



## 7.06.01 Infrastructure Sector Tutorial

*Disclaimer: The objective of this tutorial is to get familiar with the GIS software. The tutorial only covers some parts that are being done in a real analysis. The results that are being displayed in the tutorial can't be compared with the results a real analysis would generate.*

### Introduction

*The objectives of this exercise are to get more familiar to some basic ArcGIS operations. We will **create shapefiles**, work with **attribute data in Excel**, **digitize features** to a new shapefile and **join attributes** to a shapefile.*

*The scenario of this exercise is that we will prepare an analysis based on road data to identify the bottlenecks of a road leading from the transport corridor at the municipal boundary where a major new settlement is located to the poblacion at the lake.*

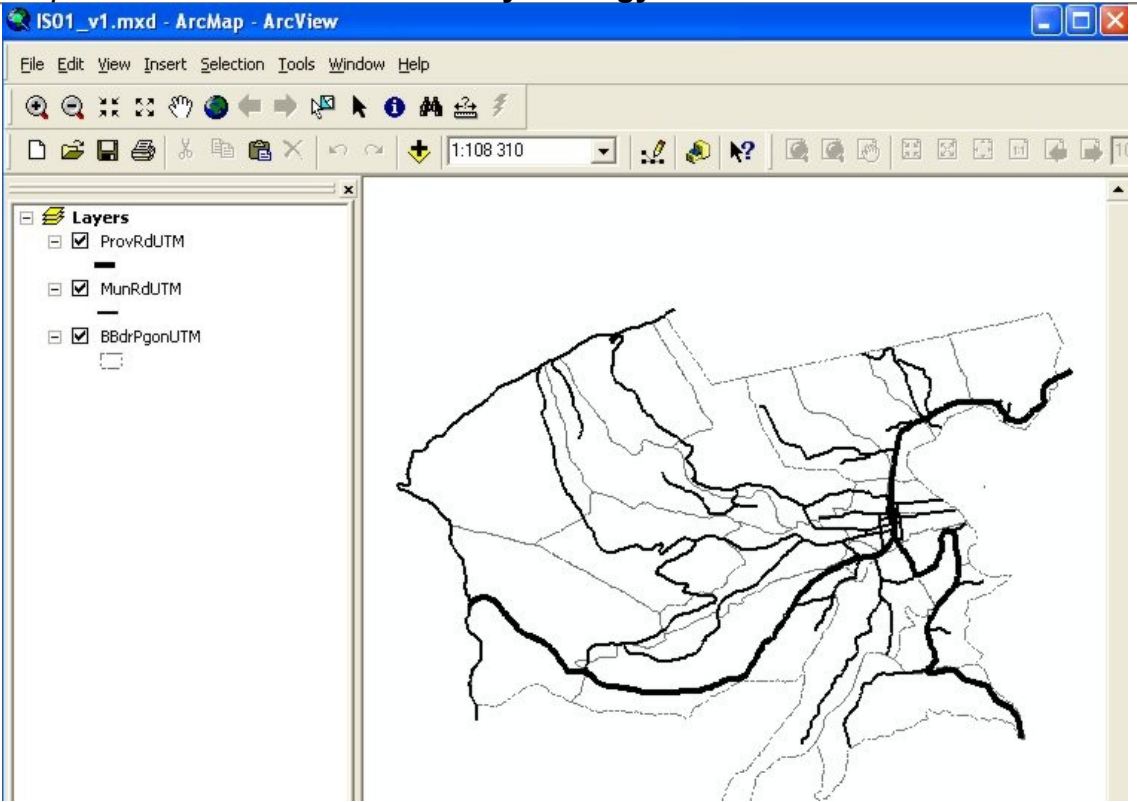

*It should be noted that the procedure (digitizing an already digitized feature) in the tutorial is very unlikely to be used in real GIS applications. Rather, the existing road layer would be broken down in segments constituting a network, and the attribute data would be joined to the original, but modified, dataset. Constructing networks in ArcGIS is however an advanced task and a precondition is that the software is expanded to include network extension applications.*

