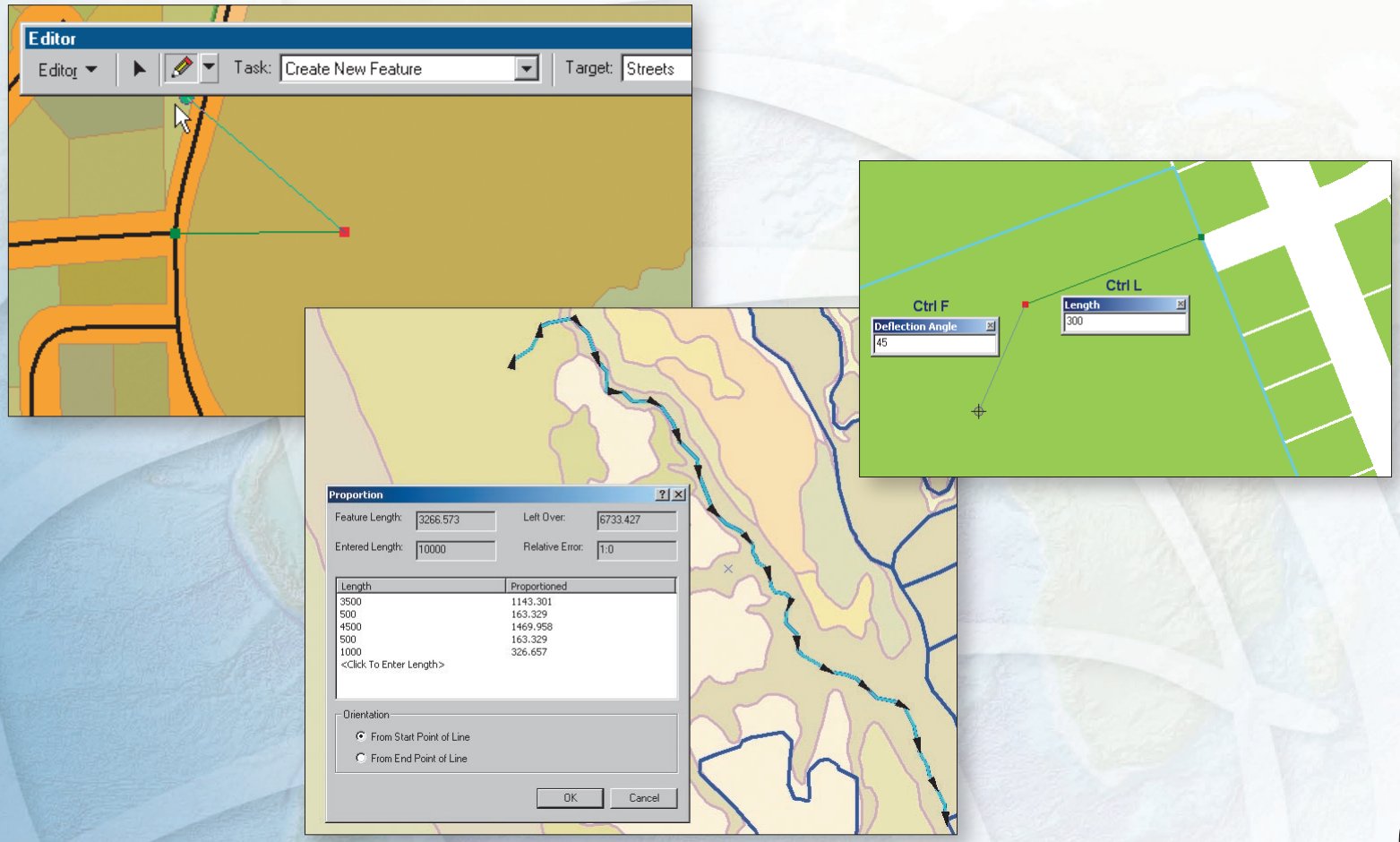
GIS Best Practices

Be More Productive With ArcGIS: ArcMap



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What Is GIS?

Making decisions based on geography is basic to human thinking. Where shall we go, what will it be like, and what shall we do when we get there are applied to the simple event of going to the store or to the major event of launching a bathysphere into the ocean's depths. By understanding geography and people's relationship to location, we can make informed decisions about the way we live on our planet. A geographic information system (GIS) is a technological tool for comprehending geography and making intelligent decisions.

GIS organizes geographic data so that a person reading a map can select data necessary for a specific project or task. A thematic map has a table of contents that allows the reader to add layers of information to a basemap of real-world locations. For example, a social analyst might use the basemap of Eugene, Oregon, and select datasets from the U.S. Census Bureau to add data layers to a map that shows residents' education levels, ages, and employment status. With an ability to combine a variety of datasets in an infinite number of ways, GIS is a useful tool for nearly every field of knowledge from archaeology to zoology.

A good GIS program is able to process geographic data from a variety of sources and integrate it into a map project. Many countries have an abundance of geographic data for analysis, and governments often make GIS datasets publicly available. Map file databases often come included with GIS packages; others can be obtained from both commercial vendors and government agencies. Some data is gathered in the field by global positioning units that attach a location coordinate (latitude and longitude) to a feature such as a pump station.

GIS maps are interactive. On the computer screen, map users can scan a GIS map in any direction, zoom in or out, and change the nature of the information contained in the map. They can choose whether to see the roads, how many roads to see, and how roads should be depicted. Then they can select what other items they wish to view alongside these roads such as storm drains, gas lines, rare plants, or hospitals. Some GIS programs are designed to perform sophisticated calculations for tracking storms or predicting erosion patterns. GIS applications can be embedded into common activities such as verifying an address.

From routinely performing work-related tasks to scientifically exploring the complexities of our world, GIS gives people the geographic advantage to become more productive, more aware, and more responsive citizens of planet Earth.

Have More Productive Editing Sessions

ArcMap is an application within the ArcGIS Desktop products (ArcInfo, ArcEditor, and ArcView). It can be used for creating and editing geographic and tabular data as well as making maps and performing spatial analysis. ArcMap provides a common editing interface using sophisticated editing tools that work the same way in ArcInfo, ArcEditor, and ArcView. With these tools, features can be constructed quickly and easily while maintaining the data's spatial integrity. Multiple users within an organization can simultaneously edit data on a shared geodatabase using ArcMap in concert with ArcSDE. This combination provides tools for managing long editing transactions and resolving possible conflicts.

This booklet contains a three-part series that shares tips for enhancing map editing productivity. Written by ESRI staff members Colin Childs and Keith Mann, these articles originally appeared in *ArcUser* magazine. Childs and Mann present productivity tips as a series of challenges. For each challenge, a scenario describing a common editing task or problem is identified and followed by its solution.

The first article covers basic strategies for working with layers and controlling how features are edited. The second article shows how to take advantage of the Sketch tool, Sketch constraints, and the Midpoint tool to enhance common workflows. The third article supplies information on dividing features, changing x,y coordinates, and working with more complex features such as multipart features.

Be More Productive with ArcGIS: ArcMap

By Colin Childs and Keith Mann, ESRI Educational Services

ArcMap is the comprehensive map authoring application for ArcGIS Desktop. In addition to data display and query, it is also used for high-level map creation and sophisticated editing so features can be created quickly and easily while maintaining the spatial integrity of a GIS database.

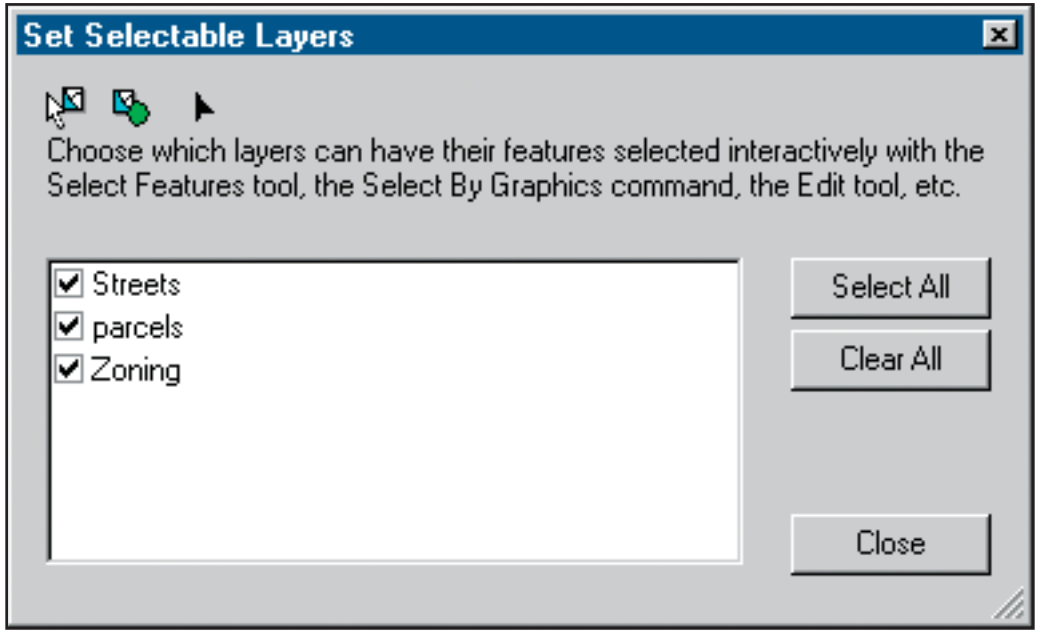
The same editing tools are available in ArcMap at all license levels—ArcInfo, ArcEditor, and ArcView. In ArcMap, you can edit shapefiles and geodatabases using a common user interface. This article highlights 11 useful tips and tricks that will make you more productive when editing in ArcMap. You will learn how to perform the following tasks:

Task	Challenge
Modify feature selection by individual layer.	1
Select the desired feature from overlapping selectable layers.	2
Prevent selected features from being moved accidentally.	3
See the feature type or layer currently affected by the active snap agent.	4
Control which features snap.	5
Override snapping environment settings.	6
Toggle between the Sketch tool and other editing tools using shortcut keys.	7
Use units different than the map units when specifying distance for a sketch segment.	8
Cut polygon features based on a specified distance from a line feature.	9
Rotate a selected line feature on one endpoint and snap the other endpoint to another feature.	10
Explore a map in detail and perform edits without changing the map display scale.	11

Each topic will be presented as a challenge with a solution. This article assumes you are already familiar with the edit features in ArcMap, know how to start an edit session, and are familiar with the Editor toolbar in ArcMap.

Challenge 1

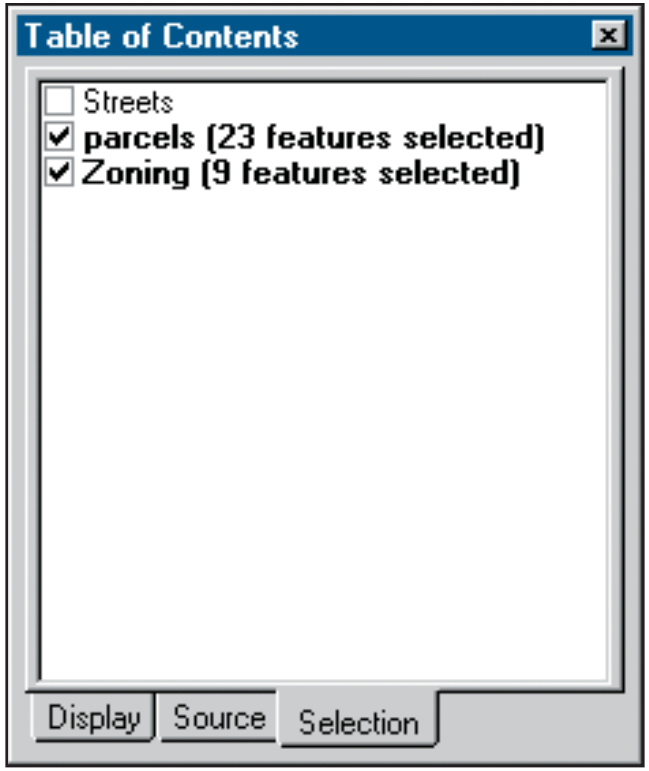
When working with multiple selectable layers, how can you modify feature selection by individual layer?



Shortcut keys let you change selectable layers without returning to the Set Selectable Layers dialog box.

