TPC Desktop Series

Ground Traversing Learning Guide

2/24

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https://traverse-pc.com

Help System: Ground Traversing

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Typography

We will be using the following typography to distinguish items in the text:

[Enter]	Brackets indicate keys on the keyboard.
flexibility	Italics are used to highlight words for more emphasis.
Lot 2	Numbers or text that you enter.

System Requirements

This version of TPC Desktop requires Windows 11 / 10 / 8.1 / 8 or later. We recommend you have 2 GB of RAM 32-bit OS) 4 GB RAM (64-bit OS) and 60 MB of free hard disk space in which to install the program. **An internet connection is required for program validation.**

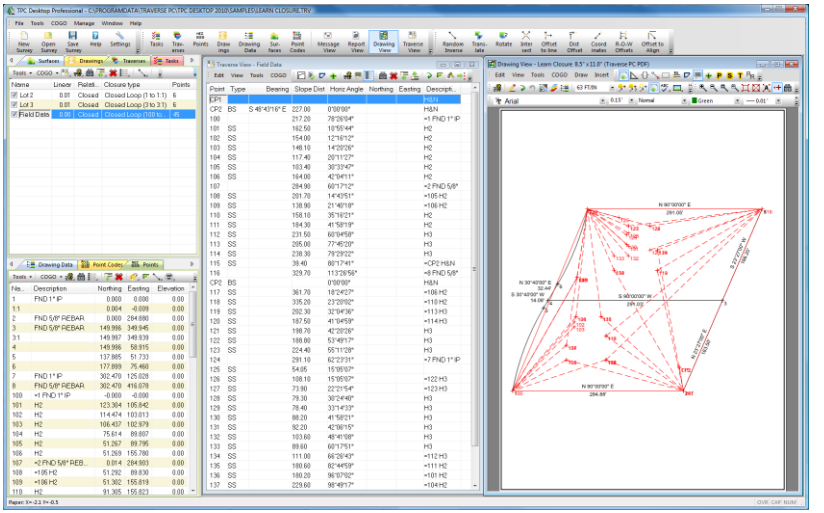
Important Licensing Information

Our License Agreement allows you to use TPC on only one computer at a time unless you purchase additional licenses. We do offer one courtesy installation for an additional home or field computer, *but not for a second user* and assuming that the two programs are not being used at the same time. To request a courtesy license contact Traverse PC.

Entering Field Data

►This chapter demonstrates:

- Adding a field data traverse to a survey
- Entering field data
- Entering sideshots
- Traversing ahead
- Traversing ahead using a different backsight
- Viewing the field data
- Viewing the survey
- Translating the field data to record data
- Rotating the field data to record data
- Calibrating instead of rotating and translating.
- Checking the results
- Ending the survey



Overview

In this chapter, you will enter field data (angles and distances) for the two lots you entered record data for in the chapter on Entering Record Data. You will rotate and translate the field data to the record data and check the results. This is typical of field data collected with a robotic total station.

►GPS/GNSS

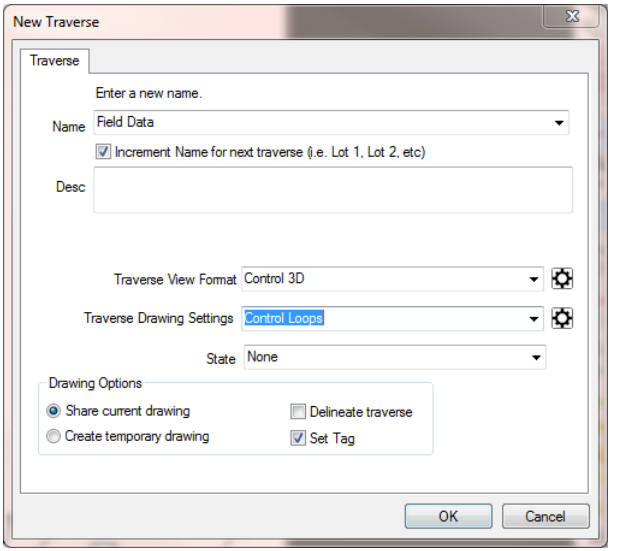
You could do this same field work with a GPS/GNSS unit and import the geodetic positions and calibrate them to your record data. See Calibrations (login required).