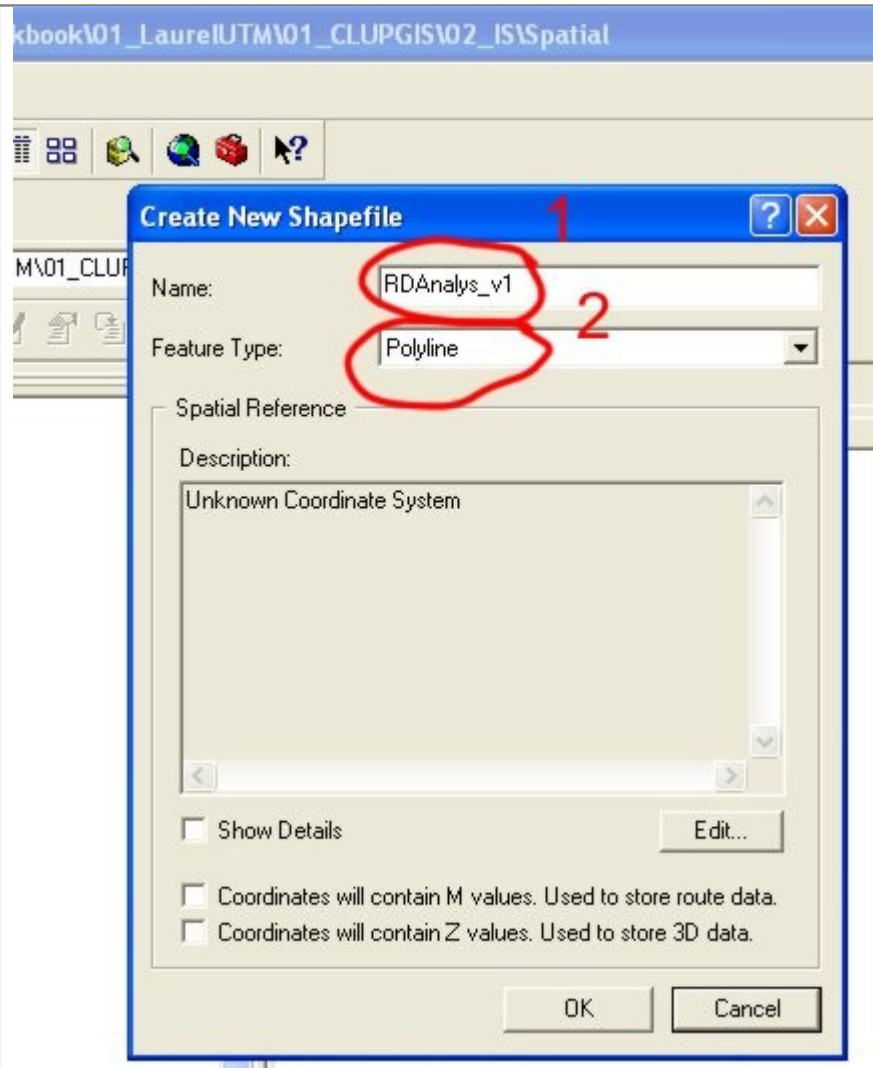


### 1 Getting started

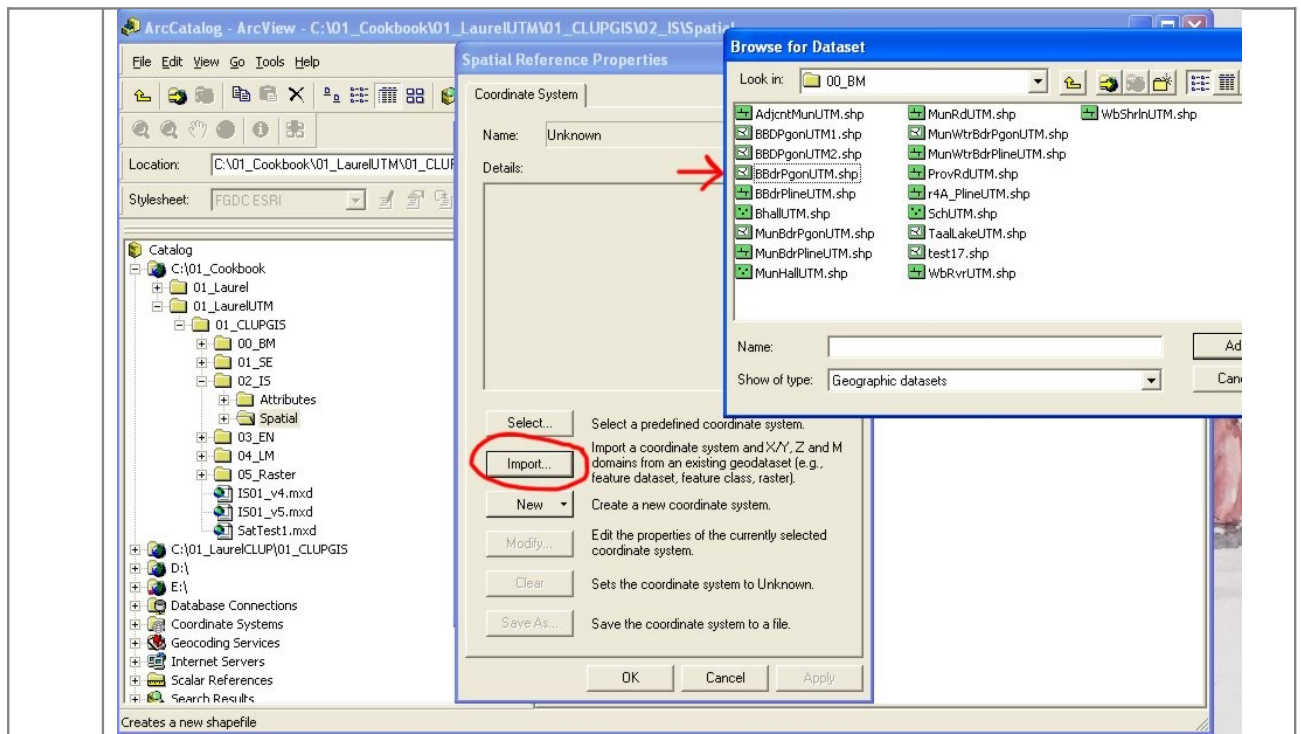
1.1 Open ArcMap. Select *A new empty map*.

