

Use Geodatabase Subtypes and Attribute Domains for Automatic Validation Tutorial

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Overview

This tutorial supplements the article *Use Geodatabase Subtypes and Attribute Domain for Automatic Validation* that appeared in the April-June 2000 issue of *ArcUser* magazine. This article describes when and how you would use subtypes and domains to control the integrity of new data entered in your geodatabase.

For this tutorial you will need to have ArcInfo 8.02 loaded on an Windows NT computer with 1.2 MB of free disk space for the sample database. The sample database contains road data for Santa Barbara, California that has been modified so it is only suitable for completing these exercises. Please print this document so you can refer to it while completing the tutorial.

Defining subtypes on a geodatabase feature class or table allows the attribute values stored in one field to categorize the data and allows for automatic data entry. Domains ensure that you may only enter legal attribute values. The following steps outline how to create subtypes and attribute domains for a geodatabase feature class.

Getting Started

Step 1

Download the data.

- Create a new folder that will become your working directory (e.g., C:\tutorial).
- Download the self extracting data file sb_gdb.exe into this directory.
- Double-click on the file to unzip the data.

This file contains the sample geodatabase, SantaBarbara.mdb.

Step 2

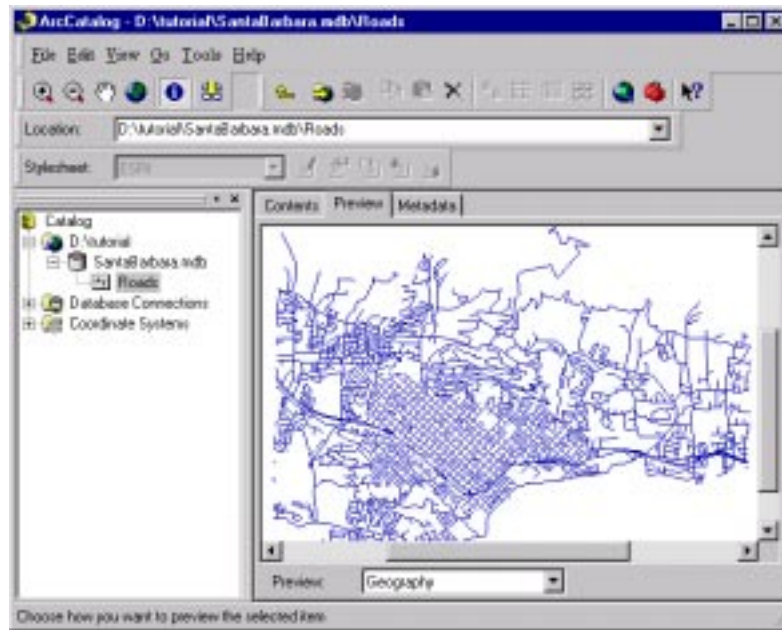
Start ArcCatalog, navigate to the sample data location, and preview the data.

- Start ArcCatalog.
- Navigate to the Santa Barbara geodatabase.
- Click the Roads feature class in the ArcCatalog tree.

Using Subtypes

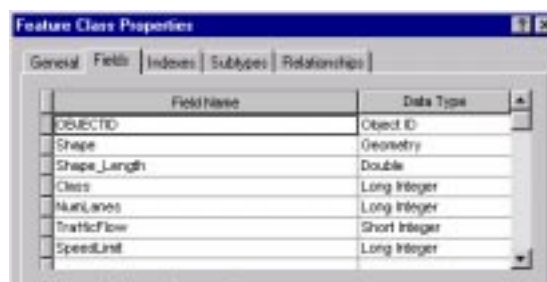
Click the Preview tab in the right pane. View the geography or table for the Roads feature class by choosing Geography or Table from the drop-down list next to Preview at the

bottom of the frame. The Geography view is shown below.



You will be creating subtypes on the Roads feature class. Your subtypes coding scheme will categorize the Roads data into four separate types without physically splitting the data into multiple feature classes. Not only will this organize the data for display, but the subtypes will ensure consistency when new data is added or existing data is edited.

- Right-click on the Roads feature class and choose Properties from the context menu or double-click on the Roads feature class to bring up the Feature Class Properties dialog box.
- Click the Fields tab.
- Scroll through the field names and note their corresponding data types.



Remember, subtypes are only permitted on Long Integer fields. Although several fields meet the Long Integer criteria, in this exercise you will create subtypes based on the values stored in the Class field. This field represents the type of road and has values ranging from 1 to 4.