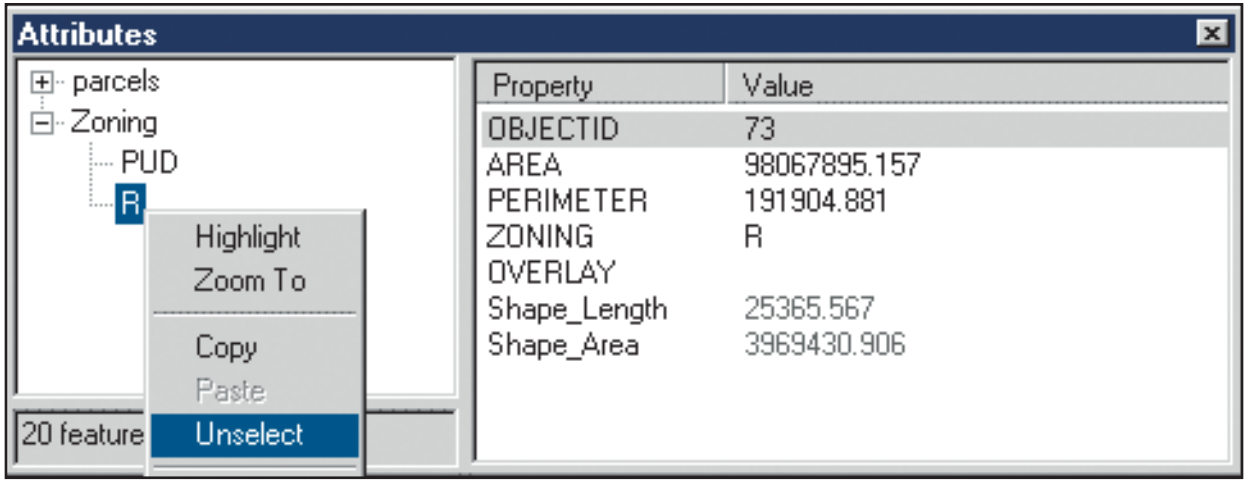
Scenario

Often in an edit session, more than one layer has been made selectable in the Set Selectable Layers dialog box. However, there are occasions when you may want to modify a selection from a layer or disable a selection from a layer without returning to the Set Selectable Layers dialog box.



Use the Selection tab of the Table of Contents in ArcMap to quickly turn selectability off and on for layers.

Solution Use the Selection tab on the ArcMap Table of Contents. With this tab selected, you can control which layers are selectable by checking them. When you select features in the map, those layers are shown in bold and the number of selected features on each layer is reported in parentheses.



Right-click on the feature attribute and choose Unselect from the context menu to use the Attributes dialog box to modify a selection.

On the Selection tab, right-clicking on a layer with selected features invokes a context menu that contains options for modifying the selection that include Zoom to Selected Features, Clear Selected Features, and Switch Selection. Note that each function in this context menu operates only on features in that layer, not on all features in all selectable layers (which is the case when using the Selection dialog box).

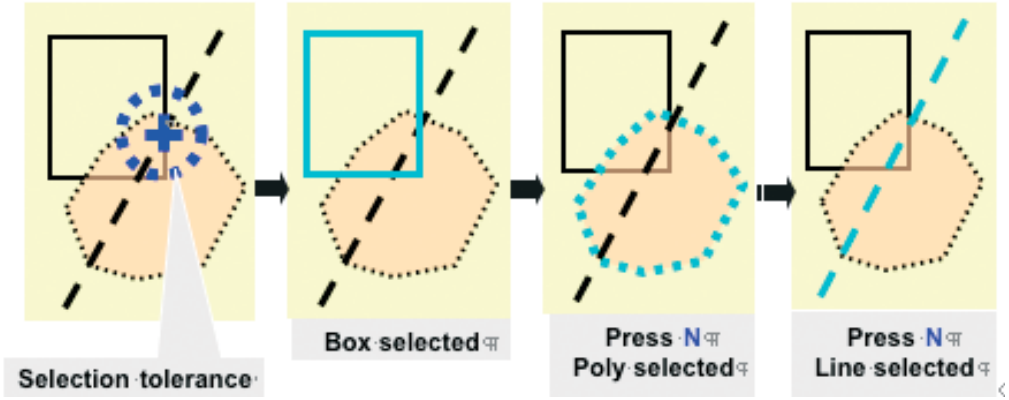
The Attributes dialog box can also be used to modify a selection by unselecting features from a set of selected features based on an attribute value. Click on the Attributes button on the Editor toolbar to open the Attributes dialog box. Expand the layer in the layer list of selected features. Right-click on the feature attribute and choose Unselect from the context menu.

Challenge 2 How can you make sure you are selecting the right feature from overlapping selectable layers?

Scenario When selecting features that overlap with other features within the selection tolerance, how do you ensure you have selected the right feature? Furthermore, how can you cycle between the overlapping features to choose the correct one for editing?

Solution Select a feature on the map with the Edit tool, and use the Select Next function to cycle through all features within the selection tolerance of that selected feature. Simply press the N key to cycle through the selections. This is a useful way to select a particular feature where several features overlap. If you select the wrong feature with the Edit tool, press the N key to deselect this feature and select the next feature within the selection tolerance. Continue pressing the N key to cycle through all the features under the originally selected feature, based on the order of the selectable layers.

Use the Select Next function to cycle through all the features within a selection tolerance.

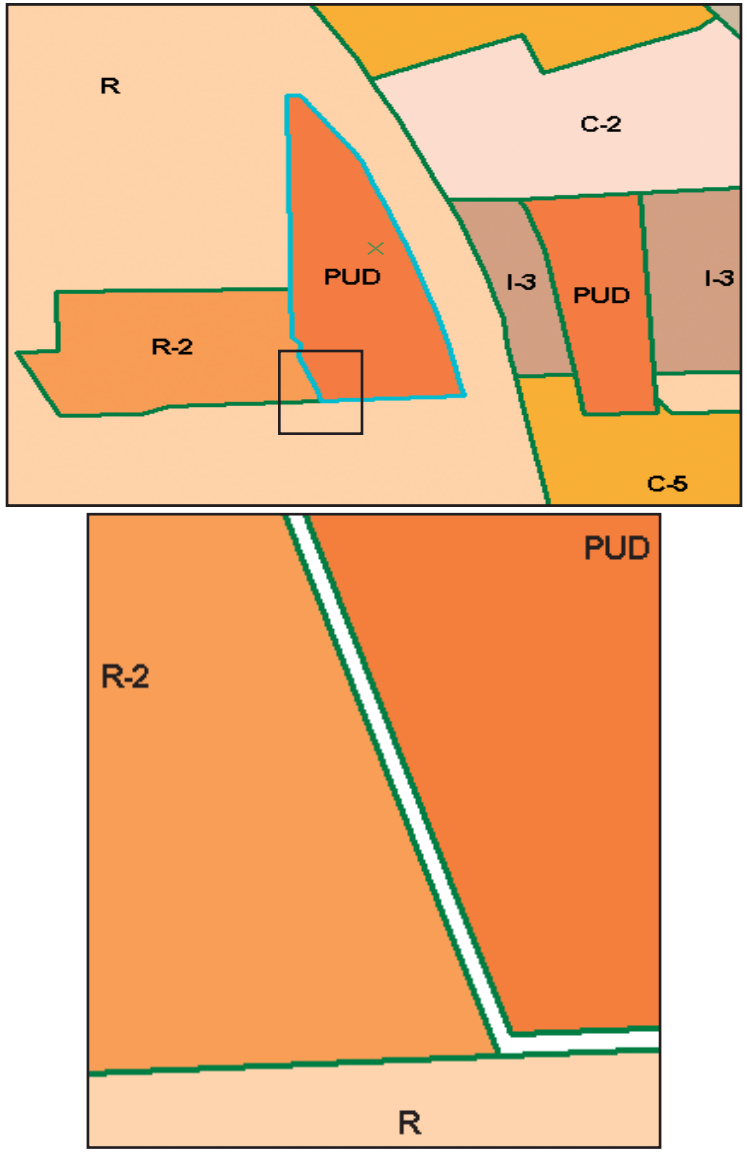


If you select the wrong feature with the Edit tool, simply press the N key to deselect this feature and select the feature that is within the selection tolerance.

Challenge 3 How can you avoid accidentally moving selected features?

Scenario While editing features, it is easy to unintentionally move a selected feature. This can create small gaps between features that should be contiguous and share coincident boundaries or edges.

Solution Set the Sticky Move Tolerance in the Editing Options dialog box. Click on the Editor menu in the Editor toolbar, choose Options, and click on the General tab in the Editing Options dialog box. The Sticky Move Tolerance sets the minimum distance, in pixels, that the cursor needs to be moved before selected features will be moved with the Edit tool. This minimizes the risk of inadvertently moving selected features with the Edit tool.



Set the Sticky Move Tolerance to avoid unintentionally moving features and creating small gaps between features. These gaps, not visible when zoomed out (top), become apparent when zoomed in (bottom).

Challenge 4 How can you visualize the snapping environment while editing?

Scenario It is often difficult to visualize which feature type or layer is currently affected by an active snapping agent. Knowing the feature type and/or layer gives greater control over snapping operations and minimizes the chances of inadvertently snapping to the wrong feature.

Solution There are several tools that help identify whether snapping will be to a vertex or edge and on which layer snapping is taking place. These tools—snap tips, the snapping indicator, and the T shortcut key—are available during an editing session if the snapping tolerance on the General tab of the Editing Options dialog box has been set.

Click on the Editor menu in the Editor toolbar, choose Options, click on the General tab in the Editing Options dialog box, and check the box next to Show Snap Tips. When snapping, a snap tip (a small text box) will appear on the map identifying the layer and showing the type of features just snapped to. The snapping indicator displays the same information in the ArcMap window status line in the snapping indicator. Holding the T shortcut key down while using the Sketch tool will display a circle showing the current snapping tolerance around a vertex.

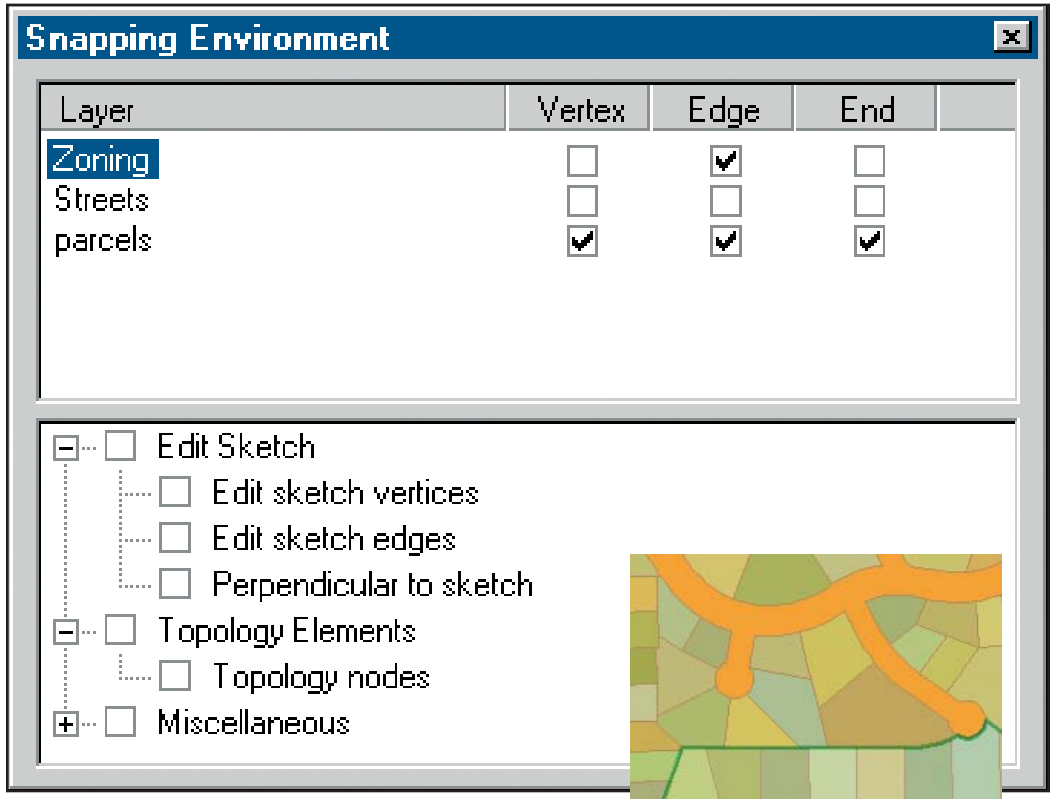
Challenge 5 How do you control how features snap to one another and which snap agents take precedence when snapping occurs?

Scenario Snapping is an important ArcMap function that allows you to make precise and efficient edits. However, it is important to control how features snap together by setting snap agents and their priorities.

