

Dynamic Segmentation in ArcGIS

An article, "Dynamic Segmentation in ArcGIS" in the July–September 2002 issue of *ArcUser* magazine, described basic concepts associated with dynamic segmentation and working with routes in ArcGIS. Dynamic segmentation allows multiple sets of attributes to be associated with any portion of a linear feature. These attributes can be stored, displayed, queried, and analyzed without affecting the underlying linear data's x,y coordinates.

In this companion tutorial you will migrate one route feature class in coverage format to a geodatabase feature class as a polyline with an M feature class using ArcCatalog. In ArcMap, you will find route locations on existing routes and create and calibrate a new polylineM feature.

These exercises use a sample dataset that can be downloaded from the *ArcUser Online Web site*. Unzip this archive using WinZIP or a similar utility. The sample dataset includes a coverage, four event tables, a personal geodatabase, and a field calculator file.

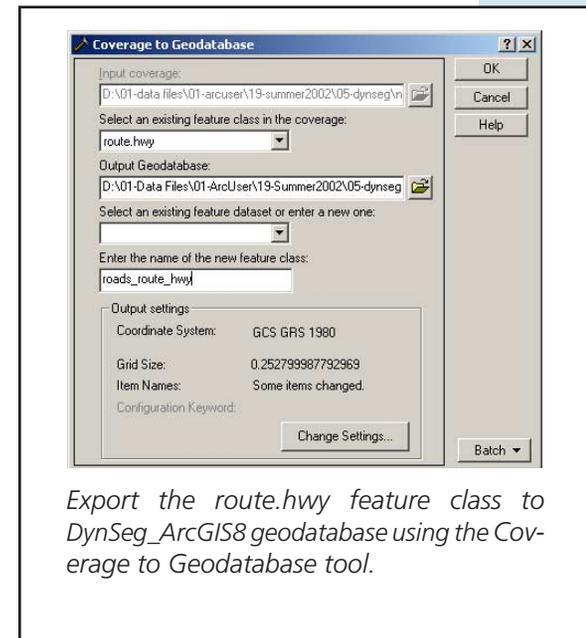
Exporting a Coverage Feature Class to a Geodatabase

Feature classes existing in a geodatabase cannot be modified to store measures. When existing feature classes are migrated to a geodatabase for routing applications, they must already have M values enabled or the ability to store M values must be set before exporting a coverage to a geodatabase.

1. Start ArcCatalog and connect to the folder containing the tutorial data. In the left pane of the ArcCatalog expand the roads coverage and view its feature classes (arc, node, point, route.hwy, and tic).
2. Select route.hwy and right-click on it. Choose the Export > Coverage to Geodatabase from the context menu.
3. In the Coverage to Geodatabase dialog box, choose route.hwy as the existing feature class in the coverage to convert.
4. Click on the button with the folder icon next to Output Geodatabase and navigate to and select DynSeg_ArcGIS8.gdb, the geodatabase included with the sample dataset.
5. Still in the Coverage to Geodatabase dialog box, click on the Change Settings button. In the Output Settings dialog box, click on the Geometry tab. This may require scrolling through the tabs using the arrow buttons on the upper right hand corner. Check the box next to Enable M Values on the Output. Do NOT click OK yet.

What You Will Need

- ArcGIS 8.1 (ArcInfo or ArcEditor licenses)
- Sample dataset download from the *ArcUser Online Web site*
- An unzipping utility such as WinZIP



- Still in the Coverage to Geodatabase dialog box, click on the Spatial Reference tab. Click on the Change button. In the Spatial Reference dialog box, click on the M Domain tab and change the Min: to -1000 and Precision to 1000. Click OK twice to exit Output Settings, accept the default name for the new geodatabase feature class, roads_route_hwy. Click OK to complete the export process.