►Getting started

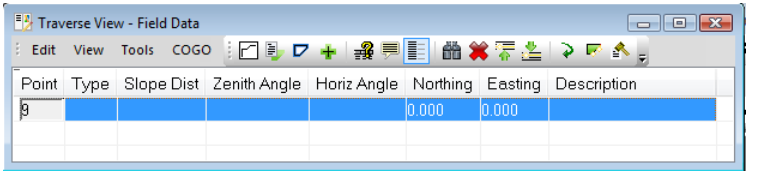
1) From the Tasks Manager , choose **Sample Surveys**.
2) Double-click the **LEARN FIELD DATA.TRV** file.
3) Choose **File | Save Survey As** then enter the name **Field Data** and choose **Save**.
4) If prompted to replace the existing file, choose **Yes**.

Add a Traverse to the Survey

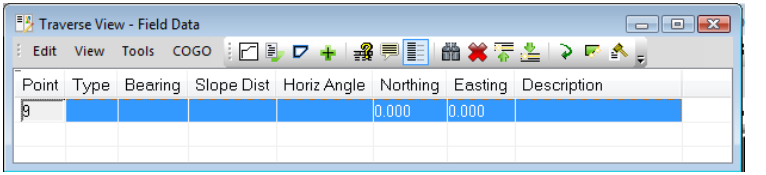
You will start by entering the field data.



1) At the Traverses Manager, double-click in blank space to bring up the New Traverse dialog box.
2) Type **Field Data** for the **Name**.
3) Using the mouse, left-click the down arrow on the right side of the **Format** list to display the list of pre-defined formats. Left-click **Control 2D**. We will modify this format to meet our needs.
4) From the **Settings** list choose **Control Loops**.
5) Choose **Create temporary drawing**.
6) Choose **OK**. You will see the following Traverse View.



7) Choose **View** | **Format View** and left-click the **Format** tab.
8) Change the **Display Sequence** to **BSFYXD** and the **Edit Sequence** to **SFD**.
9) Turn on **Copy Descriptions to New Points** and choose **OK**.



You will see the following Traverse View.

To learn more about Traverse View formats

1) Choose **Help** | **Search For Help On…** and left-click the Index tab.
2) Scroll down to **Traverse View Formats**, highlight it and choose **Display**.

Entering the Field Data

We set two hubs on the property to act as control while we tie everything down. We will also take redundant shots to these points so that we can do a Least Squares adjustment later if we choose to. We will start this traverse by setting up on CP1 and back sighting CP2.

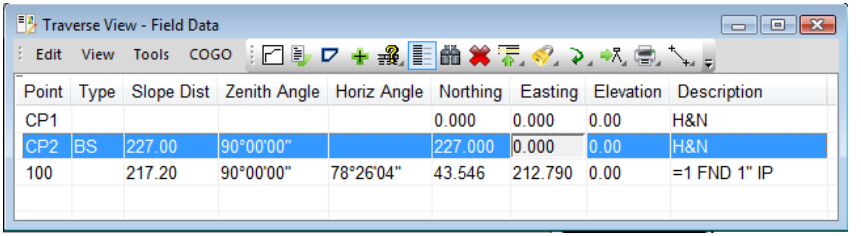
1) Type CP1 over the Point label 9 to rename it to CP1. There is nothing special about the label CP1, it is simply an annotation to indicate that this is a control point.
2) Press the [Enter] key on your keyboard until the **Description** field for point **CP1** is selected, type **H&N** and press [Enter].

Traverse PC automatically puts **CP2** in the **Point** label, **BS** in the **Type** and **H&N** in the **Description** (if this Format option is turned on). It also selects the **Slope Dist** field as the active field. This all occurred because of the Traverse View Format we set earlier.

3) Enter **227** in the **Slope Dist** field and **0** in the **Horiz Angle** field.
4) Press [Enter] from the **Description** field and TPC inserts **CP3** as the next point.

Notice that TPC automatically provided an assumed bearing for the backsight. We could have provided the assumed bearing but it really doesn't matter as we will rotate and translate later to set the field data onto the record data.

5) Click on the **Point** label **CP3** and type **100** to rename it to point **100**.
6) Press the [Enter] key until the **Slope Dist** field is selected, type **217.2** and press [Enter].
7) Type **78.2604** in the **Horiz Angle** field and press [Enter].
8) Type **=1 FND 1" IP** in the **Description** field and press [Enter].



