Editing Tutorial

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Table of Contents

Introduction to the Editing tutorial

The easiest way to learn how to edit in ArcMap is to complete the exercises in this tutorial. Most of these exercises can be completed with an ArcView license—the exception is the geodatabase topology exercise, which requires an ArcEditor or ArcInfo license.

Complexity:
Beginner
Data Requirement:
ArcGIS Tutorial Data Setup
Data Path:
\ArcGIS\ArcTutor\Editing

The first portion of the tutorial (Exercises 1–3) uses data from Utah's Zion National Park, which contains such geologic wonders as red and tan sandstone rocks, steep cliffs, and multitudes of canyons. You will use the editing environment in ArcMap to create and modify spatial features to represent various natural and human-made phenomena in the park. After completing these exercises, you are able to create different types of new features, including points, lines, polygons, and text; assign attribute values; edit shapes; and build and use feature templates. You will also become familiar with many of the tools and parts of the user interface available to you when editing.

The remaining exercises (Exercises 4–5) show you how to edit data. You will learn how to maintain spatial integrity through topology and how to integrate new data with existing datasets using spatial adjustment.

You should complete the tutorial in sequence, since the software methods build on those introduced in earlier exercises and assume you understand those concepts. For exercises 1–3, you should complete the all subparts (such as a, b, c, and d) at the same time, then only stop after completing a whole exercise. For exercises 4–5, you can restart the tutorial again on either the next exercise or subpart without any difficulty since the maps and data are independent in these exercises.

Overview of the tutorial exercises

The tutorial is divided into a series of exercises and subparts:

- Exercise 1 introduces the editing environment, including the terminology and ArcMap user interface. You learn how to create new points, digitize lines and polygons on the map, change editing tools, utilize snapping while creating features, and use feature templates.

- Exercise 2 builds on these skills. You learn how to create features from existing features and how to edit existing features.

- Exercise 3 is all about text on your map. You convert labels to geodatabase annotation, place the text on the map, and create new annotation features using the editing tools.

- Exercise 4 shows you how to edit features to maintain spatial integrity. You use map topology to edit shared features and geodatabase topology to ensure that your line features connect properly. An ArcEditor or ArcInfo license is required to complete exercise 4b on geodatabase topology.

- Exercise 5 uses spatial adjustment to transform and align your spatial data and transfer attributes among features.

Note: The tutorial assumes that you are using the default settings for the editing environment. If you have customized your options, you may need to reset them to match the steps in the tutorial. For example, by default, angular measurements are entered in degrees using the polar system, which is the format of the values provided in the tutorial. You can change the settings for

Data credits

Zion National Park datasets are courtesy of the National Park Service and the United States Geological Survey.

Map topology datasets are courtesy of the United States Geological Survey.

The world imagery is a Web-based layer being served from ArcGIS.com.

Exercise 1a: Creating new points

About creating new points

In this exercise, you will use an aerial photograph to create a new point feature representing a park ranger station in Zion National Park. Once the feature is created, you will then add attribute values to the point. You are introduced to the Editor toolbar, the Create Features window, and the Attributes window, which are the main elements of the ArcMap user interface when editing.

To start this exercise, you first need to zoom the map to your area of interest. A spatial bookmark, which is similar to a bookmark in a Web browser, is a way to save frequently used locations on your map so you can easily access them. A bookmark has been created for you containing the map extent in which you will be working.

Note: This exercise requires an active Internet connection since it uses imagery served from the Web. If you do not have an Internet connection or if the imagery is loading slowly, you can still perform the tutorial using an image that is installed with the tutorial data. You need to turn on the **DOQQ imagery (local)** layer in the table of contents, then you can turn off the **World imagery (Web)** layer.

Prerequisite:
Start ArcMap.

Steps:

1. Click the **Open** button on the *Standard* toolbar.
2. Navigate to the **Exercise1.mxd** map document in the Editing directory where you installed the tutorial data. (C:\ArcGIS\ArcTutor is the default location.) If the *Getting Started* window opens, choose to browse for an existing map and navigate to Exercise1.mxd.
3. Click the map and click **Open**.
4. If you are prompted to enable hardware acceleration to improve performance, click **Yes**.
5. Click the **Bookmarks** menu and click **Visitor center** to zoom you to the area around a visitor center ranger station at the south entrance of Zion National Park.
6. Click the **Editor Toolbar** button on the *Standard* toolbar.
7. Click the **Editor** menu on the *Editor* toolbar and click **Start Editing**.
8. In the *Create Features* window, click the **Ranger stations** point feature template. This sets up the editing environment so that you will be creating new point features in the Ranger stations layer.

   These feature templates were created for you and saved in the tutorial map document. In a later tutorial exercise, you will create feature templates yourself and modify their properties.
9. Click the **Point** tool on the *Create Features* window.

10. Using the aerial imagery, click the map to place a point directly over the visitor center building in the center of the display. Since you are creating points, clicking the map once adds the feature. If you were drawing lines or polygons, however, you would need to use more than one click so you could create segments in between vertices.


Visitor center building

Notice that the center of the symbol contains a solid, cyan-colored (light, bright blue) circle. By default, as soon as you create new features when editing, they are selected. This allows you to easily identify the new feature and add attribute values to it.

11. Click the **Attributes** button ▤ on the *Editor* toolbar.

Using the Attributes window is a quick way of updating the attribute values of one or more selected features when you are editing. The top of the window shows a hierarchy of the name of the layer and, underneath it, an identifier for the individual feature from that layer. The bottom of the window shows the field (a column in a table) names and the attribute values (a row in a table) for the feature.

12. Click inside the box for the **Location** property value, which is currently **<Null>**.

13. Type `Visitor Center` and press ENTER. This action stores the attribute values for that feature. Notice that the entry for the feature on the top of the window is no longer a generic number but has been replaced with the more descriptive Visitor Center.
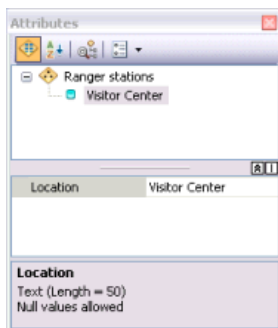
14. Close the *Attributes* window.

15. To continue to the next exercise, click Exercise 1b: Digitizing lines and snapping.

You have now completed the first exercise and created a new point feature. In the next exercises, you will learn how to create new lines and polygons.

Exercise 1b: Digitizing lines and snapping

About digitizing with snapping

In the first exercise, you digitized a point over an aerial photograph; in this one, you will trace over the image to create a new line representing a road.

Because part of the road has already been created, you should use snapping to help ensure the new road feature connects to the existing roads. When snapping is turned on, your pointer will jump, or snap to, edges, vertices, and other geometric elements when it is near them. This enables you to position a feature easily in relation to the locations of other features. All the settings you need to work with snapping are located on the Snapping toolbar.

Note: This exercise requires an active Internet connection since it uses imagery served from the Web. If you do not have an Internet connection or if the imagery is loading slowly, you can still perform the tutorial using an image that is installed with the tutorial data. You need to turn on the **DOQQ imagery (local)** layer in the table of contents, then you can turn off the **World imagery (Web)** layer.

Setting options for snapping

Prerequisite:
The Exercise1.mxd is open and you are in an edit session.

Steps:

1. Navigate to the **Digitizing roads** bookmark. The extent is just south of the point feature you created in the previous exercise.

2. Add the *Snapping* toolbar to ArcMap. You can add a toolbar by clicking the Customize menu, pointing to Toolbars, then clicking the toolbar's name in the list. You can also add the Snapping toolbar by clicking the Editor menu, pointing to Snapping, the clicking Snapping Toolbar.

3. On the *Snapping* toolbar, click the **Snapping** menu and confirm that **Use Snapping** is checked. If it is already checked, do not click it again, since that will turn off snapping. If **Use Snapping** is not checked, click it to enable snapping.

4. Look on the *Snapping* toolbar and confirm that **End** , **Vertex** , and **Edge** snapping types are active. When enabled, the buttons are highlighted. If they are not enabled, click each button to enable those agents.

5. Click the **Snapping** menu and click **Options**. From this dialog box, you can specify settings for snapping in ArcMap.

6. Ensure the snap tolerance is at least `10` pixels.

   The snapping tolerance is the distance within which the pointer or a feature is snapped to another location. If the element being snapped to—such as a vertex or edge—is within the distance you set, the pointer automatically snaps to the location.

7. Check the boxes for **Show Tips**, **Layer Name**, **Snap Type**, and **Background**. Most likely, you only need to check on **Background**, as the others are turned on by default. A SnapTip is a small piece of text that pops up to indicate the layer you are snapped to and with which snap type (edge, end, vertex, and so on). The background is useful to help you see the SnapTip when working over an image.
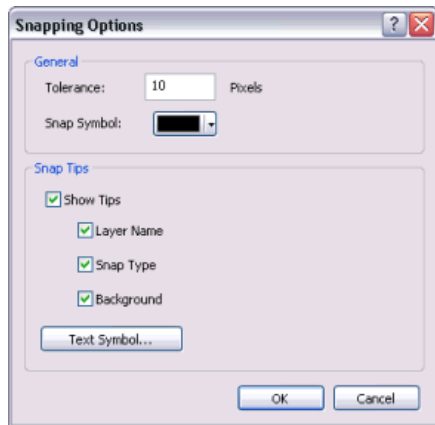
8. Optionally, you can change the color used for the snap symbol and set SnapTip display options, such as the size or font of the tip.

9. Click **OK** to close the *Snapping Options* dialog box.

Digitizing a line

Steps:

1. You are now ready to begin digitizing the new road. In the *Create Features* window, click the **Local road** line template, which is grouped under Roads. This feature template was created for you and saved in the tutorial map document.
The list of available construction tools at the bottom of the window changes to those used to create lines. Since the **Line** tool ╱ is the default tool for this template, it is activated automatically.

2. Rest your pointer over the endpoint of the existing line in the western portion of the map display, but do not click yet. Notice that the pointer icon changes to a square snap symbol and a SnapTip appears with the name of the layer (Roads) and the snap type (Endpoint) in use. You can zoom or pan closer if you need to do so.

3. Click once.

You digitize, or sketch, a new line or polygon by defining the feature's shape. You see a preview with the actual symbology used for that feature, with vertices symbolized as green and red boxes. As you are digitizing, the Feature Construction toolbar appears near your pointer. It is a small, semitransparent toolbar that allows quick access to some of the most common tools and commands used when editing. If you find that the toolbar gets in the way of where you want to add a vertex, press the TAB key to reposition it. You will use the Feature Construction toolbar more in a later exercise.

4. Using the aerial photo as a guide, digitize the new line by clicking the map each place you want to add a vertex.
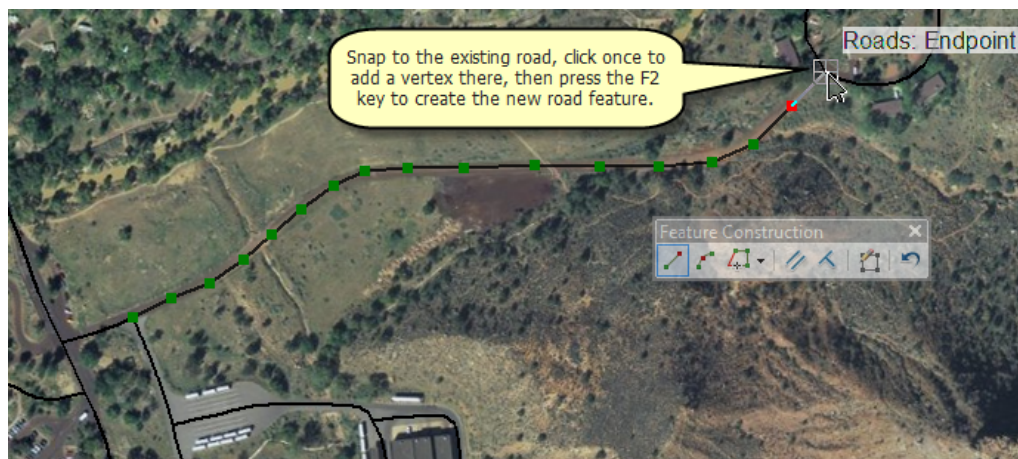
5. Once you have digitized the new line, snap to the end of the existing feature and click to place a vertex there.

6. Press the F2 key, which finishes the sketch to turn your shape into an actual feature in the geodatabase. You can finish a sketch in one of several ways: pressing F2, double-clicking, or using the right-click shortcut menu or the pop-up Feature Construction toolbar.

7. To continue to the next exercise, click Exercise 1c: Creating new feature templates.

In this exercise, you learned how to set up snapping and use it to help you digitize a new road that connects to existing roads.

Exercise 1c: Creating new feature templates

About creating feature templates

In the first exercises, you used feature templates that were already created for you. Now, you will make your own template using a wizard. You will create a template for a polygon layer representing private landownership.

Complexity:
Beginner

Data Requirement:
ArcGIS Tutorial Data Setup

Data Path:
\ArcGIS\ArcTutor\Editing

Prerequisite:
The Exercise1.mxd is open and you are in an edit session.

Steps:

1. Click **Organize Templates** on the *Create Features* window.

2. Click **Tracts** on the left side of the *Organize Feature Templates* dialog box. If this layer had any existing templates, they would be listed on the right.

3. Click **New Template**.
   The *Create New Templates Wizard* opens. The first page shows you a list of all the layers in your map that are currently being edited.

4. Because the Tracts polygon layer was selected when you started the wizard, only this layer should be checked. Otherwise, check it and uncheck any other layers.
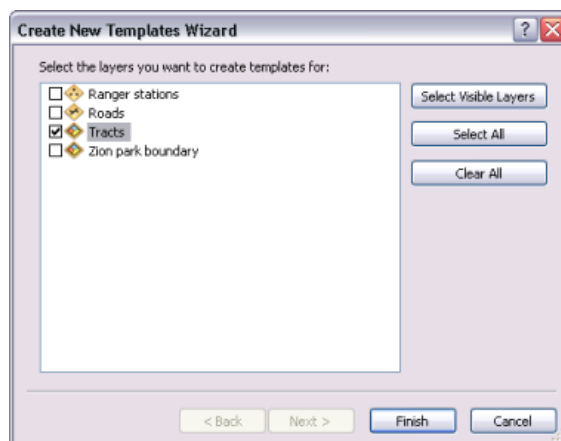
5. Click **Finish**.

   When layers are symbolized by categories, you are able to click **Next** and choose the categories for which you want to make feature templates. Since the Tracts layer is symbolized as a single symbol, the wizard is finished in one step.

6. A template for Tracts appears in the *Organize Feature Templates* dialog box. Click the **Tracts** template and click **Properties**.
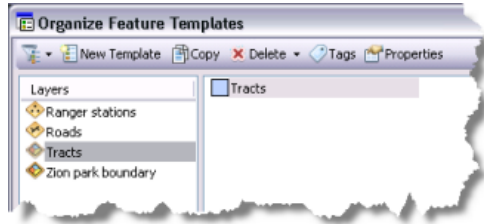
The *Template Properties* dialog box allows you to review and change the template settings. For example, you can rename a template, provide a description, set the default construction tool, and specify the attribute values that should be assigned to new features created with this template.

7. In the **Description** box, type `Private lands in Zion`. The description appears when you rest your pointer over a template in the Create Features window.
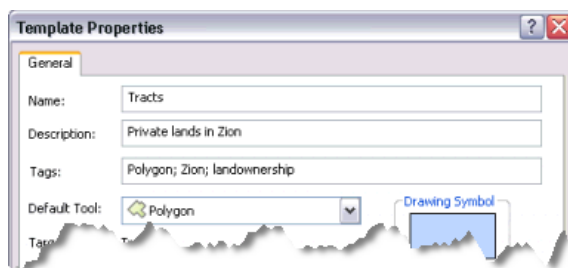

You can also use tags to identify and help search for templates in the future. A tag representing the layer type—Polygon—is added automatically.

8. Click in the **Tags** box immediately after `Polygon`, type a semicolon (`;`), add a space, then type `Zion`. Type another semicolon, add a space, and type `landownership`.
The **Tags** box should look like this when the tags are entered: `Polygon; Zion; landownership`.

9. The default tool should be Polygon. If it is not, click the **Default Tool** arrow and click **Polygon**. This ensures that the Polygon tool activates each time you choose the Tracts template.

10. Click the **Ownership** field in the grid. System information about the field is listed at the bottom of the dialog box.

11. Click **<Null>** for the value on the right side to clear the text and type `Private`, which will assign the attribute value Private. This sets Private as the default attribute value for that field for all new features created with this template.

12. Click **OK**.

13. Close the *Organize Feature Templates* dialog box. Notice that the new template is listed in the Create Features window. When you rest your pointer on the template, you see the text you entered for the description.
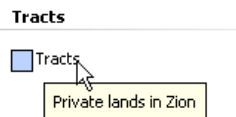
You can also access the properties of a template by double-clicking it in the Create Features window. By default, the templates are grouped and sorted by layer name. If you want to group them differently or filter to hide some of them, you can do so from the Arrange menu at the top of the Create Features window.

14. To continue to the next exercise, click Exercise 1d: Creating new polygon features.

You are now ready to create features using the properties specified in this feature template.

Exercise 1d: Creating new polygon features

About creating polygons

Since you have been exposed to the basic concepts and user interface elements of editing and creating features, you are now ready to learn advanced feature creation techniques. You will use several different methods to construct the polygon tract boundaries, including snapping, entering measurements, and drawing rectangles. You also will use keyboard shortcuts and right-click menus to improve productivity while creating features.

When Zion National Park became a protected area in the early 1900s, multiple owners held the land that became the park. Although Zion is mostly United States federal government land now, there are some areas within the park that are still owned privately. In this exercise, you will create some boundary lines representing the privately held features.

> **Note:** The values, shapes, measurements, and attributes in this exercise are for demonstration purposes only and do not reflect the actual property records.

Creating polygons using different construction methods

Prerequisite:
The Exercise1.mxd is open and you are in an edit session.

Choosing a template sets up the editing environment for the settings in that template. This action sets the target layer in which your new features will be stored, activates a feature construction tool at the bottom of the Create Features window, and prepares to assign the default attributes to the new feature. Since the layer's template is set up so the Polygon tool is the default feature construction tool, the Polygon tool becomes active.

By default, the Line and Polygon tools create straight segments between the vertices you click. These tools also have additional ways to define a feature's shape, such as creating curved lines or tracing existing features. These are known as construction methods and are located on the Editor toolbar.

