ArcGIS® 9

Using ArcGIS Survey Analyst

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Quick-start tutorial

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ArcGIS Survey Analyst has the tools you need to enter survey data and coordinate geometry (COGO) into survey datasets. You can import the data you've collected from a total station or enter the tape measurements recorded on a field sketch or a survey plan. Completing the exercises in this chapter will provide you with the basic knowledge to use these capabilities.

Tutorial scenario

Your organization is building a geodatabase for Maricopa County, Arizona. The geodatabase represents parcels and physical infrastructure. Your field crew has performed a survey to relocate some parcel boundary monuments and to fix the location of buildings for an existing subdivision. Coordinated locations of section corners in the area were used as control for the field survey. You will use a survey project in your geodatabase to import measurement data for the boundary monuments that were found, and for some corners of buildings on the site of the survey. You will use this information to update the geometry of an existing subdivision block in your geodatabase and add a new building based on tape measurements recorded in the field.

You will use a second project to add values recorded on the original subdivision plan. The survey points computed in this second project will be exported for use by the field crew to locate any monuments that were not found in the first field survey. You will use georeferenced images of the original subdivision survey plans as a background for your work.

Introduction to the tutorial

To use this tutorial, you need to have the Survey Analyst extension and ArcGIS installed. You also need to have the tutorial data installed on a local or shared network drive on your system. Ask your system administrator for the correct path to the tutorial data if you do not find it at the default installation path. The default installation path is arcgis\ArcTutor\Survey_Analyst, on the drive where the tutorial data is installed.

Details of the datasets that you will use in this tutorial are described in the following tables.

Geodatabase	Description
Arizona	Database containing the data that you will use and edit (located in Maricopa County, Arizona)

Feature datasets	Description
MaricopaCountyParcels	Parcel data
MaricopaCountyInfra	Physical infrastructure data
MaricopaCountyPLSS	Public Land Survey System (PLSS) data

Survey dataset	Description
Arizona	Survey data

Survey folder	Description
Maricopa County	Folder representing all survey data in the county

Survey project	Description
Carmel Bay	Project for managing and entering field-based survey data
Carmel Sub Plan	Project for managing and entering plan-based survey data

Feature classes	Description
Parcels	Parcel polygons
ParcelLines	Parcel polylines
Buildings	Building polygons
T2SouthR5East_Sect	PLSS sections
T2SouthR5East_Qtr	PLSS quarter sections
T2SouthR5East_Cnrs	PLSS corners
T2SouthR5East_Lns	PLSS quarter-quarter section lines
T2SouthR5East_Polys	PLSS quarter-quarter sections

Images (TIFF)	Description
Book389Page27Sheet01	Final subdivision plan for Carmel Bay at Ocotillo
Book389Page27Sheet02	Sheet 2 Extract
Sheet2Tables	Sheet 2 Extract curve tables

The tutorial scenario is fictitious, and the field survey data has been simulated. The basic source data can be retrieved online from the Bureau of Land Management's Geographic Coordinate Database (GCDB) and from the public record of Maricopa County, as detailed below:

Source

The Bureau of Land Management's map server for the GCDB

(URL: http://www.geocommunicator.gov/lsi/)

Source

Maricopa County Recorder of Deeds online site

(URL: http://recorder.maricopa.gov/recorder.htm)

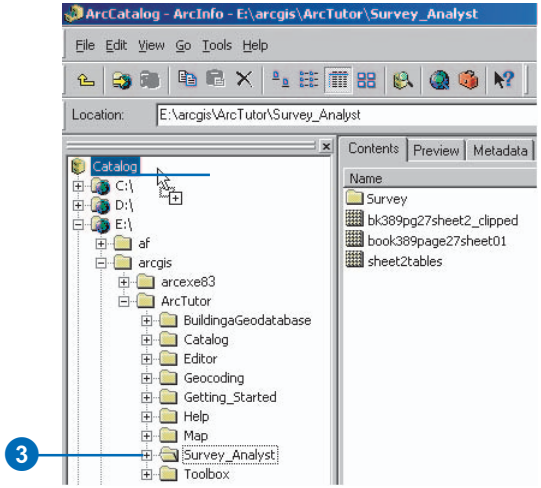
The datasets have been simplified by ESRI for the purposes of the tasks in this tutorial; they are presented solely for educational and training purposes. ESRI does not invite reliance on this data for any other purpose, and the user of this data should exercise their own professional judgment when acting on its content.

This tutorial lets you explore the basic capabilities of ArcGIS Survey Analyst. The complete tutorial will take you two to three hours to complete. You can also complete the exercises separately if that is more convenient for you.

Exercise 1: Organizing the tutorial data

Before you can begin this tutorial, you must first find and organize the tutorial data that you will need. Using ArcCatalog, browse for and create a new folder connection to your data:

1. Click the Start menu, point to Programs, point to ArcGIS, and click ArcCatalog.
2. Navigate to the location of the tutorial data (the default path is \arcgis\ArcTutor on the drive where ArcGIS is installed).
3. Click the Survey_Analyst folder and drag it onto the top-level node of the Catalog tree.

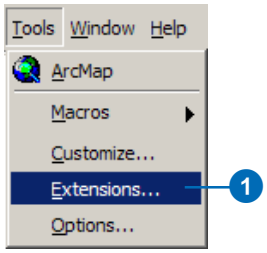


Your new folder connection is now listed in the Catalog tree. Folder connections simplify the task of navigating to your most frequently used datasets. You will now be able to access all the data needed for this tutorial through this new connection.

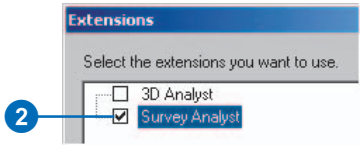
Enabling the Survey Analyst extension

Before continuing, you must enable Survey Analyst for use in ArcCatalog.

1. Click Tools and click Extensions.



2. Check the Survey Analyst check box.

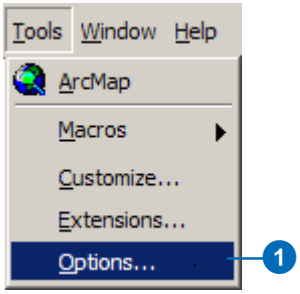


3. Click Close.

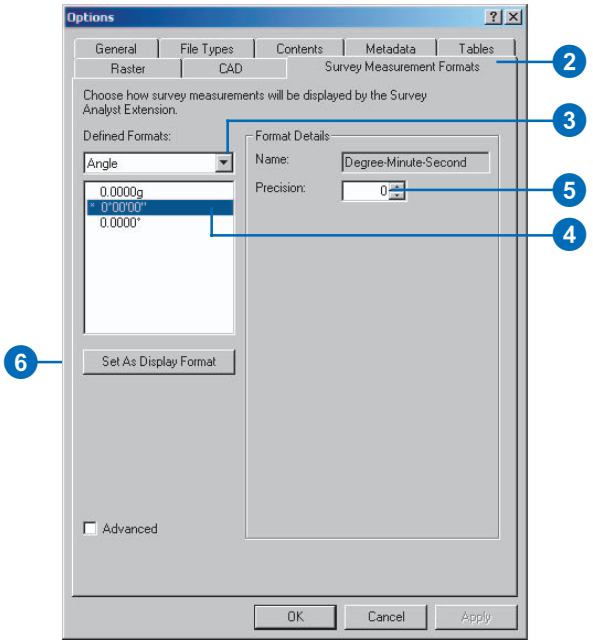
Defining the display units

Different units are available for displaying lengths and angles. You will define these for the units displayed in ArcCatalog.

1. Click Tools and click Options.



2. Click the Survey Measurement Formats tab.
3. Click the Defined Formats dropdown arrow and click Angle.
4. Click the Degree-Minute-Second option to select it.
5. Change the precision to 0. You will work in whole units of seconds.
6. Click Set As Display Format.



7. Click the Defined Formats dropdown arrow and click Length.
8. Click the second 0.000ft in the list for US Feet, and click Set As Display Format.
9. Click OK.

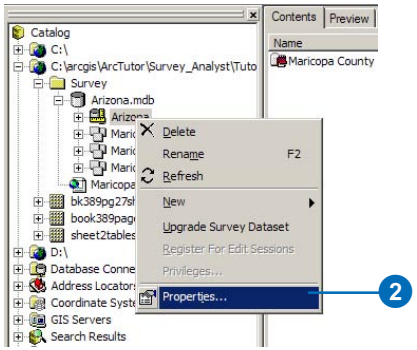
You are now ready to start exploring the survey dataset and working with your survey information. All of the survey information will be displayed using the units you've specified.

Exercise 2: Exploring the survey dataset

Survey information is stored in the geodatabase in survey datasets. A survey dataset is a comprehensive collection of survey points, measurements, and computations. You define a single survey dataset to provide *survey-awareness* for each logical group of feature datasets and feature classes. The survey dataset covers the extents of your management area.

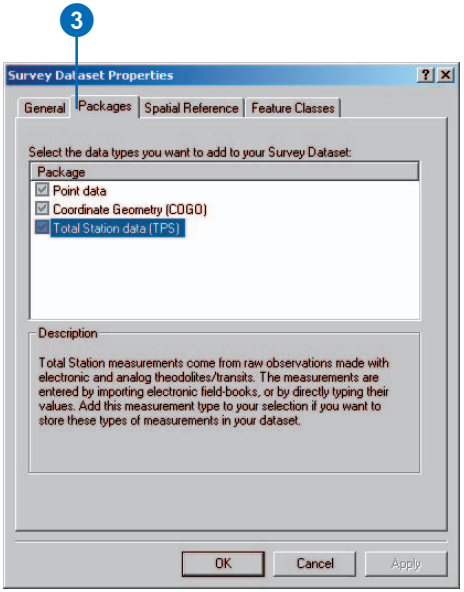
Viewing the survey dataset properties

1. In ArcCatalog, click the plus sign next to your new folder connection. Click the plus sign next to the Survey folder. Click the plus sign next to the Arizona geodatabase.
2. Right-click the Arizona survey dataset and click Properties.



The Survey Dataset Properties dialog box appears.

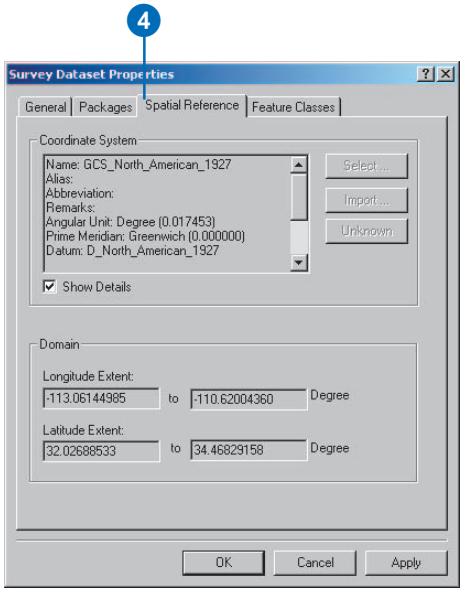
3. Click the Packages tab.



The packages are the survey data types that can be stored in the survey dataset. In this tutorial, you will be importing and working with field survey data from total positioning station (TPS) equipment, and you will also be using and storing COGO.

Once packages are added, you cannot remove them from the survey dataset.

4. Click the Spatial Reference tab.

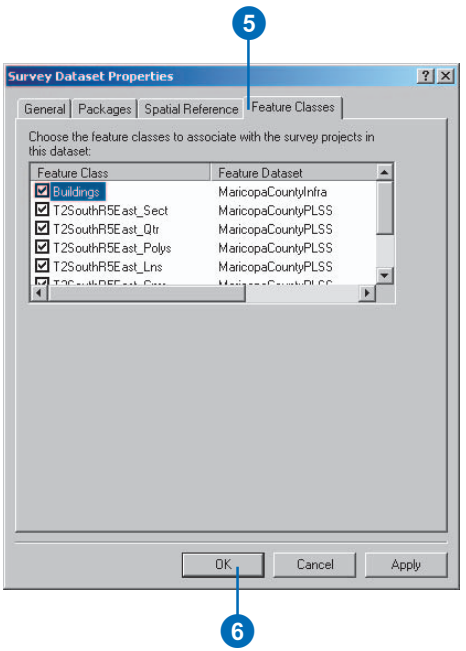


This survey dataset has a geographic coordinate system—North American Datum 1927. The latitude and longitude extents of the survey dataset are represented in decimal degrees and cover the state of Arizona.