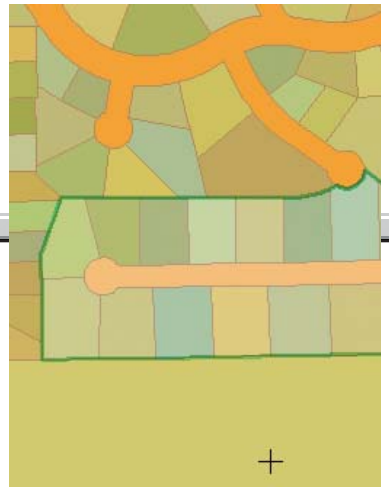
Solution In addition to choosing layer snapping agents (vertex, edge, or endpoint), set the snapping tolerance and snapping priority of the layers. Set snapping tolerance explicitly on the General tab of the Editing Options dialog box as a distance value in either map units or pixels. Alternately, the Snap Tolerance tool can be used to interactively set the snapping tolerance. Add the Snap Tolerance tool to the Editor toolbar by choosing Tools > Customize, clicking on the Commands tab, and dragging the Snap Tolerance tool to the Editor toolbar. To use the Snap Tolerance tool, click on it in the toolbar, click on the map, and drag out a circle the size of the desired snapping tolerance.

Prioritizing snap layers controls the actions of snap agents. From the Editor toolbar menu, choose Snapping. Snapping occurs first to features on the top layer listed in the Snapping

Environment dialog box. Drag layers with priority to the top of the list. Setting snapping priorities helps in situations in which the target features in one layer are surrounded by features from other layers.



Explicitly set layer snapping agents in the Snapping Environment dialog box.



Alternatively, layer snapping agents can be set interactively by adding the Snap Tolerance tool from the Customize dialog box.

Challenge 6 How can you override the snapping environment?

Scenario

You may want to snap to a vertex, edge, or endpoint of a feature regardless of the current snapping environment settings and snap agents.

Solution

Use the Snap To Feature option available from the Sketch tool context menu. While sketching, right-click and choose Snap to Features > Endpoint, Vertex, Midpoint, and Edge from the context menu. Snapping on the fly overrides the current snapping environment settings. Snap to Features can also enable Snap to Feature Geometry without setting individual snap agents. Using Snap to Features also allows for snapping to the midpoint of a line or polygon boundary—an option not available with the regular snap agent. The snapping environment can temporarily be suspended by holding down the spacebar.

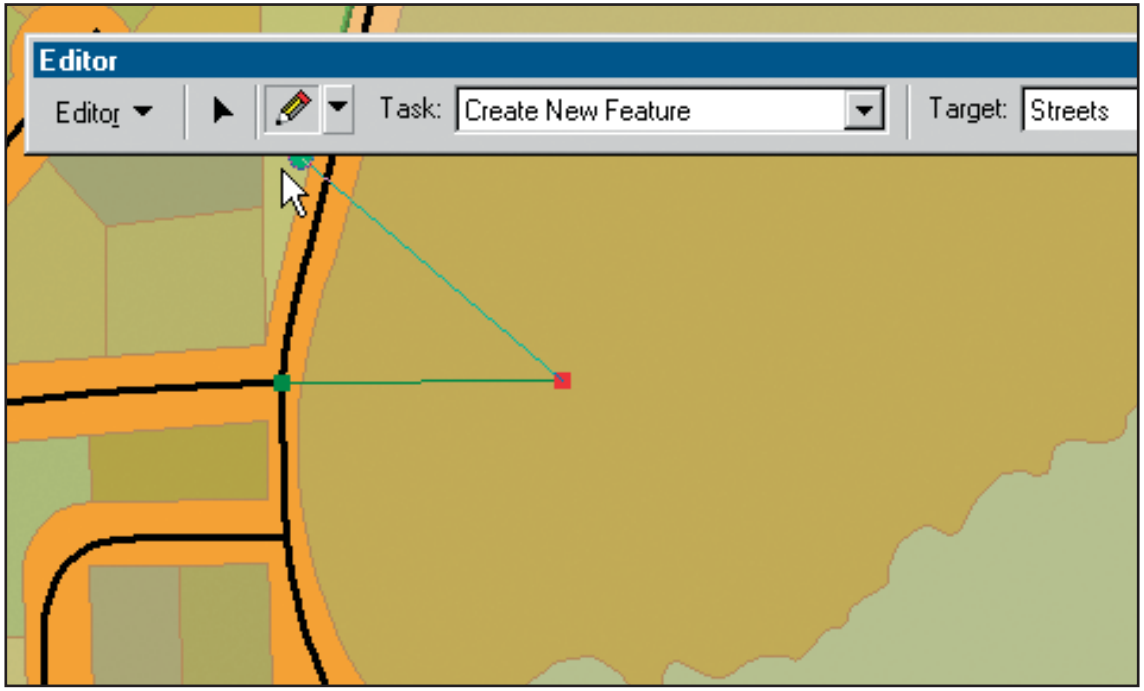
Z key	Zoom in
X key	Zoom out
C key	Pan
V key	Show vertices
Esc	Cancel
Ctrl + Z	Undo
Ctrl + Y	Redo
Spacebar	Suspend snapping

Table 1: Useful shortcut keys.

Challenge 7 **How can you quickly switch between the Sketch tool and other tools without visiting the toolbar?**

Scenario While constructing a new feature with the Trace sketch tool, you realize you need to suspend tracing to select additional features. However, you don't want to complete the current sketch feature and restart a new feature.

Solution Use the shortcut keys. For the scenario just described, use the E shortcut key to toggle between Sketch and Edit tools. Some of the most useful shortcut keys are listed in Table 1. More shortcut keys can be found in ArcGIS Desktop Help by typing "shortcuts" in the Index search box and choosing "For editing in ArcMap" in the results list.



Toggle between the Sketch tool and other editing tools by using the shortcut keys.

Challenge 8 **When sketching a segment, how can you specify a distance in units that are different than the map units?**

Scenario You received data in feet but the map units for the features your database features is meters. Rather than converting this data before creating new features, you want to specify lengths in meters while sketching.

Solution While sketching, type an abbreviation for any unit and ArcMap will convert the sketch unit automatically to the map unit used in the Data Frame.

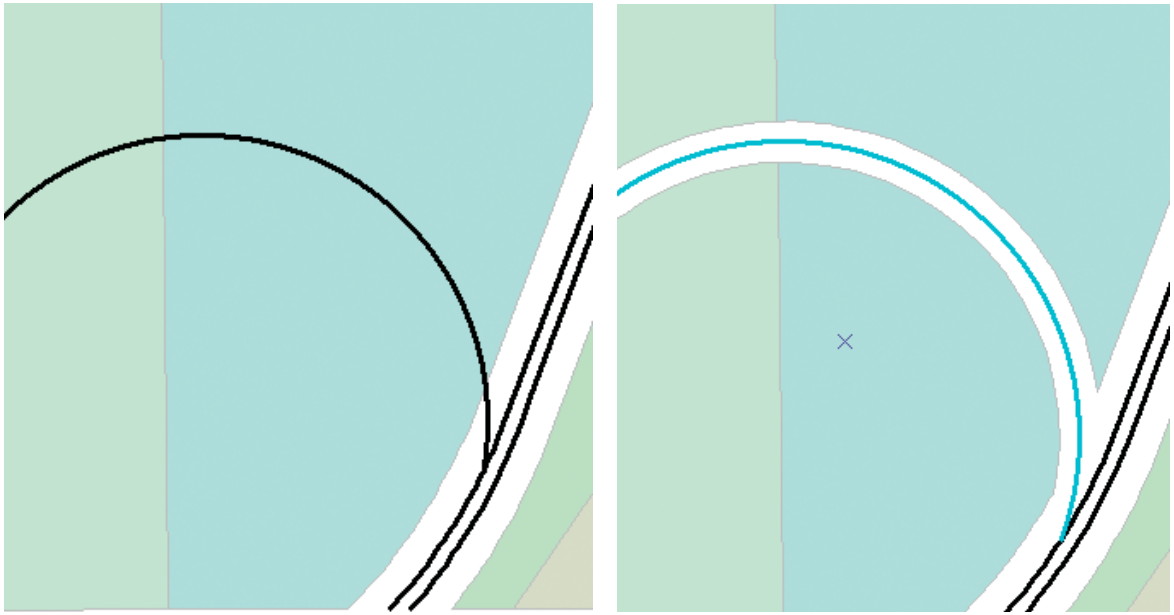
Unit	Abbreviation
Meter	m
Kilometer	km
Millimeter	mm
Foot	ft
Mile	mi
Nautical mile	nm
Chain	ch
Yard	yd
Inch	in
Survey Foot	ftUS
Survey Chain	chUS
Survey Mile	miUS
Survey Yard	ydUS

Table 2: Unit abbreviations.

Challenge 9 How can you cut polygon features based on a specified distance from a line feature?

Scenario You need to use a line feature as a template for constructing new features in a polygon target feature class. The line feature serves as a basis for cutting away from the target polygon feature class.

Solution Use the Clip tool in the Editor toolbar menu. Before using the Clip tool, select the source feature and set the target layer where features will be modified. The Clip tool will buffer the selected feature and erase the buffer area from the target feature class.



Cut polygon features based on a specified distance from a line feature using the Clip tool.

Challenge 10

How can you rotate a selected line feature on one endpoint and snap the other end to another feature?

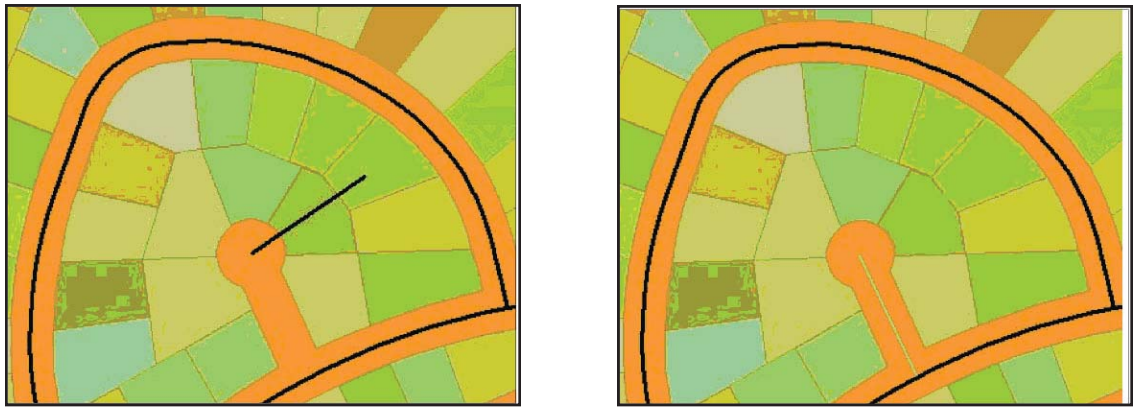
Scenario

You have received some coordinate geometry data that describes length and other characteristics of a new road located in a cul-de-sac. When you construct the road with the traverse tools, you find the angle supplied was incorrect. The feature needs to be rotated and snapped to another street, but you do not want to alter the starting position of the feature and you want to snap the endpoint to the existing road.

Solution

Use the Auxiliary Selection Anchor. Add a secondary selection anchor to a feature by pressing the S key while the feature is selected. The original selection anchor serves as a pivot point and the new auxiliary anchor becomes the snapping point. Accomplish this by

- Setting the snapping environment.
- Selecting the line feature.
- Pressing the S key to create an Auxiliary Selection Anchor. Position both anchors.
- Clicking on the Rotate tool in the Editor toolbar. Use it to position the selection anchors. The first anchor acts as the pivot point and the second anchor acts as the snapping point so the features can rotate and snapping will occur.



Use the Auxiliary Selection Anchor to rotate and snap features.