Steps:

1. Turn off the **World imagery (Web)** layer in the table of contents.

2. Zoom to the **Tracts** bookmark.

3. In the *Create Features* window, click the **Tracts** template. This activates the **Polygon** construction tool , which you set as the default tool using the Template Properties.

    Since the tracts share an edge with the park boundary and an adjacent tract, you can use them to help you construct the shape of the polygon.

4. Click the **Straight Segment** construction method on the *Editor* toolbar.

    With the Straight Segment construction method, a vertex is placed each time you click, with the segments between vertices being straight lines.

5. Snap to the intersection of the park boundary polygon and the tract line feature and click once.

6. Move your pointer up (to the north), snap at the corner of the tract and the park boundary, then click again. You now have created two vertices with a straight line connecting them to define the eastern boundary of this tract.

7. Click **Midpoint** ⟋ on the palette on the *Feature Construction* mini toolbar, which appeared on-screen near your pointer after you placed the first vertex of the polygon. This changes the active segment construction method from Straight Segment to Midpoint, which creates a vertex in the center of two locations you click. You will use Midpoint to create a vertex between two corners of the existing tract.
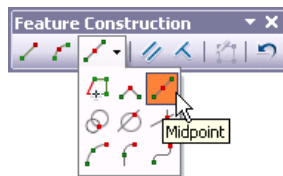
The buttons to choose a segment construction method on the Feature Construction toolbar are also found on the Editor toolbar, but it is often easier to access them on the Feature Construction toolbar since it is closer to your pointer. If you click a segment construction method on the Feature Construction toolbar, it then becomes active on the Editor toolbar, and vice versa. Two of the most common segment construction methods, Straight Segment and Endpoint Arc Segment, are located directly on the toolbar, but there is a palette to the right of these buttons containing additional methods.

8. Move the pointer to the right and click the eastern corner of the tract (the previous vertex you added). As you move the pointer, notice a black line with a small square in the middle. The square indicates where the new vertex will be added.

9. Move your pointer to the left and click the western corner of the existing tract. The new vertex is added where the square was located as soon as you click the second point.
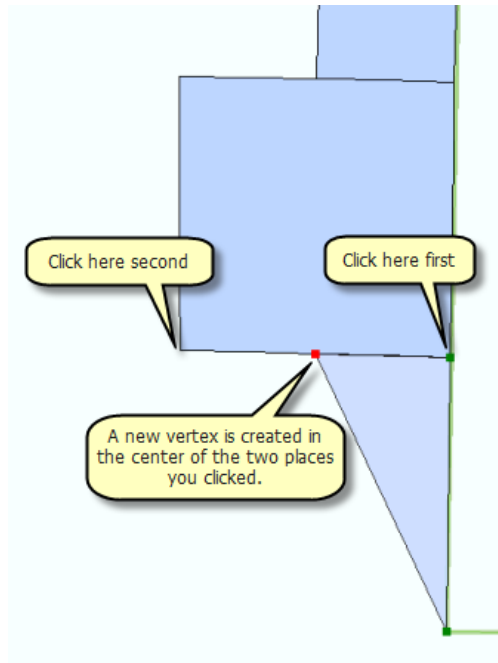
10. Click the **Straight Segment** construction method ✏ on the *Feature Construction* mini toolbar.

This changes the active segment construction method back to Straight Segment rather than Midpoint.

11. To enter the final measurement for the corner, you need to type a specific coordinate.

12. Press the F6 key. This is the keyboard shortcut for Absolute XY, which allows you to type an exact x,y coordinate for the next vertex. By default, the values you enter are in map units, which are meters for this map. If you want to enter values in decimal degrees or other formats, you can click the arrow to change the input boxes.
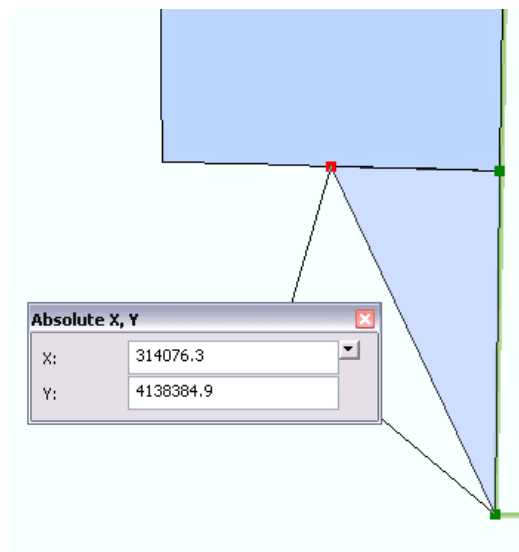
> 💡 **Tip:** If you make a mistake and want to cancel out of a sketch constraint, which is a command that limits the placement of the next vertex, you can press the ESC key. Once a vertex is added, you can delete it by pressing the **Undo** button 🔄 on either the *Feature Construction* toolbar or the *Standard* toolbar.

13. Type `314076.3` in the **X:** box, type `4138384.9` in the **Y:** box, then press ENTER. A new vertex is automatically created in that location.

14. Click **Finish Sketch** 📐 on the *Feature Construction* mini toolbar.

    You have created the first polygon lot feature. You could also use the F2 key, double-click the map, or right-click to finish the sketch.

15. Click the **Identify** tool on the *Tools* toolbar.

16. Click the new feature and notice that the attribute value for the Ownership field is Private, which is the default value you set in the template's properties.

    If you identified a different layer, click the **Identify from** arrow, click the **Tracts** layer, then try clicking the feature again.

17. Close the *Identify* window.

Creating rectangular polygons

Sometimes you need to create rectangular polygons. Rather than clicking each vertex individually as you have been doing, you can use the Rectangle construction tool. The first click with the Rectangle tool creates the first vertex, then the second click establishes the "angle" of the rectangle, and the final click adds the remaining corner vertices. In addition, the Rectangle tool allows you to enter x,y coordinates for the vertices, as well as directions and lengths for the sides.

Steps:

1. Click the **Pan** tool on the *Tools* toolbar and pan the map slightly to the west so the J-shaped polygon is centered in the display.

2. Click the **Tracts** template, then the **Rectangle** tool ▫ on the *Create Features* window to make it the active construction tool.

3. Snap to the upper left corner of the J-shaped polygon and click to set the first corner of the rectangle.
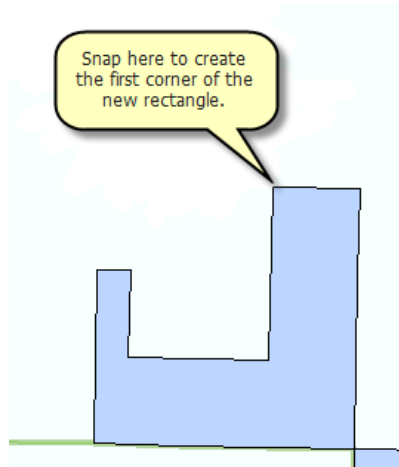
4. Press the D key, type 179 (as in 179 degrees), then press ENTER. This establishes the angle for the rectangle. As you move your pointer around the map, you see a rectangle preview of the feature.
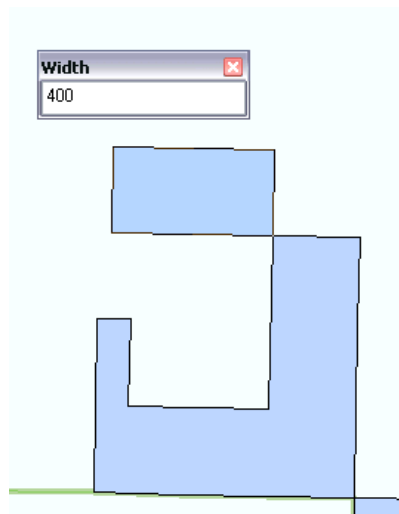
   By default, angles are entered in degrees using the polar system, which is measured counterclockwise from the positive x-axis. You can specify a different direction measuring system or unit on the Editing Options dialog box > Units tab.

5. Press the W key, type 400, then press ENTER. This is the shortcut to set a width of 400 meters, which are the map units.

6. Move your pointer up and to the left so the rectangle is created in the correct position in relation to the existing feature. Press the L key, type 800, then press ENTER. This is the shortcut to set a length of 800 meters.

   💡 **Tip:** In addition to using these keyboard shortcuts, you can right-click to access a menu containing commands for the direction, length, width, and other settings for creating a rectangle.

Creating adjoining polygons

You now need to create one more polygon to fill in the space between these two polygons. You could snap to every vertex, but an easier way is to use the Auto-Complete Polygon tool, which uses the geometry of existing polygons to create new adjacent polygons that do not overlap or have gaps.

Steps:

1. Click the **Tracts** template, then the **Auto-Complete Polygon** tool 🔲 on the *Create Features* window to make it the active construction tool.

2. Snap to the lower left corner of the rectangle you just created and click.

3. Move southward, snap to the corner of the original existing J-shaped polygon, and click to add a vertex.
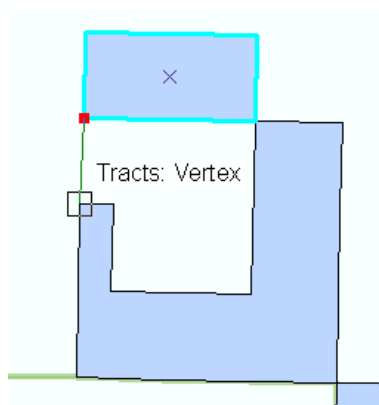
4. Click **Finish Sketch** 🔂 on the *Feature Construction* mini toolbar.

   When using the Auto-Complete Polygon tool, ArcMap automatically uses the shapes of the surrounding polygons in that layer to create the geometry for the new polygon.
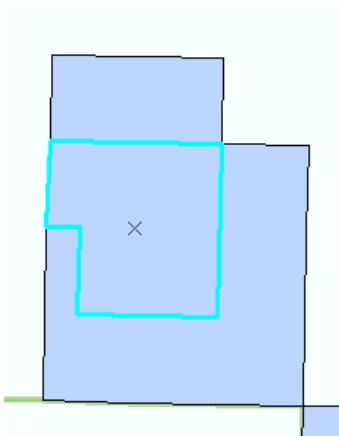
5. Click the **Editor** menu on the *Editor* toolbar and click **Stop Editing**.

6. Click **Yes** to save your edits.

7. Close ArcMap if you are done working with the tutorial. You do not need to save the map document.

8. To continue to the next exercise, click Exercise 2a: Defining new types of features to create.

The new features have been created with the default attribute values (Private) specified in the template. If you wanted to add other information, such as ID numbers, select the features and type the values into the Attributes window.

Exercise 2a: Defining new types of features to create

About the Define New Feature Type wizard

Sometimes you may want to create features of a certain type in an existing layer, but the layer is not set up to capture those features. For example, you want to add features to a roads layer to represent an unpaved road, but you currently only have categories in your data for

Complexity: Beginner
Data Requirement: ArcGIS Tutorial Data Setup
Data Path: \ArcGIS\ArcTutor\Editing

freeway, major highway, and local road. Through a wizard, you can define everything about the unpaved road category at one time—making it easy to prepare your data to display and store the new types of features. ArcMap automatically adds a symbol for the new category, any required geodatabase information (such as subtype value or coded domain value) for that layer, and a feature template to use when creating an unpaved road. The wizard saves you from having to stop your work to open multiple dialog boxes to set up the data on your own.

The park contains several areas of natural, cultural, or historical significance that are designated for research and education purposes only and are not open for public recreational use. In this exercise, you will define a new category of features to represent buffer regions around areas in the park that have been proposed for research-only use. This new category can show the area where travel is not recommended but is not prohibited.

The Research areas layer is symbolized by unique values, so the Define New Feature Type wizard allows you to define the symbol and create a feature template containing the default attributes for the new buffer zones category. You will use an existing feature to create the new buffer around it in a later exercise.

Steps:

1. Click the **Open** button ⬛ on the *Standard* toolbar.

2. Navigate to the **Exercise2.mxd** map document in the Editing directory where you installed the tutorial data. (C:\ArcGIS\ArcTutor is the default location.)

3. Click the map and click **Open**.

4. If you still have the map document open from the previous exercise and are prompted to close it, you can do so without saving your changes.

5. If you are prompted to enable hardware acceleration to improve performance, click **Yes**.

6. Right-click the **Research areas** layer in the table of contents, point to **Edit Features**, then click **Define New Types Of Features**.
   The *Define New Feature Type* wizard starts.

7. Click **Change Symbol** to choose a different symbol to be used for the new buffer areas.

8. Click the **Color** drop-down arrow and click **Gray 30%** to change the fill color to gray.
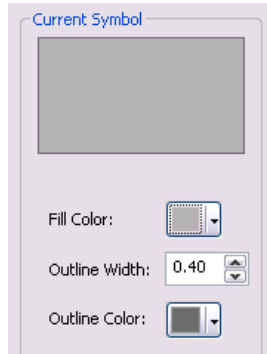
9. Click **OK** on the *Symbol Selector* dialog box.

10. Click in the **Name** box and type `Buffer zones`.
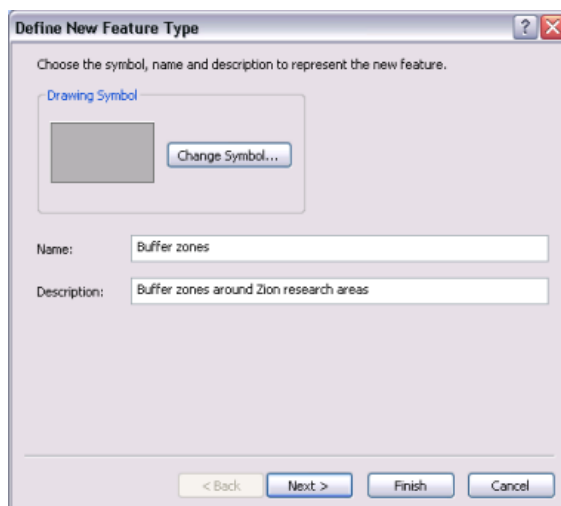
11. Click in the **Description** box and type `Buffer zones around Zion research areas.`

12. Click in the **Tags** box. Select the text following `Polygon;`, delete it, then type `Buffers`. The **Tags** box should appear as `Polygon; Buffers` when you are finished. Make sure the tags are separated by a semicolon.

13. Click **Next**.

    The next panel in the wizard shows you the existing categories in the layer.

14. For **Value** and **Label**, type `Buffer zones`. They should be populated automatically from the name you set on the previous panel of the wizard. The label is used to display the symbol category in the table of contents and legend.
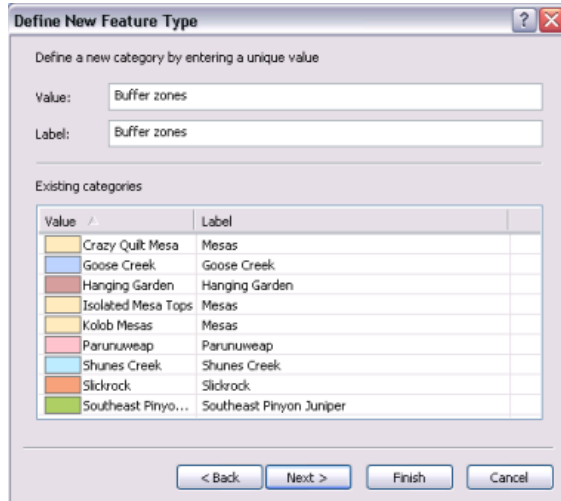
15. Click **Next**.

    The next panel in the wizard allows you to set the default attribute values that will be used for new features created with the new Buffer zones feature template. This panel should be familiar to you from the exercise where you set the default attribute values for the landownership tracts.

16. Notice that `Buffer zones` is already set as the default attribute value for the **Name** field. You could also set defaults for the **Comment** field; however, you will leave it blank since any comments will be specific to each feature you create, rather than a universal default.
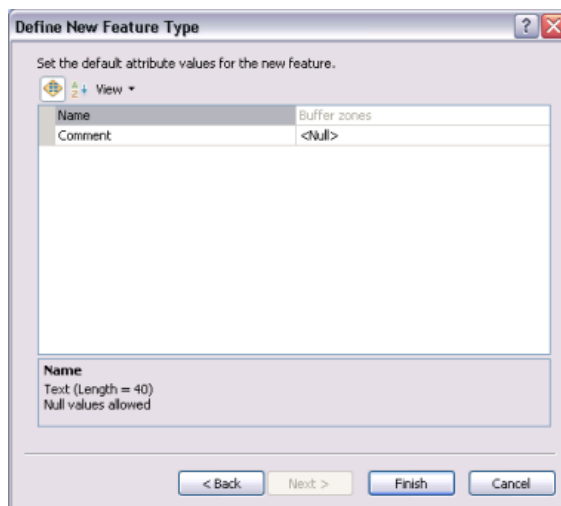
17. Click **Finish**.

18. A message appears that the new feature type was added successfully. Click **No** to quit adding new types.
    The new symbol appears in the layer's entry in the table of contents, and a new feature template has been created.

19. Click the **Editor** menu on the *Editor* toolbar and click **Start Editing**.

    Notice that the *Create Features* window lists a new feature template for the Buffer zones.

20. To continue to the next exercise, click Exercise 2b: Creating features from existing features.

Now that you have added a feature template for the new type, you are ready to start creating features.

Exercise 2b: Creating features from existing features

About buffering features

You are provided with a polygon feature showing one of these research-only locations in the park and will use it to create another feature representing a buffer zone around it. You will select the original research-only polygon and use the Editor menu > Buffer command to create the new feature.

When you click the Buffer command, a dialog box opens allowing you to specify a feature template and buffer distance. Like other measurements when editing, the buffer distance is specified in map units, but you can also give the value in other units by specifying a distance units abbreviation with the value that you enter.

Prerequisite:
The Exercise2.mxd is open and you are in an edit session.

Editing commands that create new features automatically from existing features, such as Buffer, require you to choose the feature template to use when creating the new feature. Similar to clicking a feature template in the Create Features window, choosing a template on these dialog boxes defines the layer where a feature will be stored and the default attributes for the new feature. A buffer feature can be created as either a line or a polygon, so you could see both line and polygon templates listed but no templates for any other types of features.

Steps:

1. Navigate to the **Research-only area** bookmark. The map zooms to the Goose Creek area of the park. The polygons depict research-only areas.

2. Turn off the **Streams** layer in the table of contents. This makes it easier for you to see and select the correct features.