Once defined, a dataset's spatial reference cannot be changed.

Now you will view the feature classes in the Arizona geodatabase that are *survey-aware* and participate with your survey dataset.

5. Click the Feature Classes tab.



Survey-aware feature classes have enhanced characteristics that enable the features they contain to be synchronized with the locations of survey points.

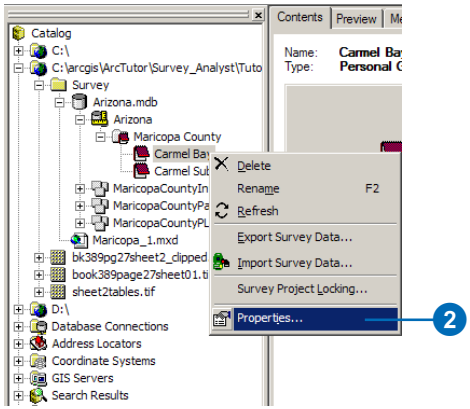
All the feature classes in this geodatabase are survey-aware.

6. Click OK.

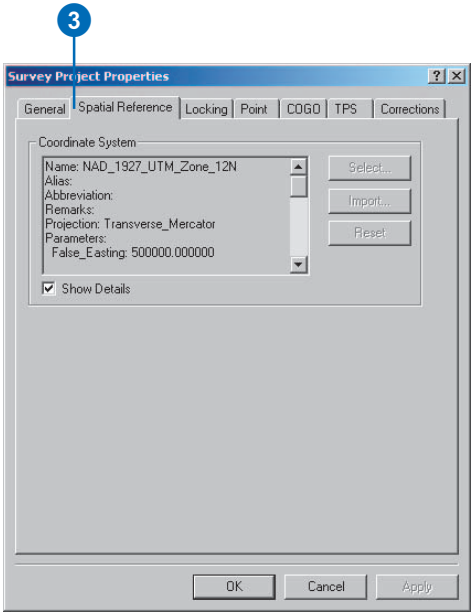
Survey datasets can contain a large amount of survey information from many different sources. Survey projects are used to organize your survey data into logically structured and manageable groups of measurements, survey points, and computations. You always add new survey data through survey projects.

Viewing the survey project properties

1. In ArcCatalog, click the plus sign next to the Arizona survey dataset. Click the plus sign next to the Maricopa County survey folder.
2. Right-click the Carmel Bay survey project and click Properties.



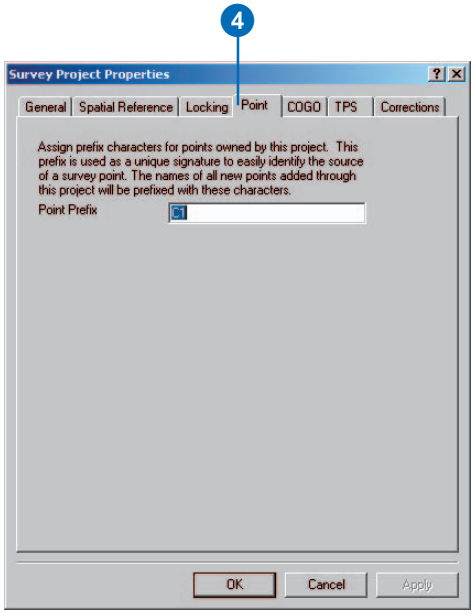
The Survey Project Properties dialog box appears.



3. Click the Spatial Reference tab.

   Each survey project can have its own projected coordinate system.

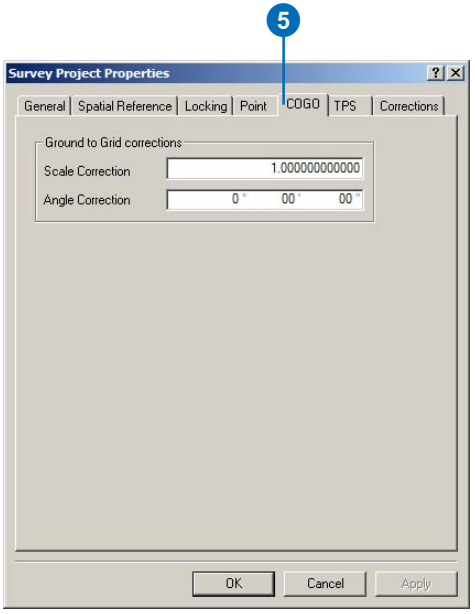
4. Click the Point tab.



Different points from different projects may have the same name. Since all points in the survey dataset are shared between projects, they need to be uniquely identified. Do this by assigning a string to each survey project. Each point name is associated with this string, which is called a *prefix*.

If needed, you can change this string. Survey Analyst notifies you if this string is already in use by a different project. Leave the string as C1 for this project.

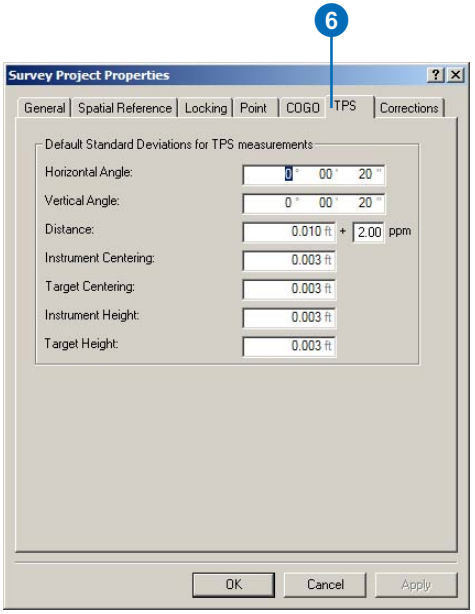
5. Click the COGO tab.



The Scale Correction applies a scale factor to all distances entered in COGO computations. The original unscaled distance values are stored.

The Angle Correction value for the Ground to Grid corrections applies a rotation of entered directions during coordinate geometry computations. The original unrotated direction measurement values are stored.

6. Click the TPS tab.



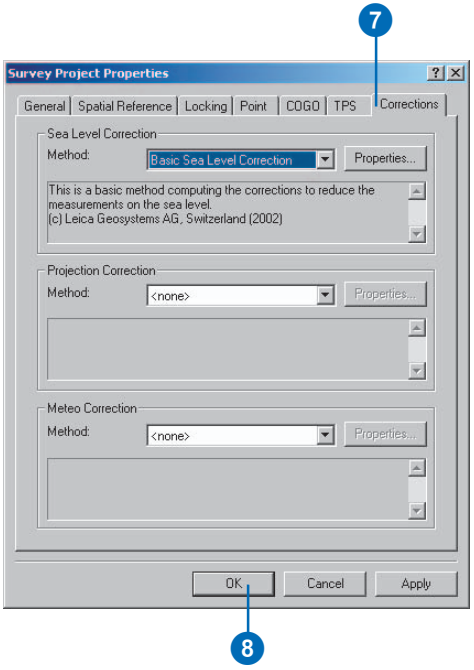
Standard deviations are used to define the expected level of precision in calibrated measuring devices.

The values on this tab are the default standard deviations assigned in new computations that use measurements from total station equipment. When working with specific computations, you can either accept or change these standard deviations.

If needed, on this property tab you can also change the defaults used by projects.

You do not need to change the default standard deviations for this project.

7. Click the Corrections tab.



These correction methods are used in computations to take into account the effects of meridian convergence, meteorological conditions, and height above sea level on the computed coordinates. The original measurement values entered into the system are not altered by these corrections.

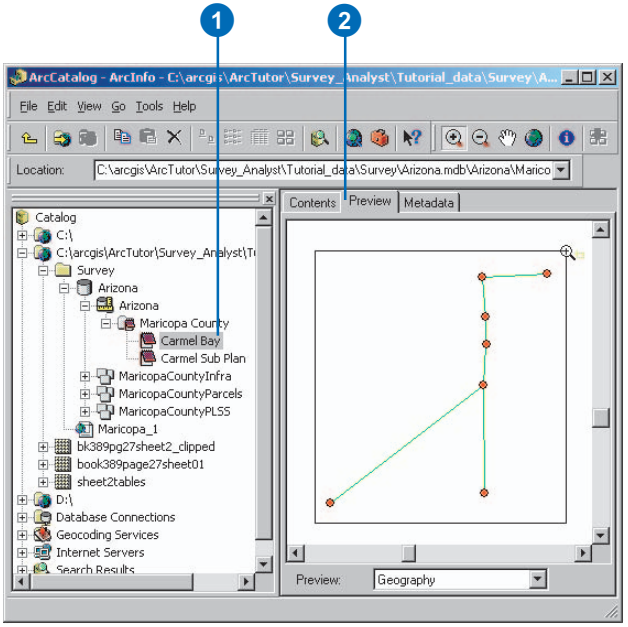
You do not need to change or assign correction methods for this project; only the Basic Sea Level Correction is required.

8. Click OK.

Previewing the data for survey projects

Next you will preview the data for the survey projects in the survey dataset. Previewing the data provides a visual representation of the survey measurements in the survey dataset.

1. Click the Carmel Bay survey project.
2. Click the Preview tab to see the survey data for this project.



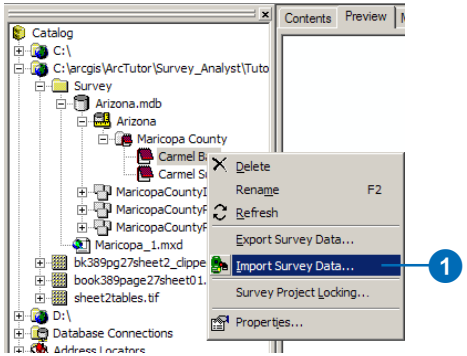
Importing from a data collector file

The information stored in the data collectors from field equipment devices is added to survey projects using the Import Survey Data Wizard.

You will use the Import Survey Data Wizard to browse for a Geo Serial Interface (GSI) file and bring this data into your survey dataset.

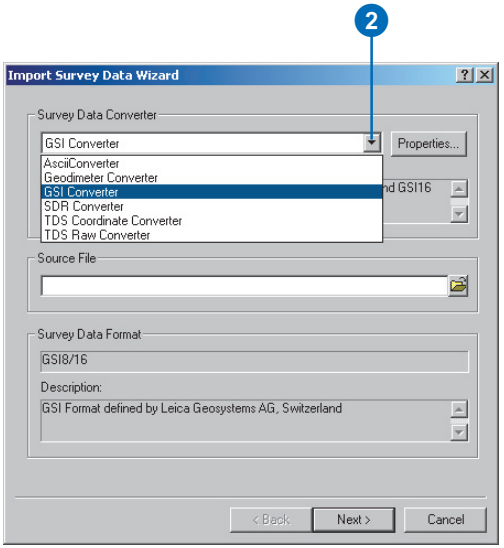
Using the Import Survey Data Wizard

1. Right-click the CarmelBay project and click Import Survey Data.

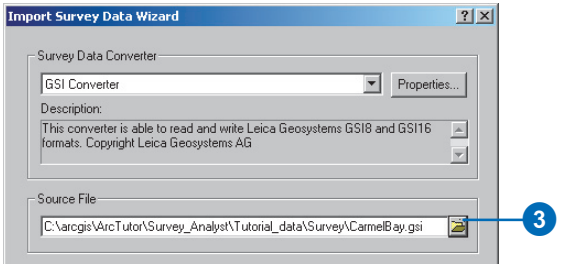


Survey Analyst provides a set of converter types that allows the data from these different formats to be imported. You will import a GSI file format.

2. Click the dropdown arrow and click GSI Converter.



3. Click the Browse button and navigate to the CarmelBay.gsi file located in the Survey folder where you installed the tutorial data.