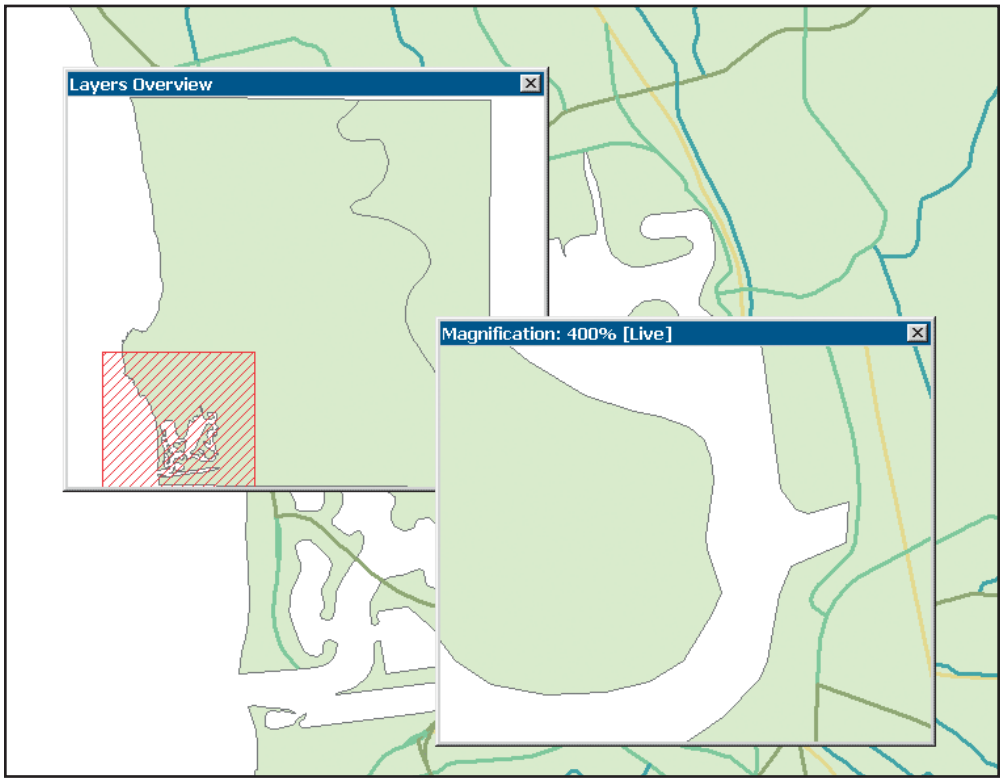
Challenge 11 How can you explore your map in detail and edit without changing the map display?

Scenario

While editing data, you want to magnify an area without changing the map scale. You may have several edits located across an area and you need to locate where these edits will be made and make snapshots of each location so the edits can be executed later.

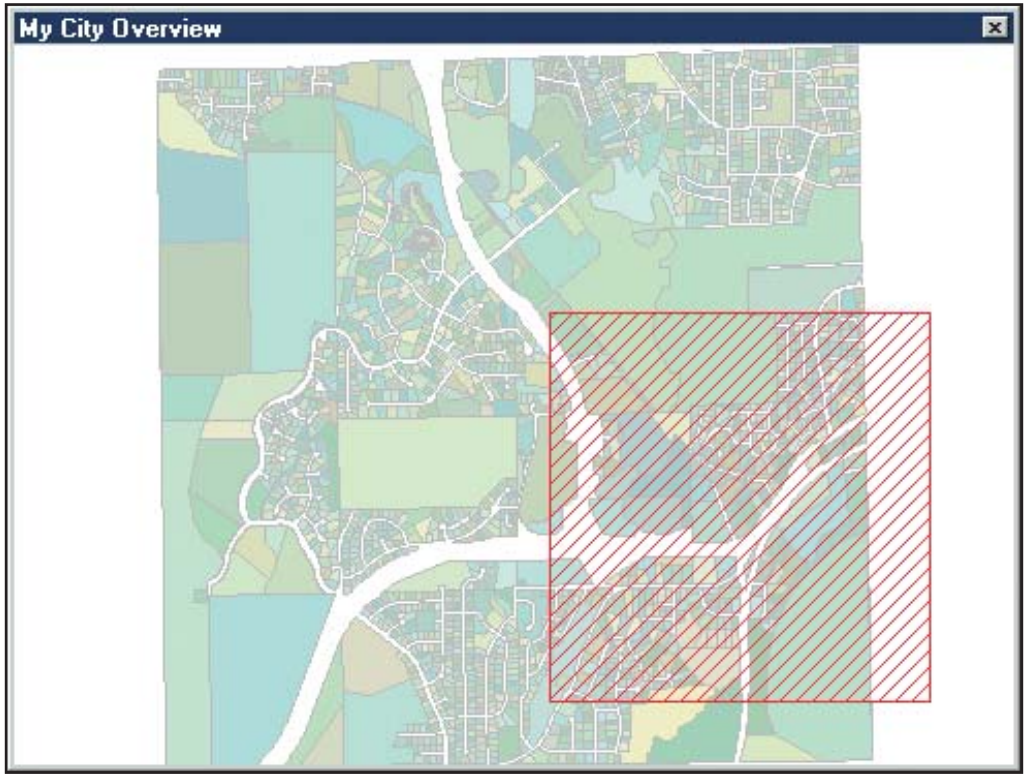
Solution

Use the Overview and Magnifier windows. The Overview window shows the full extent of the data. Adjust the selection box in the Overview window by dragging, shrinking, or expanding it to change the map display in the active data frame.



Use the Magnifier window to view an area more closely without changing the map scale. Create snapshots of several areas using the Magnifier window and return quickly to them later to complete the edits. Use the Magnifier window in conjunction with the Overview window to speed editing tasks (see the next illustration).

The Magnifier window works like a magnifying glass. Pass the window over the desired map features to see a magnified view of that location. Moving the Magnifier window does not affect the current map display. Right-click the title bar and click Properties to set the zoom property for the window. Create snapshots from the Magnify window by right-clicking on the title bar and choosing Snapshot to capture the current view.



The Overview window shows the full extent of the data. Adjust the selection box in the Overview window by dragging, shrinking, or expanding it to change the map display in the active data frame.

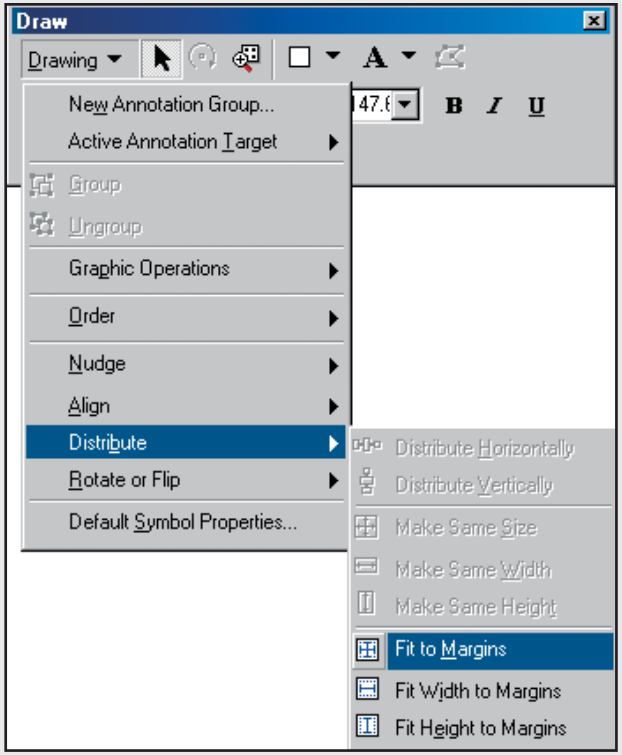
Conclusion

Much of the content covered in this article is demonstrated in *Editing in ArcGIS 9: Tips and Tricks,* an hour-long, self-paced, online training seminar presented by one of the authors, Colin Childs, and offered at no charge by the ESRI Virtual Campus.

There are many ways to make editing easier and more efficient, and these are just a few techniques. For one of the best sources for more editing tips, see *Editing in ArcMap,* a manual that is part of documentation for ArcGIS 9. Also, the ESRI Virtual Campus (campus.esri.com) offers several courses such as *Creating and Editing Geodatabase Features with ArcGIS 9, Creating and Editing Linearly Referenced Features with ArcGIS 9,* and *Creating and Editing Geodatabase Topology with ArcGIS 9.* Visit www.esri.com/training to learn about instructor-led training courses that include information on editing such as *Introduction to ArcGIS II, Building Geodatabases I,* and *Creating and Editing Parcels with ArcGIS.*

Size Map Elements to Margins

When in Layout View, three new options in the Draw toolbar automatically size selected map elements or graphics to fit within the margins of a map layout. These commands—Fit To Margins, Fit Width To Margins, and Fit Height To Margins—are accessed by clicking on the Drawing menu in the Draw toolbar and choosing Distribute. If Use Printer Paper Settings was checked as the Map Page Size in the Page and Print Setup dialog box, these commands will use the printer margins to orient elements. If this option was not checked in the Page and Print Setup dialog box, these commands will use the edge of the page.



(Reprinted from the July–September 2005 issue of *ArcUser* magazine)

ArcMap Editing Tips and Tricks Using Sketch and Midpoint Tools

By Keith Mann, ESRI Industry Solutions on the Government Team, and Colin Childs, ESRI Educational Services

This article supplies ArcMap editing tips and tricks that will make users more productive by helping them take advantage of additional functionality and enhanced workflow features that speed common tasks. It will cover the use of the Sketch tool, Sketch tool constraints, and the Midpoint tool. The material is presented as a series of challenges and solutions. See Table 1 for an overview of the topics covered.

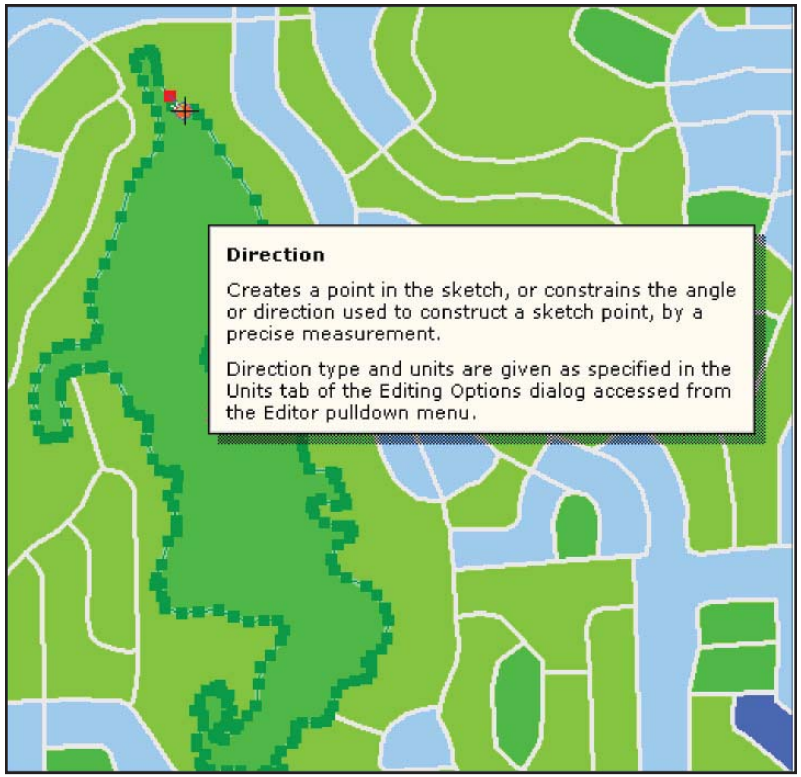
Task	Challenge
Getting Help in Context	1
How Do You Edit in Projected Space?	2
Sketch Constraints	3
Adding New Features Using Existing Features	4
Squaring a Polygon or Polyline	5
Constraining Sketch Length, Direction, and Curves	6
Constructing a Segment Parallel or Perpendicular to Another Segment	7
Creating a Segment Using an Angle or Deflection and a Length	8
Creating a Segment at an Angle from Another Segment	9
Constructing Centerlines with the Midpoint Tool	10
Constructing Features Offset from Other Features	11

Table 1: List of topics covered.

Challenge 1 Getting Help in Context

Scenario You need specific help about a tool, button, menu command, or dialog box in ArcMap but don't want to invoke the help system.

Solution Positioning a mouse pointer over a button or menu command causes the name of the item to pop up in a small box. A brief description of the item also appears in the status bar at the bottom of the application window. Access additional help about any command, button, or control in the application by clicking on the item in question with the What's This? tool. For context help, press Shift + F1.



For help in a context menu, highlight the command and press Shift + F1.

Click on a menu choice or button with the What's This? tool to get context-sensitive help.