Point	Type	Slope Dist	Zenith Angle	Horiz Angle	Northing	Easting	Elevation	Description
CP1					0.000	0.000	0.00	H&N
CP2	BS	227.00	90°00'00"		227.000	0.000	0.00	H&N
100		217.20	90°00'00"	78°26'04"	43.546	212.790	0.00	=1 FND 1" IP

This is a shot to the southwest corner of Lot 2. This point was originally entered as point 1 in the record data so we annotated the description so that we can easily tell what this point is as well as use it as redundant data for a Least Squares adjustment if we choose to.

▶Entering Sideshots

As you enter data, TPC computes the position of the foresight, adds another point to the traverse, automatically numbers the point by adding 1 to the previous point label and highlights the new point. TPC automatically inserted point **101** into the traverse. Because this will be the first point in a series of sideshots, we need to tell TPC that it is a sideshot.

1) Choose **Edit** | **Point Type** | **Sideshot** and TPC inserts **SS** into the **Type** field.
2) Enter **162.5** in the **Slope Dist** field, **10.5544** in the **Horiz Angle** field and **H2** in the **Description**.
3) Enter points **102** through **106** as sideshots with the following **Slope Dist**, **Horiz Angle** and **Descriptions**. (TPC automatically brings them in as sideshots and copies the **Descriptions** down so you only need to change the **Description** if it changes. You can simply press the [Enter] key to advance to the next point.)

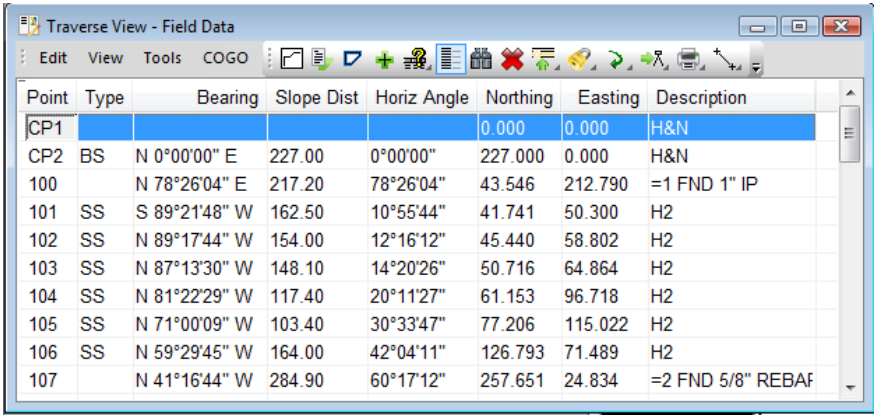
102	**SS**	**154**	**12°16'12"**	**H2**
103	**SS**	**148.1**	**14°20'26"**	**H2**
104	**SS**	**117.4**	**20°11'27"**	**H2**
105	**SS**	**103.4**	**30°33'47"**	**H2**
106	**SS**	**164**	**42°04'11"**	**H2**

▶Traversing Ahead

We will traverse ahead to our next point but TPC brought point **107** in as a sideshot so we need to change it to an occupied point.

4) Choose **Edit** | **Point Type** | **Occupied**, enter 284.9 in **Slope Dist**, 60.1712 in **Horiz Angle** and =2 FND 5/8" REBAR in Description.

This is a shot to point 2 at the southeast corner of Lot 2.



Point	Type	Bearing	Slope Dist	Horiz Angle	Northing	Easting	Description
CP1					0.000	0.000	H&N
CP2	BS	N 0°00'00" E	227.00	0°00'00"	227.000	0.000	H&N
100		N 78°26'04" E	217.20	78°26'04"	43.546	212.790	=1 FND 1" IP
101	SS	S 89°21'48" W	162.50	10°55'44"	41.741	50.300	H2
102	SS	N 89°17'44" W	154.00	12°16'12"	45.440	58.802	H2
103	SS	N 87°13'30" W	148.10	14°20'26"	50.716	64.864	H2
104	SS	N 81°22'29" W	117.40	20°11'27"	61.153	96.718	H2
105	SS	N 71°00'09" W	103.40	30°33'47"	77.206	115.022	H2
106	SS	N 59°29'45" W	164.00	42°04'11"	126.793	71.489	H2
107		N 41°16'44" W	284.90	60°17'12"	257.651	24.834	=2 FND 5/8" REBAR

►Entering Sideshots

Traverse PC assumes that you will backsight the previous occupied point with a zero horizontal angle. Because of this assumption, we don't bother to display the backsight in the **Traverse View**.