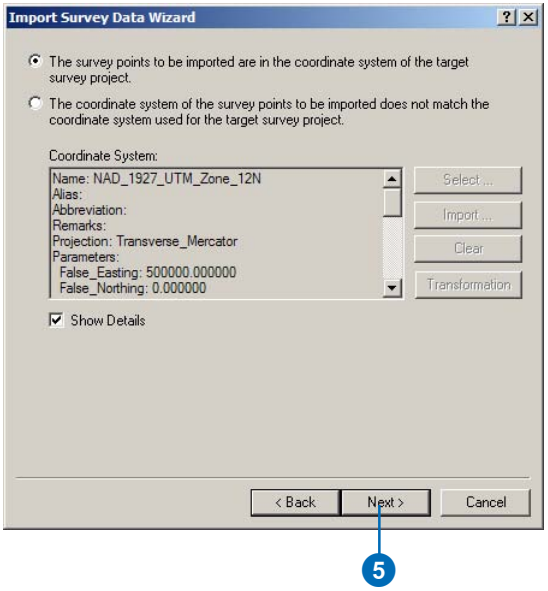


4. Click Next.

   If the source data has coordinates, they may not be in the same coordinate system as your project. In this case, you can select the coordinate system of your source data, and the importer will project it into the coordinate system of your survey project.

   The data in the the CarmelBay.gsi file is in the same coordinate system as the CarmelBay project. You will keep the default option.

5. Click Next.

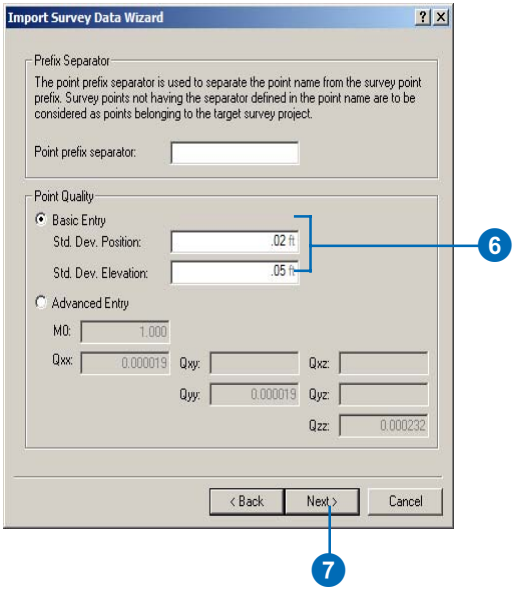


   The source file data can be connected with control point locations. These points may be in the source file itself or in an existing survey project. They are always identified by a name.

   A source file point naming convention can take advantage of the prefix system of Survey Analyst to uniquely identify control points that already exist in the survey dataset. In these source files, the prefix of the name is separated from the rest of the name by a single character separator. In this panel, you can choose the separator that is used in the import file. The coordinates in the CarmelBay.gsi file do not depend on points in an existing project, so you will accept the default and not use a separator.

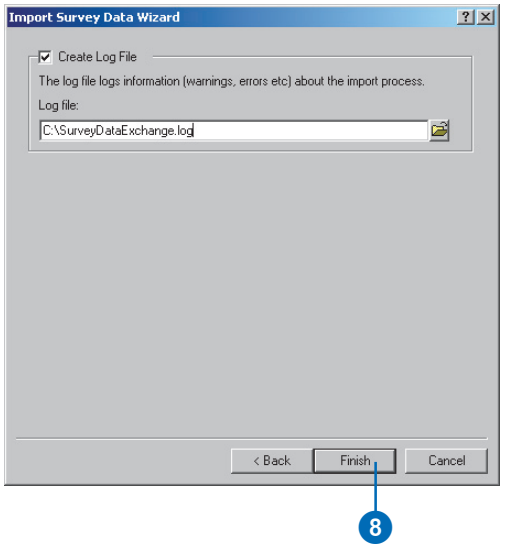
6. Type ".02" for standard deviation in x,y coordinates and ".05" for standard deviation in elevation. These values denote the expected precision of the measurements based on the equipment and techniques used in the field.

7. Click Next.



You can choose to generate a log file that reports the results of the import.

8. Choose a log file path and name and click Finish.



The additional measurements from the GSI file are now stored in the survey dataset. These will be managed and used in the Carmel Bay survey project.

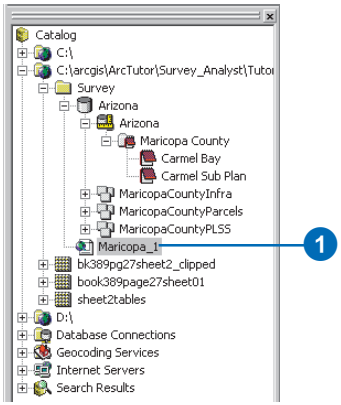
Exercise 3: Working with survey data

Survey layers let you symbolize and label survey points and measurements on a map. A map document displaying the Carmel Bay survey project has already been created. You will add a new survey layer to this existing map of the area and refine its properties for the Carmel Sub Plan project.

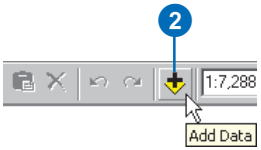
First you must open the map document. You will do this from ArcCatalog.

1. Double-click the Maricopa_1.mxd map document.

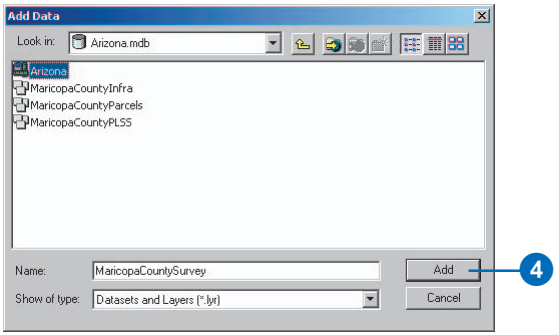
   ArcMap starts and displays a map of the survey area.



2. Click the Add Data button.

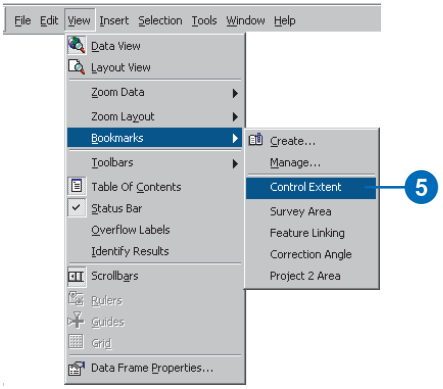


3. Navigate to the Arizona geodatabase where the Arizona survey dataset is located.
4. Click the Arizona survey dataset and click Add.



   The survey layer appears in the table of contents.

5. Click View, point to Bookmarks, and click Control Extent.

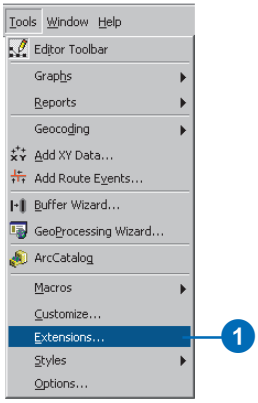


This bookmark displays the survey area at a larger scale.

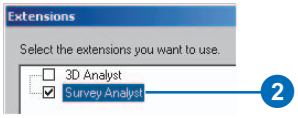
Enabling the Survey Analyst extension

Before continuing, you must enable Survey Analyst for use in ArcMap.

1. Click Tools and click Extensions.



2. Check the Survey Analyst check box.

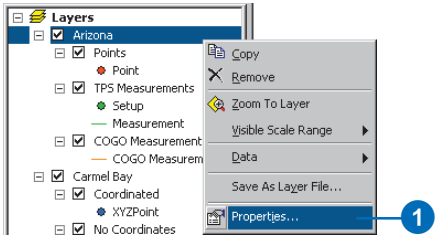


3. Click the Close button.

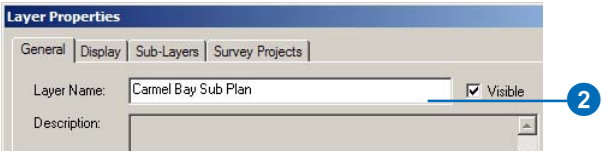
Setting the survey layer properties

A survey layer provides flexibility in displaying survey information in a way that is meaningful for your task. You'll change the properties for the new survey layer to best represent the Carmel Sub Plan project.

1. Right-click the Arizona survey layer and click Properties.

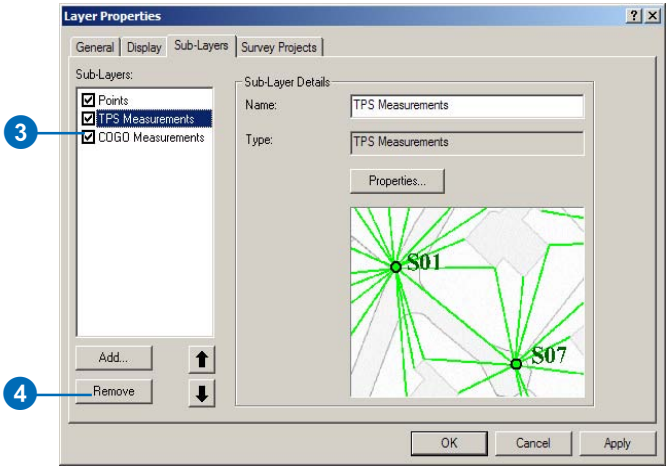


2. Type "Carmel Bay Sub Plan" as the Layer Name on the General tab.



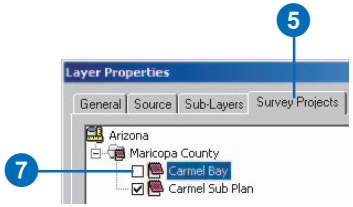
A survey layer has a sublayer for each of the data types supported by the survey dataset. You can control the number of sublayers displayed in the survey layer. The total station measurements are not needed for the Carmel Bay Sub Plan survey project, so the sublayer that represents these is not required. Therefore, you need to remove the sublayer representing total station measurements.

3. Click the Sub-Layers tab and click TPS Measurements.
4. Click the Remove button.



The survey layer can be used to display data from all the projects of the survey dataset, or it can be used to display data from a specific set of survey projects. You'll ensure that when other new projects are added to the survey dataset, this survey layer will only display the Carmel Sub Plan project.

5. Click the Survey Projects tab.
6. Click the plus sign next to the Maricopa County survey folder.

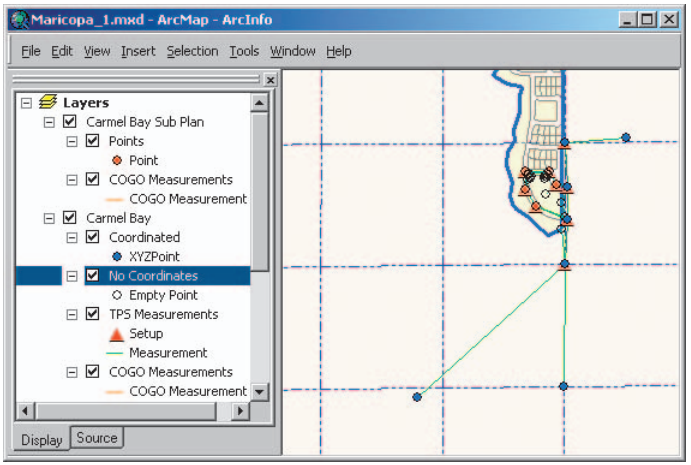


7. Uncheck the Carmel Bay project and verify that the Carmel Sub Plan project is checked.
8. Click OK on the Layer Properties dialog box.

Saving your map document

Now you will save the changes you have made to the map document so that you do not need to repeat this section if you choose to stop this tutorial and continue at a later time.

1. Click the Save button.



Map displaying the survey information in the Arizona survey dataset.

Working with the Survey Explorer

The previous section describes how you can visualize measurements and survey points in the map. This important map visualization is complemented by the equally important functionality provided through the Survey Explorer. The Survey Explorer is used to view and enter the numerical values required for computing coordinates.

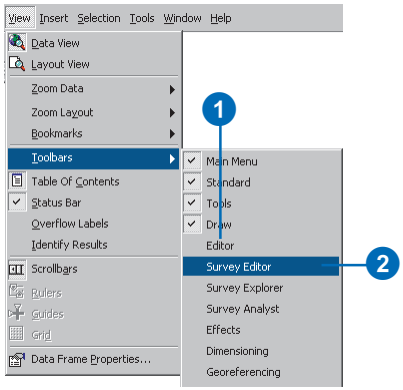
Adding the required toolbars

Before you can use the Survey Explorer, you need to add the Editor and Survey Editor toolbars to ArcMap.