- Click Cancel to close the Properties dialog.
- Preview the Roads attribute table by choosing Table from the drop-down box in below the Preview frame. This time, examine the Class field values.

The following table shows the existing numeric Class codes and the corresponding descriptions you will be assigning for the subtype.

Code	Description
1	Interstate Highway
2	Primary Road
3	Secondary Road
4	Ramp or Interchange

Now you will create subtypes for the Roads' Class field.

Step 3 Create new subtypes and set their default values.

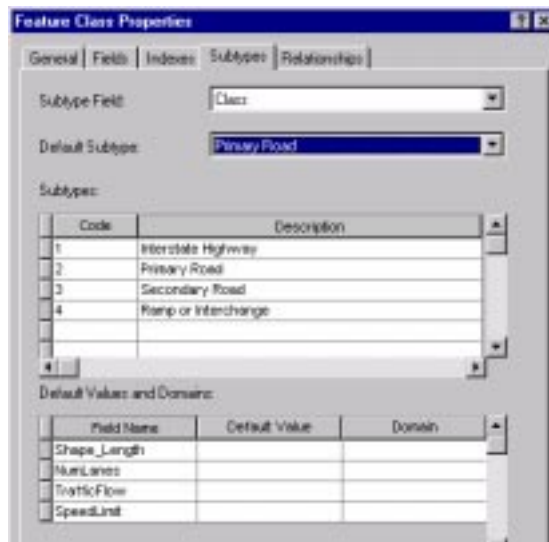
- Open the Feature Class Properties dialog box for the Roads layers by double-clicking on the Roads layer or right-clicking on the Roads layer and choosing Properties in the context menu. Click on the Subtypes tab in the Feature Class Properties dialog box.
- From the Subtype Field pull-down menu, choose Class.

Now you will specify the code and related description for each value stored in the Class field.

- In the first cell under the Code heading, overwrite 0 with 1.
- In the first cell under Description, overwrite New subtype with Interstate Highway.

Notice that the Default Subtype now reads Interstate Highway. You'll change that in just a minute.

- Fill in the rest of the subtype values and descriptions from the table above and click the Apply button when finished. The dialog box should resemble the illustration below.

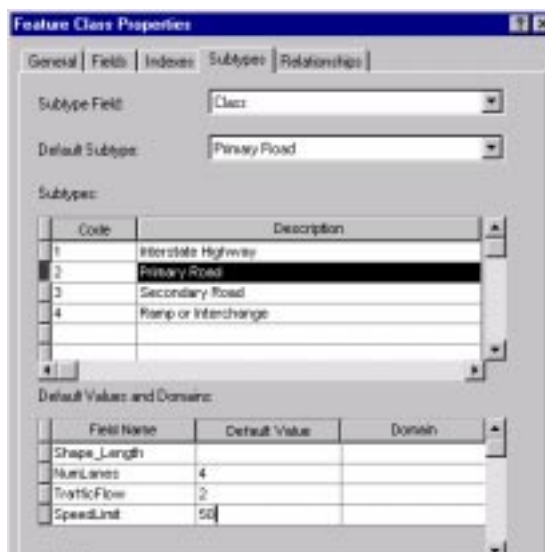


You can choose one of the subtype codes as the default value. Newly added features will inherit this code. You will change the default subtype since you believe you will be adding many new Primary Roads.

- Set the default subtype value by choosing Primary Road from the drop-down list for Default Subtype. Click on the Apply button.

Using this dialog box it is possible to set default attribute values for each subtype. For example, if the majority of new Secondary Roads will have two lanes and a speed limit of 35 miles per hour, these values may be set as defaults to save editing time. You will set default values for Primary and Secondary Roads as you believe these are the most frequently edited features.

- Click on the bar just to the left of the Primary Road in the subtype list to select the Primary Roads subtype.
- Enter default values of 4 for NumLanes, 2 for TrafficFlow, and 50 for SpeedLimit the selected subtype in the bottom menu list. Click on the Apply button when these values have been entered. Next, set the default values for the Secondary Roads subtype by clicking the bar next to it and entering 2 for NumLanes, 2 for TrafficFlow, and 35 for SpeedLimit



- Click Apply, and then OK to dismiss the dialog box.

New Primary and Secondary Roads will automatically inherit these default values for NumLanes, TrafficFlow, and SpeedLimit.