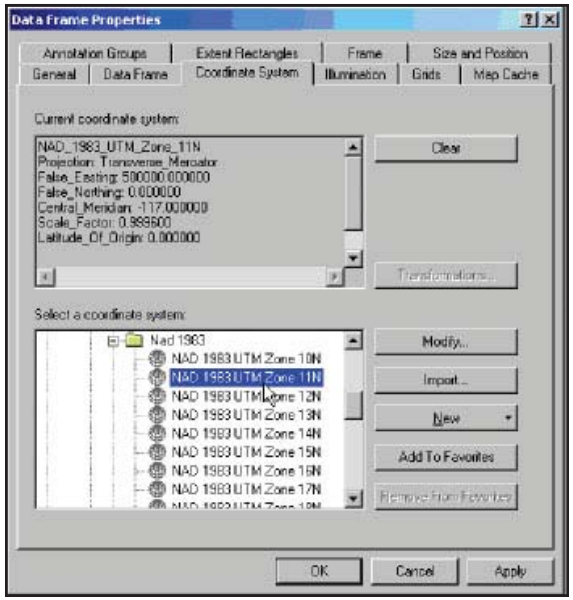
Challenge 2 How Do You Edit in Projected Space?

Scenario You've collected data from a variety of sources, and not all these layers are in the same coordinate system information. While reprojecting the data into a common coordinate system before editing is a solution, it may not always be practical.

Solution In ArcMap, the properties of a Data Frame define the context for the data. These properties include measurement units; scale; and, most important for this scenario, the coordinate system. Layers are automatically transformed to the coordinate system set for the Data Frame. Consequently, the shapes and attributes of a layer can be edited regardless of the coordinate system that layer is stored in. After making and saving edits, the edits will be committed back to the source feature class in its original coordinate system.

Issues to consider when editing features in a projection different from the source:

- Changing the shapes of features
- Snapping to the edge or boundary of features
- Extending or trimming features
- Editing curves in projected space can, in some cases, change the shape of the curve.



Use the Data Frame Properties dialog box to set the coordinate system.

How ArcMap Sets the Data Frame's Coordinate System

Remember that with a new, empty map, the coordinate system for the default Data Frame is not defined. ArcMap will adopt the coordinate system of the first layer added to the map that has a defined coordinate system. ArcMap will apply this coordinate system to any layers subsequently added to the map. If the data source has no defined coordinate system, ArcMap will automatically analyze the coordinates in the source data. If the coordinates range from 0–180, ArcMap sets the Data Frame coordinate system to GCS_Assumed_Geographic.
If coordinates fall outside that range, the coordinate system will be set to Unknown. To use a specific coordinate system, set the coordinate system in the Data Frame Properties dialog box.

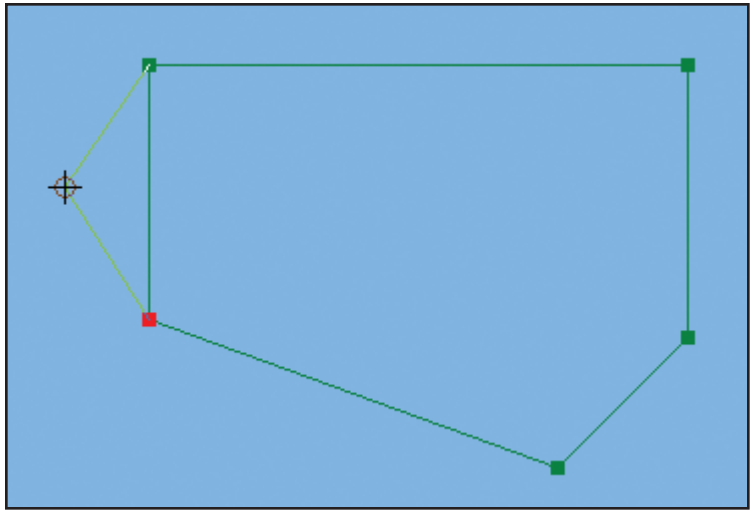
Challenge 3

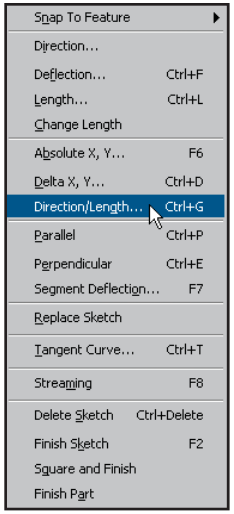
Sketch Constraints

To create a new feature in ArcMap, you create an edit sketch using the sketch construction tools. A sketch is a shape that is used to complete the current edit task. It is composed of vertices (i.e., the points where the sketch changes direction) and segments (i.e., the lines that connect the vertices).

Create a point feature by clicking once on the map with the Sketch tool. Use the Sketch tool to digitize the vertices that make up the line or polygon feature. To create the last vertex of a line or polygon and finish the sketch, double-click the mouse. ArcMap will add the final segment of the sketch, and the sketch will turn into a feature.

The Sketch context menu can be accessed while working with the sketch by right-clicking on the sketch. In addition to adding, moving, and deleting vertices, the commands in this menu can be used to switch the direction of the sketch, reduce the length of the sketch, or display the properties of the sketch shape.





The Sketch tool context menu gives direct access to commands for modifying the sketch.

Scenario New spatial features may have specific construction requirements such as squared corners or a segment with specifically defined directions. Other than using coordinate geometry, how can you construct features that meet these requirements?

Solution The Sketch tool contains more advanced methods for constructing features—sketch constraints. Sketch constraints are generally employed during sketch construction to limit, restrict, or prescribe how segments of the sketch should be constructed before the last vertex is created and the sketch is finished. Right-click on a segment to invoke the Sketch context menu. The Sketch tools also support many useful shortcut keys that make it simple and quick to apply a specific constraint when needed. See Table 2 for a list of shortcut keys.

Shortcut key	Editing function
Ctrl + A	Angle
Ctrl + F	Deflection
Ctrl + L	Length
Ctrl + D	Delta x,y
Ctrl + G	Direction/Length
Ctrl + P	Parallel
Ctrl + E	Perpendicular
Ctrl + T	Tangent curve
T key	Display the snapping tolerance
F6	Absolute x,y
F7	Segment deflection
F8	Streaming
Ctrl + Delete	Delete sketch
F2	Finish sketch
E key	Toggle between Sketch tool, Edit tool, and Edit Annotation tool

Table 2: Table of shortcut keys.

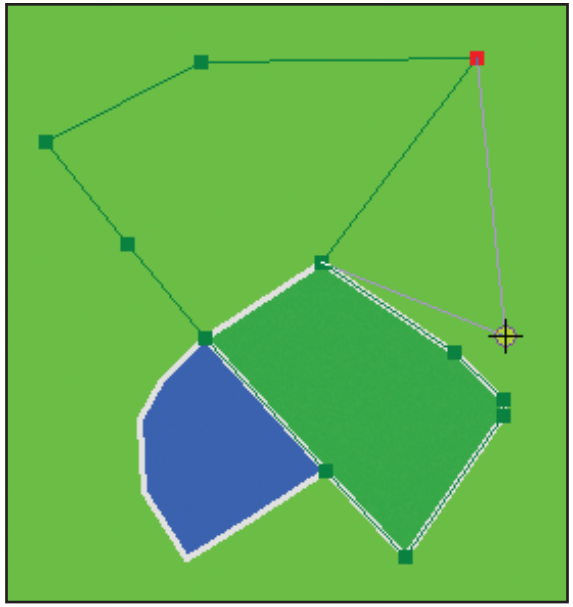
Challenge 4 Adding New Features Using Existing Features

Scenario

Capturing features representing natural resources, such as soil types, vegetation polygons, lakes, and shorelines, generally doesn't involve the use of sketch constraints. However, creating new features may require the use of existing features as the source for a boundary. For example, a lake boundary forms a segment of the boundary for a vegetation polygon. How can you use the lake boundary to construct the vegetation boundary?

Solution

Creating a new line or polygon feature can be done with the Sketch tool located on the Tool Palette. To use an existing feature from another layer as the basis for the feature currently under construction, add the shape of the source line or polygon feature to the current sketch by right-clicking over the source feature with the Sketch tool and clicking Replace sketch. The current sketch will now contain the shape of the source feature.



You can use an existing feature from another layer as the basis for a new feature by using the Replace Sketch command.

Challenge 5 Squaring a Polygon or Polyline

Scenario You are capturing building footprints. The angles from the first to the last vertex must be squared so the footprint feature will be squared.

Solution Use the Sketch tool to digitize at least two segments of the feature. Right-click anywhere on the map and click Square and Finish. The angles from the first vertex and the last vertex are squared. A new vertex is added, and the polygon or polyline is finished where the resulting segments intersect.

Challenge 6 Constraining Sketch Length, Direction, and Curves

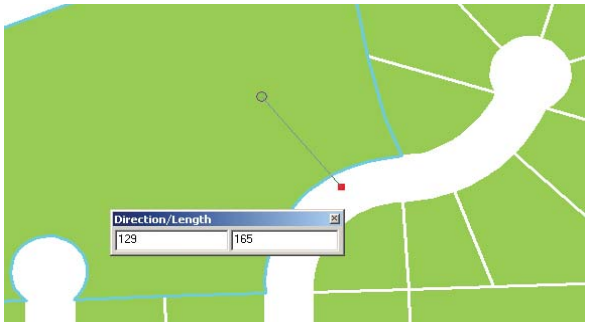
Scenario

You have been tasked with capturing the street casings for a new subdivision. Street casings consist of many straight and curved line segments. Segments are often parallel to each other or perpendicular to existing segments. How best can you incorporate these requirements in the feature creation process?

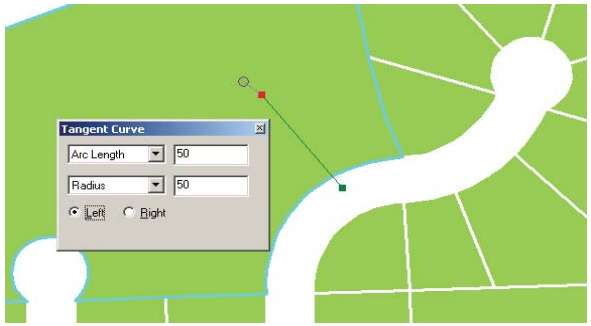
Solution

To construct straight segments, use the Sketch tool and apply Sketch constraints such as Perpendicular and Parallel to ensure the casements are constructed as required. To construct curves, use the Arc, End Point Arc, or Tangent tools from the Tool Palette or the Tangent Curve sketch constraint. Switch easily between the Sketch tool and the Arc, End Point Arc, or Tangent tool by holding down the keyboard E key to suspend the current tool and choosing the new tool. Use the following tools for specific tasks.

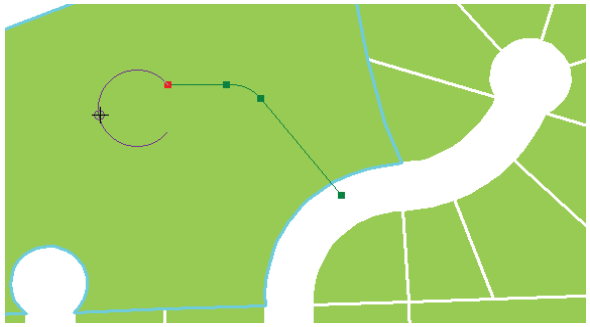
- Use the Arc tool to create a circular arc curve to digitize a cul-de-sac.
- Use the Endpoint Arc tool to place vertices for both ends of the arc and adjust the radius.
- When using the Tangent Curve tool, specify two of the following options: arc length, chord, radius, or delta angle and specify whether the curve will be created to the right or to the left of the line.
- Use the Tangent Curve sketch constraint to add a circular arc curve to an existing segment such as adding a curved segment to extend a centerline along a curved road. Specify two of the following options: arc length, chord, radius, or delta angle and specify the direction of the curve. The curve is created from the last vertex of the existing segment based on the parameters defined.



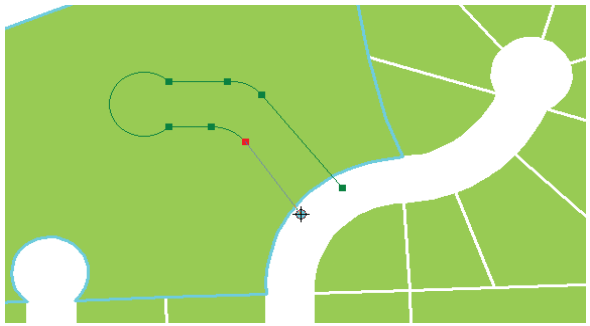
Use the Direction/Length constraint with the Sketch tool to control straight-line segments in a line.



When using the Tangent Curve tool, specify two of the following options: arc length, chord, radius, or delta angle and specify whether the curve will be created to the right or to the left of the line.



Use the Tangent Curve Sketch constraint to add a curve segment to an existing sketch that describes the circular termination of a cul-de-sac.