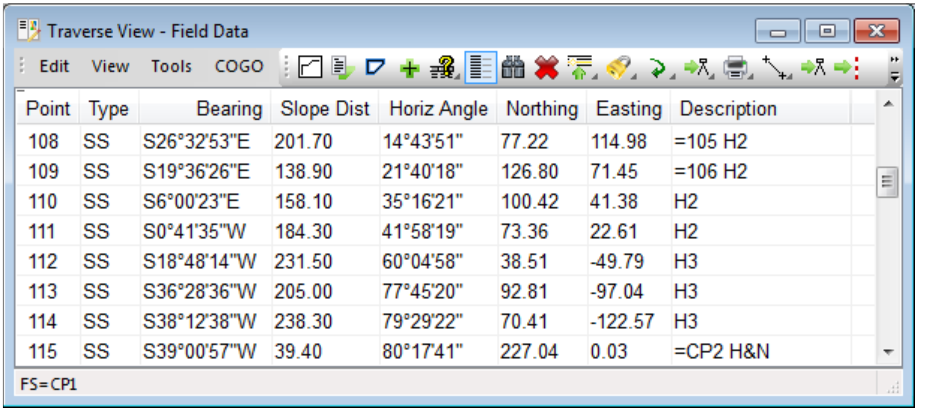
TPC automatically brings point **108** in as another occupied point but we are ready to shoot another series of sideshots.

1) Choose **Edit | Point Type | SS=Side Shot**, enter 201.7 in **Slope Dist**, 14.4351 in **Horiz Angle** and =105 H2 in **Description**.

This is a redundant shot to the southwest corner of the house on Lot 2 that we shot as point 105 previously.

2) Enter points 109 through 115 as sideshots with the following Slope Dist, Horiz Angle and Descriptions. (TPC automatically brings them in as sideshots and copies the Descriptions down so you only need to change the Description if it changes. You can simply press the [Enter] key to advance to the next point.)

109	**SS**	**138.9**	**21°40'18"**	**=106 H2**
110	**SS**	**158.1**	**35°16'21"**	**H2**
111	**SS**	**184.3**	**41°58'19"**	**H2**
112	**SS**	**231.5**	**60°04'58"**	**H3**
113	**SS**	**205**	**77°45'20"**	**H3**
114	**SS**	**238.3**	**79°29'22"**	**H3**
115	**SS**	**39.4**	**80°17'41"**	**=CP2 H&N**



►Traversing Ahead Using a Different Backsight

We will traverse ahead to our next point but TPC brought point **116** in as a sideshot so we need to change it to an occupied point.

1) Choose **Edit | Point Type | Occupied**, enter 329.7 in **Slope Dist**, 113.2656 in **Horiz Angle** and =8 FND 5/8" REBAR in **Description**.

This is a shot to point 8 at the northeast corner of Lot 3.

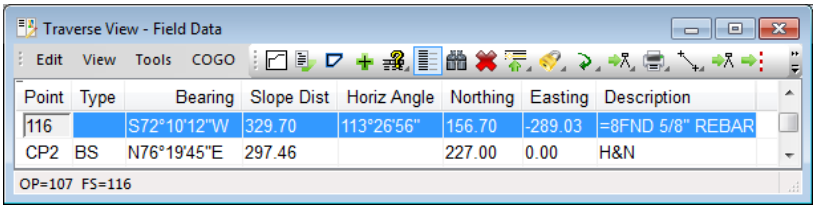
There are times when you need to use a different point than the previous occupied point as your backsight. Because Traverse PC assumes that we are using the previous occupied point, we need to tell it what our backsight will actually be.

2) After entering point **116** as an occupied point, TPC brings in point **117** as another occupied point. We actually want to backsight point CP2.
3) On point **117**, choose **Type | BS=Backsight** to change it from an occupied point to a backsight.
4) Recall point **CP2** by clicking on the point label **117** and entering **CP2**.

TPC will tell us that **"CP2" already exists!** and will ask if we want to **Recall existing point and its coordinates**.

5) Choose **OK**.

TPC recalls point **CP2** with its coordinates and brings in point **117** as an occupied point. We need to change this point to a sideshot to continue entering our data.