1. Click View, point to Toolbars, and click Editor.

   The Editor toolbar appears in ArcMap.

2. Add the Survey Editor toolbar the same way.



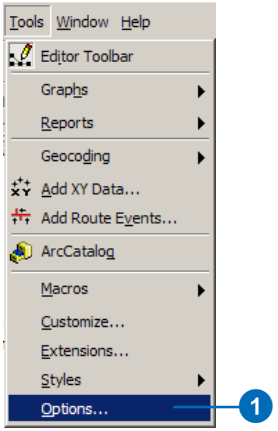
3. Click the Survey Editor toolbar's title bar and drag it to the top of the ArcMap application window. This will dock the toolbar.

You can dock the Editor toolbar the same way.

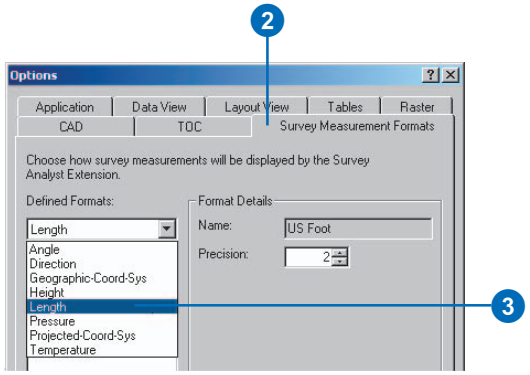
Setting the display units for length measurements

Since the measurements you are working with are in feet, you will need to change the display units for the new COGO computations that you will create.

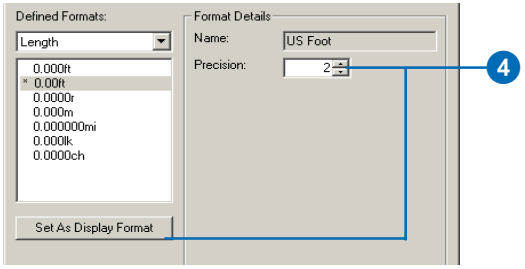
1. Click the Tools menu and click Options.



2. Click the Survey Measurement Formats tab.
3. Click the Defined Formats dropdown arrow and click Length.



4. Click 0.00ft, type “2” for precision, click Set As Display Format, then click OK.

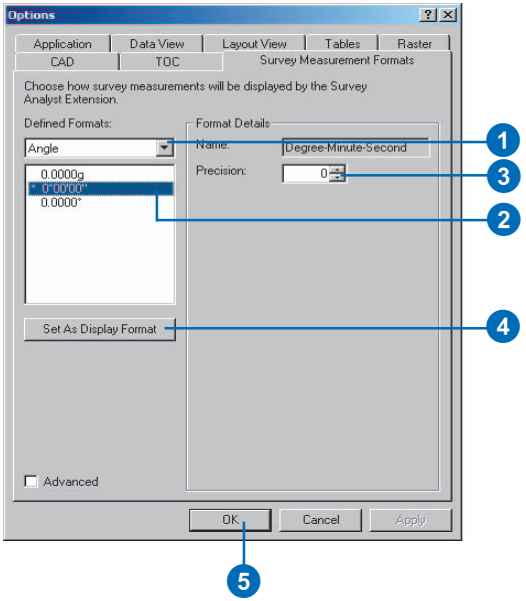


All length measurements that appear while using the Survey Explorer and Survey Analyst commands will be displayed to two decimal places in units of feet.

Setting the display units for angle measurements

Next, you will repeat these steps to change the units for angles.

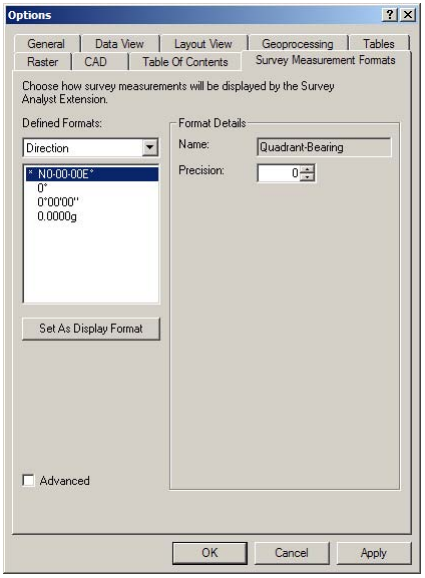
1. Click the Defined Formats dropdown arrow and click Angle.
2. Click the Degree-Minute-Second option to select it.
3. Change the precision to 0. You will work in whole units of seconds.
4. Click Set As Display Format.
5. Click OK.



Setting the display units for direction measurements

Repeat these steps to change the units for directions.

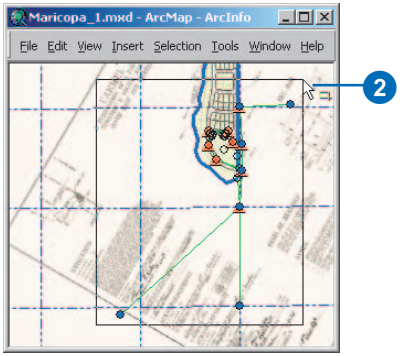
1. Click the Defined Formats dropdown arrow and click Direction.
2. Click the N0–00–00E option.
3. Change the precision to 0.
4. Click Set as Display format.
5. Click OK.



Listing points in the Survey Explorer

1. Click the List Survey Objects tool.

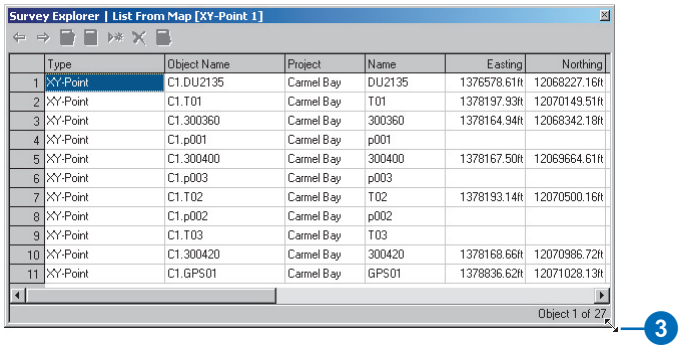
2. Click and drag a box around all the survey points in the current map extents.



The Survey Explorer opens, displaying a list containing all the survey points in the map extents.

Next, you will resize the Survey Explorer so that you can see more columns in the list.

3. Move the mouse pointer to the bottom-right corner of the window. Click and drag the corner until the easting and northing values are visible.



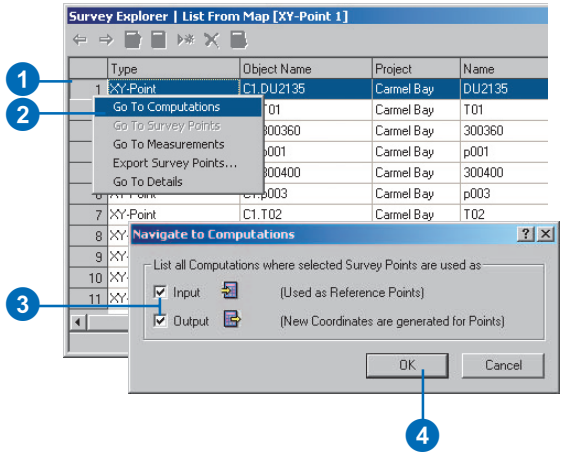
Note that certain survey points do not have easting and northing values. These points resulted from the import of the GSI file. This file has no coordinates; it contains measurements between coordinated points stored in the survey dataset.

The importer automatically computed provisional locations for the newly measured points by using the raw measurements in the file.

The two point sublayers for the Carmel Bay survey layer are used to distinguish between the coordinated points and the empty points, which still need to be computed.

Finding stored computations with the Survey Explorer

1. Click the leftmost column of the row in the Survey Explorer list that represents the point DU2135.
2. Right-click the row and click Go To Computations.
3. Check Input and Output to find computations that both use or create coordinates for the selected survey point.
4. Click OK.

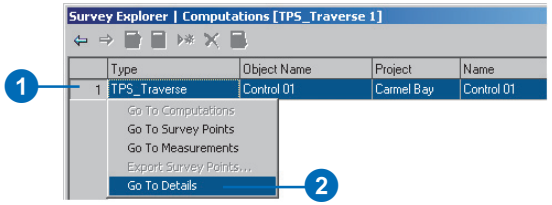


The Survey Explorer displays a new list containing a field traverse computation. This computation is a control traverse that used DU2135 as a reference point for orientation.

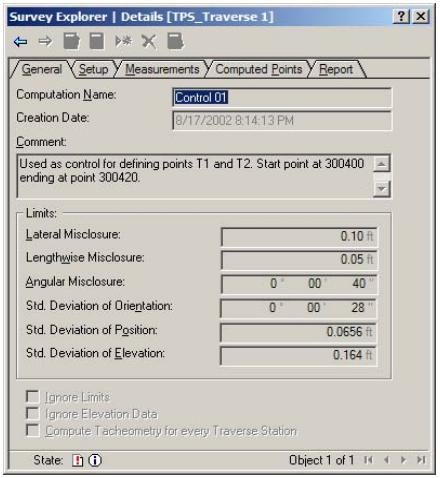
Next, you will view some of the details of this stored computation.

Navigating to the details of a stored computation

1. Click the leftmost column of the Survey Explorer list for the Control 01 computation.
2. Right-click the row and click Go To Details.



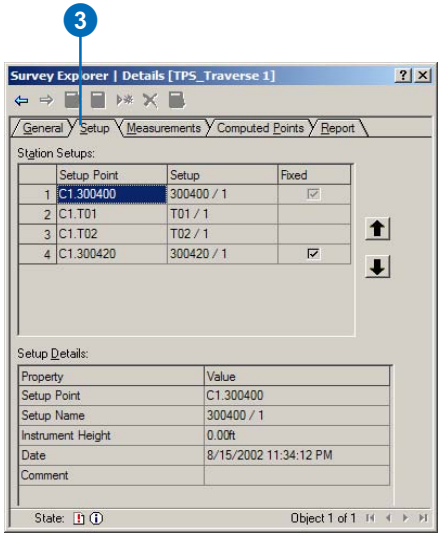
The Survey Explorer displays a detailed view of the field traverse computation. The General tab displays information that identifies the computation and its allowable limits.



The General tab provides information to identify the computation and its limits.

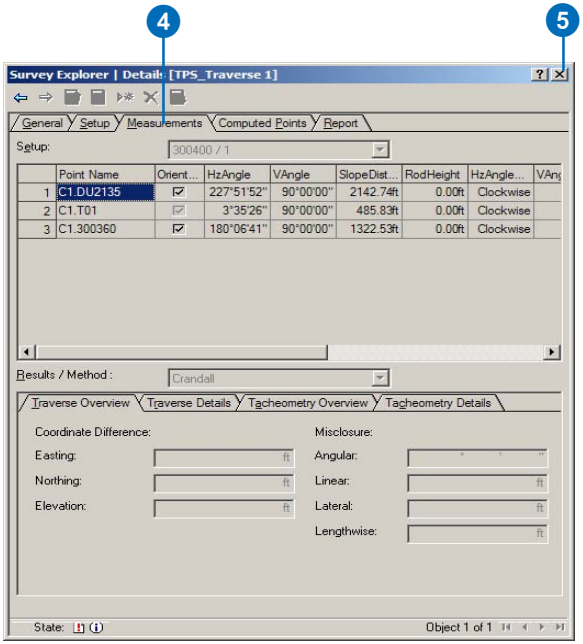
3. Click the Setup tab.

   The Setup tab displays all the instrument setups processed in this traverse.



4. Click the Measurements tab.

   Values for the measurements from the different setups are displayed.



5. Close the Survey Explorer.

You have now learned a little bit about using the Survey Explorer by importing instrument setups and measurements. In the next exercise, you will build on this by adding your imported instrument setups and measurements to a new computation.

