collimation height of your Level.
- Backsight - allows you to take a backsight reading on a benchmark to fix your collimation height.
- Foresight - here you can take a foresight reading on a point to establish a new benchmark in case you want to change the position of your Level and determine a new collimation height.

#### For a Total Station:

- Unknown Coords - you do not know where you are.
- Known Coords - you know the coordinates of your setup point
- Stake + Offset - you are standing at a known stake value and offset relative to the alignment of the Job that is active.
- Orient - use this to orientate your Station.
- Trig Hgt - this will fix the height of your Station.
- Stn Hgt - you know where you are, but the height is unknown.
- Polar Fix - fix the coordinates of a new point.

#### For a GPS:

- Setup Base - setup your Base Station.
- Setup Rover - setup your Rover.
- Calibration - calibrate your survey system.

All observations, misclosures and final coordinates can be stored, downloaded to the PC and a hardcopy printed for record purposes.

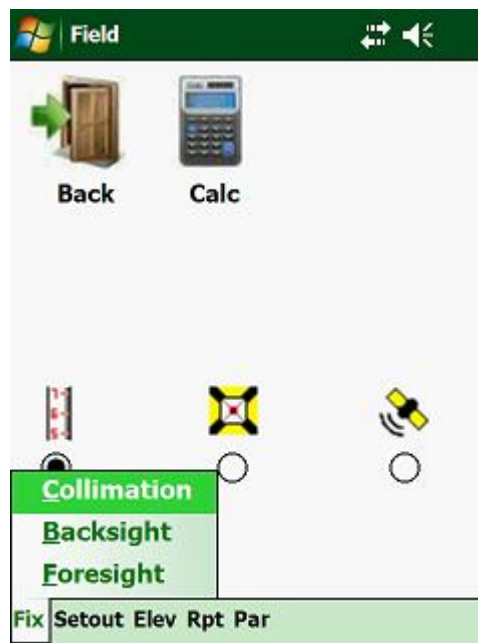
If the “Record” option under your parameters is set to “Yes”, **Ceaser** will store the raw field observations automatically.

Once you have fixed your position in the field, the station name will appear on the screen of the PDA, at the left bottom side. This station will then be used for all the Sites and Jobs that you work on, until such time that you fix your instrument at a new station. This also applies should you exit the program and return again.

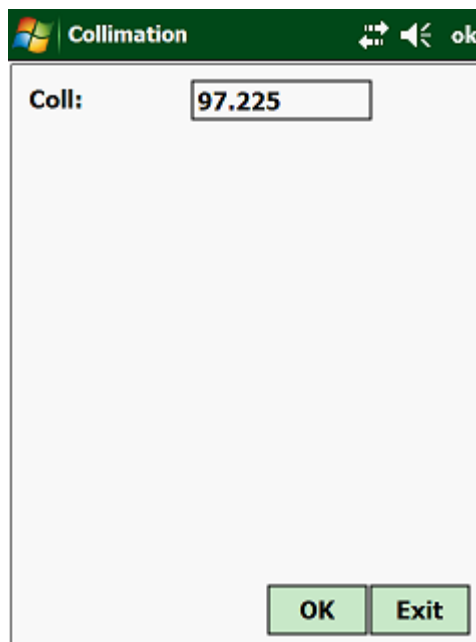


### **3.2.01 Collimation:**

When using a Level and you want to override the collimation that is in memory, tap on “Collimation”:



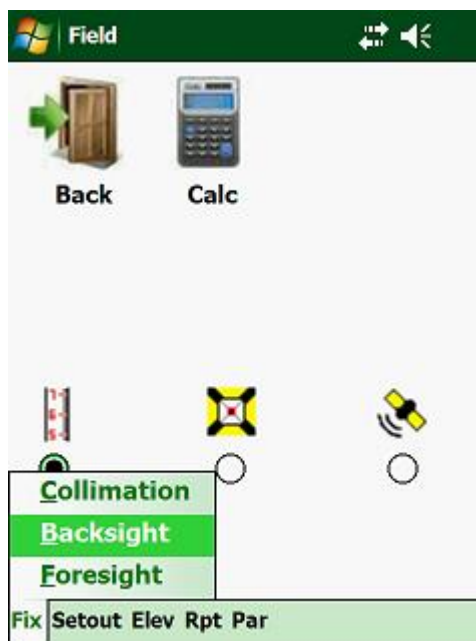
Which will display the next:



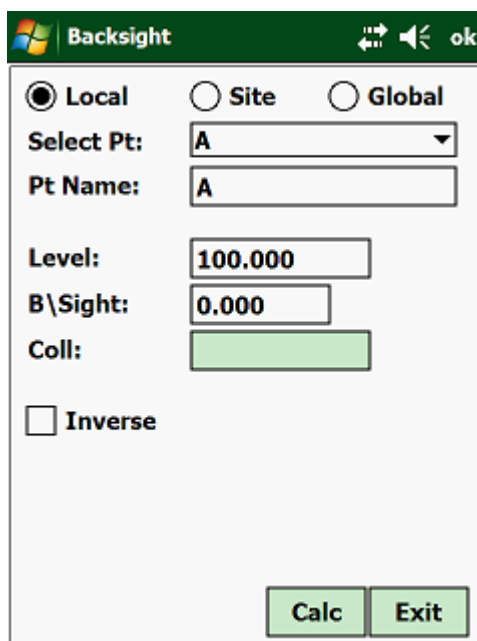
Enter the new collimation and tap on the <OK> button.

### **3.2.02 Backsight:**

If you want calculate a new collimation using one of the control points in your reference files, select “Backsight” from the pulldown menu:



This will display the following:



At the top of the screen, you have the option of selecting which coordinate file you want to access, i.e. “Local”, “Site” or “Global”, by tapping on the respective file type.

Bear in mind that “Local” coordinates are only those that belong to the opened Job, “Site” coordinates can be accessed from all the Jobs related to a Site and “Global” coordinates can be accessed from all Sites and Jobs.

You can select the height of the control point from the combo dropdown box or by typing in the name of the control point and then tapping on the “?” button. This will display the height of the point in the “Elevation” box.

Next, type in the staff reading in the “B\S Reading” box and tap on the <Calc> button. This will calculate the collimation height.

If you are connected to an Electronic Level, there will be a <Read> button at the bottom of the screen, instead of a <Calc> button. Tap on the <Read> button, which will attempt to read the bar coded staff and if successful, will display the reading in the “B\S Reading” box and the new collimation in the “Collimation” box.

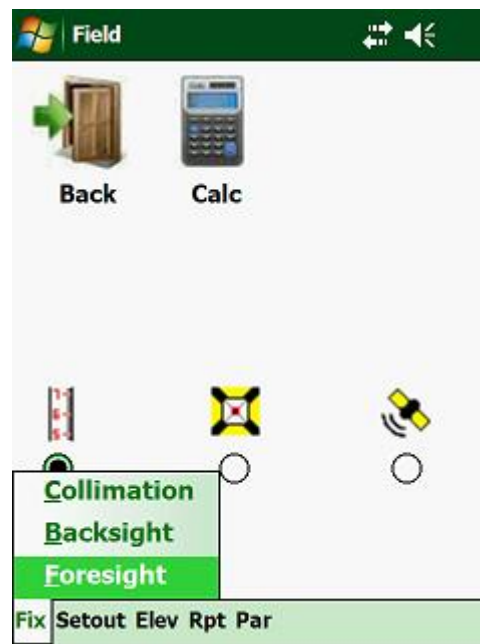
If you accept the new collimation height calculated, tap on the <OK> button.

### **3.2.03 Foresight:**

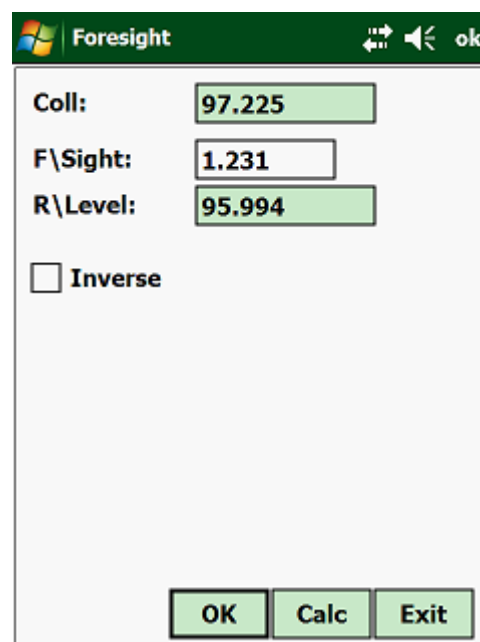
The “Foresight” is a reading to either an existing control point, to check the integrity of your survey or when you want to make a change point, move the instrument and establish a new collimation height.



From the main menu select “Foresight”:

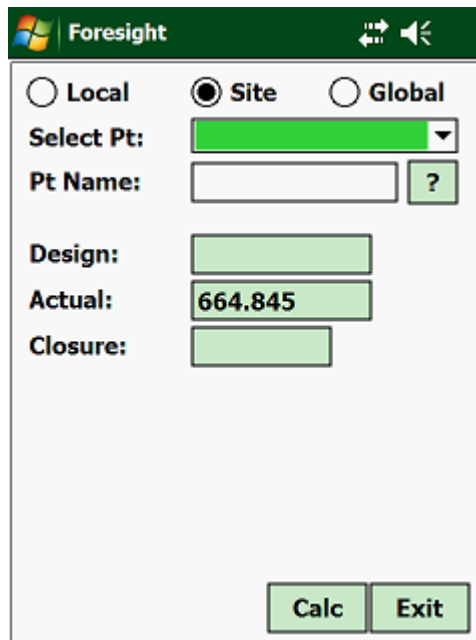


Which will show you:



The top box will show you the present collimation. Next, type in the staff reading or tap on the <Read> button if you are connected to an Electronic Level. The <Calc> button will be replaced by a <Read> button should you be connected to an Electronic Level.

Next the program will calculate the reduced level. If this is not a change point, but a closer on a known point, you can check your misclosure by tapping on the “Check” button:



**Foresight**

☐ Local    ☒ Site    ☐ Global

Select Pt:   ▼

Pt Name:  ?

Design:

Actual: 664.845

Closure:

Calc    Exit

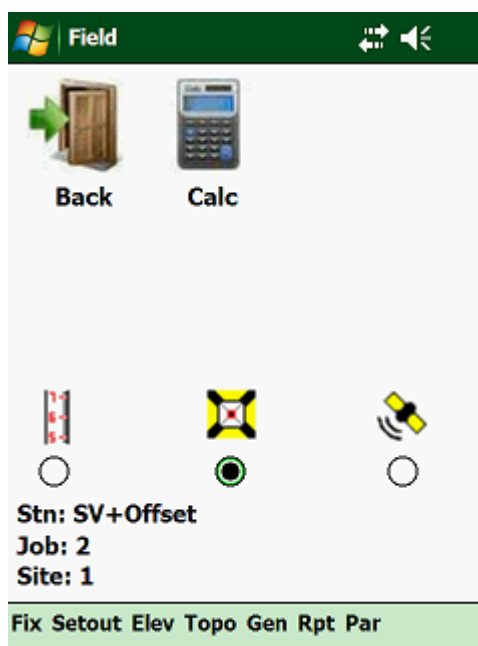
Select which coordinate file you want to use, select the required point or type in the name of the point and tap on “?”.

The program will then display the height of the point, the actual height and the misclosure.

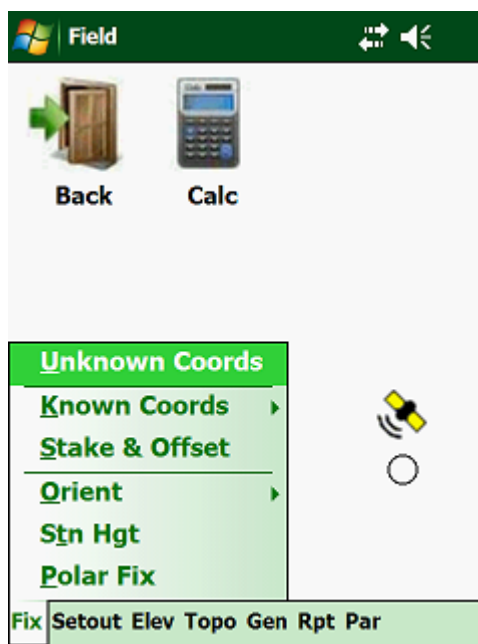
### **3.3.00 Unknown Coords:**

Unknown coordinates are, as the name implies, a place that your instrument occupies which coordinates are unknown to you. It is much quicker to be able to set up your instrument at any place you choose, than to set up your instrument over a known point.

First tap on the “Total Station” icon at the bottom of the screen:



From the pulldown menu, tap on “Unknown Coords”



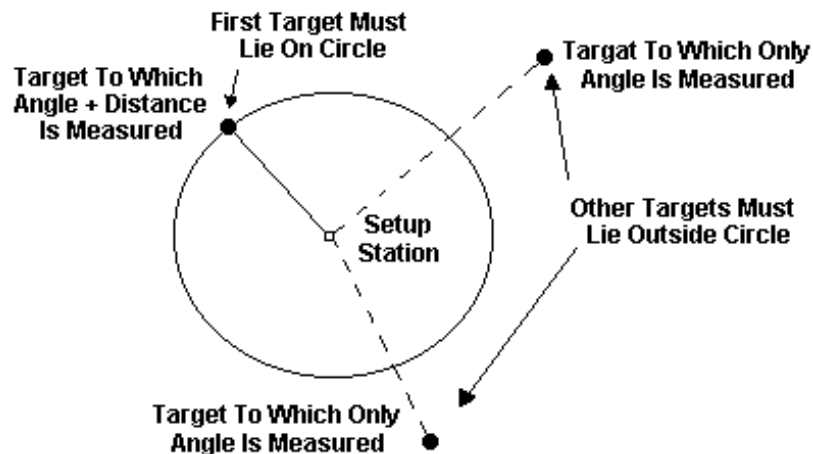
Depending on what targets and how many and also the type of observations you have logged, the program will solve for one of the following:

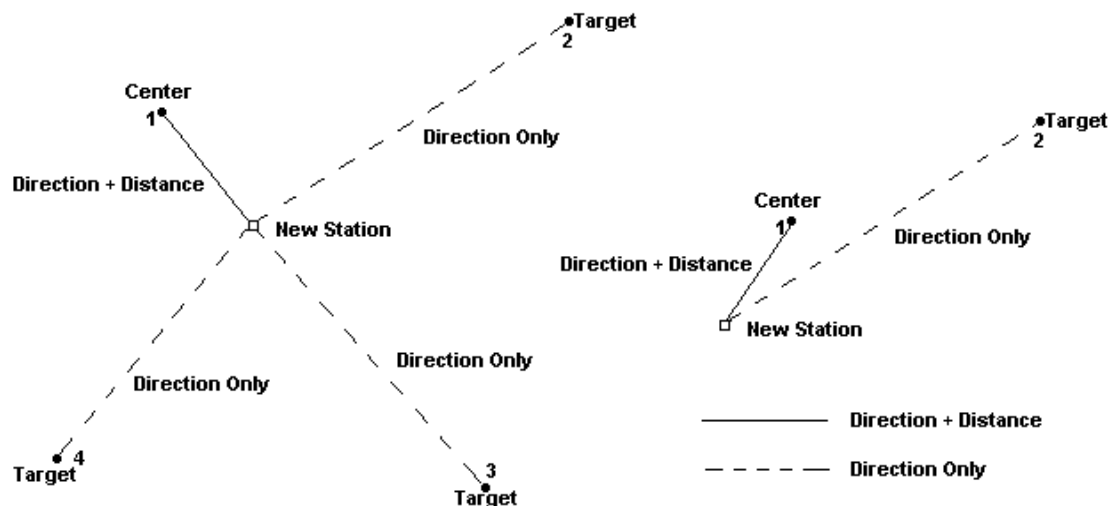
- Eccentric setup
- Resection
- Free Positioning

It will depend on the field conditions and the reference points available, which method the program will be used to fix your position in the field.

**a) Eccentric:**

An eccentric setup, is where you set up your instrument close to a known point, observe the angle and distance to this known point and then observe only the angle to some other known point. It is important that the target to which you observe the angle and distance to, is closer than the other target, to which you only observe the angle. In other words, the targets to which you are only recording the angles to, must lie outside the circle subscribing the first known point and the setup point.

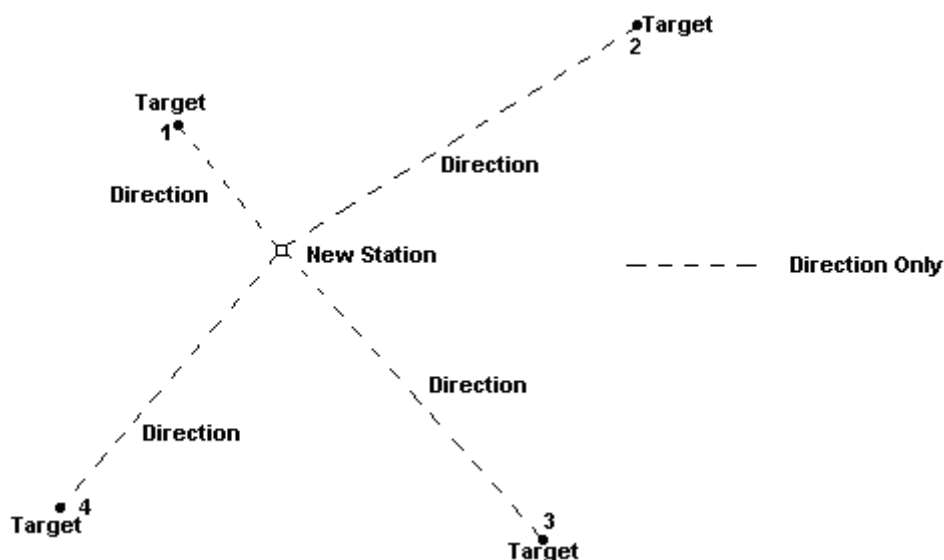




Also, you must keep the angle between the first target (the one to which the distance and angle is observed) and the other targets observed bigger than 30 degrees. The accuracy of the calculated point will diminish as the included angle gets smaller.

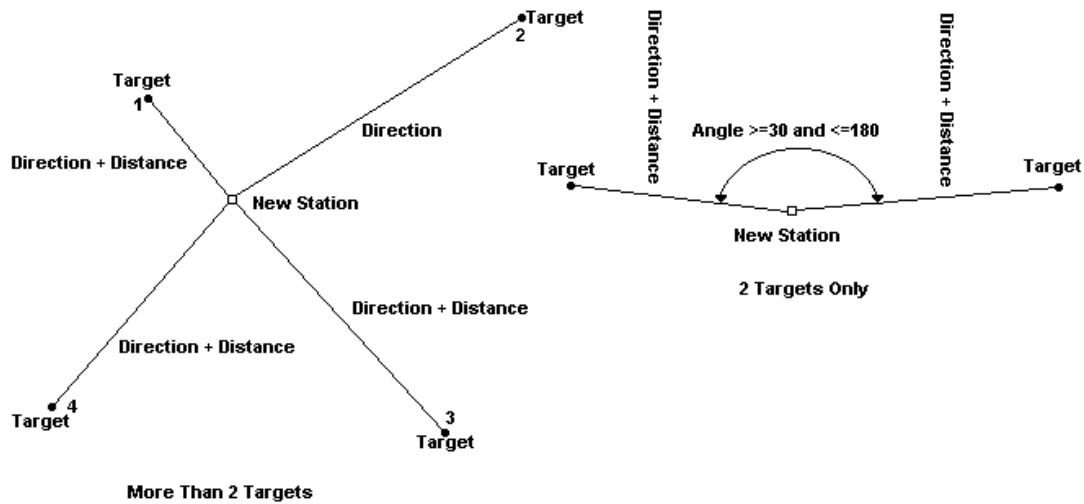
#### **b) Resection:**

A Resection lets you determine the coordinates of your setup point, by observing only the horizontal and vertical angles to at least three targets. If possible try to observe a 4<sup>th</sup> target to verify the accuracy of the calculated point.



**c) Free Positioning:**

Free Positioning is the method of fixing your position in the Y, X and Z plane by observing the angles and distances to at least 2 targets.



After tapping on “Unknown Coords”, the following will be displayed:

The screenshot shows the 'Free Station Setup' dialog box. It has a title bar with a Windows logo, the text 'Free Station Setup', and icons for help, back, and 'ok'. The dialog contains the following fields and controls:

- ☒ Calc Hgt
- ☒ Orient
- Inst Hgt: 0.000
- Inst Face: Left (dropdown menu)
- ☒ Local, ☐ Site, ☐ Global
- Select Pt: A (dropdown menu)
- Pt Name: A
- Target: 0.000 (input field) and a green button with a question mark
- Buttons at the bottom: HVS, HV, and Exit

Tap on “HVS” to observe the horizontal, vertical and slope distance to a target. Tap on “HV” to observe only the horizontal and vertical angles to a target. Once you have logged all your targets, tap on <Calc> to calculate a position (Y,X & Z) of your setup point. The program will also calculate a horizontal angle correction for you.

Once all the observations have been completed, the program will then calculate the coordinates of the setup point, as well as the horizontal correction:

If you are linked up to a Total Station, the program will orientate the instrument for you.

If you have observed more than 2 targets, the program will calculate and display the residuals to you.

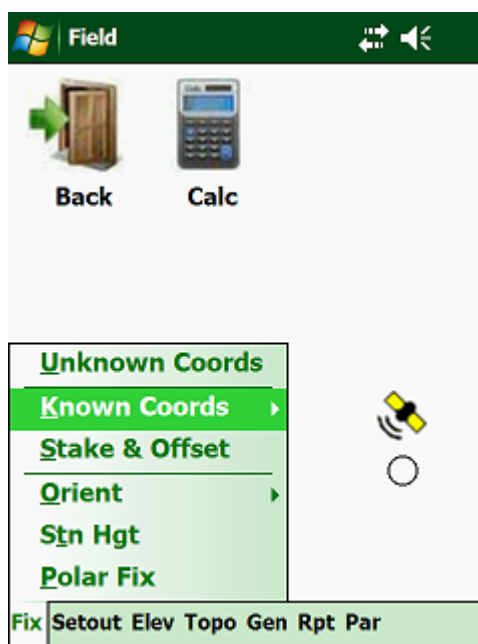
**Note:**

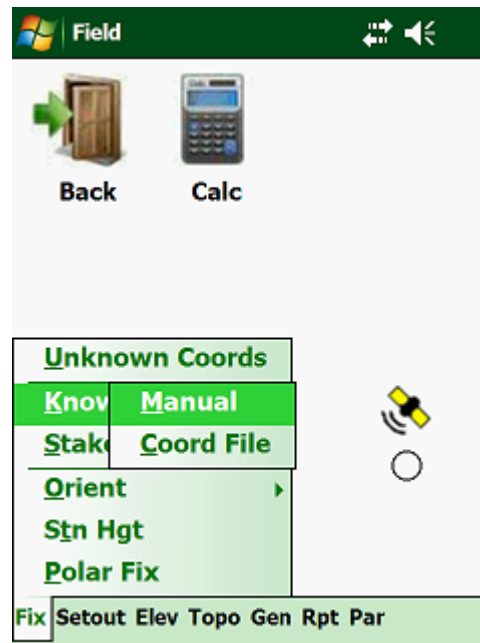
- A maximum of 50 targets for both faces and a maximum of 100 targets, for single faces, observations can be made.

### **3.3.01 Known Coords:**

If you know the coordinates of the point where you have set up your instrument, then you can type them in via the keyboard or call them up from the local or global coordinate file.

To select this option tap on “Known Coords”:



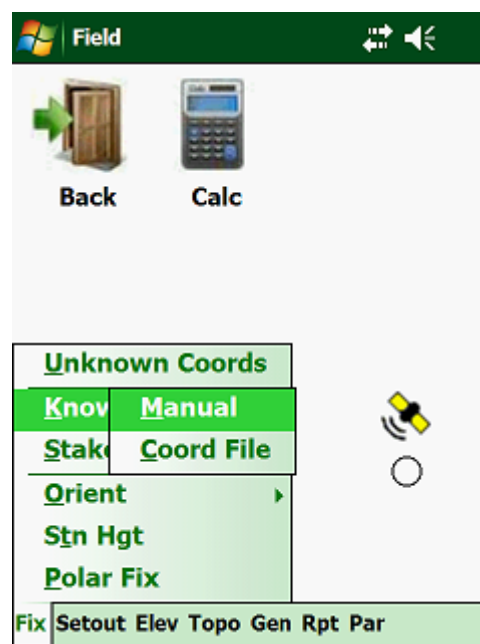


Here you have two options:

- Manual - type in the coordinates.
- Coord File - select from either the Local, Site or Global file your setup point.

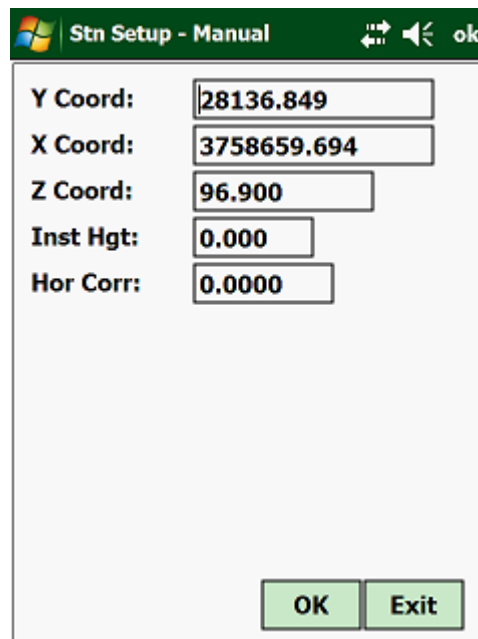
### **3.3.02 Manual:**

To enter the coordinates of your setup station manually, tap on “Known Coords” and then on “Manual”.





This will display the following screen:



The screenshot shows a software window titled "Stn Setup - Manual". It contains five input fields for station data: "Y Coord:" with the value "28136.849", "X Coord:" with "3758659.694", "Z Coord:" with "96.900", "Inst Hgt:" with "0.000", and "Hor Corr:" with "0.0000". At the bottom right, there are two buttons labeled "OK" and "Exit". The window has a standard Windows-style title bar with a logo, the title, and icons for help, back, and OK.

Here you must enter the following:

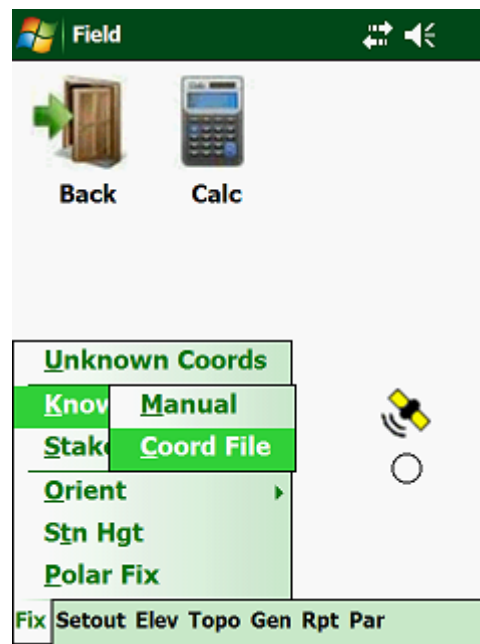
- Y Coord - Y coordinate of the station.
- X Coord - X coordinate of the station.
- Z Coord - Z coordinate (the height) of the station.
- Inst Hgt - enter the height of your instrument.
- Hor Corr - horizontal correction. This will be added to all your horizontal angles for the setting out routines and when logging Topo data, i.e. you will be working with false bearings.

To apply the new station setup, tap on the <OK> icon.

### **3.3.03 Coordinate File:**

If you are set up at a known station and know the name of the point, then you can call up the coordinates from either the local or global coordinate file. You can toggle between the local and global coordinate file by tapping on the required file type.

To access this routine tap on “Known Coords” and then on “Coord File”.



This will display the following screen:

First select whether you want to use the Local, Site or Global coordinate file.

Next you must enter the following:

- Pnt Name - select from the pulldown list at which station you are standing.
- Inst Hgt - enter the height of your instrument.

- Hor Corr - enter the horizontal correction.

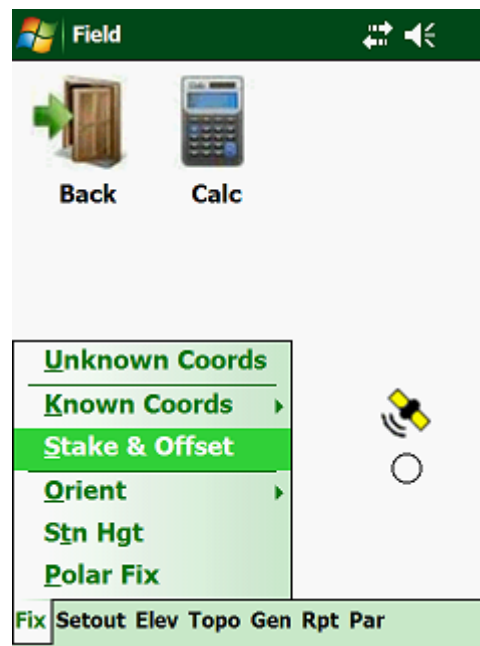
You can also type in the name of the control point and then tap on the “?”. The program will then look for the point in the coordinate file and display the coordinates of the point in the respective textboxes.

To apply the new station setup, tap on the <OK> icon.

### **3.3.04 Stake + Offset:**

If have an alignment stored for the particular Job that you are working with, you can also fix your position if you know at what stake value and offset you have set up. The program will not be able to fix the Z coordinate, but this you can determine with one of the other routines.

Tap on “Stake + Offset”



The input screen is as follows:

Setup By Stake & Offset

Stake:

Offset:

Inst Hgt:

Y Coord:

X Coord:

Z Coord:

Calc Exit

Data that has to be entered here:

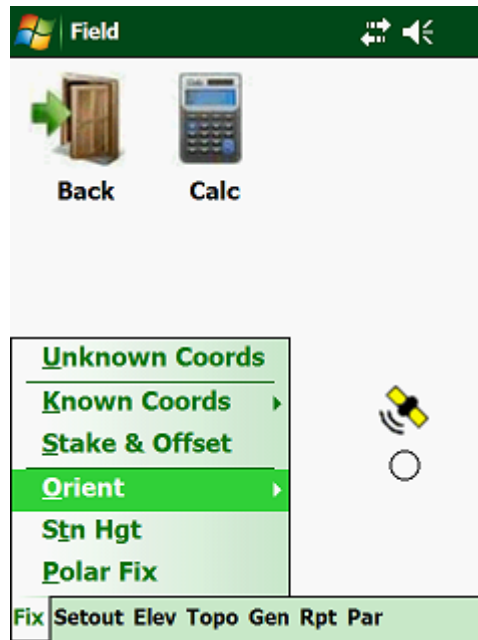
- Stake Value - enter the stake value at the point where your instrument is set up.
- Offset - enter the offset from the stakeline where your instrument is setup. If you are to the left of the stakeline, then enter the offset as a negative value, else if you are to the right of the stakeline, enter the offset as a positive value.

Once you have entered the stake value and offset of your setup point, you will be required to enter the horizontal correction and the height of your instrument.

To apply the new station setup, tap on the <OK> icon.

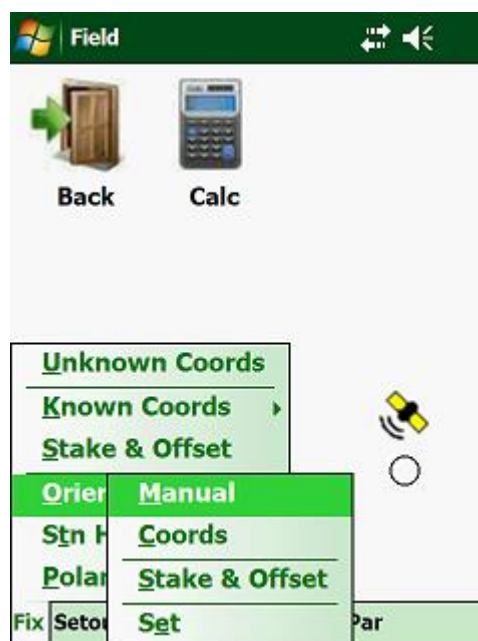
### 3.3.05 Orient:

If you have selected to setup at a known point, your instrument would most likely not be orientated. Use this function to orientate your instrument. From the pulldown menu select “Orient”:



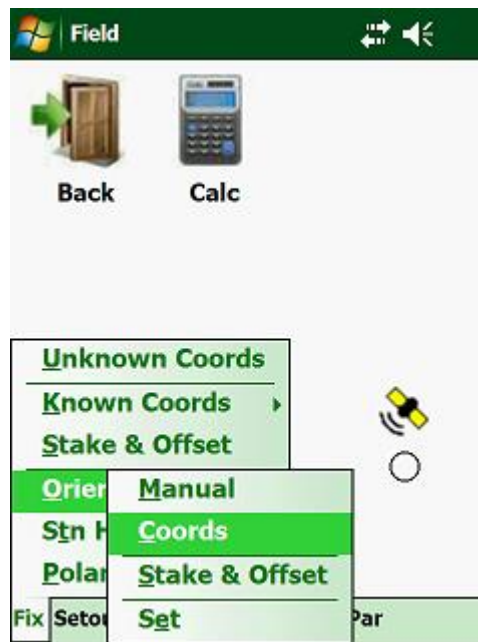
Here you have four options:

- Manual - orientate your instrument by entering coordinates.
- Coords - orientate your instrument using one of your coordinate files.
- Stake + Offset - orientate your instrument on a Stake value and Offset point.
- Set - set the horizontal angle on your instrument.



### **3.3.06 Coords:**

To orientate on a known point from one of your coordinate files, tap on “Coords” from the menu:



Input screen:

A screenshot of the 'Orientate Station' input screen. The screen has a green header bar with the title 'Orientate Station' and icons for navigation and an 'ok' button. The main area contains the following controls: a checked checkbox for 'Orient'; three radio buttons for 'Local' (selected), 'Site', and 'Global'; a 'Select Pt:' dropdown menu with a green bar; a 'Pt Name:' text input field; an 'Inst Face:' dropdown menu with 'Left' selected and a '?' button; and three empty input fields for 'Angle:', 'Bear:', and 'Hor Corr:'. An 'Exit' button is located at the bottom right.

Tap on which file you want use, i.e. Local, Site or Global file.

Bear in mind that the “Local” file holds only coordinates for the Job that is open. The “Site” file that be opened by all the Jobs that are related to the opened Site and the “Global” file can be accessed by all the Sites and Jobs.

Next tap on the arrow in the Combobox to display all the available points and then tap on the required point.

Else you can enter the name of the point in the “Pnt Name” textbox and tap on the “?” button.

Select next whether your instrument is in the face left or face right position.

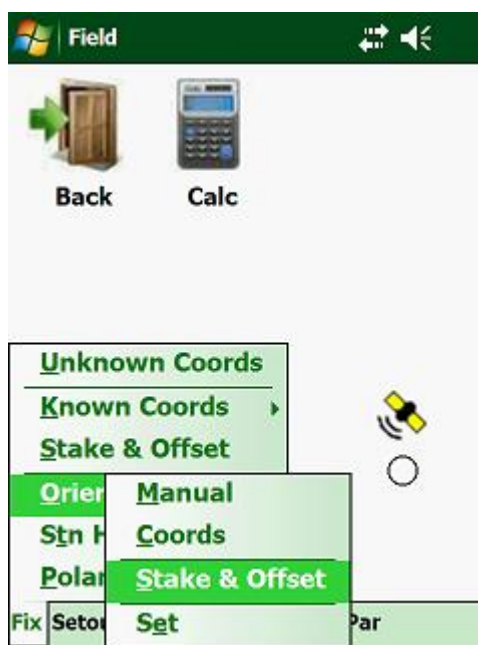
If you are connected to a Total Station the <Calc> button will be replaced by a <Read> button. If working in manual mode you have to type in the horizontal angle in the “Hor Angle” textbox.

Tap on the <Calc> button to calculate the horizontal correction.

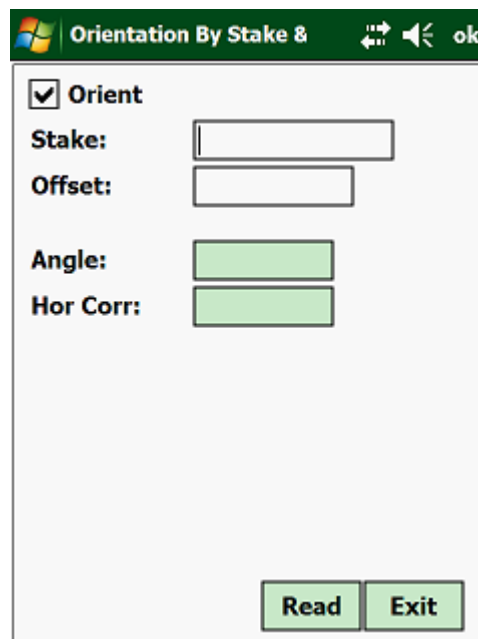
To apply the horizontal correction tap on the <OK> button. If working in manual mode, this correction will be applied to all the horizontal angles. If attached to a Total Station, the program will orientate the instrument for you and the horizontal correction will be zero.

### **3.3.07 Stake + Offset:**

If you have a known point on your Job, which stake value and offset are known to you, you can use it to orientate your Total Station. From the pulldown tap on “Orient” and then on “Stake + Offset”:



Input screen:



- Stake Value - enter the stake value of the point.
- Offset - enter the offset of the point from the stakeline, either negative if to the left or positive if to the right.

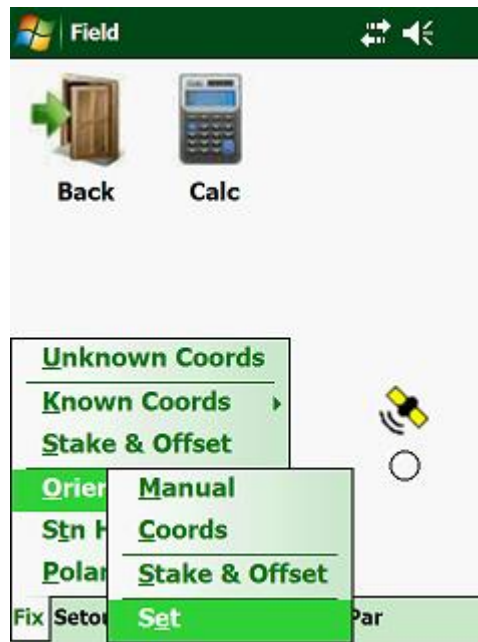
Tap on the <Read> button and your instrument will read the horizontal angle from the instrument and display it in the “Angle” textbox.

The horizontal angle correction will be displayed in the “Hor Corr” textbox. The program will change the angle on your instrument to the correct bearing.

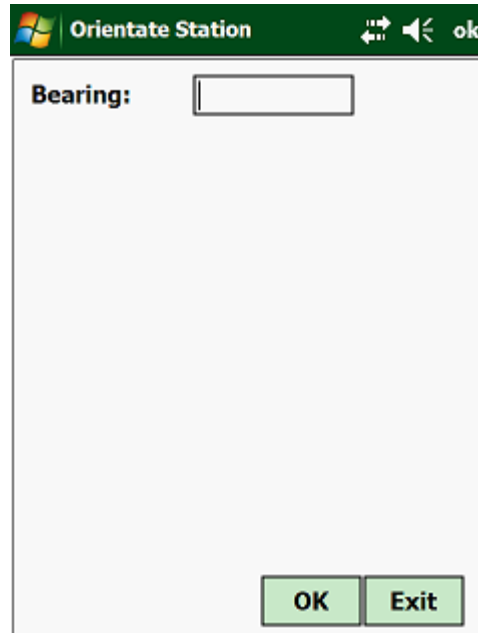


**3.3.08 Set:**

This lets you set the horizontal angle on your Total Station. Tap “Orient” and then on “Set”:



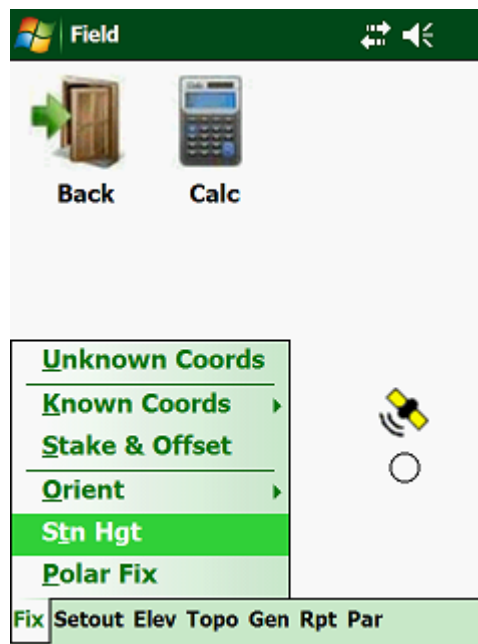
The following input screen will then be displayed:



Enter the angle that you want to have displayed on your Total Station and tap on the <OK> button.

### **3.3.09 Stn Hgt:**

Use this function to determine the height of your instrument using the coordinates in one of your control files. From the menu select “Trig Hgt”:



Input screen:

A screenshot of the 'Station Height Fix' input screen. At the top, there are three radio buttons: 'Local' (which is selected), 'Site', and 'Global'. Below these are several input fields: 'Select Pt:' with a dropdown arrow, 'Pt Name:' with a text box, 'Inst Face:' with a dropdown menu showing 'Left', 'Target:' with a text box containing '0.000', 'Inst Hgt:' with a text box containing '0.000', and 'Stn Hgt:' with a text box containing '28136.849'. At the bottom right, there is a green 'Exit' button. The title bar at the top says 'Station Height Fix' and includes 'ok' and navigation icons.

Tap on which file you want use, i.e. Local, Site or Global file.

Bear in mind that the “Local” file holds only coordinates for the Job that is open. The “Site” file that be opened by all the Jobs that are related to the opened Site and the “Global” file can be accessed by all the Sites and Jobs.

Next tap on the arrow in the Combobox to display all the available points and then tap on the required point.

Else you can enter the name of the point in the “Pnt Name” textbox and tap on the “?” button.

Select next whether your instrument is in the face left or face right position.

Next:

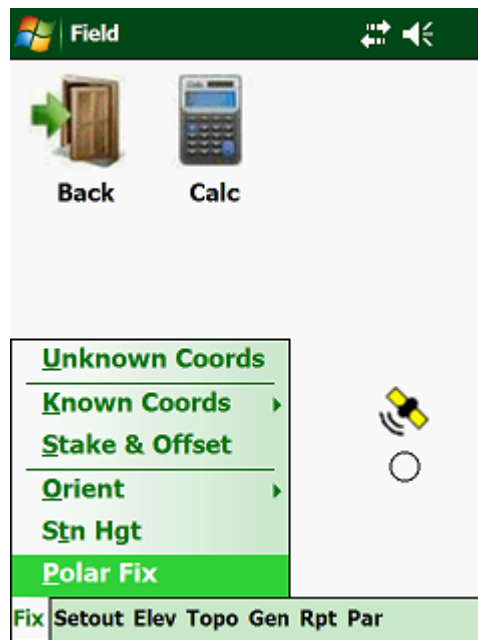
- Target - enter the target height.
- Inst Hgt - enter the height of your instrument above the point where your instrument is set up. If you have fixed yourself under the free positioning option, enter your height as zero, “0”.

Tap on the <Read> button to calculate the new height of your setup.

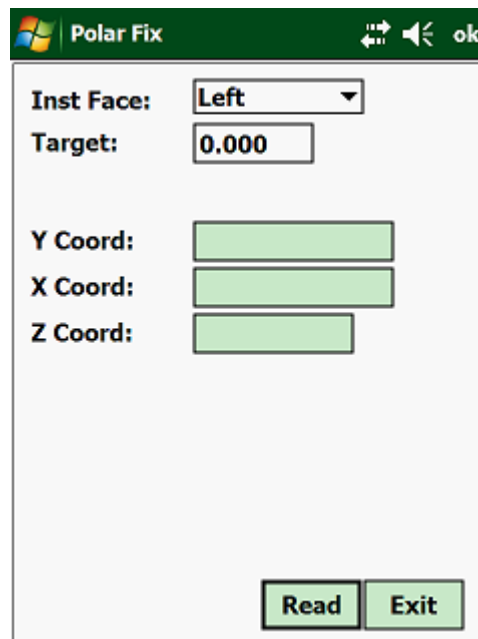
### **3.3.10 Polar Fix:**

This option can be selected, if you want to calculate the Y, X and Z coordinate of some other unknown point - i.e. a new station.

To access this routine tap on “Polar Fix”



The following screen will then be displayed:



**Inst Face:** Left

**Target:** 0.000

**Y Coord:**

**X Coord:**

**Z Coord:**

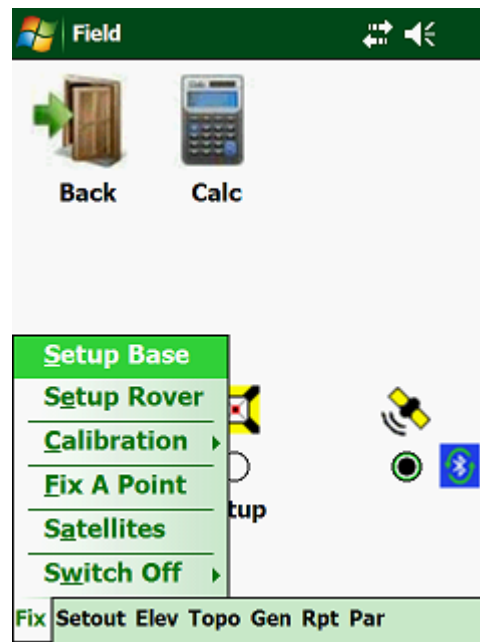
**Read** **Exit**

- Inst Face - select on which side your vertical angle circle is.
- Target - enter the height of your prism

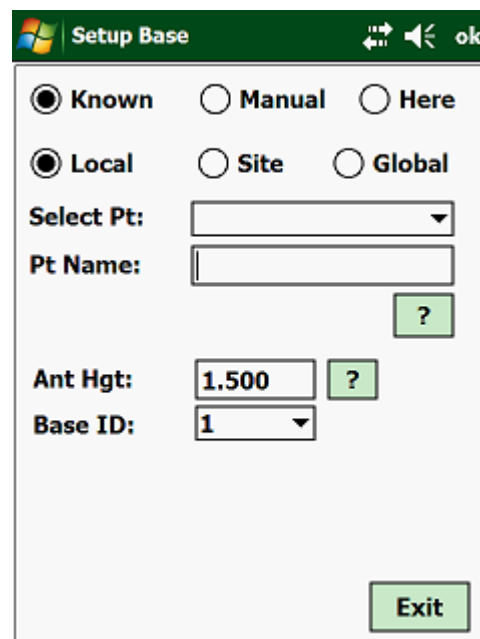
Once the above has been entered, the program will then calculate the Y, X and Z coordinate of the new point. You will also have the option of storing the new point in either the Local, Site or Global coordinate file.

### 3.4.00 Setup Base:

Before using the GPS, you will have to configure the Base and Rover. First setup your Base.