3. Click the **Edit** tool ▸ on the *Editor* toolbar.

4. Select the southernmost **Research areas** polygon—the tan-colored one.
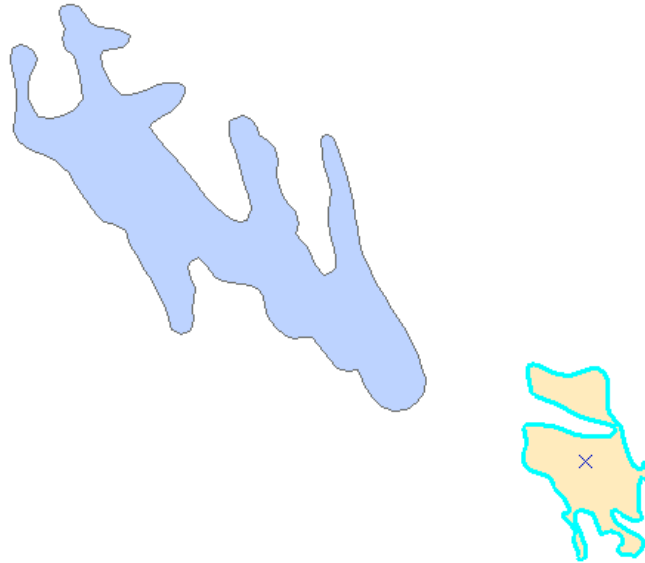
5. Click the **Editor** menu and click **Buffer**.

6. Click the **Template** button on the *Buffer* dialog box.

7. Click the **Buffer zones** polygon template on the window.

   The Select Feature Template window shows only templates that are valid output types for the particular command rather than all the templates listed on the Create Features window. In the case of Buffer, polygon and line templates would be listed, if available, since both these geometry types can store the new buffer feature. On the other hand, when using a command, such as Copy Parallel, that creates line features, only line feature templates are listed for that command. If you want to find a template by name, you can enter it into the <Search> box.

8. Click **OK** on the *Select Feature Template* window.

9. Type 300 in the **Buffer Distance** text box. This means a buffer will be created 300 meters (the map units) from the border of the selected polygon.
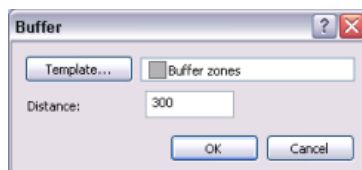
10. Click **OK**.
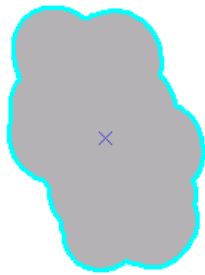
The new 300-meter polygon buffer feature is created using the properties of the **Buffer zones** feature template. The new feature is selected and is drawn on top of the existing feature.

11. To continue to the next exercise, click Exercise 2c: Editing polygon features.

In this exercise, you used an editing command, Buffer, to generate a feature from an existing feature and chose the feature template to use when creating the new feature.

Exercise 2c: Editing polygon features

About editing polygons

In the previous exercise, the Buffer command created a feature that is the extent of the original feature plus the buffer distance. Since this feature should just be the buffer, you need to remove the shape of the original inner feature from the current buffer feature. You can use the Editor menu > Clip command to cut a hole in the polygon feature.

You will also use the Cut Polygons tool to split a polygon by an overlapping line feature.

Complexity:
Intermediate

Data Requirement:
ArcGIS Tutorial Data Setup

Data Path:
\ArcGIS\ArcTutor\Editing

Cutting a hole in a polygon

Prerequisite:
The Exercise2.mxd is open and you are in an edit session.

The new feature is drawn on top of the existing one. To use Clip, you need to select the underlying existing feature. The Edit tool has special capabilities to help you select the correct feature from overlapping ones.

Steps:

1. Click the **Edit** tool ▸ on the *Editor* toolbar.

2. Click the center of the buffer feature. Since there are multiple selectable features where you clicked, the selection chip appears. Click the arrow to the right of the icon to view a list of the features from which you can select. Features are listed in the selection chip by their display expression, which is set on the Layer Properties > Display tab.
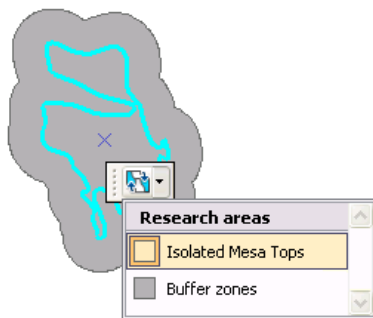
3. Rest your pointer over a feature in the list to flash it on the map. Click the **Isolated Mesa Tops** feature to select it. You will use this feature to clip a hole in the Buffer zone polygon.

4. You can check that the correct feature is selected by clicking the **List By Selection** button in the table of contents and noting that only the **Isolated Mesa Tops** is listed in the **Research areas** layer in the **Selected** category.

    The Editor > Clip command only clips polygon features that are within a buffer distance of a selected feature—in this case, the Isolated Mesa Tops research area.

5. Click the **Editor** menu and click **Clip**.

6. Ensure the **Buffer Distance** is 0. This way, you will be clipping to the exact border of the selected feature rather than at a distance from it.
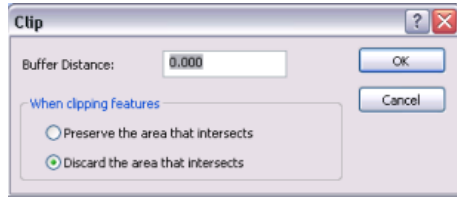
7. Click **Discard the area that intersects**. This removes the overlapping area from the feature that is being clipped.

8. Click **OK**. The overlapping area is clipped and now the original Research areas feature is visible through the hole in the buffer feature.

9. Click the **List By Selection** button in the table of contents, if you are not already listing layers this way, then click each feature on the map and note that the selected feature changes in the list in the table of contents. The **1** to the right of the selection icons indicates that there is one selected feature.
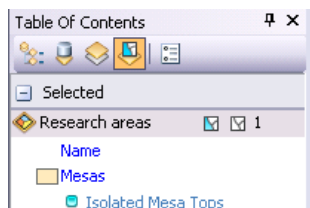
Since the buffer feature has a hole in it, its geometry is represented in ArcGIS as a multipart polygon. Multipart features either contain holes in them or are composed of more than one physical part that only references one set of attributes. For example, the individual islands that make up Hawaii are often represented as a multipart polygon feature. You can view the list of parts in a feature by double-clicking it with the Edit tool and opening the Edit Sketch Properties window.

Cutting a polygon

The neighboring research area needs to be divided into two polygons based on the river that runs through the middle. You can use the Cut Polygons tool to split the polygon.

To use the Cut Polygons tool, you need to select the polygon, then digitize a line where you want to cut the polygon. To change the shape of the line used to cut the polygon, click a construction method type on the

Editor toolbar or on the Feature Construction mini toolbar. Segments can be created using a variety of methods, for example, as straight lines, with curves, or traced from the shapes of other features.

If you are cutting a polygon along a simple line, you can click to draw the line using the Straight Segment construction method. However, in this case, the river feature you want to use to cut with is long and curved, so it will be easier to trace around the border to create the line.

Steps:

1. Click the **Edit** tool ▸ on the *Editor* toolbar.

2. Click the **Goose Creek** research area, the blue polygon just to the west of the polygons you were previously editing. You may need to zoom in or pan to this feature so you can see it better.

3. In the table of contents, click the gray layer icon to the left of the **Streams** layer to make the streams visible again so you can trace along them. When you do this, the layer icon becomes colored ◈.
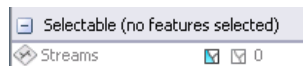
4. Click the **Snapping** menu on the *Snapping* toolbar and click **Intersection Snapping** . This turns on snapping to intersections between features, which will help you ensure that the line used to cut the polygon starts and stops at the intersection of the polygon and line edges.

5. Click the **Cut Polygons** tool ⊞ on the *Editor* toolbar.

6. Click **Trace** ◿ on the *Editor* toolbar palette.

7. Snap to the intersection of the polygon edge and the stream line near the buffer polygons, then click to start tracing the line through the polygon. Follow along the stream line to trace it.
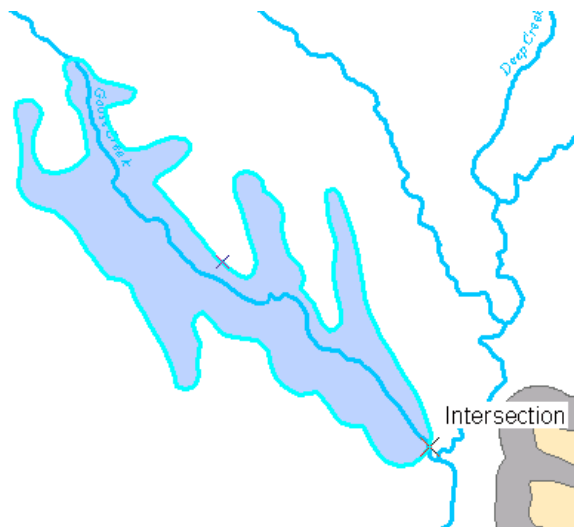
8. Once you have traced all the way across the polygon, snap to the intersection of the polygon and line at the northern edge of the polygon, and click the map to place vertices.

9. Right-click anywhere on the map and click **Finish Sketch**.

10. You are finishing the sketch used to cut the polygon. The polygons flash on the map as the cut is made and the new features are selected. If an error occurs, ensure that you have the correct feature selected, try the trace again, then make sure your line goes completely across the polygon. It may help to zoom in when you start and end the trace.
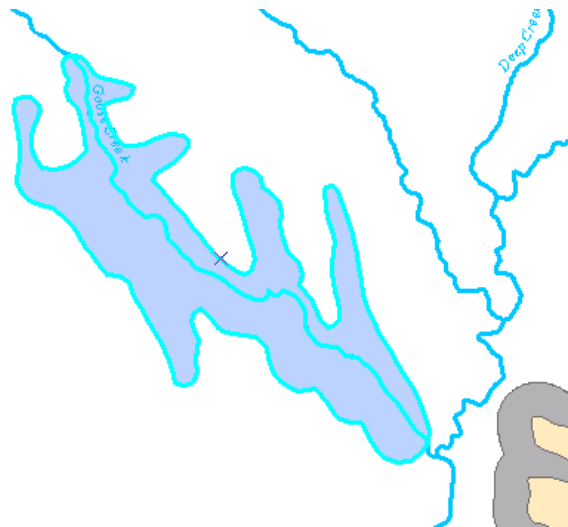
11. Click the **Edit** tool ▸ on the *Editor* toolbar.

12. Click each new feature and notice that you now have two polygons.

13. Click the **Editor** menu on the *Editor* toolbar and click **Save Edits**.

14. Click the **Editor** menu on the *Editor* toolbar and click **Stop Editing**.

15. To continue to the next exercise, click Exercise 2d: Editing vertices and segments.

In this exercise, you learned how to clip polygons and split them by tracing along an overlapping line feature.

Exercise 2d: Editing vertices and segments

About editing vertices and segments

In the previous exercise, you edited whole features. In this exercise, you will be editing the vertices and segments that make up a feature. You can double-click a feature with the Edit tool to edit its shape. When you do this, the Edit tool pointer changes from a black arrow to a white arrow to show you can directly select vertices and modify segments.

The Edit Vertices toolbar provides quick access to some of the most commonly used commands when editing vertices. It appears on-screen whenever either the Edit tool or the Topology Edit tool is active and you are editing the vertices of a feature or topology edge. The toolbar floats the first time it appears but can be docked after that.

> **Note:** This exercise requires an active Internet connection since it uses imagery served from the Web. If you do not have an Internet connection or if the imagery is loading slowly, you can still perform the tutorial using an image that is installed with the tutorial data. You need to turn on the **DOQQ imagery (local)** layer in the table of contents, then you can turn off the **World imagery (Web)** layer.

Editing vertices and segments

You will drag the vertices and handles to edit the shape of a line that was poorly digitized on a trailhead that starts at a road and ends near a stream.

Steps:

1. Make sure you have stopped editing from the previous exercise.

2. In the table of contents, click the **List By Drawing Order** button .

3. Right-click the **Editing features** data frame name and click **Activate** to make this the active data frame.

4. Click the **Editor** menu on the *Editor* toolbar and click **Start Editing**.

5. Close the *Create Features* window. You will not need it in this exercise.

6. Navigate to the **Trail** bookmark.

7. Click the **Edit** tool ▸ on the *Editor* toolbar.

8. Select the trail line (the dashed line) that connects to the road and click the **Edit Vertices** button on the *Editor* toolbar. When you are viewing the sketch geometry of a feature, the *Edit Vertices* toolbar appears, giving you quick access to commands used when editing a feature's vertices and segments.

When compared to the aerial photograph, notice that this line is straight when it should be curved, and it also has some extra vertices. You can easily change a straight segment into a circular arc or Bézier curve, and vice versa, and delete the extra vertices. A Bézier curve is smooth and has on each of its two endpoints handles that can be moved to change the direction and the steepness of the curve. You can create Bézier curves by digitizing them using the Bézier Curve sketch construction method or by using certain editing commands, such as Smooth on the Advanced Editing toolbar.

9. Move your pointer over the middle of the segment closest to the road and notice that the pointer changes to indicate you are working with a segment. Right-click, point to **Change Segment**, then click **Circular Arc**.

10. The segment changes to an arc. Click the arc, drag it, and drop it over the trail on the aerial photograph. You can hold down the SPACEBAR key to turn off snapping temporarily if you are having difficulty placing the curve where you want it.
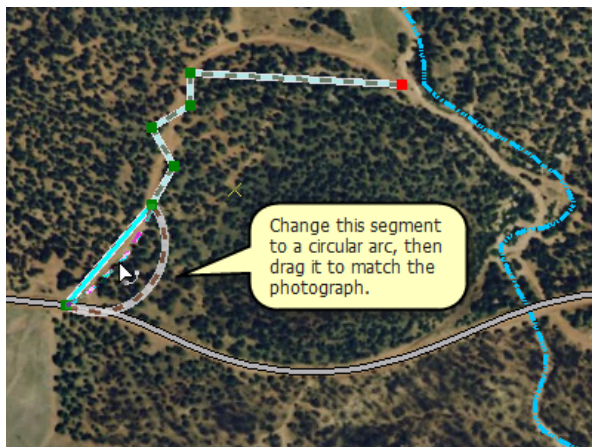
11. Click the map away from the feature to update its shape, then double-click the feature, which accomplishes the same thing as using Edit Vertices.

12. Click the **Delete Vertex** tool 📐 on the *Edit Vertices* toolbar. The Delete Vertex tool looks like the white Edit tool with a minus sign (-) next to it.

13. Drag a box around the three vertices that form a zigzag shape between the previous segment and the horizontal segment. This deletes those vertices, as they are in the incorrect locations and are not needed to maintain the shape of the line in this area.
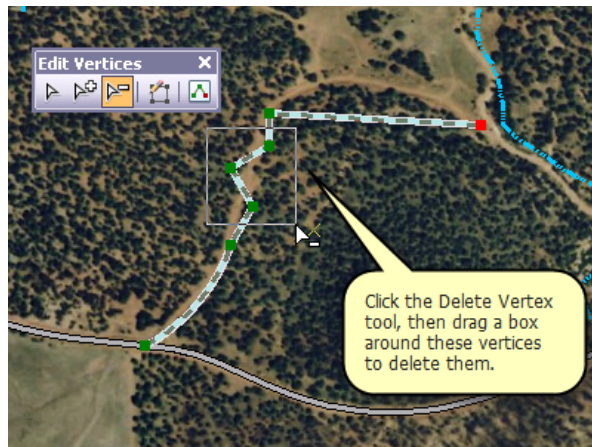
14. Click the **Modify Sketch Vertices** tool ▷ (the white Edit tool) on the *Edit Vertices* toolbar. This allows you to continue working with the segments and vertices.

15. Right-click the northernmost segment, point to **Change Segment**, then click **Bézier**.
    A new set of Bézier curve handles is added, and the segment changes into an S-shaped curve. You can see the locations of the vertices and handles, which are displayed in blue. Rest your pointer over a green vertex, then rest it over a blue handle. You get different pointer icons depending on the type of point you are over.

16. Drag the handles to reshape the curve to match the aerial photograph.
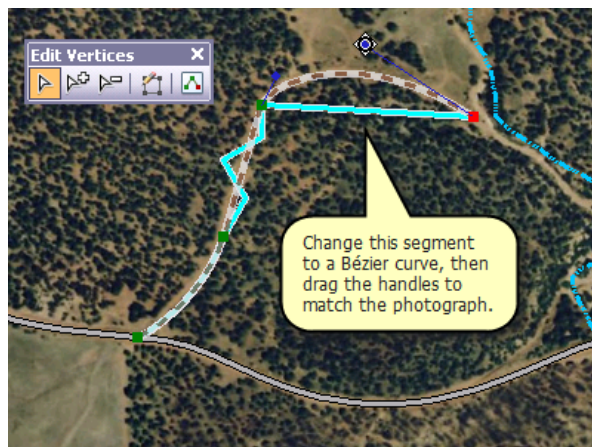
17. Click the map to update the changes you made to the shape. If you need to refine the line's shape further, double-click it again with the Edit tool and modify the segments. If you want to insert or delete a vertex, use the tools on the *Edit Vertices* toolbar.

18. Click the **Editor** menu on the *Editor* toolbar and click **Save Edits**.

19. Click the **Editor** menu on the *Editor* toolbar and click **Stop Editing**.

20. Close ArcMap if you are done working with the tutorial. You do not need to save the map document.

21. To continue to the next exercise, click Exercise 3a: Converting labels to annotation.

You changed segments into different types and edited vertices.

Exercise 3a: Converting labels to annotation

About annotation features

Annotation is a way to store text to place on your maps. With annotation, each piece of text stores its own position, text string, and display properties. Dynamic labels, based on one or more attributes of features, are the other primary option for placing text on maps. If the exact position of each piece of text is important, you should store your text as annotation in a geodatabase. Annotation provides flexibility in the appearance and placement of your text because you can select individual pieces of text and edit them. You can convert labels to create new annotation features.

In this exercise, you will convert labels into geodatabase annotation so you can edit the text features.

Preparing the labels for conversion

The map you will use in this exercise contains roads and water features in Zion National Park. The layers in the map have dynamic labels, but some of the map features could not be labeled due to space constraints. When you convert the labels to annotation, you can position each piece of text manually.