1.2 Add the following layers to the workspace:

	<p><b>Bdrbgy_pgon</b>  <b>MunRdUTM</b>  <b>ProvRdUTM</b></p> <p>The first file is found in <b>C:\HLURB\CLUP\01_CLUPGIS (Laurel)\00_BM\</b> and the two other files are all found in the <b>02_IS\</b> folder.</p>
1.3	<p>Assign proper symbology to the layers and rename them in the list of content. Since we will digitize the road layers, assign a line symbol with a rather large width (e.g. 3,0). See image below. To start changing the symbology, either double-click on the layer symbol in the table of content or open the <i>Layer Properties</i> window and select the <b>Symbology</b> tab.</p>
	 <p>The screenshot shows the ArcMap interface. The title bar reads 'IS01_v1.mxd - ArcMap - ArcView'. The menu bar includes File, Edit, View, Insert, Selection, Tools, Window, and Help. The toolbar contains various navigation and editing tools. The Layers panel on the left shows three checked layers: 'ProvRdUTM', 'MunRdUTM', and 'BdrPgonUTM'. The main map area displays a network of roads with thick black lines, overlaid on a light gray background representing a map of a region.</p>
1.4.	<p>In the menu bar click <b>File &gt; Save As...</b> to save a map document as <i>road_analysis_v1</i> in <b>C:\HLURB\CLUP\01_CLUPGIS (Laurel)\06_Workfolder\</b>. Don't forget to save your progress now and then throughout the exercise.</p>
<b>2</b>	<b>Creating a shapefile</b>
2.1	<p>Open ArcCatalog (click on  in the ArcMap tool bar).</p>
2.2	<p>In the catalog tree, navigate to the <b>C:\HLURB\CLUP\01_CLUPGIS (Laurel)\02_IS\</b> folder. In the menu bar click <b>File &gt; New &gt; Shapefile...</b> The <i>Create New Shapefile</i> window appears.</p>
2.3	<p>Type the Name 'RdAnalysis' and select <i>Polyline</i> as <i>Feature Type</i>. See image below.</p>



2.4 Assign the same coordinate system as the *RdMun* layer. First click **Edit...** to open the *Spatial Reference Properties* window. Click **Import**, browse for the *RdMun* layer and click **OK**. See image below.





2.5 Click **OK** in the *Spatial Reference Properties* window. Click **OK** in the *Create New Shapefile* window. The new shapefile is created.

**3 Digitizing**


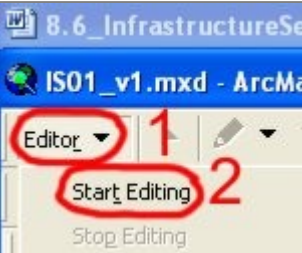
*We will use GIS to show road segments that are in a critical or poor condition or have an inadequate width compare to road classification standards. The road will be digitized in segments where the nodes are defined at barangay crossings (so that the analysis can be used for comparisons between the barangays) and intersections with other roads (so network analyses can be made). In step 1.2 we added those files with road features and barangay boundaries to the workspace and we can thus proceed.*

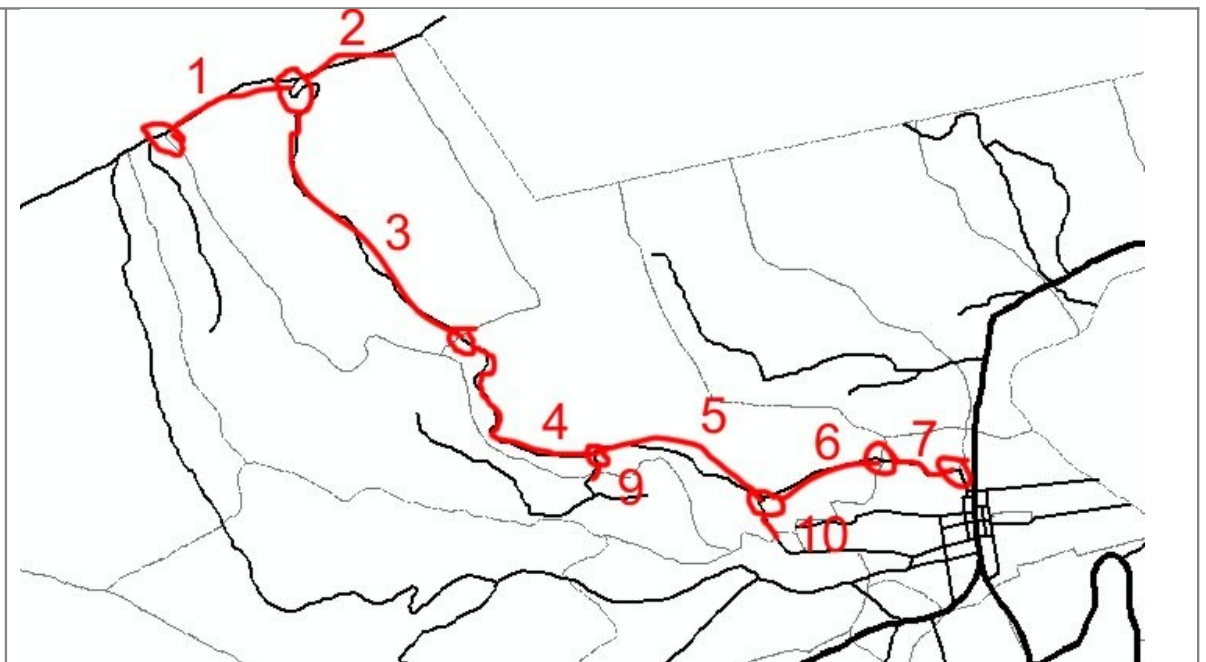
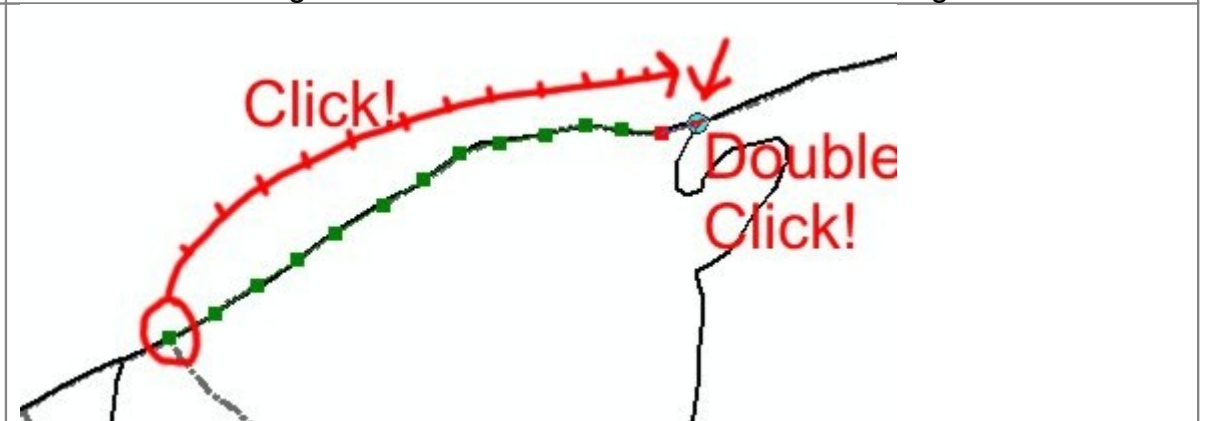
*A good idea is that you print a map and use the paper map to make a sketch where the nodes should be located before you start with the screen digitizing:*