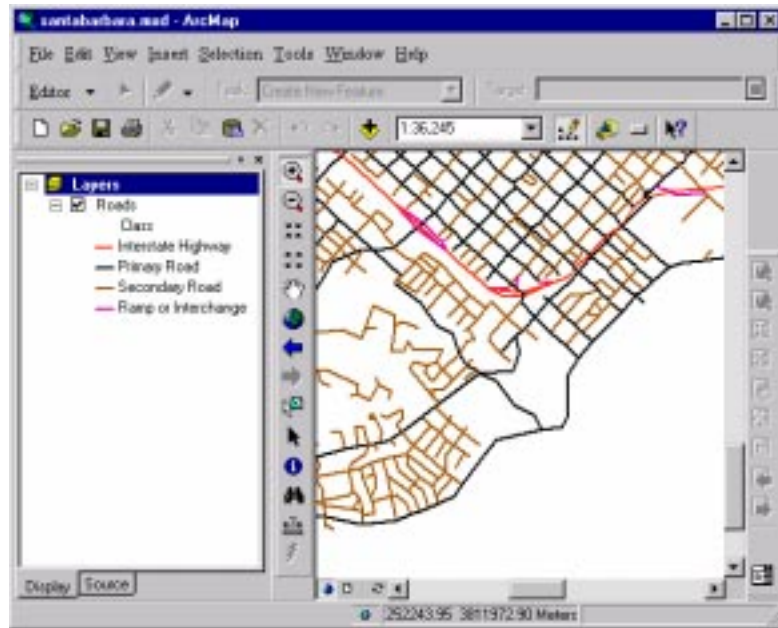
Step 4 View the subtypes in ArcMap.

Now that the subtypes have been defined, you will take a look at how they are displayed in ArcMap.

- From the ArcCatalog menu, launch ArcMap.
- Add the Roads feature class from ArcCatalog by dragging and dropping it onto the ArcMap display canvas or by choosing File > Add from the ArcMap interface or by

pressing the AddData button and browsing for the file.

- Zoom in to the Roads layer as desired.



Notice how ArcMap automatically displays the Roads data classified by your subtypes. Note that the Class field stores Long Integer values (e.g., 1,2,3) and the subtype translates these codes into textual descriptions.

Double clicking on the symbols in the Table of Contents will allow you to choose something other than ArcMap's default symbology for the subtypes.

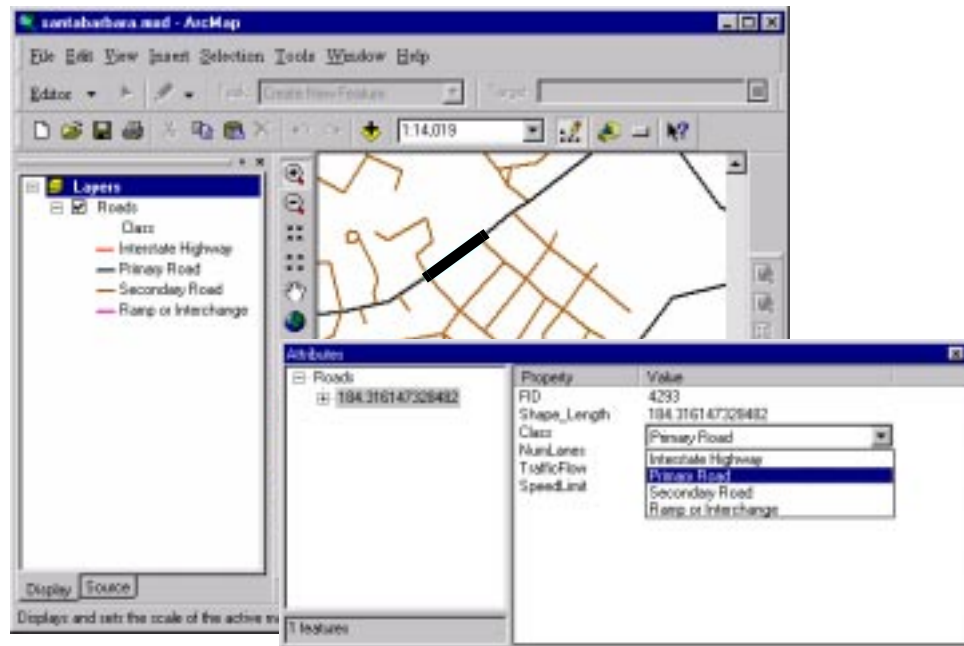
- Change the symbology of the subtypes if desired.

Step 5 Edit with subtypes in ArcMap.

Next, you will look at how subtypes allow for automatic data entry. When adding new features or editing existing features in ArcMap, your data will be constrained by the subtypes you've defined.