Steps:

1. Click the **Open** button ⬆ on the *Standard* toolbar.

2. Navigate to the **Exercise3.mxd** map document in the Editing directory where you installed the tutorial data. (C:\ArcGIS\ArcTutor is the default location.)

3. Click the map and click **Open**.

4. If you still have the map document open from the previous exercise and are prompted to close it, you can do so without saving your changes.

   Each feature layer has dynamic labels, and the Streams layer has label classes based on the layer's symbology. Label classes let you create different labels for different types of features in a given layer, so for example, intermittent streams can be given smaller labels than perennial streams.

5. Click **Customize**, point to **Toolbars**, then click **Labeling**.

6. To view which labels do not fit, view the unplaced labels. Click the **View Unplaced Labels** button .

   The labels that could not be placed are displayed in red. It might be possible to fit these labels by adjusting their size, changing the feature and label weights, or making the map larger. However, for this exercise, you will convert the labels to annotation and place or delete the unplaced annotation.

<div style="background:#e5e5e5">
Complexity:
   Beginner
Data Requirement:
   ArcGIS Tutorial Data Setup
Data Path:
   \ArcGIS\ArcTutor\Editing
</div>
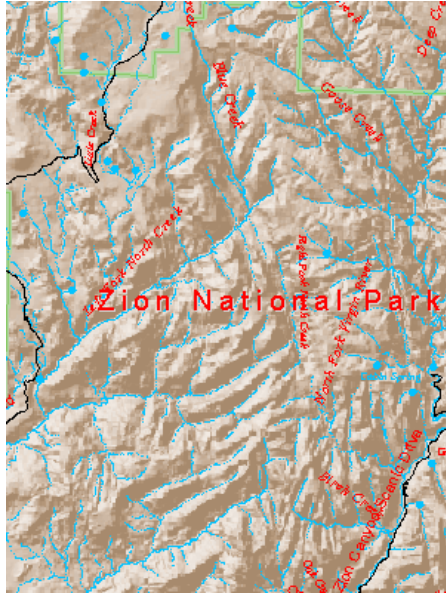
7. Click the **View Unplaced Labels** button again to hide the unplaced labels.

   Annotation features have a fixed position and size, so when you zoom in to the map, they appear to get larger. Labels are dynamically drawn according to their layer's label properties. If the map does not have a reference scale, they are drawn at their specified font size regardless of the map scale. To make labels behave more like annotation, you can set a reference scale for the map. The labels are drawn with their specified font size scaled relative to the reference scale. When converting labels to annotation, you should specify a reference scale. If you do not, the current map scale is used as the reference scale for the annotation.

8. Type `170000` in the **Map Scale** box on the *Standard* toolbar and press <u>ENTER</u>.

9. In the table of contents, click the **List By Drawing Order** button , if it is not already the active way to sort layers. Then, right-click **Layers** (the name of the data frame), point to **Reference Scale**, then click **Set Reference Scale**.

   Now if you zoom in or out, the labels become correspondingly larger or smaller. You are ready to convert these labels to annotation.

Converting labels to annotation

Annotation can be stored in a map document or in feature classes in a geodatabase. You will convert these labels to annotation stored in a geodatabase. The Convert Labels to Annotation dialog box allows you to specify what kind of annotation to create from the labels, which features to create annotation for, and where the annotation will be stored.

   Steps:

1. In the table of contents, right-click **Layers** and click **Convert Labels to Annotation**.

   ArcView users can view feature-linked annotation, but they cannot create it or edit datasets that contain it. If you have an ArcView license, the Feature Linked column of check boxes is unavailable. In this exercise, you will create standard annotation features. Skip the next step if you have an ArcView license.

2. Uncheck the check boxes in the **Feature Linked** column.
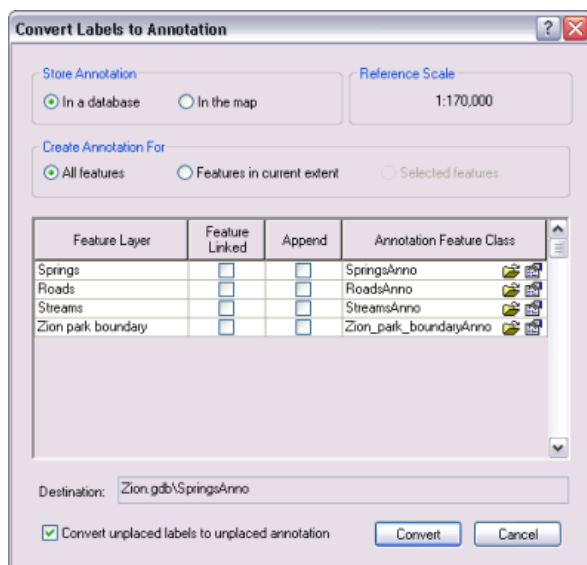
Small folder icons, the browse buttons, appear beside the annotation feature class names as you uncheck the **Feature Linked** check boxes. Feature-linked annotation must be stored with the feature class that it is related to in the geodatabase. Standard annotation feature classes can be stored in other geodatabases; after unchecking the boxes, you have the option to specify a new location for your annotation. Standard annotation feature classes are stored in the same dataset as their source feature class by default. If a feature layer on the map was based on a shapefile or coverage feature class, the browse button would have been visible and you would need to browse to a geodatabase to store the new annotation feature class.

3. Verify that **Convert unplaced labels to unplaced annotation** is checked. This gives you a chance to manually place the annotation for the features that could not be labeled.

4. Click **Convert**.
   The labels are converted to annotation. The process should take less than a minute, though the speed depends on your computer. When the annotation feature classes are created, they are added to ArcMap.

   Each layer's label classes are stored as separate annotation classes within a single annotation feature class. For example, the two label classes for streams become two annotation classes, Intermittent and Perennial, within the StreamsAnno annotation feature class. These annotation classes can be turned on and off independently, and they can have their own visible scale ranges.

5. To continue to the next exercise, click Exercise 3b: Editing annotation features.

You have converted labels to annotation features. Next, you will place them on the map and edit their positions.

Exercise 3b: Editing annotation features

About editing annotation features

Now that the labels have been created, you will start an edit session and add the unplaced annotation features to the map. The Unplaced Annotation window lets you view unplaced annotation features in a table that can show all the unplaced annotation in the annotation feature classes on your map. You can filter the table to show annotation for a specific annotation class and choose whether to show annotation for the whole extent of the data or for the current visible extent. You can sort the table alphabetically by the unplaced annotation's text content or annotation class by clicking either the Text or Class column heading.

Placing unplaced annotation features

Prerequisite:
The Exercise3.mxd is open.

Steps:

1. Click the **Editor** menu on the *Editor* toolbar and click **Start Editing**.

2. Click the **Editor** menu on the *Editor* toolbar, point to **Editing Windows**, then click **Unplaced Annotation**.

3. On the *Unplaced Annotation* window, check the **Draw** box to display the unplaced annotation features on the map.

4. Click **Search Now**. A number of annotation features are listed in the table. If you scroll through the table, you can see there are unplaced annotation features from several annotation classes represented. You can also see some new annotation features outlined in red on the map. You see these unplaced annotation features because the Draw box is checked.

5. Click the **Edit Annotation** tool ▸ on the *Editor* toolbar.

6. Click the map, press and hold down the Z key, then click and drag a box around the small cluster of unplaced annotation features at the east side of the park. The Z key is the keyboard shortcut to zoom in. To pan to this area, you can press the C key. You can also navigate to the **Zion Canyon** bookmark.
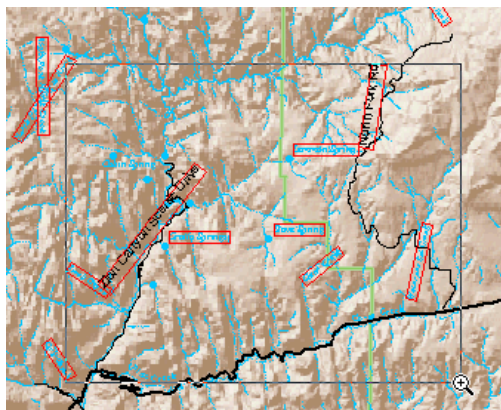
The Hillshade background layer has a visible scale range; when you zoom in closer than 1:85,000, it is no longer displayed. Setting a visible scale range is also a good idea for annotation feature classes, as they are most useful within the range of scales where they are legible. There is no need to spend time or—especially for multiuser geodatabases—network and database resources drawing annotation features when they cannot be read. You can set a visible scale range for a layer in ArcMap, or you can change the properties of the annotation feature class itself. The second method has the advantage that the annotation feature class will always be drawn within its visible scale range when it is added to a map.

7. Now that you have zoomed in to the cluster of unplaced annotation in the east side of the park, you are ready to start placing the unplaced annotation features. Click **Search Now**.

8. Right-click **Birch Creek** in the **Text** column and click **Place Annotation**. The Birch Creek annotation feature is placed. It is selected, so it has a blue outline instead of a red outline.

Making annotation follow along the edge of a feature

The annotation feature is straight and placed parallel to a segment of the stream feature. The other stream annotation features curve to follow the streams, so you will make this newly placed annotation feature follow the stream. You can make an annotation feature follow a line feature or the boundary of a polygon feature. The Follow Feature Options dialog box allows you to specify how annotation will behave when it follows a feature.

Steps:

1. With the **Edit Annotation** tool, right-click the **Birch Creek** annotation feature, point to **Follow**, then click **Follow Feature Options**.

2. For **Make annotation**, click **Curved**.
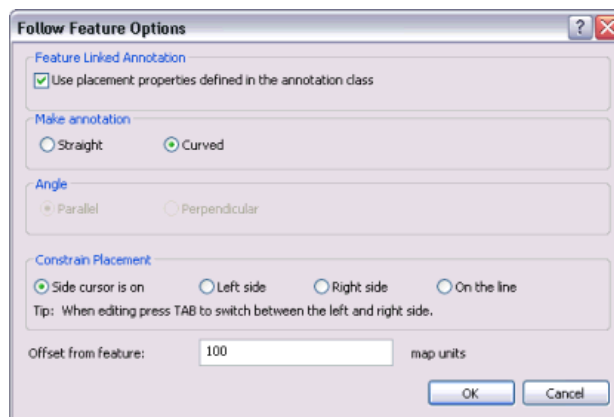
3. For **Constrain Placement**, click the **Side cursor is on** button to constrain the placement of the annotation.

4. Type `100` in the **Offset from feature** text box. The annotation will be offset 100 meters from the stream.

5. Click **OK**.

6. Move the pointer over the stream feature just south of the Birch Creek annotation feature, right-click, then click **Follow This Feature**.

The stream feature flashes, and the annotation feature bends to follow the stream. The selected annotation feature follows any line feature that you right-click and tell it to follow using the Edit Annotation tool.

7. Place the pointer over the middle of the **Birch Creek** annotation feature. The pointer changes to the four-pointed Move Annotation pointer.


8. Drag the **Birch Creek** annotation feature along the stream feature. Press the L key as you drag the annotation if you need to flip its reading direction.

Stacking and rotating annotation

You have placed an annotation feature and made it follow another feature with the Edit Annotation tool. The Edit Annotation tool also allows you to make other edits to annotation features. Now that you have placed the annotation feature from the StreamsAnno feature class, you will place the other nearby annotation features.

Steps:

1. On the *Unplaced Annotation* window, click **Grotto Springs**, then right-click it and click **Pan to Annotation**.

2. Press the SPACEBAR, which is the keyboard shortcut to place a selected annotation feature. The Grotto Springs annotation feature is placed.
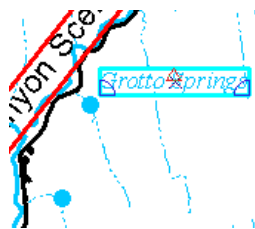
3. Right-click the feature on the map and click **Stack**. The Grotto Springs annotation feature is split at the space in the text, and the word **Grotto** is placed above the word **Springs.**

4. Move the pointer over the middle of the **Grotto Springs** annotation feature. The pointer will change to the four-pointed Move Annotation pointer. Click the middle of the **Grotto Springs** annotation feature and drag it toward the southwest so it is between the spring features.

5. On the *Unplaced Annotation* window, click **Zion Canyon Scenic Drive** and press the P key, which is the keyboard shortcut to pan to a selected annotation feature.

6. Right-click **Zion Canyon Scenic Drive** and click **Place Annotation**.

7. Right-click the **Zion Canyon Scenic Drive** annotation feature on the map and click **Stack**.

8. Click the middle of the **Zion Canyon Scenic Drive** annotation feature with the four-pointed Move Annotation pointer and drag it toward the southwest until the south end of the annotation feature is near the intersection with the road that branches off to the east, Highway 9.

9. Move the pointer over the blue, wedge-shaped rotate handle on the northeast corner of the **Zion Canyon Scenic Drive** annotation feature until the pointer becomes the Rotate pointer. Click the corner and drag it counterclockwise until the annotation feature follows the general trend of the road.
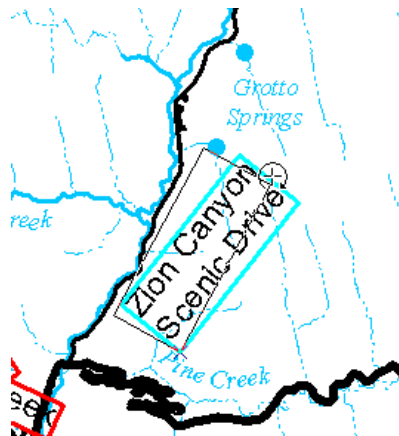
10. If you wanted, you could continue to place and edit the annotation features. When you are done, close the *Unplaced Annotation* window.

11. To continue to the next exercise, click Exercise 3c: Creating new annotation features.

You have placed, moved, stacked, and rotated annotation features with the Edit Annotation tool. Next, you will create new annotation features and edit them.

Exercise 3c: Creating new annotation features

About creating and editing annotation

Complexity:
Intermediate
Data Requirement:
ArcGIS Tutorial Data Setup
Data Path:
\ArcGIS\ArcTutor\Editing

With the completion of the exercises so far, you have learned how to create feature templates and set their properties. You created point, line, and polygon features by digitizing over an image, snapping to existing features, entering exact measurements, and using various construction tools and editing commands. In this exercise, you will learn how to create and edit annotation on your map, which has a similar workflow to creating other types of features. There are several different tools you can use to add annotation to the map; you will use two of them, Straight and Follow Feature.

Creating straight annotation

Prerequisite:
The Exercise3.mxd is open and you are in an edit session.

You will use the Straight annotation construction tool, which allows you to place annotation that has a straight baseline but may be rotated at an angle, to add some text to your map to identify canyons in the park.

Steps:

1. In the **Create Features** window, click the **Canyons** annotation feature template in the **CanyonsAnno** layer.

    When you activate an annotation template, the **Annotation Construction** window appears so you can enter the text and change the formatting of the feature you are going to create.

2. Click the **Straight** construction tool ⯈ on the **Create Features** window.

3. Type `Zion Canyon` in the **Annotation Construction** window. As you type, the text on your pointer changes as well.
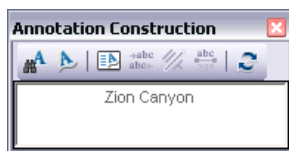
4. Click the map to the left of the road near **Grotto Springs**. The location you click is the center point of the new feature.

5. Rotate the annotation sketch counterclockwise to create annotation that is aligned with the road, stream, and canyon.

6. Click to place the annotation.

7. Press the E key until you have activated the **Edit Annotation** tool. The E key switches among the construction tools, the Edit tool, and the Edit Annotation tool.

8. Place the pointer over the red triangle on the edge of the Zion Canyon annotation feature. The pointer changes to the two-pointed Resize Annotation pointer, allowing you to resize interactively so the feature fits better.

9. Drag the resize handle toward the middle of the annotation feature. The feature shrinks as you drag it.
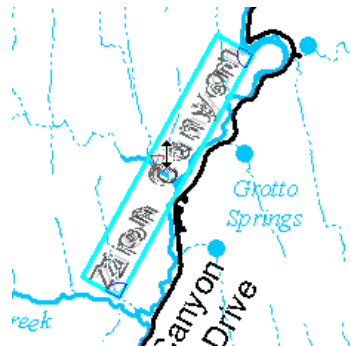
10. Drag the annotation feature if you need to reposition it again.

Creating annotation that follows the edge of a line

The next style of annotation you will create is follow feature annotation, which is designed to follow along or match the shape of lines or polygon edges. You will use the Follow Feature construction tool to create annotation that follows the shape of the road and use the road's attributes as the text for the annotation.

Steps:

1. In the *Create Features* window, click the **Default** annotation feature template in the **RoadsAnno** layer.

2. Click the **Follow Feature** construction tool ⬥ on the *Create Features* window.

3. On the *Annotation Construction* window, click **Follow Feature Options** to set options for how the annotation will be placed as it is dragged along the stream. The options should still be set from when you constructed follow feature annotation. If not, make the annotation curved and constrained to be placed on the side the cursor is on at a 100-meter offset. Click **OK** when you are done.
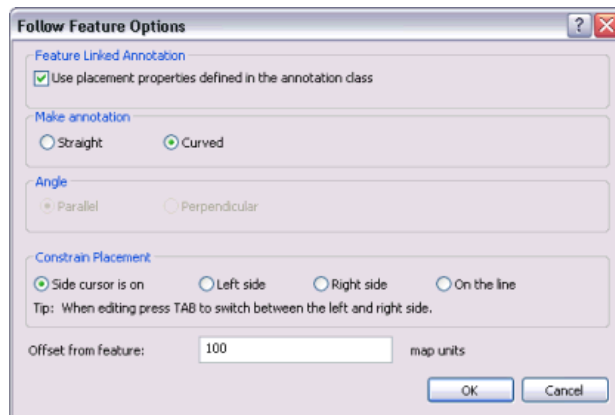
4. Click **Find Text** on the *Annotation Construction* window. **Find Text** allows you to click a feature and populate the annotation string with an attribute from another feature.

5. Move the pointer over the road feature that branches off toward the east from the intersection with **Zion Canyon Scenic Drive** and snap to and click the road. **Highway 9** should appear in the **Text** box on the *Annotation Construction* window and on the tool's pointer. If Zion National Park or Clear Creek appear, click **Find Text**, move the pointer over the road feature, then try again.

47

6. Click the road feature, which becomes highlighted, and drag the Highway 9 annotation feature along the line. Press the <u>L</u> key if you need to flip the reading direction.