Next:

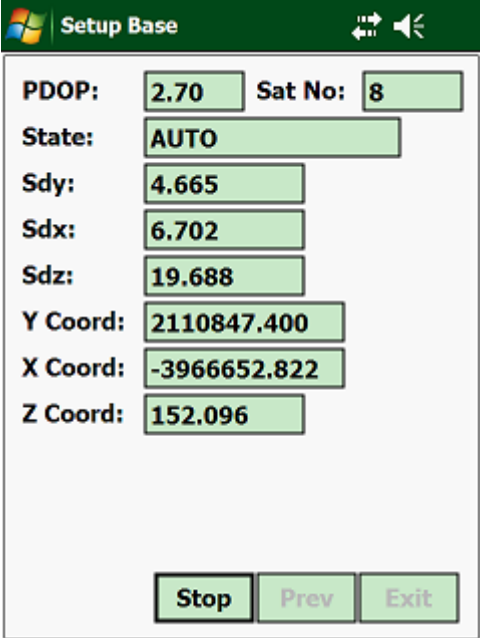


Here you have three options to fix your Base:

- Known - retrieve the base coordinates from one of your coordinate files.
- Manual - enter the coordinates of your base Station.
- Here - request a position from the Base as received by the Satellites.

Also make sure that our Antenna height of the Base is correct and enter a unique Base ID number. When working on a site where there is more than one Base, the ID number is important, so that you don't end up receiving data from another Base.

Next:

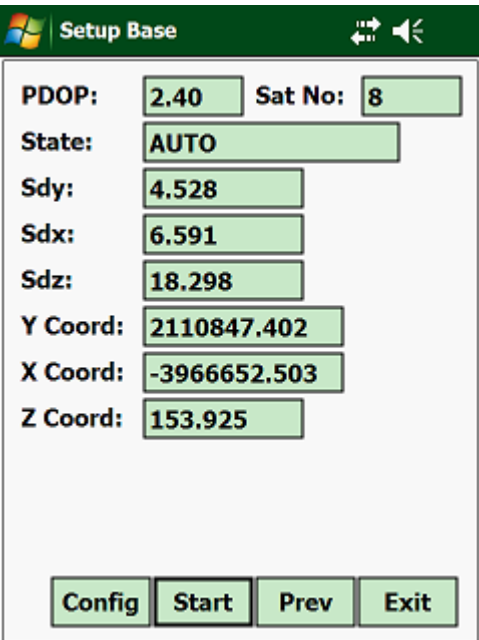


The 'Setup Base' window displays the following parameters and buttons:

Parameter	Value
PDOP:	2.70
Sat No:	8
State:	AUTO
Sdy:	4.665
Sdx:	6.702
Sdz:	19.688
Y Coord:	2110847.400
X Coord:	-3966652.822
Z Coord:	152.096

Buttons at the bottom: Stop, Prev, Exit.

Click on the <Start> button and wait for a couple of minutes until the readings have stabilized and press on the <Stop> button.



The 'Setup Base' window displays the following parameters and buttons:

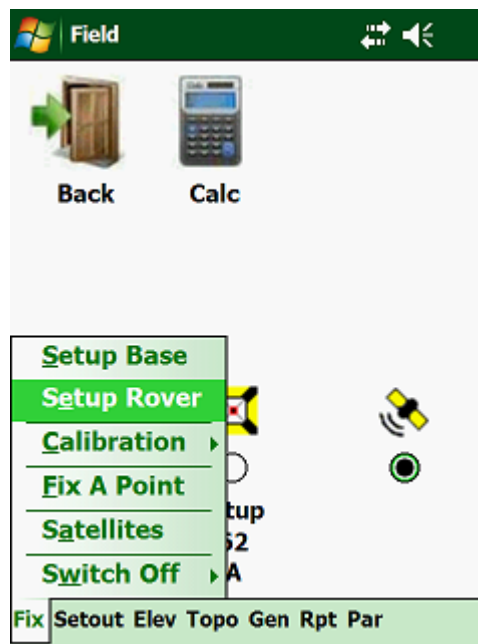
Parameter	Value
PDOP:	2.40
Sat No:	8
State:	AUTO
Sdy:	4.528
Sdx:	6.591
Sdz:	18.298
Y Coord:	2110847.402
X Coord:	-3966652.503
Z Coord:	153.925

Buttons at the bottom: Config, Start, Prev, Exit.

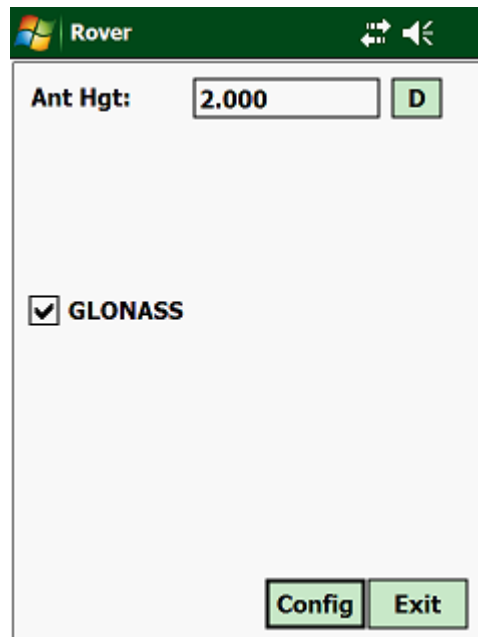
Click on the <Config> button and the program will configure your base for you and return you to the main screen.

**3.4.01 Setup Rover:**

Once you have setup your Base, you will need to configure your Rover. Click on “Setup Rover”:



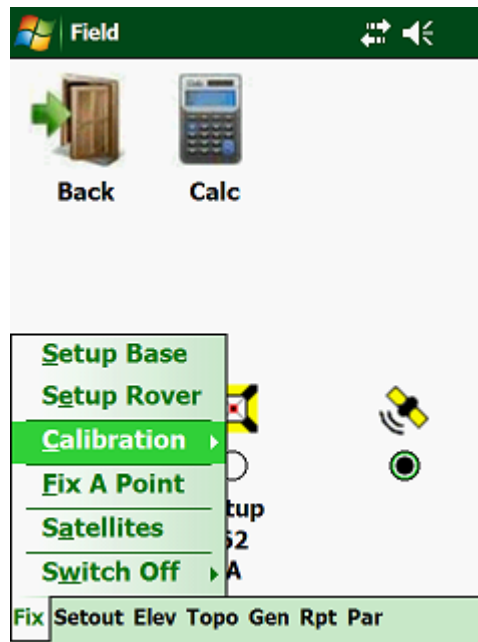
Next:



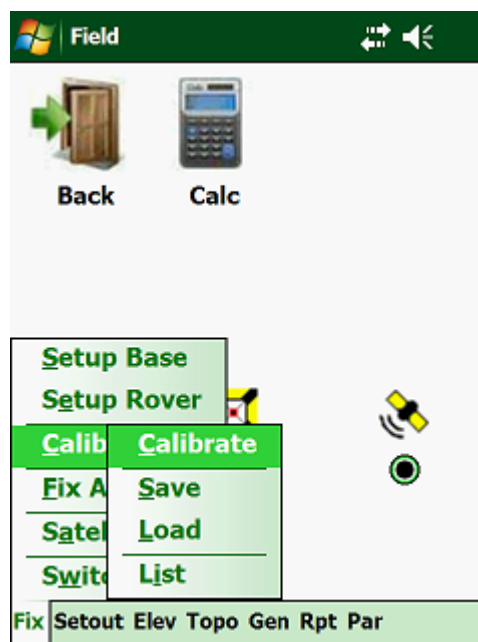
Enter the correct Antenna height and tap on the <Click> button.

### **3.4.02 Calibration:**

When working for the first time in an area, it is advisable to calibrate your system to known points in the area. Select “Calibration” from the pulldown menu:



Next:



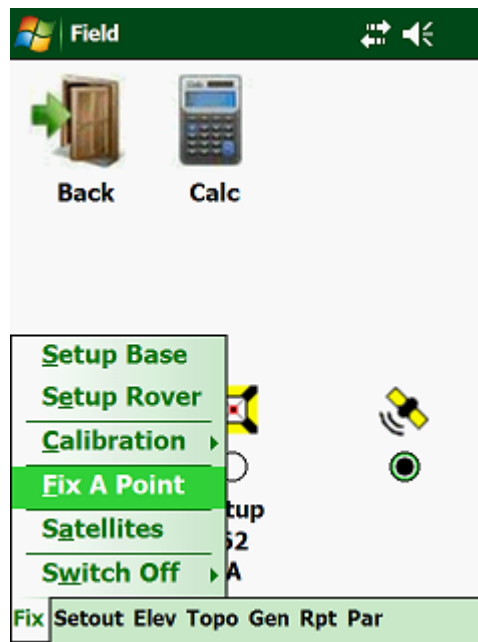
Options:

- Calibrate - calibrate your system on known points.
- Save - save your Calibration data to a file.
- Load - load a Calibration file.
- List - list the active Calibration data.



### **3.4.03 Fix A Point:**

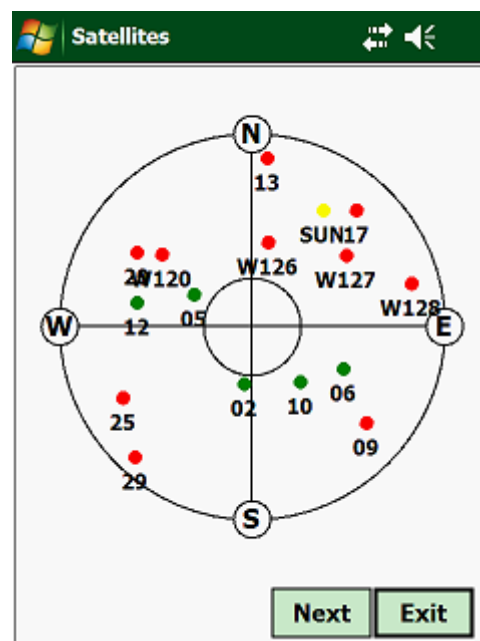
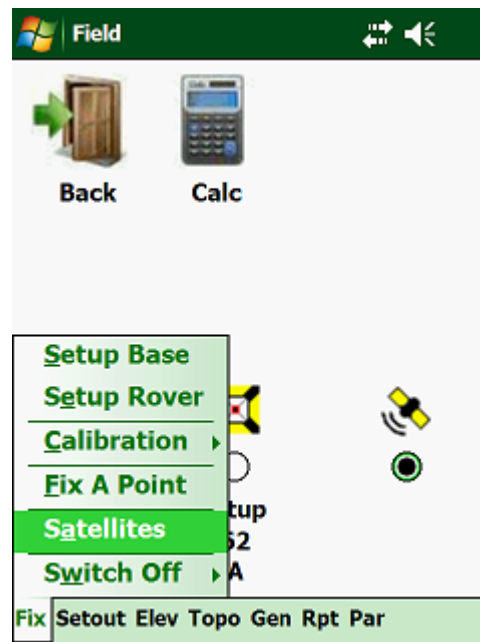
This is very similar to a “Polar Fix” under the Total Station option to fix a new control point and save it in one of your Coordinate Files.



Next:

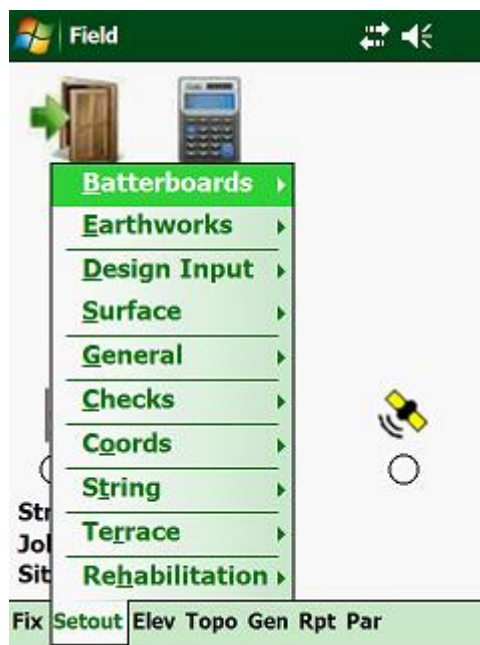
A screenshot of the CEASER Point Fix application interface. The title bar is green with a Windows logo and the text 'Point Fix'. The form contains the following fields: 'Ant Hgt:' with a text box containing '2.000'; 'Pt Name:' with an empty text box; 'Y Coord:' with an empty green text box; 'X Coord:' with an empty green text box; and 'Z Coord:' with an empty green text box. At the bottom left, there is red text: 'Sat:0|PDOP:0.0|[N/A]|Age:0'. At the bottom right are two buttons: 'Start' and 'Exit'.

### 3.4.04 Satellites:



The Satellites shown in red are not used and the Satellites shown in green are being used.

### 3.5.00 Setout:



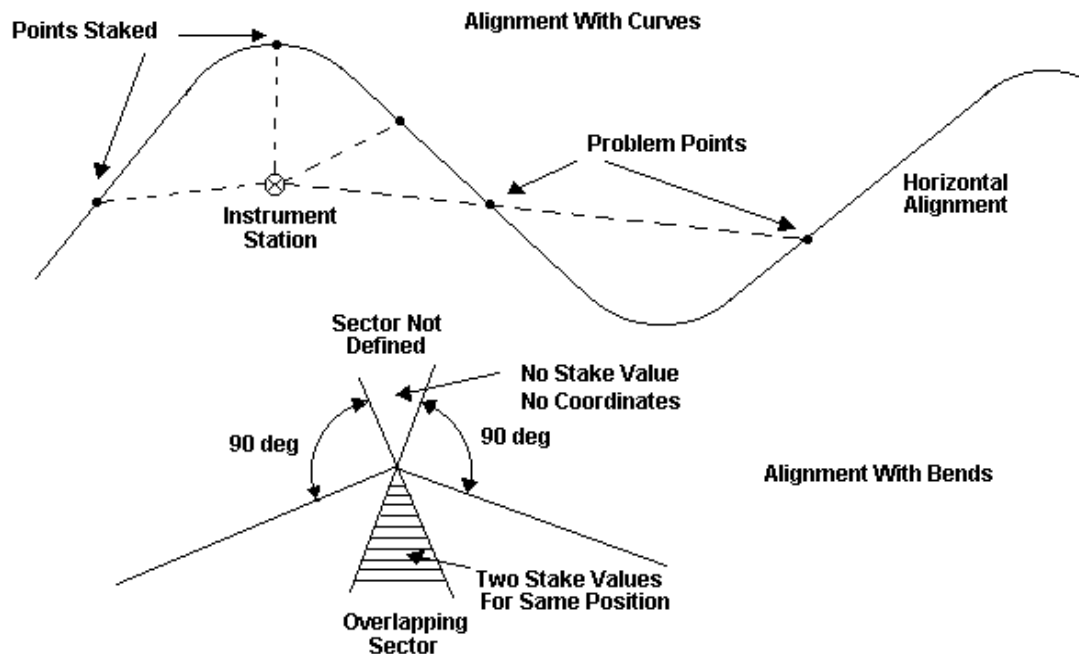
- All setting out options facilitate an on line link to a Total Station. When connected to a Total Station with dual communication facilities, the setting out data is automatically transmitted, displaying the relevant data on the instrument.
- Setting out data are all computed in co-ordinates, derived from the various Design parameters entered in “Design”. Module.
- The setting out provides for staking centre line or offset line to the centre line.
- Any stake value and offset can be set out from anywhere - no need to set up at a centre line point.
- Simply call up the stake value and offset of your choice, and a few seconds later the coordinates will be displayed.
- Batters can be set out from any remote station with no centre line staked in the field or using a tape and spirit level with a stake line. Results can be stored and printed providing a full data line, from the readymade point in the field up to recorded and printed results.
- Earthworks can be controlled instantly for cut and fill displaying the remaining portion. This is done at any stake value.
- Any point can be surveyed and its relation to the stake line, stake value, offset, design level and ground level will be displayed instantly.
- Checking of existing points are done immediately, displaying the difference in co-ordinates (dy, dx, dz).
- If points are set out by “Polar” using instruments other than a tape for distance measuring, a correction plus or minus is displayed after the vertical direction and distance has been entered (backward, forward = horizontal distance). Backward indicates, that the observed distance was too short. Forward indicates that the observed distance was too long.
- Before backward or forward is displayed, the constants in “Survey Parameter” such as scale factor, prism constant etc. are applied (the comparison is done on

the Lo-surface).

**IMPORTANT:**

- Make sure that the correct station (co-ordinates, orientation) is already established using the “Fix” facilities.
- The orientation correction (Hcorr) always applies to the observed direction.
- If the orientation correction is not = 0.0000, all calculated setting out directions are false bearings.
- Ensure, that the orientation correction is valid (using the “Orientation” option under “Fix”), the rest is organised by **Ceaser**.

**3.5.01 Restrictions for Horizontal Alignment Computations:**



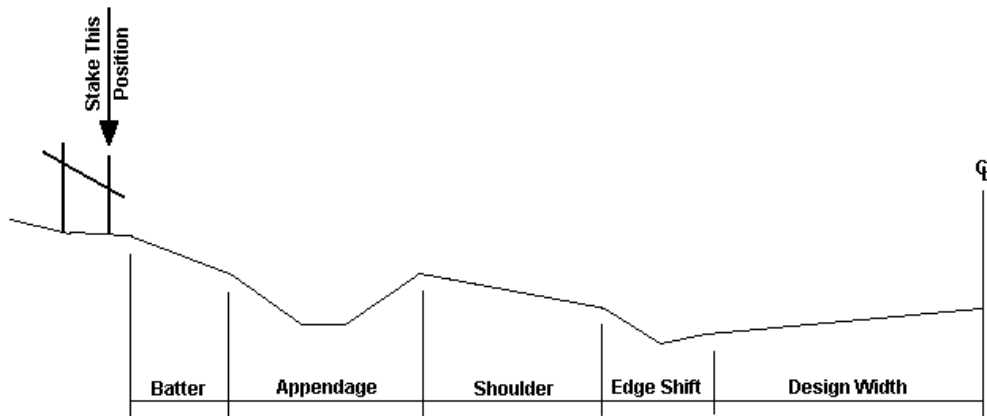
- Computation of the relevant YX - co-ordinates from stake value and offset:

For bends, no co-ordinates are calculated within the "outside sector". If the stake value of the bend and an offset to the "outside" or "inside" is entered, two different co-ordinates may be calculated for the same stake value and offset. This depends on the straight used, to compute the co-ordinates. To force the "alignment pointer" to the straight for which the computations are required, ensure that the entered stake value is within the limits of that particular straight, but a minimum of two millimetre off the bend. Thereafter enter the "bend stake value" again.

- Computation of the stake value and offset from YX - coordinates:

It may occur, that the computed stake value and offset is very large and seems to be incorrect. This is not so, as the program may have located a more distant "alignment pattern" with its tangent perpendicular to the position entered. This is likely to happen, in very "curved alignments" if you enter positions far apart from each other. The software may have a "tracking problem". To force the "alignment tracking" closer to the stake required, estimate the stake value for that particular position and enter the data as described in 3.5.1 thereafter enter the YX - coordinates again. At bends, the "outside sector" is not defined in stake value, whereas the "inside sector" overlaps. For any position entered within the "outside sector" the software responds with a message "No Stake Value Found" and aborts. A position within the "inside sector" will have two different stake values. This depends on the straight locked on. If the problem persists, check the estimated stake value entered, or check your horizontal alignment data or enter a very small radius for bends.

### **3.5.02 Batterboards:**



. This is one of the most powerful options in **Ceaser**:

- Batters may be set out from any remote station at any stake value without any pre-calculations required or previous cross-sections taken.
- What is first established in the field is the pole position (not the toe position).
- The batter level for the pole is computed directly at the instrument and may be set instantly with the instruments used.
- Results, such as toe level, toe offset, slope distance, depth of CUT and FILL etc., are computed at the instrument and may be stored in ASCII format. Later these may be transferred to the PC.
- With a Total Station almost no field bookings have to be made, giving you the on-hand facility, to place the batter poles, level on the pole, slope angle for the plank, slope distance, offsets for toes and poles instantly at a press of a button.

**IMPORTANT:**

- The batter setting out facility finds the **POLE POSITION** and not the toe position as in the previous version of the program.
- **In** and **out** corrections are used to find the toe position:
  - In** = move towards the Stake line
  - Out** = move away from the Stake line

### Method:

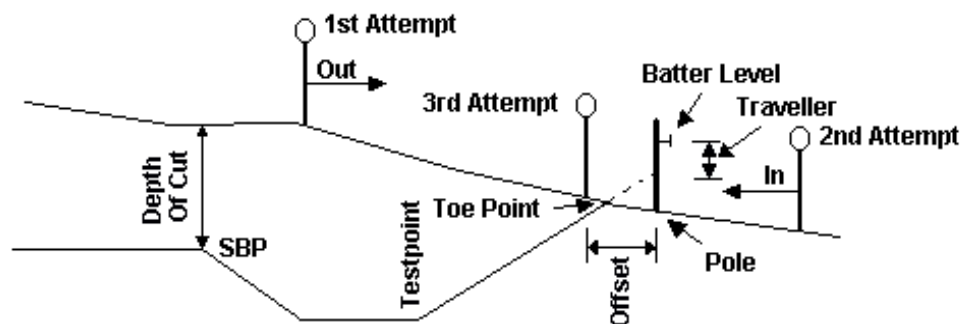
- This method **does not require a stake line placed in the field.**
- The batters may be placed at random stake values and from a coordinated remote station or from a Base when using a GPS, which can be established using the POSITIONING FACILITIES for a Total Station or GPS.

**Note:** Make sure there is an elevation for the station.

- When using a Total Station the PRISM has to be observed as a "polar" and when using a GPS click on the <Read> button. Thereafter the stake value and offset is computed and displayed as well as the depth for CUT and FILL and **in** and **out** correction for the toe position.
- Repeat until the correction for the toe position is sufficiently small, then place the poles into the correct position, press '**R**', to display and store the results, press '**S**' to set the batter level using trig-heightening.

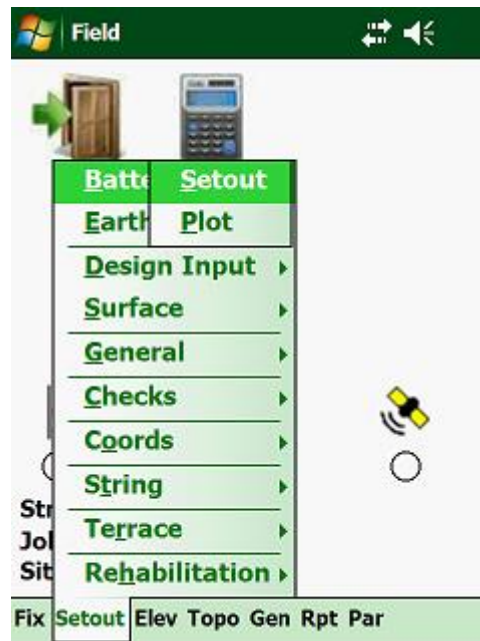
### Note:

The depth for CUT and FILL is always computed from present groundlevel to the shoulder break level (SBP) and **not** to the TESTPOINT.

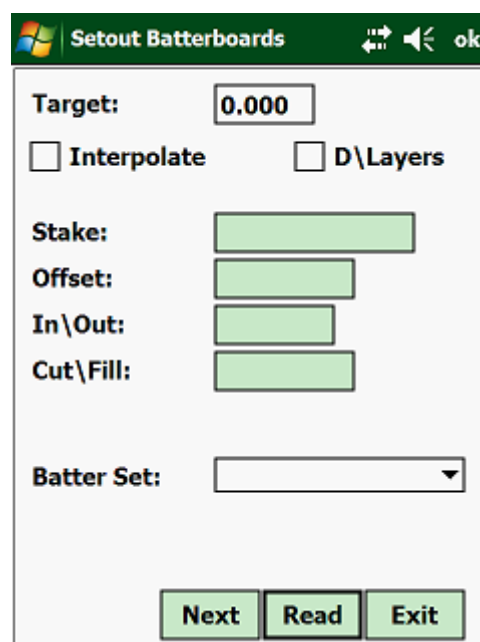


The Batterboards routine is selected by moving the highlighter bar to "Batterboards"

and pressing the <Enter> key:



Next:



- Interpolate - if you want the program to do a linear interpolation from the one Batter entry to the next, then you have to mark this option.
- Deduct Layers - if you select to deduct layers, the program will deduct the total depth of the layers when calculating the slope distance, else the slope distance will be calculated to the final design level.

It is normal practise to deduct the layers, as you would place profile pegs, once the

bulk earthworks levels have been attained.

Irrespective whether you connected to a Total Station or to a GPS, click on the <Read> button.

**Setout Batterboards**

Ant Hgt: 2.000

☐ Interpolate ☒ D\Layers

Stake: 56382.187

Offset: -4515451.

In: 4514712

Down(Cut): 486.220

Batter Set: ▼

Sat:8|PDOP:3.8|[AUTO]|Age:0

Next Read Exit

- Stake - tells you the stake value where the prism is being held.
- Out - this tells you the distance that you must move to reach the toe of your Job. Out = move away from stakeline; In = move towards the stakeline.
- Down(Cut) - this tells you that you are in a “Cut” condition and the surface is 486.220 down. If you are in a “Fill” condition, then the label will change to “Up(Fill)”.

Tap on the “Next” button:



Setout Batterboards

Ant Hgt: 2.000

Nail Level: 836.224

Up: 0.500

Slope Dist: 876.935

Batter Angle: 33.6901

Slope (1:X): 1.500

Back Peg: 0.500 -0.75

Sat:6|PDOP:4

Prev Read Exit

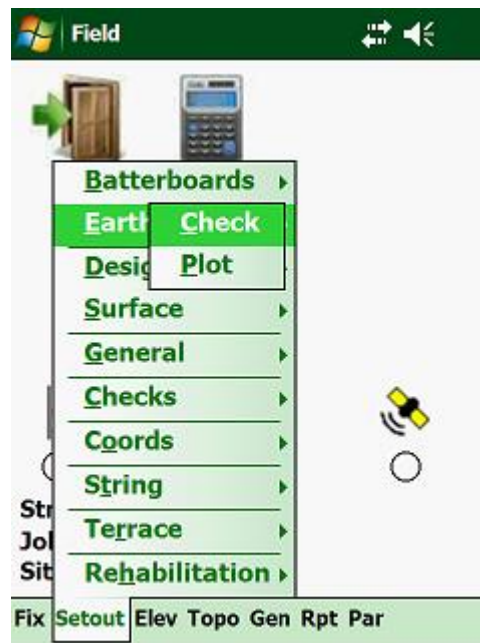
- Nail Level - this is the level of the front pole.
- Up - this is the height measured up from the target pole to the nail level. If you are at the correct position, then this distance should be equal to your travel if no offset has been defined.
- Slope Dist - this is the slope distance measured from the nail to the surface.

### **3.5.03 Earthworks:**

With this option, you can place the prism, staff or even tape at any offset from the stakeline at any stake value required, and the program will calculate the cut/fill depth/height, the distance to the SBP, etc.

To access this option, move the highlight bar down to “Earthworks” and press the

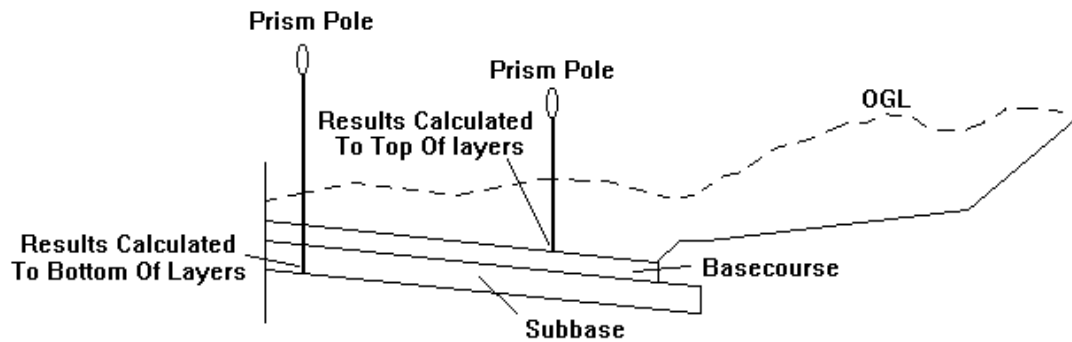
<Enter> key:



Next:

- Interpolate - if you want the program to do a linear interpolation from the one Batter entry to the next, then you have to mark this option.
- Deduct Layers - if you select to deduct layers, the program will deduct the total depth of the layers when calculating the slope distance, else the slope distance will be calculated to the

final design level.



- Target Hgt - enter the prism.

If you are linked up to a Total Station or GPS, then the only variable that you can enter, will be the prism height, as all other variables are measured automatically from the instrument.

Results:

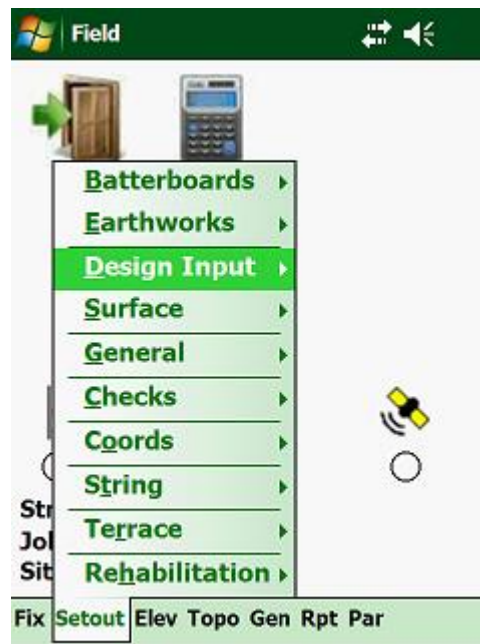
- Stake - the stake value calculated.
- Out - this is the distance that the target must move in or out to be at the offset where that specific level intersects the batter.
- Down(Cut) - this tells you that you are in a “Cut” condition and the surface is 0.969m down. If you are in a “Fill” condition, then the label will change to “Up(Fill)”.

**3.6.00 Design Input:**

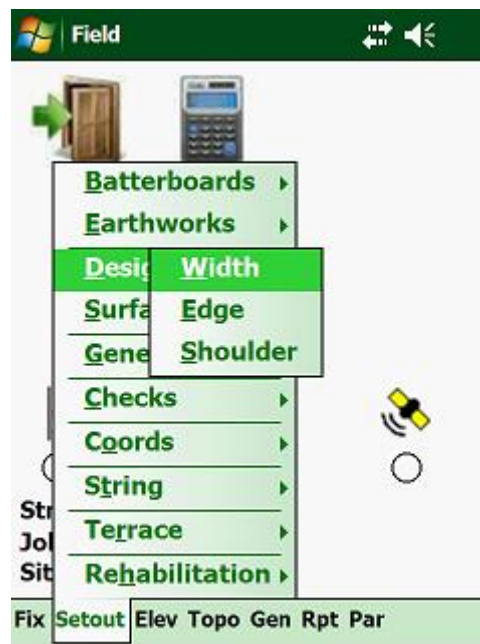
This facility lets you set out all the design input parameters as entered under the “Design” module, which includes:

- Design Width
- Outer Edge Shift
- Shoulders
- Appendage Data

Use your left and right arrows to activate the pull down menu called “Setout”

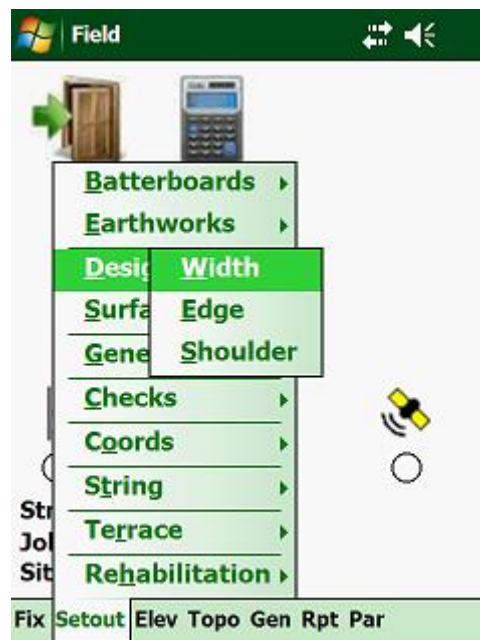


The following menu will then be displayed:

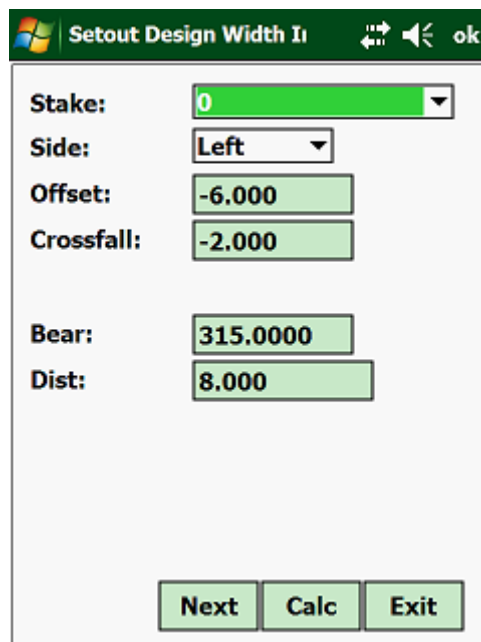


### **3.6.01 Surface Width:**

This will list in a Combobox all the parameters entered for the surface width definition under the “Design” module. From the pulldown menu tap on “Design Input” and then on “Surface Width”:



Input screen:



Setout Design Width I

Stake: 0

Side: Left

Offset: -6.000

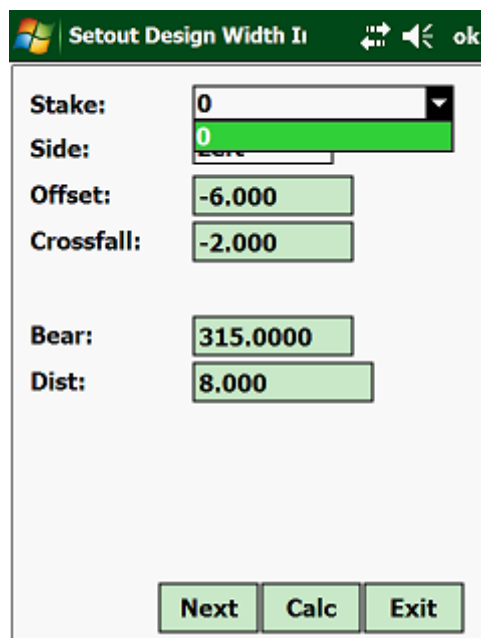
Crossfall: -2.000

Bear: 315.0000

Dist: 8.000

Next Calc Exit

From the dropdown list, select the required stake value:



Setout Design Width I

Stake: 0

Side: Left

Offset: -6.000

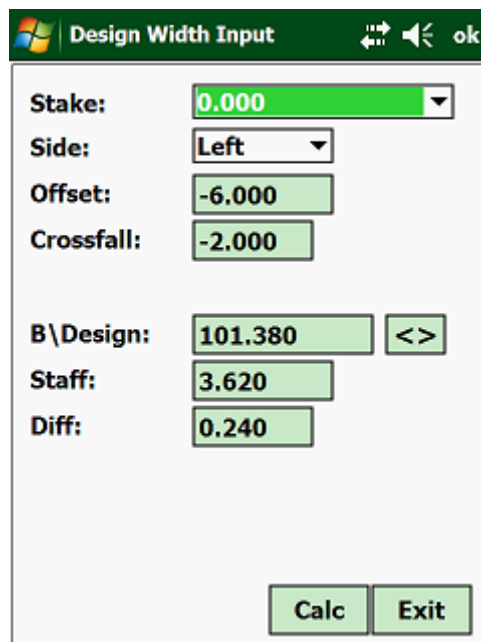
Crossfall: -2.000

Bear: 315.0000

Dist: 8.000

Next Calc Exit

Which will give you:



Design Width Input

Stake: 0.000

Side: Left

Offset: -6.000

Crossfall: -2.000

B\Design: 101.380 <>

Staff: 3.620

Diff: 0.240

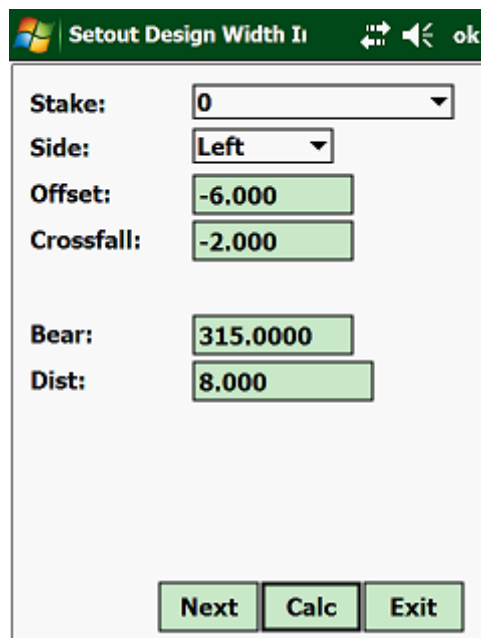
Calc Exit

The above screen is when working with a Level.

Button options:

- <> - swap between the top and bottom level where applicable.

When connected to a Total Station or using a GPS, the screen will be as follows:



Setout Design Width I

Stake: 0

Side: Left

Offset: -6.000

Crossfall: -2.000

Bear: 315.0000

Dist: 8.000

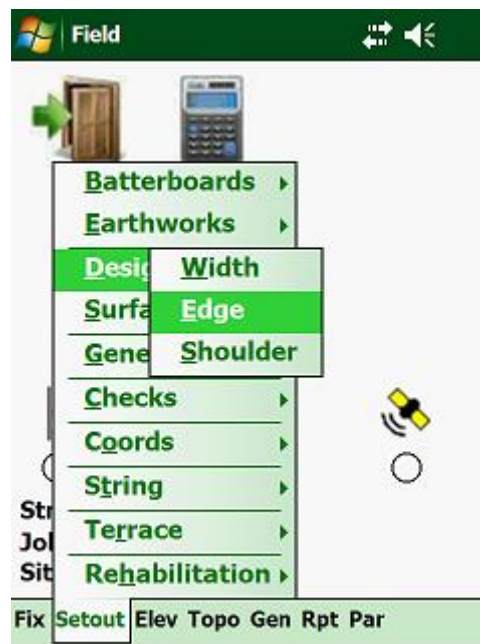
Next Calc Exit

The same procedure is followed for:

- Edge Shift

- Shoulder

The different screens will vary slightly depending on which instrument you are using.



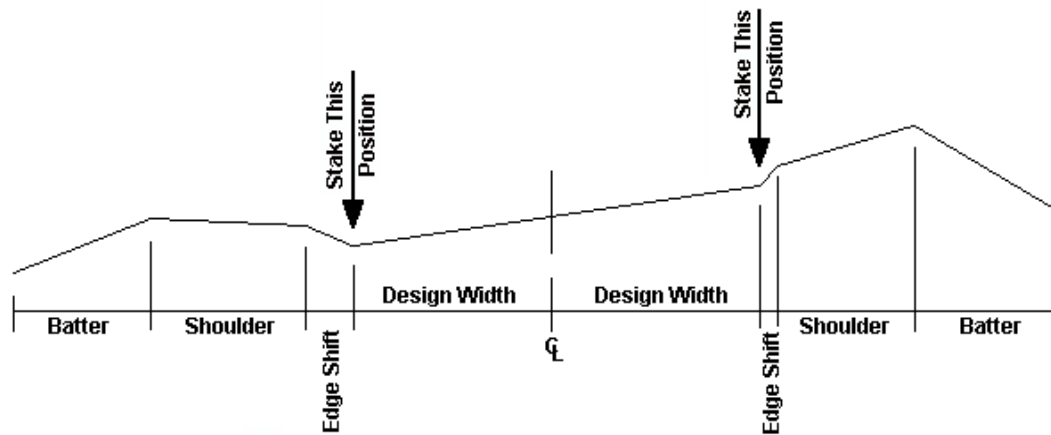
### **3.6.02 Surface:**

Here you can calculate the offsets and levels to the edge of the design width, adjusted by the parameters as selected under the “Parameters” option. If you have specified an offset and travel, then these will be added to the design width data.

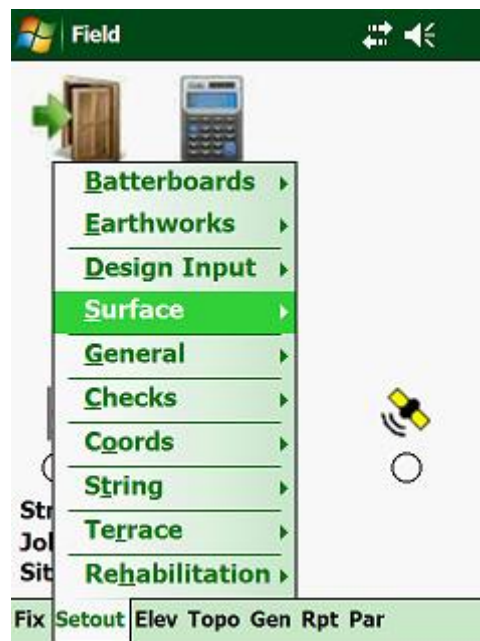
If you are using a level, then the input and the display of the results will be by stake value, offset and staff reading. You must be sure that the correct collimation is in the program. This you can check under the “Levelling” option.

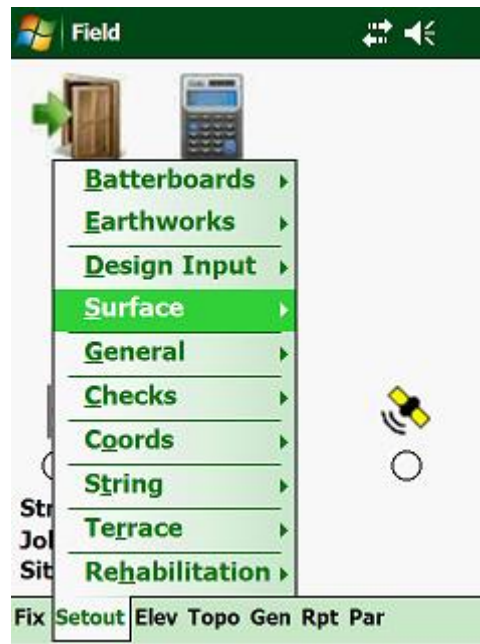
If you are using a total station or a theodolite, then the output will be by angles and distances.





To access this routine, use your arrow keys, until “Surface” is highlighted and press <Enter>:



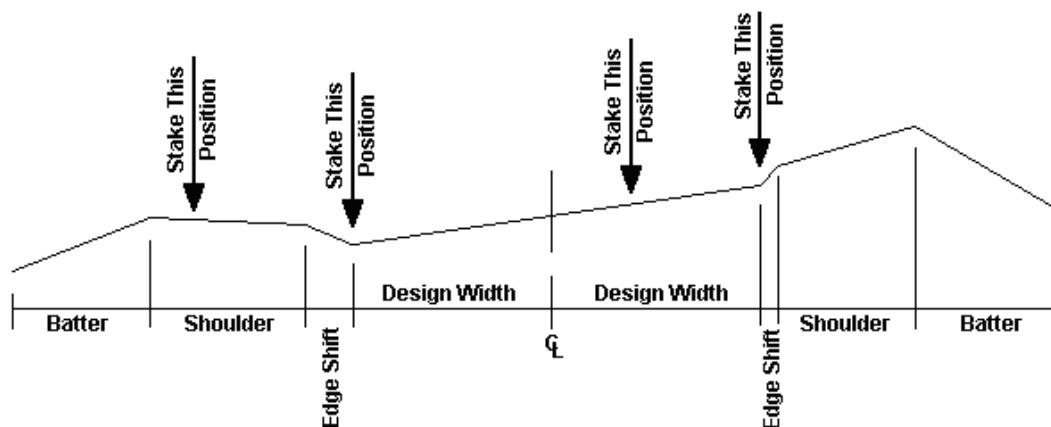


Here you have the following setout options:

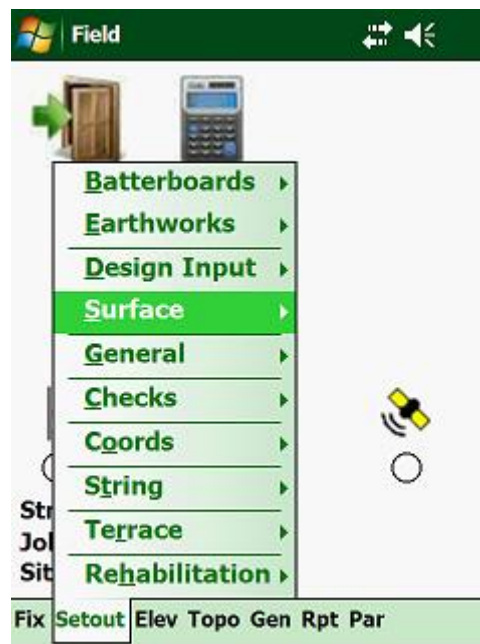
- Plot
- Full Surface
- Surface Width
- Edge Shift
- Shoulder
- Cut Appendage
- Fill Appendage

### **3.6.03 Full Design:**

The Full Design option lets you setout anywhere across the width of your design. Depending on the offset that you enter, the program will calculate where the offset is located in relation to your design.



From the menu, tap on “Surface” and then on “Full Design”:



The screen layout will vary slightly depending on which instrument you are using.

Input screen:

A screenshot of the 'Full Design' input screen in the CEASER application. The screen has a green header with the 'Full Design' title and navigation icons. Below the header, there are four input fields: 'Stake' with the value '20.000', 'Offset' with the value '0.000' and a red 'D' next to it, 'Design' with the value '101.010', and 'Staff' with the value '3.990'. To the right of the 'Stake' and 'Offset' fields are navigation buttons '<' and '>'. At the bottom of the screen are two buttons: 'Calc' and 'Exit'.

Here you have enter the following:

- Stake - enter the required stake value to set out.
- Offset - enter the required offset.

Depending on the design parameters that have been entered and also the offset entered, the letter next the “Offset” textbox will change as follows:

- D - the offset is in the Surface Width area.
- E - the offset is in the Edge Shift area.
- S - the offset is in the Shoulder area.

If you are in “Level” mode, tap on the <Calc> button and the program will calculate the design level and the staff reading. This will be adjusted according to the parameters (Travel and Layer Depth) as entered in the “Full Design”.

If you are connected to a Total Station, the screen will be as follows:

The screenshot shows the 'Setout Full Design' screen. At the top is a green header bar with a Windows logo, the text 'Setout Full Design', and icons for back, forward, and OK. The main area contains four input fields: 'Stake:' with the value '20.000' and a '<' button; 'Offset:' with the value '0.000', a red 'D' indicator, and a '>' button; 'Bear:' with the value '39.1722'; and 'Dist:' with the value '20.100'. At the bottom are three buttons: 'Next', 'Calc', and 'Exit'.

Tap on the “Next” button:

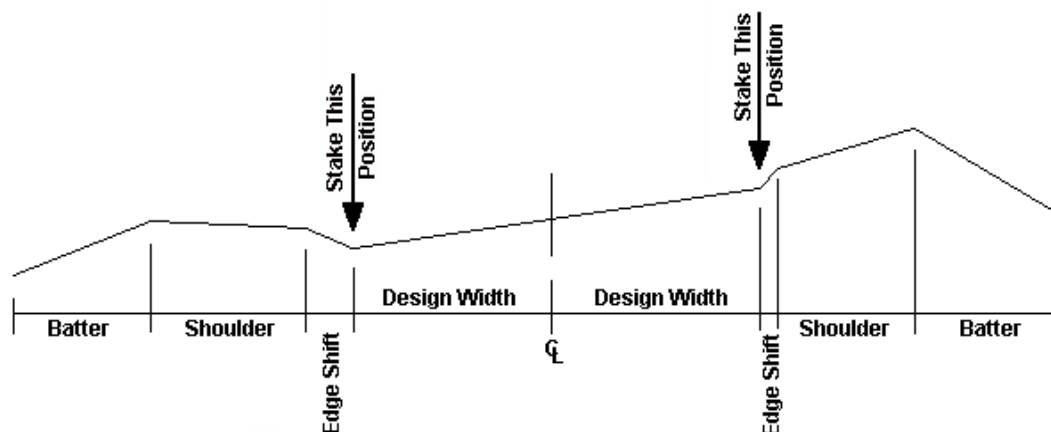
The screenshot shows the 'Setout Full Design' screen after tapping the 'Next' button. The header bar is the same. The main area contains six input fields: 'Target:' with the value '0.000'; 'Left\Right:'; 'Fore\Back:'; 'Design:'; 'Actual:'; and 'Up\Down:'. At the bottom are three buttons: 'Prev', 'Read', and 'Exit'.