The Tangent Curve sketch constraint creates the curve from the last vertex of the existing segment based on the parameters defined.

Challenge 7 Constructing a Segment Parallel or Perpendicular to Another Segment

Scenario You need to create the lanes for a dual carriage road. These lanes are parallel to an access road.

Solution The Parallel command on the Sketch tool context menu constrains a segment to be parallel to a specified segment. The Perpendicular command on the Sketch tool context menu constrains a segment to be perpendicular to an existing segment.

To create a segment parallel to another segment:

1. Create at least one vertex with the Sketch tool.
2. Position the pointer over the segment that the new segment will be parallel to and right-click.
3. Choose Parallel from the context menu or press Ctrl + P to make the segment parallel.
4. The segment is now constrained to be parallel to the specified segment.
5. Click once to digitize the endpoint of the segment.

To create a segment perpendicular to another segment:

1. Create at least one vertex with the Sketch tool.
2. Position the pointer over the segment that the new segment will be perpendicular to and right-click.
3. Choose Perpendicular or press Ctrl + E to make the segment perpendicular.
4. The segment is now constrained to be perpendicular to the specified segment.
5. Click once to digitize the endpoint of the segment.

Challenge 8 Creating a Segment Using an Angle or Deflection and a Length

Scenario

While constructing road casings, you need to construct some casing segments at specific angles. Other casing segments must be constructed using a deflection away from the last segment constructed. Some of these segments also need to be a specific length.

Solution

Apply angle and length constraints while creating the road casing segments. Do this by either applying the Angle or Deflection command and a length constraint. Both the Angle and Deflection commands constrain the angle of the segment. Angle uses east as 0 degrees and measures positive angles counterclockwise. Deflection uses the last segment as 0 degrees and calculates the angle specified from there.

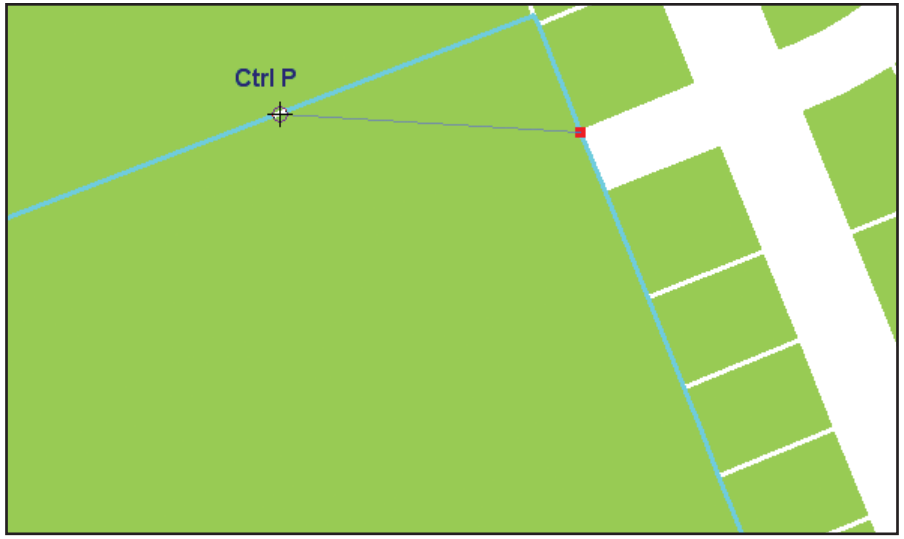
To create a segment using an angle or deflection and a length:

1. Create at least one vertex.
2. Right-click away from the sketch and choose Angle or press Ctrl + A.
3. Type the angle and press Enter. The segment will be constrained to the specified angle.
4. If creating a segment using a deflection angle from the last segment, click on the Deflection tool and type the angle from the last segment and press Enter.
5. Right-click anywhere on the map and choose Length or press Ctrl + L.
6. Type the length and press Enter.
7. Continue sketching. The new segment will be constructed with the desired angle and length.

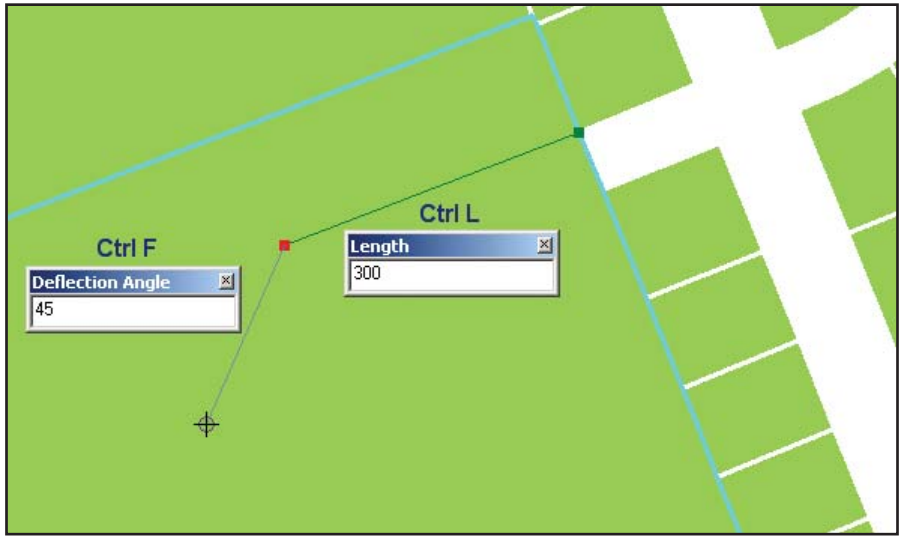
If you want to change the length of a segment you have already created, choose Change Length from the Sketch tool context menu. This will undo the last vertex but keep the angle constraint. To set the angle and length at the same time, choose the Angle/Length command from the Sketch tool context menu or press Ctrl + G.

Tip

Press Ctrl + F to set the deflection angle.



You can use a deflection away from an existing segment to create a new segment.



Both the deflection angle and the length of the segment can be specified.

Challenge 9 Creating a Segment at an Angle from Another Segment

Scenario

You are constructing a new road casing feature that must be deflected 45 degrees from a previous constructed segment that is not the last segment constructed.

Solution

Use the Segment Deflection constraint to create a segment at an angle relative to any existing segment. The selected segment is 0 degrees, and the deflection angle specified for the new segment is calculated from this segment. Positive values are calculated in a counterclockwise direction from the existing segment, and negative values are calculated clockwise.

Create a segment at an angle from another segment using Segment Deflection:

1. Create at least one vertex.
2. Position the pointer over the segment you want to create a segment from. Right-click and choose Segment Deflection.
3. Type the desired angle from the selected segment and press Enter or press F7 to set the angle. The segment is constrained to the specified angle.
4. Click once to digitize the endpoint of the segment or choose Length from the Sketch tool context menu.

Challenge 10 Constructing Centerlines with the Midpoint Tool

Scenario

If you are constructing street centerlines for existing street casing features, the centerline vertices must be created relative to the street casings. How do you accomplish this?

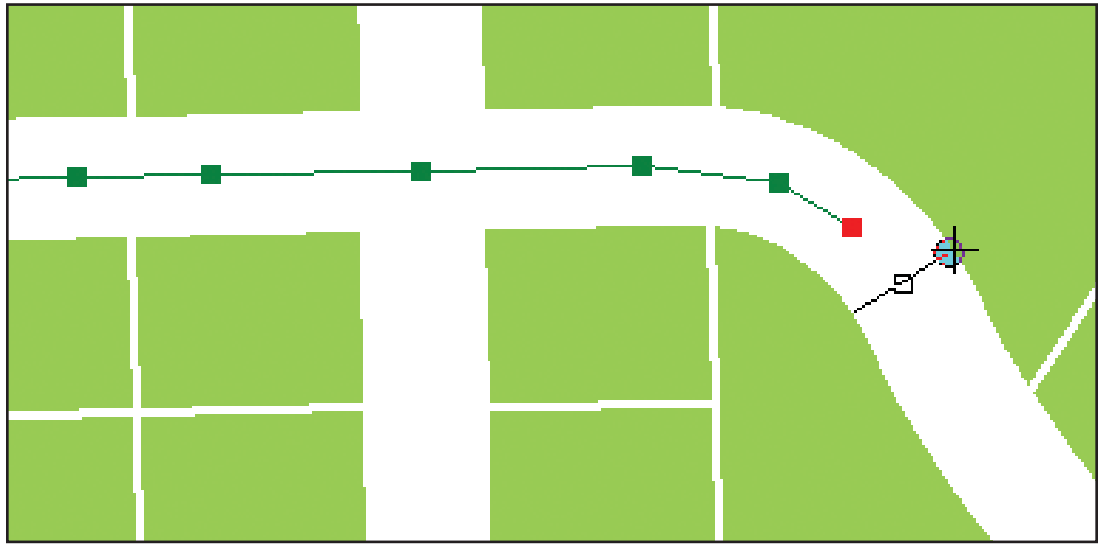
Solution

You may begin constructing the new centerline features with the Sketch tool. However, the Sketch tool does not allow vertices to be constructed relative to other features. You will need to switch to the Midpoint tool. Using the Midpoint tool, click to set the from point of the segment. Click again to set the to point. The midpoint of that line will be added to the edit sketch.

Tip

Create a snap agent and set an appropriate snap tolerance before using the Midpoint tool. Press and hold the Z, X, or C key to zoom or pan in the display while using the Midpoint tool. Press and hold the V key to see vertices within three times the snapping tolerance.

The Midpoint tool is helpful in constructing street centerlines relative to existing street casing.



With snapping turned on for the edges of the street casings, setting the from and to points for each segment is more precise, making it easier to generate centerline vertices.

Challenge 11 Constructing Features Offset from Other Features

Scenario

The owners of a commercial property have reserved a portion of a land parcel that will be developed for parking. The building inspector has required that the land reserved for parking be increased. Rather than resurvey the reserved portion, the owners want to increase its size by defining a new parking area boundary with the same angles as the old parking area, but offset the boundary to increase its size. What method could be used to accomplish this?

Solution

Using the Trace tool, create new sketch segments by tracing over the segments of selected parcel boundaries. Apply an offset so the segments will follow the angle of the selected parcels but be created away from the boundaries. Offset retains vertices from the selected features in the newly created feature.

Conclusion

Understanding how to use the powerful Sketch tool and applying constraints when working will help you accomplish common editing tasks more accurately and rapidly. For more editing tips, see *Editing in ArcMap,* a manual that is part of documentation for ArcGIS 9. The ESRI Virtual Campus (campus.esri.com) also offers several courses such as *Creating and Editing Geodatabase Features with ArcGIS 9, Creating and Editing Linearly Referenced Features with ArcGIS 9,* and *Creating and Editing Geodatabase Topology with ArcGIS 9.* Visit www.esri.com/training to learn about instructor-led training courses that include information on editing such as *Introduction to ArcGIS II, Building Geodatabases I,* and *Creating and Editing Parcels with ArcGIS.*

Additional Tips

- To delete a single vertex from a sketch, center the pointer over the vertex until the pointer changes. Right-click and select Delete Vertex.
- To delete the entire sketch of the feature being constructed, position the pointer over any part of the sketch, right-click, and choose Delete Sketch or press Ctrl + Delete.
- To finish a sketch, double-click the last vertex of the feature or press F2.
- Undo the last vertex created by clicking the Undo button on the ArcMap Standard toolbar. Click the button again to undo the second-to-last vertex created, and so on. Click the Redo button to store the vertex.

More Tips for the Trace Tool

- Press the O key to set an offset distance. Type a value for the offset distance and press Enter.
- Trace directly on top of existing features by entering a value of 0. Enter a positive value to trace to the right of the selected feature or a negative value to trace to the left of the selected feature.
- Press the Tab key to change sides when tracing.
- If the trace went too far or traced too many segments, move the mouse back over the segments to be removed or press the Esc key to cancel the trace.
- Limit the length of the trace using Limit Length in the Options dialog box.
- Change the method for how corners are created.
  - Mitered—extends line segments until they intersect
  - Beveled—adds a line segment to create a beveled corner
  - Rounded—adds a curved segment at the corner
- Change the selected features while tracing by clicking on the Edit tool, making a new selection, and clicking the Trace tool.