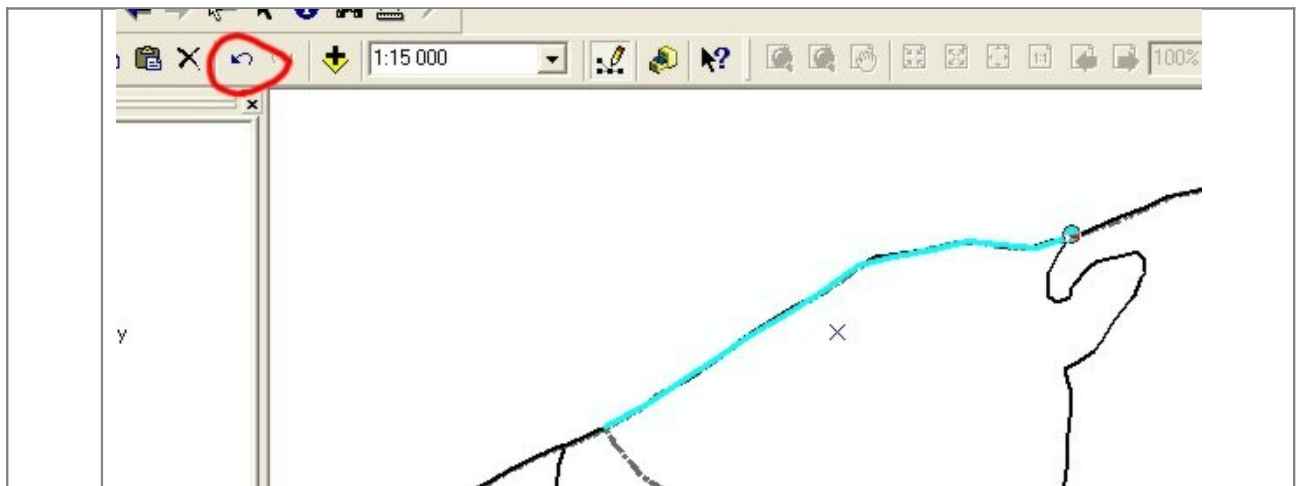
3.1 Go back to the ArcMap window. (If you have closed it, you can start it again by clicking on  in the ArcCatalog toolbar. If this is the case you also have to open the map document *road\_analysis\_v1.mxd*.)

3.2 Now it is time to add the shapefile we prepared for the analysis of the road condition. Click on  and browse for *RdAnalysis.shp*. Click **Add**.

*Nothing is seen on the map although the *RdAnalysis* layer is activated to be shown. The reason for this of course that no roads have yet been digitized into the layer. If you open the attribute table to the shapefile, you will find it empty, compare to image below. Now it's time to start*