►Entering Sideshots

1) Choose **Edit | Point Type | SS=Side Shot**.
2) Enter the distances, angles and descriptions for the following sideshots:

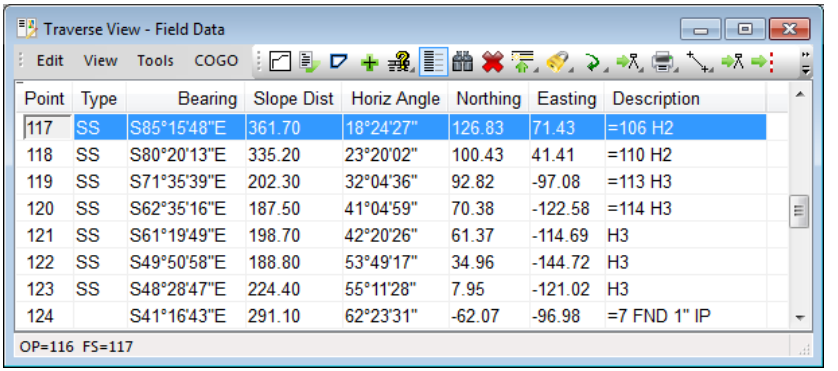
117	**SS**	**361.7**	**18°24'27"**	**=106 H2**
118	**SS**	**335.2**	**23°20'02"**	**=110 H2**
119	**SS**	**202.3**	**32°04'36"**	**=113 H3**
120	**SS**	**187.5**	**41°04'59"**	**=114 H3**
121	**SS**	**198.7**	**42°20'26"**	**H3**
122	**SS**	**188.8**	**53°49'17"**	**H3**
123	**SS**	**224.4**	**55°11'28"**	**H3**

►Traversing Ahead

We will traverse ahead to our next point but TPC brought point **124** in as a sideshot so we need to change it to an occupied point.

1) Choose **Edit** | **Point Type** | **Occupied**, enter 291.1 in **Slope Dist**, 62.23312 in **Horiz Angle** and =7 FND 1" IP in Description.

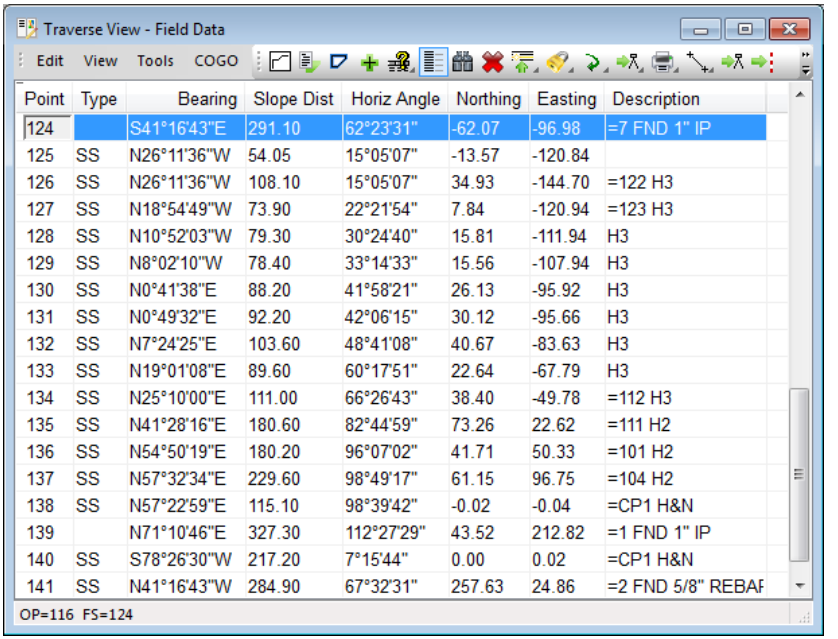
This is a shot to point 7 at the northwest corner of Lot 3.



Point	Type	Bearing	Slope Dist	Horiz Angle	Northing	Easting	Description
117	SS	S85°15'48"E	361.70	18°24'27"	126.83	71.43	=106 H2
118	SS	S80°20'13"E	335.20	23°20'02"	100.43	41.41	=110 H2
119	SS	S71°35'39"E	202.30	32°04'36"	92.82	-97.08	=113 H3
120	SS	S62°35'16"E	187.50	41°04'59"	70.38	-122.58	=114 H3
121	SS	S61°19'49"E	198.70	42°20'26"	61.37	-114.69	H3
122	SS	S49°50'58"E	188.80	53°49'17"	34.96	-144.72	H3
123	SS	S48°28'47"E	224.40	55°11'28"	7.95	-121.02	H3
124		S41°16'43"E	291.10	62°23'31"	-62.07	-96.98	=7 FND 1" IP

►Entering the Remaining Field Data

Enter the remaining field data as shown here using the techniques you have learned in the previous steps.