Editing survey data

Computing coordinates and analyzing coordinate quality is the most important feature of Survey Analyst.

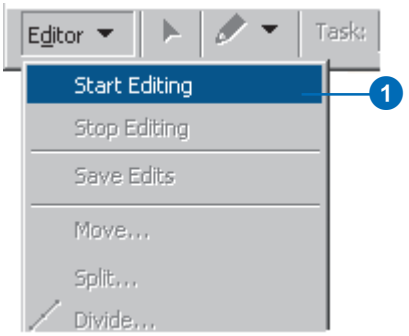
In this exercise, you will define computations to calculate coordinates for points, link a parcel block feature to points, and update the feature's location. To do this, you will add your imported measurements to a new computation.

Starting an edit session and setting the editing environment

Before you start defining computations, you need to start editng and also set the Target project for your edits.

Adding an edit task

1. Click the Editor menu and click Start Editing.



   If the Starting To Edit In A Different Coordinate System dialog box appears, click Start Editing.

Creating a new field traverse computation

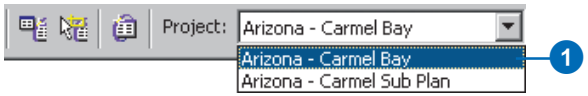
To calculate coordinates for the measured points, two traverse computations will be used. The first traverse has already been defined; this is the computation you found in the previous exercise. It was used to extend control into the project area, and it created two new survey points: T1 and T2.

You will now create a second field traverse computation to calculate coordinates for control points T3–T7. Additional measurements were also imported as part of the GSI file and were used to calculate coordinates for building corners and found parcel corner monuments in the project area.

Setting the target project

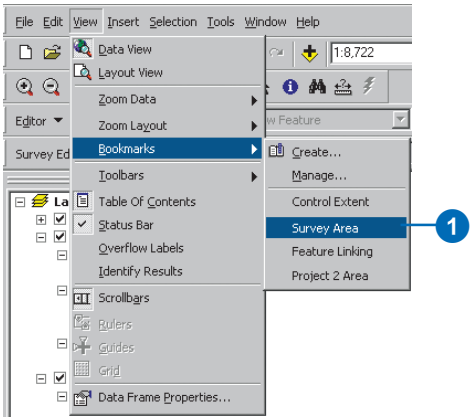
Before you start defining new computations, you must set the project that will own the points, measurements, and computations that will be stored.

1. Click the Project dropdown arrow and click Arizona - Carmel Bay.

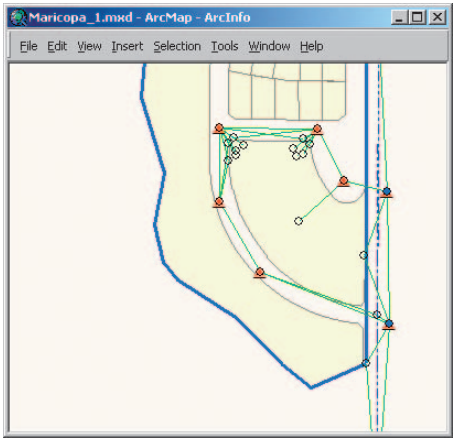


Zooming to the Carmel Bay project area

1. Click View, point to Bookmarks, then click Survey Area.



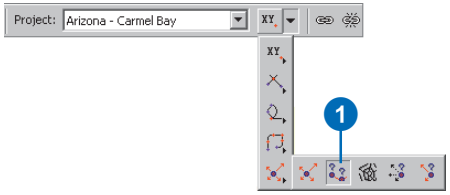
The Survey Area bookmark changes the map display to show the area of the second traverse.



Map extents showing the area of the second traverse

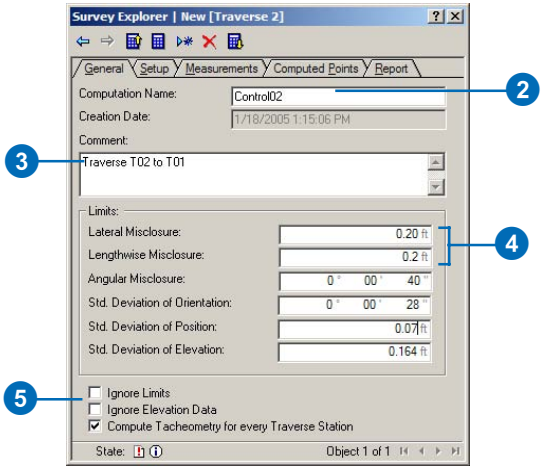
Defining the second traverse and side-shots

1. Click the tool palette dropdown arrow, point to the TPS Computations button, and click the Traverse button.

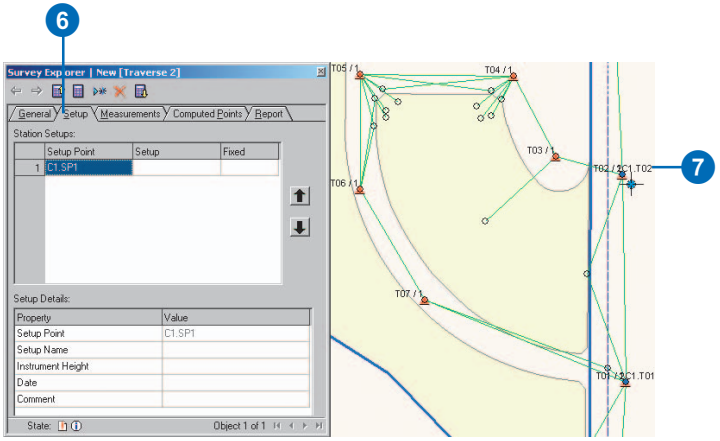


   The Survey Explorer appears with pages for a new field traverse.

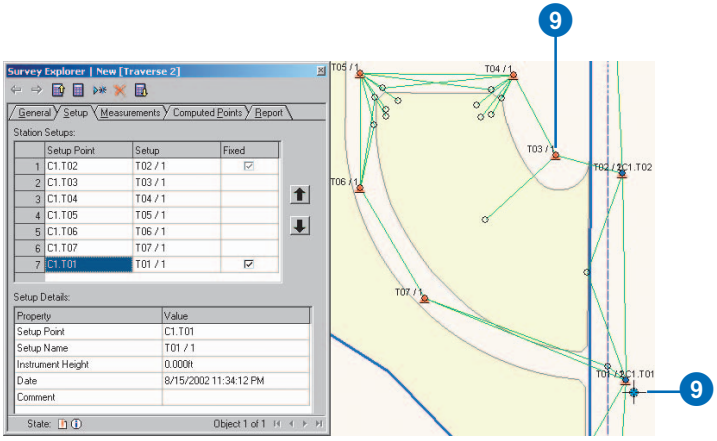
2. Type “Control 02” for the traverse name. You will use this name again later to find this computation.
3. Type “Traverse T02 to T01” for the comment.
4. Type “0.200” for Lateral Misclosure and “0.2” for Lengthwise Misclosure.
5. Check Compute Tacheometry for every Traverse Station.



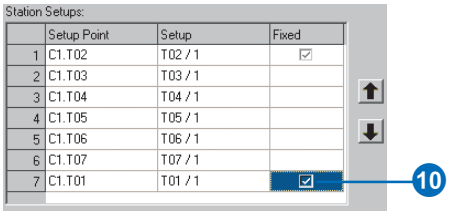
6. Click the Setup tab.
7. Snap to and click T02 on the map.



8. Press Enter twice to accept the default name and Fixed option.
9. Add the remaining traverse setups—shown as red triangles on the map—working in a counterclockwise direction and ending with T01.



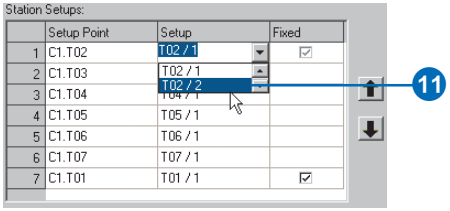
10. Click T01 on the map and check Fixed.



The final traverse setup will participate in this traverse as a fixed closure point.

Each survey point can have many instrument setups. There are two setups at the T1 and T2 points. The first setups at these points were used for the initial control traverse—Control 01. The second setups at each of these points were imported during the import exercise; these are the setups that must be processed in this traverse. This traverse is presently using the first setups for T01 and T02. You will now change these to the correct setups.

11. Double-click the Setup field for T02, click the dropdown arrow, and click T02 / 2.

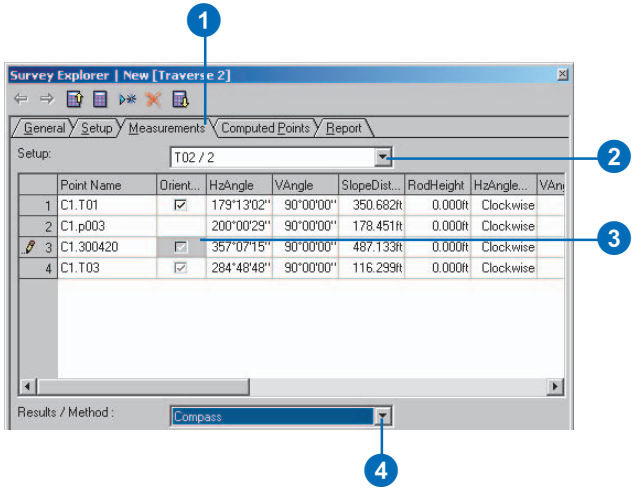


12. Double-click the Setup field for T01, click the dropdown arrow, and click T01 / 2.

Defining orientation and computing

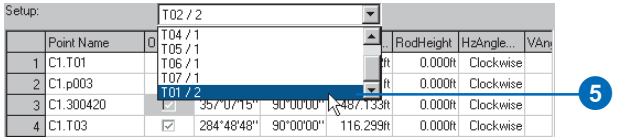
You will now view the measurements and define the points that were used for orientation during the field survey. You will do this for each of the setups.

1. Click the Measurements tab.
2. Click the Setup dropdown arrow and click T02 / 2.
3. Check 300420 in the orientation field.
4. Click the Adjustment method dropdown arrow and click Compass.

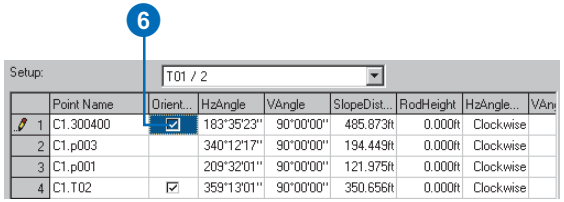


You will next ensure that the correct orientation points are being used for the setup at T01.

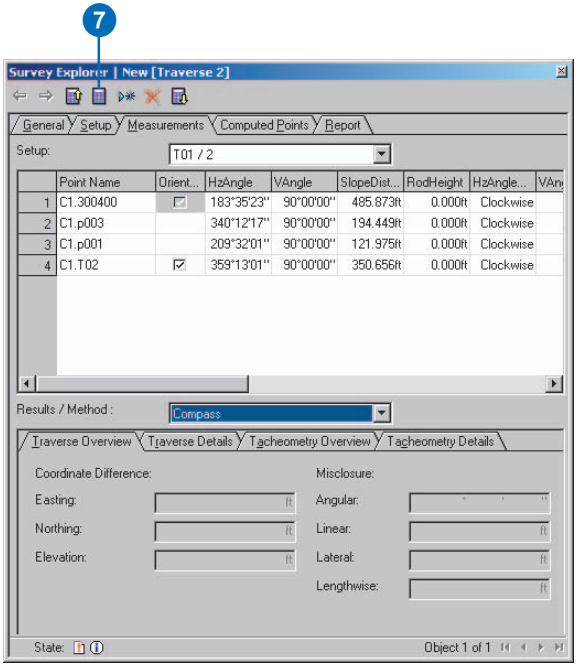
5. Click the Setup dropdown arrow and click T01 / 2.



6. Check 300400 in the orientation field.



7. Click the Compute button on the Survey Explorer toolbar.



Coordinates for the second traverse have been computed, including the locations for the building corners and found monuments. The survey points have coordinates and are labeled and displayed with a different symbol.