7. Click to place the annotation.

   You could continue to place unplaced annotation, edit annotation, create new annotation features, and delete unwanted annotation until the map suits your needs. This annotation is stored in geodatabase annotation feature classes, each of which can be reused on other maps. When you have completed your edits, stop editing and save them.

8. Click the **Editor** menu on the *Editor* toolbar and click **Stop Editing**.

9. Click **Yes** to save your edits.

10. Close ArcMap if you are done working with the tutorial. You do not need to save the map document.

11. To continue to the next exercise, click Exercise 4a: Editing shared features with a map topology.

In this exercise, you created new annotation features, edited their size and position, set the text string for a new annotation feature using attributes from another feature, and placed annotation features along a line.

Exercise 4a: Editing shared features with a map topology

About map topology

Many vector datasets contain features that share geometry. Features can share edges—for example, line segments—or nodes, the points at the ends of segments. For example, watershed polygons might have common edges along ridgelines, and lake polygons might share their shoreline edges with land-cover polygons. Three watersheds might share a single node at a mountain peak, and three river-reach features might share a node at a confluence. The Topology toolbar contains tools for working with topologically related features.

A map topology creates topological relationships between the parts of features that are coincident. You can specify the feature classes that you want to participate in the map topology. You can also choose the distance, or cluster tolerance, that defines how close together edges and vertices must be in order to be considered coincident. You can simultaneously edit shared edges and nodes with the Topology Edit tool when you create a map topology.

ArcView users can create and edit a map topology, which is the type used in this exercise. ArcEditor and ArcInfo users also can edit geodatabase topology, which defines a set of rules about the relationships between feature classes in a feature dataset. You will edit a geodatabase topology in another exercise.

Creating a map topology

Prerequisite:
Start ArcMap and display the ***Editor***, ***Snapping***, and ***Topology*** toolbars.

In this exercise, you will update multiple watershed features in two feature classes by creating a map topology.

Steps:

1. Click the **Open** button 📂 on the ***Standard*** toolbar.

2. Navigate to the **MapTopology.mxd** map document located in the \Editing\Topology directory where you installed the tutorial data. (C:\ArcGIS\ArcTutor is the default location.)

3. Click the map and click **Open**.

4. If you still have the map document open from the previous exercise and are prompted to close it, you can do so without saving your changes.

The map opens to the following view:
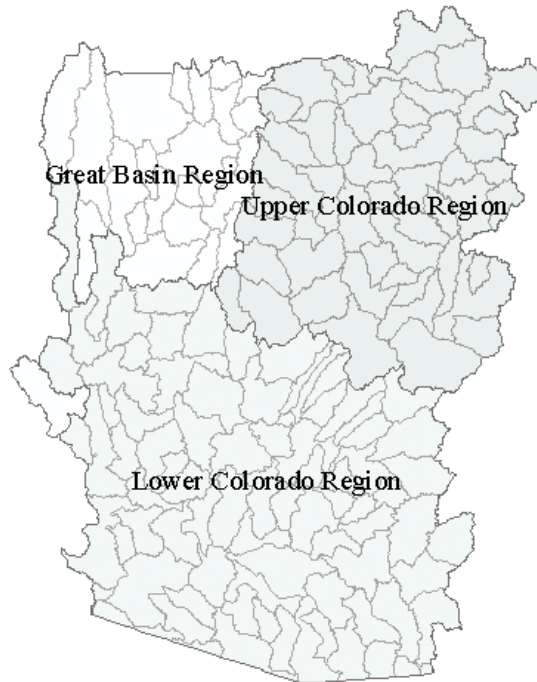
This map contains two feature classes. Hydro_region contains polygon features representing three large hydrologic regions in the southwestern United States. Note that part of the Great Basin regional watershed has been omitted from the tutorial dataset. Hydro_units contains polygon features representing smaller watersheds within these regions. You can see the features in the Hydro_units feature class because the Hydro_region features are partly transparent.

The regional data was derived by dissolving the smaller hydrologic units, so the boundaries of the features in Hydro_region are already coincident with the boundaries of the smaller watersheds. In this exercise, you will create a map topology to allow you to edit the vertices that make up a shared edge and move a node that defines the intersection of multiple features.

5. Click the **Editor** menu on the *Editor* toolbar and click **Start Editing**.

6. Close the *Create Features* window. You will not need it in this exercise.

   Before you create the map topology, zoom in to the area that you want to edit. Zooming in to an area reduces the number of features that the map topology analyzes when building the topology cache.

7. Click **Bookmarks** and click **3 Region Divide**.
   The map zooms to the bookmarked area. Now you can see labels for the smaller watersheds.

8. Click the **Map Topology** button on the *Topology* toolbar.

   The *Map Topology* dialog box appears. You can select the feature classes that will participate in the topology and choose a cluster tolerance. The cluster tolerance defines how close together parts of features must be before they are considered coincident.

9. Click **Select All**. You want all the features on the map from both feature classes to participate in the map topology.

The default cluster tolerance is the minimum possible cluster tolerance and is given in coordinate system units. In this case, the dataset is in the universal transverse Mercator coordinate system, and the units are meters. Accept the default cluster tolerance.

10. Click **OK**.

Finding shared features

Now you will start editing the map topology using the Topology Edit tool to select an edge and determine which features share it. You can use the Show Shared Features dialog box to investigate which features share a given topology edge or node and control whether edits that you make to a given topology element will be shared by certain features.

Steps:

1. Click the **Topology Edit** tool on the *Topology* toolbar.

2. Click the edge that is shared by the **East Fork Sevier. Utah. polygon (#16030002)** and **Kanab. Arizona, Utah. polygon (#15010003)**.

   The edge is selected and changes color. This edge is also shared by the larger regional polygons. To check this, you will use the Show Shared Features command.

3. Click **Show Shared Features** on the *Topology* toolbar.

   The names of both feature classes in the map topology, Hydro_region and Hydro_units, are listed with check marks on this dialog box. The checks mean that the selected topology element is shared by features in these feature classes and are affected by any edits you make to the shared edge. Next, you will see which features share this edge.
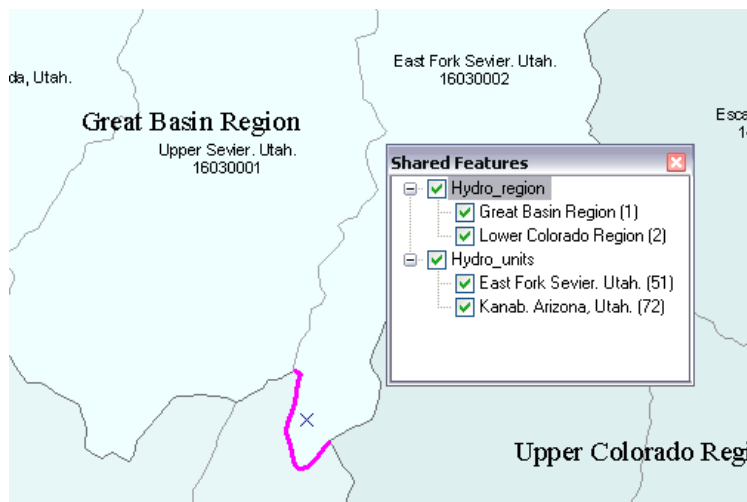
4. Double-click **Hydro_units**. The plus sign changes to a minus, and two more branches expand below **Hydro_units**. Each of these represents a hydrologic unit feature that shares this edge.

5. Click **East Fork Sevier. Utah. (51)**.
   Feature number 51 in the Hydro_units feature class, the East Fork Sevier hydrologic unit, flashes on the map.

6. Double-click **Hydro_region** and click **Great Basin Region (1)**.

Feature number 1 in the Hydro_region feature class, the Great Basin region, flashes on the map.

7. Close the **Shared Features** dialog box.

Editing a shared edge in a map topology

Now that you have seen that the features you need to update share this edge, you'll update the boundary of the watersheds to better fit the terrain.

Steps:

1. Check **Hillshaded_terrain.sid** in the ArcMap table of contents to turn on the image.

This is a small area of hillshaded terrain extracted from the National Elevation Dataset Shaded Relief Image Service, published by the United States Geological Survey. You will use this image, and the guidelines that have been added to it, to update your watershed data.

2. Press and hold the Z key. The pointer becomes the Zoom In tool.

3. While pressing the Z key, drag a box around the selected edge.

The watershed data that you have is derived from the medium-resolution National Hydrography Dataset, published by the U. S. Geological Survey and the United States Environmental Protection Agency. This data was compiled at a scale of 1:100,000. The National Elevation Dataset hillshade is derived from 1:24,000-scale digital elevation model data. You will use the higher-resolution hillshade data to improve the watershed boundaries.

4. Double-click the edge. Now you can see the vertices (in green) that define the shape of this edge.
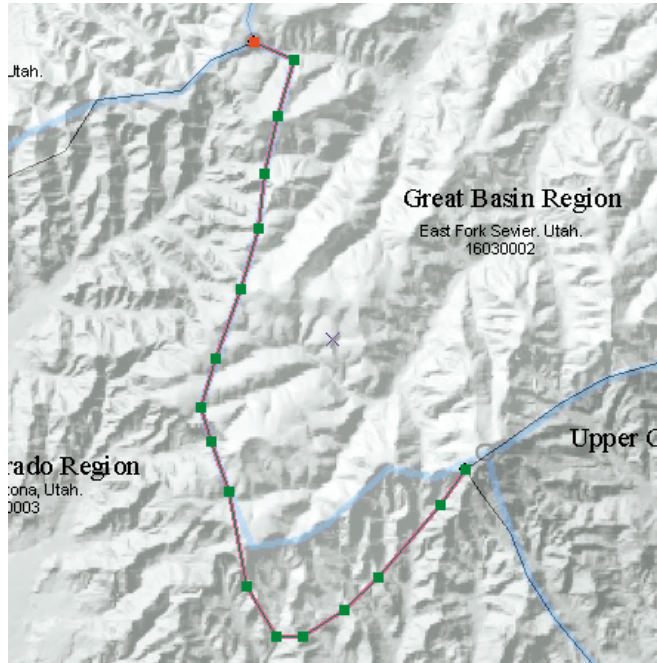
5. Move the pointer over the second vertex from the eastern end of the edge. When the pointer changes to a box with four arrows, click the vertex, drag it toward the northwest, then drop it on the blue guideline.

You could continue reshaping this edge vertex by vertex, but there is a faster way to update it.

6. Click once on the map, off the edge, to deselect it. Then click the edge again to reselect it.
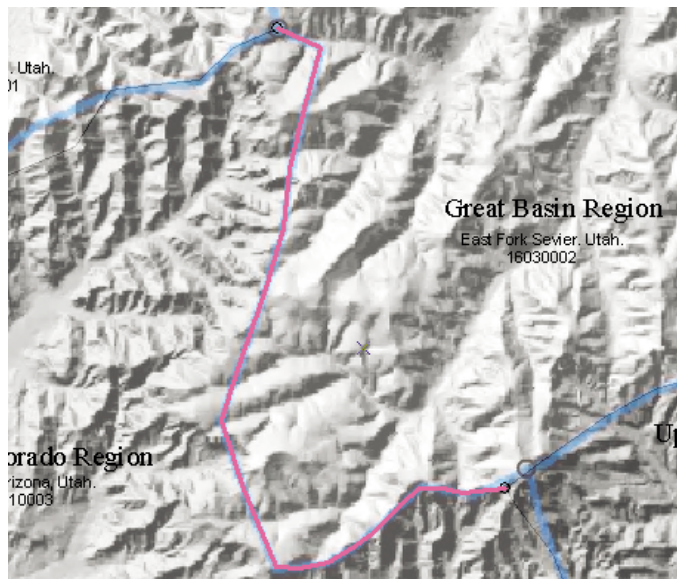
Reshaping a shared edge in a map topology

Steps:

Now you'll use an edit sketch to reshape the shared edge. You'll need to use the Reshape Edge tool and snap to the watershed edges.

1. Ensure edge snapping is enabled. If it is not, click **Edge Snapping** on the *Snapping* toolbar.

2. Click the **Reshape Edge** tool on the *Topology* toolbar.

3. Move the pointer over the edge where the selected topology edge and the blue guideline begin to diverge.
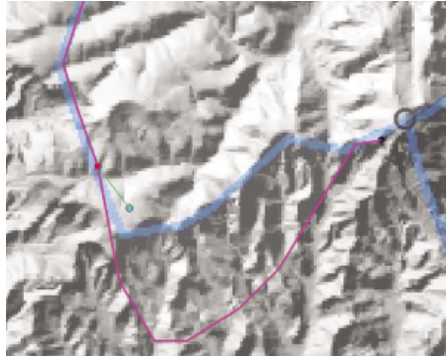
4. Click the edge to begin an edit sketch.

5. Continue adding vertices along the guideline. You can hold down the SPACEBAR key to turn off snapping temporarily if you are having difficulty placing the reshape line where you want it along the blue line.

6. Make sure that the last vertex you add to the sketch snaps to the edge near the vertex you moved.

7. Right-click anywhere on the map and click **Finish Sketch**.

   The edge looks like this once you finish the sketch:

Moving a shared node in a map topology

Now that you've adjusted the edge shared by the watershed boundaries, another problem with the existing data needs to be fixed. The node at the east end of the edge is the point where the Great Basin, Upper Colorado, and Lower Colorado region watersheds come together. You'll move this shared node by a specified number of meters.

Steps:

1. Click the **Topology Edit** tool on the *Topology* toolbar.

54

2. Click once on the map, off the edge, to deselect it.

3. Press and hold the <u>N</u> key. This temporarily limits the selectable topology elements to nodes.

4. Drag a box around the node while holding down the <u>N</u> key.
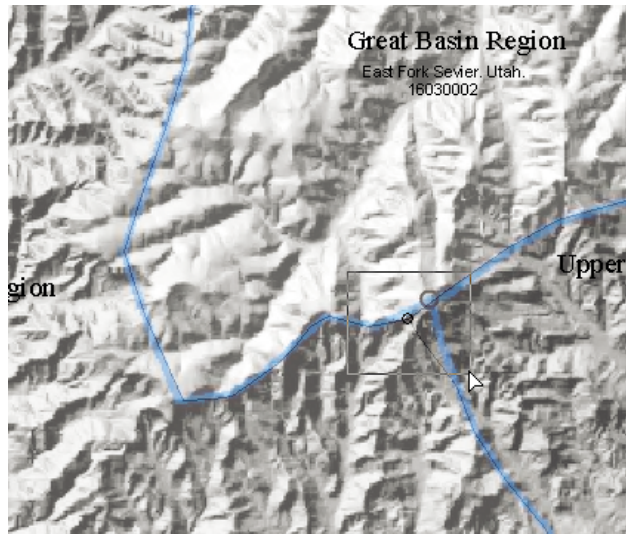
The node is selected. Now you'll move it to the correct location.

5. Right-click and click **Move**.

You will move this node 460 meters in the x direction (east) and 410 meters in the y direction (north).

6. Type `460` and `410` in the x and y boxes, respectively, and press <u>ENTER</u>.
The node is moved to the new location, and all the features that share it in the map topology are updated. You can also move the node by dragging it as you move the vertex of the topology edge.

7. Click the **Editor** menu on the *Editor* toolbar and click **Stop Editing**.

8. Click **Yes** to save your edits.

9. Close ArcMap if you are done working with the tutorial. You do not need to save the map document.

10. To continue to the next exercise, click Exercise 4b: Using geodatabase topology to fix line errors.

In this exercise, you learned how to create a map topology and how to use the Topology Edit tool to edit multiple features that share edges and nodes. The map topology allowed you to maintain the common boundary between the features while simultaneously editing four, then six, features in two different feature classes. The Topology Edit tool and the topology editing tasks can also be used to edit the edges and nodes in a geodatabase topology.

Exercise 4b: Using geodatabase topology to fix line errors

About geodatabase topology

Complexity:
Intermediate
Data Requirement:
ArcGIS Tutorial Data Setup
Data Path:
\ArcGIS\ArcTutor\Editing\Topology

Geodatabase topology is a set of rules that define how the features in one or more feature classes share geometry. Geodatabase topology is created in the Catalog window or ArcCatalog and can be added to ArcMap as a layer, just like any other data. After editing has been performed on the feature classes, you validate the geodatabase topology to see if the edits break any of the topology's rules. An ArcEditor or ArcInfo license is required to create, edit, or validate geodatabase topology.

In this exercise, you will create a simple geodatabase topology rule to help you find digitizing errors in lot line data that has been imported from CAD, then use the topology and editing tools to fix these errors.

License: This tutorial requires an ArcEditor or ArcInfo license to complete.
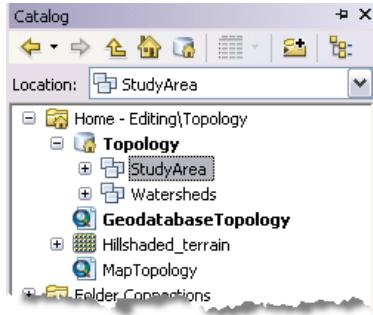
Creating a geodatabase topology

Prerequisite:
Start ArcMap and display the *Editor* and *Topology* toolbars.

Steps:

1. Click the **Open** button 📂 on the *Standard* toolbar.

2. Navigate to the **GeodatabaseTopology.mxd** map document located in the \Editing\Topology directory where you installed the tutorial data. (C:\ArcGIS\ArcTutor is the default location.)

3. Click the map and click **Open**.

4. If you still have the map document open from the previous exercise and are prompted to close it, you can do so without saving your changes.

    This map contains two layers, one for parcel lot lines and another one showing the area you are studying. You need to create a geodatabase topology so you can find and fix any spatial errors in the lot lines data.

5. If the *Catalog* window is not already open, click the **Catalog Window** button 🗂 on the *Standard* toolbar to display it. The Catalog window allows you to manage your datasets and is where you will add the topology. You can dock the window to the ArcMap user interface by clicking the pin in the upper righthand corner.

6. If necessary, expand the **Home - Editing\Topology** folder, which displays the contents of the Topology folder installed with the tutorial data.

7. Expand the **Topology** geodatabase, if needed, and click the **StudyArea** feature dataset. Now you will create a geodatabase topology to help you find errors in the lot lines data. The topology will be simple, involving one feature class and one topology rule.