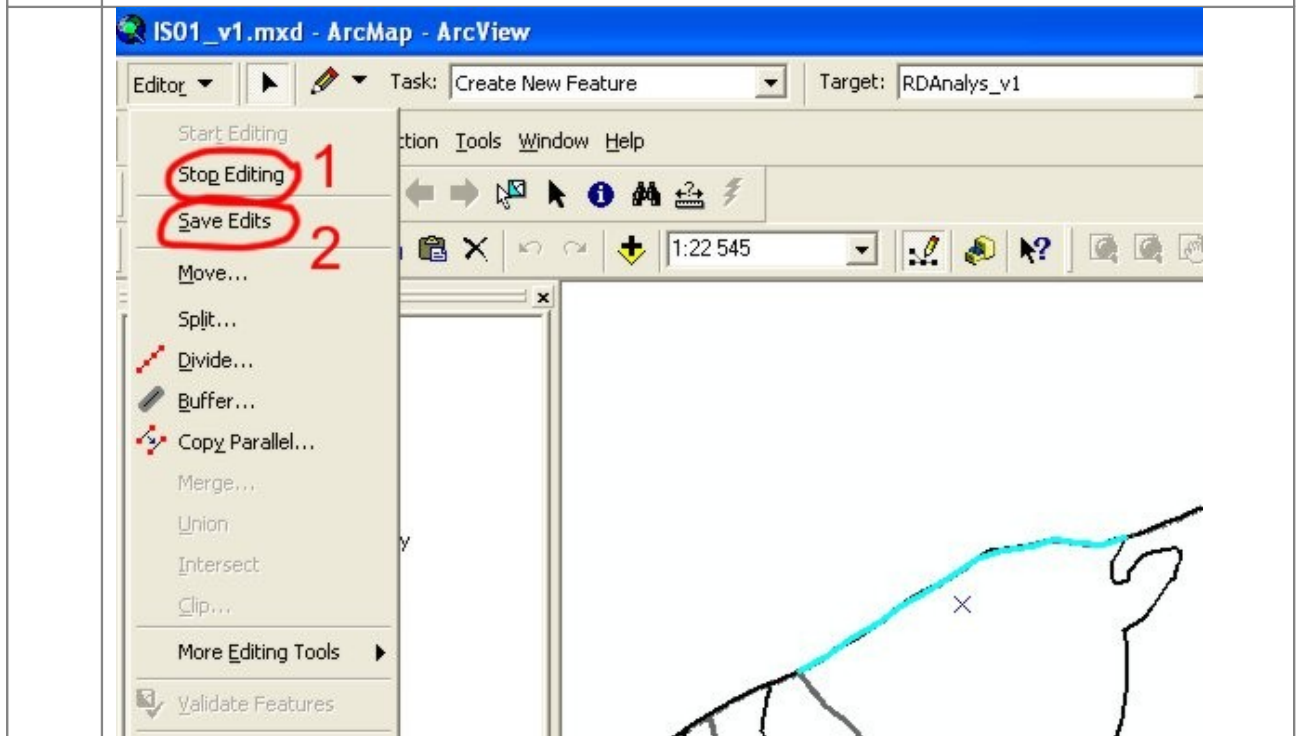
	<p>digitizing.</p>
	
<p>3.3</p>	<p>If it's not already visible, you need to open the Editor toolbar. In the menu bar click <b>Tools &gt; Editor</b>. The <i>Editor toolbar</i> appears. Drag and drop it to a suitable place in the workspace (e.g. within the toolbar).</p>
<p>3.4</p>	<p>In the Editor toolbar, click <b>Editor &gt; Start editing</b>. See image below.</p>
	
<p>3.5</p>	<p>Make sure that the settings are set to <i>Create New Features</i> and that the target layer is <i>RdAnalysis</i>. Click ???</p>
<p>3.6</p>	<p>Set the snapping properties so that your digitizing effort will snap to <i>vertices</i>, along the <i>line</i> and the <i>endpoints</i> of both the <i>IS01_RdTp2008</i> and <i>barangay</i> layers. In the editor menu, click <b>Editor &gt; Snapping...</b> The <i>Snapping xxx</i> appears between the table of content and your map (see image below). Select (check the corresponding box) according to what is mentioned above. You can now close the <i>Snapping xxx</i>.</p>
	<p><i>The plan is now to digitize as indicated below. A RdAnalysis line segment's nodes will be at either crossings with barangay boundaries or intersections with other roads:</i></p>

	
<p>3.7</p>	<p>Zoom in to segment 1 to a scale about 1:15000 or use the scale selector and the <i>pan</i> tool. (Now it will be easier to digitize.)</p>
<p>3.8</p>	<p>Refer to the image below. Start (click once) at the barangay boundary and follow the road and click again after a small section. Continue to click once at points along the road. End at the crossing of the road leading south by double-clicking to finalize the road segment. The result is shown in the second image below:</p>
	

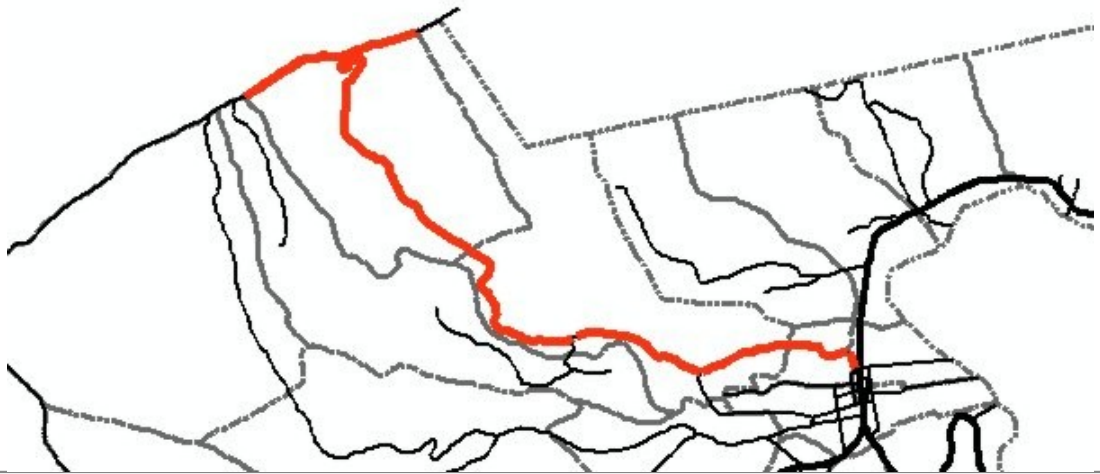


3.9 Assign another symbology to the *RdAnalysis* layer, so that your digital effort is clearly seen in the map. Choose for example a red and wide line symbol.