- If it is not already available, add the Editor toolbar to your ArcMap session by choosing Tools > Editor toolbar.
- Choose Start Editing from the Editor menu on the Editor toolbar.
- If necessary, Zoom into a small portion of the display.
- Select any Primary Road.
- Click on the table icon in the Editor toolbar to open the Attribute Editor.
- Click on the value for the Class property.

Notice how descriptions rather than the numeric codes are provided as an attribute choices in the drop down box.



- Choose a Secondary Road for the Class attribute.

Notice that the values for NumLanes and SpeedLimit have automatically been updated to the default values of the new subtype you set.

- Experiment with editing operations as desired.
- Choose Stop Editing from the Editor menu in the Editor Toolbar and click on No when prompted to save your edits.
- Quit ArcMap.

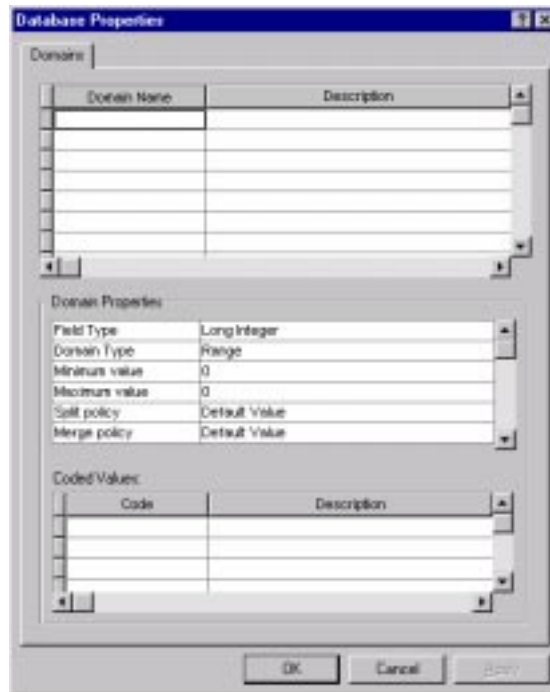
Working with Domains

Step 6

Create attribute domains.

Next you will explore setting domains for the geodatabase. Recall that a domain defines a set of legal attribute values for a field subtype code. Domains are created in ArcCatalog and can be either coded values or ranges. Since they are a property of the geodatabase, domains can be shared by fields in multiple tables. Now you will create several attribute domains.

- In ArcCatalog, right-click on the Santa Barbara geodatabase and choose Properties in the context menu to bring up the Database Properties dialog box.



The Domains dialog box has three data input sections. The top section lets you add a domain name and description. The section in the middle allows you to edit domain properties and the bottom section lets you specify the valid attributes for a domain that uses coded values.

Domains help when you are editing. For instance, coded value domains provide a list of valid attribute values when you are editing inside the Attribute Editor. Range domains ensure the your edited attributes fall within a specified range of numeric values. You will create coded value domains for the fields NumLanes and TrafficFlow and a range domain for SpeedLimit by using the Domains section of the Database Properties dialog box.

Click on the bar next to the first cell under Domain Name to enter the LaneNo domain properties specified in the LaneNo domain table. Enter the information from the table in each of the three sections of the Database Properties dialog box as indicated. Be sure to click the Apply button to update the dialog box after the domain information is added.

Follow the same procedure to enter the domain properties for TrafficDirection and SpeedLimit using the values shown in the Traffic Direction and SpeedLimit domain tables. Make sure to click the bar next to the cell under Domain Name when entering the parameters for each domain. Be sure to click the Apply button to update the dialog box after the domain information is added. Note that since SpeedLimit uses a range rather than coded values, the dialog box will change to provide Minimum Value and Maximum Value fields but will omit the coded value section. Leave the Split Policy and Merge Policy Fields with the default value.