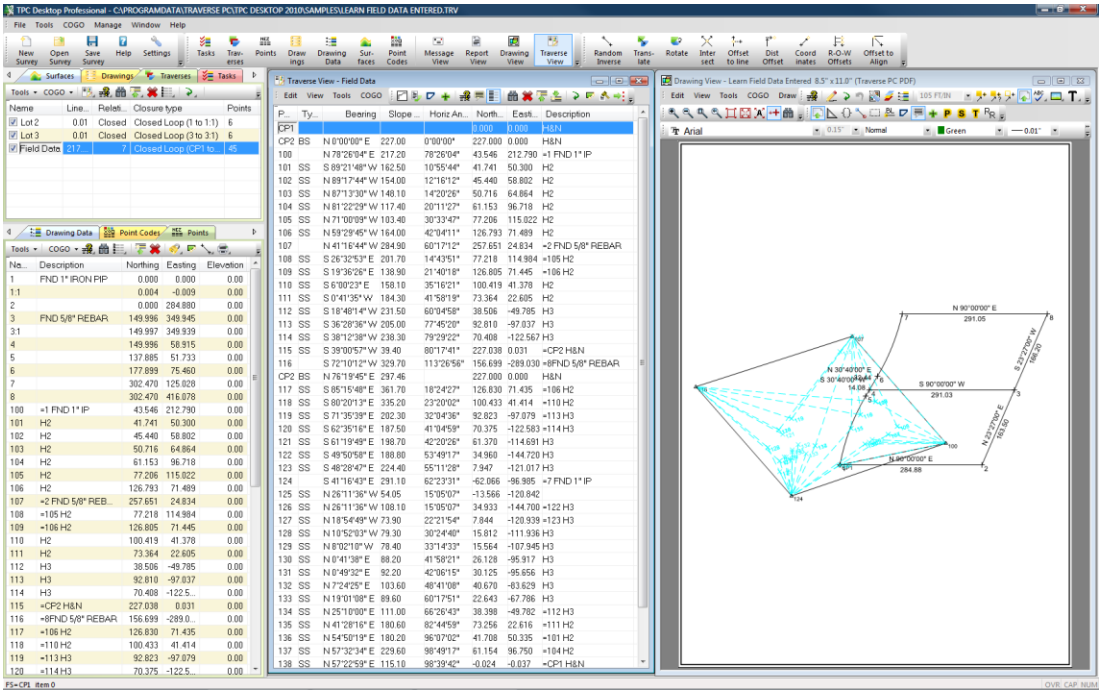


Point	Type	Bearing	Slope Dist	Horiz Angle	Northing	Easting	Description
124		S41°16'43"E	291.10	62°23'31"	-62.07	-96.98	=7 FND 1" IP
125	SS	N26°11'36"W	54.05	15°05'07"	-13.57	-120.84	
126	SS	N26°11'36"W	108.10	15°05'07"	34.93	-144.70	=122 H3
127	SS	N18°54'49"W	73.90	22°21'54"	7.84	-120.94	=123 H3
128	SS	N10°52'03"W	79.30	30°24'40"	15.81	-111.94	H3
129	SS	N8°02'10"W	78.40	33°14'33"	15.56	-107.94	H3
130	SS	N0°41'38"E	88.20	41°58'21"	26.13	-95.92	H3
131	SS	N0°49'32"E	92.20	42°06'15"	30.12	-95.66	H3
132	SS	N7°24'25"E	103.60	48°41'08"	40.67	-83.63	H3
133	SS	N19°01'08"E	89.60	60°17'51"	22.64	-67.79	H3
134	SS	N25°10'00"E	111.00	66°26'43"	38.40	-49.78	=112 H3
135	SS	N41°28'16"E	180.60	82°44'59"	73.26	22.62	=111 H2
136	SS	N54°50'19"E	180.20	96°07'02"	41.71	50.33	=101 H2
137	SS	N57°32'34"E	229.60	98°49'17"	61.15	96.75	=104 H2
138	SS	N57°22'59"E	115.10	98°39'42"	-0.02	-0.04	=CP1 H&N
139		N71°10'46"E	327.30	112°27'29"	43.52	212.82	=1 FND 1" IP
140	SS	S78°26'30"W	217.20	7°15'44"	0.00	0.02	=CP1 H&N
141	SS	N41°16'43"W	284.90	67°32'31"	257.63	24.86	=2 FND 5/8" REBAI

Reconciling the Field Data

To make sure your data exactly matches the examples on the following pages, you'll open a file with the field data already entered.