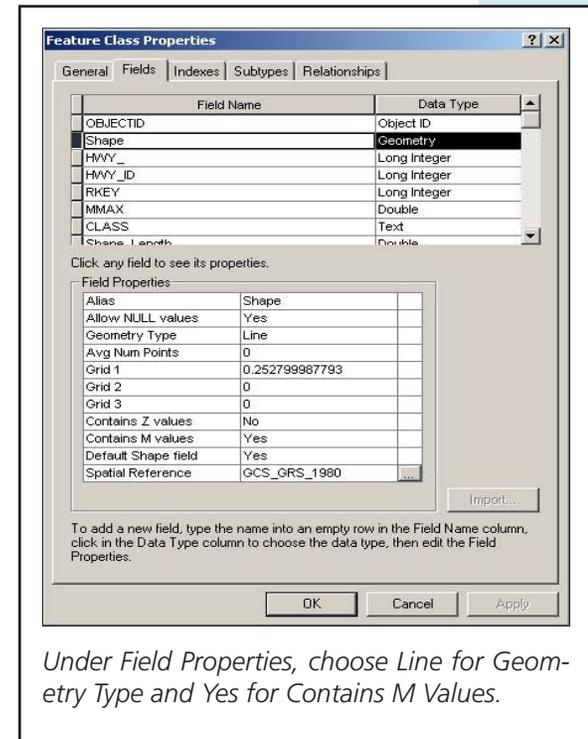
Verify Feature Class Properties

- View the properties of the newly-created roads_route_hwy feature class by expanding DynSeg_ArcGIS8.mdb and right-clicking on roads_route_hwy and choosing Properties from the context menu.
- In the Properties dialog box, click on the Fields tab and select Shape under Field name. Verify that the Geometry Type is set to Line and Contains M Values is set to Yes. If roads_route_hwy does not have these settings, reexport it, making sure to follow the directions in step 6 in the previous section.
- Under Field Properties in the Feature Class Properties dialog box, click on the button at the end of the line next to Spatial Reference to open the Spatial Reference Properties dialog box. Click the M Domain tab and Verify that the Precision is set to 1000 and Min is set to -1000. Click OK twice to exit the Feature Class Properties dialog box.

When data is stored in a geodatabase, all numeric values are converted to integers. To ensure accuracy, it's a good rule of thumb to choose a precision value that is a multiple of 10. The range (minimum and maximum values) represents the range of allowable M values. When setting an M domain, only the minimum value and precision need to be specified because these two values are used by ArcGIS to determine the maximum M value.

Create a New Polyline with an M Feature Class

- Right-click on the DynSeg_ArcGIS8 geodatabase and choose New > Features Class from the context menu.
- In the New Features Class dialog box, type TestFeatureClass and click Next. Accept the default database configuration and click Next.
- Click on the Shape field. Under Field Properties, click on the value for Geometry Type and choose Line from the drop-down box. Click on the value for Contains M Values and choose Yes from the drop-down box.
- Still in the New Features Class dialog box in the Field Properties section, click on the button at the end of the line next to Spatial Reference to open the Spatial Reference Properties dialog. Click the M Domain tab. Set the Precision to 1000 and the minimum M value to -1000.



Under Field Properties, choose Line for Geometry Type and Yes for Contains M Values.

- Click on the Coordinate System tab. This information could be created but for this exercise, click on the Import button and navigate to DynSeg_ArcGIS8 and select roads_route_hwy to import coordinate information from that layer. Click Apply and OK. Click Finish to exit the New Feature Class dialog box. TestFeatureClass will appear in ArcCatalog under DynSeg_ArcGIS8.