(Reprinted from the April–June 2006 issue of *ArcUser* magazine)

Divide and Conquer

ArcMap editing techniques for splitting and subdividing features

By Colin Childs, ESRI Educational Services, and Keith Mann,
ESRI Industry Solutions Government Team

This is the third in a series of tips and tricks articles on editing in ArcMap. ArcGIS at the ArcEditor or ArcInfo license level is required for these operations. This article will help make editing sessions more productive by supplying information on dividing features, changing XY coordinates for features, and working with more complex features. The material is presented as a series of challenges and solutions. See the accompanying table for an overview of the content.

Challenge	Topic
1	Splitting two lines where they intersect (interactively)
2	Splitting two or more lines where they intersect
3	Subdividing lines and generating coincident point features at line endpoints
4	Subdividing a line into two lines using percentage of length
5	Subdividing a line into three or more lines by specifying the length as a percentage of the original line length
6	Changing XY coordinates of an existing feature
7	Creating and working with multipart features
8	Creating or removing an empty hole in an existing polygon feature

Topics covered in this tutorial.

Challenge 1 Splitting two lines where they intersect (interactively).

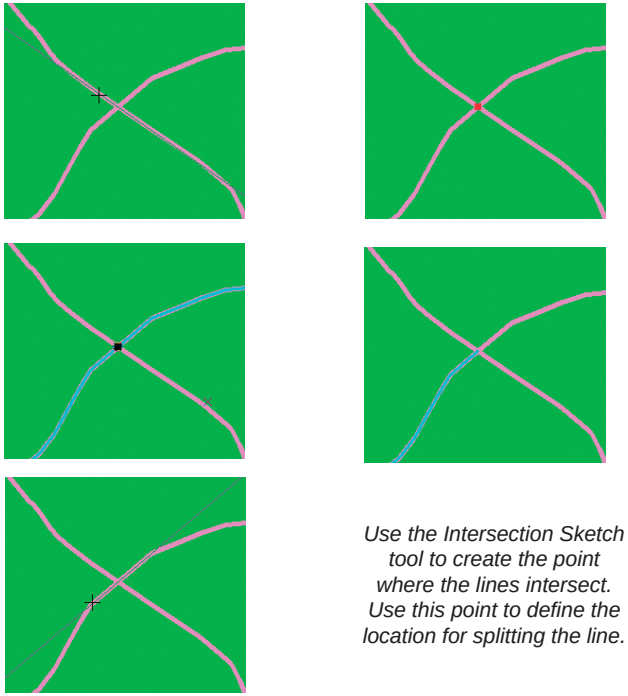
Scenario

While performing some quality control on street data, you notice that two street features that intersect at a traffic light were captured without creating an intersection. This will cause errors if network analysis is performed using these streets because the location where the streets are coincident would be represented as an overpass or underpass on the street network. Splitting the streets at their exact intersection will eliminate this problem.

Solution

Use the Intersection Sketch tool in a novel way to create the point where the lines intersect. Typically the Intersection Sketch tool is used to create a point or vertex at the implied intersection of two segments. In this case, this point will define the location for splitting two features. To construct the intersection:

1. In the Editor toolbar, choose Start Editing from the menu. Click the Tool Palette drop-down arrow and click the Intersection tool. The pointer turns into crosshairs.
2. Position the crosshairs over the first segment you want to create an intersection with, then click. A line extends from that segment across the map display so that you can see the first angle used to construct the point of intersection.
3. Position the crosshairs over the second segment and click. A construction point is added at the implied intersection of the two segments.
4. Use the construction point to split the lines at the intersection by defining a snapping agent to snap to the edit sketch vertex and then using the Split tool and snapping to the construction point.
5. To define the snapping agent, choose Snapping from the Editor menu. In the Snapping Environment window, check the Edit sketch vertices option. The Edit Sketch snapping options are located at the bottom of the Snapping Environment window. Note that snapping properties are effective as soon as they are checked or unchecked.
6. With the snapping agent defined, use the Split tool by selecting the line to split and clicking the Edit tool. Click on the construction point just created to select it. Click the Split tool on the Editor toolbar. Click the selected construction point, and the line is split into two features. Notice that snapping ensures the mouse pointer snaps to the construction point.



Use the Intersection Sketch tool to create the point where the lines intersect. Use this point to define the location for splitting the line.

Challenge 2 Splitting two or more lines where they intersect

Scenario While performing some quality control checks on street data, you notice several street features that cross without intersections. Because several of these intersections exist, you want to automate this process because splitting these streets interactively one at a time would be time consuming.

Solution A quick and simple solution would be to use the Construct Features tool.

1. Select all intersecting line features.
2. On the Topology toolbar, click the Construct Features tool.
3. A cluster tolerance can be included. Check the box to consider existing features of the target layer in the current extent. Click OK. This will use existing lines as input geometry and split the features where the selected lines cross them.

Challenge 3 Subdividing lines and generating coincident point features at line endpoints

Scenario

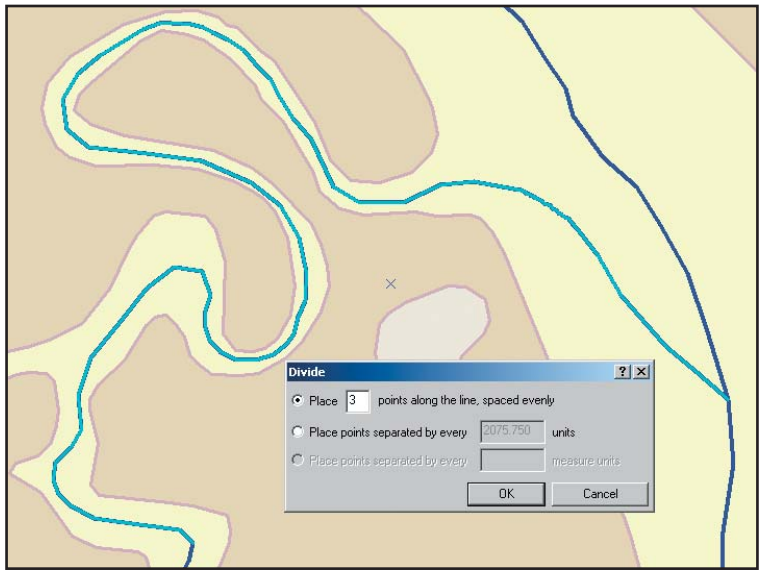
You are creating a river management plan. As part of this plan, you need to subdivide the feature representing an environmentally important river into an equal number of parts. Water quality monitoring equipment will be installed at the endpoints of these segments. How will you subdivide the river into equal parts and create point features coincident to the endpoints of the parts?

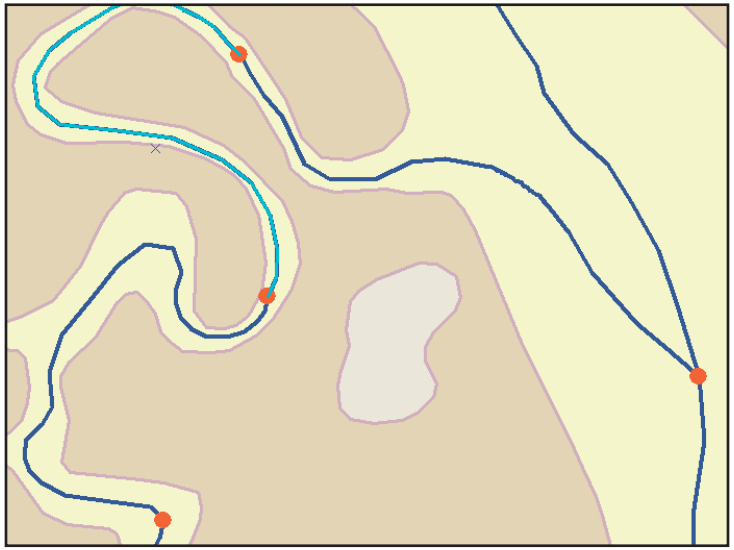
Solution

Make the target feature class the same as the line that will be subdivided.

1. Select the line feature and choose the Divide command from the Editor menu.
2. In the Divide dialog box, choose Place 3 points along the line, spaced evenly, then click OK.
3. Three new line features are added to the map but the original feature remains. All are selected.
4. Unselect the features by clicking on the original line feature to select it and changing the target layer to point feature class.
5. Use the Divide command again and choose Place 2 points along the line, spaced evenly.
6. Click OK.

Follow these steps to add four points—two where the line was subdivided by points and two at each end of the line. Select the original line feature again and delete it.





Use the Divide command to place three points, evenly spaced, along the line.

Challenge 4 Subdividing a line into two lines using percentage of length

Scenario

An existing street is being resurfaced. The contractor has only completed 60 percent of the resurfacing. You need to subdivide the street feature and update the attributes of the two resulting street parts to indicate their pavement conditions.

Solution

To subdivide the street by percentage of length, use the Split command. This command can use a specified distance value, a percentage of total length, or a measure value from either the start or end point of the feature.

1. Select the line using the Edit tool.
2. Choose the Split command **from the Editor menu.**
3. In the Split dialog box, choose Percentage of the line length.
4. In the text box, enter the percentage (in this example, 60). Click OK.

The original line feature is divided into two new line features with the first feature being 60 percent of the original line feature's length and the second feature 40 percent. Update the attributes.

Tip

The Split tool works with all license levels but will only be enabled if a single line feature is selected.

Challenge 5 Subdividing a line into three or more lines by specifying the length as a percentage of the original line length

Scenario

You are editing data in a natural resources application. A river feature has to be divided into several management units that will be assigned to different field offices for monitoring. How can the river feature be subdivided into three or more new features that are created as a percentage of the original river's length?

Solution

Using the Proportion command can split a selected line feature into a number of segments based on specified distance values. If there is a difference between the feature length and the entered values, this difference is proportioned between all of the new segments. Distance

values are given in map units by default. The challenge is to proportion the river feature with segments that are a percentage of the total river length.

1. Make the Advanced Editing toolbar active. Select the line feature and click on the Proportion tool on the Advanced Editing toolbar.

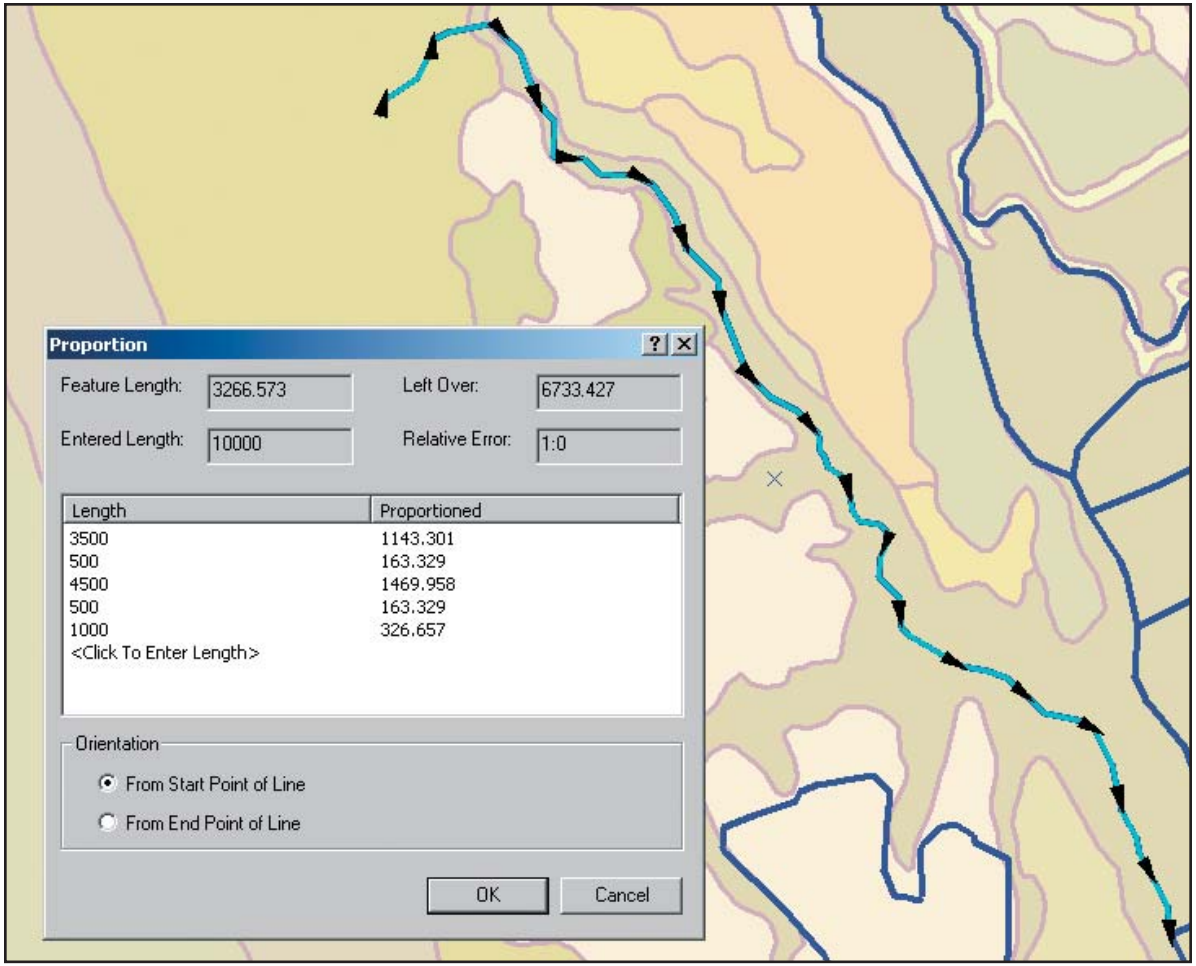
2 In the Proportion dialog box, the length of the selected feature is provided. Because the Proportion tool automatically redistributes leftover lengths (even negative lengths), you can subdivide line features into percentages as long as the percentages add up to 100 percent.

a. The trick is to choose a factor of 10 to represent 100 percent depending on the length of the feature.

b. If the feature length is less than 100 units (e.g., meters), enter lengths that add up to 100.

c. If the feature length is less than 1,000 units, enter lengths that add up to 1,000, and so on.

d. For example, if the line feature is 1,459.094 meters long, enter lengths that add up to 10,000 (3,500 + 500 + 4,500 + 500 + 1,000 = 10,000). The proportion tool divides the line into new lines of the appropriate percentage of the original line.