### 3.6.04 Surface Width:

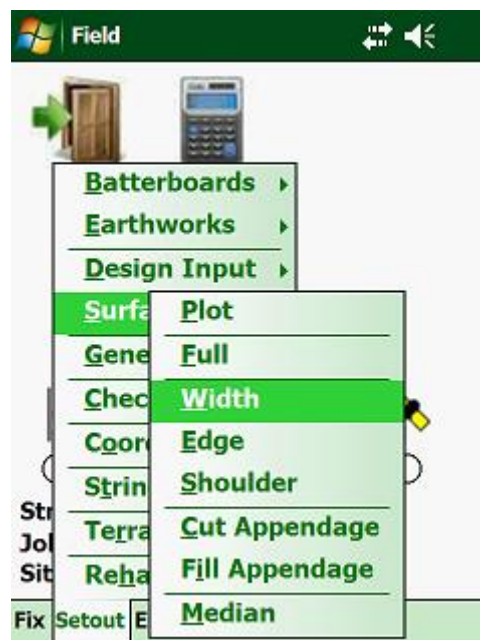
Here you can calculate the offsets and levels to the edge of the design width, adjusted by the parameters as selected under the “Parameters” option. If you have specified an offset and travel, then these will be added to the design width data.

If you are using a level, then the input and the display of the results will be by stake value, offset and staff reading. You must be sure that the correct collimation is in the program. This you can check under the “Levelling” option.

If you are using a total station or a theodolite, then the output will be by angles and distances.



From the menu tap on “Surface” and then on “Surface Width”:



The following input screen will then appear:

Design Width

Stake: 20.000 <

Side Left >

Offset: -6.000

Crossfall: -2.000

B\Design: 101.390 <>

Staff: 3.610

Diff: 0.240

Calc Exit

- Stake Value - Enter the required stake value.
- Select Side - Select either “Left” for left-hand side or “Right” for right-hand side.

The input screen is the same, whether you are working with a Level, Total Station, or GPS.

Working in manual mode with a level, the output will be as follows:

- Stake Value - that is the stake value that was requested.
- Offset - this is the offset calculated as per the design widths. If the profile peg is to the left of the stakeline, then the offset will be a negative number, else if the profile is to the right of the stakeline, then the offset will have a positive value.
- B\Design - final nail level as calculated per the design and surface parameters input.
- Staff - that is the reading on staff to place the nail on the profile peg at the correct level. Make sure that you have the correct collimation in the program. This you can check under the “Leveling” option.
- Diff - this is the difference between the bottom and top level.

Tap on the “<>” button to swap between the bottom and top level.

Working with a Total Station, the output is as follows:

- Hor Angle - this is the horizontal angle that you must have displayed on or instrument, to be in the correct direction. All directions given are already adjusted by the horizontal correction. If you have a robotic Total Station then the instrument will turn to the calculated horizontal bearing.
- Distance - that is the horizontal distance to the peg.

**Setout Design Width**

Stake: 20.000 <

Side: Left >

Offset: -6.000

Crossfall: -2.000

Bear: 23.1155

Dist: 21.541

Next Calc Exit

When working with a GPS, the Bearing and Distance is from your Base Station.

Tap on the “Next” button:

**Setout Design Width**

Target: 0.000

Left\Right:

Fore\Back:

Design: <>

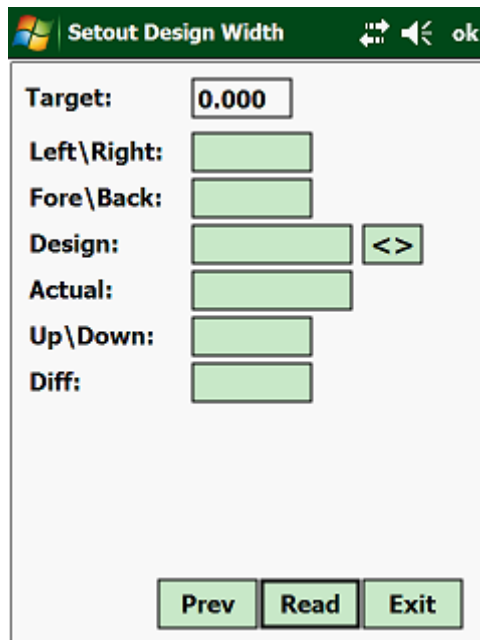
Actual:

Up\Down:

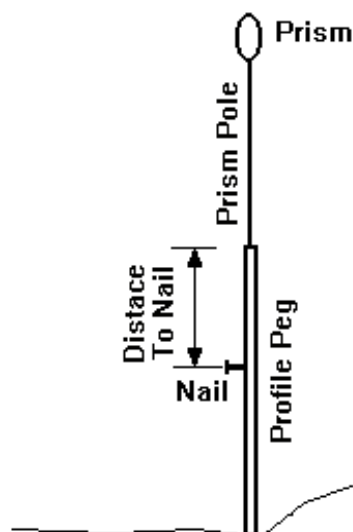
Diff:

Prev Read Exit

If connected to a Total Station, tap on the <Read> button:

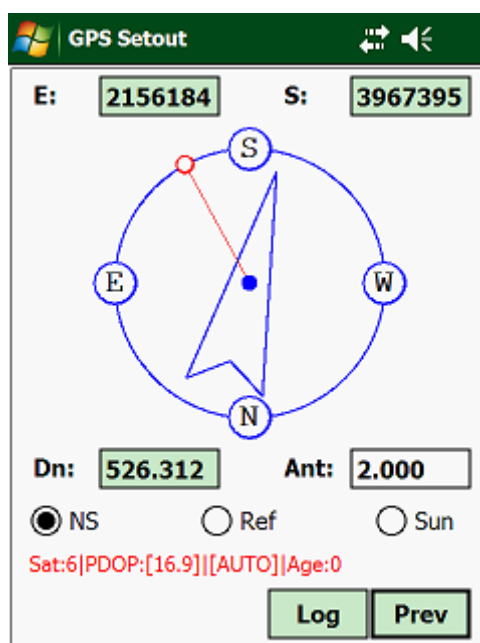


The program will then calculate the correction to the distance measured, by displaying either backward (move further away from the instrument) or forward (move closer to the instrument), together with a distance.



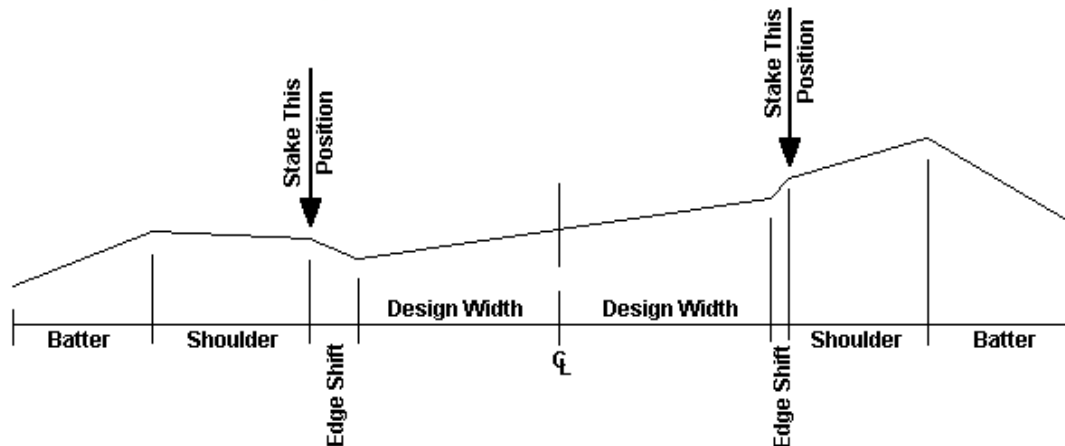


The display when using a GPS is slightly different:

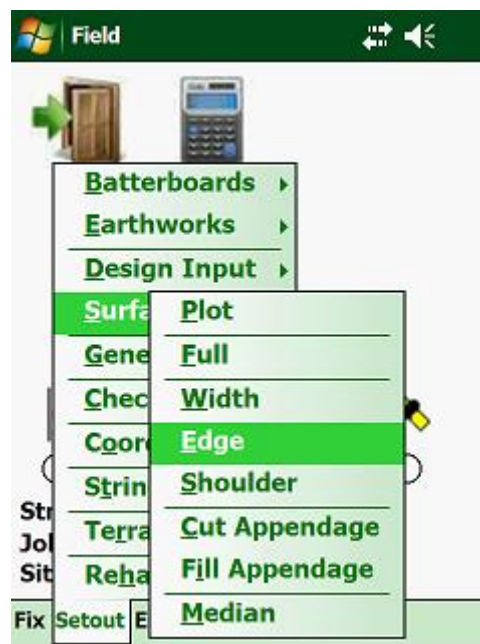


### 3.6.05 Edge Shift:

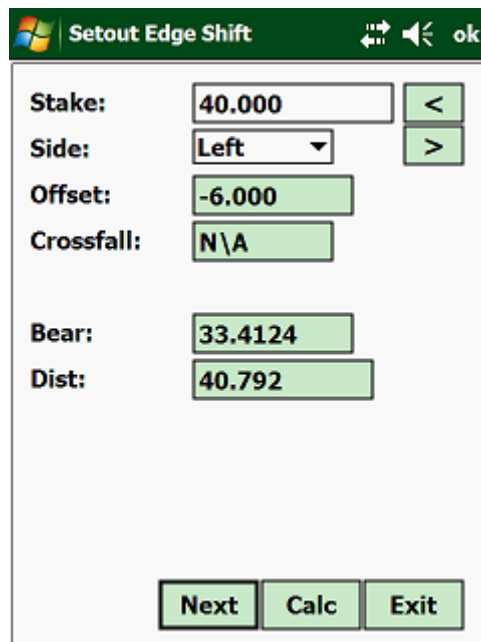
The edge shift is a feature that is added onto the outside limits of the design width. This can be a kerb line, channel, etc. It is defined by specifying the width and height relative to the edge of the design width.



To access this routine, tap with your stylus on “Design” and then on “Edge Shift”:



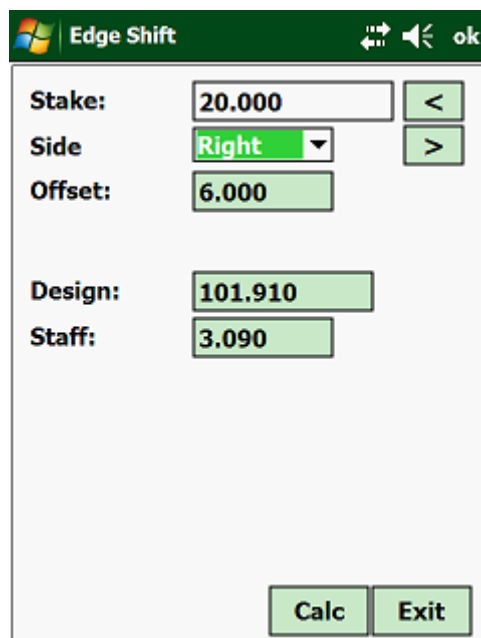
The following input screen will then appear:



- Stake Value - enter the required stake value.
- Select Side - select either “Left” for left hand side or “Right” for right hand side.

The input screen is a bit different, depending on whether you are working with a Total Station, Theodolite or a Level.

Working in manual mode with a level, the output will be as follows:



- Stake Value - that is the stake value that was requested.
- Side - select on which side you want to work.

Next tap on <Calc>:

- Offset - this is the offset calculated as per the design widths plus the edge shift. If the profile peg is to the left of the stakeline, then the offset will be a negative number, else if the profile is to the right of the stakeline, then the offset will have a positive value.
- Nail Level - final nail level as calculated per the design plus the relative height of the edge shift and surface parameters input.
- Staff - that is the reading on staff to place the nail on the profile peg at the correct level. Make sure that you have the correct collimation in the program. This you can check under the “Leveling” option.

With the levels for the edge shift, only one level will be displayed. If this peg is to be used for earthworks operations, then you must pull a string from the bottom nail on the profile peg for the design width to this nail that you have just placed. Make sure that the travel and layer depth for the design surface and for the edge shift is the same.

Working with a Total Station, the output is as follows:

Stake: 40.000 < >

Side: Left

Offset: -6.000

Crossfall: N\A

Bear: 33.4124

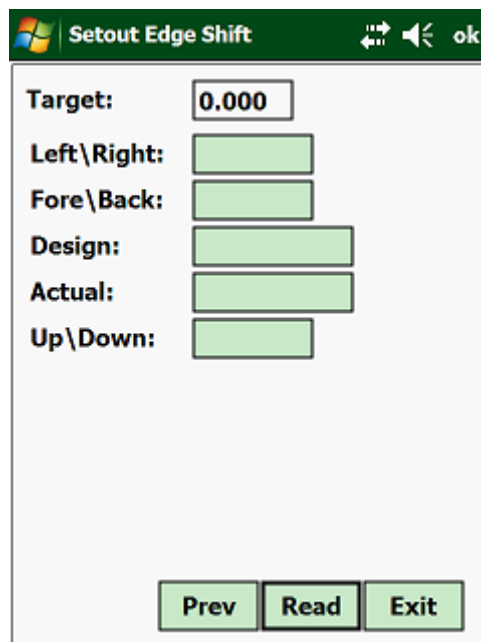
Dist: 40.792

Next Calc Exit

- Hor Angle - This is the horizontal angle that you must have displayed on or instrument, to be in the correct direction. All directions given, are already adjusted by the horizontal correction.
- Distance - That is the horizontal distance to the peg.

When working with a GPS, the Bearing and Distance is from your Base Station.

Tap on “Next”:



Setout Edge Shift

Target: 0.000

Left\Right:

Fore\Back:

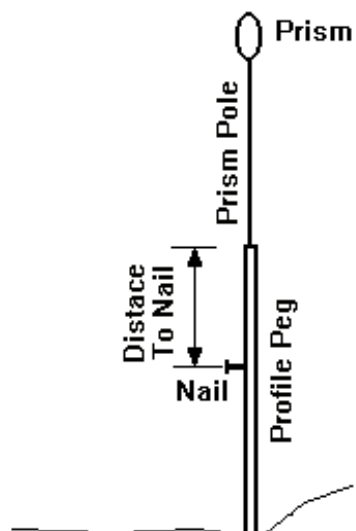
Design:

Actual:

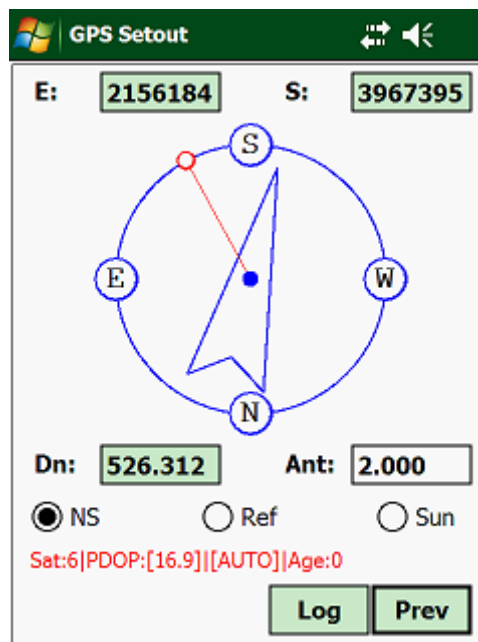
Up\Down:

Prev Read Exit

Tap on <Read> and the program will then calculate the correction to the distance measured, by displaying either backward (move further away from the instrument) or forward (move closer to the instrument), together with a distance.

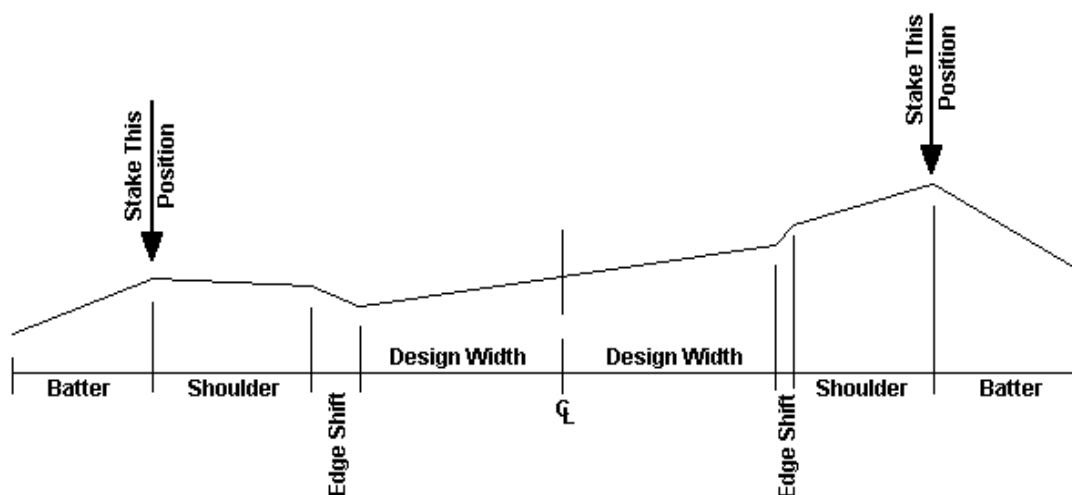


The display when using a GPS is slightly different:

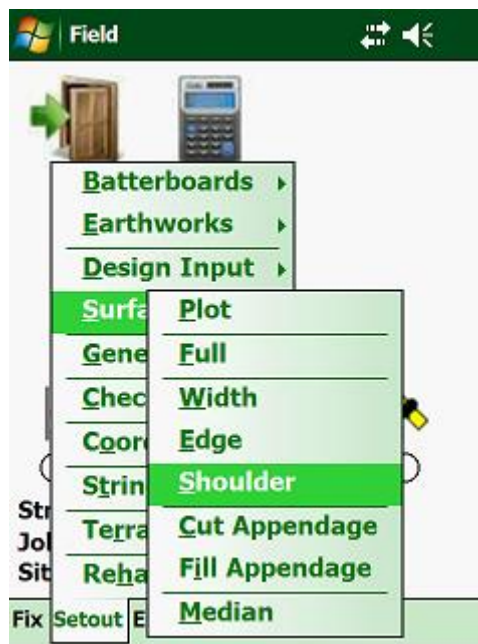


### **3.6.06 Shoulder:**

The shoulder is a feature that is tied to the outer edge. This can include a sidewalk, gravel shoulder on a major freeway, etc. The feature is defined by specifying the width of the shoulder and the percentage grade relative to the edge shift. This is then added onto the edge shift.



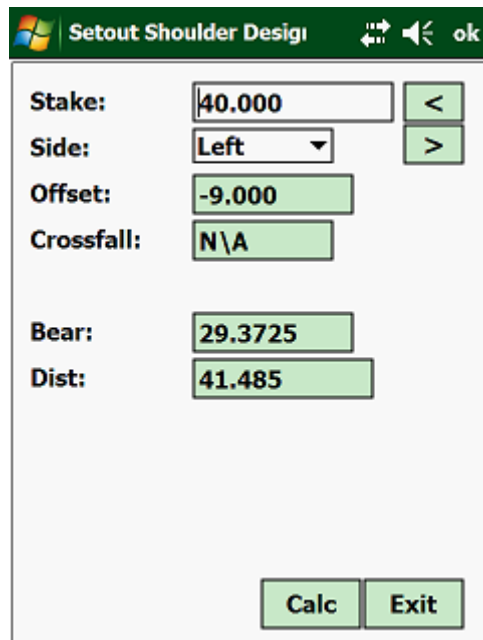
To access this routine, tap on “Design” and then on “Shoulder”:



The following input screen will then appear:

A screenshot of the 'Setout Shoulder Design' input screen. The title bar is green with the Windows logo, the text 'Setout Shoulder Design', and navigation icons. The screen contains several input fields: 'Stake:' with the value '40.000' and a '<' button; 'Side:' with a dropdown menu set to 'Left' and a '>' button; 'Offset:' with the value '-9.000'; 'Crossfall:' with the value 'N\A'; 'Bear:' with the value '29.3725'; and 'Dist:' with the value '41.485'. At the bottom, there are two buttons: 'Calc' and 'Exit'.

- Stake Value - That is the stake value that was requested.
- Side - Select on which side you want to work.



Stake: 40.000 < >

Side: Left

Offset: -9.000

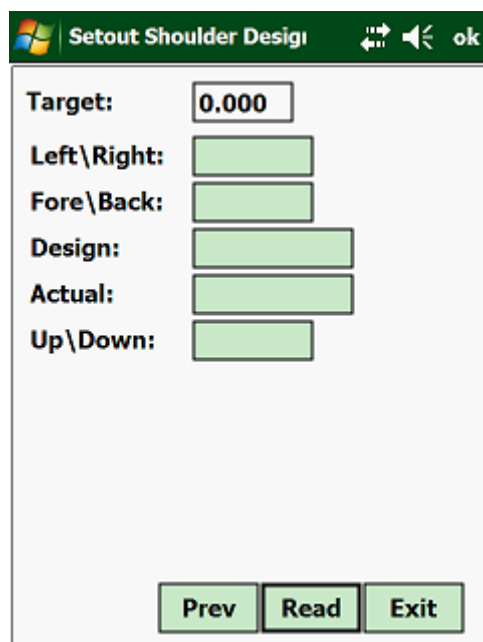
Crossfall: N\A

Bear: 29.3725

Dist: 41.485

Calc Exit

Tap on the “Next” button:



Target: 0.000

Left\Right:

Fore\Back:

Design:

Actual:

Up\Down:

Prev Read Exit

The input screen is very similar, whether you are working with a Level, Total Station, Total Station or GPS.



Working in manual mode with a level, the output will be as follows:

The screenshot shows a software window titled "Shoulder Design". It contains several input fields with their current values: Stake is 20.000, Side is set to Left, Offset is -9.000, Crossfall is 2.000, Design is 101.970, and Staff is 3.030. Navigation buttons (< and >) are next to the Stake and Side fields. At the bottom of the window are two buttons labeled "Calc" and "Exit".

- Stake Value - that is the stake value that was requested.
- Side - select the side that you want to work on.

Tap on <Calc>, which will display the following:

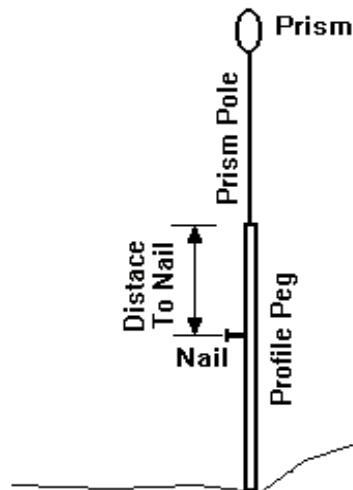
- Offset - this is the offset calculated as per the design widths plus the edge shift plus the shoulder width. If the profile peg is to the left of the stakeline, then the offset will be a negative number, else if the profile is to the right of the stakeline, then the offset will have a positive value.
- Nail Level - final nail level as calculated per the design plus the relative height of the edge shift plus the percentage fall of the shoulder and surface parameters input.
- Staff - that is the reading on staff to place the nail on the profile peg at the correct level. Make sure that you have the correct collimation in the program. This you can check under the "Leveling" option.
- Diff - this is the difference between the bottom and top level.

With the levels for the shoulder, both levels will be displayed. If this peg is to be used for earthworks operations, then you must pull a string from the bottom nail on the profile peg for the design width to the top nail that you have just placed and vice versa. Make sure that the travel and layer depth for the design surface and for the edge shift is the same.

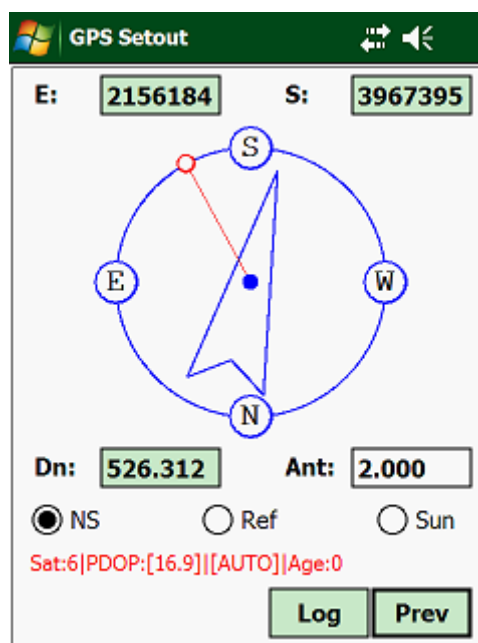
- Click on the <Read> button.

The program will then calculate the correction to the distance, by displaying either backward (move further away from the instrument) or forward (move closer to the instrument), together with a distance.

The program will also display the distance measured from the top of the peg to the respective nails.

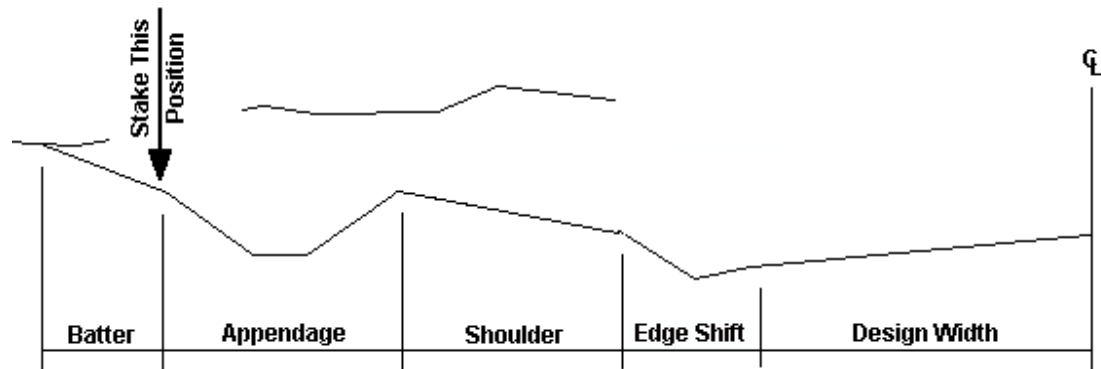


For a GPS, the screen is as follows:

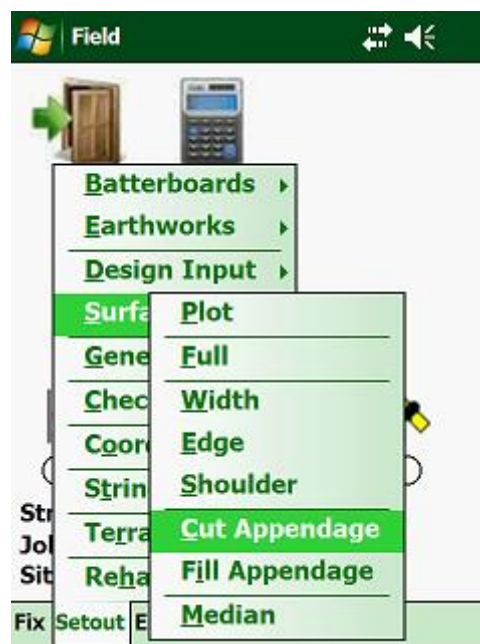


### 3.6.07 Appendage:

The appendage data is the feature that is lodged between your shoulder or the edge shift or the design width, depending upon your design input data and your batter. This could be a side drain, retaining wall, etc.



To access this routine, tap on “Surface” and then on either “Cut Appendage” or “Fill Appendage”:



The following input screen will then appear:

**Cut Appendage**

Stake: 40.000 <

Side: Left >

Offset: -9.000

Crossfall: N\A

Bear: 29.3725

Dist: 41.485

Calc Exit

- Stake Value - that is the stake value that was requested.
- Side - select the side that you want to work on.

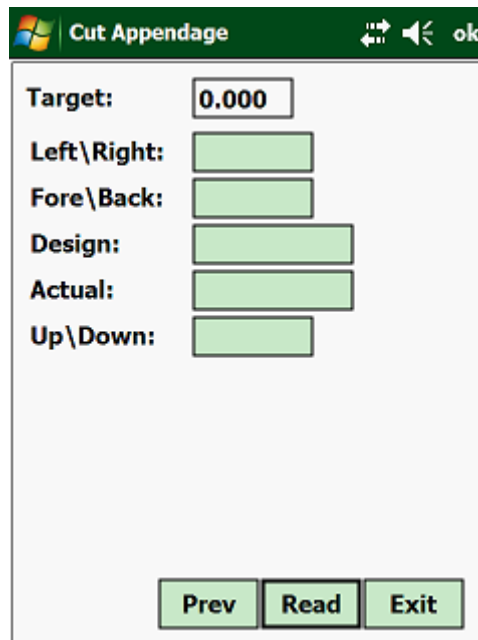
The input screen is very similar, whether you are working with a Total Station, GPS or a Level.

Tap on <Calc> to display the next:

- Offset - this is the offset calculated as per the design widths plus the edge shift plus the shoulder width plus the appendage width. If the profile peg is to the left of the stakeline, then the offset will be a negative number, else if the profile is to the right of the stakeline, then the offset will have a positive value.
- B\Design - final nail level as calculated per the design plus the relative height of the edge shift plus the percentage fall of the shoulder plus the relative height of the appendage width and surface parameters input.
- Staff - that is the reading on staff to place the nail on the profile peg at the correct level. Make sure that you have the correct collimation in the program. This you can check under the “Leveling” option.

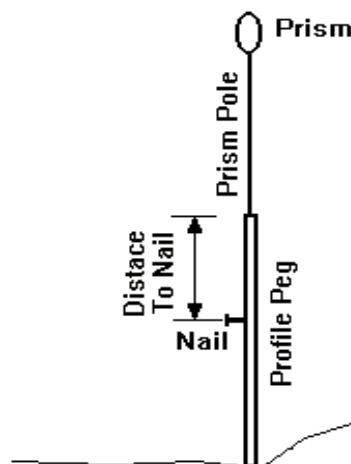
With the levels for the appendage width, only one level will be displayed. If this peg is to be used for earthworks operations, then you must pull a string from the bottom nail on the profile peg for the shoulder to this nail that you have just placed. Make sure that the travel and layer depth for the shoulder and for the appendage width is the same. In practice, one would normally use the batterboards for the bulk earthworks, and then once the levels are more or less to design, then only place the appendage width pegs.

Working with a Total Station, the output is as follows:

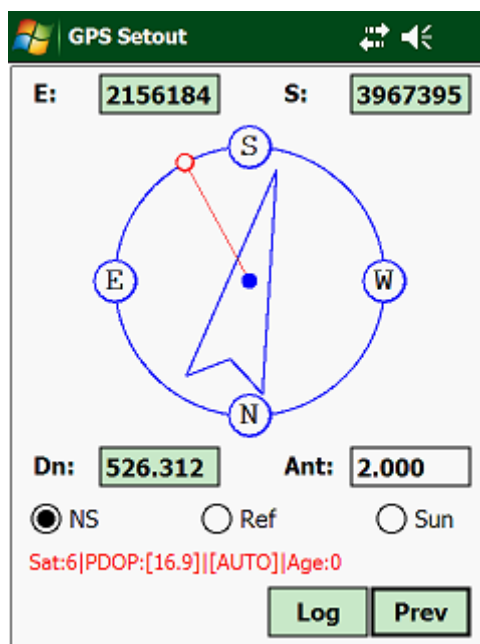


- Left\Right - this is for the person at the Prism Pole to move either left or right to get in line with the calculated bearing.
- Fore\Back - this is also for the person at the Prism Pole to move forwards or backwards relative to the Total Station.
- Design - this is the calculated design level.
- Actual - this is the actual level where the Prism Pole is.
- Up\Down - the distance from the actual level to the design level.

The program will then calculate the correction to the distance, by displaying either backward (move further away from the instrument) or forward (move closer to the instrument), together with a distance.

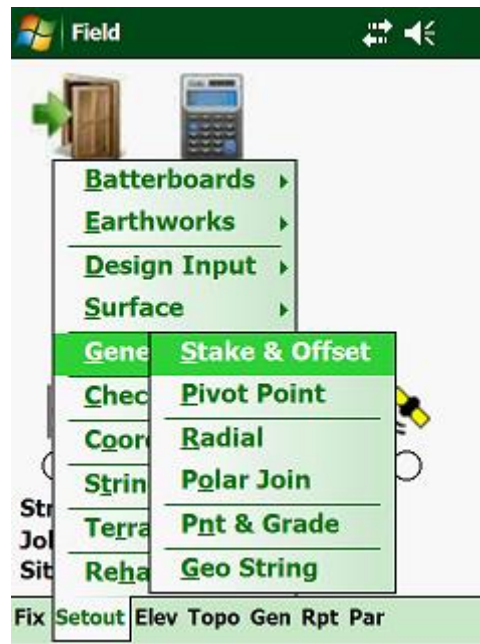


When using a GPS:



**3.7.00 General:**

Here you will find general surveying routines that can help you with your surveying tasks. Tap on “Setout” and then on “General”:



Routines available:

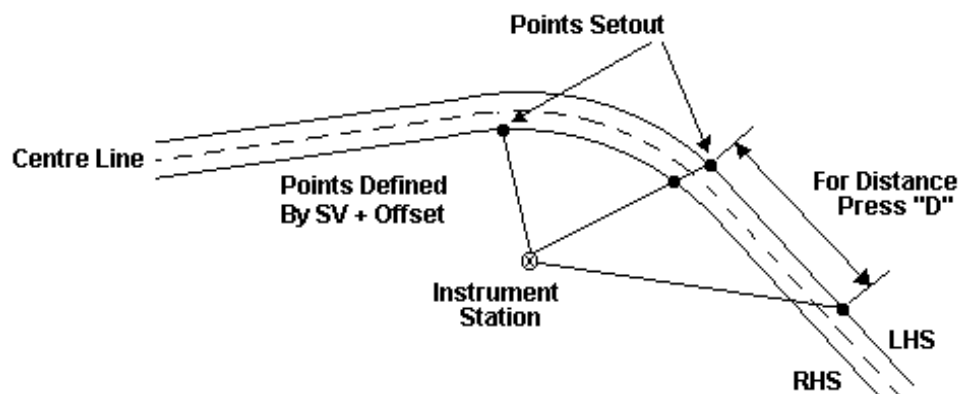
- Stake + Offset - set out a point by specifying the Stake value and offset from the stakeline.
- Pivot Point - place the position where the vertical alignment is defined. This can be used when the centreline is at an offset from the stakeline.
- Radial - place a peg by defining the direction and distance from a selected reference point from one of your control files.
- Polar Join - calculate the distance and direction between two observed points.
- Pnt & Grade - observe a point and then specify the grade from this point. The program will calculate the vertical movement to attain the design level.
- Geo String - this is a String defined by a start and end point, which is tied to the geometric design of the Job.

### 3.7.01 Stake + Offset:

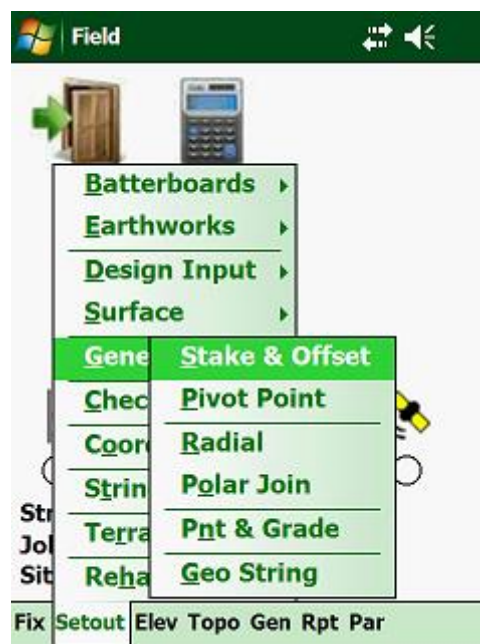
Stake value is the distance along the horizontal alignment, defined by horizontal Pi's or by the alignment points.

The offset is the perpendicular distance from the tangent.

Any stake value and offset can be placed from anywhere, provided the station to set out from, has been established in "Fix".

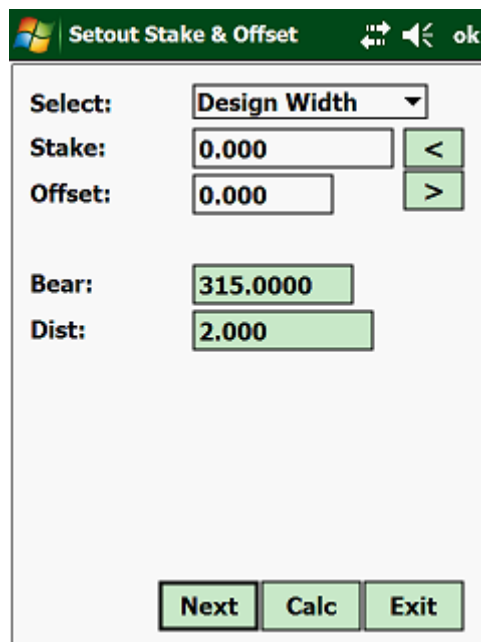


To access this option, tap on "General" and then on "Stake Offset":





The input screen is as follows:



**Select:** Design Width

**Stake:** 0.000 <

**Offset:** 0.000 >

**Bear:** 315.0000

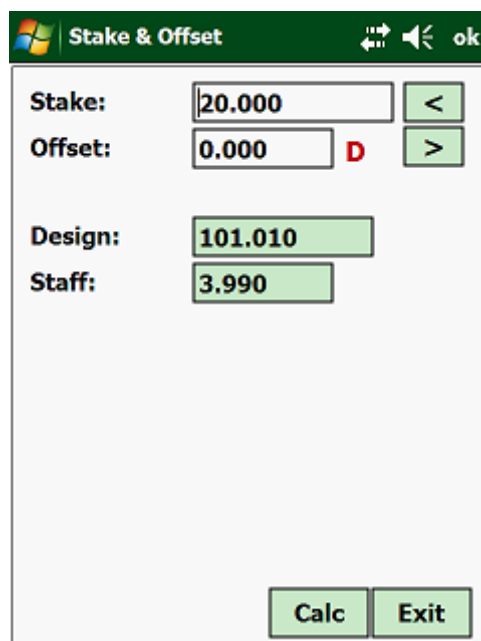
**Dist:** 2.000

Next Calc Exit

- Stake - Enter the required stake value. Make sure that you are within the limits of the Job.
- Offset - Enter the offset to set out. If you are left of the centerline, then enter the offset as a negative value, else if you are to the right of the centerline, enter the offset as a positive value.

Next tap <Calc>:

If the level mode is active, the following will be displayed:



**Stake:** 20.000 <

**Offset:** 0.000 D >

**Design:** 101.010

**Staff:** 3.990

Calc Exit

The design level and the staff reading will be displayed. The staff reading is the reading that you must place the nail at on the profile. This level has been calculated according to the parameters set under the “parameters” option. You must make sure that your collimation is correct - this you can check under the “Leveling” option.

If you are using a theodolite or a Total Station, then the display will be as follows:

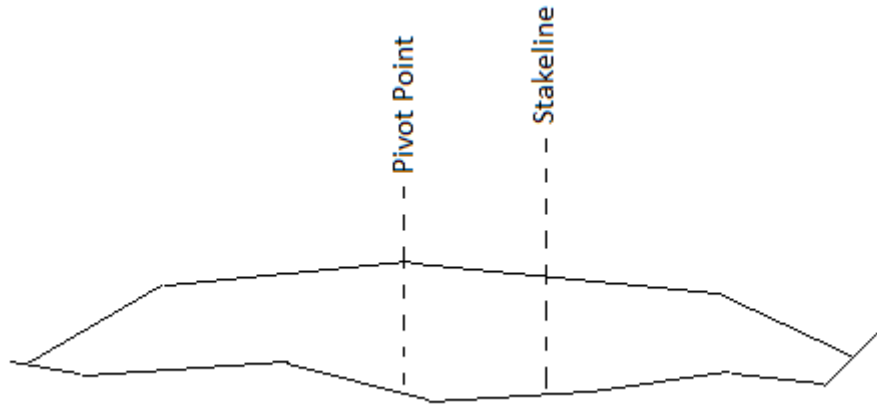
The screenshot shows a software interface titled "Setout Stake & Offset". It features a Windows logo in the top left corner and navigation icons (back, forward, and a speaker icon) in the top right corner, along with an "ok" button. The main area contains several input fields: "Select:" with a dropdown menu showing "Design Width", "Stake:" with a text box containing "0.000" and a "<" button, "Offset:" with a text box containing "0.000" and a ">" button, "Bear:" with a text box containing "315.0000", and "Dist:" with a text box containing "2.000". At the bottom, there are three buttons: "Next", "Calc", and "Exit".

Tap on the “Next” button:

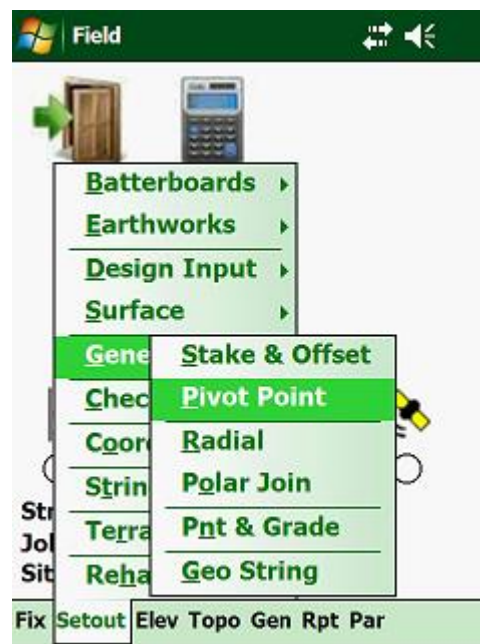
The screenshot shows the same software interface after tapping the "Next" button. The title "Setout Stake & Offset" and the top navigation icons remain the same. The input fields have changed: "Target:" with a text box containing "0.000", "Left\Right:" with an empty text box, "Fore\Back:" with an empty text box, "Design:" with an empty text box, "Actual:" with an empty text box, and "Up\Down:" with an empty text box. At the bottom, the buttons are now "Prev", "Read", and "Exit".

### **3.7.02 Pivot Point:**

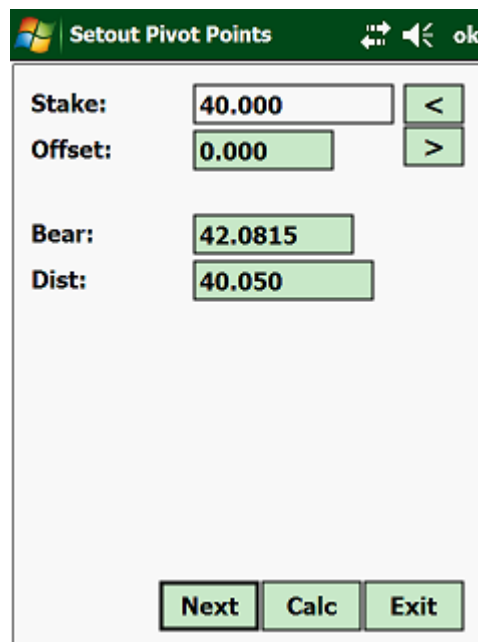
The Pivot Point defines the position where the vertical alignment is located in relation to the stake line.



Tap on “General” and then on “Pivot Point”:



Input Screen:



Stake: 40.000 <

Offset: 0.000 >

Bear: 42.0815

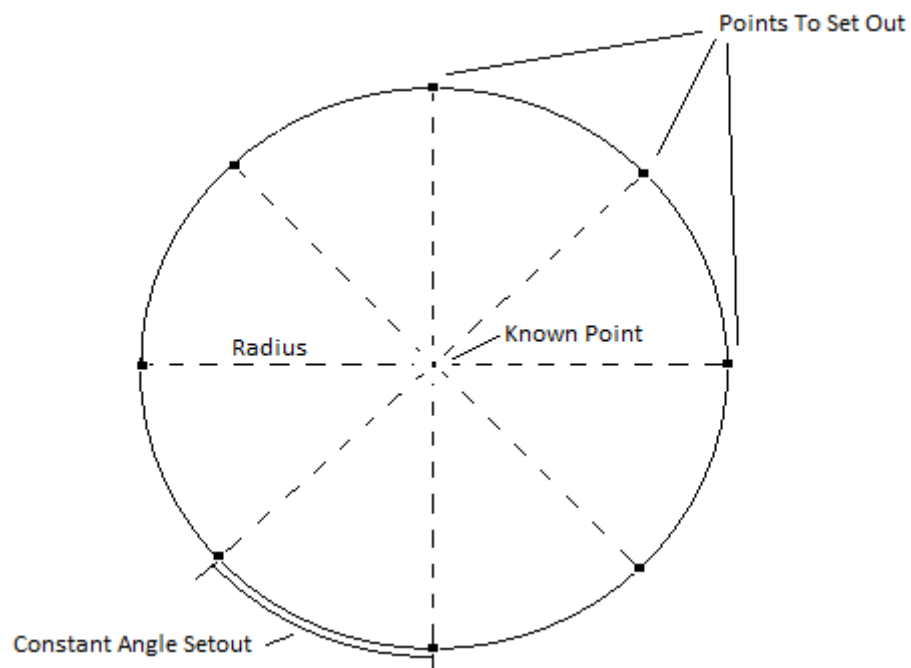
Dist: 40.050

Next Calc Exit

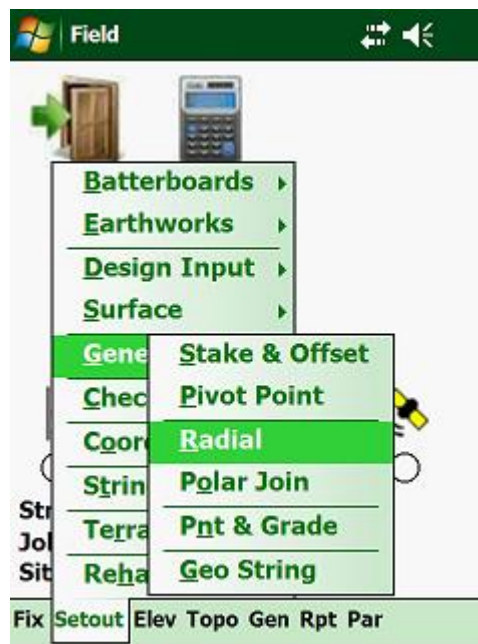
Enter the stake value required and the program will calculate the offset from the stakeline, as well as the horizontal angle and distance to the position.

### **3.7.03 Radial:**

With this you can set out a point from a control point by specifying the distance, direction and offset from the specified direction.



Tap on “General” and then on “Radial”:

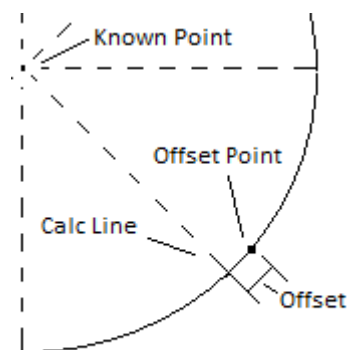


This will display the following screen:

A screenshot of the 'Setout Radial Points' dialog box in the CEASER<sub>field</sub> application. The dialog box has a title bar with the text 'Setout Radial Points' and an 'ok' button. Inside the dialog, there are three radio buttons for 'Local', 'Site', and 'Global'. The 'Local' radio button is selected. Below the radio buttons, there is a 'Select Pt:' dropdown menu with 'A' selected, and a 'Pt Name:' text field with 'A' entered. To the right of the 'Pt Name:' field is a green button with a question mark. Below these fields are five input fields for 'Start Ang:', 'Ang Incr:', 'Radius:', and 'Offset:', with values '0.0000', '20.0000', '10.000', and '0.100' respectively. At the bottom of the dialog are two buttons: 'Next' and 'Exit'.