8. Right-click the **StudyArea** dataset, point to **New**, then click **Topology**.

9. Click **Next** on the introduction.

    On the next panel of the wizard, you can set the cluster tolerance. The cluster tolerance is the minimum distance that separate parts of features can be from each other. Vertices and edges of features that fall within the cluster tolerance are snapped together. By default, the wizard gives the smallest possible cluster tolerance, which is determined by the precision of the spatial reference of the dataset. The precision of a dataset defines how many system units can be stored per unit of linear measure and controls how precisely coordinates are stored in the dataset.

10. Accept the default name and cluster tolerance and click **Next**.

11. Now you can choose which feature classes in the dataset to include in the topology. Check **LotLines** and click **Next**.

    When you have more than one feature class in a topology, you can give them different ranks. When vertices or edges of features fall within the cluster tolerance of each other, the feature class rank controls which is moved to the other's location. Feature classes of a lower rank will be snapped to feature classes of a higher rank. The highest rank is 1; the lowest is 50. Parts of features of the same rank that fall within the cluster tolerance are geometrically averaged.

12. Accept the default ranks and click **Next**.

    When you build a topology, you can pick the rules that will govern the allowable spatial relationships between features.

13. Click **Add Rule**.

14. Click the **Rule** arrow and click **Must Not Have Dangles**.
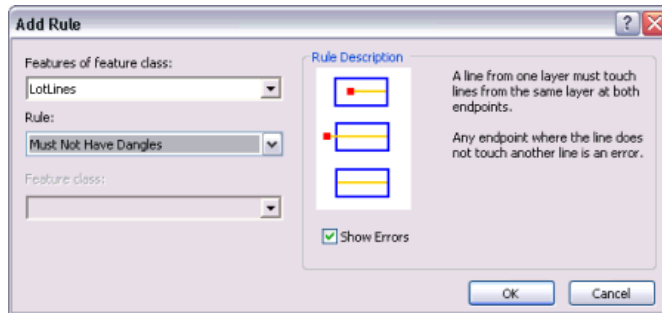
Dangles are the endpoints of lines that are not snapped to other lines in the feature class. You will want to find the dangles in the LotLines feature class, because they represent places where the imported CAD line work is not connected properly.

15. Click **OK**.

16. The rule is added to the list of topology rules. Click **Next**.

17. Review the summary and click **Finish**.
A message appears informing you that the topology is being built, then another asks whether you want to validate the topology now. Validation discovers errors in the layer.

18. Click **Yes**.

A message appears informing you that the topology is being validated, and the new topology appears in the StudyArea dataset.

Adding the topology to the map

Now you'll use the topology to help you find the dangle errors in the lot lines data. In the future, you may need to build polygon lot features from these lines. Therefore, it is important to clean up this data first because only one lot polygon will be created if a line dividing two lots does not completely separate them.

Steps:

1. In the *Catalog* window, expand the **StudyArea** feature dataset, if needed, then click **StudyArea_Topology** and drag it onto the map.

2. Click **No** when you are asked whether to add all the layers that participate in the topology, since the layers are already in the map.

3. Close the *Catalog* window.

The topology layer shows all the topology errors. Notice that in the ArcMap table of contents, the topology layer can show area, line, and point errors. This topology only has one feature class and one rule, so all the topology errors relate to that rule. The topology rule specifies that lot lines must not have dangles. The error geometry for dangles is a point, located at the dangling end of a line feature. All the red error features on the map are dangles.

Finding topology errors

The next step to make this data useful is to identify the topology errors that are present. Lot lines that have a dangle, where one end of the line is not connected to another lot line, are errors that you need to find to clean up this data so you can create lot polygons. Some dangles need to be extended to close a polygon;

others overshoot the line that they should snap to and need to be trimmed. You will find some of these errors now.

Steps:

1. Click **Bookmarks** and click **Dangle errors**.
   The map zooms to the bookmarked area. Now you can see three dangle errors, which you will fix in this exercise.
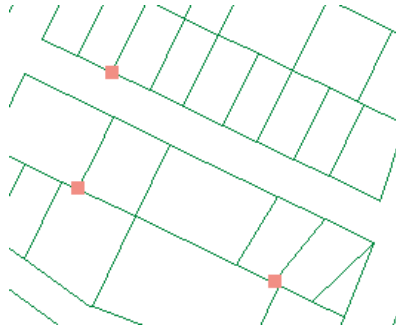
2. Click the **Editor** menu on the *Editor* toolbar and click **Start Editing**.

3. Close the *Create Features* window. You will not need it in this exercise.

4. Click **Error Inspector** on the *Topology* toolbar.

   The *Error Inspector* window allows you to manage and interact with all the topology errors on your map.

5. Make you sure can see the same three errors on the map with the *Error Inspector* window open. You may need to pan the map to make them visible again.

6. Check the **Errors** and **Visible extent only** check boxes on the *Error Inspector* window.

7. Click **Search Now** on the *Error Inspector* window.
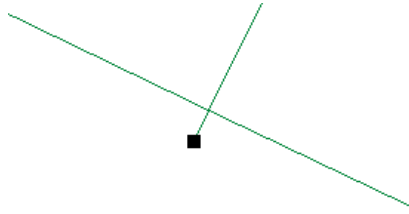
Correcting an overshoot error

All the errors on the map are violations of the Must Not Have Dangles rule. However, there are several different problems that can cause this type of error. A dangle error can be caused by a line that extends too far beyond the line it is supposed to touch or by a line that doesn't extend quite far enough. These are overshoots and undershoots, respectively.

Dangles can also occur where features have been digitized from adjacent map sheets. These lines sometimes need to be snapped together so they connect to form a continuous line. Other dangle errors occur at the edge of map sheets, where a line is cut off on the original source data.

You will now correct one of the errors on this map.

Steps:

1. Click in the **Feature 1** column on the *Error Inspector* window until the northernmost feature on the map flashes and turns black to show that it is selected.

2. Zoom in to the error until you can see where the lot line with the error crosses the other lot line.

This is an overshoot error, a type of error that is often found in line work imported from CAD programs or digitized without using snapping to control the connectivity of the line features.

3. Right-click the error on the *Error Inspector* window and click **Trim**.

4. Type 3 in the **Maximum Distance** text box and press <u>ENTER</u>.
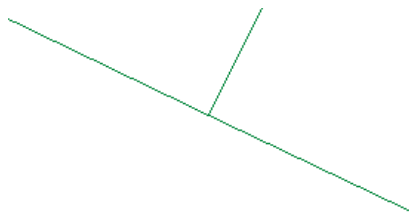
The dangling segment is trimmed back to where the lines intersect, and the error disappears. The *Error Inspector* shortcut menu provides a list of potential fixes for this error. You trimmed the line feature to fix this error. You also could have marked the error as an exception or snapped or extended the line until it reached another feature.
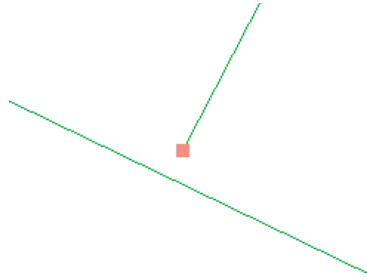
Correcting an undershoot error

Steps:

1. Click the **Go Back To Previous Extent** button on the *Tools* toolbar until you can see the two remaining errors in this area of the data. Now you'll correct another type of dangle error.
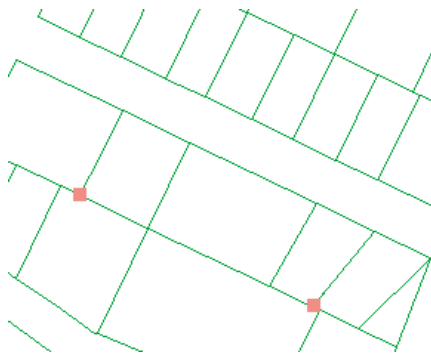

2. Zoom in to the westernmost of the two remaining errors.

3. Zoom in again, if necessary, until you can see where the lot line with the error fails to connect to the other lot line.

    This is an undershoot error, another type of error that is often found in line work imported from CAD programs or digitized without using snapping to control the connectivity of the line features. The end of this line fell short by a little more than half a meter. You'll fix this error by extending the undershoot until it meets the line to which it should have been snapped.

4. Click the **Fix Topology Error** tool on the *Topology* toolbar. This tool lets you interactively select and apply predefined fixes to topology errors on the map.

5. Drag a box around the error.
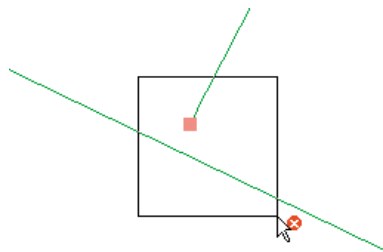
6. Right-click the map and click **Extend**.

7. Type 3 in the **Maximum Distance** text box and press <u>ENTER</u>.
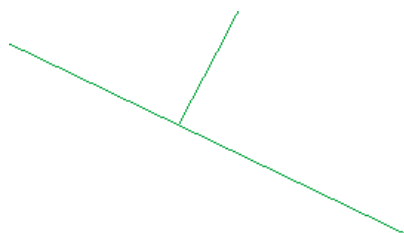
    You have corrected the undershoot by extending the line with the dangle to the other line. If the distance to the next line had been greater than the three-meter maximum distance you specified, the line would not have been extended.

*Correcting a double-digitized line*

Sometimes a given line or part of a line is digitized twice in the course of creating the data. This may happen with CAD drawings or with lines digitized on a digitizing tablet.

Steps:

1. Click the **Go Back To Previous Extent** button on the *Tools* toolbar until you can see the one remaining error in this area of the data.
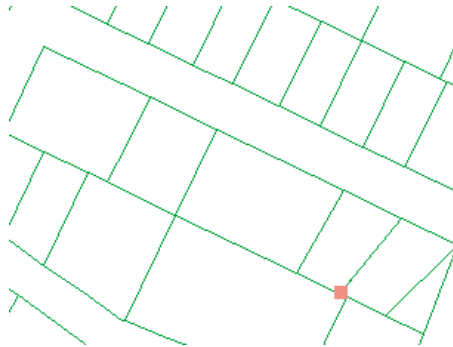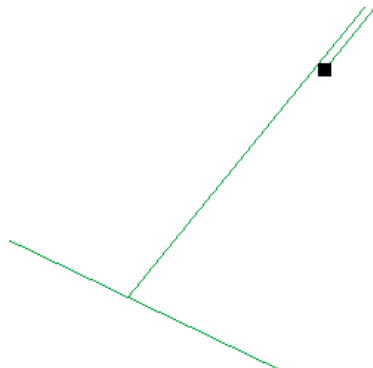

2. Zoom in to the remaining error.
3. Click **Search Now** on the *Error Inspector* window.
4. Click the numeric value in the **Feature 1** column.
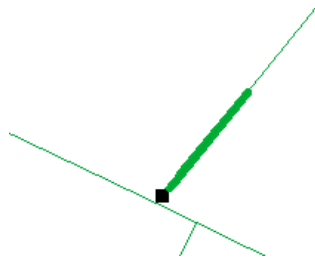
The line feature with the dangle flashes. Notice that the whole lot line did not flash.

5. Zoom in until you can see that there are two nearly parallel lot lines, one of which has the dangle.

You'll correct this error by deleting the extra line.

6. Right-click the numeric value in the Feature 1 column, click **Select Features**, then press the DELETE key. This deletes the extra line.
7. Click the **Go Back To Previous Extent** button on the *Tools* toolbar until you can see the area in which you have been working.
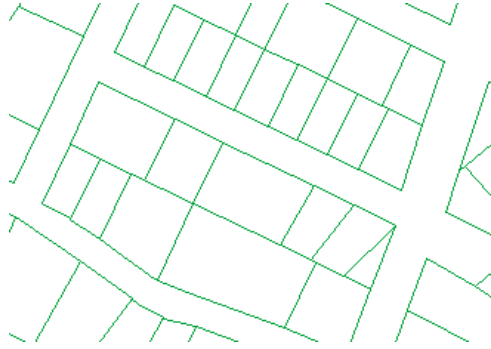
Reviewing the areas you have edited

You have fixed three errors that resulted from violations of the Must Not Have Dangles rule. In each case, the error was corrected by editing the geometry of a lot line feature by trimming, extending, or deleting the feature.

Viewing topology errors is useful for tracking where there are problems with your data, but correcting the error requires you to correct the data—you cannot edit the topology error feature layer directly.

When you edit features in a topology, the topology tracks where changes have been made. These places are called dirty areas because a topology rule could potentially have been violated by the edits, but the error, if it exists, cannot be found until the dirty area is validated again. When you validate the topology again, it just checks the dirty areas.

You can see the areas that have been edited by showing the dirty areas in the topology layer.
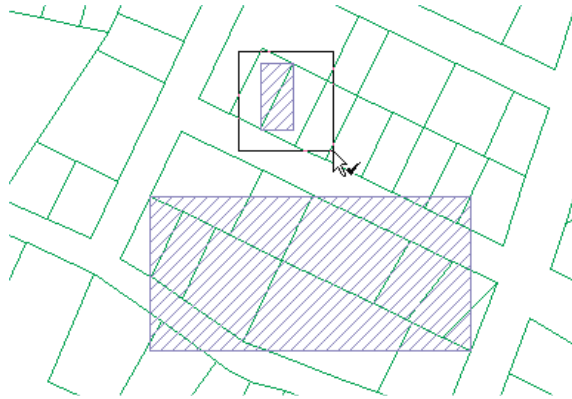
   Steps:

   1. Right-click the topology in the table of contents and click **Properties**.

   2. Click the *Symbology* tab.

   3. Check **Dirty Areas**.

   4. Click **OK**.
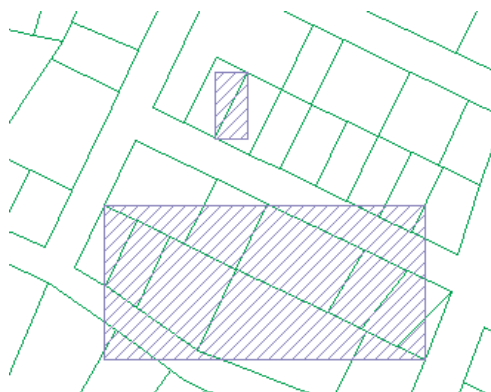
   Now you can see the dirty areas on the map. The dirty areas cover the features that you edited. Dirty areas optimize the validation process, as only these must be checked for errors. Zoom out, if needed, so you can see all the entire extent of the dirty area boxes.
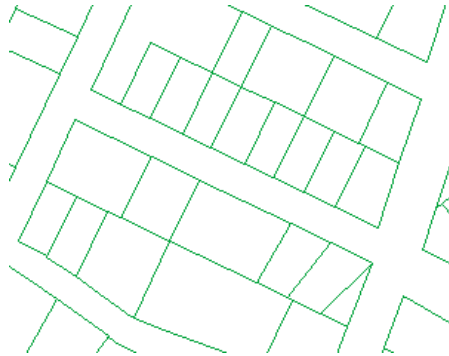
   5. Click the **Validate Topology In Specified Area** button on the *Topology* toolbar.

6. Drag a box around the northern dirty area.

The dirty area is removed, and no errors are found in the area you validated.

7. Click the **Validate Topology In Current Extent** button on the *Topology* toolbar.

The topology is validated for the other areas you edited, and the dirty area is removed.

Creating a report of the status of the data

Steps:

Next you will generate a report summarizing the number of topology errors remaining in the data.

1. Right-click the topology in the table of contents and click **Properties**.

2. Click the *Errors* tab.

3. Click **Generate Summary**.

The summary shows the number of topology errors and exceptions; you could have a different number of errors. You can save this report to a text file to document the status of the data, but you do not need to for this exercise.

Rule	Errors	Exceptions
Must Be Larger Than Cluster Tolerance	0	0
Must Not Have Dangles		
LotLines	147	0
Total	147	0

4. Click **OK**.

Fixing multiple errors at once

Many errors, like the double-digitized line, need to be fixed one at a time by deleting, modifying, or moving individual features. Some errors must be fixed by creating new features. However, sometimes a feature class contains a number of errors, such as overshoots and undershoots, that are simple to fix. When this is the case, you can select multiple errors at once with the Fix Topology Error tool and apply the same fix to all of them. If you prefer, you can individually check each error using the Error Inspector window. This is a workflow and quality assurance decision that your organization should make before you begin applying topology fixes to multiple errors.

It is also a good idea to look at your data and evaluate whether the fixes are appropriate. You would not want to trim lines with dangles that actually needed to be snapped to another line, or extend a line that actually needed to be trimmed. In this case, if you extend dangling lines that are within three meters of another line, you're not likely to cause problems with your data, since the parcels and rights-of-way are larger than three meters.

Now you'll use this method to clean up several errors at one time.

Steps:

1. Click the **Full Extent** button on the *Tools* toolbar.

2. Click the **Fix Topology Error** tool on the *Topology* toolbar.

3. Drag a box around all the errors on the map. This selects all of the errors. Now you'll fix the undershoots.

4. Right-click the map and click **Extend**.

5. The maximum distance you set when you fixed the other undershoot is fine, so press <u>ENTER</u>. The process may take a few seconds while all the features with dangles are checked to see if there is a feature within three meters to which they can be extended.
   The undershoots are fixed, and a number of dirty areas appear on the map. Each dirty area marks the bounding box of a feature that was edited by the extend error fix.

6. Click **Search Now** on the *Error Inspector* window. (If you closed the Error Inspector window, you can open it again from the Topology toolbar.)

   The number of topology errors is displayed to the right of the **Show** drop-down menu. Notice that many have not been fixed. You can trim the remaining errors and continue fixing topology errors to clean up this data if you want.

7. Click the **Editor** menu on the *Editor* toolbar and click **Stop Editing**.

8. Click **Yes** to save your edits.

9. Close ArcMap if you are done working with the tutorial. You do not need to save the map document.

10. To continue to the next exercise, click Exercise 5a: Transforming data.

In this exercise, you created a geodatabase topology with simple rules to help you clean up data. You learned how to use the Error Inspector to find errors of a particular type and how to use some of the editing tools to fix errors in your data.

Exercise 5a: Transforming data

About transforming data

A spatial adjustment transformation is used to convert the coordinates of a layer from one location to another. This involves scaling, shifting, and rotating features based on displacement links defined by the user. Transformations are applied uniformly to all features in a feature class and are often used to convert data created in digitizer units into real-world units represented on a map.