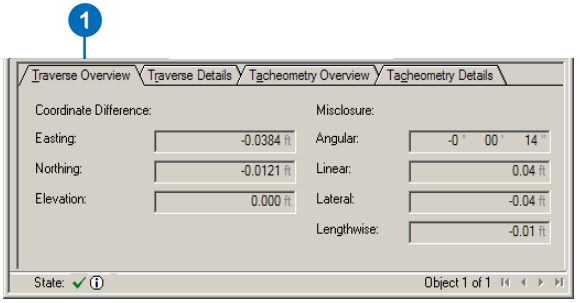
Viewing the traverse misclosure information

If the computation results are within the limits you defined, the computation is marked as valid. This is indicated by the check mark in the lower-left portion of the computation page.

The computation has a valid state.

Additional information concerning the traverse misclosure is also available. You will now verify these results.

1. Click the Traverse Overview tab.



The details of the traverse misclosure are displayed.

Saving your edits

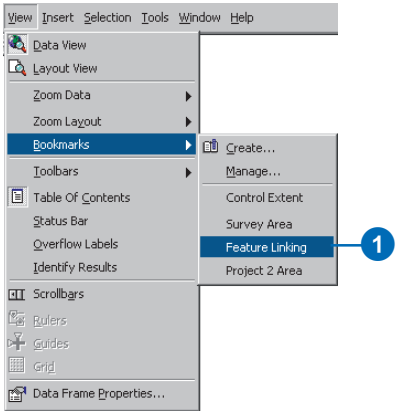
Now that you have successfully added the second computation to the geodatabase, you can save your edits.

1. Click the Editor menu and click Save Edits.

Editing features using survey points

Now that you have computed survey point locations for the found monuments and building corners, you will associate these coordinated locations with the features in the feature layers. You will start with the subdivision block in the parcel layer. First you will set the map to a bookmark of the area.

1. Click View, point to Bookmarks, and click Feature Linking.



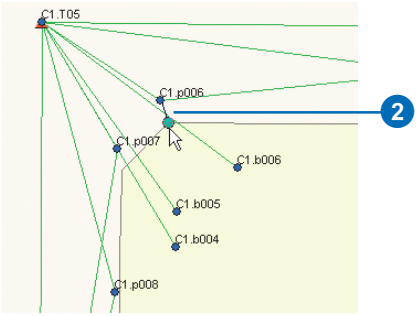
Using the Link tool

You can link the vertices of features to survey points without changing the location of features. The geometry of the feature stores the link information of the associated survey points. You will now make a link from a survey point to a feature vertex for the subdivision block.

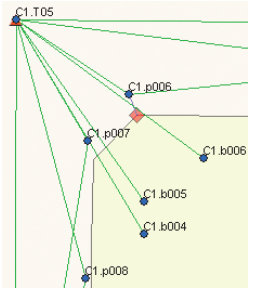
1. Click the Link tool on the Survey Editor toolbar.

The Link tool will work together with the snapping environment of the Editor.

2. Snap and click C1.p006, then click the parcel feature vertex closest to this point.



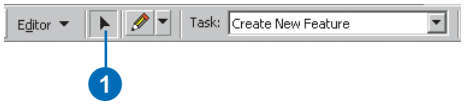
The symbol for the vertex of the feature is updated, and a link-line is displayed between the survey point and the feature vertex.



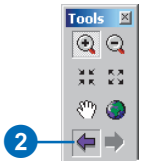
Using the Link command

Instead of using the Link tool for each of the feature vertices, you will link the remaining survey points using the Link command. This command will search for survey points to link within a defined distance of each feature vertex.

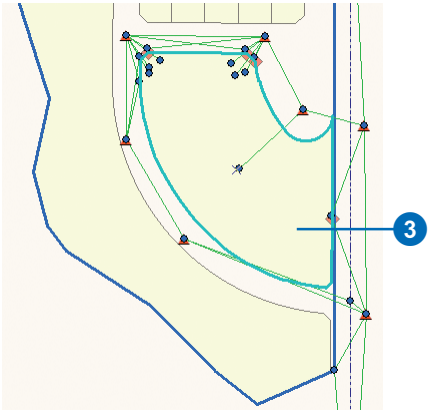
1. Click the Edit tool on the Editor toolbar.



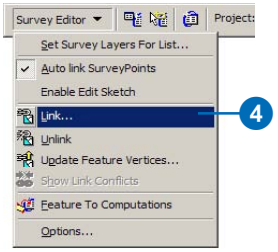
2. Click the Go Back To Previous Extent button on the Tools toolbar.



3. Select the subdivision block.

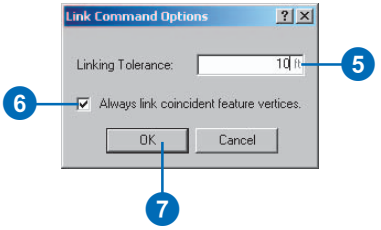


4. Click the Survey Editor dropdown arrow and click Link.



The dialog box for the Link command options appears. Use a linking tolerance of 10 feet. This is the distance that is used at each feature vertex when the command searches for survey points to link.

5. Type 10 in the Linking Tolerance box.
6. Check Always link coincident feature vertices.
7. Click OK.

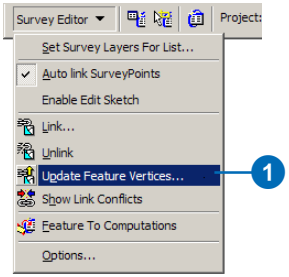


Now all of the survey points used to define the locations of parcel corners have been linked to the subdivision block in the parcel layer. The link-lines between the feature vertices and survey points are displayed, and the symbols at the feature vertices are udpated.

Using the Update Feature Vertices command

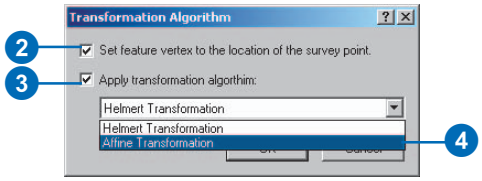
Until now, you have made no changes to the locations of features. You will now use the survey points and links to change the location of the subdivision block.

1. Click Survey Editor and click Update Feature Vertices.



   The Transformation Algorithm dialog box appears. You can select the type of transformation applied to the unlinked feature vertices when the geometry update is applied.

2. Check Set feature vertex to the location of the survey point.
3. Check Apply transformation algorithm.
4. Click the dropdown arrow on the Algorithm, click Affine Transformation, then click OK.

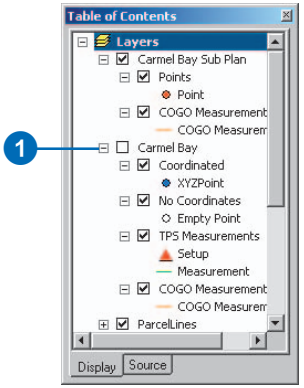


   The parcel block is updated so that the linked vertices share the same locations as the survey points. In addition, the locations of the unlinked vertices have been transformed to provide a relative match with the surveyed vertices.

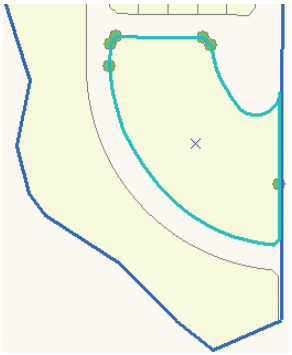
Turning off the survey layer

The symbols of the linked feature vertices are changed to indicate that these vertices share locations with survey points. You will now turn off the survey layer so you can easily see how the symbols have changed.

1. Uncheck the Carmel Bay survey layer in the map's table of contents.



The map displays only the features and the link symbols for the vertices of the linked feature.



Saving your edits and your map document

Now that you have updated the parcel feature in your geodatabase, you can save your edits.

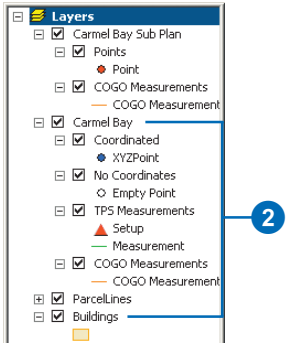
1. Click Editor in the Editor toolbar and click Save Edits.
2. Click the Save button to save your map document.

Exercise 4: Creating COGO computations

Your field crew was not able to measure all the building corners directly from the total station equipment. To completely define the geometry for buildings, a tape measure was used in the field to measure between the building corners. These values were recorded in a field sketch. Based on the values from these field sketches, you will now use COGO computations to add a new building to the buildings layer.

First, you must return to the spatial bookmark for the new building and turn on the Carmel Bay survey layer and the Buildings layer.

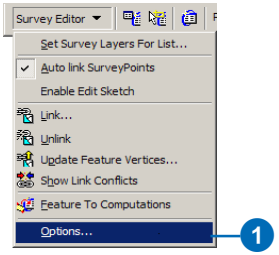
1. Click View, point to Bookmarks, and click Feature Linking.
2. Check the Carmel Bay survey layer and the Buildings feature layer in the map's table of contents.



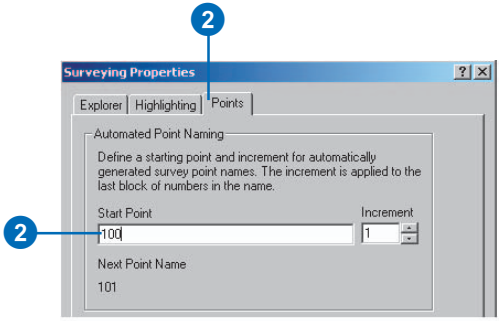
Setting up a point naming increment

The names of survey points in this survey project start with an alphanumeric character and also have a numeric value at the end of the character string. The system can automatically generate these survey point names and increment the numeric value. You will now specify that the new points entering the system will start from 101.

1. Click Survey Editor and click Options. The Surveying Properties dialog box appears.



2. Click the Points tab and type "100" for the Start Point.

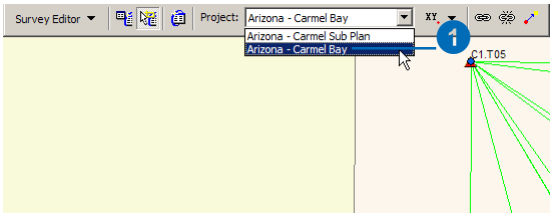


3. Click OK on the Surveying Properties dialog box.

Adding a building using COGO computations

Coordinate geometry computations can be used together with the Editor's edit tasks and target layer. You have the option to add a sketch vertex for each new survey point created. Instead of using this option, you will create the survey points for the building and, as a second step, create the new building feature. Next, you will turn off the option to create an edit sketch.

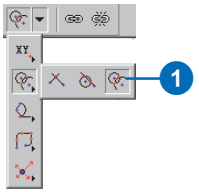
1. Click the Project dropdown arrow and click Arizona - Carmel Bay.



Using the distance-distance intersection computation

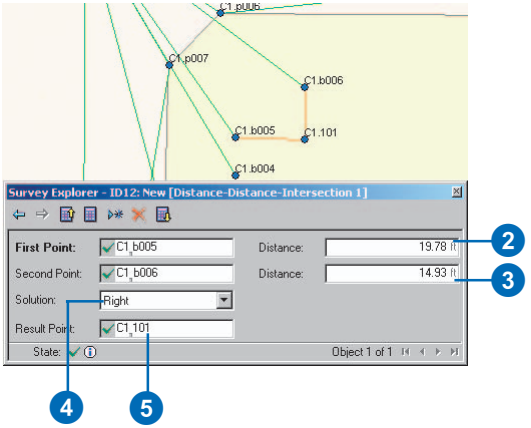
The first COGO computation will be an intersection of distances in order to define the coordinates of one of the building corners.

1. Click the tool palette dropdown arrow, point to the COGO Intersections button, and click the distance-distance intersection button.



The Survey Explorer appears and shows the distance-distance COGO computation.

2. Type "b005" as the first point, press Enter, type "19.78" in the first distance field, and press Enter again.
3. Type "b006" as the second point name, press Enter, type "14.93" in the second distance field, and press Enter.