- Firstly select the control file that you want to use (Local, Site or Global) by tapping with your stylus on it.

- From the pulldown list, that will display the control points in the selected type of file, select your starting point.
- Start Angle - enter the start bearing from where the calculations have to start.
- Angle Incr - enter the angle increment.
- Dist - this will be the distance (radius) from the selected reference point to the circumference.
- Offset - this is the distance away from the calculated setout line. If the offset is to the left then enter a negative number else enter a positive number.



Tap on the “Next” button:

The program will display the horizontal angle and distance to the first point. By tapping on the “Arrow” buttons, you can progress forward or backward to each point on the circumference.

If you are connected to a Total Station then tap on the <Read> button to get the results. If you are working in manual mode, then enter all the variables and tap on the <Calc> button.



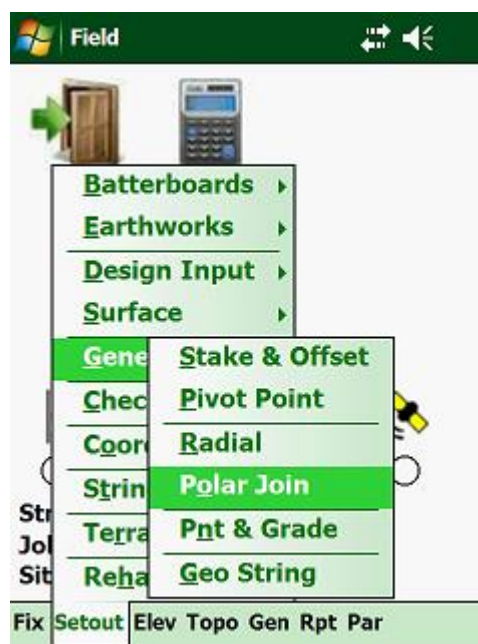
Field	Value
S\Ang:	20.0000
Hor Ang:	0.0219
Dist:	3730855.7
Target:	0.000
Back\Fore:	
Left\Right:	
Up\Down:	

Buttons: Prev, Read, Exit

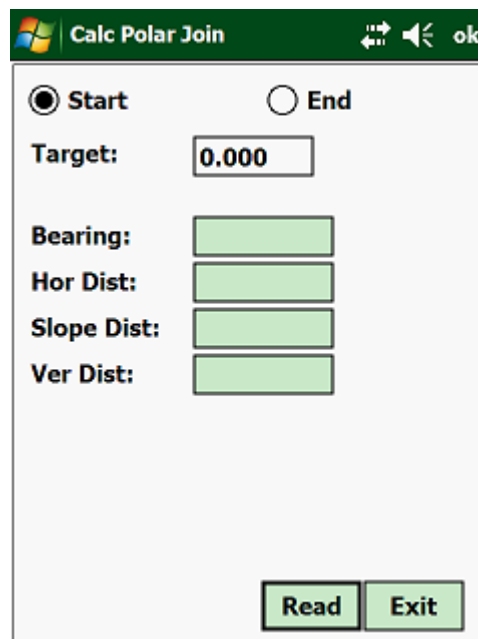
### 3.7.04 Polar Join:

A “Polar Join” will calculate you the distance and direction between two observed points.

Tap on “General” and then on “Polar Join”:



This will display the following:



Calc Polar Join

☒ Start ☐ End

Target: 0.000

Bearing:

Hor Dist:

Slope Dist:

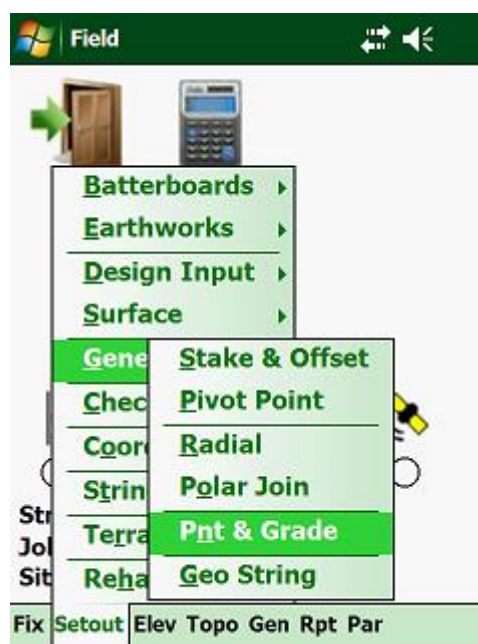
Ver Dist:

Read Exit

Select whether you are reading the start or end of the line. Once both ends have been observed, the program will calculate the distance and bearing between the two points.

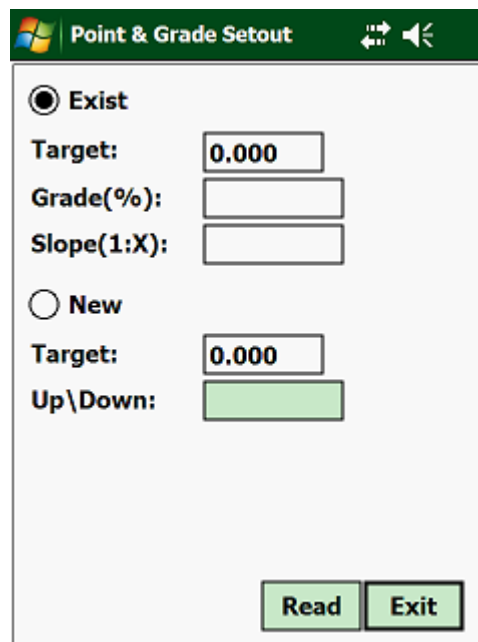
### 3.7.05 Pnt & Grade:

Point and Grade is where you pick up an existing point and specify the grade as a percentage or the slope either negative or positive. This can be useful on the Rehabilitation of a road, controlling the elevation of a pipeline, etc. From the pull down menu, select “General” and then “Pnt & Grade”:





Next:



**Point & Grade Setout**

☒ **Exist**

Target: 0.000

Grade(%):

Slope(1:X):

☐ **New**

Target: 0.000

Up\Down:

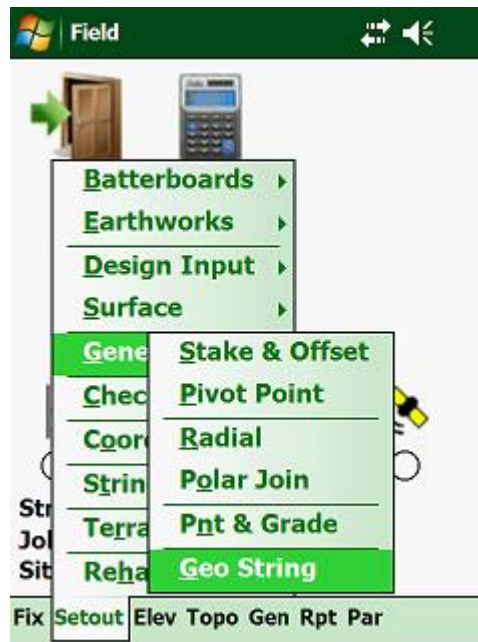
Read Exit

Make sure that the “Exist” is marked and enter a Grade value or a Slope. Also check that your Target Height (Prism) is correct. If you are using a Rover, then it will be the height of your Prism.

Next, click on “New”. Now as you move along the program will calculate the “Design” based on your initial level and grade (or slope) entered and compare that to the ground level on each “Read” action.

### **3.7.06 Geo String:**

A Geo String is a line defined by a start and end point fixed to your Geometric parameters of your Job. From the “General” menu select “Geo String”:



Next:

The screenshot shows the 'Geo String' dialog box in the CEASER\_field software. The dialog box has a title bar with the Windows logo and the text 'Geo String'. It contains two sections: 'Start:' and 'End:'. Each section has two input fields: 'Stake:' and 'Offset:'. At the bottom of the dialog box, there are three buttons: 'Check', 'Setout', and 'Exit'.

Values to be entered:

- Start - enter the start stake and offset relative to your Job.
- End - enter the end stake and offset relative to your Job.

Next you have either the option to “Check” or “setout” the String.

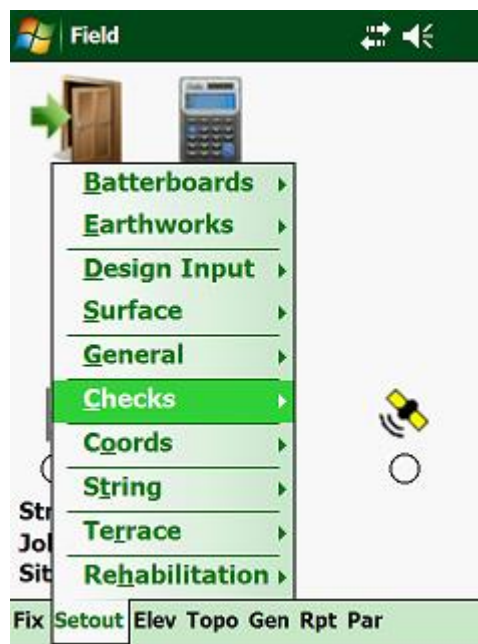
Note: should the String cover an area where there is a curve in the Job, then the String will follow this curve.

**3.8.00 Checks:**

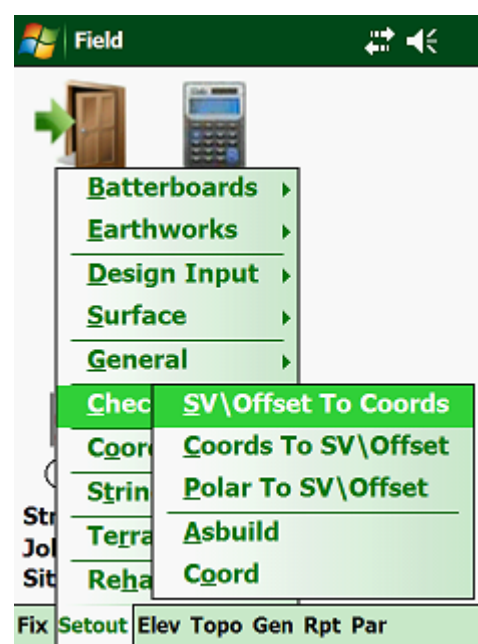
With this option, you have the following routines:

- SV/Offset To YXZ
- YXZ To SV/Offset
- Polar To SV/Offset
- Asbuild
- Point

To select this option, move the highlight bar to “Checks” and press the <Enter> key:



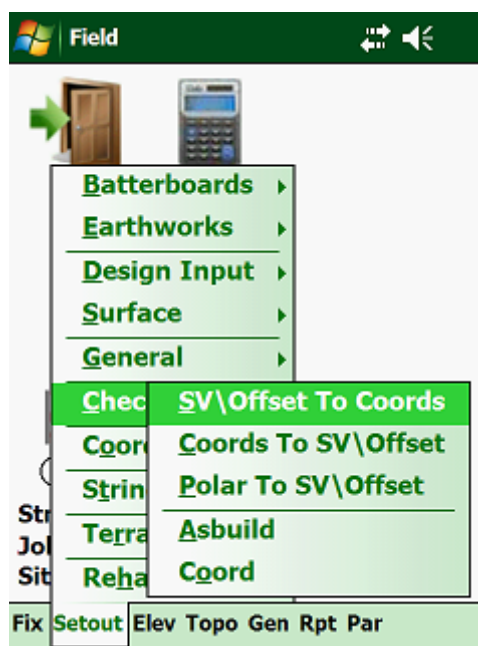
This will display the following options:



### **3.8.01 SV/Offset To YXZ:**

With this option you can enter any stake value and offset within the parameters of the Job and the program will calculate the Y, X and Z (the design height) coordinates of the point.

To select this option, move the cursor to “Sv/Offset To YXZ” and press the <Enter> key:



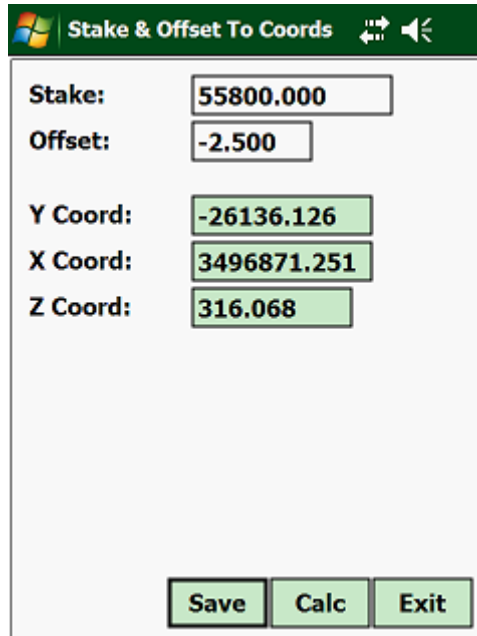
This will then display the following:

A screenshot of the 'Stake & Offset To Coords' form in the CEASER Field software. The top bar is green with the Windows logo, the text 'Stake & Offset To Coords', and navigation icons. The form contains several input fields: 'Stake:' with the value '50800.000', 'Offset:' with the value '-2.500', 'Y Coord:', 'X Coord:', and 'Z Coord:'. At the bottom right, there are two buttons: 'Calc' and 'Exit'.

Here you have to enter the following:

- Stake - enter the stake value of the required point.
- Offset - enter the required offset from the stakeline of the point required.  
If the point is to the left of the stakeline then enter as a negative value, else if the point is to the right of the stakeline, then enter the offset as a positive point.

Then:



Stake:	55800.000
Offset:	-2.500
Y Coord:	-26136.126
X Coord:	3496871.251
Z Coord:	316.068

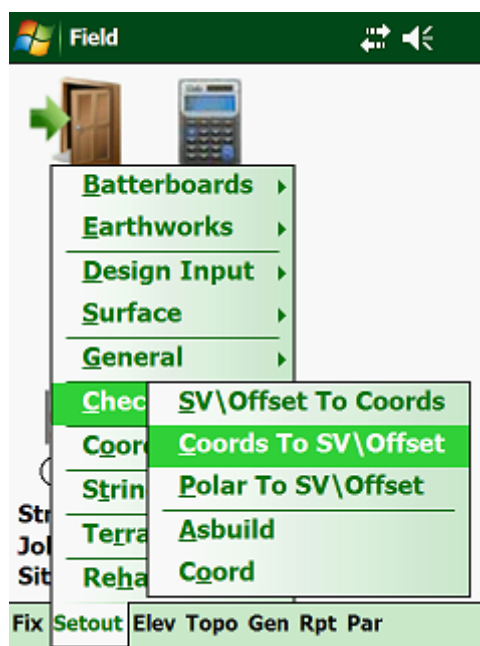
Save Calc Exit

Here you have the option of saving the coordinate in either the Local, Site or Global coordinate file.

### **3.8.02 YXZ To SV/Offset:**

This option is the reverse of the above option. Here you enter the point name of the coordinates and the program will calculate the stake value and offset of the point entered.

To select this option, move the cursor to “YXZ To Sv/Offset” and press the <Enter> key:



This will then display the following:

A screenshot of the 'Coords To Stake & Offset' dialog box. The dialog box has a title bar with the Windows logo and the text 'Coords To Stake & Offset'. It contains several input fields and buttons. At the top, there are three radio buttons: 'Local', 'Site' (which is selected), and 'Global'. Below these are two text boxes: 'Select Pt:' with a dropdown menu showing 'A', and 'Pt Name:' with a text box containing 'A' and a question mark button. Below these are five text boxes for numerical values: 'Stake:' (55800.000), 'Offset:' (-2.500), 'Design:' (316.068), 'Actual:' (316.068), and 'Down:' (0.000). At the bottom right, there are two buttons: 'Calc' and 'Exit'.

Tap on the required file type, i.e. “Local”, “Site” or “Global”.

Bear in mind that the “Local” file holds only coordinates for the Job that is open. The “Site” file that be opened by all the Jobs that are related to the opened Site and the “Global” file can be accessed by all the Sites and Jobs.

Next you must enter the following:

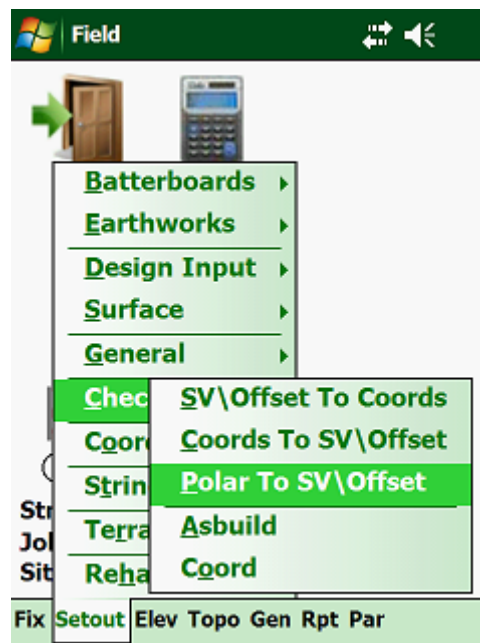
- Pnt Name - select from the pulldown list at which station you are standing.

You can also type in the name of the control point and then tap on the “?”. The program will look for the point in the coordinate file and display the coordinates of the point in the respective textboxes.

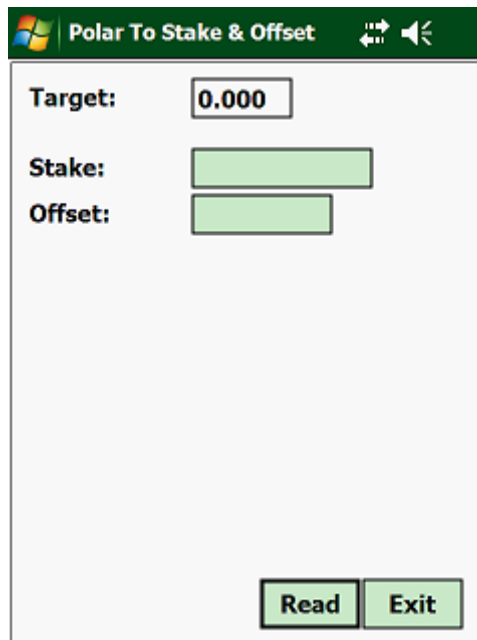
Tap on <Calc> to calculate the stake value, offset and design height of the point entered. This will only work if the coordinates are within the limits of the Job.

### **3.8.03 Polar To SV/Offset:**

Here one can calculate the stake value and offset of the point observed. To select this option, move the cursor to “Polar To SV/Offset” and press the <Enter> key:



Input:



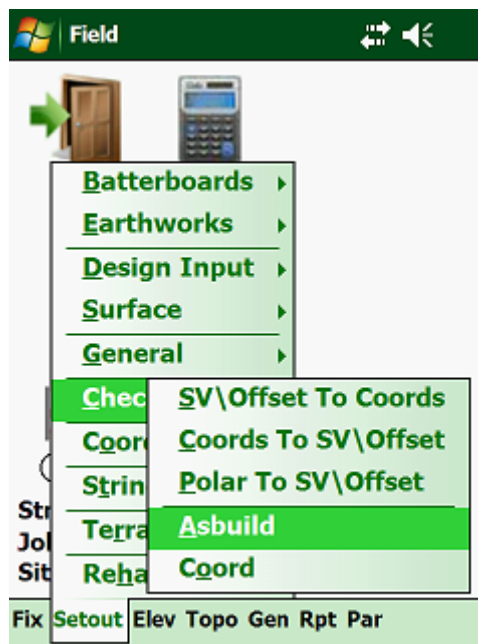
Tap on <Read> to read the Prism when using the Total Station or Rover when using a GPS and the program will calculate the Stake and Offset were the Prism or Rover is held.

#### **3.8.04 Asbuild:**

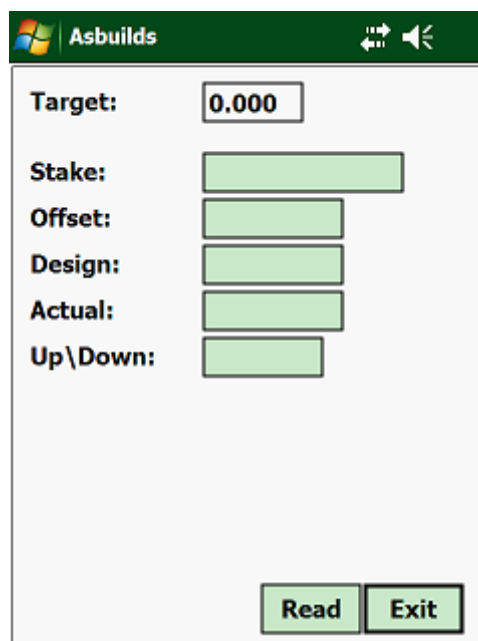
This is similar to the above function, but here **Ceaser** also makes a comparison between the actual observations and the design parameters. One could use this routine on Jobs where there are certain tolerances that apply. Using this option you will then be able to immediately see whether the observed points are within tolerance.



To select this option, move the cursor to “Asbuild and press the <Enter> key:



Then:

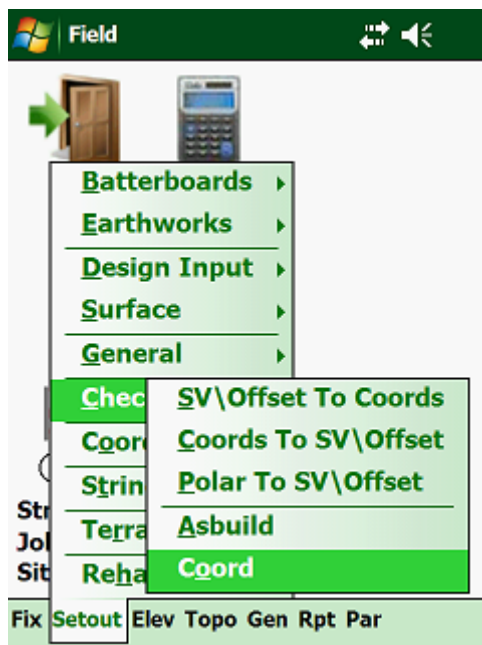


Tap on the <Read> button irrespective whether you are using a Total Station or a GPS.

### **3.8.05 Check A Point:**

With this routine, you can check the position of points already placed that exist in your local or global coordinate file.

To access this routine, move the highlight bar down to “Check A Point” and press the <Enter> key:



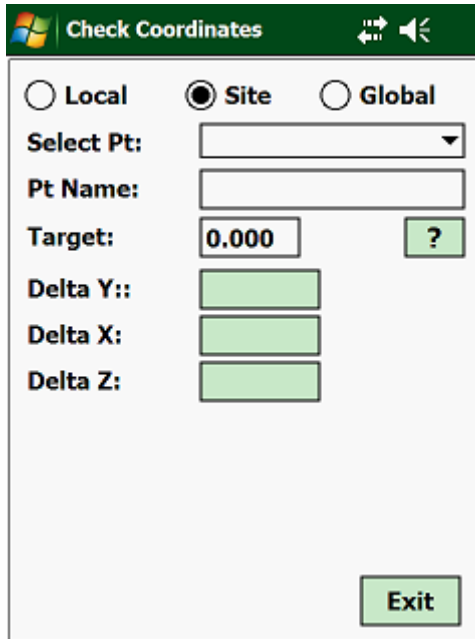
Tap on the required file type, i.e. “Local”, “Site”, “Global” or “Setout”

Next you must enter the following:

- Pnt Name - select from the pulldown list at which station you are standing.

You can also type in the name of the control point and then tap on the “?”. The program will then look for the point in the coordinate file and display the coordinates of the point in the respective textboxes.

When linked up to a Total Station or GPS, then the only variable that you can change, will be the prism height, as the angles and the slope distance is read automatically from the instrument. This will then make a comparison between the actual and theoretical values of the target observed.



**Check Coordinates**

☐ Local    ☒ Site    ☐ Global

Select Pt:

Pt Name:

Target:

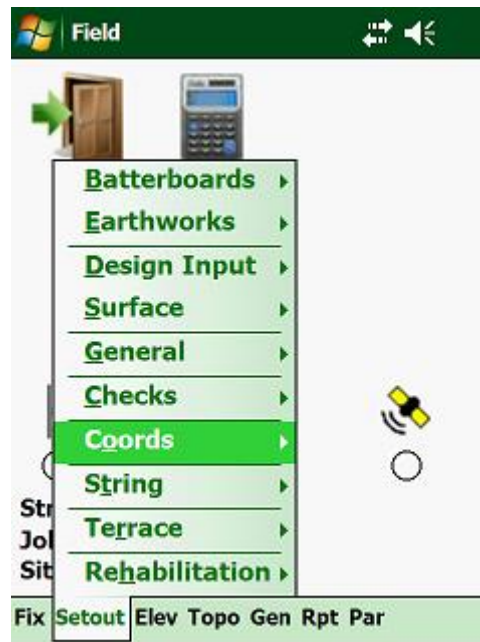
Delta Y:

Delta X:

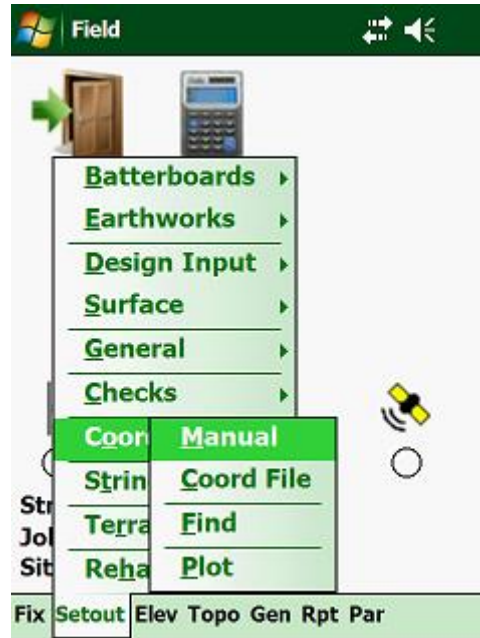
Delta Z:

### 3.9.00 Coordinates:

These routines will let you set out coordinates from your Local, Site or Global coordinate files. Or you can enter manual coordinates to set out.



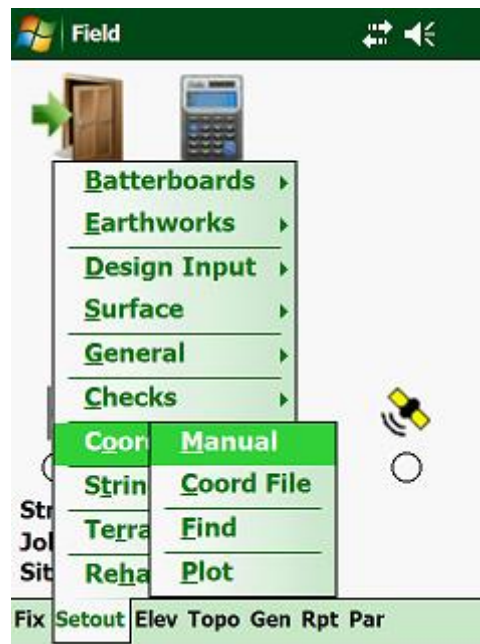
This will give you the following options:



- Manual - here you can enter the Y, X and Z coordinate to be set out.
- Coord File - here you can set out coordinates which are stored in either the Local, Site or Global coordinate file.
- Check A Point - any point stored can be recorded and compared with the theoretical position, displaying the delta values.

**3.9.01 Manual:**

This option lets you type in Y, X and Z co-ordinates, which you want to set out.



Here the input screen is as follows:

A screenshot of the 'Setout Manual Coords' input screen in the CEASER Field software. The title bar at the top is green with the Windows logo and the text 'Setout Manual Coords'. The screen contains input fields for 'Y Coord:', 'X Coord:', and 'Z Coord:'. Below these are fields for 'Bear:' and 'Dist:'. At the bottom of the screen, there are three buttons: 'Calc', 'Next', and 'Exit'.

- Y Coord - Enter the Y co-ordinate of the point
- X Coord - Enter the X co-ordinate of the point
- Z Coord - Enter the Z co-ordinate of the point.

If you have selected the “Level” option, then the program will display the stake value, offset and the staff reading of the selected point.

If you have selected the “Total Station” option, then the program will display the horizontal angle and the horizontal distance to the point. You must then enter the vertical angle and the slope distance observed, in order for the program to calculate a correction distance to that point.

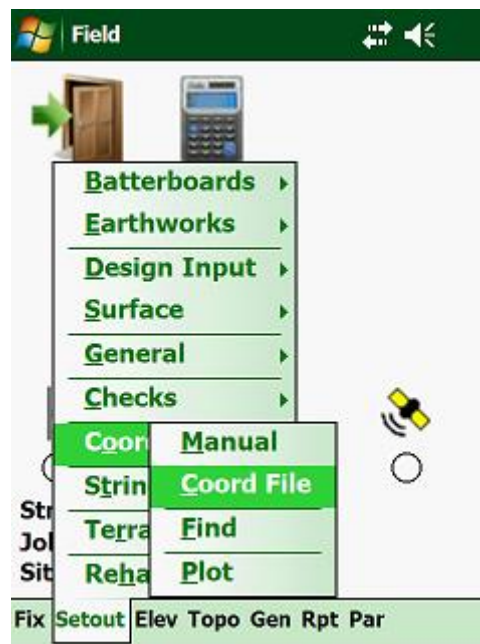
Y Coord:	58000.000
X Coord:	375483.000
Z Coord:	60.000
Bear:	178.2721
Dist:	3122524.164

Calc Next Exit

### **3.9.02 Coord File:**

This option provides for setting out points stored in the local or global coordinate file. The coordinates for the point entered are extracted from the file. The relevant setting out data is computed and displayed. If the name does not exist, you will be asked to enter the coordinates.

Move the highlighter bar to “Coord File” and press the <Enter> key:



The input menu is as follows:

The screenshot shows the 'Setout File Coords' input menu. It features four radio buttons for file type selection: Local, Site (selected), Global, and Set. Below these are two text input fields: 'Select Pt:' with a dropdown menu showing 'NRB27/02' and 'Pt Name:' with a text box containing 'NRB27/02'. A green button with a question mark is located to the right of the 'Pt Name' field. Below these are two more text input fields: 'Bear:' with the value '90.4957' and 'Dist:' with the value '45065.536'. At the bottom of the form are three buttons: 'Calc', 'Next', and 'Exit'.

Tap on the required file type, i.e. “Local”, “Site”, “Global” or “Setout”

Next you must enter the following:

- Pnt Name - select from the pulldown list at which station you are standing.

You can also type in the name of the control point and then tap on the “?”. The program will then look for the point in the coordinate file and display the coordinates of the point in the respective textboxes.

Next:

Setout File Coords

☐ Local ☒ Site ☐ Global ☐ Set

Select Pt: NRB27/02

Pt Name: NRB27/02 ?

Bear: 90.4957

Dist: 45065.536

Calc Next Exit

If you have selected the “Level” option, then the program will display the stake value, offset and the staff reading of the selected point.

If you have selected the “Total Station” or “GPS” option, then the program will display the horizontal angle and the horizontal distance to the point.

Setout File Coords

Target: 0.000

Left\Right:

Fore\Back:

Design:

Actual:

Up\Down: S

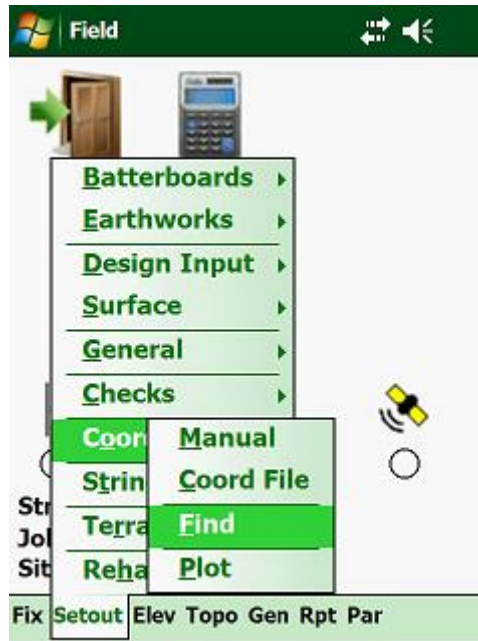
Prev Read Exit

If you are linked up to a Total Station, then you will only be able to change the height of your prism, as the angles and distance is recorded straight from the instrument.



### 3.9.03 Find Point:

This function lets you enter stake value and offset or coordinates, after which the program will find the closest point to the values entered. From the pulldown menu tap on “Checks” and then on “Find Point”:

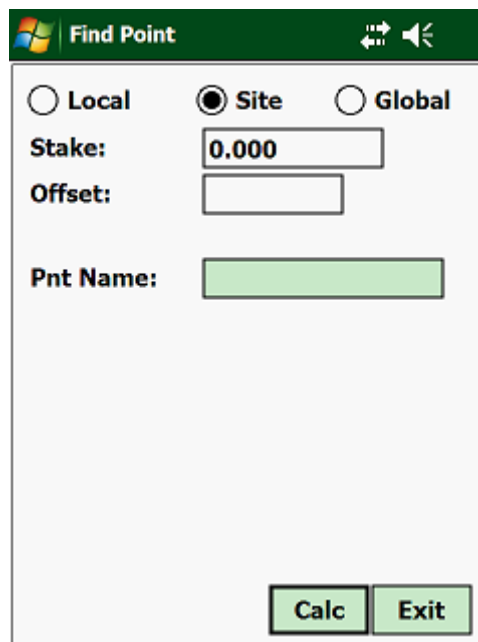


Input screen:

Tap on the required file type, i.e. “Local”, “Site” or “Global”.

Bear in mind that the “Local” file holds only coordinates for the Job that is open. The “Site” file that be opened by all the Jobs that are related to the opened Site and the “Global” file can be accessed by all the Sites and Jobs.

When working in “Level” manual mode:

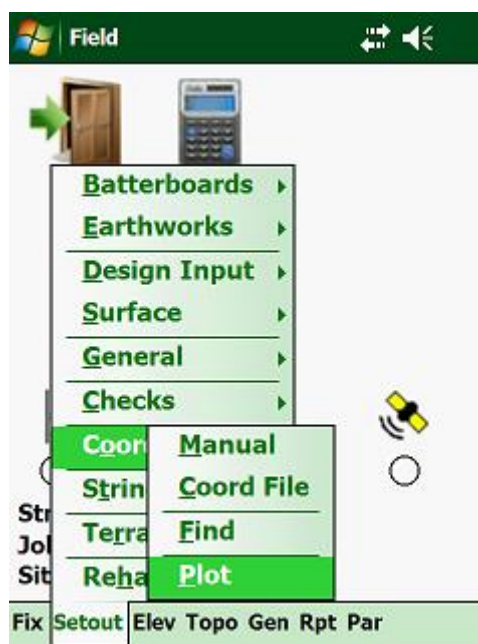


The "Find Point" dialog box has a green header bar with a Windows logo, the title "Find Point", and icons for help and volume. It contains three radio buttons: "Local", "Site" (which is selected), and "Global". Below these are input fields for "Stake:" (containing "0.000"), "Offset:" (empty), and "Pnt Name:" (empty). At the bottom right are "Calc" and "Exit" buttons.

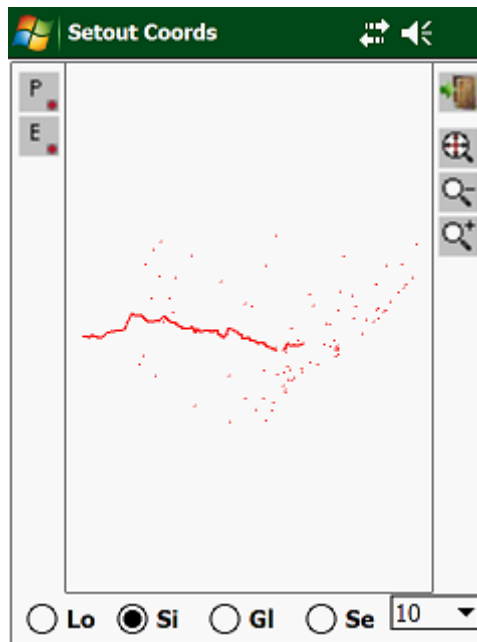
You can either type in the Stake and Offset, or type in the coordinates and the program will find which coordinate point is closest to the values entered.

### **3.9.04 Plot:**

This will plot the control points that you can stored in the selected file. Tap on “Coordinates” and then on “Plot”:



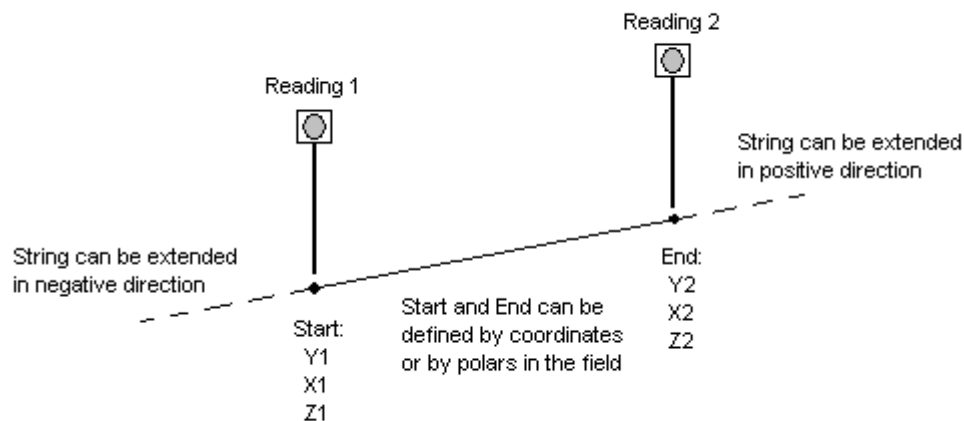
Next:



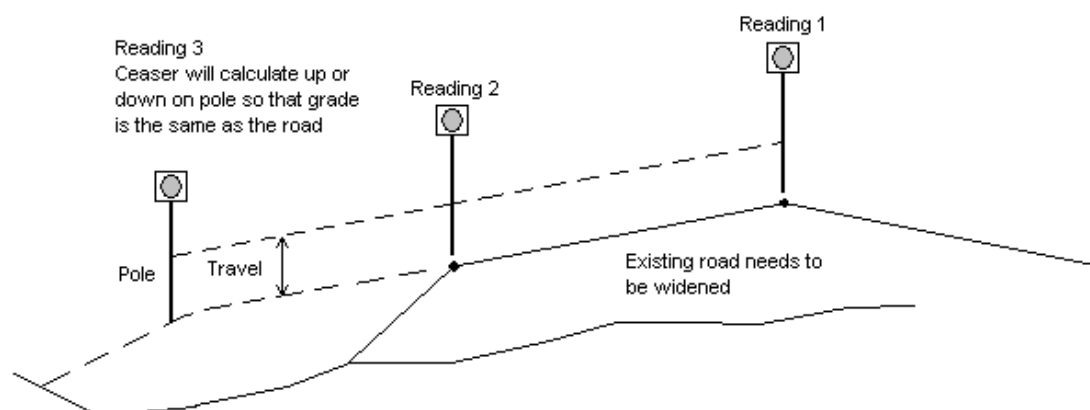
If you have fixed your station setup, the program will also plot the position of your Total Station relative to the rest of the points.

**3.10.00 String:**

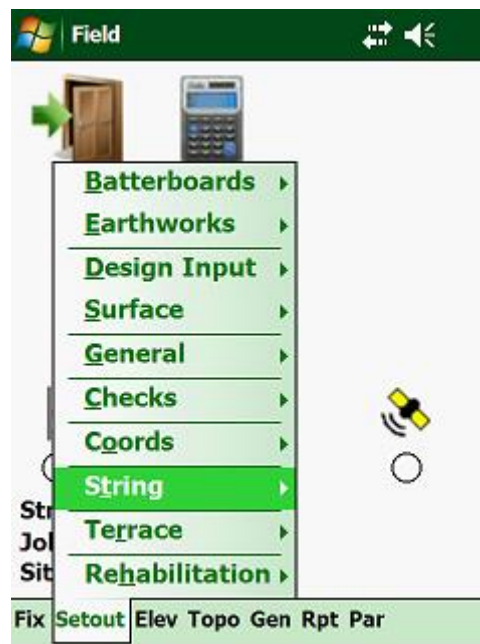
A string is a line that is defined by two points; Y, X and Z at the start and Y, X and Z at the end. This string can either be a straight line between the two points or it can have a circular curve. The string is also not confined between these two points, but can be extended either way.



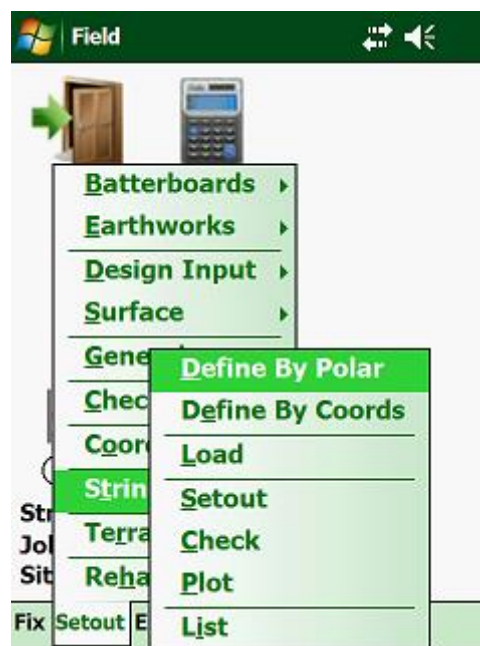
One example where you could use strings would be on an existing road which needs to be widened, but for which there is no design data available. Here you would first knock in the pegs at a predetermined distance from the edge of the road at any interval required. Then you will take a reading on the center of the road and then on the edge of the road. Next hold the prism on top of the pole and read the prism. The program will then calculate the distance up or down from the peg, such that it has the same grade as the road.



Tap on “Setout” and then on “String”:



This will then display the following:

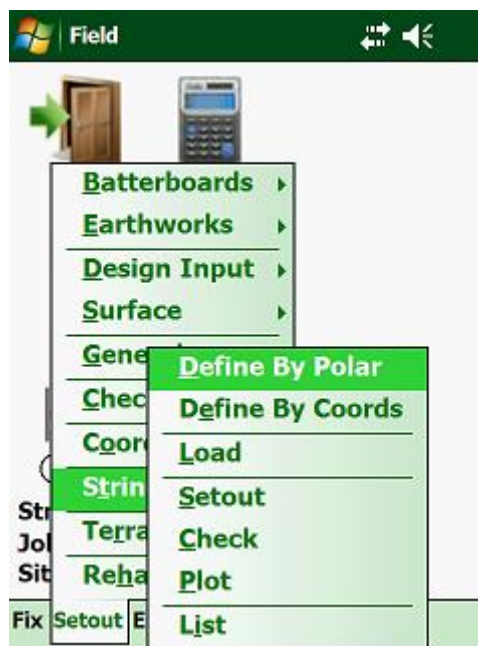


- Define By Polar - this lets you take two readings in the field to determine the two points that will define your string.
- Define By Coords - here one can recall the two points of your string from either the Local, Site or Global coordinate file.
- Load A String - load one of your stored strings.
- Setout String - set out points along the string by specifying the stake and offset with reference to the first point defined on the string.

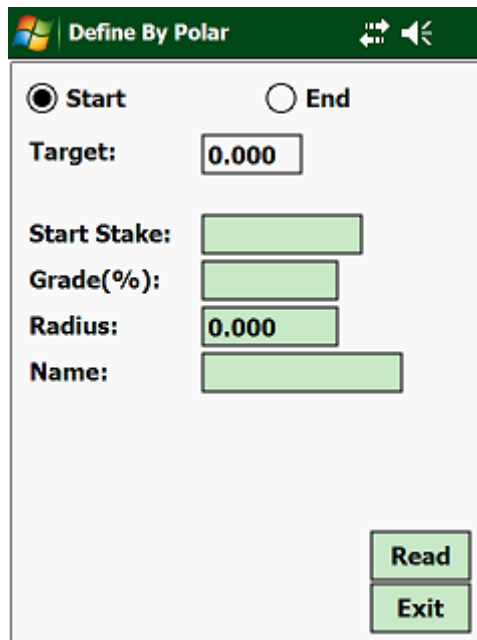
- Check String - here you hold the prism anywhere along the string, and the program will calculate the stake, offset and the design level. The level will be adjusted according to the travel entered under the parameter option.
- Plot - plot the strings.
- List - this will list all your stored strings.

### **3.10.01 Define By Polar:**

Let's you define a string by observing 2 points in the field. Tap on "String" and then on "Define By Polar" from the pulldown menu:



Input Screen:



Tap on either the “Start” or “End” option button, depending on which end of the string you are going to observe first.

Next:

Tap on the “Read” Button and then on the “Add” button.

Next tap on the other option (either “Start” or “End”) and repeat the above input.

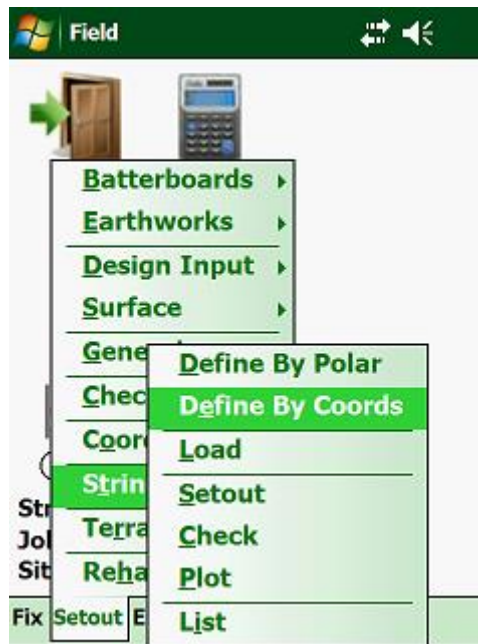
Once this has been, the program will calculate a grade and radius for the string. If the curve is to the left change the radius as a negative value, else keep it as a positive value if the curve is to the right. If you want a straight line between the two points, change the radius to zero.

Next enter the start stake of the string.

If you want to save the string, enter a name and tap on the <Save> button. If you do not save the string, then the parameters of the string will be kept in memory until another string is defined or loaded from the database.

### **3.10.02 Define By Coords:**

Let's you define a string by selecting 2 points from one of your coordinate files. Tap on "String" and then on "Define By Coords" from the pulldown menu:



Input screen:

A screenshot of the 'Define By Coords' input screen. The screen has a green header with the title 'Define By Coords' and navigation icons. Below the header, there are three radio buttons for 'Local', 'Site' (which is selected), and 'Global'. There are two dropdown menus labeled 'Start:' and 'End:'. Below these are five text input fields labeled 'Start Stake:', 'Grade(%)', 'Radius:', and 'Name:'. At the bottom right, there are two buttons labeled 'Save' and 'Exit'.

For the start of the string select the required file type, i.e. "Local", "Site" or "Global". From the pulldown box select the required point.

For the end of the string select the required file type, i.e. "Local", "Site" or "Global". From the pulldown box select the required point.



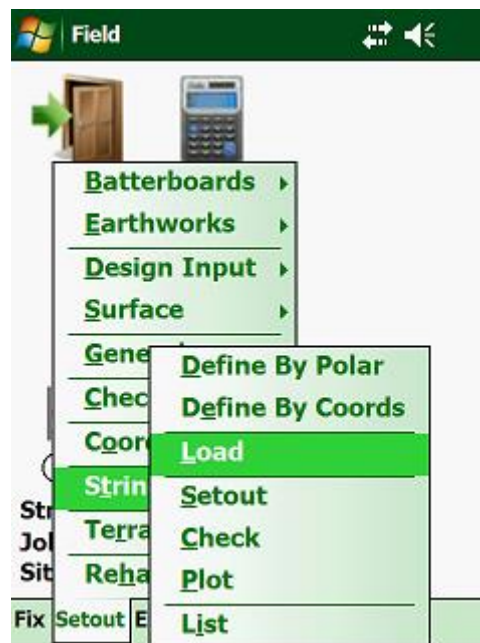
Once this has been, the program will calculate a grade and radius for the string. If the curve is to the left change the radius as a negative value, else keep it as a positive value if the curve is to the right. If you want a straight line between the two points, change the radius to zero.