LaneNo Domain

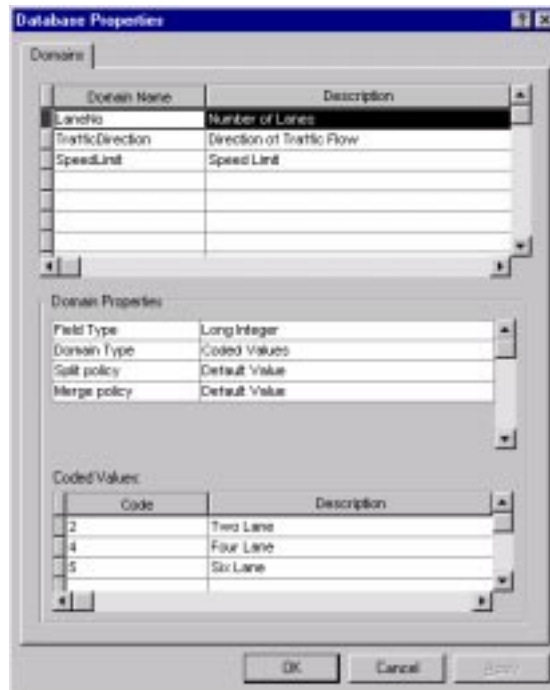
Domain Name	Description
LaneNo	Number of Lanes
Domain Properties	
Field Type	Long Integer
Domain Type	Coded Values
Coded Values	
Code	Description
2	Two Lane
4	Four Lane
6	Six Lane

TrafficDirection Domain

Domain Name	Description
TrafficDirection	Direction of Traffic
Domain Properties	
Field Type	Short Integer
Domain Type	Coded Values
Coded Values	
Code	Description
1	One Way
2	Two Way

SpeedLimit

Domain Name	Description
SpeedLimit	Speed Limit
Domain Properties	
Field Type	Long Integer
Domain Type	Range
Minimum value	5
Maximum value	70



The completed Database Properties dialog should look like the illustration above.

Step 7 Apply your domains.

In this step you will apply your new domains to the fields of the Roads data.

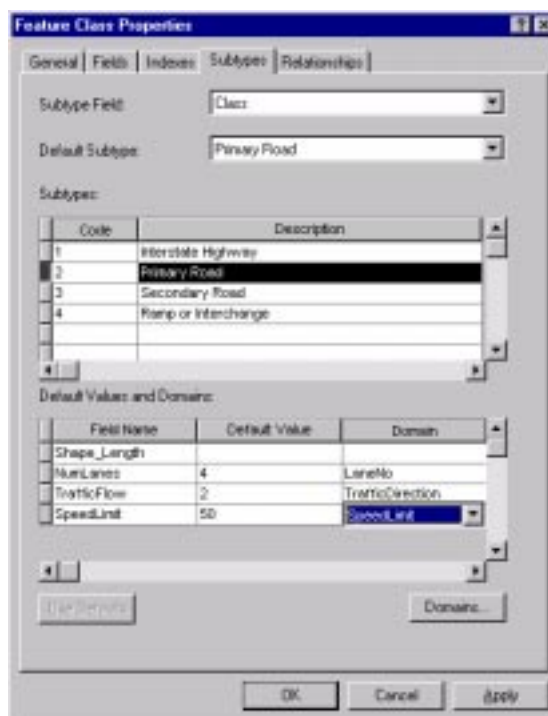
- In ArcCatalog, display the property sheet for the Roads feature class.
- Click the Subtypes tab.

You can set the domain for each subtype field by choosing from the list of defined domains in the Default Values and Domains scrolling list.

- Click on the bar to the left of the Interstate Highway subtype and apply the domains you created in the previous section to the fields as shown in the table below.

Field Name	Domain Name
NumLanes	LaneNo
TrafficFlow	TrafficDirection
SpeedLimit	SpeedLimit

- Now apply the same domains to the other three subtypes.



- When domains have been applied to all the subtypes, click on Apply and OK.

You just applied a domain to each individual subtype. When you apply domains in this manner, you have more flexibility in specifying which domain associates with each subtype. If all of your subtypes have the same domains (as in our example), you can use a shortcut. Apply the domains you created by to the entire field by using the dialog box under the Fields tab.

Now that the domains have been applied, experiment editing with them in ArcMap.

Step 8 Edit with the domains in ArcMap.

- Launch ArcMap. Add the Roads feature class from ArcCatalog by dragging and dropping it onto the ArcMap display canvas or by choosing File > Add from the ArcMap interface or by pressing the AddData button and browsing for the file.
- Open Editor toolbar if it is not available.
- Choose Editing > Start Editing from the Editor toolbar.
- Zoom in as desired.
- Use the selection tool in the Editor Toolbar to select a roads. Hold down the Shift key to select additional roads. Open the Attribute Editor by clicking on the Table icon in the Editor toolbar.
- Click the values for the NumLanes or TrafficFlow fields. Note that these coded value domains list the available values.