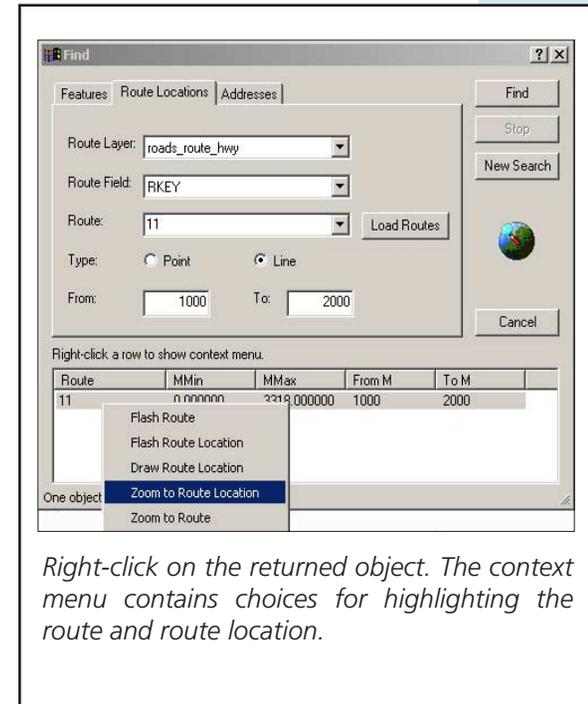
Returning Route Locations in ArcMap

Depending on the type of route location specified by the user, the Find dialog box can be used to return either a linear segment along the specified route between From and To locations or a discrete point along the specified route at the given location.

- Start ArcMap and open Tutorial.mxd, the map document that was included in the sample dataset. Resize the ArcCatalog and ArcMap windows so that both applications are accessible.
- Add the roads_route_hwy feature class to ArcMap by dragging and dropping it from ArcCatalog onto ArcMap.
- In ArcMap menu, choose Edit > Find from the main menu to bring up the Find dialog box. In the Find dialog box, click on the Route Locations tab.
- On the Route Locations tab, make the selections shown in Figure 1. Click on the Load Routes button to display all unique Route numbers and choose 11.
- Click on the Find button. The object returned is displayed in the lower portion of the dialog box.

| Field | Value |
|--------------|-----------------|
| Route Layer | roads_route_hwy |
| Route Field | RKEY |
| Route | 11 |
| Type | Line |
| From Measure | 1000 |
| To Measure | 2000 |

Figure 1: Values for the Find dialog box



Right-click on the returned object. The context menu contains choices for highlighting the route and route location.

Displaying a Returned Route

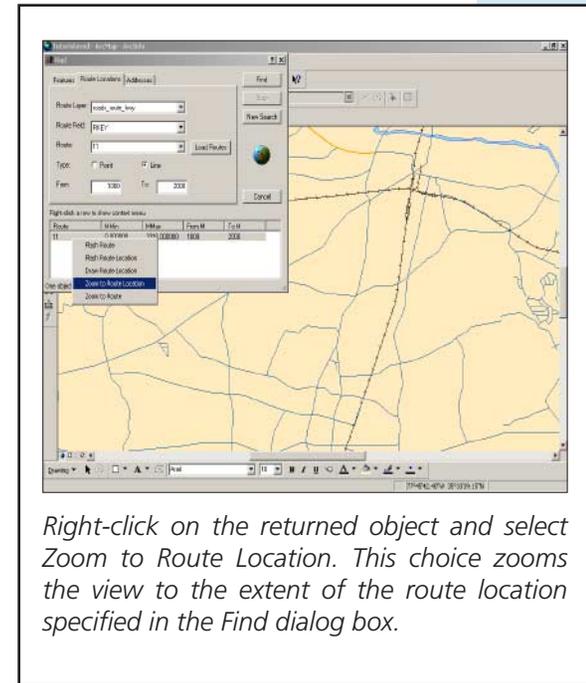
1. In the Find dialog box, right-click on the route object that was returned and select Zoom to Route from the context menu. This choice zooms the view to the extent of the entire route feature.
2. Right-click on route object that was returned but this time select Flash Route Location from the context menu. Only the section of the route specified is highlighted.
3. Right-click on the returned object to select Zoom to Route Location, which zooms to extent of the route location.
4. Right-click on the returned object and select Draw Route Location. If desired, the line symbology can be changed to emphasize the route. Choose View > Toolbars > Drawing if the Drawing toolbar is not already visible. In the Drawing toolbar, click on the Draw menu and select Change Default Symbology to change the color and thickness of the route line. Right-click on the returned object and select Draw Route Location and the line will be redrawn with new symbology. Close the Find dialog box.

Note: ArcGIS 8.3 will include functionality that can create, modify, and calibrate portions of routes or entire routes with graphical verification of measures. To edit a route's geometry, continue to use the core ArcGIS editing tools.

Create a New Route

Adding a polyline from the New_Route layer as a polylineM feature in the roads_route_hwy layer can be accomplished in a number of ways, including using edit tools to trace the feature. However, the simplest method is to cut and paste the feature.