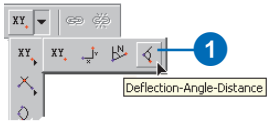


4. Press Enter, accepting the default Right solution. There are two possible solutions when you are intersecting two distances. When you look along a straight line from the first point to the second point, the new point to compute is on the right-hand side.
5. Press Enter to accept 101 as the name of the new survey point.

Using the deflection angle distance computation

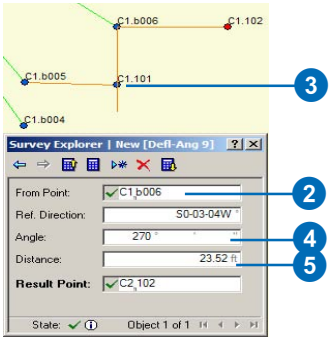
On the field sketch for the building, an assumption is made that the building walls are *orthogonal* to each other. For the next measured building corner, this assumption is used in the deflection angle distance COGO computation.

1. Click the tool palette dropdown arrow, point to the COGO Basic Computations button, and click the Deflection-Angle-Distance button.



   The Deflection-Angle-Distance computation is displayed in the Survey Explorer.

2. Type “b006” as the from point and press Enter.
3. Click survey point 101 on the map to define the reference direction.
4. Type “270” as the deflection angle and press Enter.
5. Type “23.520” as the distance and press Enter.

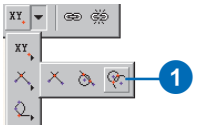


6. Press Enter to accept 102 as the new point name.

Adding the final building corner

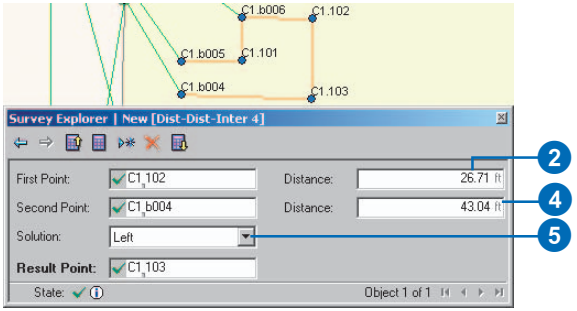
You will now add a second distance-distance intersection computation to add the final building corner.

1. Click the tool palette dropdown arrow, point to the COGO Intersections button, and click the Distance-Distance intersection button.



The first point of the new computation is, by default, the last point that was computed.

2. Press Enter to accept point 102 as the first point, type “26.71” as the first distance, and press Enter.
3. Type “b004” as the second point name.
4. Type “43.04” as the second distance.
5. Click the Solution dropdown arrow and click Left.

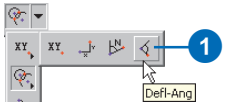


6. Press Enter to accept 103 as the new point name.

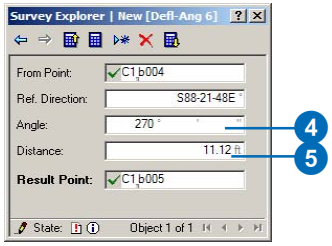
Using the final closing distance as a check

The tape measurements made around the building perimeter have been used to define its location. You will now add the closing tape measurement distance to calculate a second check coordinate.

1. Click the tool palette dropdown arrow, point to the COGO Basic Computations button, and click the Deflection Angle Distance button.

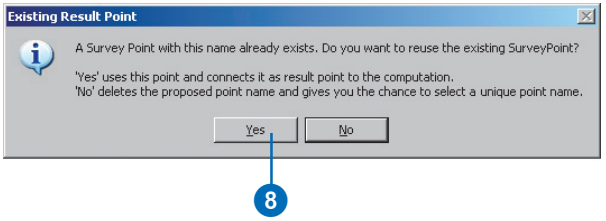


2. Type “b004” as the from point and press Enter.
3. Click the survey point called 103 on the map to define the reference direction.
4. Type “270” as the deflection angle and press Enter.
5. Type “11.12” as the distance and press Enter.
6. Type “b005” as the Result Point.



7. Press Enter to compute the new coordinate.

The Existing Result Point message box appears:

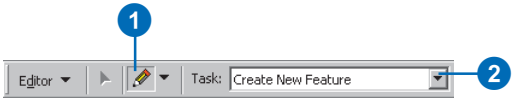


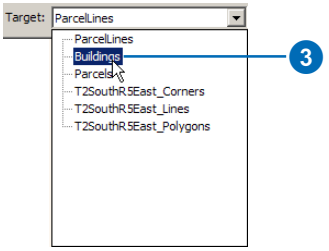
8. Click Yes to indicate that the calculated coordinate should be added to the existing survey point.

This coordinate will be used in the next exercise as a check on the other tape measurements around the building perimeter, but first you will create the new building feature.

Creating the building feature

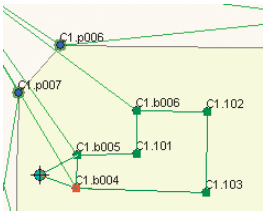
1. Click the Sketch tool on the Editor toolbar.
2. Click the Task dropdown arrow and click Create New Feature.



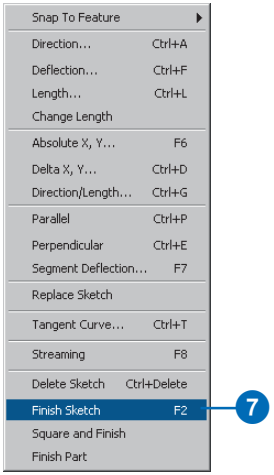


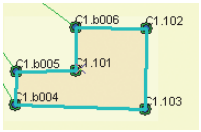
3. Click the Target dropdown arrow and click Buildings.

4. Snap to and click point b005.
5. Repeat step 4 in sequence for each of the following points: 101, b006, 102, 103, b004.



6. Right-click the map. The Sketch context menu appears.
7. Click Finish Sketch in the Sketch context menu.





Comparing coordinates of a survey point

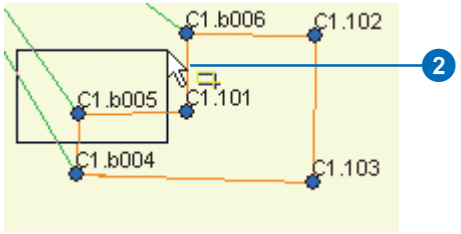
New computations can use existing survey points as targets for computed coordinates. In the previous exercise, you selected the existing point b005 as a result point for a COGO computation. This was based on a check measurement that was used to compute a second coordinate for b005.

In this exercise, you will use this check measurement to ensure that no mistake was made in the other tape measurements. You will do this by viewing and comparing the sets of coordinates computed for b005.

Navigating to survey point details

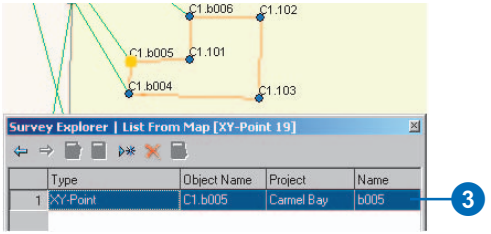
1. Click the Survey Object List tool in the Survey Editor toolbar.

2. Click and drag a box around point b005.



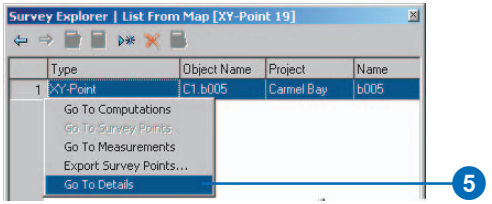
The Survey Explorer displays a single row list showing the survey point b005.

3. Click the row for b005 to select the point.



The survey point is highlighted on the map.

4. Right-click the first column in the selected row. The Survey Explorer column context menu appears.
5. Click Go To Details.



The Survey Explorer displays the detail page for b005.

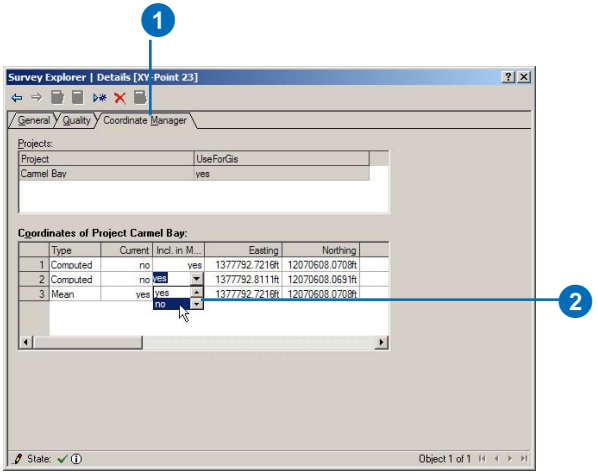
Comparing and averaging coordinates of a survey point

When two coordinates for a point are computed, their average value is automatically determined and used as the current coordinate for the point. You will use the final tape measurement to b005 as a check measurement. This measurement is not required to contribute to the average coordinate for b005.

You will now compare the coordinates computed for b005 and remove the second coordinate from the computed mean for this survey point.

1. Click the Coordinate Manager tab.

   The difference in the coordinates is acceptable as a check on the tape measurements around the building perimeter. This indicates that no mistakes were made in reading the tape measurements.

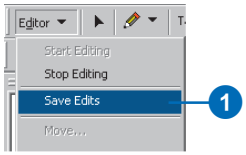


2. Double-click the Include in Mean column for the second computed coordinate, click no, then press Enter.

   The mean value is updated. The current coordinate is the coordinate computed from the total station measurement.

Saving your edits

Now that you have added field survey measurements, computations, survey points, and a new building feature to your geodatabase, you can save your edits.



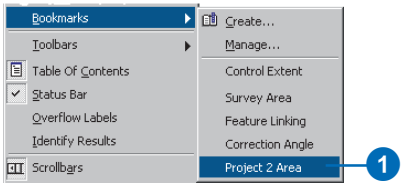
1. Click the Editor menu in the Editor toolbar and click Save Edits.

Entering COGO from plan data

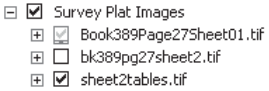
When your organization does not have coordinates for the parcel corners represented on a subdivision plan, using COGO computations is one method to calculate them. You will now use the dimensions available on Sheet 2 of the Carmel Bay subdivision plan to get approximate coordinates for a parcel monument. Since these computed coordinates will be based on the survey points measured by your field crew, they can be used to more easily find physical evidence of this parcel corner, which could not be found during the first field survey.

First you will need to go to the Project 2 Area bookmark.

1. Click View, point to Bookmarks, and click Project 2 Area.



2. Check Survey Plat Images in the table of contents.



Changing the automated point management settings

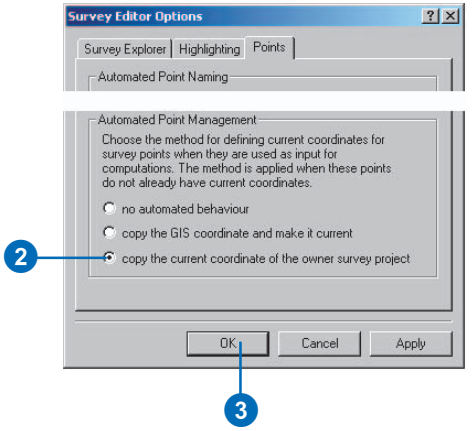
Computations can use the survey points created and owned by other projects. When these survey points are used, a copy of the coordinate is made for exclusive use in your project. Since survey points may have many coordinates, you need to define the coordinate that should be copied for your project. You can automate the choice for this coordinate. Since there are only two projects in the map, the project that owns all existing points is Carmel Bay.

You will now choose to always copy the current coordinate of the owning project when using survey points from other projects.

1. Click Survey Editor and click Options.

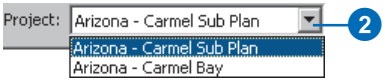
   The Survey Editor Options dialog box appears.