Next enter the start stake of the string.

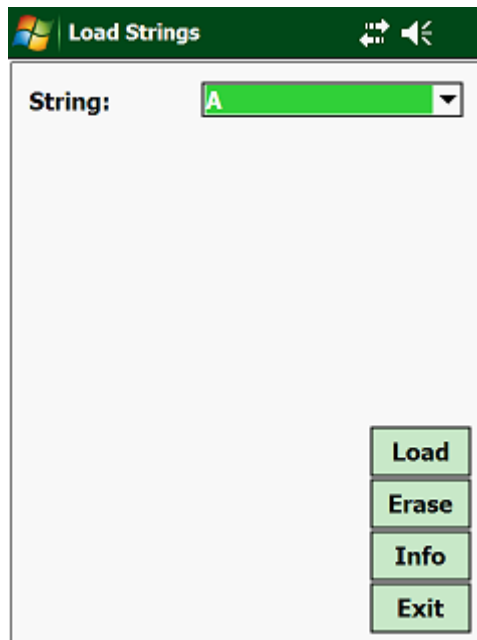
If you want to save the string, enter a name and tap on the <Save> button. If you do not save the string, then the parameters of the string will be kept in memory until another string is defined or loaded from the database.

### **3.10.03 Load A String:**

This lets you load a stored string that has either been defined in the field or by coordinates that you want to work with. Tap on “String” and then on “Load A String”:



Next:

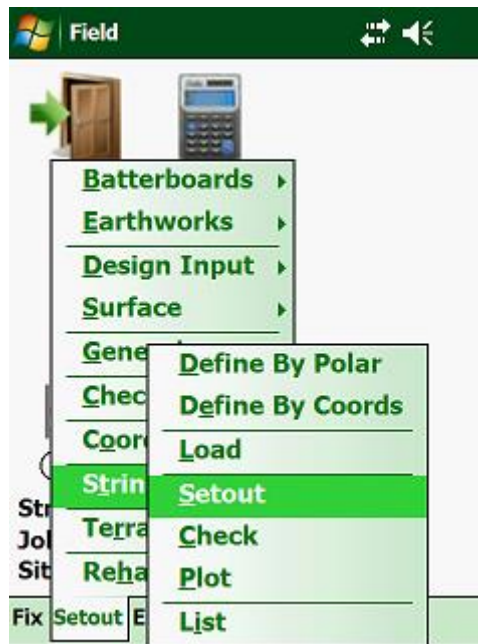


From the pulldown box, select the string that you want to work with and tap on the “Load” button. Other options available:

- Erase - erase the selected string.
- Info - display the properties of the selected string. You have the options to change any of the string properties.

### **3.10.04 Setout String:**

Once you have loaded a string in memory, use this function to set out the string using the Stake and Offset method. Tap on “String” and then on “Setout String”:

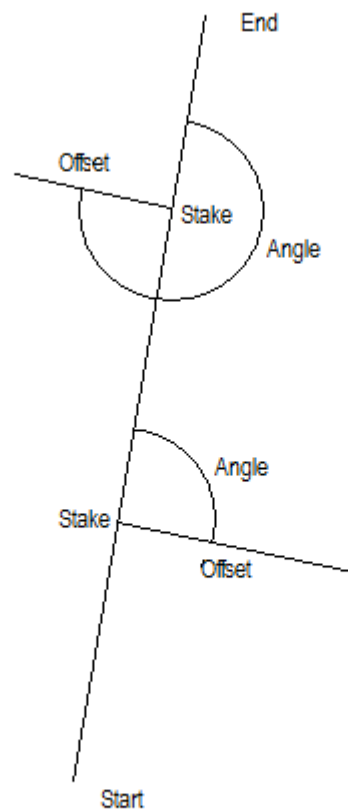


Next:

A screenshot of the 'Setout String' screen in the CEASER Field application. The screen displays the following information: 'Str Name: A' in red, 'Len: 377.235' in red, 'Stake:' with an input field and a '<' button, 'Offset:' with an input field and a '>' button, 'Bear:' with an input field, and 'Dist:' with an input field. At the bottom right, there are two buttons: 'Calc' and 'Exit'.

Input:

- Stake - enter the required stake value along the string.
- Offset - enter the offset relative to the string.
- Ref Angle - enter the angle of the point to be set out.



Tap on <Calc> and the program will calculate the horizontal angle and distance to the required point. Tap on the “Next” button:

**Str Name: A**  
**Len: 377.235**

Stake: 20.000 <  
Offset: 0.000 >

Bear: 90.5414  
Dist: 45418.316

Next Calc Exit

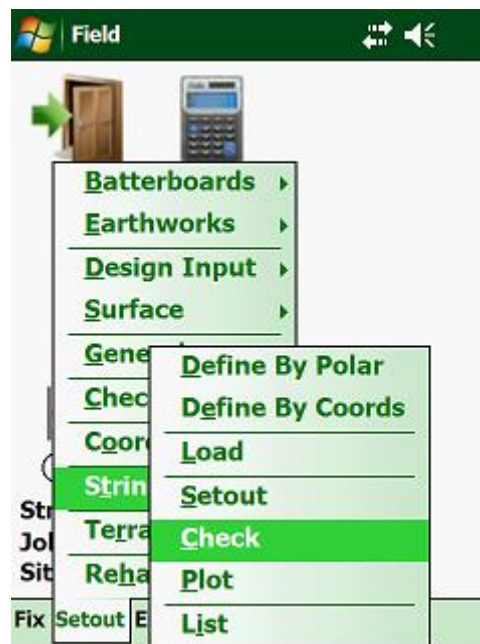
If you are connected to a Total Station, then the vertical angle and slope distance will be read from the instrument. The only variable that you can change is the target height.

Next the program will display the following:

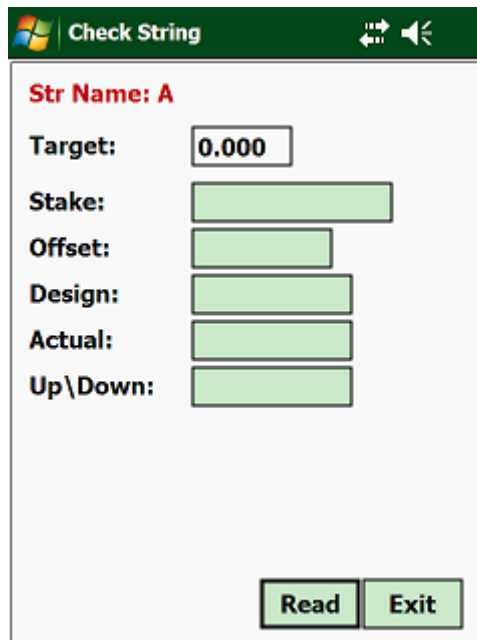
- Backward\Forward      -    this is the distance that the target must move forward or backward to reach the required setting out point.
- Design                    -    the design level of the string at that point.
- Actual                    -    the actual level where the target was kept.
- Up\Down                -    the distance up or down to reach the design level.

### **3.10.05 Check String:**

With this function you can hold your target\prism anywhere along the string and the program will display the stake, offset, design level, actual level and the difference between the 2 elevations. Tap on “String” and then on “Check String”:



Input screen:



- Target Hgt - enter the target height.

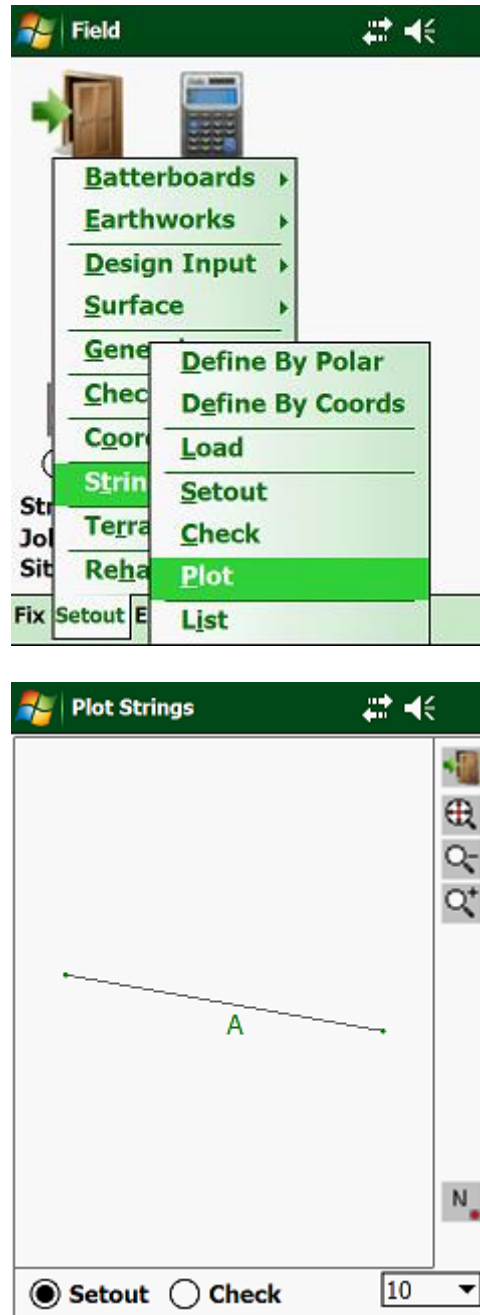
If you are connected to a Total Station, then the horizontal angle, vertical angle and slope distance will be read from the instrument. The only variable that you can change is the target height.

Next the program will display:

- Stake - the stake value relative to the string.
- Offset - offset of the target relative to the string.
- Design - the design level of the string at that point.
- Actual - the actual level where the target was kept.
- Up\Down - the distance up or down to reach the design level.

### 3.10.06 Plot Strings:

Here you plot all your stored strings. The strings will be plotted on your screen and you can tap on the specific string that you want to work with. Tap on “String” and then on “Plot Strings”:

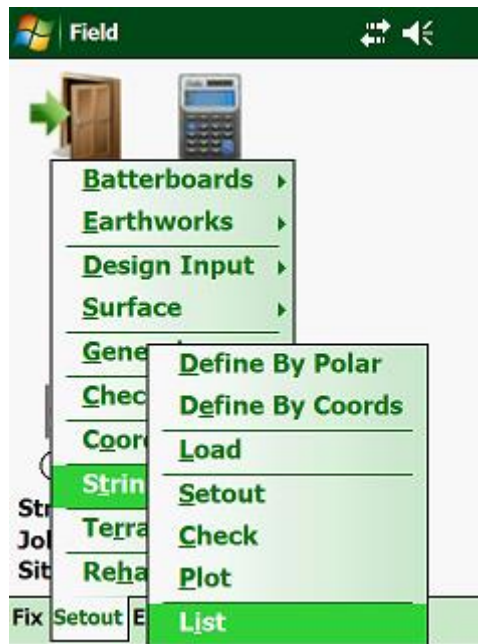


Tap with the stylus on the string that you want to work with. At the bottom of the screen tap either on “Setout” or “Check” and then on the “Next” button. The colour of the selected string will turn red.

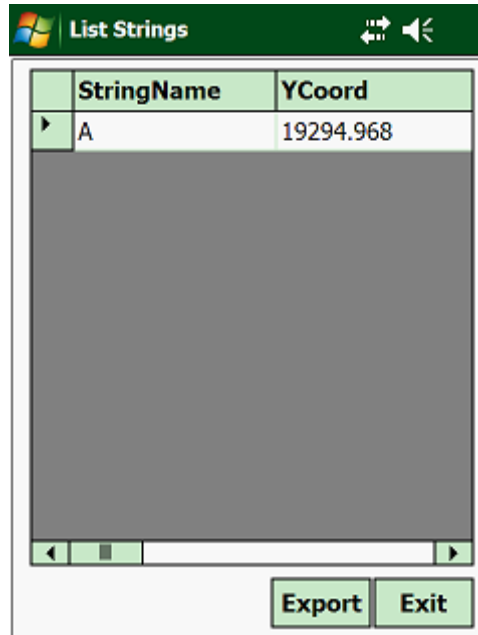
The input screens will be as below for setting out a string or checking a string.

**3.10.07 List:**

This will list all your stored Strings associated with the opened Job. Tap on “String” and then “List”:



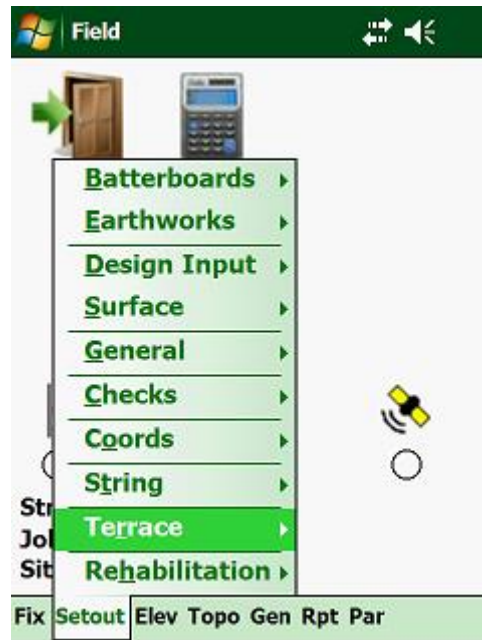
Display:





### **3.11.00 Terrace:**

Use this routine to setout and control the earthworks on areas which cannot be defined by a horizontal and vertical alignment. The logic on the Terraces is very much the same as Strings, the only difference being that it can be seen as a group of Strings put together. To access this, tap on “Setout” and then on “Terrace”:

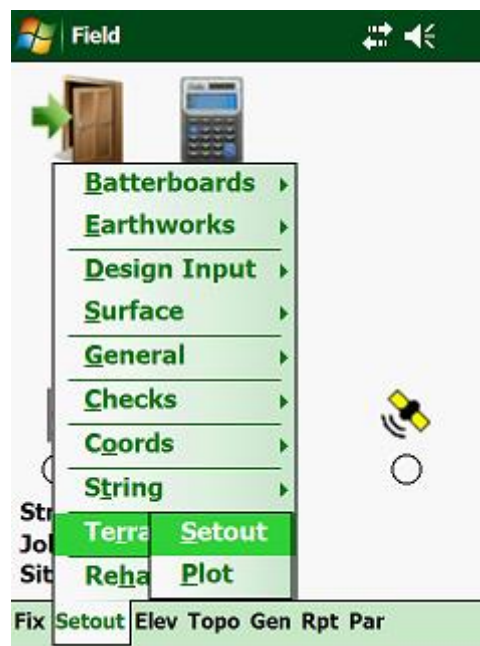


Here you have two options:

- Setout - specify the distance along a selected side to place pegs.
- Check - use this to check the construction tolerance.

**3.11.01 Setout:**

Use this routine to setout the Terrace. Tap on “Terrace” and then on “Setout”:



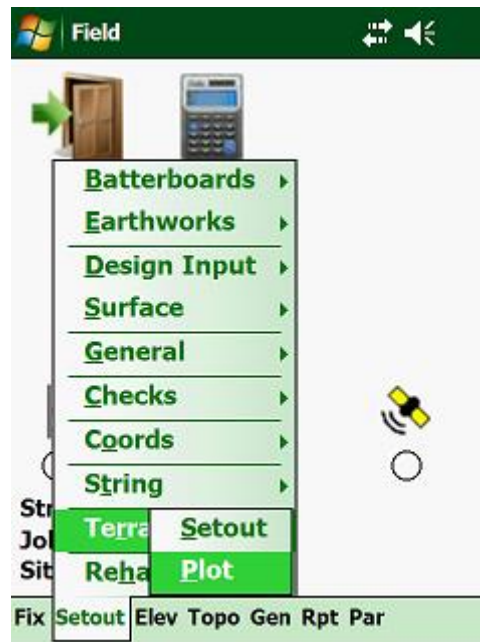
Next:

A screenshot of the 'Setout Terrace Sides' screen in the CEASER Field application. The title bar at the top is green with a Windows logo and the text 'Setout Terrace Sides'. Below the title bar, there are icons for a folder, a calculator, and a satellite. The screen contains several input fields: 'Side:' with a green dropdown menu, 'Length:' with a green text box, 'Dist:' with a white text box, 'Bear:' with a green text box, and 'Dist:' with a green text box. At the bottom right, there is a green button labeled 'Exit'.

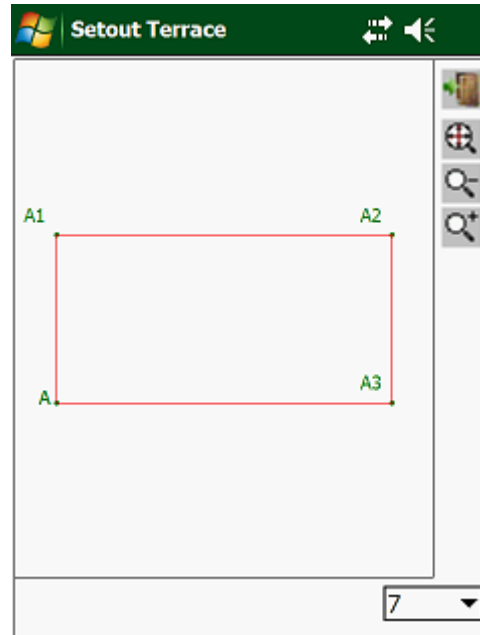
Select which side of the Terrace you want to set out. The program will then display the length of the selected side. Next you need to enter the distance along the selected side that you want to set out. The program in turn will calculate the horizontal angle and distance to the position.

**3.11.02 Plot:**

With this routine you can plot your Terrace and tap on the side of the Terrace that you want to set out. Tap on “Terrace” and then on “Plot”:

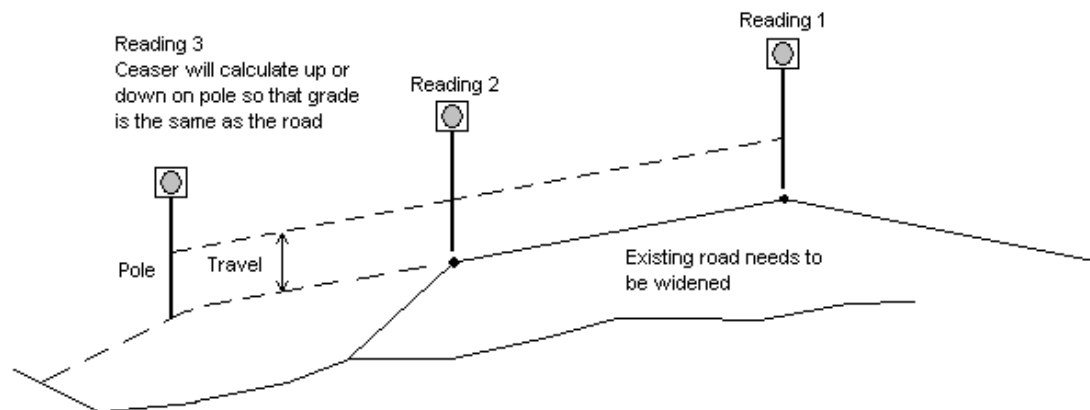


Next:



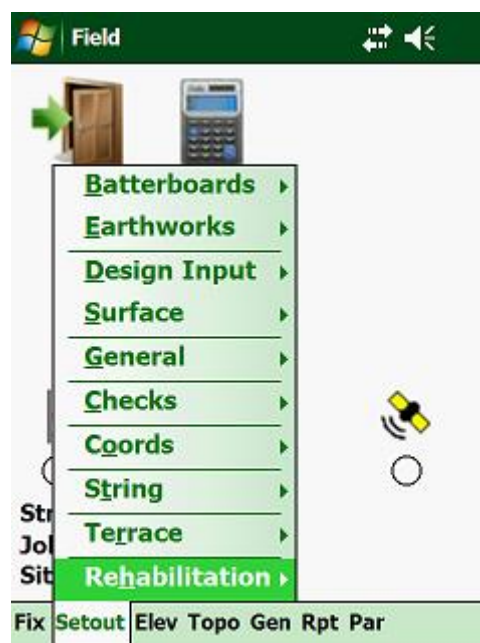
### 3.12.00 Rehabilitation:

The rehabilitation function works very similar to the string function. Here you would first knock in the pegs at a predetermined distance from the edge of the road at any interval required. Then you will take a reading on the center of the road and then on the edge of the road. Next hold the prism on top of the pole and read the prism. The program will then calculate the distance up or down from the peg, such that it has the same grade as the road.

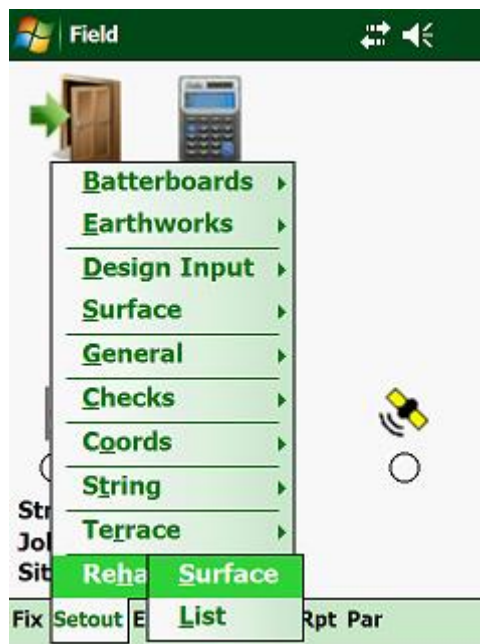


The option also exists to place Batterboards and Check Earthworks progress.

From the pulldown menu, select "Rehabilitation":



Here you have the following options:



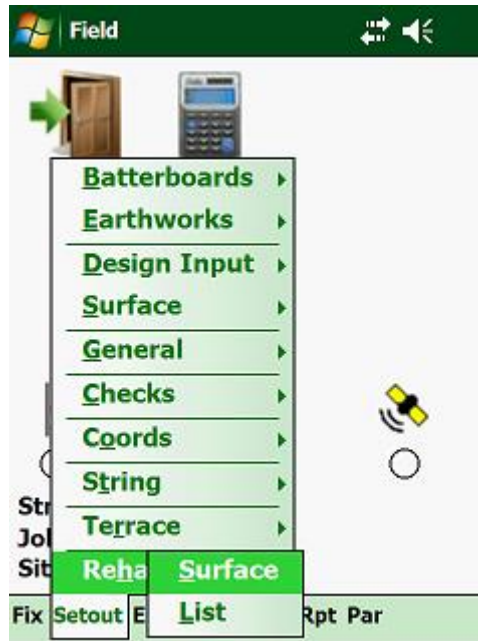
Options:

- Surface - place profile pegs.
- List - lists all the setting out that has been recorded.

The Batterboards parameters (Travel, Offset, etc) are based on the parameters that have been entered for the opened Job.

### **3.12.01 Surface:**

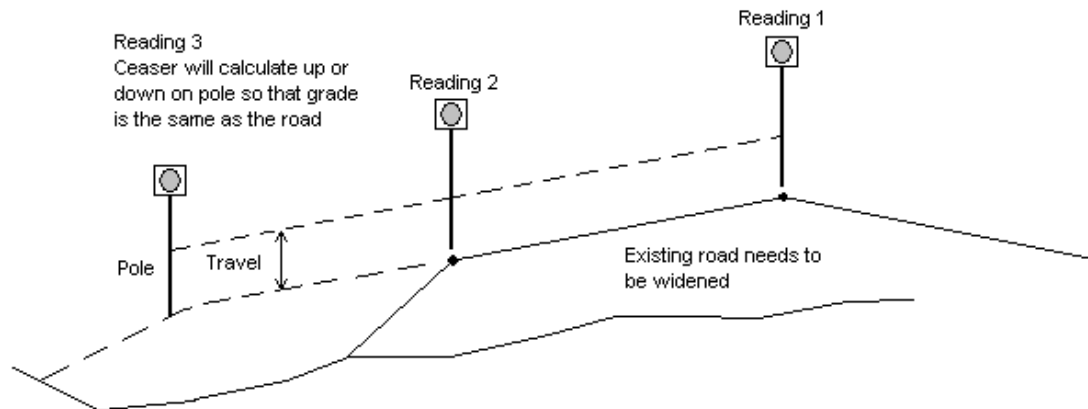
Once you have completed the earthworks operations on your Rehabilitation project, it is time to profile pegs. To access this routine tap on “Rehabilitation” and then on “Surface”:



Next:

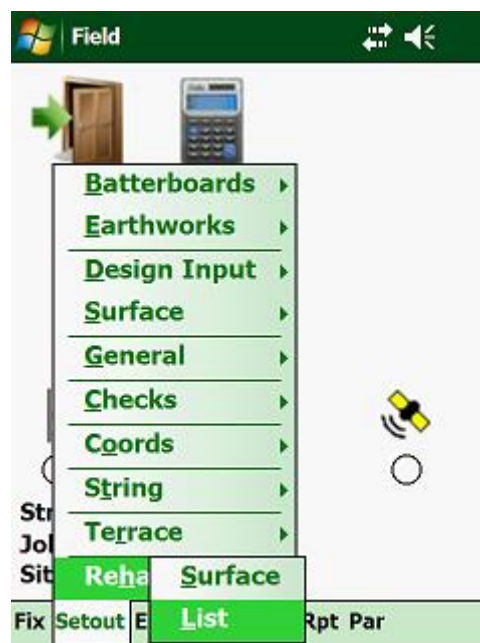
A screenshot of the CEASER Rehabilitation application's form. The form has a green header bar with the title 'Rehabilitation'. Below the header, there are three radio buttons: 'Start' (selected), 'End', and 'New'. Below the radio buttons, there are several input fields: 'Target:' with a value of '0.000', 'Grade(%)', 'Offset:', 'Design:', and 'Up\Down:'. At the bottom right of the form, there are two buttons: 'Read' and 'Exit'.

Enter the 2 staff readings as well as the width between the 2 staff readings. Next the program will calculate the gradient between the 2 staff readings, which can be altered. Next you need to enter the distance from the second staff reading to your profile and the program will calculate the staff reading adjusted by the travel and layer depth.

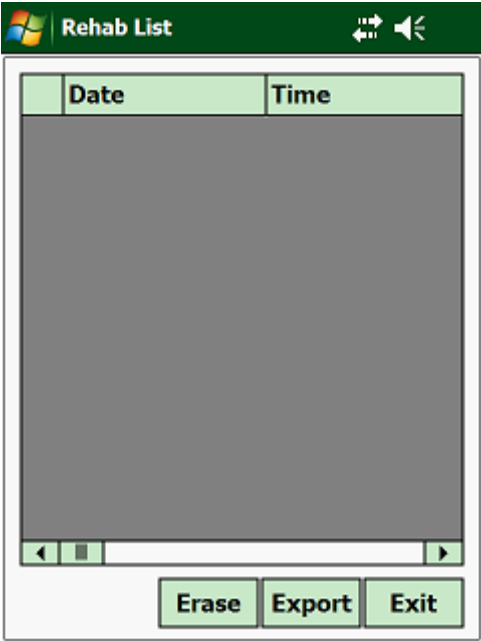


### **3.12.02 List:**

Here the program will list all the Rehabilitation setting out which has been saved. Tap on “Rehabilitation” and then on “List”:



Next:





### **3.13.00 Elevations:**

Elevations are concerned with the control of the Z coordinate (height) of a Job.

Features include:

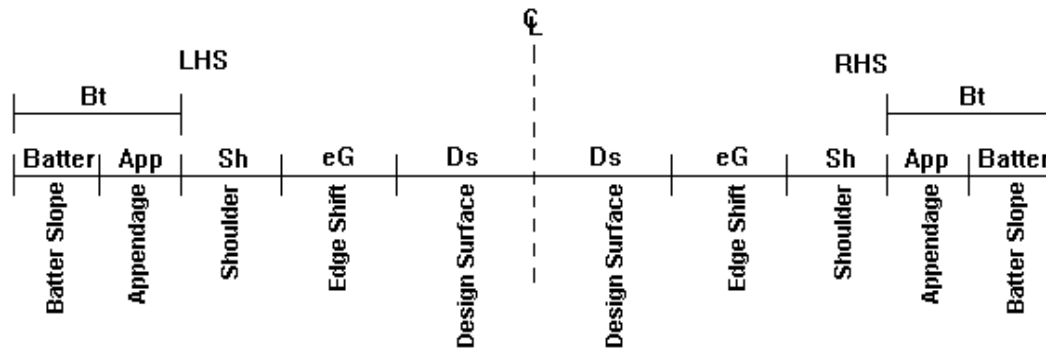
- Elevations may be set out at any stake value and offset on the full cross-section as defined in “Data Input” including all the surfaces or for specific surfaces with pole offsets.
- Parameters are defined for each surface. The surface may have different layer depths, pole offsets and travellers, which are individually specified for LHS and RHS.
- Elevations can be checked at any stake value for layers, poles, drains, kerbs, shoulders. The batter slopes can also be controlled for over and under filling at any offset and stake value.
- The storing of these results into an ASCII - file is optional. These may then be downloaded to a PC and a hardcopy obtained.
- Instruments such as a level instrument or theodolite may be selected.
- Setting out and checking of manually entered elevations or points stored in the coordinate file can also be done
- Surfaces used, are interpolated in width, crossfalls or height depending on the type of surface and number of entries.
- The parameter (such as pole offsets, layers, travellers) must be defined in “Elevation Parameter“ before using the options offered in “Elevations”. If you are using a Total Station or a theodolite, make sure that the coordinates of the setup station is correct. This you can check under the “Fix” routines.

#### **Note:**

- All offsets selected or computed are the distances from the Stakeline.
- The sequence of the surfaces are as follows:
  - 1) Design surface
  - 2) Edge shift
  - 3) Shoulders
  - 4) Appendage width
  - 5) Batter slope area - only check-levels
- The minimum required data entries for elevations are:
  - 1) Vertical alignment
  - 2) Crossfalls
  - 3) Design surface
  - 4) Horizontal alignment

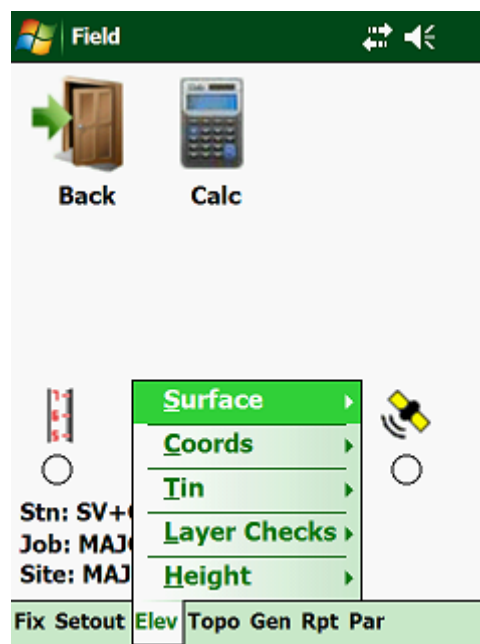
**Important:**

- A surface may be left out, but the sequence as shown below **cannot** be changed.



- The collimation of the different type of instruments used must be carried separately and may be changed at any time.

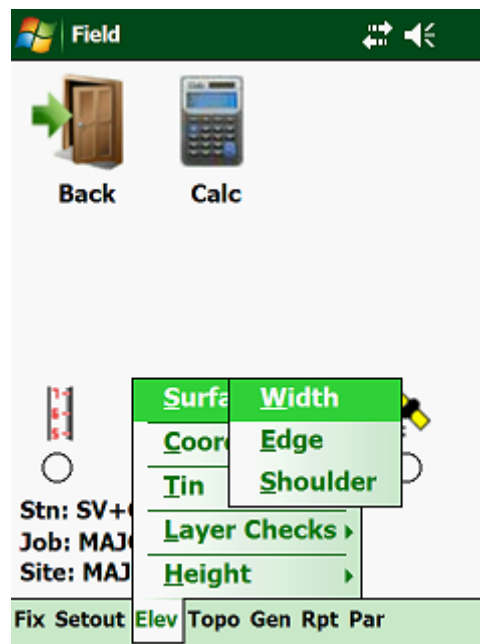
To access these routines, highlight “Elev” on the main level menu and press the <Enter> key, to activate the pull down menu:



### **3.14.00 Surface:**

These routines will include the functions necessary to check the elevations of the design input, which consists of:

- Surface Width
- Outer Edge Shift
- Shoulder Width



**Note:**

- An additional entry for the offset is expected, if full design is selected.
- The pole offset from stake line, staff reading and final level to be placed are computed and displayed. The final level is the actual level to be placed, and has been adjusted for the specified layer depth and traveller. The point where levels are set is the edge of the specified surface plus the pole offset as entered in "Elevation Parameter".
- The checking of levels requires the entry of a stake value, offset and staff reading, if level instrument is selected.
- For a theodolite setup, the horizontal direction, vertical direction, slope distance and target height must be entered. The stake value and offset is computed from the instrument measurements.
- The final elevation is computed and adjusted for layer depth and traveller, and then compared with the "observed elevation". The **up and down** correction, stake value, offset, observed elevation and final check elevation is displayed.

**3.14.01 Surface Width:**

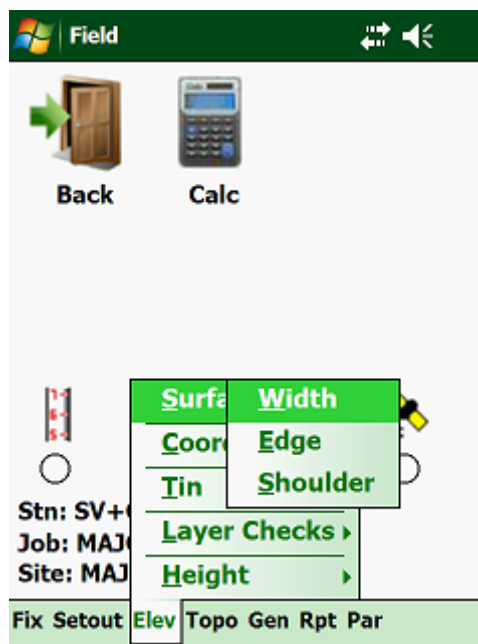
The design surface is the main surface defined in the “Design” module.

Pole offsets defined in “Elevation Parameter” add to the edge of the design surface.

Surface slopes are determined by the “Crossfalls”

The final elevation to be placed or checked, is the final level computed at the pole position or at the specified offset adjusted for layer depth and traveller.

Tap on “Surface” and then on “Surface”:



Then:

The screenshot shows a software interface titled "Check Design Width". It contains several input fields with numerical values and navigation buttons. The fields are: Stake (55020.000), Side (Left), Offset (-6.762), Crossfall (6.500), B\Design (288.194), Staff (2.000), Actual (663.845), and Down (375.651). Navigation buttons include "<", ">", "<>", and "<|>". At the bottom are "Calc" and "Exit" buttons.

Stake:	55020.000	<
Side	Left	>
Offset:	-6.762	
Crossfall:	6.500	
B\Design:	288.194	<>
Staff:	2.000	
Actual:	663.845	
Down:	375.651	

Calc Exit

In the top screen enter the following:

- Stake - enter the required stake value.
- Side - select which side you want to work on.

If you are working with a Total Station the screen will look differently:

The screenshot shows a software interface titled "Check Design Width" for Total Station use. It contains several input fields, some with numerical values and others empty. The fields are: Target (0.000), Stake, Offset, Off Prof, Off Edge, Design, Actual, and Diff. Navigation buttons include "<>" and "<|>". At the bottom are "Read" and "Exit" buttons.

Target:	0.000	
Stake:		
Offset:		
Off Prof:		
Off Edge:		
Design:		<>
Actual:		
Diff:		

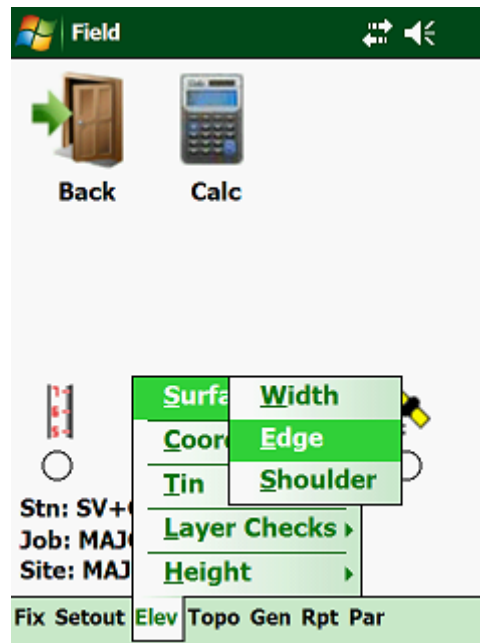
Read Exit

Here you enter the horizontal and vertical angles, the slope distance and the target height and the program will calculate the result for you. The final elevation, computed at the check-position is adjusted for layer depth and traveller.

### 3.14.02 Edge Shift:

The edge shift is an additional shift or extension added to the edge of the design surface. The edge shift may define a retaining wall, kerb, a step in the batter slope etc, etc.

Pole offsets defined in “Elevation Parameter” add to the outer limits of the edge shifts.



Then:

The screenshot shows the 'Check Edge Shift' dialog box. It has a green title bar with the Windows logo and the text 'Check Edge Shift'. The dialog box contains several input fields and buttons. The fields are: 'Stake:' with the value '55020.000', 'Side' with a dropdown menu showing 'Left', 'Offset:' with the value '-6.762', 'Crossfall:' with the value '288.194', 'Design:' with the value '2.000', 'Staff:' with the value '663.845', 'Actual:' with the value '375.651', and 'Down:' with the value '375.651'. There are green buttons for '<' and '>' next to the 'Stake' and 'Side' fields. At the bottom right are two green buttons labeled 'Calc' and 'Exit'.

Inputs, screen layout and results are as per “Surface Width”, depending on which type of instrument you are using.

### **3.14.03 Shoulder:**

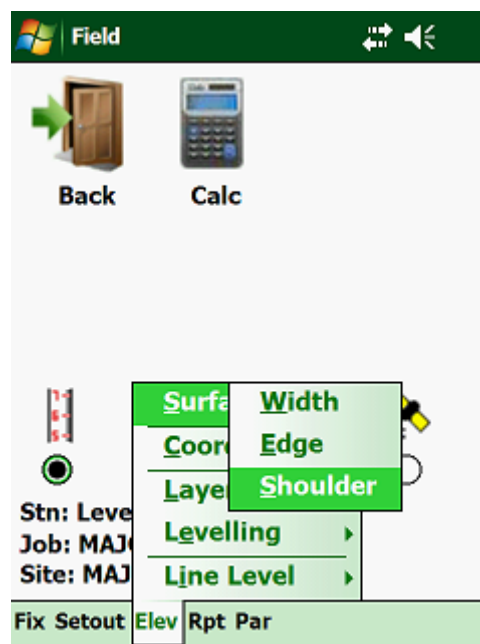
The shoulders are an extension or addition to the main surface and normally add to the **edge shift**.

If no **edge shifts** are defined, the shoulders add to the **design surface**.

Shoulders do have their own **SUPERELEVATIONS OR CROSSFALLS** and work independently to the crossfall of the design surface.

Pole offsets defined in “Elevation Parameter” add to the outer edge of the shoulders.

EXAMPLE: If the design surface width is only one millimetre and no edge shifts defined, the shoulders can replace the design surface.



Next:

Stake:	55020.000	<
Side	Left	>
Offset:	-6.762	
Crossfall:	6.500	
Design:	288.194	
Staff:	2.000	
Actual:	663.845	
Down:	375.651	

Calc Exit

Inputs, screen layout and results are as per “Surface Width”, depending on which type of instrument you are using.

Checks can be taken on the actual surface as well as outside of the surface limits. The shoulders extend with its crossfall towards the centre line and to the outside without a limit in offset.

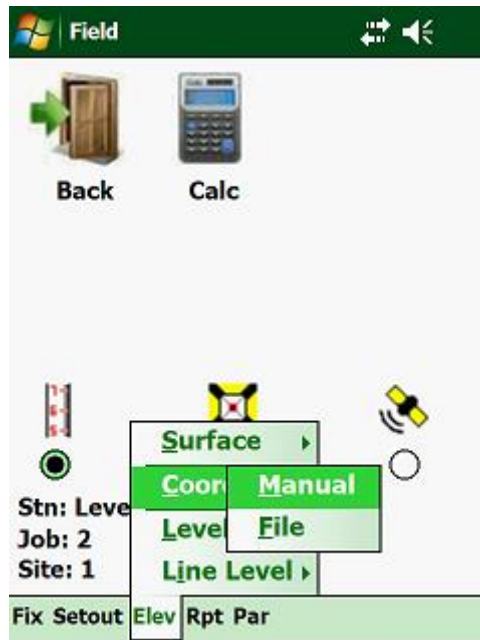
The final elevation, computed at the check-position is adjusted for layer depth and traveller.



**3.15.00 Coordinates:**

This function allows you to place or check an elevation from one of your coordinate files or manually.

Tap on “Elev” and then on “Coordinates”:

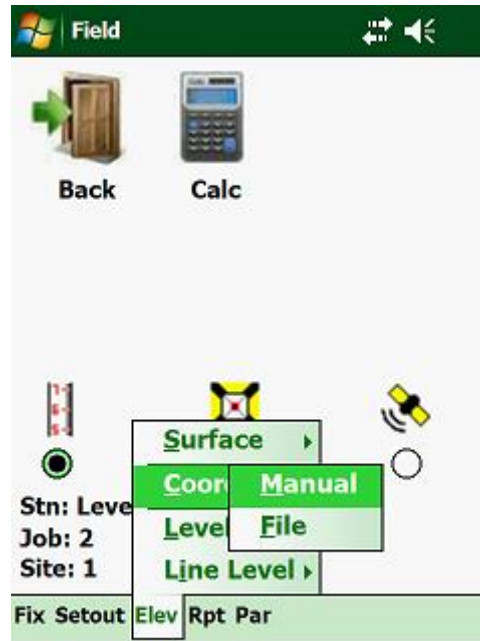


The elevation entered will be adjusted for layer depth and traveller as defined in “Elevation Parameter”.

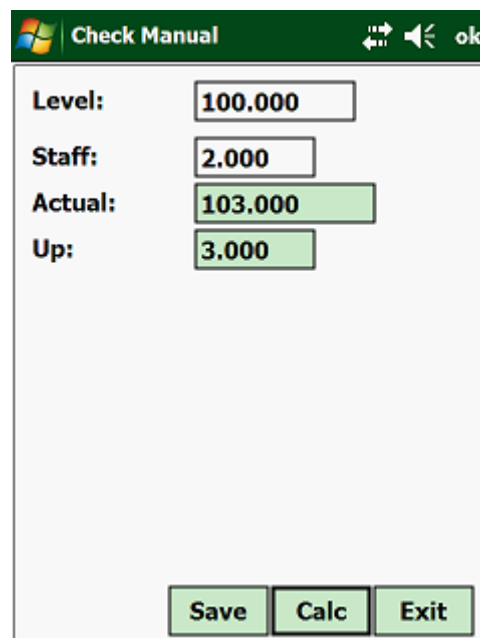
### **3.15.01 Manual:**

Here you can enter the elevation to be placed or checked, manually into the program.

Tap on “Coordinates” and then on “Manual”:



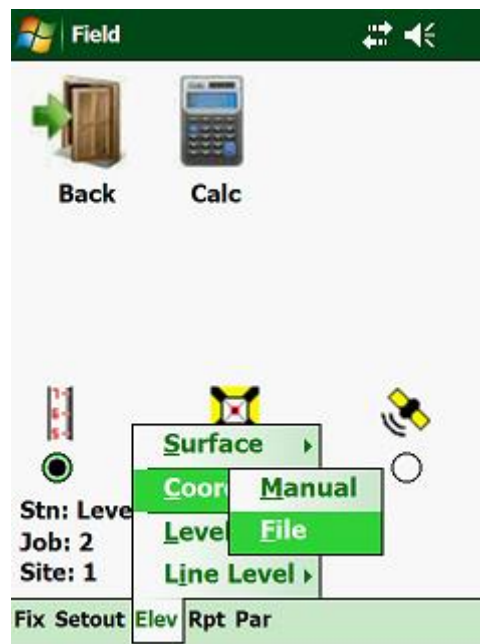
Next:



Enter the required elevation, tap on <Calc> and the program will display the required staff reading. When working with a Total Station the screen layout will be slightly different.

**3.15.02 Coord File:**

Here you can call up the levels from the “Local”, “Site” or “Global” coordinate file to place or check the levels. Tap on “Coordinates” and then on “Coord File”:



Next:

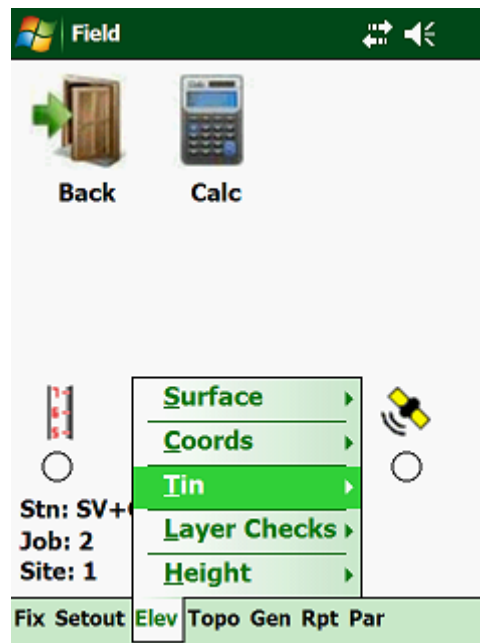
The screenshot shows the 'Check Coords' dialog box. It has a green header bar with the Windows logo, the text 'Check Coords', and navigation icons. The dialog contains several input fields and buttons. At the top, there are three radio buttons: 'Local' (selected), 'Site', and 'Global'. Below them is a 'Select Pt:' dropdown menu showing 'A'. Then there are text input fields for 'Pt Name:' (containing 'A'), 'Level:' (containing '166.588'), 'Staff:' (containing '1.000'), 'Actual:' (containing '104.000'), and 'Up:' (containing '62.588'). At the bottom, there are three buttons: 'Save', 'Calc', and 'Exit'.

**3.16.00 Tin Model:**

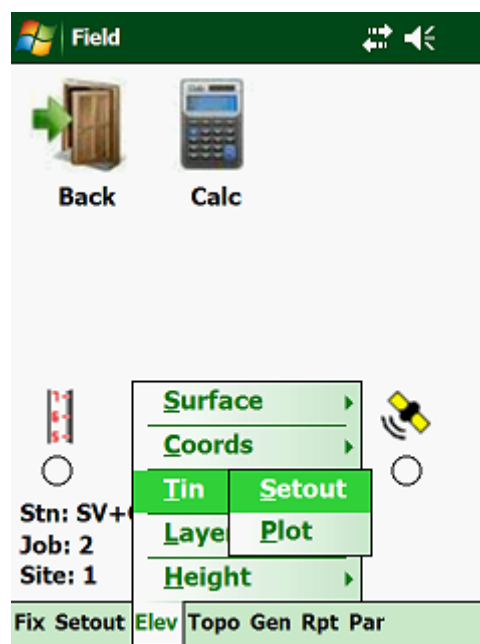
Use this option to control the elevation and setting out of the TIN model. This function is only available if you are in “Total Station” or “GPS” mode.

This type of setting out\level control works very well on bulk earthworks, golf courses, etc.