*If you are not pleased with the result, use the redo button before you proceed with the next segment. Also get into the habit of saving (2) your work often. When you are finished or need to proceed with another GIS operation you should stop editing (1). Refer to image below.*



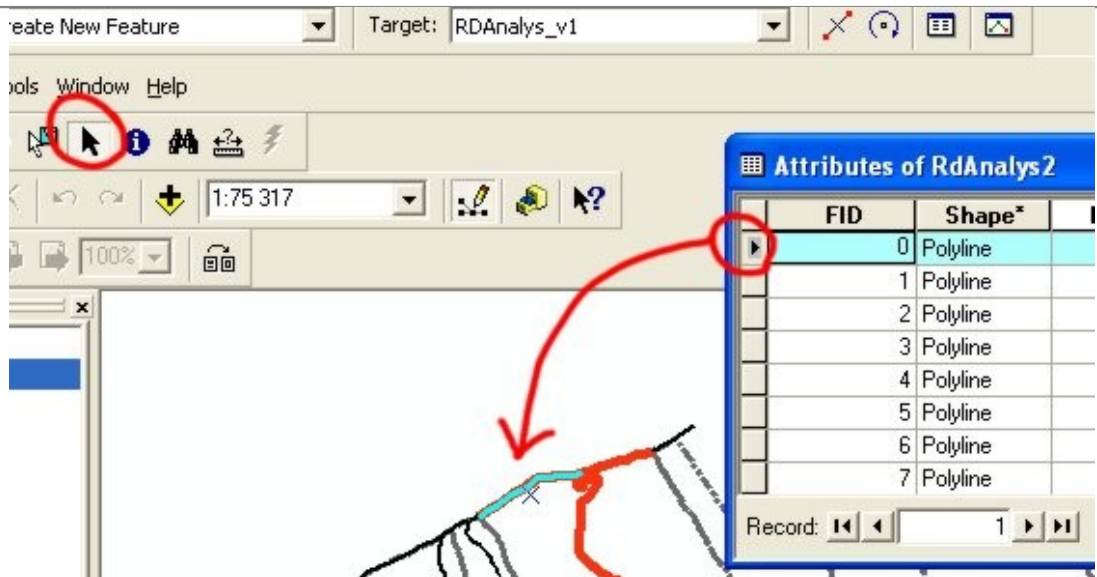
3.10 Repeat step 3.8 on the other segments. Follow the order given in the sketch image just before step 3.7 above. When you're done with this, your map should look something like this.



3.10 Click **Editor > Stop Editing**.

#### 4 Assigning Road Segment ID to Conform with Attributes in the dBase File

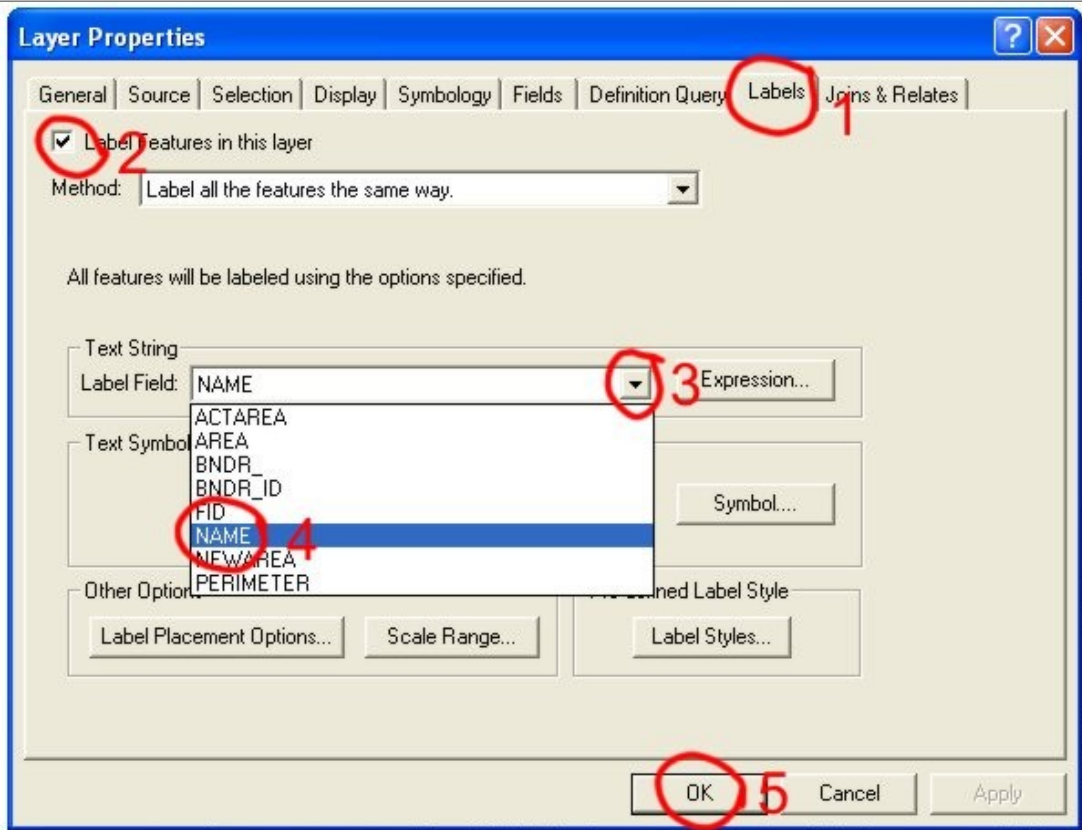
4.1 Don't close the editor. Open the attribute table by right-clicking on *RdAnalysis* in the list of content and selecting **Open Attribute Table**. The *Attributes of RdAnalysis* window appears. See image below. If you have followed the sketch above you should have ten segments in the table, each with its unique *FID* number. There is also another *Id* column that has zeros at the moment but needs to be identified in order to connect it with the attributes in the Excel/dBase tables.