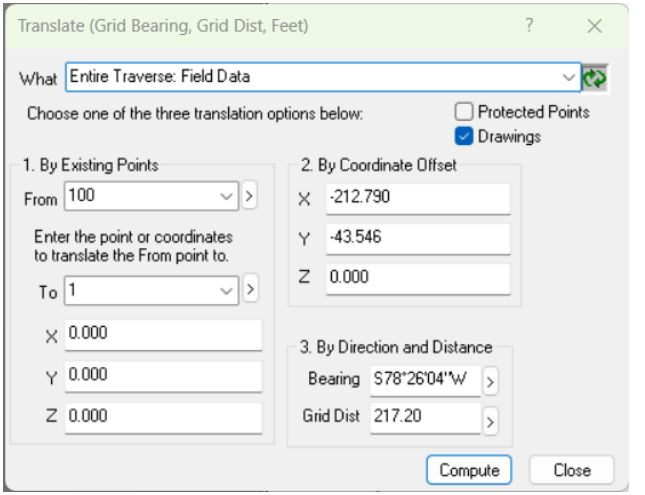
1) From the Tasks Manager choose **Sample Surveys**.
2) Double-click the **LEARN FIELD DATA ENTERED.TRV** file.
3) Choose **File | Save Survey As**.
4) Enter the name **Field Data** and choose **Save**.
5) When prompted to replace the existing file, choose **Yes**.



At this point, you will want to translate and rotate the field data to get it on the same survey grid as the record data for the lots.

Translating the Field Data Traverse

We can use any point in our Field Data that is equivalent to one of the points in our record data to use as a base point for our translation and rotation. We will need to use the same point for both operations so that the second operation does not change the results of the first operation. The order that you do the translation and rotation in does not matter. We will start here by doing the translation first.



1) Select the Field Data traverse in the Traverses Manager or double-click it to open its Traverse View. Choose **COGO** | **Translate** from either of those views.
2) From the **What** list, choose **Entire Traverse: Field Data**.
3) Enter **100** in **From** and **1** in **To** as shown here.
4) Choose **Compute**.

Because point 100 was a shot to point 1 in the original record data, we can tell Traverse PC to move the Field Data traverse based on the coordinates of points 100 and 1. The middle column of the Translate dialog box shows us how much the traverse will move in coordinates and Bearing and Distance.

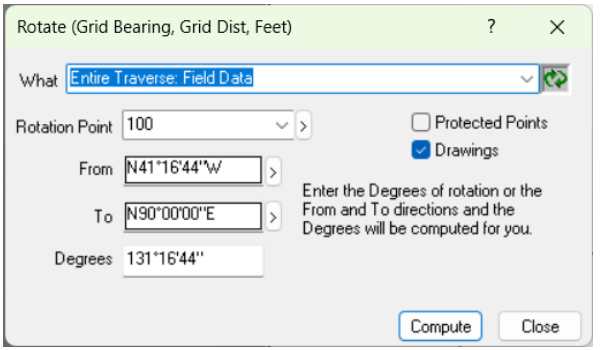
We must tell Traverse PC that we only want to translate the Selected Traverse because translating the Entire Survey would result in no relative change between the Field Data traverse and our record data traverses.

To learn more about using COGO tools in Traverse PC

1) Choose **Help** | **Search For Help On…** and left-click the Index tab.
2) Scroll down to **COGO**, highlight it and choose **Display**.
3) Choose the topic you are interested in and choose **Display**.

Rotating the Field Data Traverse

Because we used point 100 to match up with point 1, we will need to use point 100 as our rotate point or we will have to translate the Field Data traverse again.



1) Now choose **COGO** | **Rotate**.
2) From the **What** list, choose **Entire Traverse: Field Data**.
3) Enter **100** in **Rotate Point** and tab to the **From** field.
4) Enter **100..107** in **From** and tab to **To**.
5) Enter **1..2** in **To**.
6) Choose **Compute**.

Because point 100 was a shot to point 1 and point 107 was a shot to point 2 in the original record data, we can tell Traverse PC to rotate from the bearing between 100 and 107 (100..107) to the bearing from 1 to 2 (1..2). The Degrees field of the Rotate dialog box shows us how much the traverse will rotate. You have just used Equations to recall the bearings between points in the file.

As in most COGO commands, you tell Traverse PC that you only want to rotate specific data, like this traverse, because rotating the entire survey would result in no relative change between the Field Data traverse and our record data traverses.