To access this routine, move the cursor to “Tin Model” and press the <Enter> key:



Here you have two options:



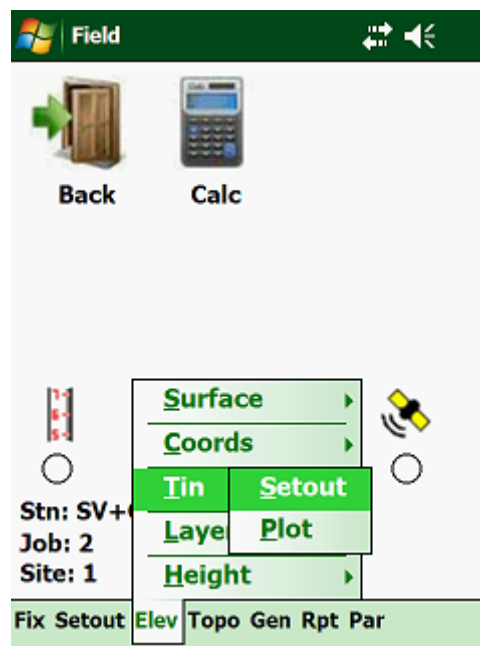
- Setout      -    here you read the Prism or Rover and the program will determine in which triangle your target is and calculate the design level versus the design.
- Select      -    you will have a graphical display of your Tin Model and you read the Prism or Rover and the program will determine in which triangle your target is and calculate the design level versus the design.

**3.16.01 Setout:**

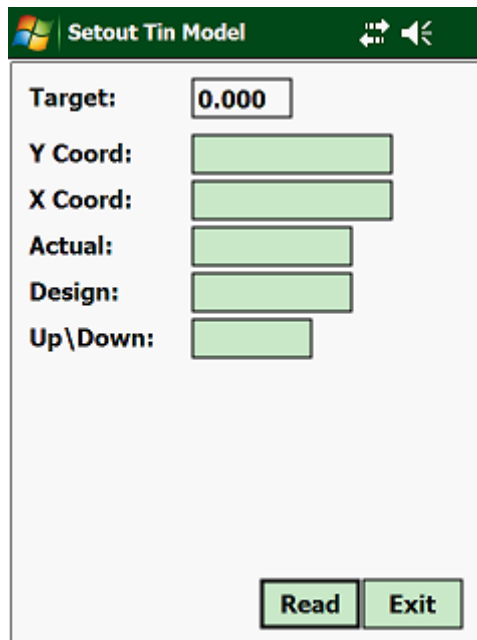
With this method you hold your prism anywhere in the field and firstly the program will check whether your target is within your model. The program will warn you if you are outside your model.

Once it has been established that you are inside the model, the program will determine in which triangle the target is located. Then it will use the heights of the three vertexes of the triangle to calculate the design height inside the triangle. This height will be adjusted according to the parameters entered under the “Tin Model” option.

Tap on “Tin Model” and then on “Random”:



Next:



The screenshot shows a software dialog box titled "Setout Tin Model". It features a green header bar with a Windows logo on the left, the title text in the center, and icons for help and volume on the right. The main area is white and contains several input fields: "Target:" with the value "0.000", "Y Coord:", "X Coord:", "Actual:", "Design:", and "Up\Down:". Each label is followed by a light green rectangular input box. At the bottom right of the dialog are two buttons labeled "Read" and "Exit".

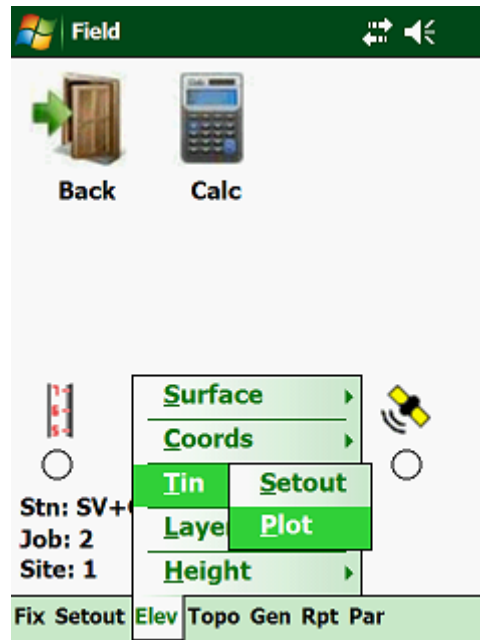
The program will then calculate the coordinates of the occupied point as well as:

- Design - the calculated design height using the heights of the specified triangle.
- Up\Down - the distance that you must move up or down to reach the design height.

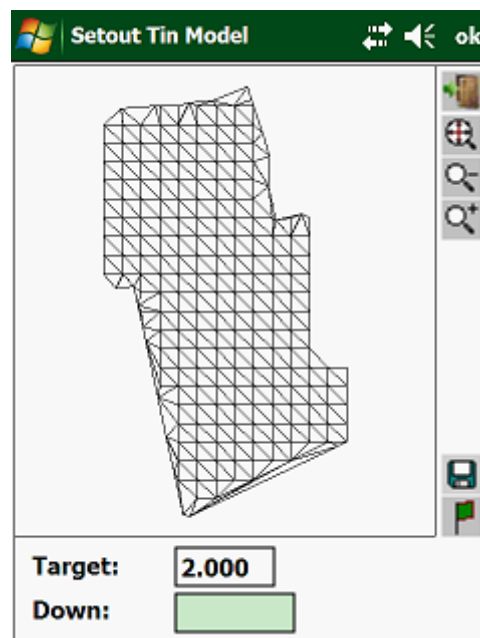
**3.16.02 Plot:**

This function is very similar to the above, except that here a graphical presentation is shown of the Tin Model.

Tap on “Tin Model” and then on “Plot”:



Next:



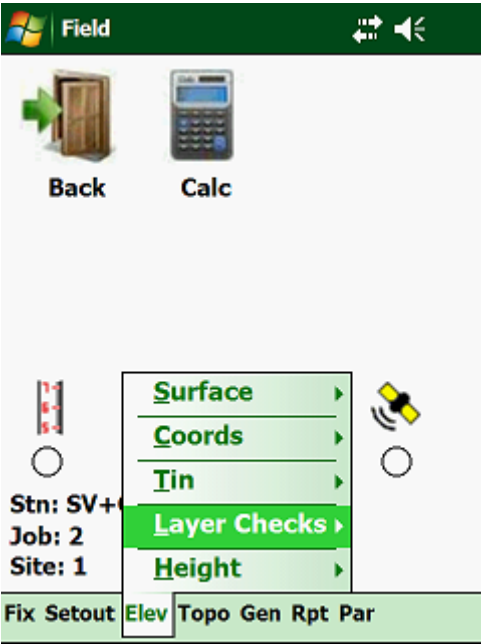
Read the Prism or Rover and the same results as in “Setout” will be displayed.



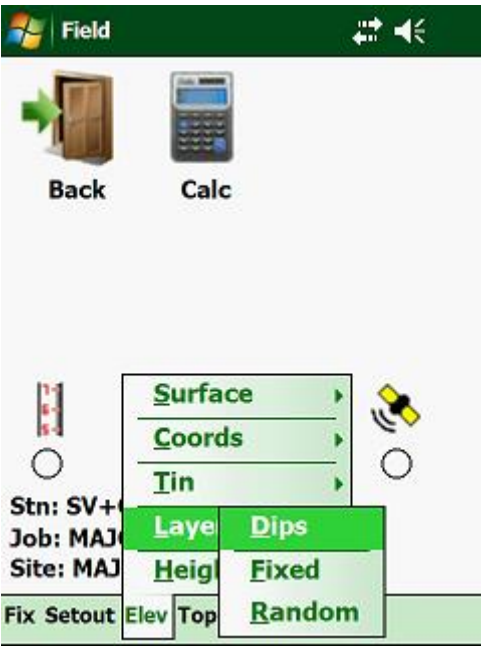
**3.17.00 Layer Checks:**

On a Job that consists of geometric parameters, you will find that the top section of the Job consists of selected layers which have to be build according to strict specifications, i.e. level tolerances, layer thicknesses, etc.

Tap on “Layer Checks”:



Next:

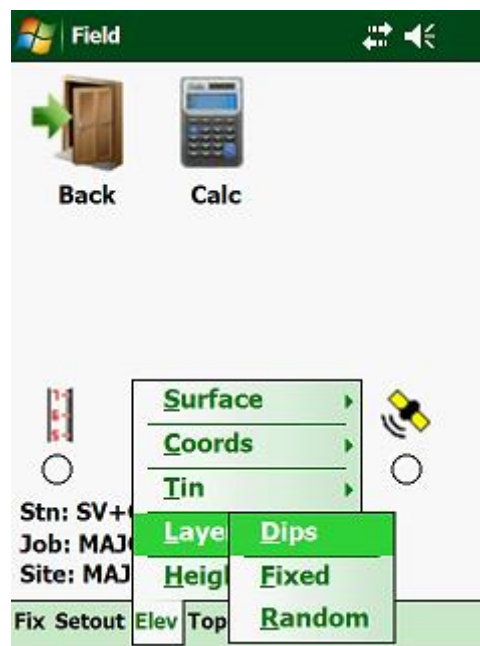


Here you have the following options:

- Dips            -    using the nails on your profile pegs, you can dip from the nails to the build layer. The program will convert the dips to levels and compare the actual level with the design level.
- Fixed           -    using either a Level or a Total Station, you can pick up checks at predefined positions.
- Random        -    here you can hold your target anywhere and the program will calculate where the prism was held and do the comparison on the calculated design.

**3.17.01 Dips:**

To access the layer checks using dips, tap on “Layer Checks” and then on “Dips”:



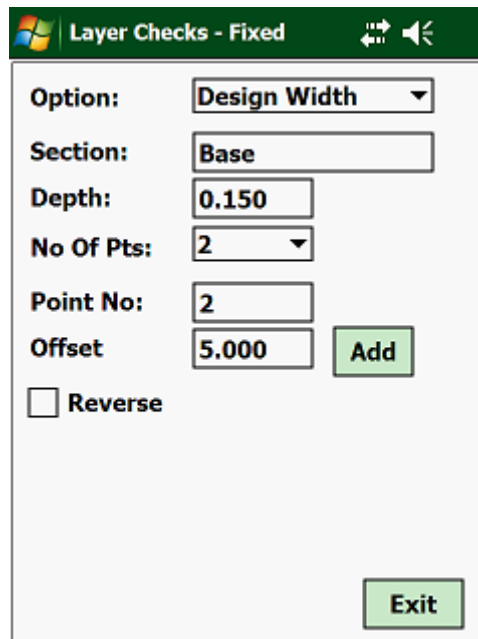
Next:

The screenshot shows the 'Layer Checks - Fixed' screen. It has a green header with the 'Layer Checks - Fixed' title and navigation icons. Below the header, there are several input fields: 'Option:' with a dropdown menu set to 'Design Width', 'Section:' with a text input field, 'Depth:' with a text input field, 'No Of Pts:' with a dropdown menu, 'Point No:' with a text input field, and 'Offset' with a text input field. There is an 'Add' button next to the 'Offset' field. At the bottom left, there is a checkbox labeled 'Reverse'. At the bottom right, there is an 'Exit' button.

Input:

- Option - select whether you want to check on the “Design Width” or on the “Full Design” by tapping on one of the options.
- Section - give your section that you want to check a name, i.e. Lower Selected, Subbase, Basecourse, etc. This way you can see which section is which in your database.

- Layer Depth - enter the depth of your layer as an absolute value.
- Reverse Seq - if you select “No” (the default), then all your checks will be done from left to right. If however you select “Yes”, then each section that you check will alternate between left to right and right to left.
- No Of Pnts - select how many positions you want to check on each section.
- Offset - enter for each point an offset from the stake line, starting from the left. After each offset that you have entered, tap on the “Add” button.



Layer Checks - Fixed

Option: Design Width

Section: Base

Depth: 0.150

No Of Pnts: 2

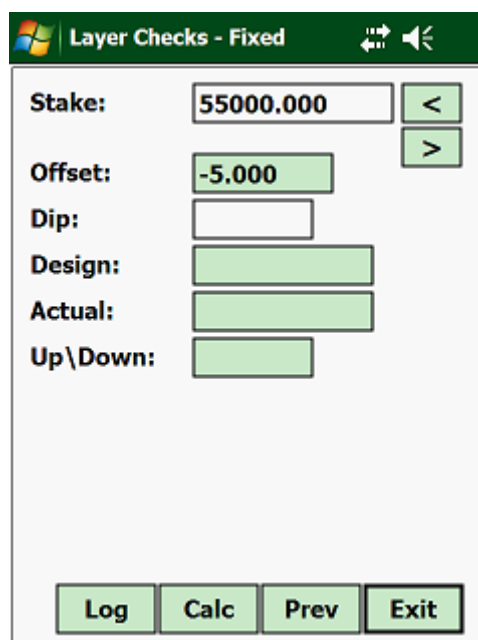
Point No: 2

Offset 5.000 Add

☐ Reverse

Exit

Tap on the “Next” button:



Layer Checks - Fixed

Stake: 55000.000 < >

Offset: -5.000

Dip:

Design:

Actual:

Up\Down:

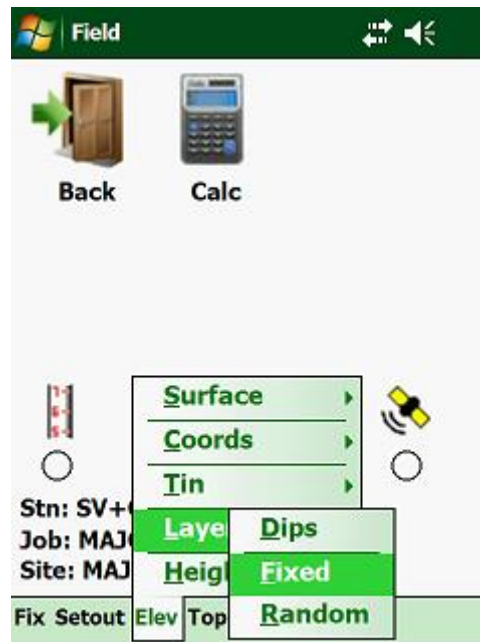
Log Calc Prev Exit

Data to enter:

- Stake Value - enter the stake value where to want to check the completed layer.
- Dip Reading - enter the dip reading at each predefined offset. Once you have entered the dip reading, tap on the “Cal” button. The program will then convert the dip reading to an actual level and calculate the difference between the design level and the actual level. Before you can continue to the next offset or stake value, you must tap on the <Save> button. This will then save the observations in the relevant database.

**3.17.02 Fixed:**

The “Fixed” option is very similar to the above, except that here you use either your Level or Total Station. Tap on “Layer Checks” and then on “Fixed”:



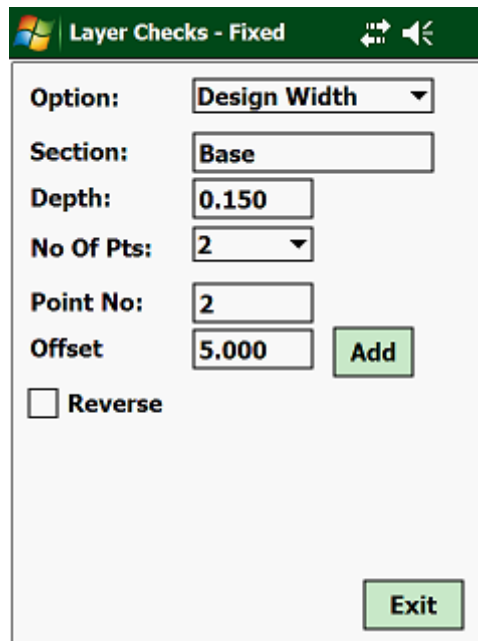
Next:

The screenshot shows the 'Layer Checks - Fixed' screen. It has a green header bar with the Windows logo, the text 'Layer Checks - Fixed', and navigation icons. The screen contains several input fields and buttons. The 'Option:' field is a dropdown menu set to 'Design Width'. The 'Section:' field is a text box containing 'Base'. The 'Depth:' field is a text box containing '0.150'. The 'No Of Pts:' field is a dropdown menu set to '2'. The 'Point No:' field is a text box containing '2'. The 'Offset' field is a text box containing '5.000'. There is an 'Add' button next to the 'Offset' field. Below these fields is a checkbox labeled 'Reverse' which is currently unchecked. At the bottom right of the screen is an 'Exit' button.

Input:

- Option - select whether you want to check on the “Design Width” or on the “Full Design” by tapping on one of the options.
- Section - give your section that you want to check a name, i.e. Lower Selected, Subbase, Basecourse, etc. This way you can see

- Layer Depth - enter the depth of your layer as an absolute value.
- Reverse Seq - if you select “No” (the default), then all your checks will be done from left to right. If however you select “Yes”, then each section that you check will alternate between left to right and right to left.
- No Of Pnts - select how many positions you want to check on each section.
- Offset - enter for each point an offset from the stakeline, starting from the left. After each offset that you have entered, tap on the “Add” button.



Layer Checks - Fixed

Option: Design Width

Section: Base

Depth: 0.150

No Of Pnts: 2

Point No: 2

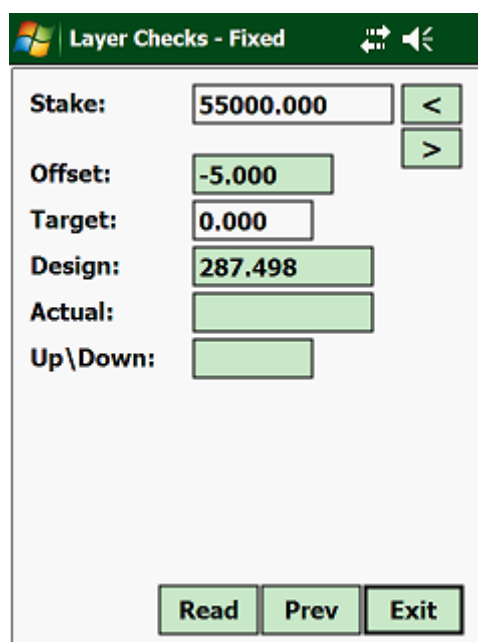
Offset: 5.000

Add

☐ Reverse

Exit

Tap on the “Next” button:



Layer Checks - Fixed

Stake: 55000.000

Offset: -5.000

Target: 0.000

Design: 287.498

Actual:

Up\Down:

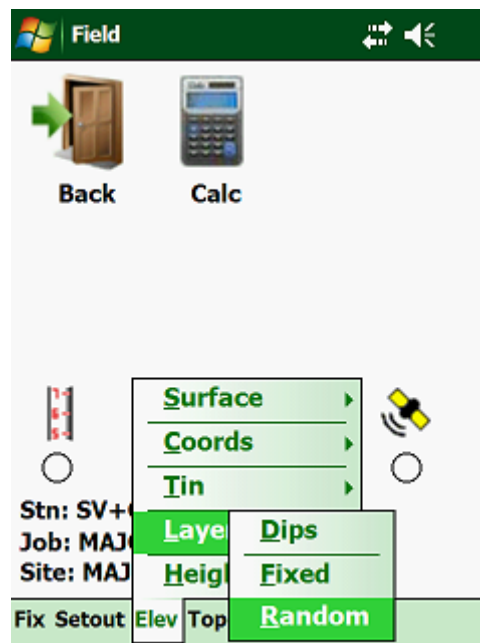
Read Prev Exit

Data to enter:

- Stake Value - enter the stake value where to want to check the completed layer.

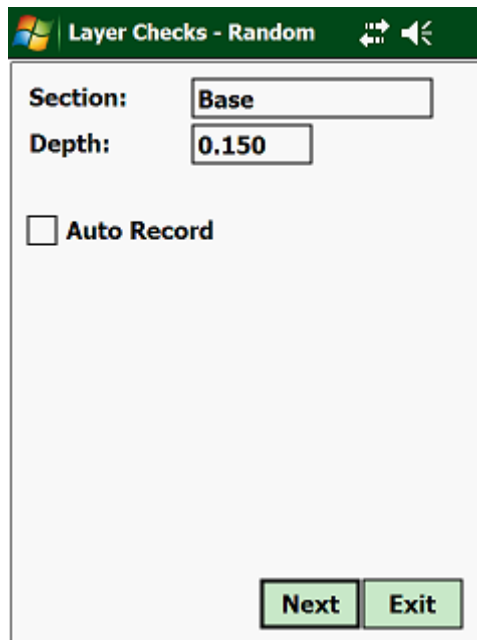
### **3.17.03 Random:**

To use function, you have to be connected to a Total Station to read your observations automatically from the instrument or type them in the input boxes. To access this routine tap on “Layer Checks” and then on “Random”:





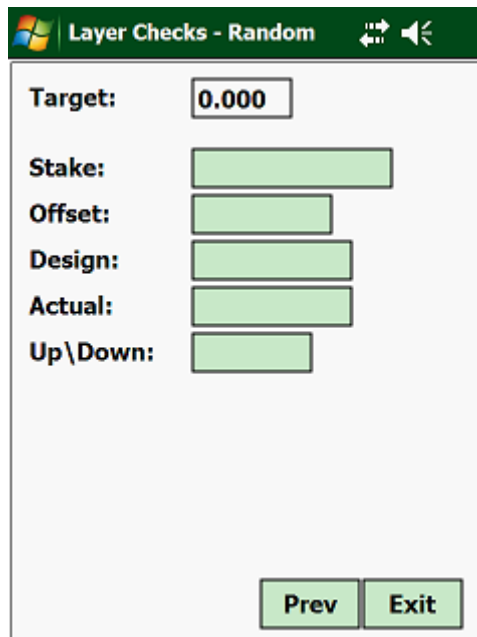
Next:



Data to be entered:

- Section - enter a name for the section to be checked.
- Layer Depth - enter the theoretical depth to the layer as an absolute value.
- Auto Record - if checked the program will store the results automatically.

Next:



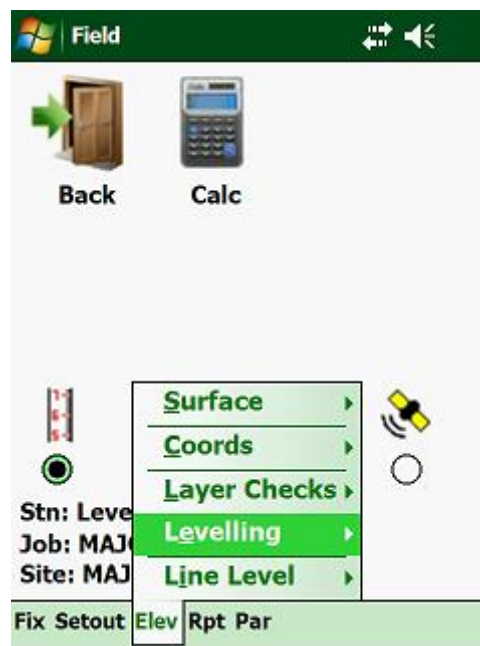
Once the above has been entered, tap on the <Calc> button. To save the results, tap on the <Save> button.

If you are connected to a Total Station the above will be recorded automatically and the results displayed.

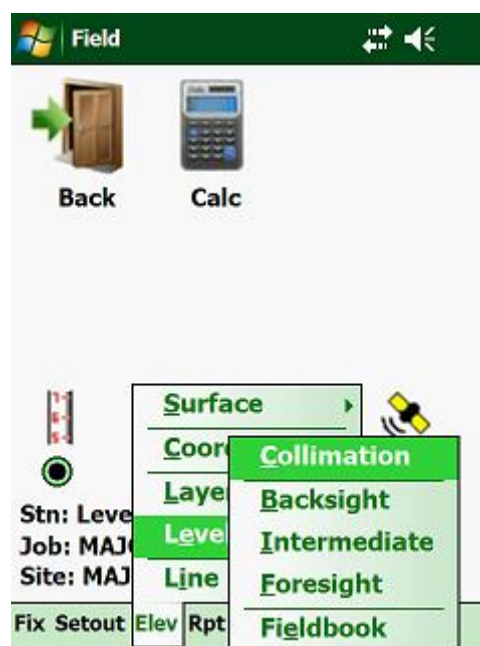
### **3.18.00 Levelling:**

Here you have routines, which you can use to control the collimation if you are using a level to place levels. If you are linked up to an electronic level, then all observations will be recorded automatically, else you will have to enter the observations via the keyboard.

To select this option, move the highlight bar to “Levelling” and press the <Enter> key.

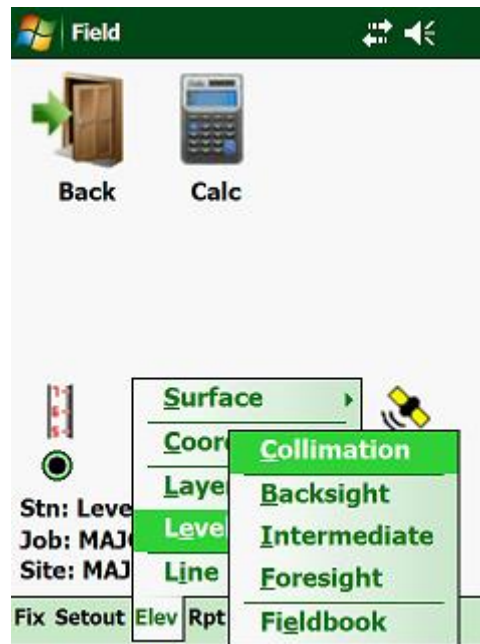


This will display the following:

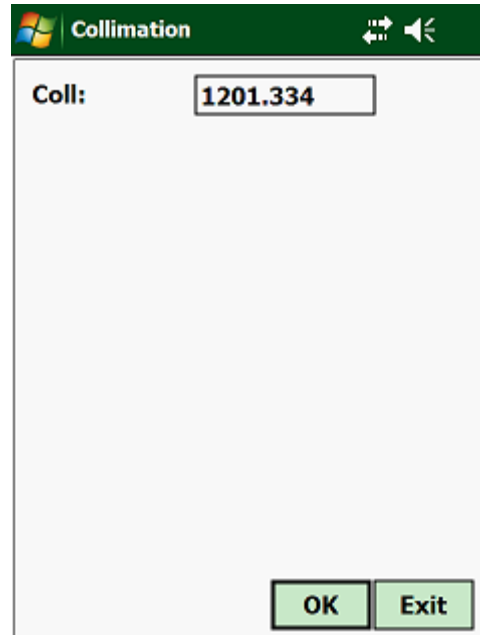


**3.18.01 Collimation:**

This is the height of the instrument, which will be used in all elevation calculations when in “Level” mode.



Next:

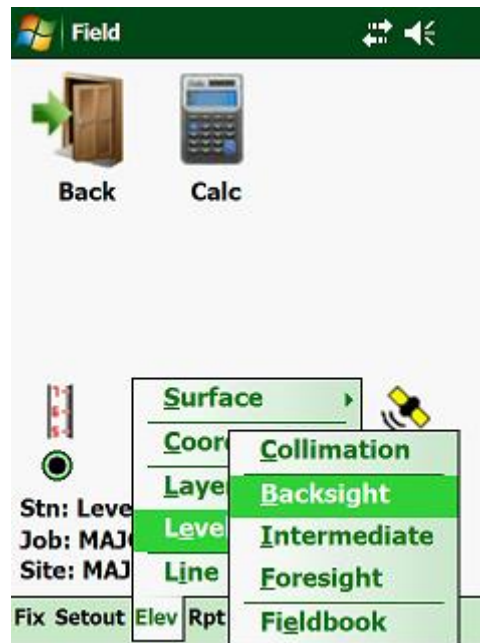


- Collimation - this is the height of your collimation. If the collimation is incorrect, then all your elevations will also be incorrect. It is therefore important that this height is correct and that you do not change it, if you are not sure of the correct height.

### **3.18.02 Backsight:**

Whenever you start to level or you have made a changepoint, the program needs to know the new collimation height. This can be achieved by taking a backsight reading on the benchmark, reference beacon or changepoint.

Move the highlight bar to “Backsight” and press the <Enter> key:



Next:

At the top of the screen, you have the option of selecting which coordinate file you want to access, i.e. “Local”, “Site” or “Global”, by tapping on the respective file type.

Bear in mind that “Local” coordinates are only those that belong to the opened Job, “Site” coordinates can be accessed from all the Jobs related to a Site and “Global” coordinates can be accessed from all Sites and Jobs.

You can select the height of the control point from the combo dropdown box or by typing in the name of the control point and then tapping on the “?” button. This will display the height of the point in the “Elevation” box.

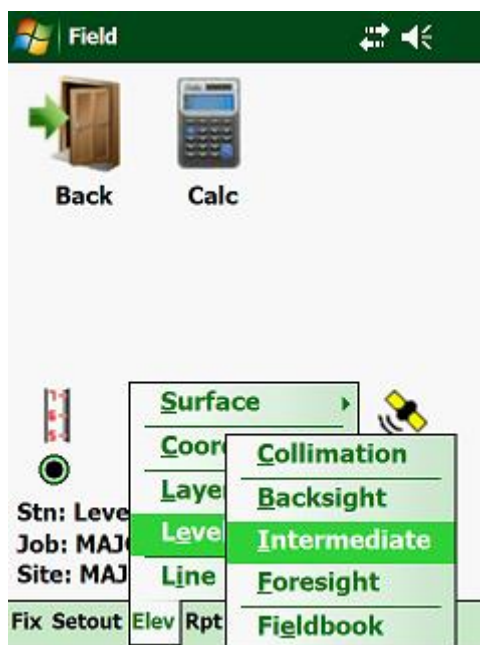
Next, type in the staff reading in the “B\S Reading” box and tap on the <Calc> button. This will calculate the collimation height.

If you are connected to an Electronic Level, there will be a <Read> button at the bottom of the screen, instead of a <Calc> button. Tap on the <Read> button, which will attempt to read the bar coded staff and if successful, will display the reading in the “B\S Reading” box and the new collimation in the “Collimation” box.

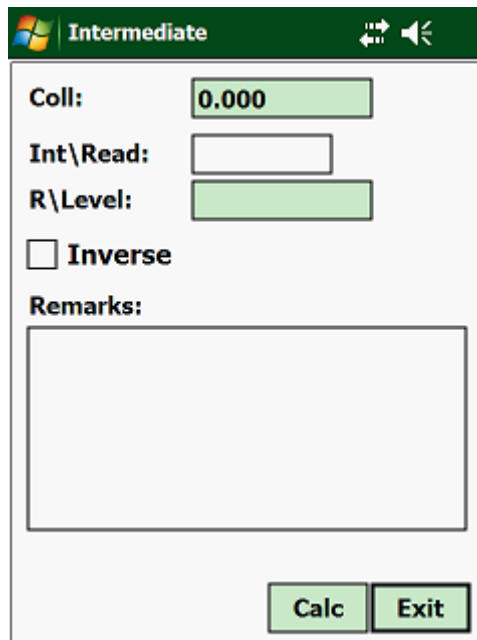
If you accept the new collimation height calculated, tap on the <OK> button.

### **3.18.03 Intermediate:**

Intermediate readings do not have an influence on the height of the instrument. Use this option to record heights of features. Move the highlight bar to “Intermediate” and press the <Enter> key:



Next:



Intermediate

Coll: 0.000

Int\Read:

R\Level:

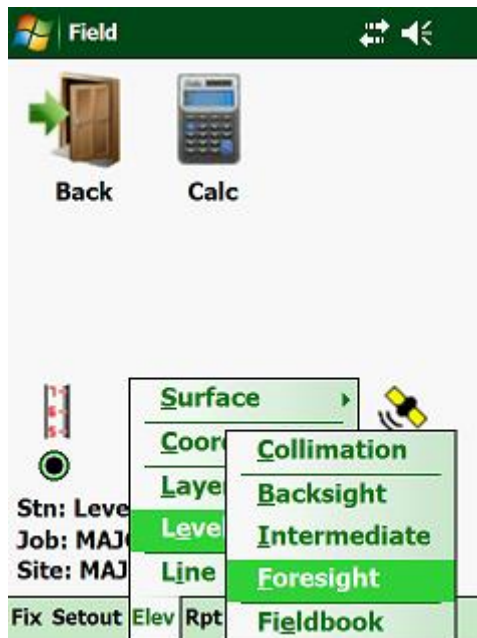
☐ Inverse

Remarks:

Calc Exit

### **3.18.04 Foresight:**

The “Foresight” is a reading to either an existing control point, to check the integrity of your survey or when you want to make a change point, move the instrument and establish a new collimation height.



Field

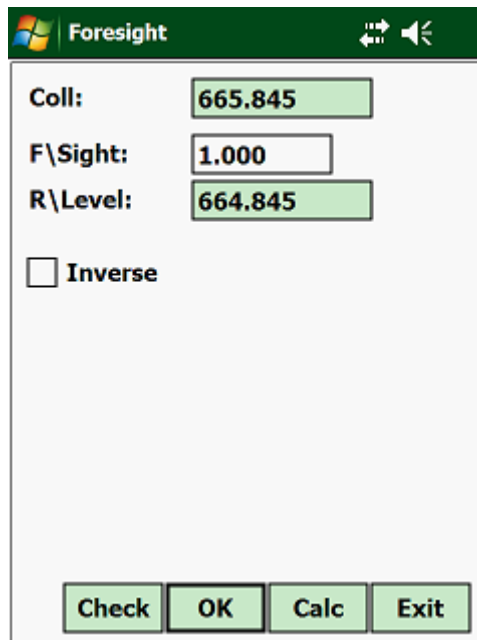
Back Calc

Stn: Level  
Job: MAJ  
Site: MAJ  
Fix Setout

Surface  
Coord  
Layer  
Level  
Line  
Foresight

Collimation  
Backsight  
Intermediate  
Fieldbook

Next:

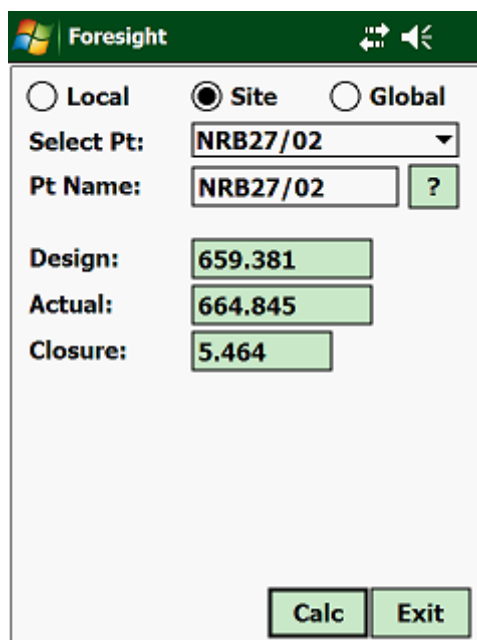


The screenshot shows the 'Foresight' application window. It has a green title bar with the Windows logo and the text 'Foresight'. Below the title bar, there are three input fields: 'Coll:' with the value '665.845', 'F\Sight:' with the value '1.000', and 'R\Level:' with the value '664.845'. Below these fields is a checkbox labeled 'Inverse' which is currently unchecked. At the bottom of the window, there are four buttons: 'Check', 'OK', 'Calc', and 'Exit'.

The top box will show you the present collimation. Next type in the staff reading or tap on the <Read> button if you are connected to an Electronic Level. The <Calc> button will be replaced by a <Read> button should you be connected to an Electronic Level.

Next the program will calculate the reduced level. If this is not a change point, but a closer on a known point, you can check your misclosure by tapping on the “Check” button:

Tap the “Check” button to check the closing error if you have taken a reading on a known point.



The screenshot shows the 'Foresight' application window. It has a green title bar with the Windows logo and the text 'Foresight'. Below the title bar, there are three radio buttons: 'Local', 'Site' (which is selected), and 'Global'. Below these are two input fields: 'Select Pt:' with a dropdown menu showing 'NRB27/02' and 'Pt Name:' with a text box containing 'NRB27/02' and a green button with a question mark. Below these are three input fields: 'Design:' with the value '659.381', 'Actual:' with the value '664.845', and 'Closure:' with the value '5.464'. At the bottom of the window, there are two buttons: 'Calc' and 'Exit'.

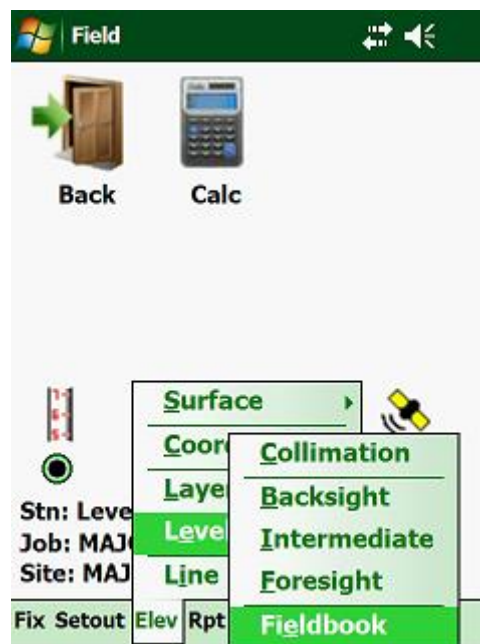


Select in which coordinate file your point is located by tapping on one of the option boxes.

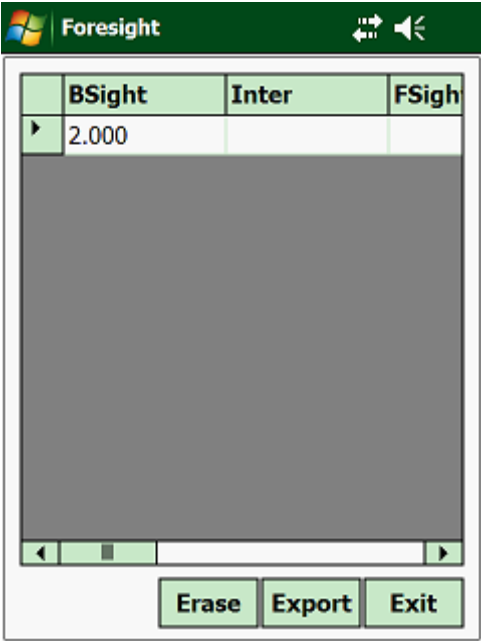
Next select the point from the combo box or type the name of the point in the “Pnt Name” input box and tap on the “?” button. The program will then calculate the misclosure.

### **3.18.05 Fieldbook:**

This will list your fieldbook.



Next:

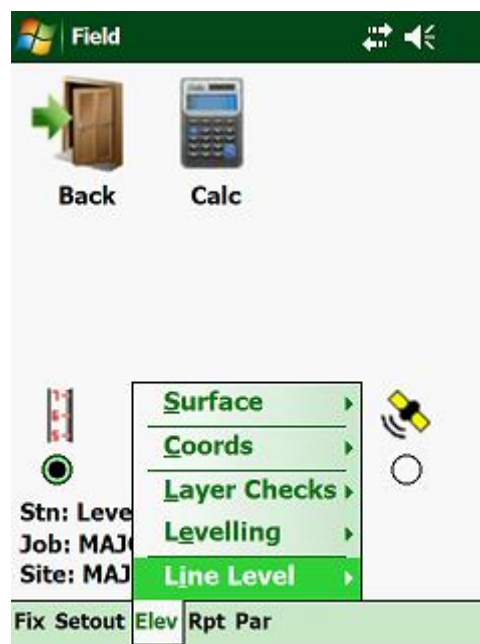


**3.19.00 Line Level:**

When levelling a line of benchmarks for elevation control, the normal practise is to start at the beginning and go all the way to the end of the line. Once you have reached the end, it is required to level back again to the beginning of the line to enable you to check the integrity of the elevations of the individual benchmarks.

Another method is to use 2 staffs. You read the backsight and then the foresight, change the collimation of your instrument and read again the backsight and foresight. The difference between the backsight and foresight of both sets of readings should be the same. Once this is so, you know that the levelling is correct and you make your change point.

To access this, tap on “Elev” and then on “Line Level”:

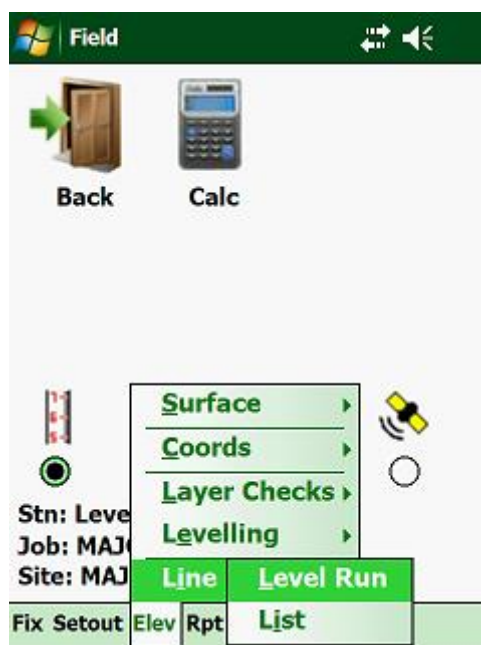


Here you have the following:

- Level Run - the field work.
- List - list the level run.

**3.19.01 Level Run:**

Tap on “Line Level” and then on “Level Run”:

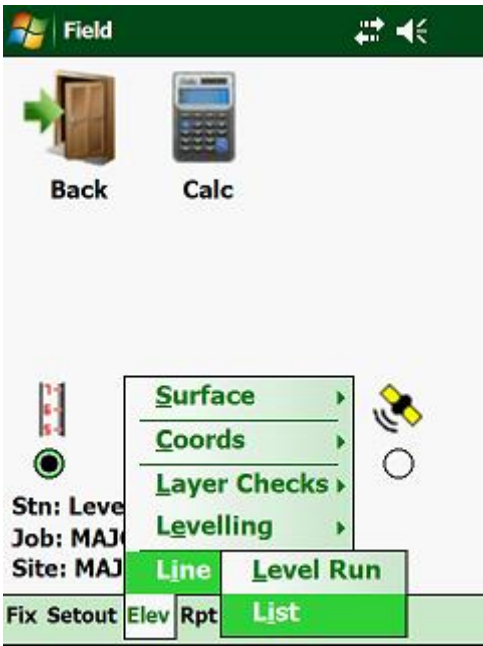


Next:

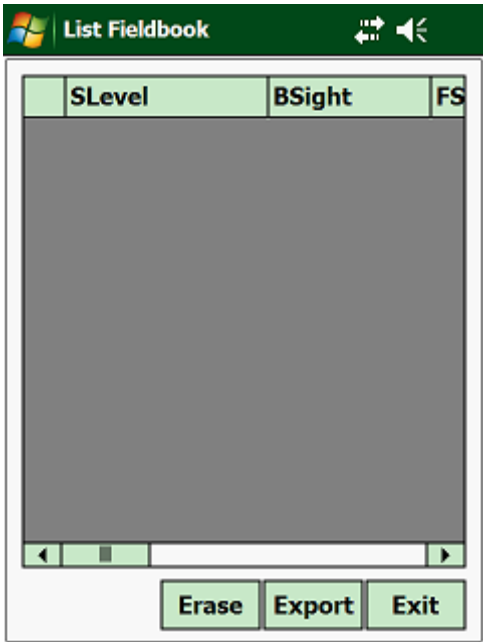
The screenshot shows the 'Line Levelling' dialog box. It has a green header bar with the Windows logo, the text 'Line Levelling', and navigation icons. The dialog contains several input fields and buttons. At the top, there are three radio buttons: 'Local', 'Site' (which is selected), and 'Global'. Below these are three input fields: 'Select Pt:' with a dropdown arrow, 'Pt Name:', and 'Elevation:' with the value '0.000' and a '?' button. There are two sets of input fields labeled 'Set 1:' and 'Set 2:'. Each set has 'BS:' and 'FS:' labels followed by input boxes. At the bottom, there are three input fields: 'F\Level:', 'Remarks:', and three buttons: 'OK', 'Calc', and 'Exit'.

**3.19.02 List:**

This will list all your fieldwork, which can be exported to a “CSV” file. Tap on “Line Level” and then on “List”:

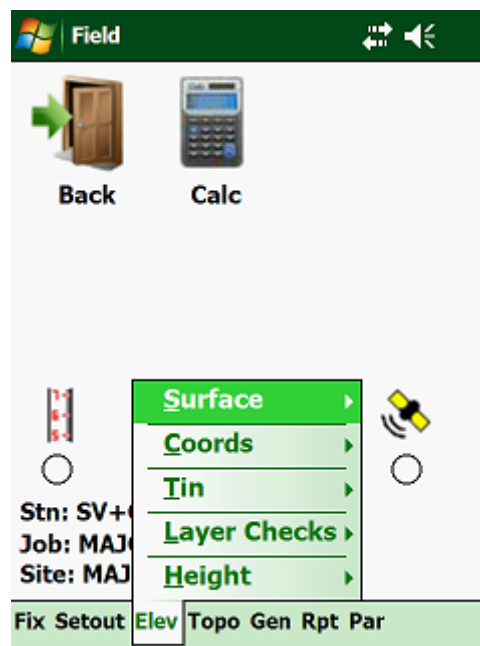


Next:

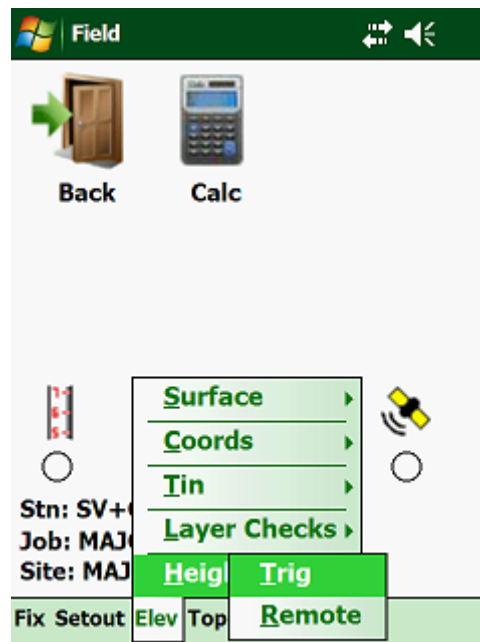


### **3.20.00 Heighting:**

This option will be used to determine the elevation of remote targets.



The program will use the collimation level plus the difference in elevation to calculate the elevation of the remote target.

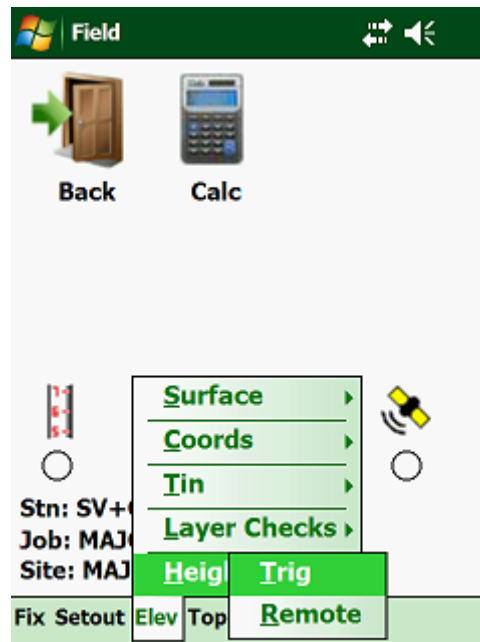


Here you have two options:

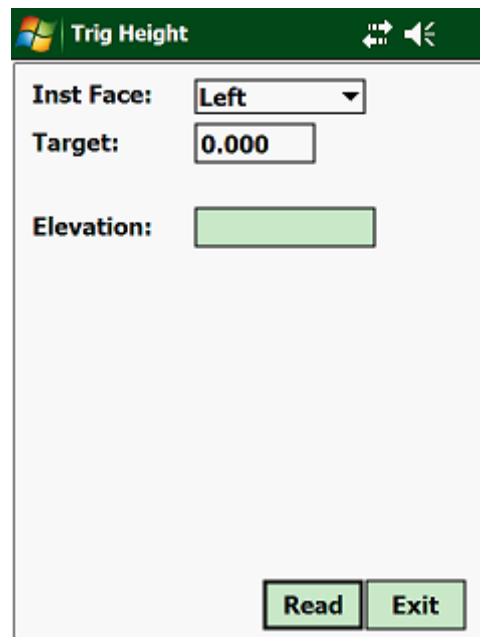
- Trig Height - calculate the height of a target where the prism is held.
- Remote - calculate the height of an inaccessible point.