4.2 So what ID should we give the segments? Well, there could be different alternatives. Here, we need to use the IDs that are found in the dBase file. decide to use the PSDG number of the barangay where the road segment is situated to give it its unique ID number. To facilitate we insert a name label for the barangays. In the table of content, right-click on the barangay boundary layer and select **Properties**.

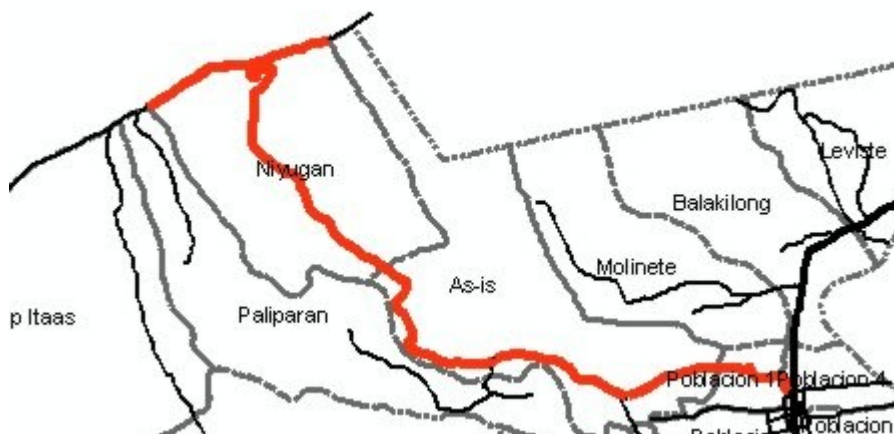
4.3 The *Layer Properties* window appears (see image below). Go to the **Labels** tab. Select *Label features in this layer*. From the list menu to *Label field* select **NAME**.

Click **OK**.



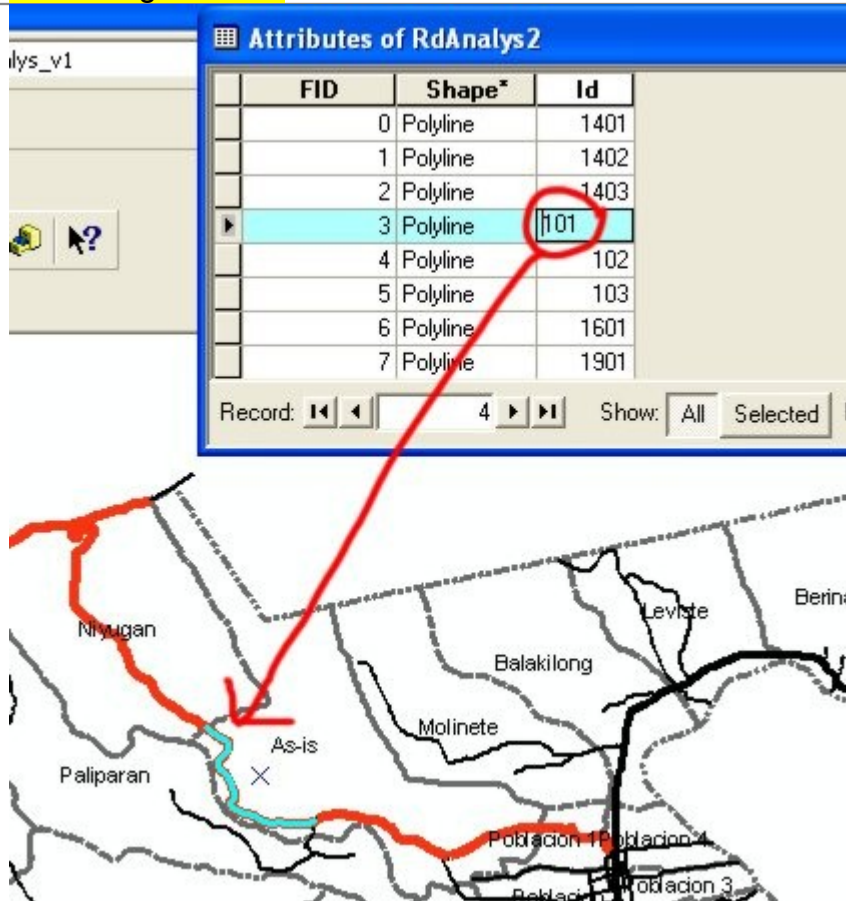
The result will look something like the image below and you see that in this case the road passes the barangays of Niyugan, As-is, Poblacion 1 and Poblacion 4.