<table>
<tr><td>Complexity:
Intermediate</td></tr>
<tr><td>Data Requirement:
ArcGIS Tutorial Data Setup</td></tr>
<tr><td>Data Path:
\ArcGIS\ArcTutor\Editing\SpatialAdjustment</td></tr>
</table>

This exercise will show you how to apply a transformation based on displacement links that you will create. This transformation will move, scale, and rotate two feature classes containing parcel and building features into alignment with another set of parcel and building feature classes. You might use this technique to adjust data that was digitized or imported into a temporary feature class in preparation for copying and pasting the features into your database. You will also learn how to specify which features to adjust, preview the adjustment, and view a link table.

Spatial adjustments are based on displacement links. These are special graphic elements that represent the source and destination locations for an adjustment.

Setting up the data and transformation options

Prerequisite:
Start ArcMap and display the *Editor*, *Snapping*, and *Spatial Adjustment* toolbars.

Steps:

1. Click the **Open** button 📂 on the *Standard* toolbar.

2. Navigate to the **Transform.mxd** map document located in the \Editing\SpatialAdjustment directory where you installed the tutorial data. (C:\ArcGIS\ArcTutor is the default location.)

3. Click the map and click **Open**.

4. If you still have the map document open from the previous exercise and are prompted to close it, you can do so without saving your changes.

5. Click the **Editor** menu on the *Editor* toolbar and click **Start Editing**.

6. Close the *Create Features* window. You will not need it in this exercise.

   Before you start adding links, you should set your snapping environment so each link you add snaps to the vertices of features.

7. Ensure vertex snapping is enabled. If it is not, click **Vertex Snapping** on the *Snapping* toolbar.

Applying a transformation

Spatial adjustment allows you to adjust a selected set of features or all the features in a layer. This setting is available on the Choose Input For Adjustment dialog box. The default is to adjust a selected set of features.
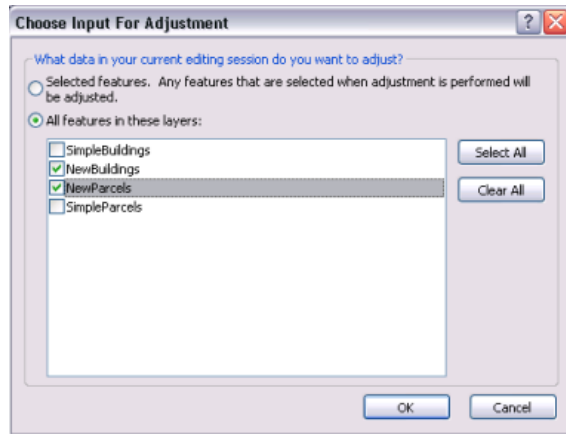
Steps:

1. You need to choose whether to adjust a selected set of features or all the features in a layer. Click the **Spatial Adjustment** menu on the *Spatial Adjustment* toolbar and click **Set Adjust Data**.

2. Click **All features in these layers**.

3. Uncheck the **SimpleBuildings** and **SimpleParcels** layers, keep the **NewBuildings** and **NewParcels** layers checked, then click **OK**.

4. Now that you have determined which features will be adjusted, the next step is to choose an adjustment method. Click the **Spatial Adjustment** menu, point to **Adjustment Methods**, then click **Transformation - Similarity** to set the adjustment method.

Adding displacement links

Displacement links define the source and destination coordinates for an adjustment. Displacement links can be created manually or loaded from a link file.

In this exercise, you will create your own displacement links from the exterior corners of the NewParcels layer to the corresponding locations in the SimpleParcels layer.

Steps:

1. Click **Bookmarks** and click **Transform**.

2. Click the **New Displacement Link** tool on the *Spatial Adjustment* toolbar.

3. Snap to a from-point in the source layer and a to-point in the target layer.
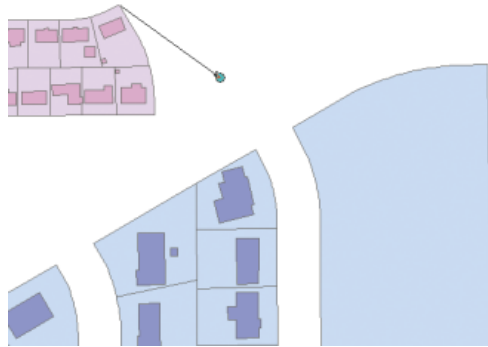
4. Continue to create additional links as shown below. For this exercise, you will have a total of four displacement links when you are finished.


Adjusting the data

Steps:

1. Click the **Spatial Adjustment** menu and click **Adjustment Preview** to examine the adjustment. The preview allows you to see an adjustment prior to actually performing it. If the results of the adjustment are not adequate, you can modify the links to improve the accuracy of the adjustment.

2. Click **View Link Table** on the *Spatial Adjustment* toolbar. The link table provides information about link coordinates, link IDs, and RMS errors.

    Right-clicking a link record opens a shortcut menu. You can edit link coordinates, flash links, zoom and pan to selected links, and delete links with these commands. If the RMS error for this adjustment is not acceptable, you can modify the links to increase the accuracy. The preview window and link table are designed to help you fine-tune your adjustment.

    The final step of the spatial adjustment process is to perform the adjustment.

3. Click the **Spatial Adjustment** menu and click **Adjust**.

The adjusted data looks like this:
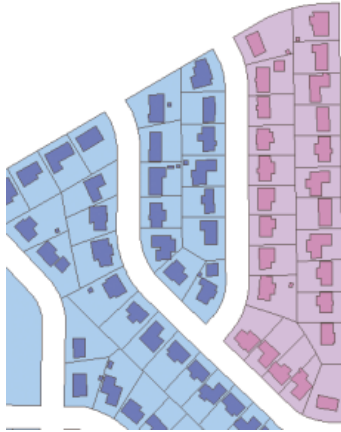
4. Click the **Editor** menu on the *Editor* toolbar and click **Stop Editing**.

5. Click **Yes** to save your edits.

6. Close ArcMap if you are done working with the tutorial. You do not need to save the map document.

7. To continue to the next exercise, click Exercise 5b: Rubbersheeting data.

In this exercise, you learned how to set your data for an adjustment, create displacement links, preview the adjustment, and adjust the data.

Exercise 5b: Rubbersheeting data

About rubbersheeting

Rubbersheeting is typically used to align two or more layers. This process moves the features of a layer using a piecewise transformation that preserves straight lines.

This exercise will show you how to rubber sheet data by using displacement links, multiple displacement links, and identity links. You will rubber sheet a newly imported set of street features to match an existing feature class of street features.

Complexity:
    Intermediate
Data Requirement:
    ArcGIS Tutorial Data Setup
Data Path:
    \ArcGIS\ArcTutor\Editing\SpatialAdjustment

Setting up the data and rubbersheeting options

Prerequisite:
Start ArcMap and display the *Editor*, *Snapping*, and *Spatial Adjustment* toolbars.

Steps:

1. Click the **Open** button on the *Standard* toolbar.

2. Navigate to the **Rubbersheet.mxd** map document located in the \Editing\SpatialAdjustment directory where you installed the tutorial data. (C:\ArcGIS\ArcTutor is the default location.)

3. Click the map and click **Open**.

4. If you still have the map document open from the previous exercise and are prompted to close it, you can do so without saving your changes.

5. Click the **Editor** menu on the *Editor* toolbar and click **Start Editing**.

6. Close the *Create Features* window. You will not need it in this exercise.

    Before you start creating links, set your snapping environment so each link you add snaps to the vertices or endpoints of features.

7. Ensure vertex snapping is enabled. If it is not, click **Vertex Snapping** on the *Snapping* toolbar.

8. You need to choose whether to adjust a selected set of features or all the features in a layer. Click the **Spatial Adjustment** menu on the *Spatial Adjustment* toolbar and click **Set Adjust Data**.

9. Click **All features in these layers**.

10. Make sure only the **ImportStreets** layer is checked. If necessary, uncheck the **ExistingStreets** layer. Click **OK**.

11. Click the **Spatial Adjustment** menu, point to **Adjustment Methods**, then click **Rubbersheet** to set the adjustment method.

12. Click the **Spatial Adjustment** menu and click **Options**.

13. Click the *General* tab.

14. Click **Rubbersheet** for the adjustment method so you can set additional options for rubbersheeting.

15. Click **Options**.

16. Click **Natural Neighbor** and click **OK**.

17. Click **OK** to close the *Adjustment Properties* dialog box.

Adding displacement links

Displacement links define the source and destination coordinates for an adjustment. Displacement links can be created manually or loaded from a link file.

In this exercise, you will create your own displacement links at several key intersections of the ExistingStreets and ImportStreets layers.

Steps:

1. Click **Bookmarks** and click **Import streets** to set the current view to the area of this exercise.
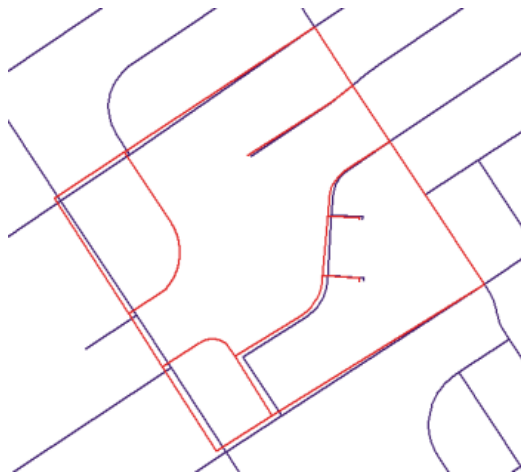
When the display refreshes, note that the ImportStreets layer is not aligned with the ExistingStreets layer. You must adjust the ImportStreets layer so it aligns with the ExistingStreets layer by using the rubbersheet adjustment method.

2. To get a better view of the adjustment area, zoom to the Intersections bookmark, which was created for you. Click **Bookmarks** and click **Intersections**.

3. Click the **New Displacement Link** tool on the *Spatial Adjustment* toolbar.

4. Snap the link to the source location in the ImportStreets layer, as shown below:
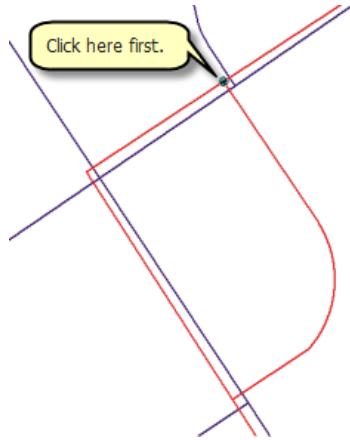
5. Snap the link to the destination location in the ExistingStreets layer, as shown below:
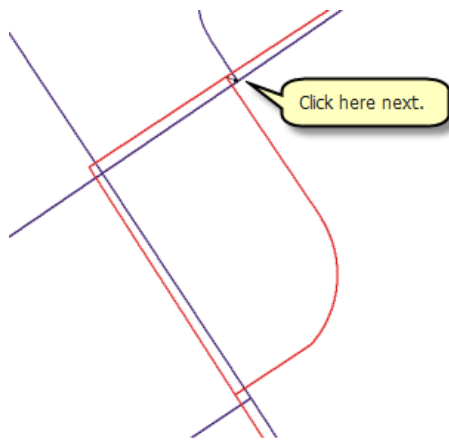
6. Continue to create links at the perimeter intersections of the layers in a counterclockwise direction. Look at the SnapTips to ensure you are snapping to the correct location. You will create a total of six displacement links, as shown below:
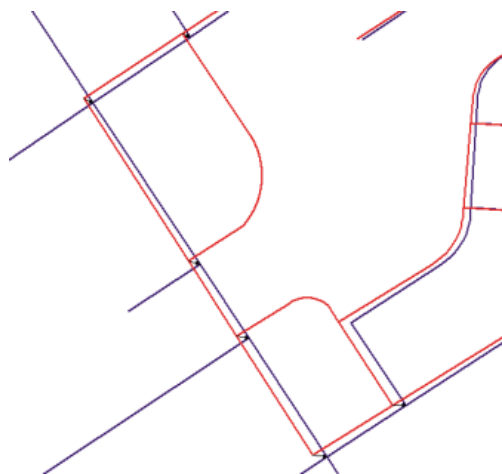
Adding multiple displacement links

Steps:

1. To get a better view of the adjustment area, zoom to the Curve features bookmark, which was created for you. Click **Bookmarks** and click **Curve features**.

   To preserve the curved road features, you can add multiple links at critical points.

2. Click the **Multiple Displacement Links** tool on the *Spatial Adjustment* toolbar.

   The Multiple Displacement Links tool allows you to create multiple displacement links in one operation. This tool can help save time by allowing you to create more than one link simultaneously; it is especially useful for curved features.

3. Click the curved road feature in the ImportStreets layer.

Click this curve first.
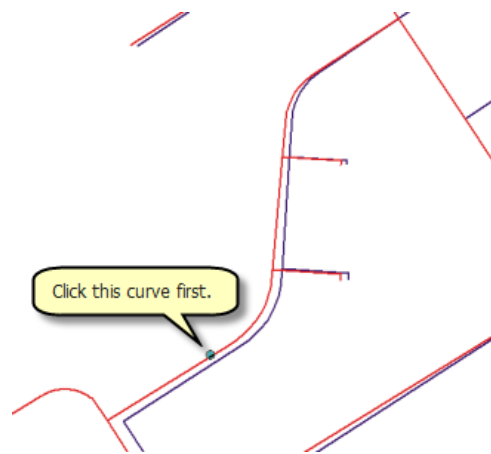
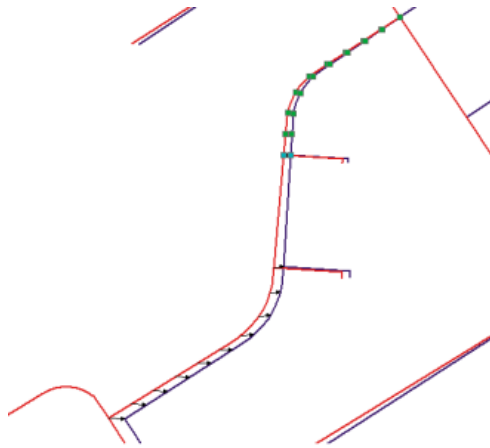4. Click the curved road feature in the ExistingStreets layer.

Click this curve next.
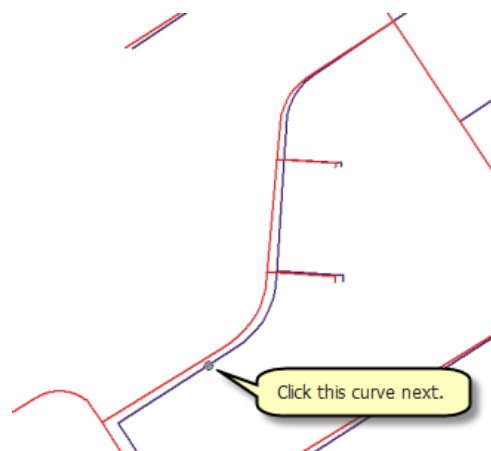
5. You will be prompted to enter the number of links to create. Accept the default value (10) and press ENTER.
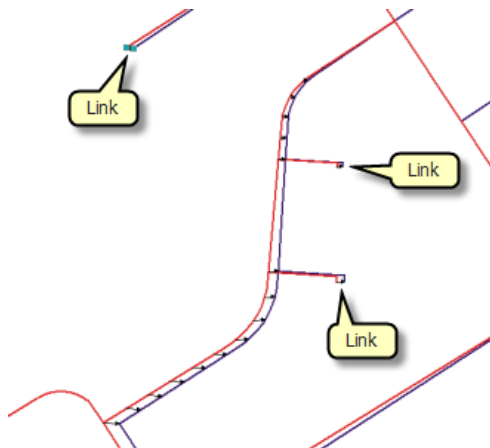   The multiple links now appear in the map.

6. Create multiple links for the other curved feature.

7. Click the **New Displacement Link** tool on the *Spatial Adjustment* toolbar.

8. Add the final displacement links, as shown below:

Adding identity links

Identity links are used to anchor features at specific points to prevent their movement during an adjustment. You will now add identity links at key intersections to maintain their locations.

Steps:

1. Click the **New Identity Link** tool on the *Spatial Adjustment* toolbar.

2. Zoom out and add five identity links at the intersections as shown below:
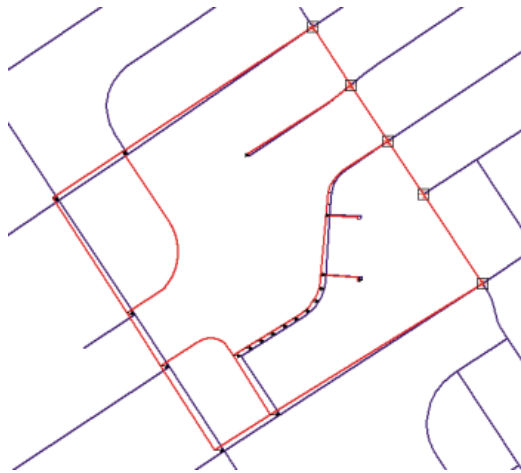
Adjusting the data

Steps:

1. Click the **Spatial Adjustment** menu and click **Adjustment Preview** to examine the adjustment. The preview allows you to see an adjustment prior to actually performing it. If the results of the adjustment are not adequate, you can modify the links to improve the accuracy of the adjustment.

2. Click the **Spatial Adjustment** menu and click **Adjust**.

3. Here is how the adjustment should appear:

Notice that all the displacement links you created have turned into identity links. The next step is to delete these links, since you no longer need them.

4. Click the **Edit** menu and click **Select All Elements**. This allows you to select the links, since they are graphic elements.

5. Press the <u>DELETE</u> key.

6. Click the **Editor** menu on the *Editor* toolbar and click **Stop Editing**.

7. Click **Yes** to save your edits.

8. Close ArcMap if you are done working with the tutorial. You do not need to save the map document.

9. To continue to the next exercise, click Exercise 5c: Edgematching data.

In this exercise, you learned how to set your data for an adjustment, create displacement links, preview the adjustment, and adjust the data.

Exercise 5c: Edgematching data

About edgematching data

Edgematching is used to align features along the edges of adjacent layers. Usually, the layer with the less accurate features is adjusted, while the other layer is used as the target layer. Edgematching relies on displacement links to define the adjustment.

In this exercise, you will edgematch two adjacent tiles of stream data by using displacement links that you will create. You will also learn how to use the Edge Match tool and set edge snap properties.

Complexity:
  Intermediate
Data Requirement:
  ArcGIS Tutorial Data Setup
Data Path:
  \ArcGIS\ArcTutor\Editing\SpatialAdjustment

Setting up the data and edgematching options

Prerequisite:
Start ArcMap and display the *Editor*, *Snapping*, and *Spatial Adjustment* toolbars.