2. Click the Points tab and click copy the current coordinate of the owner survey project.
3. Click OK.



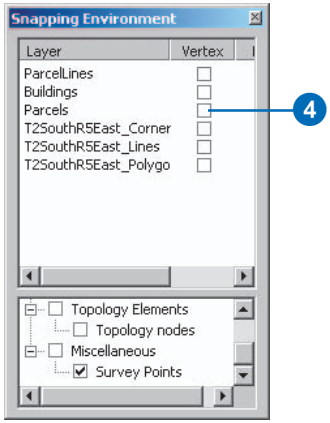
Creating a station and offset computation

1. Click the Save button to save your map document.
2. Click the Project dropdown arrow and click Arizona - Carmel Sub Plan.
3. Click the Editor and click Snapping.

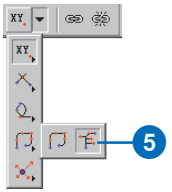


The Snapping Environment dialog box appears.

4. Uncheck Vertex for Parcels.

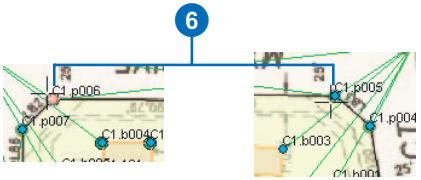


5. Click the tool palette dropdown arrow, point to the COGO Advanced Computations button and click the Station and Offset button.

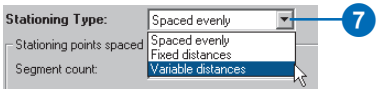


The Survey Explorer displays the new station offset computation. You will use this computation to define a point on line between points p006 and p005.

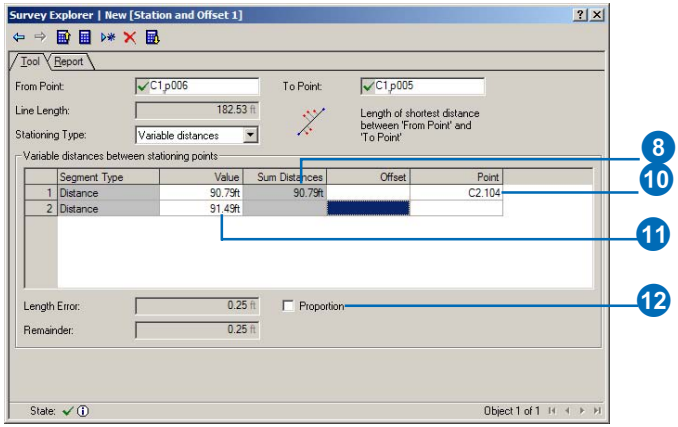
6. Click p006 on the map, then click p005.



7. Click the dropdown arrow for stationing type, click Variable distances, and press Enter.



8. Press Enter and type “90.79” for the distance value.
9. Press Enter twice to move to the Point field.
10. Type “101” for the point field and press Enter.
11. Press Enter twice, and in the Value field type “91.49”.
12. Check Proportion.



A survey point is computed online between p006 and p005. The difference between the computed closing distance and entered distance is proportioned.

Saving your edits

You have successfully added a plan-based COGO computation to the geodatabase.

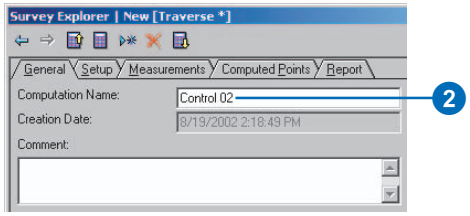
1. Click the Editor menu and click Save Edits.

Exercise 5: Updating computations and linked features

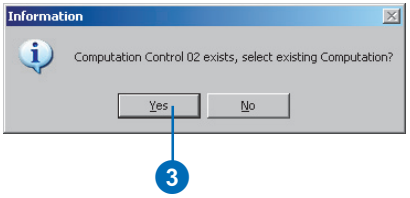
In the exercise 'Working with survey data', you learned how to find stored computations. In this exercise you will discover a different method to navigate to an existing computation. You will find and make a change to the second control traverse—Control 02. You have determined that the measurement to the point 300420 is erroneous and should be disabled.

Editing the Control 02 traverse

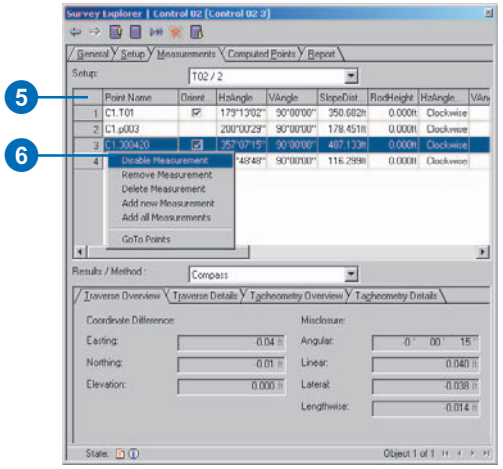
1. Click the tool palette dropdown arrow, point to TPS Computations, and click Traverse.
2. Type "Control 02" in the Computation Name box and press Enter.



3. Click Yes to view the Control 02 traverse.



4. Click the Measurements tab.
5. Click the leftmost column of the row for the measurement to 300420.
6. Right-click the row and click Disable Measurement.

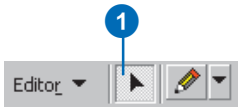


7. Click the Compute button on the Survey Explorer toolbar.

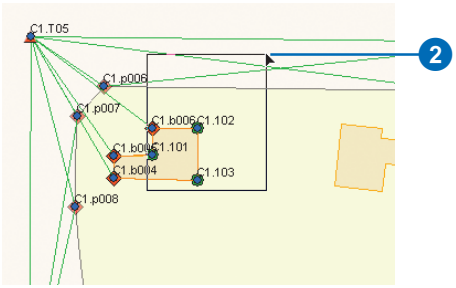
Updating the linked features

All the survey point locations are updated based on this change in the computation. You will now update the linked features to match this update in the survey points.

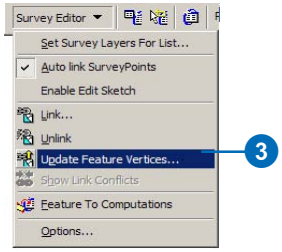
1. Click the Edit tool in the Editor toolbar.



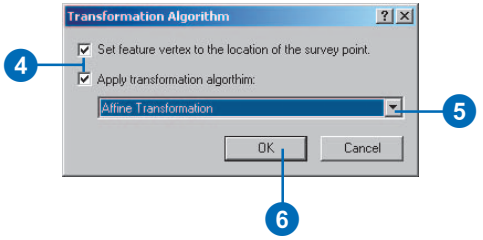
2. Select the linked features by dragging a box around the building and parcel feature.



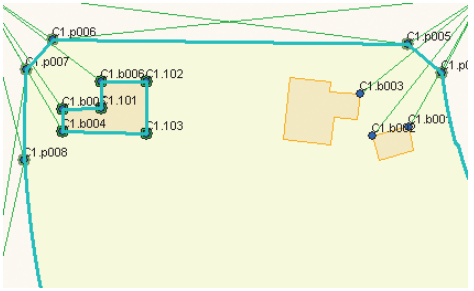
3. Click the Survey menu in the Survey Editor toolbar and click Update Feature Vertices.



4. Check Set feature vertex to the location of the survey point, and check Apply transformation algorithm.
5. Click the Transformation dropdown arrow and click Affine Transformation.
6. Click OK.



The feature locations are updated based on the recomputed locations of the survey points.



Saving your edits

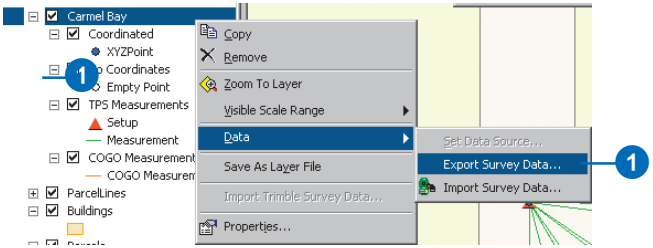
You have now updated your stored computations and the geometry of linked features.

1. Click the Editor menu and click Save Edits.

Exercise 6: Exporting survey point data

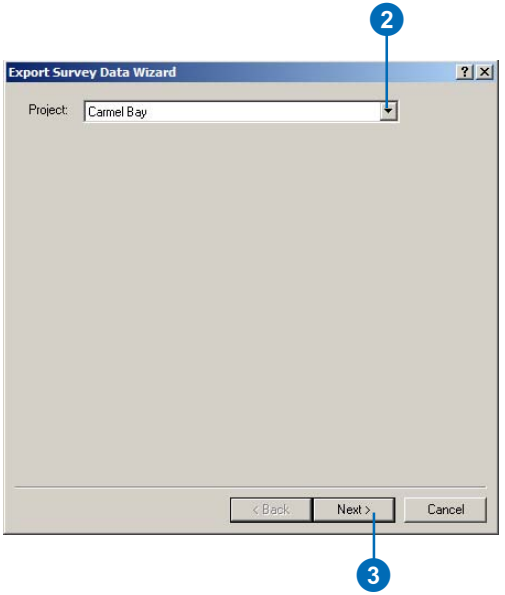
To support the work of your field crew, you need to be able to supply coordinates for locating positions in the field. In this exercise you will export the survey points that you computed. These coordinates can be made available for field work. For instance, they can be transferred onto a PCMCIA card or data collector, or directly to the field instrument.

1. Right-click the Carmel Bay survey layer, point to Data, and click Export Survey Data.

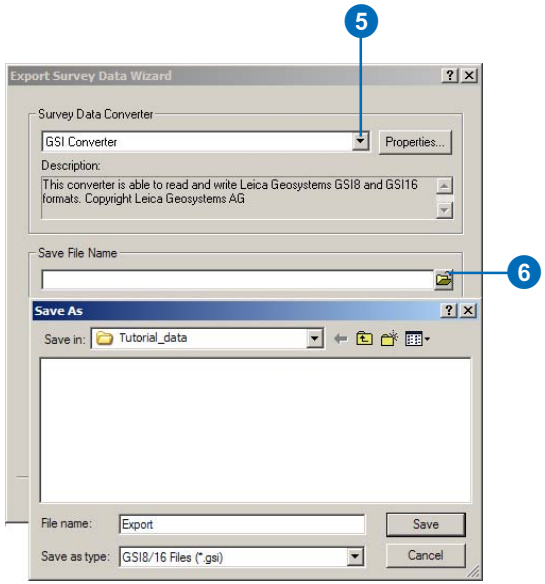


In the first page of the Data Exchange wizard, you will choose the project from which you want to export coordinates.

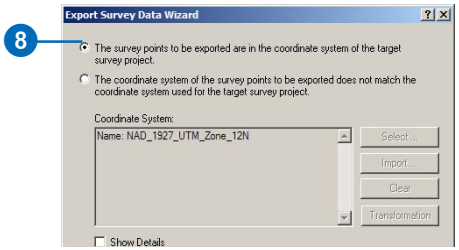
2. Click the Name dropdown arrow and click Carmel Bay.
3. Click Next.

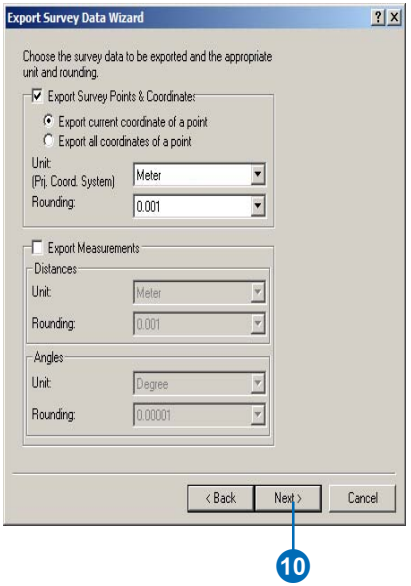


5. Click the dropdown arrow for Survey Data Converter and click GSI Converter.
6. Click the Browse button, type “Export” in the File Name box, then click Save.



7. Click Next on the Export Survey Data Wizard dialog box.
8. Click the option for the coordinates to remain in the same spatial reference as the survey project from which you are exporting data.



The points will be exported based on the coordinates system of Carmel Bay Sub Plan. The second option allows you to export into a different coordinate system. Choosing this option would project all the coordinates to your selected spatial reference. For this export, this is not required.

9. Click Next.
10. Accept the default units and coordinate precision and click Next.
11. Click Finish.