1. In ArcMap, turn on the New_Route layer if it is not already visible and turn off all other layers. This layer consists of one line feature. Choose View > Bookmarks > Create New Feature to use a bookmark that was created in Tutorial.mxd for this exercise. The single feature in New_Route is now centered in the view.
2. If the Editor toolbar is not already visible, choose View > Toolbars > Editor. From the Editor menu on the toolbar, choose Start Editing. In the toolbar, set Task to Create New Feature and Target to roads_route_hwy.
3. Using the Edit tool, select the New_Route feature.
4. From the main menu, choose Edit > Copy and Edit > Paste.
5. Turn off New_Route layer. Turn on roads_route_hwy layer. In the Editor toolbar, change Task to Modify Feature. Select the new polylineM feature.



Right-click on the returned object and select Zoom to Route Location. This choice zooms the view to the extent of the route location specified in the Find dialog box.

- The sketch vertices, displayed as green squares, should now be visible. The sketch vertices can be displayed only if ONE, *and only one*, feature in the entire map document is selected (in this case, the feature just created).
- Rest the mouse over one of the vertices and the cursor changes. Right-click on it and choose Properties from the context menu. In the Edit Sketch Properties dialog box, note that the M values are Not a Number (NaN) because this is a newly created feature. Close the Edit Sketch Properties dialog box.

The Field Calculator in ArcMap

The field calculator in ArcMap can be used to perform mathematical calculations to set a field value for any or all records on a table.

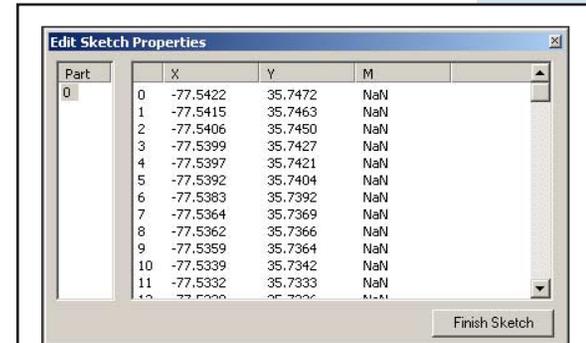
- Right-click on roads_route_hwy and choose Open Attribute Table from the context menu.
- In the attribute table, select the Shape field, right-click on it, and choose Calculate Values from the context menu.
- In Field Calculator dialog box, click the Load button and navigate to the location of SetMonShapeField.cal, the calculator included with the sample dataset. This Visual Basic for Applications (VBA) script will get the length of each line and multiply its value by 1,000 to define the maximum measure for that shape. Measures will be interpolated between 0 and the maximum measure.

Verify Measures Calculations

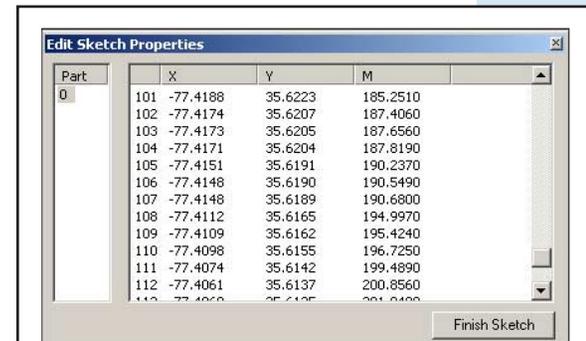
Make sure the NaN values in the M column have been replaced by inspecting the Edit Sketch properties for this features.

- Select the route pasted in roads_route_hwy and double-click on it. The sketch vertices will be displayed.
- Rest the mouse over one of the vertices and the cursor changes. Right-click on it and choose Properties from the context menu. In the Edit Sketch Properties dialog box, note that the M values are no longer NaN. The VBA script loaded in the Field Calculator has populated this column with values.

For more information on this topic, read the white paper *Linear Referencing and Dynamic Segmentation in ArcGIS 8.1*, is available from the ESRI Support Center (support.esri.com.)



Right-click on a vertex and choose Properties from the context menu to verify that the M values are set to Not a Number (NaN) because this is a newly created feature.



The VBA script loaded in the field calculator has populated this column with values.