**3.20.01 Trig:**

With this routine you can get the height of the target observed. Move the cursor to “Trig” and press the <Enter> key:



Then:



Input required:

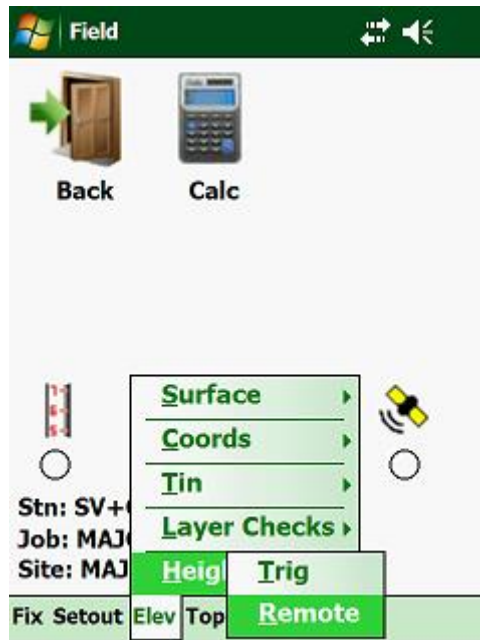
- Inst Face - select the face of your instrument .
- Ver Angle - enter the vertical angle.

This will then calculate the height of the target for you:

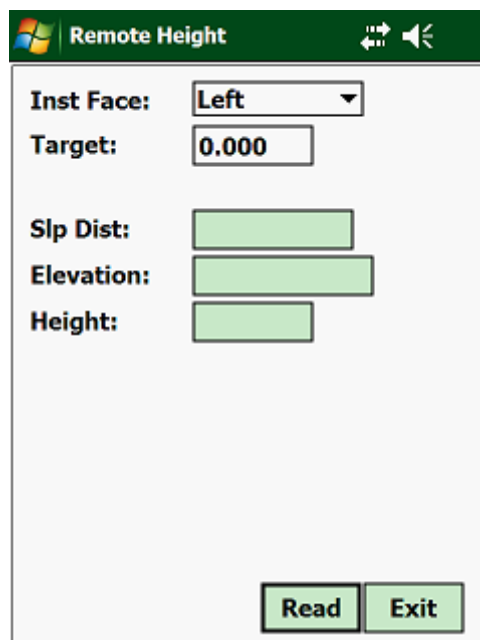
### 3.20.02 Remote:

You will use this routine to calculate the height of a target that is inaccessible. A typical example will be to determine the height of some overhead powerlines.

Move you cursor to “Remote Height” and press the <Enter> key:



Then:



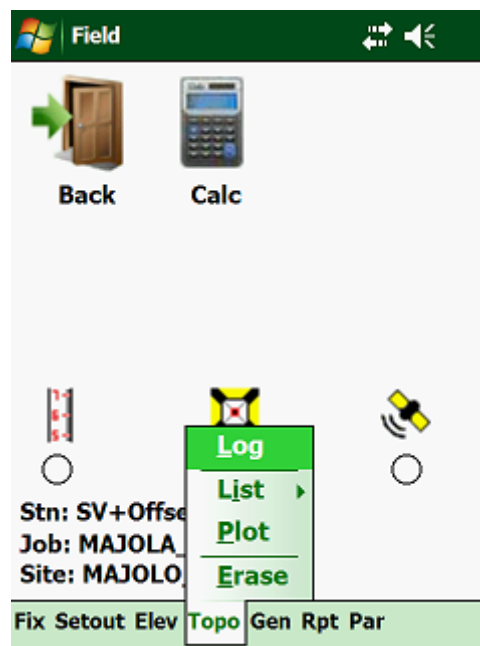
Here you will hold the prism underneath the powerline and measure the distance to the prism. Then you will tilt the telescope to the wires (or the object that you want to measure) and read the vertical angle.



**3.21.00 Topo:**

Topo surveying is one of the methods used in surveying to collect data about a terrain to enable the surveyor to represent the surface as a mathematically model with the aid of Y, X, and Z coordinates.

To access these routines, use the arrows on the Handheld, until the pull down menu under “Topo” is activated:

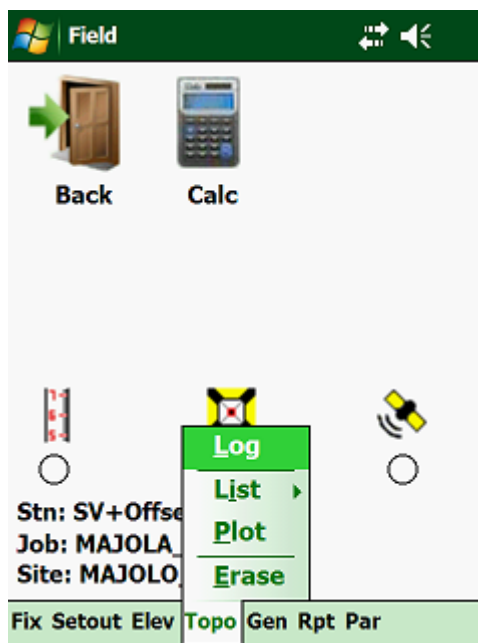


Here you have two functions:

- Log - use this to log your Topo survey.
- List - list your logged Topo shots.
- Plot - plot your Topo survey.
- Erase - erase all your Topo information.

**3.21.01 Log:**

To access this, tap on “Topo” and then on “Log”:

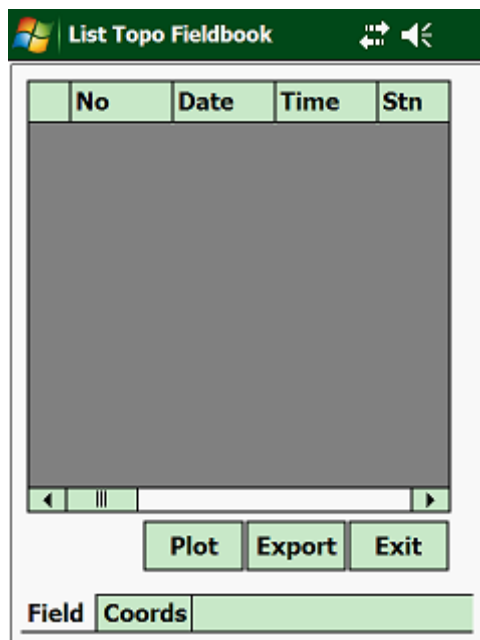


Next:

The screenshot shows the 'Log Topo Survey' form. At the top is a green header with a Windows logo and the text 'Log Topo Survey'. Below the header, there are several input fields and buttons. The fields are: 'Code:' with a dropdown menu showing 'Point'; 'Select:' with a dropdown menu; 'Feature:' with a text input field; 'Target:' with a text input field showing '0.000'; 'Hor Ang:' with a green text input field; 'Ver Ang:' with a green text input field; and 'S\Dist:' with a green text input field showing '0'. At the bottom, there are four buttons: 'Erase', 'Info', 'Read', and 'Exit'. Above the 'Read' and 'Exit' buttons, there are two more buttons: 'Plot' and 'List'.

**3.21.02 List:**

This will list the raw field data and the calculated coordinates in a spreadsheet. This can be exported to a “CSV” file for further manipulation.



### **3.21.03 Plot:**

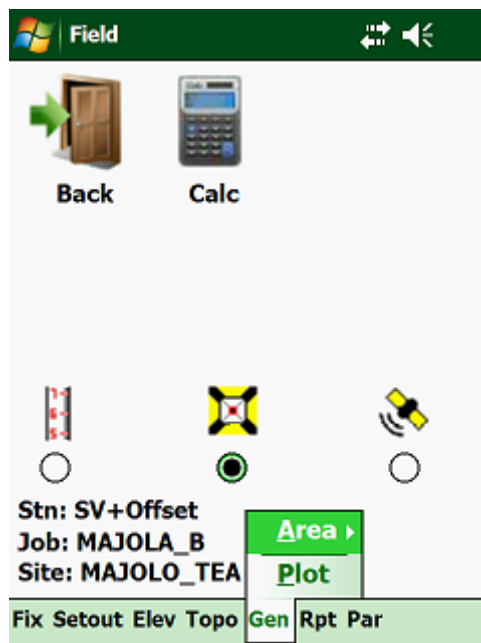
This function will plot your Topo survey.



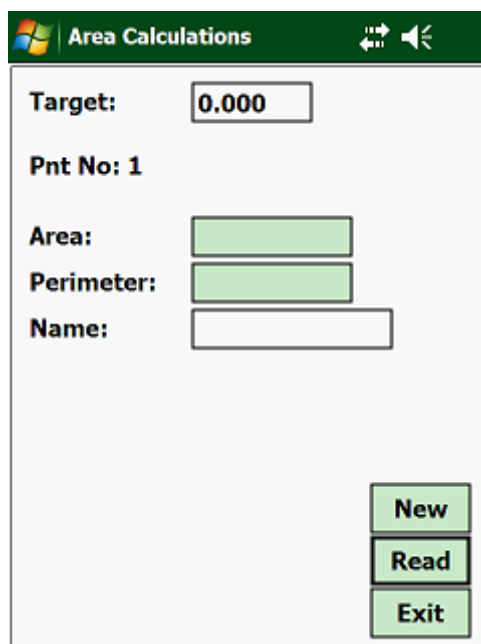
**3.22.00 Gen:**

In this version of the program, this function only has the following available:

- Area - calculation of areas in the field
- Plot - import of DXF drawings

**3.22.01 Area:**

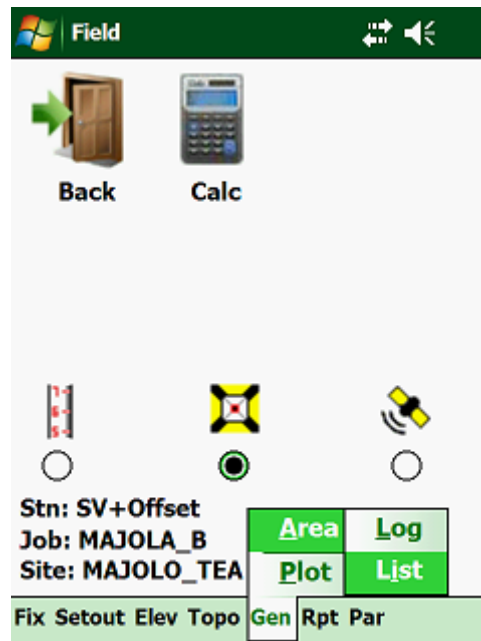
Using your Total Station or your GPS, you can determine the area in the field. At this stage the program only calculates the area on a Plane. Click on “Gen”, “Area” and then on “Log”:



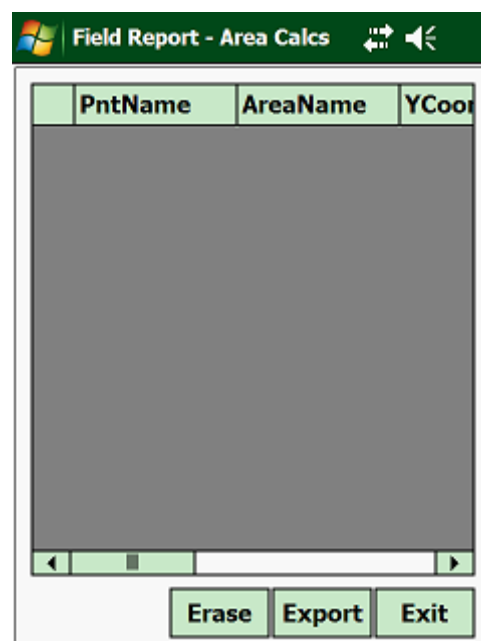
After the 3<sup>rd</sup> reading, the program will update the area and the length of the perimeter as more data is recorded. You also have the option of storing the data, which can be viewed at a later stage.

### 3.22.02 List:

Here you can list all the area calculations.

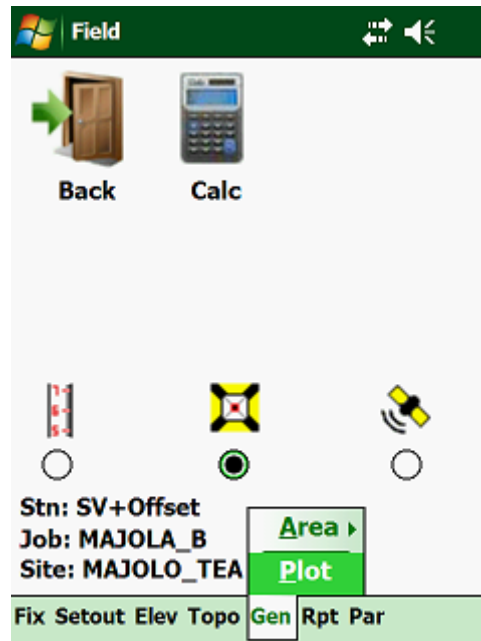


Next:

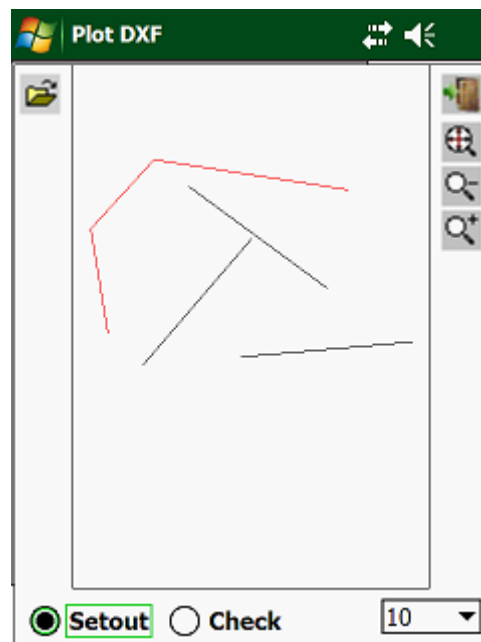


### **3.22.03 Plot:**

Here you import a DXF drawing and by selecting entities on the screen be able to set them out in the field. With this version of the program you can only select straight lines. Select “Plot”:



Next:

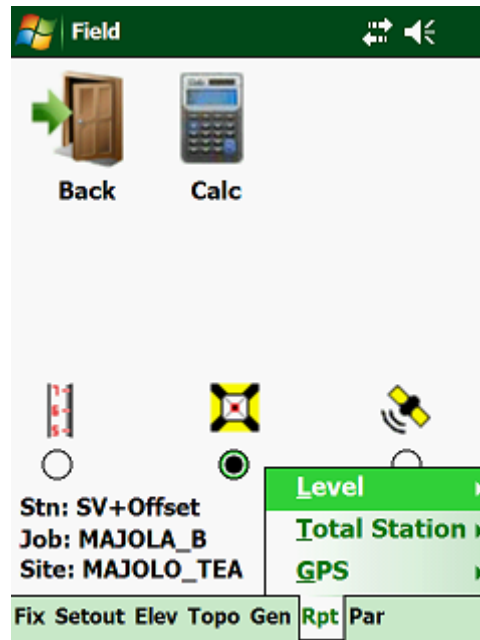


By tapping on a line, the program will load the line and take you to the String setting out or checking option.

**3.23.00 Rpts:**

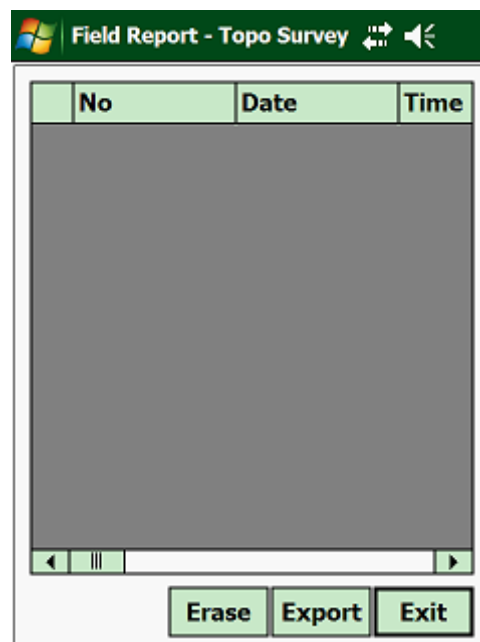
Here you can get all the field data that has been recorded manually or stored automatically as set in the “System Parameters”.

Click on “Rpts”:



Options:

- Level - view all reports which were stored when using the Level.
- Total Station - view all reports which were stored when using the Total Station.
- GPS - view all reports which were stored when using the GPS.

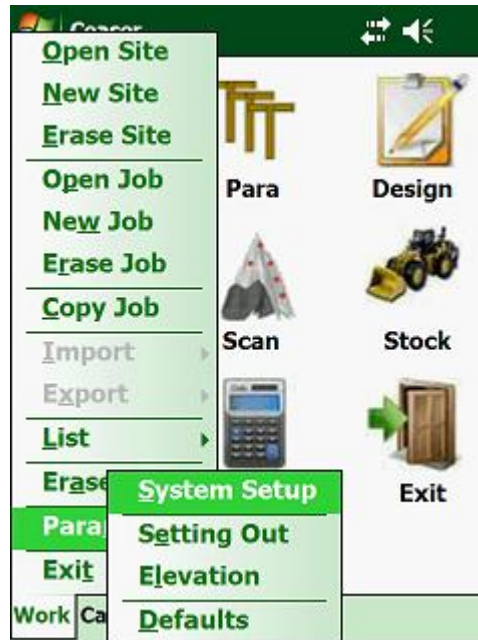




**3.24.00 Parameters:**

This routine can be used to change the survey parameters of the Job that is open - i.e. if you want to use a different instrument, change the offsets of your profile pegs, etc.

To access this routine, tab on “Parameters”:

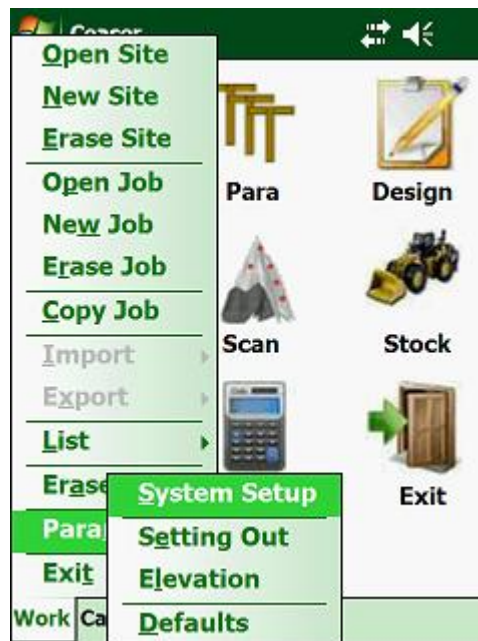


This will give you the following options:

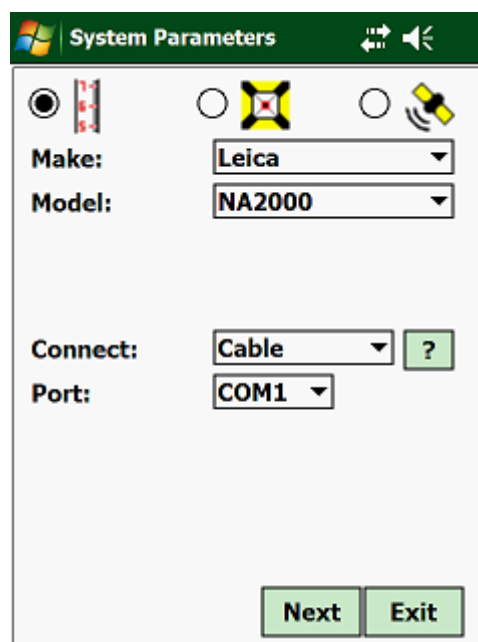
- Setup System
  - this lets you change the mode in which you want to survey, the type of instrument that you are working with, change the coordinate system, etc.
- Setting Out
  - here you change the position and travel of your pegs relative to the design of the Job.
- Elevations
  - this will control how the elevations must be relative to the design levels.
- Defaults
  - here you can set the default Batter Slopes and Stake Value increments.

### **3.24.01 Setup System:**

To change the system parameters, tab on “Setup System”:



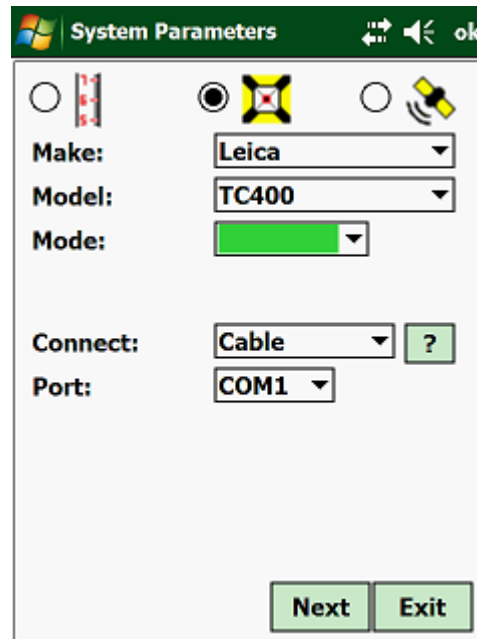
Next you will need to enter or change the Job parameters:



First select which type of instrument you want to set, i.e. Level, Total Station or GPS.

Next:

- **Make** - if you are working with a Total Station, then you must select the make of the instrument that you are working with - i.e. Geodimeter, Nikon, Leica, etc.
- **Model** - select which model of the selected instrument types you are using.
- **Mode** - toggle between “Fine” which is to millimetre accuracy or “Coarse”, which is to centimetre accuracy.



Next select how the PDA is connected to the instrument. Here you have 2 options:

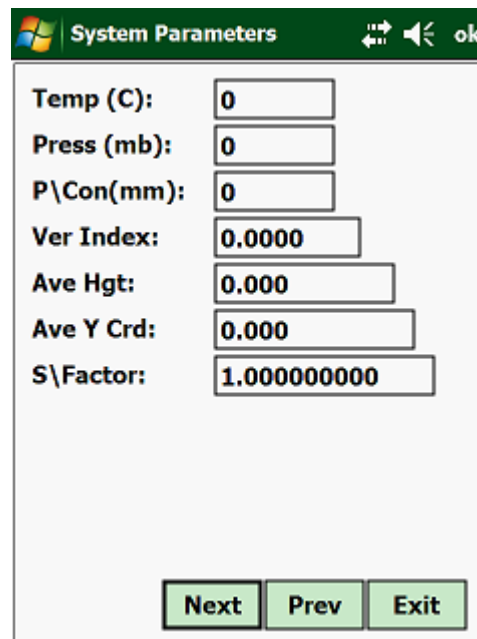
- Cable - select the Port to which the cable is connected.
- Bluetooth - here you will have to “Find” your instrument and then the program will “Pair” to your instrument.



Once the program has picked up your Instrument, you need to click on the “Pair” button. Most Instruments do not need a “Pin Code”, but if the “Pairing” is unsuccessful then you mostly likely need a Pin Code.



Next:



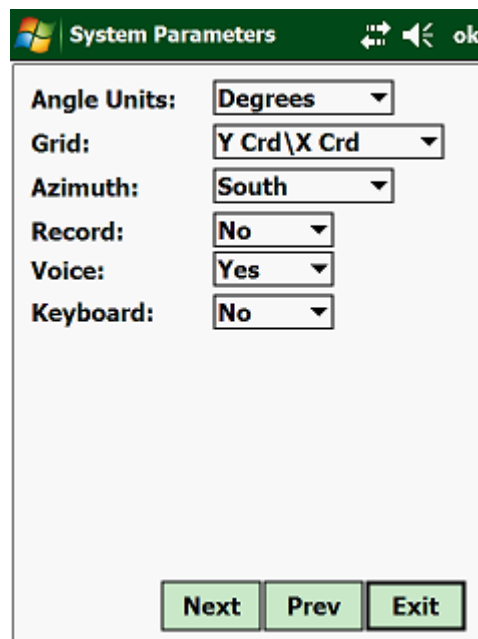
Temp (C):	0
Press (mb):	0
P\Con(mm):	0
Ver Index:	0.0000
Ave Hgt:	0.000
Ave Y Crd:	0.000
S\Factor:	1.000000000

Next Prev Exit

- Temp (C) - enter the temperature in Celsius
- Press (mb) - enter the pressure in millibars
- P\Con (mm) - enter the prism offset in millimeters
- Ver Index - enter the vertical index error of your instrument. The vertical index error can be determined by reading the vertical angle to some distant target in face left and face right. The sum of the two readings must be 360°. Half the difference between the sum of the two angles and 360° will be your index error. The program will correct all your vertical angle observations by this error.
- Ave Hgt - enter the average height above mean sea level of the area that you are going to work in.
- Ave Y Crd - enter the average Y coordinate of the area that you are going to work in.

From the above information the program will calculate a scale factor correction, which will be applied to all the distance observations. The value that the program has calculated can be overridden, by allowing you to enter your own scale factor.

Next:



**System Parameters**

Angle Units: Degrees

Grid: Y Crd\X Crd

Azimuth: South

Record: No

Voice: Yes

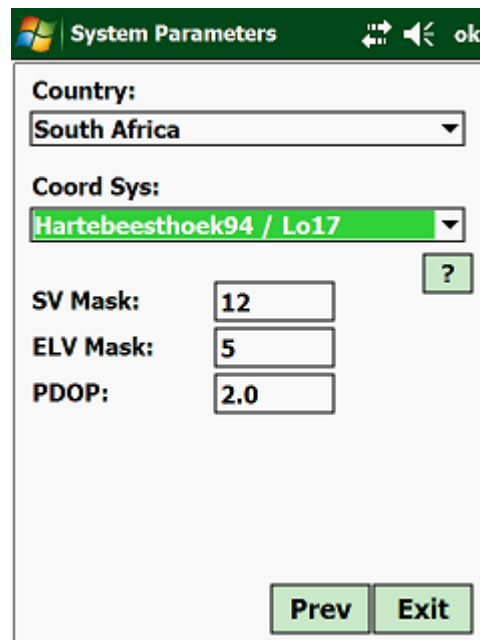
Keyboard: No

Next Prev Exit

- Angle Units
  - select the angle units that you are working with.
- Grid
  - select the coordinate system that you are going to use.
- Azimuth
  - select whether your zero bearing is North or South.
- Record
  - if you select "yes", then all your observations will be stored automatically.
- Voice
  - if set on "Yes", you will get voice messages from the program after actions have been taken.
- Keyboard
  - if your Handheld unit does not have a keyboard, then you can activate the virtual keyboard with this setting.

Next:

The following information is only required if you work with a GPS system.



- Country - select the Country that you are working in.
- Coord Sys - select the coordinate system.
- SV Mask - enter the minimum number of Satellites that you want to work with. Generally the more Satellites you have the more accurate is your position.
- ELV Mask - this is the minimum angle below which you do not want to use the Satellites. Satellites very close to the Horizon do not yield good results.
- PDOP - enter the maximum PDOP that you want to work with. The lower the PDOP the more accurate your fix is.

Once you have completed the above, tap on “Exit” to return to the main menu.

You can at any stage while in the above input screens, tap the “Exit” button to return to the main menu.

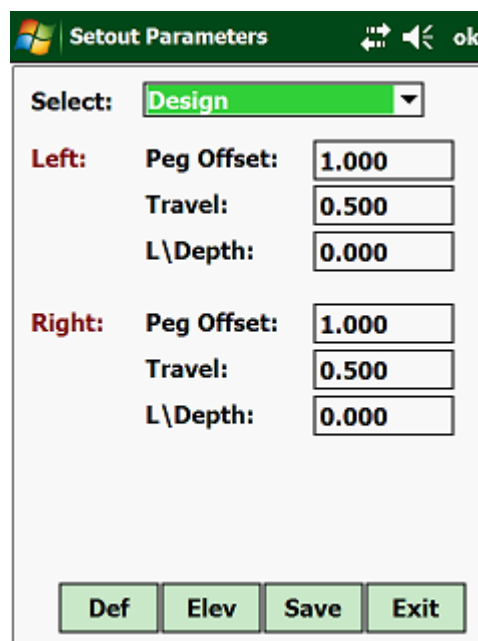


### **3.24.02 Setting Out:**

Under the “Setting Out” option, you can define the offsets, travels and layer depths in the setting out routines:



Next:



Here you will have to select the type of setting out, of which you want to change the parameters:

- Batterboards
- Full



- Design
- Edge
- Shoulder
- Appendage
- Stake & Offset
- Pivot Point
- Manual
- Coordinates
- Strings

Once you have selected the above, you will have to enter the following:

- |            |  |
|------------|--|
| Peg Offset | - Enter the offset of the pole from the relevant surface   |
| Travel     | - Enter the travel - i.e. the distance of the placed level above the design level.   |
| L\Depth    | - Enter the depth of the layer to which the level must be calculated. Normally this stays at “0”, which is the default and the Foreman or Supervisor changes the dip stick to suit what needs to be constructed. |

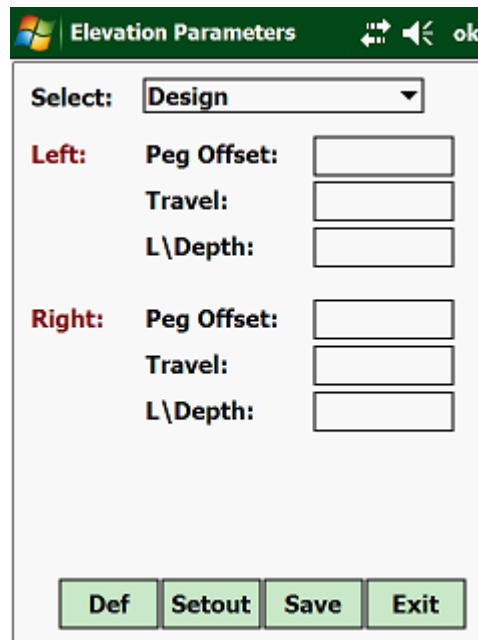
This will also have to be entered for the right side.

### **3.24.03 Elevations:**

This selection will be used to define the parameters for all the elevation options:



Next:



To access this routine, highlight “Elevations” and press the <Enter> key:

Here you will have to select the type of elevation placing, of which you want to change the parameters:

- Full
- Design
- Edge
- Shoulder
- Appendage
- Manual
- Coord
- Tin Model



Once you have entered the above, you will have to enter the following:

- |            |   |  |
|------------|---|--|
| Peg Offset | - | Enter the offset of the pole from the relevant surface   |
| Travel     | - | Enter the travel - i.e. the distance of the placed level above the design level.   |
| L\Depth    | - | Enter the depth of the layer to which the level must be calculated. Normally this stays at “0”, which is the default and the Foreman or Supervisor changes the dip stick to suit what needs to be constructed. |

### **3.24.04 Defaults:**

This option lets you enter default values for your Job.



Next:

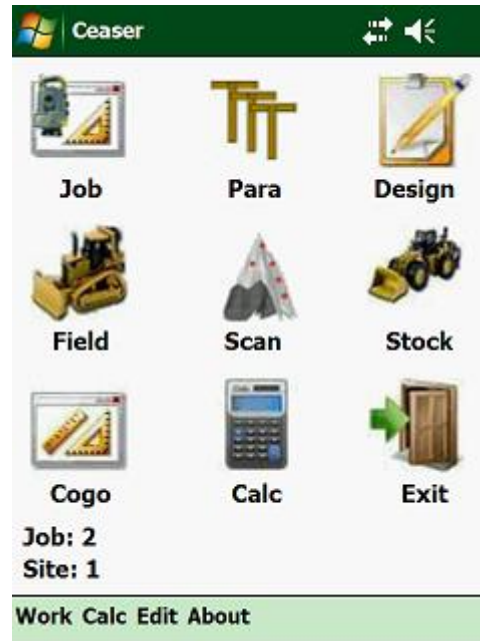
The screenshot shows the 'Default Parameters' dialog box. It has a title bar with the Windows logo, the text 'Default Parameters', and navigation icons. The main area contains three input fields: 'Stake Incr:' with the value '20.000', 'Cut Slope:' with the value '2.000', and 'Fill Slope:' with the value '2.000'. At the bottom of the dialog are four buttons: 'Elev', 'Setout', 'Save', and 'Exit'.


Here you will then be given the opportunity to enter a default Stake Value increment, Cut Slope and Fill Slope Batter.

## **CHAPTER 4: Stock**

**4.1.00 Introduction:**

With the Stockpile module, you can import Topo or ASCII points and generate Tin Models from them. Once the Tin Model has been created, the option exists to display contours, calculate areas, etc.



On the main screen tap on the  icon.



On the left, you have the following options:



- import points from the Topo Database or from a file that is in a text (CSV, ASCII, TXT, etc.) format as follows: Y, X and Z or Name, Y, X and Z.



- open an existing processed Tin Model.



- list your Tin Model.



- swap Triangles.



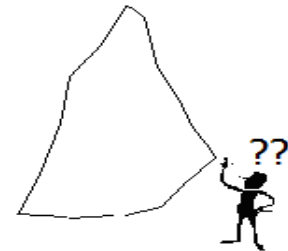
- erase Triangles.



- plot Contours.



- mark an area for area or volume calculations.



On the right, there are the following options:



- exit from the module.



- zoom all.



- zoom out.



- zoom in.



- calculate the plane area as defined by the boundary.



- calculate the slope area as defined by the boundary.



- calculate the volume as defined by the boundary.

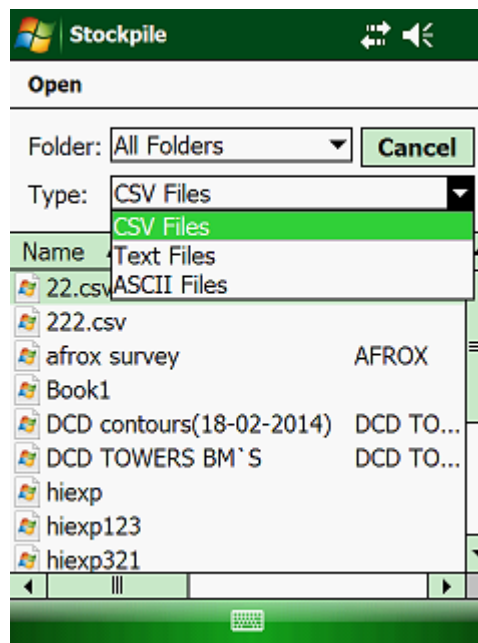
**4.2.00 Import:**

This function lets you import points from a CSV, Text or ASCII formatted file and automatically generate a TIN Model for you. Please bear in mind that the files that you want to import has to be in the following format:

- Name, Y Coord, X Coord and Z Coord
- Y Coord, X Coord and Z Coord

If the files are not in the above format, nothing will be imported.

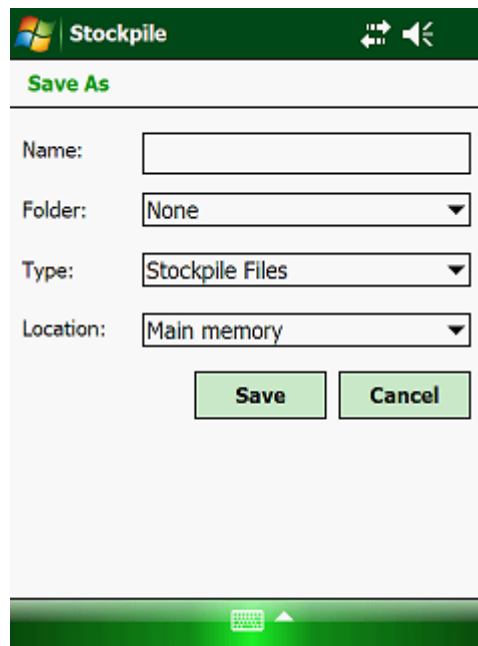
Click on the icon, which will display the next screen:



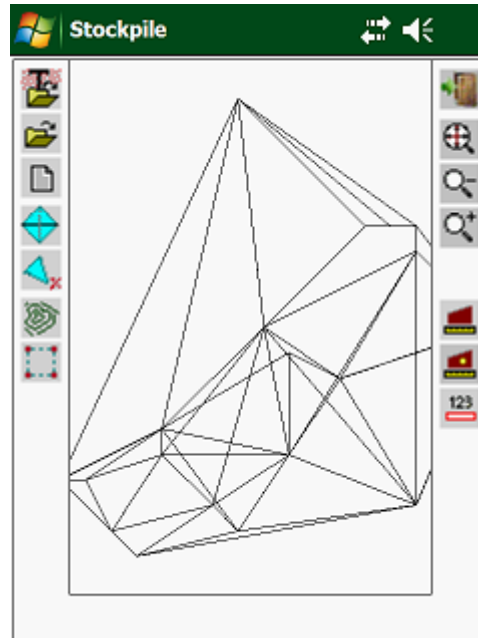
Select the file that you want to import.

Any data that is imported will override any data that exists.

Once the program has imported the selected file, you will be asked to save the imported points in a “Tin” file.



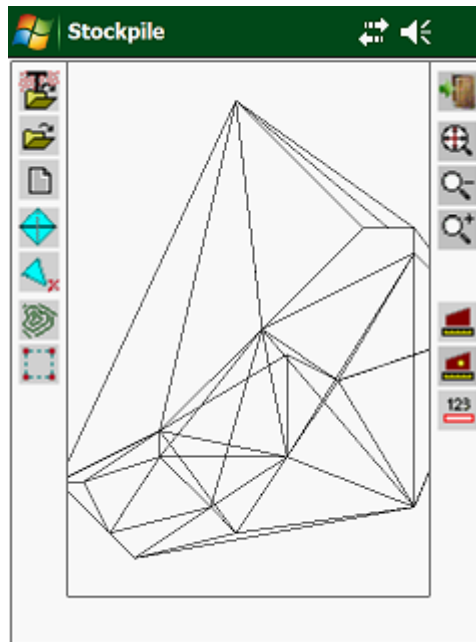
If the import has been successful, the points and the Tin Model will be plotted on the screen of your Handheld:





#### **4.2.01 Open:**

This will allow you to import one of your previously stored Tin Models.



Once the Tin Model has been loaded, the following can be done:

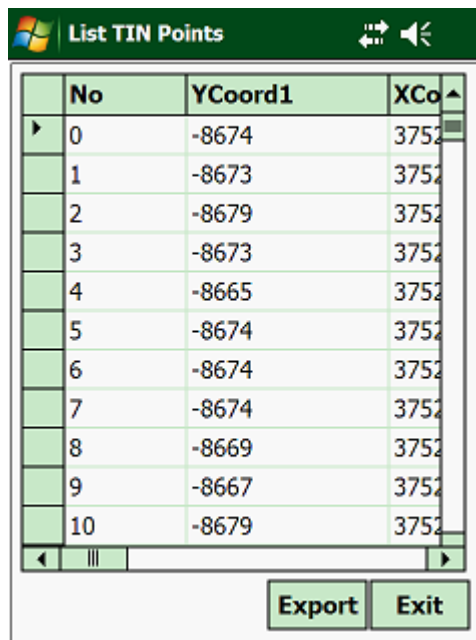
- Swap Triangles
- Delete triangles
- Plot Contours
- Define the Boundary

Once you have defined the Boundary, the following reports can be retrieved:

- Plane Areas.
- Slope Areas.
- Volumes.

**4.2.02 List:**

This will list the coordinates of your Tin Model in tabular Form.

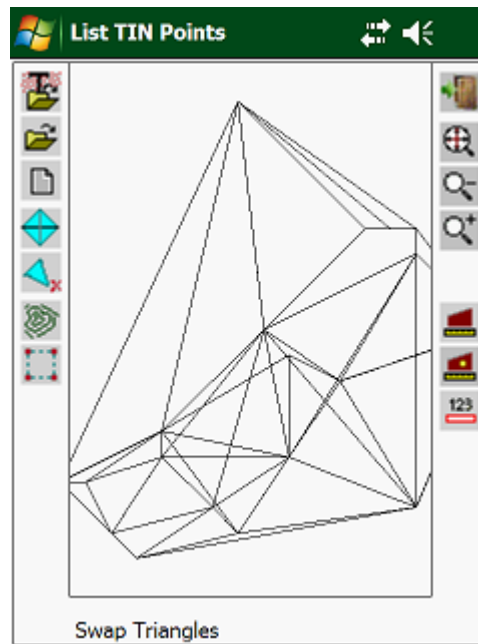


No	YCoord1	XCo	
0	-8674	3752	
1	-8673	3752	
2	-8679	3752	
3	-8673	3752	
4	-8665	3752	
5	-8674	3752	
6	-8674	3752	
7	-8674	3752	
8	-8669	3752	
9	-8667	3752	
10	-8679	3752	

The option also exists to export this Tin Model and then import it as a design in the “Design” module to enable you to set out the Tin Model in the field.

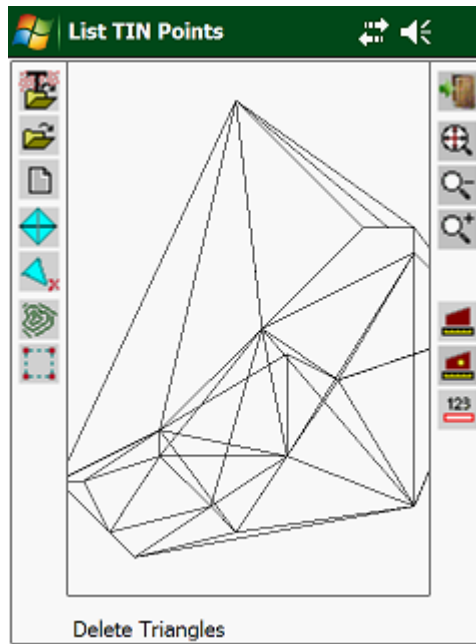
**4.2.03 Swap:**

This function lets you swap the triangles. Using your Stylus click on the common side of two triangles and the program will swap the triangles around. Normally you would plot the Contours, before you use this function. By having a look at the Contours, you can see where it is necessary to swap the Triangles, so that the Contours conform to what is in the field.



#### **4.2.04 Erase:**

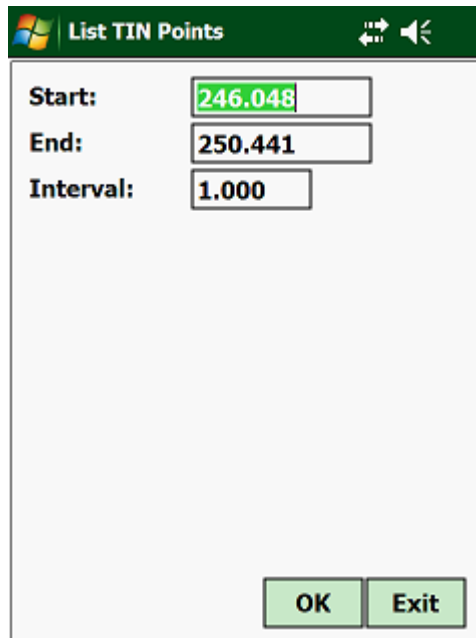
By clicking inside a Triangle, the program will erase the selected Triangles.



**4.2.05 Plot:**

This function lets you plot the Contours based on the vertices of your Triangles that make up the Tin Model.

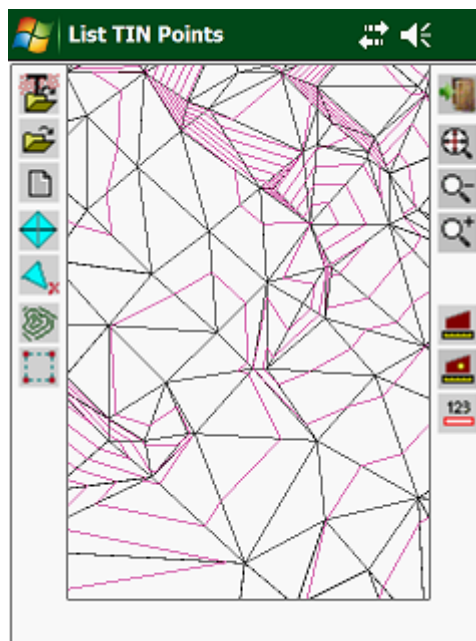
First you will have to enter the start and end of the Contour Plot:



Start: 246.048  
End: 250.441  
Interval: 1.000

OK Exit

Next:

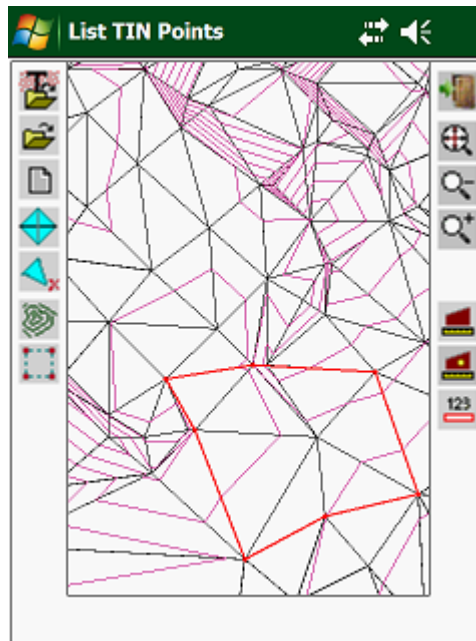


Selecting the “Contour” icon again, will hide the contours.

#### **4.2.06 Boundary:**

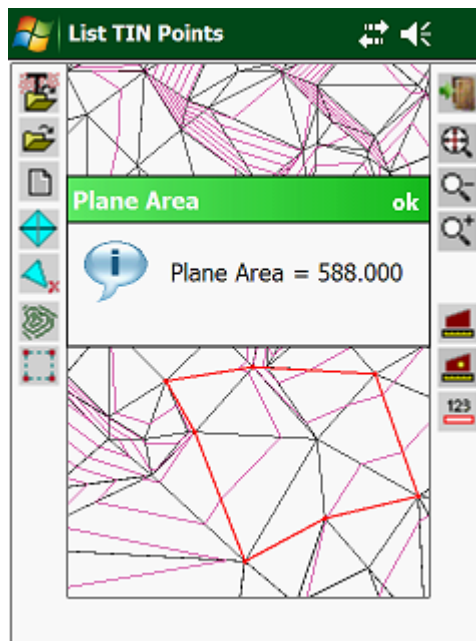
Before you can calculate any areas or volumes, you will first have to define the Boundary defining the limits of the calculations.

Using your Stylus, click on the vertices of the Tin Model. Remember to close the Boundary on the first point of the boundary. The Boundary will be shown up as a red line.

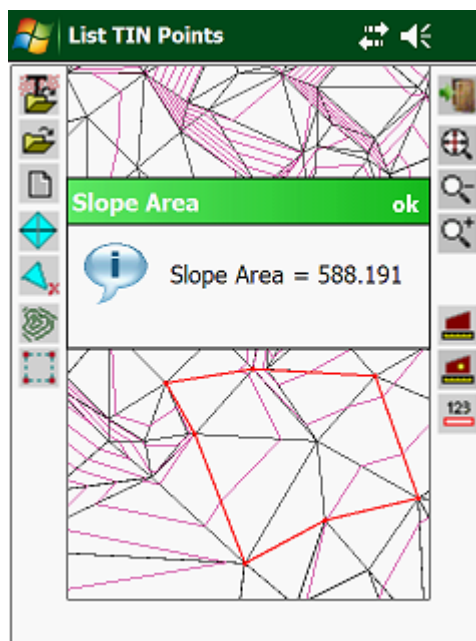


**4.3.00 Plane Area:**

This will calculate the Plane area as defined by the Boundary.