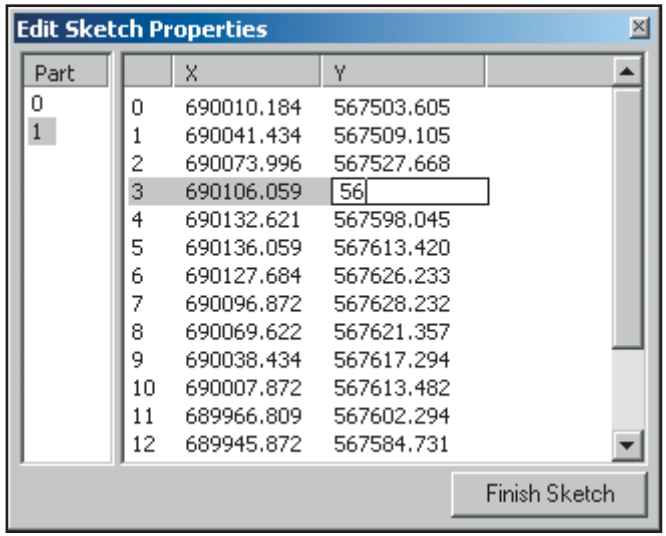


Use the Proportion command to split a selected line feature into a number of segments based on distance values.

Challenge 6 Changing XY coordinates of an existing feature

Scenario

You are working with forestry management data. Forest compartment polygons, a subunit of forestry management units, are the base mapping unit. The coordinates for several of these polygons must be updated. New environmental legislation will require that forest compartments bordering sensitive areas around streams be reduced in size. Trees within these sensitive areas will be felled. The vertices of some forest compartment boundaries must be updated and others removed. You would like to avoid recapturing the compartment polygons and, fortunately, you have a list of GPS coordinates for the new boundary positions.



Use the Edit Sketch Properties dialog box to insert and delete vertices, remove parts of multipart features, and change the z- and m-values of vertices.

Solution

Modifying coordinates for an existing feature can easily be done using the Edit Sketch Properties dialog box. This dialog box allows you to insert and delete vertices, remove parts from a multipart feature, and change the z- and m-values of vertices. This scenario requires deleting several vertices and inserting new ones to modify the boundaries.

1. Verify that the Task is set to Modify Feature and that editing is enabled. Double-click the feature with the Edit tool.

2. Click Edit Sketch Properties.
3. In the Edit Sketch Properties dialog box, click to highlight a vertex for editing.
4. Right-click and choose Options > Insert vertices.
5. Zoom to the vertex and delete it.

Challenge 7 Creating and working with multipart features

Scenario

Forest compartments are often planted with a specific plant species, but many compartments also contain pockets of natural forest and lakes. These pockets need to be managed as part of the forest compartment, not as separate features. How can this be done effectively and efficiently?

Solution

Geodatabase feature classes support multipart features. Multipart features are composed of more than one physical part that references only one set of attributes in the database. Even though a single multipart feature can consist of several points, polygons, or lines, it only has one associated attribute record in the database. Multipart polygons have multiple rings, and one ring inside another creates a hole.

There are several ways to create and edit multipart features: Use the Merge command to combine features of the same layer into one feature. Merging nonadjacent features will create a multipart feature. When finished creating the first part of a multipart feature, right-click anywhere on the map and choose Finish Part from the context menu. Create the second part of the multipart feature, right-click, and choose Finish Sketch. Alternatively, create parts with the Sketch context menu and insert vertex coordinates.

Challenge 8 Creating or removing an empty hole in an existing polygon feature

Scenario

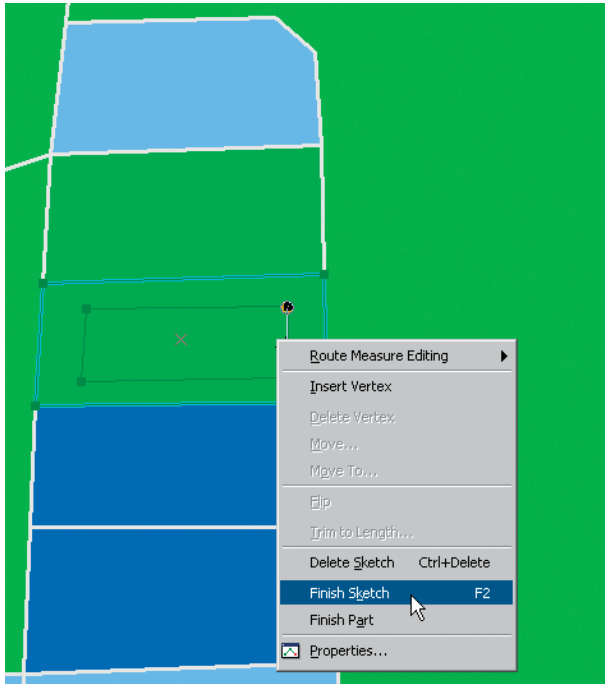
While managing forestry compartments, you must create and remove holes associated with multipart features.

Solution

Two methods for creating holes in polygons and one method for removing a hole from a polygon are given.

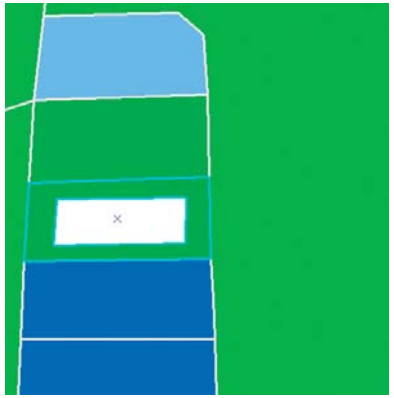
Creating an empty hole in an existing polygon feature

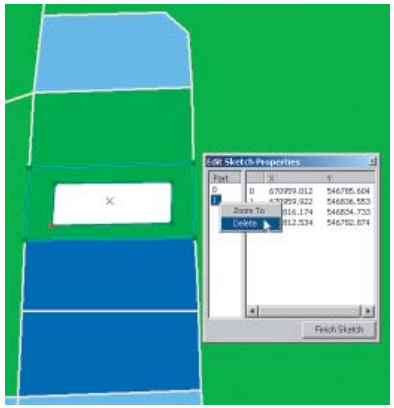
1. Double-click the polygon feature with the Edit tool to expose the vertices and automatically change the Task to Modify Feature.
2. Click the Sketch tool. In the map, right-click and select Finish Part from the context menu.
3. Digitize a polygon inside the selected polygon.
4. Right-click and click Finish Sketch to create a multipart feature.



Removing donut holes in polygons

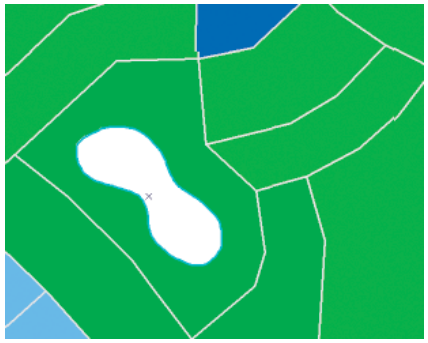
1. Double-click on the feature to modify its shape.
2. Open the Sketch Properties dialog box.
3. Right-click on the donut hole part and choose Delete.





Digitizing the empty hole in the same feature class in a new polygon

1. Create a new polygon and select it.
2. From the Editor menu, select Clip.
3. In the Clip dialog box, choose Discard the area that intersects. Click OK.
4. Press the delete key. This will create a donut hole in the coincident polygon below the digitized feature.



Conclusion

ArcGIS has many tools and commands for editing and manipulating data. These tips will help you be more productive when performing daily editing tasks. For more editing tips, see the previous two *ArcUser* articles in this booklet, "ArcMap Editing Tips and Tricks" and "More ArcMap Editing Tips and Tricks." Another resource is *Editing in ArcMap,* a manual that is part of documentation for ArcGIS 9. The ESRI Virtual Campus (campus.esri.com) also offers several courses such as *Creating and Editing Geodatabase Features with ArcGIS 9, Creating and Editing Linearly Referenced Features with ArcGIS 9,* and *Creating and Editing Geodatabase Topology with ArcGIS 9.* Visit www.esri.com/training to learn about instructor-led training courses that include information on editing such as *Introduction to ArcGIS II, Building Geodatabases I,* and *Creating and Editing Parcels with ArcGIS.*

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About the Authors

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Additional Resources

ESRI has additional resources for learning how to be more productive when editing in ArcGIS. The following resources—online and instructor-led classes, documentation, and samples—provide additional information on creating and editing data in ArcMap.

- Creating and Editing Geodatabase Features with ArcGIS 9

  This two-module Virtual Campus course teaches how to use the new and improved Sketch and Edit tools for the geodatabase to build a geodatabase from the ground up. Learn how to utilize the ArcMap standard and advanced tools to create and edit simple and complex features as well as feature-linked and dimension annotation. You will also learn how to work with features using coordinate geometry (COGO) descriptions and survey measurements.

- Creating and Editing Linearly Referenced Features with ArcGIS 9

  This two-module Virtual Campus course introduces the fundamental elements of linear referencing: routes and measures. Participants learn how to create and edit route geometry and measures and query routes to get location-specific information.

- Creating and Editing Geodatabase Topology with ArcGIS 9

  ArcGIS software provides full support for geodatabase topology including an advanced editing environment for maintaining topological relationships among features. This two-module, Virtual Campus course explains how topology is implemented in the geodatabase and teaches how to use geodatabase topology to more accurately model the real world.

- Building Geodatabases II

  This two-day, instructor-led course teaches the nuances of working in geometric networks. Learn how to create, edit, and perform analyses on geometric networks; manage linear-referenced data for displaying data that occurs along linear features; edit linear features in the field using ArcPad; and migrate coverage arcs, routes, and events to the geodatabase.

- Creating and Editing Parcels with ArcGIS

  This two-day, instructor-led course demonstrates how to effectively enter cadastral data into your geodatabase. Learn how to display and symbolize parcel data, prepare the editing environment, create and adjust tax map annotation, and enter and adjust parcels from various sources.

- Introduction to ArcGIS II

  This three-day, instructor-led course focuses on spatial analysis, automation of spatial and attribute data, editing, and advanced options for cartographic display. A portion of the class is reserved for carrying out an analysis project and applying many of the new skills and techniques learned in this course. Participants conduct queries, perform spatial analysis, and present their results in a hard-copy map.

- ArcGIS Developer Online

  Visit the ArcGIS Developer Online site at http://arcgisdeveloperonline.esri.com to download some handy editing tips and tricks. Under Samples > Editing, you will find custom editing samples including small code examples and shortcuts for adding new editing tools to ArcGIS.

- ArcGIS 9: Editing in ArcMap

  This product documentation book shows you how to put ArcMap to work immediately editing your spatial data. Designed to make it easy to identify a task you need to perform—from basic to advanced—this fully illustrated book shows you how to get it done through concise, step-by-step answers that help you complete a task.

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