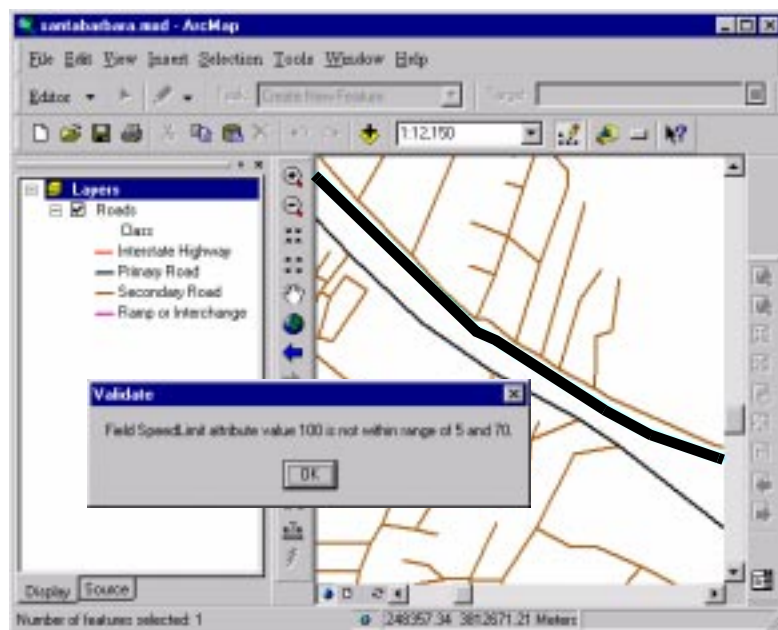
Now experiment with the range domain for the SpeedLimit field.

- Change the SpeedLimit value to 100 by selecting the Value field and typing in 100.

Notice that ArcInfo will let you add almost any numeric value, even an invalid value. For example, 100 is outside of the 5 to 70 miles per hour range. Now have ArcInfo check to see if you have any invalid attributes.

- From the Editor Toolbar choose Validate Selection.

A dialog window appears telling you that your attribute is not within the acceptable range. Any features with invalid attributes remain selected.



- Change the SpeedLimit back to a value with the range.
- Choose Editor > Validate Selection to validate the new compliant value for

SpeedLimit.

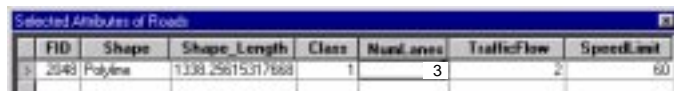
A dialog appears telling you all features are valid.

Step 9 Adding invalid data.

You want to override coded value domains. For example, your two-lane road may temporarily become three lanes due to a passing zone (i.e., an additional lane) along one of the directions of travel. You would not be able to add a “3” through the Attributes Editor dialog, but you can add this potentially invalid data by editing the table directly.

Experiment adding potentially invalid data to the table.

- With the Roads layer displayed in ArcMap, choose Start Editing from the Editor menu in the Editor Toolbar. Select a road from the layer.
- Right-click on the Roads layer in the table of contents. From the context menu, choose Selection > Open Table for Selected Features.
- Change the NumLanes to 3, a value outside the coded domain, then close the table.



FID	Shape	Shape_Length	Class	NumLanes	TrafficFlow	SpeedLimit
2548	Polyline	1338.25615317668	1	3	2	60

- From the Editor menu, choose Save Edits and then Stop Editing.

Notice that the new value was accepted without any error notification. This means you can concentrate on adding attributes rather than validating errors after each edit. When you are done editing all your values, you can save time by validating all at once.

- Choose Start Editing from the Editor menu.
- Use your mouse to select your previously edited feature(s).
- Chose Editor > Validate Selection.

A dialog box identifying the offending value and valid data parameters will be displayed.

- Open the Attribute editor and make edits as needed, or you can choose to leave the NumLanes as “3”.

ArcMap will let you save invalid data and find invalid data using the Validate Selection menu tool. You can fix invalid data by using the Attribute Editor or by directly editing the table.

- Quit ArcMap.

Congratulations, you have completed this tutorial. You have created and applied subtypes and domains and seen the benefits of these validation rules.

Learn more about subtypes, domains, and the geodatabase by reading *Modeling Our World: The ESRI Guide to Geodatabase Design*. This book ships with ArcInfo 8.01 software and is also available from ESRI Press. Several instructor-led training courses on using geodatabases, *What's New in ArcInfo*, *Introduction to ArcInfo using ArcMap*, *ArcCatalog and ArcToolbox*, and *Working with the Geodatabase*, are offered by ESRI. For more information about educational materials, visit www.esri.com/education.