**4.3.01 Slope Area:**

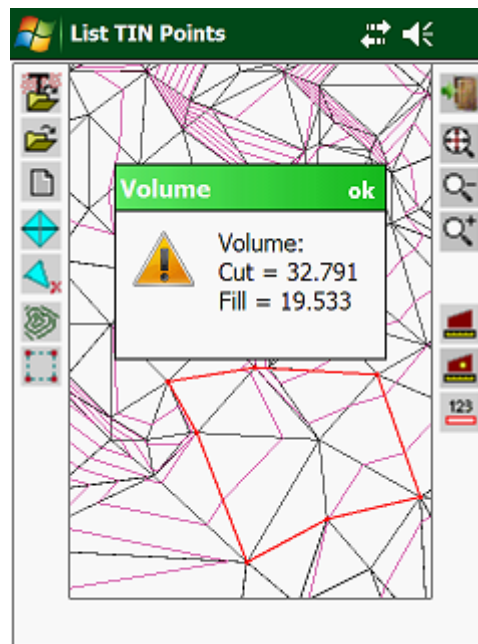
This will calculate the Slope area using the Triangles defined inside the Boundary.



The Slope area will always be more than the Plane area.

#### **4.3.02 Volume:**

This lets you calculate the Volume of your Stockpile inside the defined Boundary.





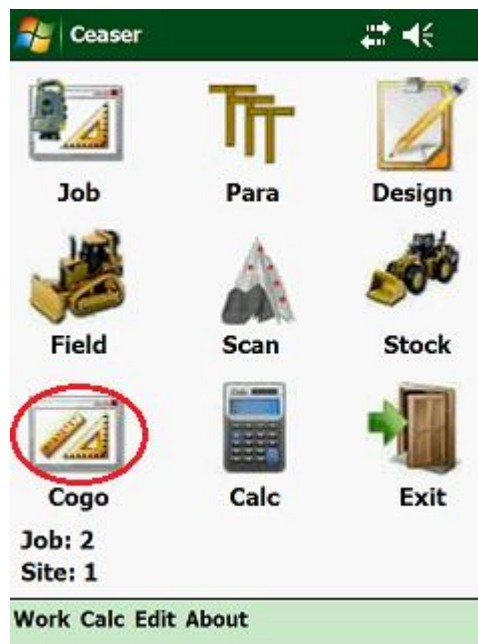
## **CHAPTER 5: COGO**

### **5.1.00 Introduction:**

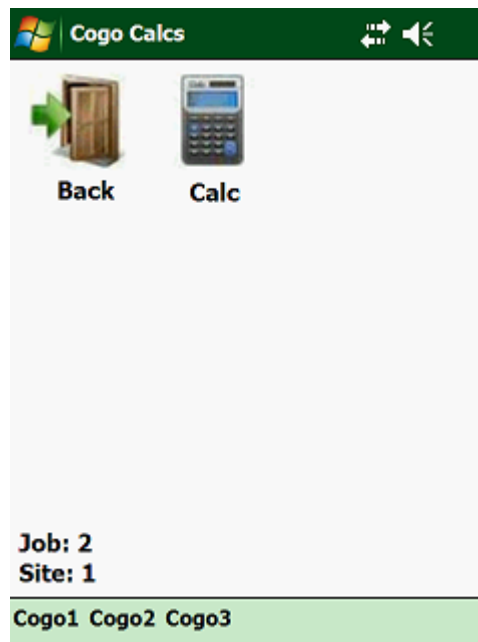
The “Cogo” module contains routines for the following:

- Areas
- Joins
- Polars
- Intersections
- Transformations
- Splays
- Arcs
- Points On Line
- Conversions.....etc.

To access these routines, tap  on the main screen:



Here you will find the following screen:



This is the main screen of the “Cogo” module. Here you will find different Cogo modules which will assist you in your day to day survey calculation requirements.

To access the calculator, tap on the “Cal” icon.

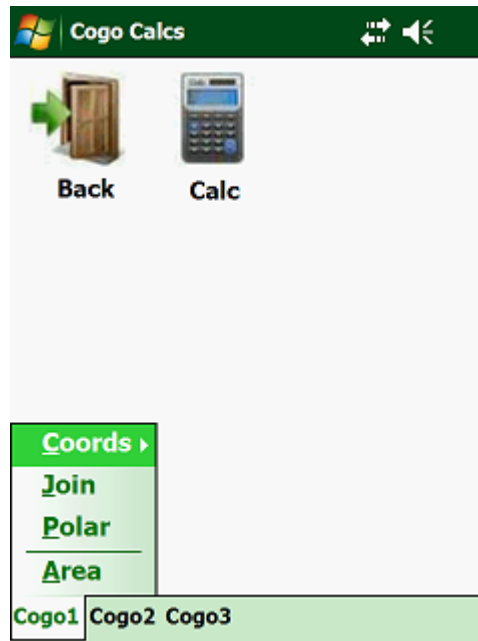
To return to the main menu, tap with your stylus on the “Door” icon.

**5.2.00 Cogo 1:**

Cogo 1 contains the following:

- Coords
- Join
- Polar
- Area

To access these routines, tap with your stylus on “Cogo 1” on the menu:



Where my coords?



**5.2.01 Coords:**


The following options are available:

- Import - import coordinate points from a tab, space or comma formatted text file.
- Edit\Add - this lets you change, erase or add a new point to your coordinate file.
- List - list your selected coordinate file in a tabular format.
- Plot - a graphical plot of your points.



### **5.2.02 Edit\Add:**

With this function you can view, edit or add coordinates in either the selected Local, Global or Setout coordinate file. The reason for placing these functions here is that most of the calculations done in this module are based on coordinates which are stored in your coordinate files. These are coordinates that are located in the Local, Global or Setout databases. You therefore do not have to return to the “Data” module to update your coordinate files.



To access the coordinates in your Local file, tap on “Local”, to access the coordinates in your Global file, tap on “Global” and to access the coordinates in your Setout file, tap on “Setout”. The program will then load the respective database.

Local coordinates are only available to that specific Job which has been loaded, whereas Global coordinates can be accessed by all the Jobs.

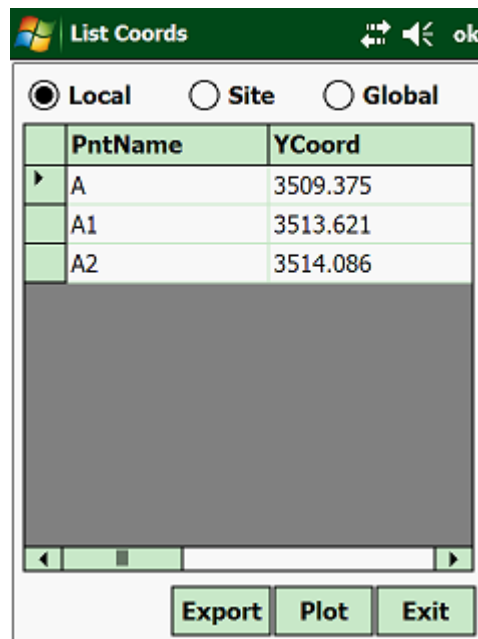
The Job that has been opened will be displayed on the left side at the bottom of the “Cogo” main screen.

Other options at the bottom of the screen are:

- Save - lets you change or add a new coordinate. This updates the respective database.
- Copy - here you can copy the displayed point from the Local coordinate file to the Global coordinate file or vice versa. If a Local coordinate is displayed, it will be copied to the Global file and if a Global coordinate is displayed, it will be copied to the Local file. If the coordinate already exists, the program will warn you. Here you will have the option to override, get the mean or ignore the action.
- Erase - this will erase a point from the selected coordinate file.

**5.2.03 List:**

This will give you a list of all the coordinates in the selected coordinate file.



To access any of the coordinates, tap on the respective type of file. The program will then load the respective database and display them in the tabular format.

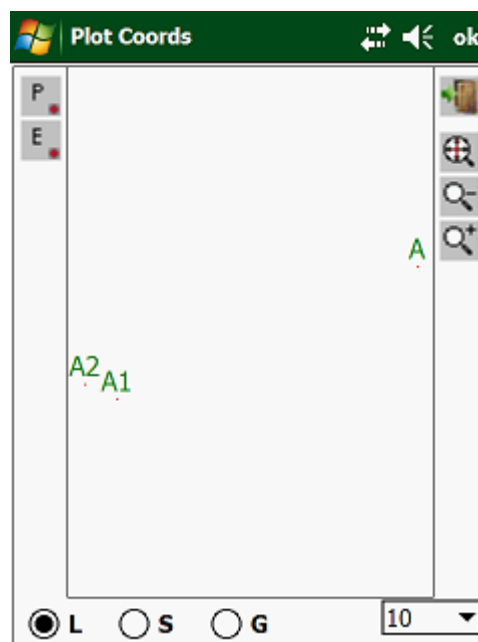
Options available:

- Exit - return to the previous screen.
- Plot - plot the selected file to the screen.
- Export - export the points to a “csv” file.

To move across the spreadsheet, hold your stylus on the horizontal scrollbar at the bottom of the screen. To scroll up and down the spreadsheet, hold your stylus on the vertical scrollbar on the right of the screen.

**5.2.04 Plot:**

This function will give you a graphical plot of the selected file. First select whether you want to plot the Local or Global file.

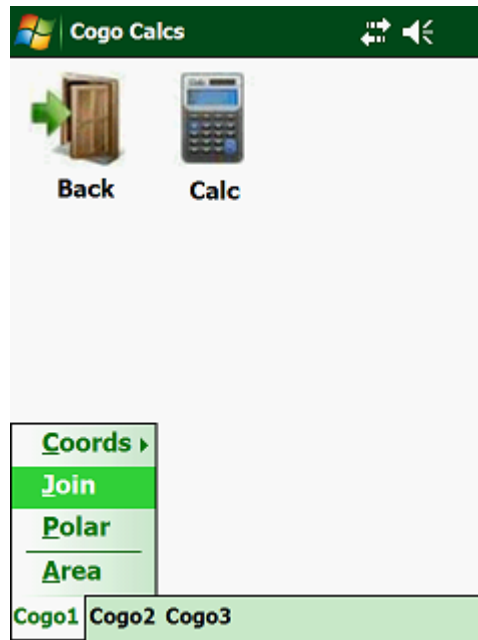




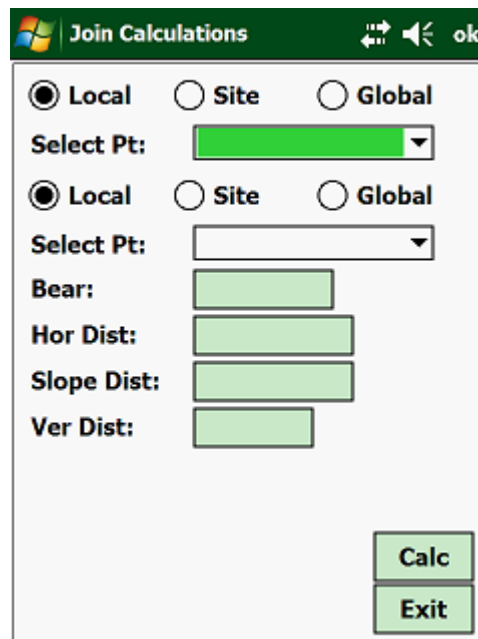
**5.3.00 Join:**

This will calculate the distance and bearing between two known points that are stored in either the local or global coordinate file.

To access this routine, tap on “Join”, which will display the following:



Next:



Join Calculations

☒ Local ☐ Site ☐ Global

Select Pt:

☒ Local ☐ Site ☐ Global

Select Pt:

Bear:

Hor Dist:

Slope Dist:

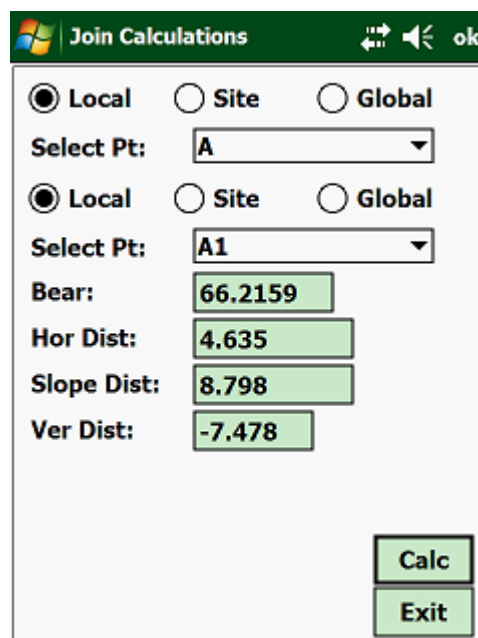
Ver Dist:

Calc

Exit

First you must select which coordinate file to use.

Once you have selected the start and end points, tap on <Calc> at the bottom and the program will display the results. If both the “From Point” and the “To Point” have a coordinate name in, then you do not need to tap the <Calc> button, as the program will calculate the Join automatically for you.



Join Calculations

☒ Local ☐ Site ☐ Global

Select Pt: A

☒ Local ☐ Site ☐ Global

Select Pt: A1

Bear: 66.2159

Hor Dist: 4.635

Slope Dist: 8.798

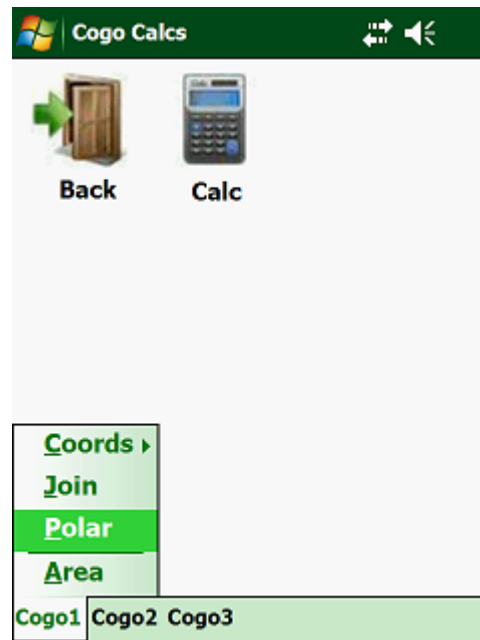
Ver Dist: -7.478

Calc

Exit

**5.3.01 Polar:**

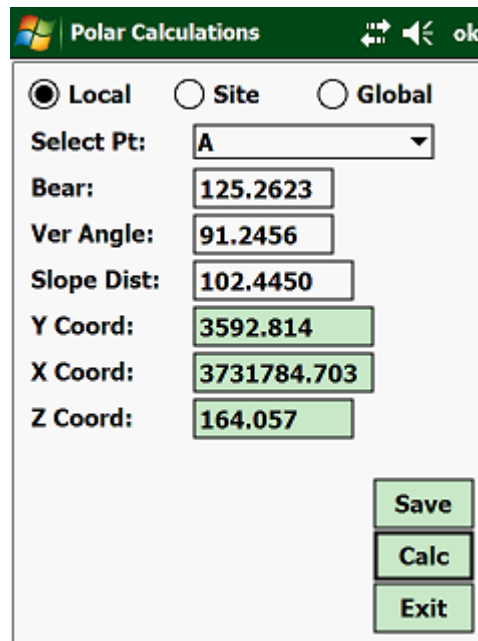
A polar will calculate the coordinates of an unknown point, if the bearing and distance to that unknown point is given from a point whose coordinates are situated in either the local, site or global coordinate file.



To access this routine, tap on “Polar”, which will display the following:

The screenshot shows the 'Polar Calculations' form. It has a green header bar with the Windows logo, the text 'Polar Calculations', and navigation icons followed by an 'ok' button. The form contains three radio buttons at the top: 'Local' (selected), 'Site', and 'Global'. Below these are several input fields: 'Select Pt:' with a green dropdown menu, 'Bear:', 'Ver Angle:', 'Slope Dist:', 'Y Coord:', 'X Coord:', and 'Z Coord:'. The 'Y Coord:', 'X Coord:', and 'Z Coord:' fields are highlighted in green. At the bottom right, there are two green buttons labeled 'Calc' and 'Exit'.

First select which coordinate file to use. Once this has been done, enter all your known variables (horizontal bearing, vertical angle and the slope distance). Next tap with your stylus on <Calc>, to calculate the coordinates of the new point.



**Polar Calculations** [Icons] ok

☒ Local   ☐ Site   ☐ Global

Select Pt: A

Bear: 125.2623

Ver Angle: 91.2456

Slope Dist: 102.4450

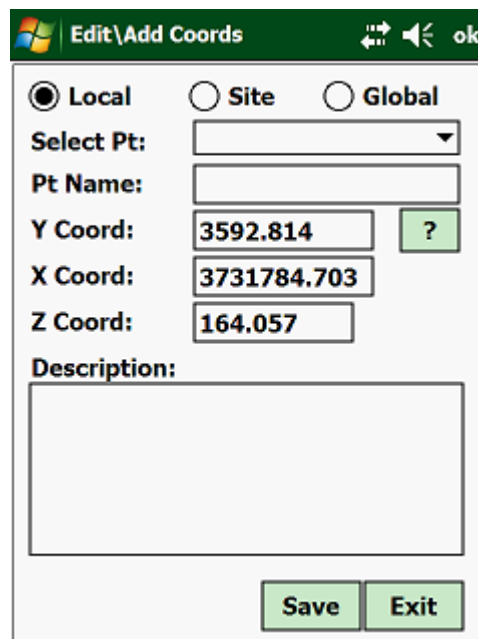
Y Coord: 3592.814

X Coord: 3731784.703

Z Coord: 164.057

Save  
Calc  
Exit

If you want to save this new calculated point, then tap on <Save>.



**Edit/Add Coords** [Icons] ok

☒ Local   ☐ Site   ☐ Global

Select Pt:

Pt Name:

Y Coord: 3592.814 ?

X Coord: 3731784.703

Z Coord: 164.057

Description:

Save   Exit

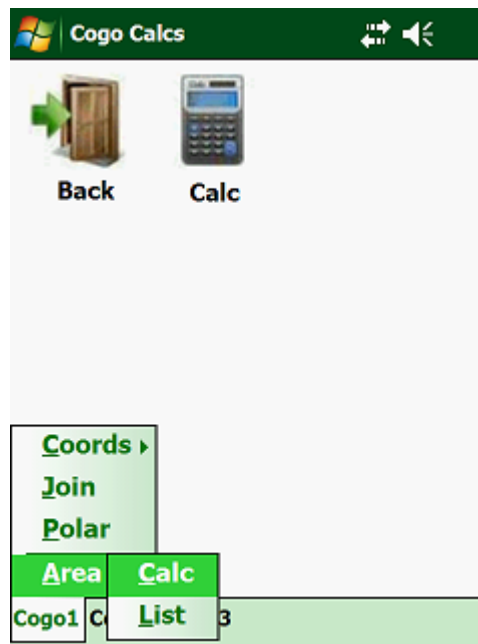
First select whether you want to store the new point in the Local, Global or Setout coordinate file. Then enter a valid point name and if you want, a description can also be entered for the new point.

The point will not be stored, unless you have entered a point name. The program will warn you if the point name already exists.

Next, tap with your stylus on <OK>, to store the new point in the selected file.

**5.4.00 Area:**

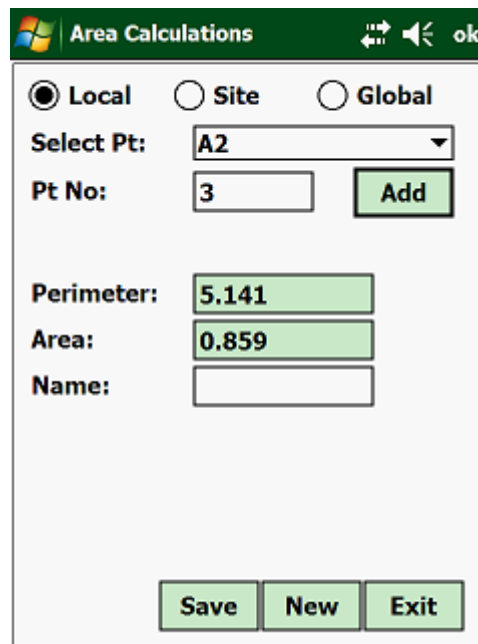
Use these routines to calculate the plane area of a figure.



Methods available:

- Coord File - use the coordinates that are stored in either in your Local or Global files to calculate the area of a figure.

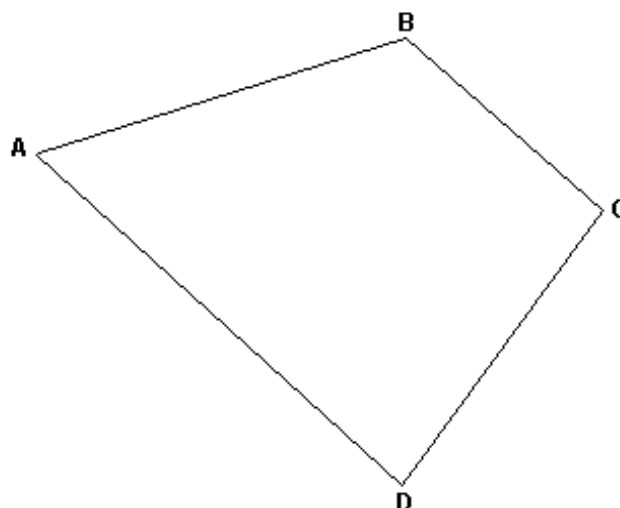
You have to enter a minimum of three points before the program will calculate an area for you.



Options:

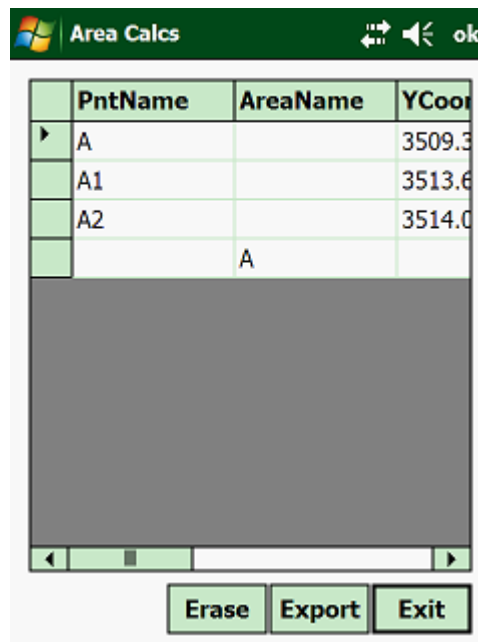
- Exit - return to the main menu of the “Cogo” module.
- Add - after you have selected each point tap on “Add” to add the entered coordinates to the calculation.
- Save - save the calculations by assigning a name to your calculations.
- New - clear the memory and start with a new area calculation.

Once a minimum of three points have been entered, the program will display the area and the perimeter of the figure. This will be updated as you enter new data.



**5.4.01 List Calcs:**

This will display all the adjusted points that have been stored in the database. These calculations can also be exported to an “csv” file.



The screenshot shows a software window titled "Area Calcs" with a green header bar. Inside the window is a table with three columns: "PntName", "AreaName", and "YCoord". The table contains four rows of data. Below the table is a large grey rectangular area, likely a plot or map. At the bottom of the window are three buttons: "Erase", "Export", and "Exit".

	PntName	AreaName	YCoord
▶	A		3509.3
	A1		3513.6
	A2		3514.0
		A	

Erase Export Exit

**5.5.00 Cogo 2:**

Routines available are:

- Arc Calcs - this will calculate coordinates of the central point, given the coordinates on the arc.
- Pts On Line - this will calculate additional points between two given points.
- Pts On Arc - this will calculate additional points given a center point and radius.
- Set Coords - calculate setting out data for coordinates

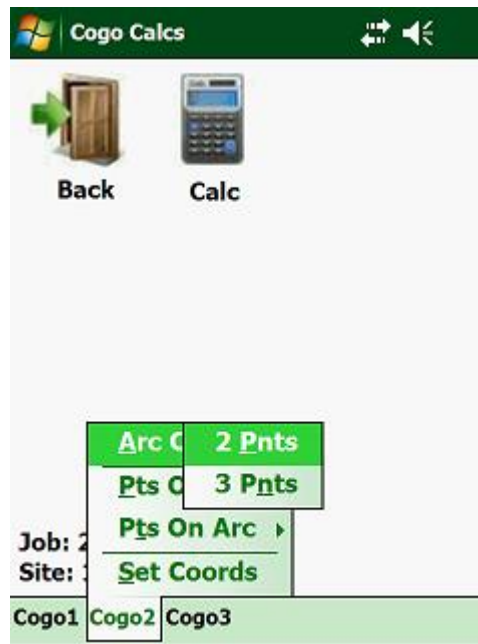




**5.5.01 Arc Calculations:**

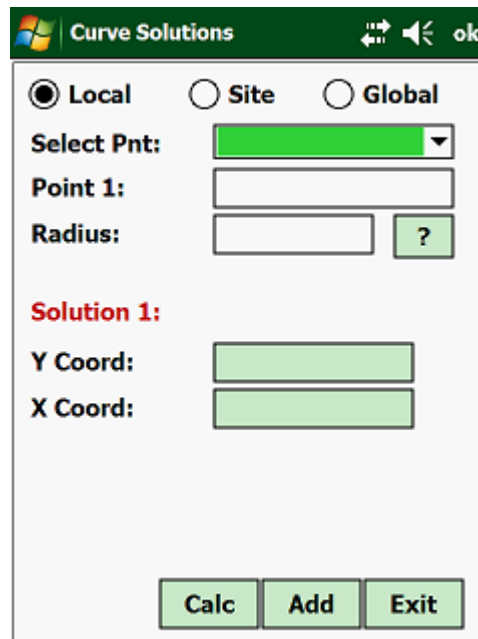
Here you have routines available to calculate the following:

- Arc Passing 2 Points - here you enter 2 coordinated points on the arc, as well as the radius of the arc and the program will then calculate the coordinates of the central point.
- Arc Passing 3 Points - here you enter 3 coordinated points on the arc and the program will calculate the coordinates of the central point.



### 5.5.02 Arc Passing 2 Points:

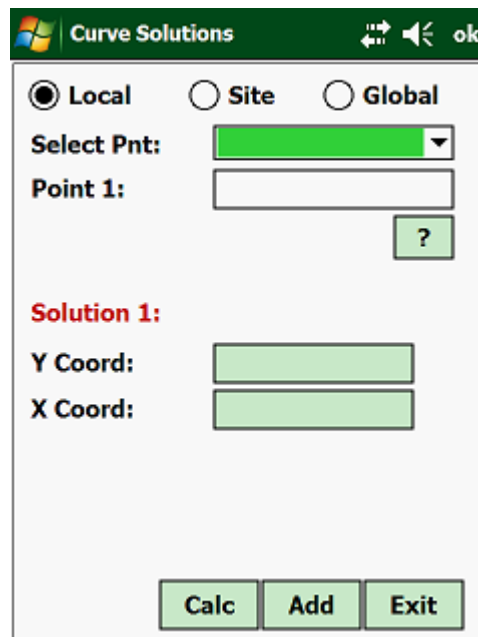
Here you enter 2 coordinated points on the arc, as well as the radius of the arc and the program will then calculate the coordinates of the central point.



The screenshot shows the 'Curve Solutions' dialog box with the 'Local' radio button selected. The 'Select Pnt:' dropdown is set to a green box. The 'Point 1:' field is empty. The 'Radius:' field is empty, and a green button with a '?' is next to it. Under 'Solution 1:', the 'Y Coord:' and 'X Coord:' fields are empty. At the bottom are 'Calc', 'Add', and 'Exit' buttons.

### 5.5.03 Arc Passing 3 Points:

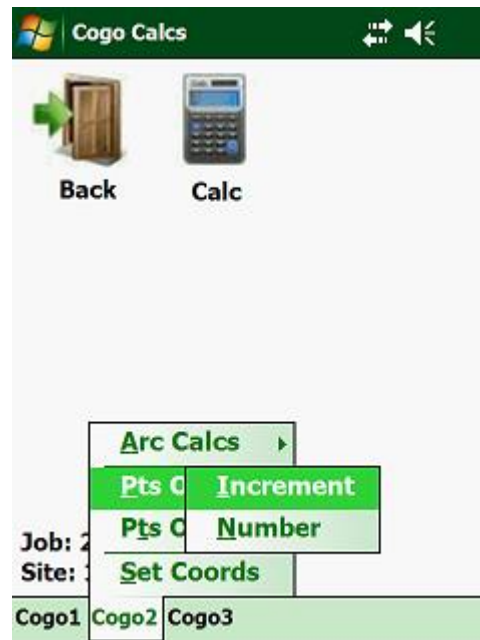
Here you enter 3 coordinated points on the arc and the program will calculate the coordinates of the central point.



The screenshot shows the 'Curve Solutions' dialog box with the 'Local' radio button selected. The 'Select Pnt:' dropdown is set to a green box. The 'Point 1:' field is empty, and a green button with a '?' is next to it. Under 'Solution 1:', the 'Y Coord:' and 'X Coord:' fields are empty. At the bottom are 'Calc', 'Add', and 'Exit' buttons.

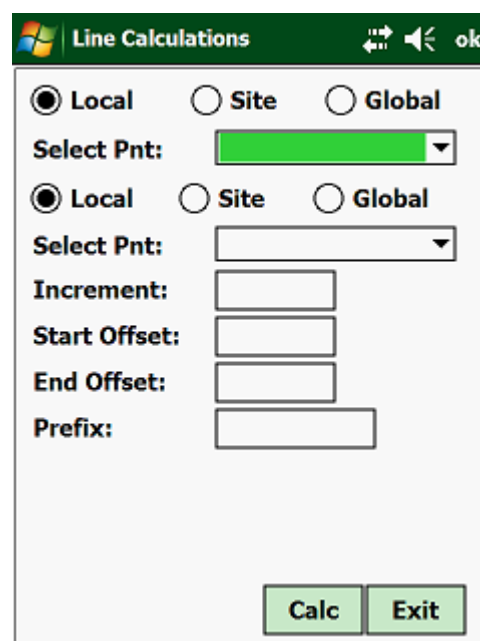
### 5.5.04 Pts On Line:

This routine lets you calculate additional points between two known points from either the Local or Global coordinate file. This new points can be saved in either the Local or Global coordinate file.

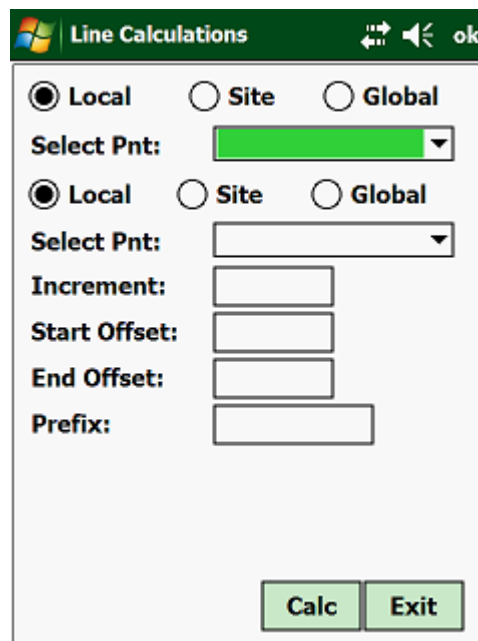


The points can be defined by increments between the two known points, or they can be evenly spaced between them.

- Increment - define the increment of the new points between the two defined points.
- Number - specify the number of new points to calculate between the two reference points.

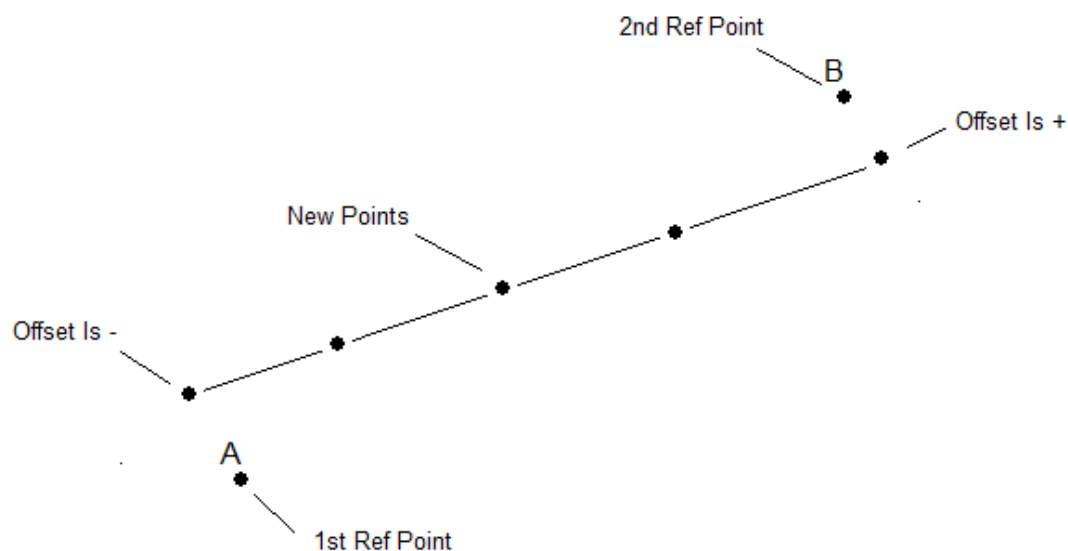


Once the start and end points have been specified, the program will display the distance between the two points. Depending on the option that you have chosen, the next input will have to be the increment or the number of points between the two known points.



The screenshot shows a Windows-style dialog box titled "Line Calculations". It has a green title bar with a Windows logo, a maximize button, a volume icon, and an "ok" button. The dialog contains two identical sections for point selection. Each section has three radio buttons: "Local" (selected), "Site", and "Global". Below the radio buttons is a "Select Pnt:" dropdown menu. Underneath the dropdowns are four input fields: "Increment:", "Start Offset:", "End Offset:", and "Prefix:". At the bottom right of the dialog are two buttons: "Calc" and "Exit".

The next required inputs are the start and end offsets. These are the offsets from the start and end points, which define the line that the new points have to follow. If the points are to the left, then the offset must be negative, else the offset must be positive.



Next will be the prefix. This is an alpha character that will be added to the start of your point names. If you entered "A" as the prefix, the program will store the points

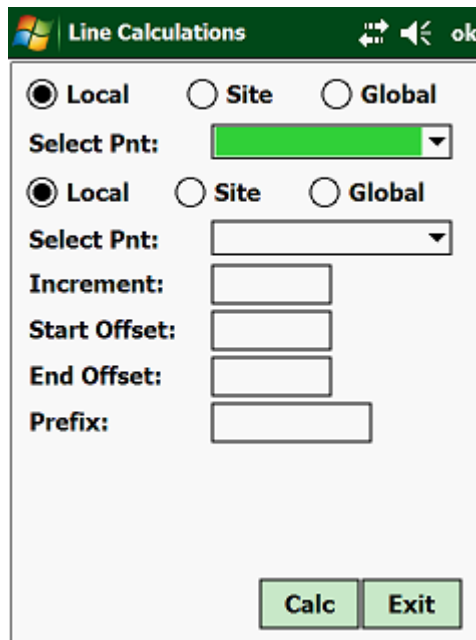
as A1, A2, A3, A4, A5.....etc. Each point calculated will be automatically stored in the “Setout” Coord file.

#### **5.5.05 Pts On Arc - Increment\Number:**

With this routine you enter the coordinates of the central point and the radius of the arc, and the program will calculate the coordinates on the arc at defined radial intervals or divide the circumference of the circle by an even number of segments.



First select the center point of the circle from either the Local or Global coordinate file. Next you have to enter the radius of the circle and then the number or increment required along the arc. The prefix entered is the alpha character that is added in front of the numeric increments.



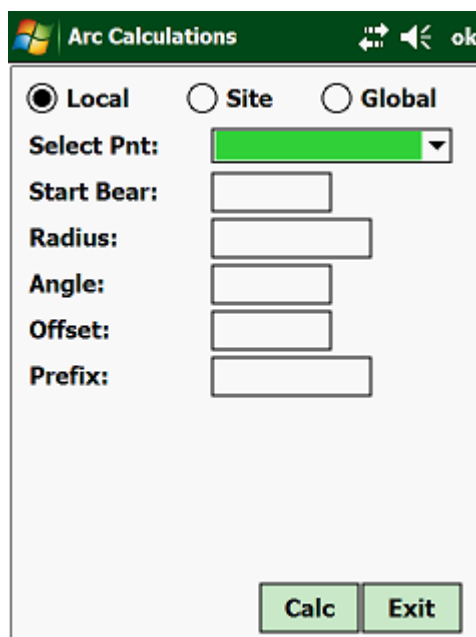
The "Line Calculations" dialog box features a green title bar with a Windows logo, the text "Line Calculations", and icons for undo, redo, and an "ok" button. The main area contains two sets of radio buttons for "Local" (selected), "Site", and "Global". Each set is followed by a "Select Pnt:" dropdown menu. Below these are input fields for "Increment:", "Start Offset:", "End Offset:", and "Prefix:". At the bottom right are "Calc" and "Exit" buttons.

Each point calculated will be automatically stored in the "Setout" Coord file.

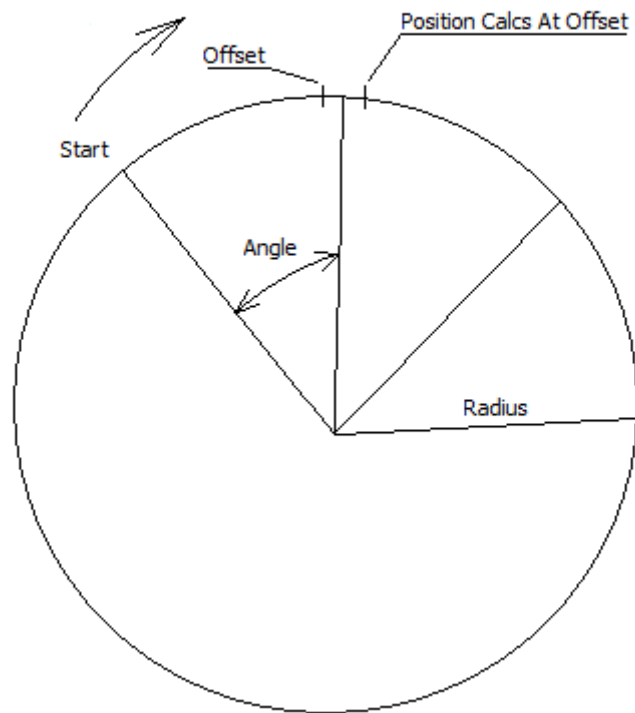
#### **5.5.06 Angle:**

Instead of defining the points along the circumference of the arc by distance or number, you can define it here by an angle.

First select the center point of the arc, then enter the start bearing, increment angle, the offset and finally the prefix.



The "Arc Calculations" dialog box has a green title bar with a Windows logo, the text "Arc Calculations", and icons for undo, redo, and an "ok" button. It includes two sets of radio buttons for "Local" (selected), "Site", and "Global", each followed by a "Select Pnt:" dropdown menu. Input fields are provided for "Start Bear:", "Radius:", "Angle:", "Offset:", and "Prefix:". "Calc" and "Exit" buttons are located at the bottom right.



### **5.6.00 Cogo 3:**

Routines available are:

- Convert Units - this will convert lengths, areas and volumes to different systems.
- Transformations - convert from one grid system to another with at least 2 common points.
- Solve Triangle - solves the variables of a Triangle based on the input given.



### **5.6.01 Convert Units:**

With conversions, you can convert lengths, areas and volumes from the metric system to other non-metric systems and vice versa. To select this option, tap on “Convert Units”:



This will give you the following options:

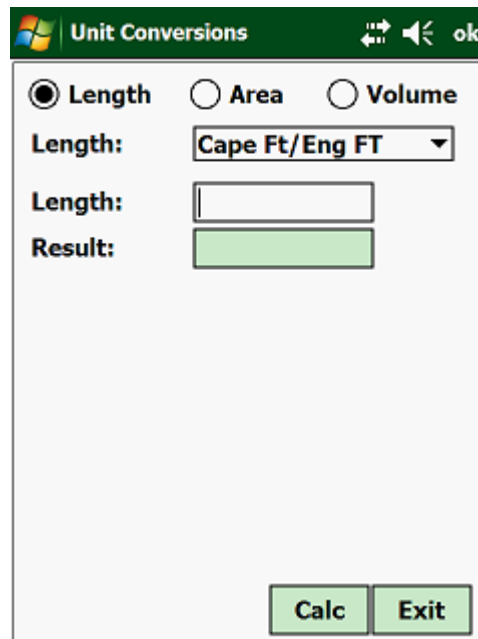
- Length To Length - this will convert your lengths entered from one unit to another unit.



- Area To Area - this will convert your areas entered from one unit to another unit.
- Volume To Volume - this will convert volumes between different units.

For any function option, you use the left and right arrow to toggle from the source unit to the target unit. Once this has been done, the program will then request the unit length, area or volume, after which the corresponding target unit will be calculated.

All three menus work the same way:

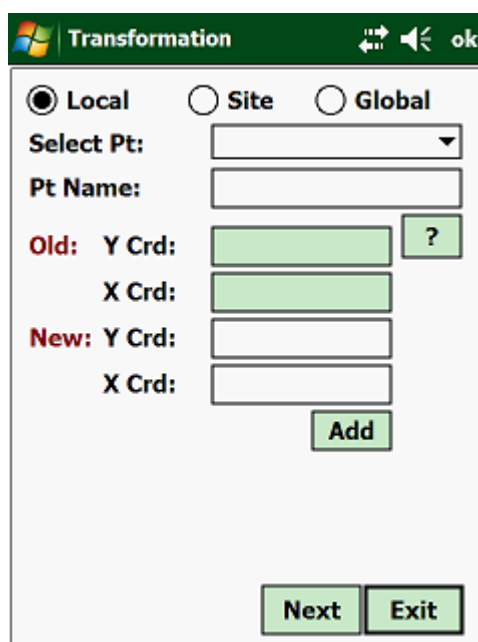


The screenshot shows a Windows-style dialog box titled "Unit Conversions". It has a green title bar with a Windows logo, a double-headed arrow icon, a speaker icon, and an "ok" button. Inside the dialog, there are three radio buttons: "Length" (selected), "Area", and "Volume". Below these, there are three labels: "Length:", "Length:", and "Result:". The first "Length:" is followed by a dropdown menu showing "Cape Ft/ Eng FT". The second "Length:" is followed by an empty text input field. The "Result:" is followed by an empty green text input field. At the bottom right, there are two green buttons: "Calc" and "Exit".

**5.7.00 Transformation:**

This lets you move your coordinates from one system to another, where you have at least two common points in both systems.

One place where you could use it is in Topo surveys. If you have done a Topo survey on a local system in the field and back at the office you determine the actual coordinates of at least two defined points in your survey. In this manner you can then move your survey to fit in with the survey system used in that area.

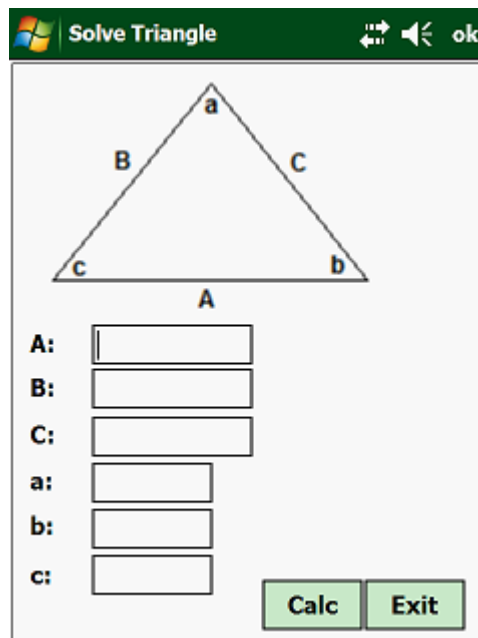


**5.8.00 Solve Triangle:**

Use this routine to solve for Triangle solutions based on the input given.



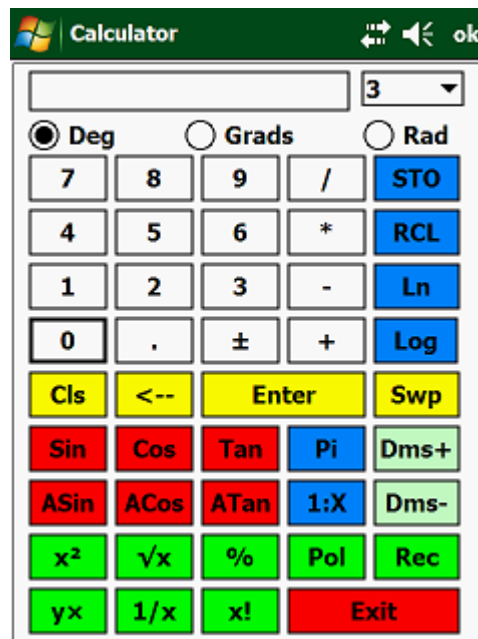
Next:



## **CHAPTER 6: UTILITIES**

**6.0.00 Cal:**

This will load the calculator.



The default angle mode is “Degrees”, but you can also work either in “Grads” or “Radian” angle mode by tapping on the respective button.

The program works very much like the Handheld Hewlett Packard’s calculators. Any arithmetic operation, the first number must be entered in the stack by tapping on the “Enter” button. Tap on the second number, followed by the operation.

Functions available:

- Sin - sine of the angle displayed.
- Cos - cosine of the angle displayed.
- Tan - tangent of the angle displayed.
- Asin - arcsine of the value displayed.
- Acos - arccosine of the value displayed.
- ATan - arctangent of the value displayed.
- DMS+ - adds two angles displayed in DDD.MMSS format and returns the result in DDD.MMSS. Type in the first angle and tap on “ENTER”. Type in the second angle and tap on “DMS+”.
- DMS- - subtracts two angles displayed in DDD.MMSS format and returns the result in DDD.MMSS. Type in the first angle and tap on “ENTER”. Type in the second angle and tap on “DMS+”.
- $x^2$  - gives you the square of the displayed number.
- $\sqrt{x}$  - returns the square root of the number displayed.
- % - will give the percentage of a number. Enter the width (say 10m) of the platform (or anything else), tap on “ENTER”. Enter the percentage fall (say 2) and tap on “%”. This should give you an answer of 0.200m.

- $1/x$  - inverse of a number.
- $y^x$  - raises a number to the power of X. Enter the first number and tap on "ENTER". Enter the second number and tap on " $y^x$ ".
- $x!$  - will calculate the permutation of the number displayed. 4 will calculate  $4 * 3 * 2 * 1 = 24$ .
- POL - calculate the Y and X distance from the distance and bearing entered. Enter the distance and tap on "ENTER". Enter the angle and tap on "POL". The Y distance will be displayed first. To swap between the Y and X results, tap on "SWP".
- REC - enter the Y and X distance and the program will calculate the relative slope distance and angle. Enter the delta Y distance and tap on "ENTER". Next enter the delta X distance and tap on "REC". The slope distance will be displayed first. To display the angle tap on "SWP".
- STO - store a number in the registry. You can store numbers in registry 0 till 9 (STO 0, STO 1, STO 2, ....., STO 9). To add or deduct new numbers from values already stored, tap on "STO" and "+" or "-", depending on whether you want to add or deduct from the values already stored.
- RCL - recall values stored in one of the registries.
- Log - calculates the logarithm of a number to the base of 10.
- In - inverse of the logarithm of a number.
- SWP - swaps the two values that are stored in the stack.
- Pi - displays the number of Pi. The value of  $\text{Pi}=3.141592653589$ .
- 1:X - by entering the X value of the slope, the program will display the angle of the slope. This can be usefull in placing batterboards where the slope of the fill or cut is specified as 1:2. Enter "2" and tap on "1:X". The program will then display 26.4.... degrees. This angle can then be set on your Abney level, which can be used to get the boards on your batterboards correct.
- Exit - exists out of the calculator mode and returns to the main screen.

### **6.1.00 Editor:**

This will bring up a simple editor with which you can view and edit different text based files.