Steps:

1. Click the **Open** button 🗁 on the *Standard* toolbar.

2. Navigate to the **EdgeMatch.mxd** map document located in the \Editing\SpatialAdjustment directory where you installed the tutorial data. (C:\ArcGIS\ArcTutor is the default location.)

3. Click the map and click **Open**.

4. If you still have the map document open from the previous exercise and are prompted to close it, you can do so without saving your changes.

5. Click the **Editor** menu on the *Editor* toolbar and click **Start Editing**.

6. Close the *Create Features* window. You will not need it in this exercise.

7. Ensure end snapping is enabled. If it is not, click **End Snapping** on the *Snapping* toolbar.

8. You need to choose whether to adjust a selected set of features or all the features in a layer. Click the **Spatial Adjustment** menu on the *Spatial Adjustment* toolbar and click **Set Adjust Data**.

9. Click **Selected features**.

10. Click **OK**.

    Now that you have determined which features will be adjusted, the next step is to choose an adjustment method. In this exercise, you will use Edge Snap.

11. Click the **Spatial Adjustment** menu, point to **Adjustment Methods**, then click **Edge Snap** to set the adjustment method.

12. Click the **Spatial Adjustment** menu and click **Options**.

13. Click the *General* tab.

14. Click **Edge Snap** for the adjustment method so you can set additional options for edgematching.

15. Click **Options**.

16. Click **Line** as the method and click **OK**.

The line method only moves the endpoint of the line being adjusted. The smooth method distributes the adjustment across the entire feature.

The edgematch adjustment method requires you to set properties that will define the source and target layers as well as determine how the displacement links will be created when using the Edge Match tool.

17. Click the *Edge Match* tab.

18. Click the **Source Layer** drop-down arrow and click **StreamsNorth**.

19. Click the **Target Layer** drop-down arrow and click **StreamsSouth**. The StreamsNorth layer will be adjusted to match the target layer, StreamsSouth.
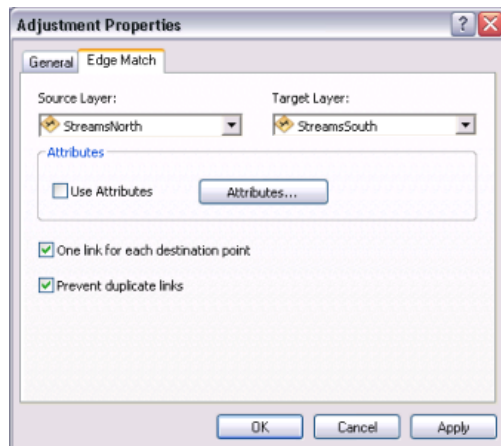
20. Check **One link for each destination point**.

21. Check **Prevent duplicate links** and click **OK**.

Adding edgematch displacement links

Steps:

1. Click **Bookmarks** and click **West streams** to set the current view to the edit area of this exercise.
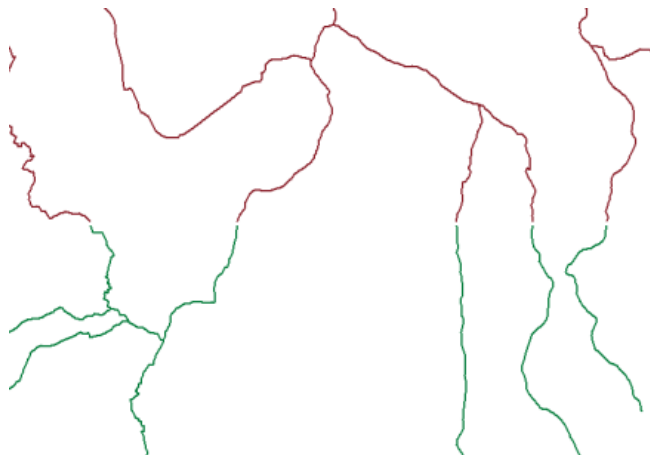
Displacement links define the source and destination coordinates for an adjustment. In this exercise, you will create multiple links using the Edge Match tool.

2. Click the **Edge Match** tool on the *Spatial Adjustment* toolbar.

3. Drag a box around the endpoints of the features. The Edge Match tool creates multiple displacement links based on the source and target features that fall inside the box.
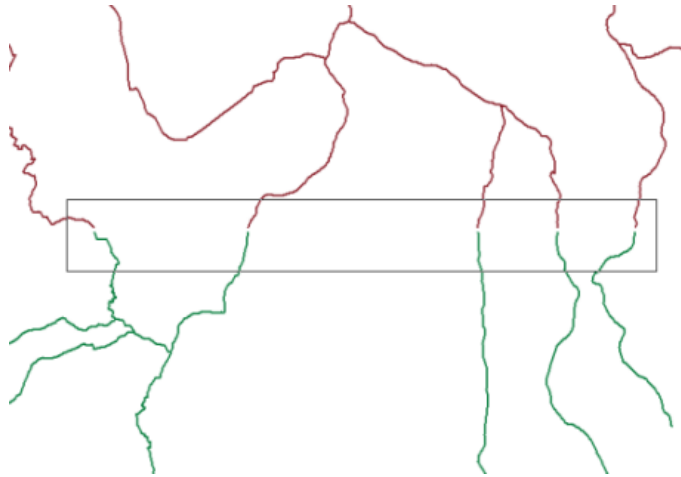

Displacement links now connect the source and target features at their endpoints.
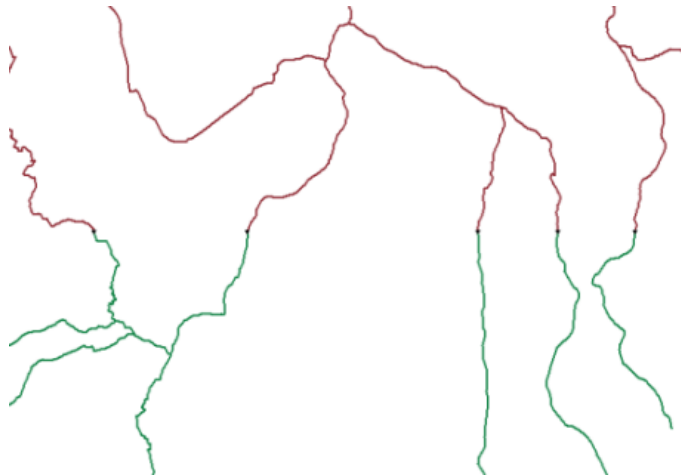
Edgematch displacement links are created between the closest source and target features that fall within the snapping tolerance distance. If links were not created when you dragged a box around the edges, zoom out a little and try again. This should help because the snapping tolerance units are screen pixels and your display resolution may be relatively high.

Since edgematching only affects the exterior regions of the layer, you must select the features you want to adjust.

4. Click the **Edit** tool ► on the *Editor* toolbar.

5. Drag a box around the features that are to be edgematched, as shown below.
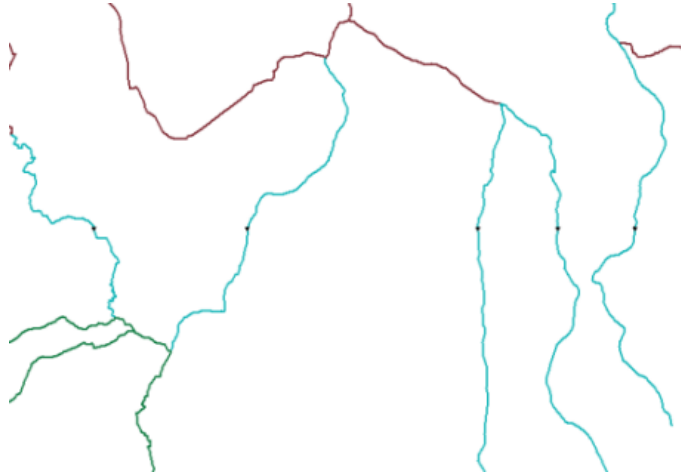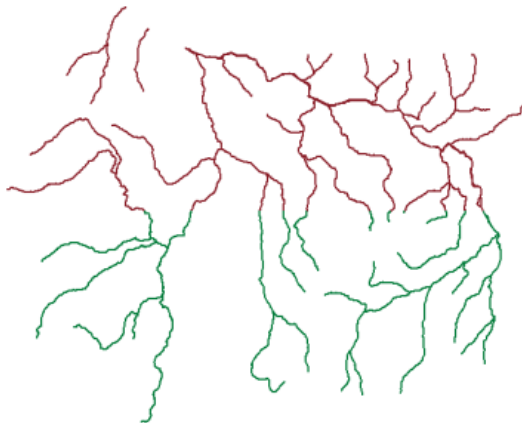
6. Click **Bookmarks** and click **East streams**.

7. Repeat the same steps used for creating links with the **Edge Match** tool for the east streams portion of the data.

8. You will need to hold down the <u>SHIFT</u> key while you select the stream features so the features from the west side stay selected.

Adjusting the data

Steps:

You can examine how an adjustment will appear prior to actually performing it with the preview window. You can use the standard ArcMap Zoom and Pan tools to navigate in the preview window.

1. Click the **Spatial Adjustment** menu and click **Adjustment Preview** to examine the adjustment. The preview allows you to see an adjustment prior to actually performing it. If the results of the adjustment are not adequate, you can modify the links to improve the accuracy of the adjustment.

2. Click the **Spatial Adjustment** menu and click **Adjust**.

3. Here is how the adjustment should appear:

4. Click the **Editor** menu on the *Editor* toolbar and click **Stop Editing**.

5. Click **Yes** to save your edits.

6. Close ArcMap if you are done working with the tutorial. You do not need to save the map document.

7. To continue to the next exercise, click .

In this exercise, you learned how to set edgematch properties, use the Edge Match tool to create displacement links, preview the adjustment, and perform it.

Exercise 5d: Transferring attributes between features

About transferring attributes

The Attribute Transfer tool is used to transfer attributes from features in a source layer to features in a target layer. Source and target layers and the attributes to be transferred are defined on the Attribute Transfer Mapping dialog box. The Attribute Transfer tool is then used to interactively transfer those attributes between features of the source and target layers.

In this exercise, you will transfer the street name and type from an existing street to a new street recently added to the database.

Setting up the data and attribute transfer options

Prerequisite:
Start ArcMap and display the *Editor*, *Snapping*, and *Spatial Adjustment* toolbars.

Steps:

1. Click the **Open** button ⏏ on the *Standard* toolbar.

2. Navigate to the **AttributeTransfer.mxd** map document located in the \Editing\SpatialAdjustment directory where you installed the tutorial data. (C:\ArcGIS\ArcTutor is the default location.)

3. Click the map and click **Open**.

4. If you still have the map document open from the previous exercise and are prompted to close it, you can do so without saving your changes.

5. Click the **Editor** menu on the *Editor* toolbar and click **Start Editing**.

6. Close the *Create Features* window. You will not need it in this exercise.

   Before you transfer attributes, set your snapping environment for your source and target layers. This will ensure that you select the correct feature when using the Attribute Transfer tool.

7. Ensure edge snapping is enabled. If it is not, click **Edge Snapping** on the *Snapping* toolbar.

   The first step in the Attribute Transfer process is to set the source and target layers. The Attribute Transfer Mapping dialog box allows you to define these settings.

8. Click the **Spatial Adjustment** menu and click **Attribute Transfer Mapping**.

9. Click the **Source Layer** drop-down arrow and click the **Streets** layer.

10. Click the **Target Layer** drop-down arrow and click the **NewStreets** layer.
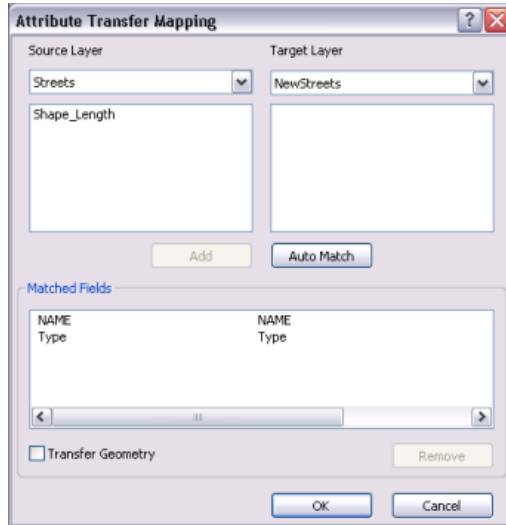
The next step is to specify which fields to use for the attribute transfer. You will select a field in the source layer and match it to a corresponding field in the target layer. The Attribute Transfer tool uses these matched fields to determine which data to transfer.

11. Click the **NAME** field in the **Source Layer** field list box.

12. Click the **NAME** field in the **Target Layer** field list box.

13. Click **Add**.
     The fields are now added to the **Matched Fields** list.

14. Repeat the same steps for the **Type** fields and click **OK**.

Using the Attribute Transfer tool

Steps:

1. Click **Bookmarks** and click **New streets** to set the current view to the edit area of this exercise.
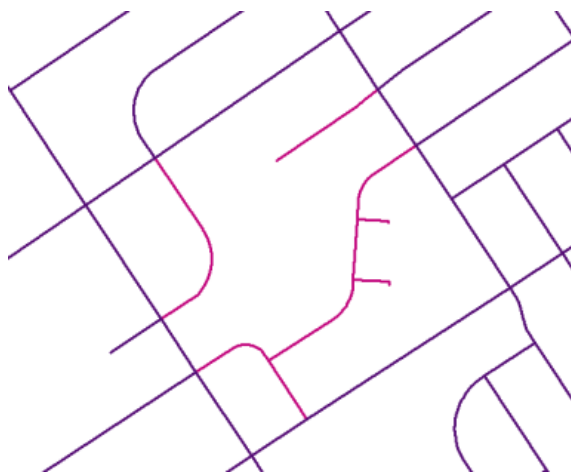
Prior to performing the attribute transfer, verify the attributes of the source and target features. This can be done using the Identify tool.
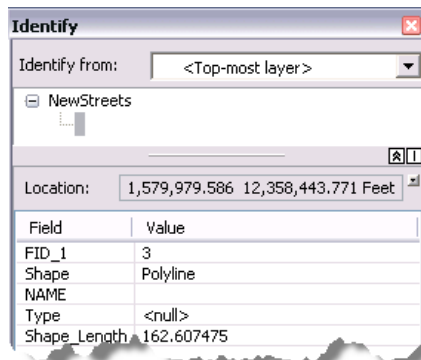
2. Click the **Identify** tool on the *Tools* toolbar.

3. Click the source feature indicated, as shown below.
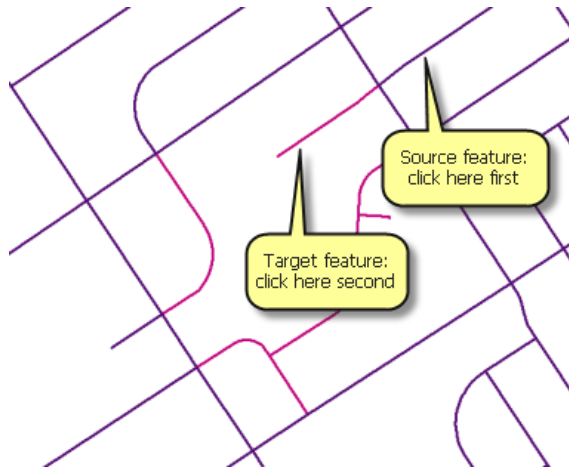
4. Notice the **NAME** and **Type** field attributes. These attribute values will be transferred to the target feature.
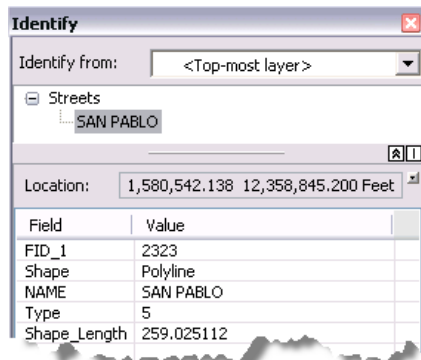

5. With the Identify tool still active, click the target feature.

6. Notice the **NAME** and **Type** fields; attribute values for these fields will be transferred from the Streets layer.

You will now use the Attribute Transfer tool to transfer the source feature attributes to the target feature.

7. Click the **Attribute Transfer** tool on the *Spatial Adjustment* toolbar.

8. Snap to an edge of the source feature, as shown below:
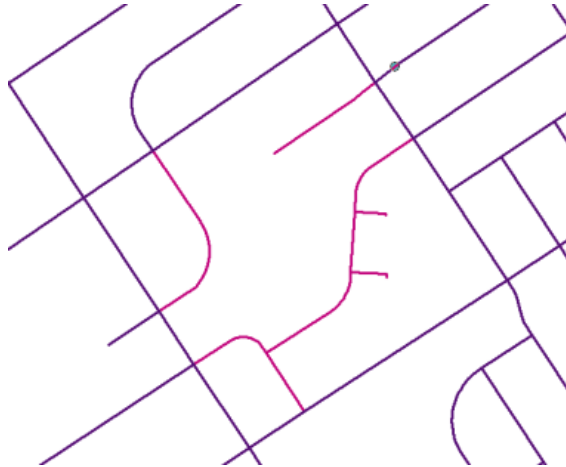
9. Drag the link toward the target feature.

10. Snap to an edge of the target feature and click.

To transfer the attributes of a source feature to multiple target features, hold down the SHIFT key while selecting the target features.

Verifying the results of the attribute transfer

Now that you have transferred the attributes from the source feature to the target feature, it is a good idea to verify that the target feature was updated with the proper information.

Steps:

1. Click the **Identify** tool on the *Tools* toolbar.

2. Click the target feature. The **NAME** and **Type** fields in the target feature reflect the new attributes.
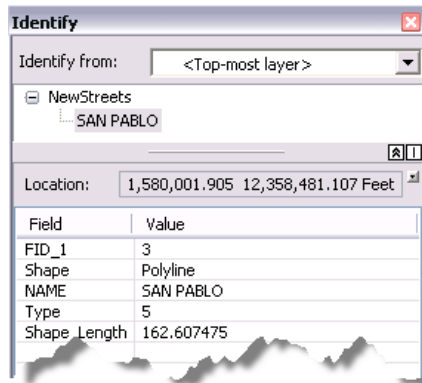
3. Click the **Editor** menu on the *Editor* toolbar and click **Stop Editing**.

4. Click **Yes** to save your edits.

5. Close ArcMap.

In this exercise, you learned how to transfer attributes from a source layer to a target layer. You have now completed the editing tutorials.