To learn more about using equations

1) Choose **Help** | **Search For Help On…** and left-click the Index tab.
2) Scroll down to **Equations**, highlight it and choose **Display**.
3) Select **Entering Equations** and choose **Display**.

Calibrating Instead of Rotating and Translating

In the Learning Center's Calibrations section, look for a sub-section called **Calibrate Total Station**. Here, you will learn how to use TPC's calibration tools to rotate, translate and scale your field data to your record data, or visa versa.

Calibrations allow you to scale data along with rotating and translating. They can even calibrate the elevations, called a 3D calibration instead of a 2D calibration, or simply apply a vertical shift to a 2D calibration (very common option).

►Local Grid

Calibrations allow you to enter record data on a local grid, say 5000/5000 and still relate your field data to it. The field data can have whatever uncalibrated coordinate positions it starts with, but it will end up on the same grid as your record data.

►Calibrating GPS/GNSS Data

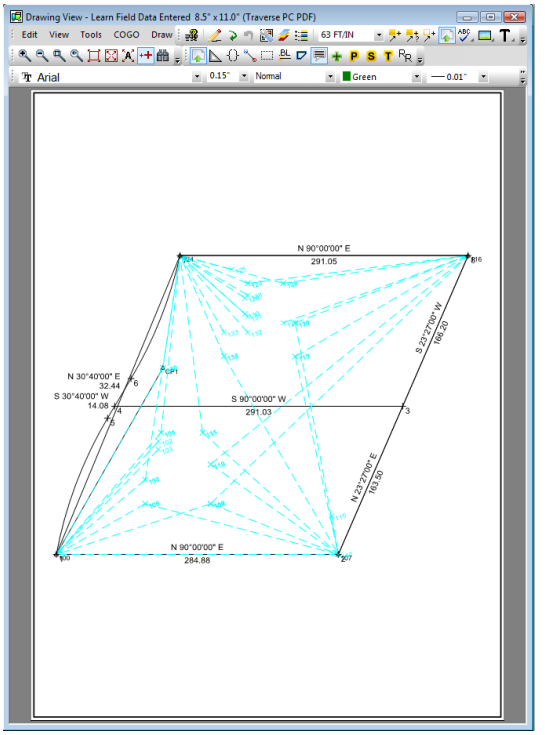
If you used GPS/GNSS for your field data, calibrating that data to your record positions takes care of all the geodetic to coordinate transformation, using the CRS of the survey, plus it then adjusts the CRS coordinates to match your local grid.

►Calibrating Total Station Data

When you calibrate total station data, you don't have to worry about whether you translate before you rotate or rotate before you translate, how you scale the measured data to the record data and so on. The calibration takes care of all that for you, providing you with a Least Squares best fit.

Checking the Results

Now that we have translated and rotated our field data to the record data, we can check to see how the field data matches up with the record data.



▶Using Drawing View

You can go to the Drawing View and zoom in on different areas of the drawing to get an idea of how close the data lines up but we won't know how close it is without checking some of the points.

▶Using COGO

You can also check your results using the COGO tools.

1) Choose **COGO | Random Inverse**.
2) Enter **100** in **From** and **1** in **To**.

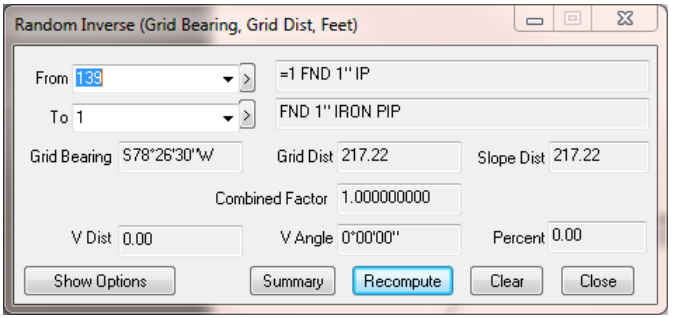
Traverse PC tells us that the coordinates of these two points are identical and there is no distance between them. That is what we expect because point 100 was the point we chose to match up with point 1.

3) Enter **107** in **From** and **2** in **To**.

The **Random Inverse** dialog box indicates there is 0.020' between these two points.

4) Enter **139** in **From** and **1** in **To**.

Point 139 was the final point in closing our loop to point 1. We find that there is 0.034' difference between these two points.



To learn about traverse closure and adjusting traverses

1) Refer to the chapter on Closure and Adjustments in this Learning Guide.