The first segment is situated in a barangay named Niyugan, which has a barangay ID (0)1. We assume that we do not need to divide a road into more than 99 segments in a barangay. As this segment is the first we give it the unique ID of 101.



4.4 Make sure that you are still in editing mode. (If not choose **Editor > Start Editing** from the editor toolbar.) Return to or open the attribute table (refer to step 4.1 if needed).

- 4.5 Place the cursor in the first row in the *Id* column in the *Attributes of RdAnalysis* table window. Click once and type 1401 for FID0. (Since As-is barangay ID is 14 and this constitutes the first road segment in barangay.)
- 4.6 Providing that you digitized the same segments in the same order as in the sketch above, repeat step 4.5 on the other rows and assign *Id* according to the table/image below:.



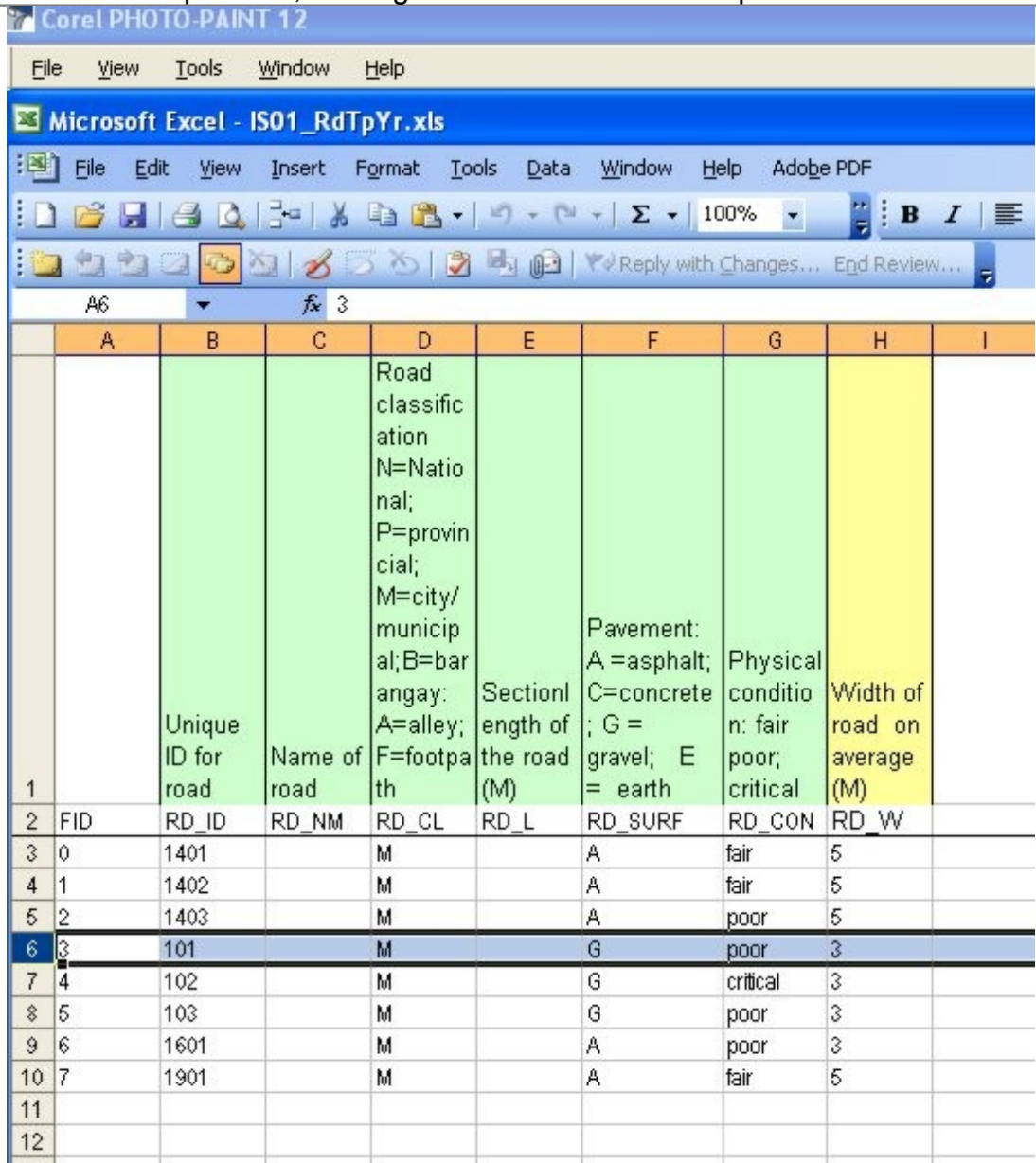
- 4.7 Click **Editor > Save Editing**.
- 4.8 Also make sure to save the map document *road\_analysis\_v1* by either clicking on  in the toolbar or selecting **File > Save** in the menu bar.

**5 Converting the Attribute Excel File to dBase Format**

*We will now work on the dBase Table with additional attribute data of the road. (This data has been captured on ground within a field survey and entered into an excel file.) When working with Excel, it is always recommended that ArcMap is closed (and vice versa). This is due to avoid accessing the same files from the two programs, which can lead to quite some problems. If you have a printed sketch map with the segments, also add the new Id numbers onto this map.*

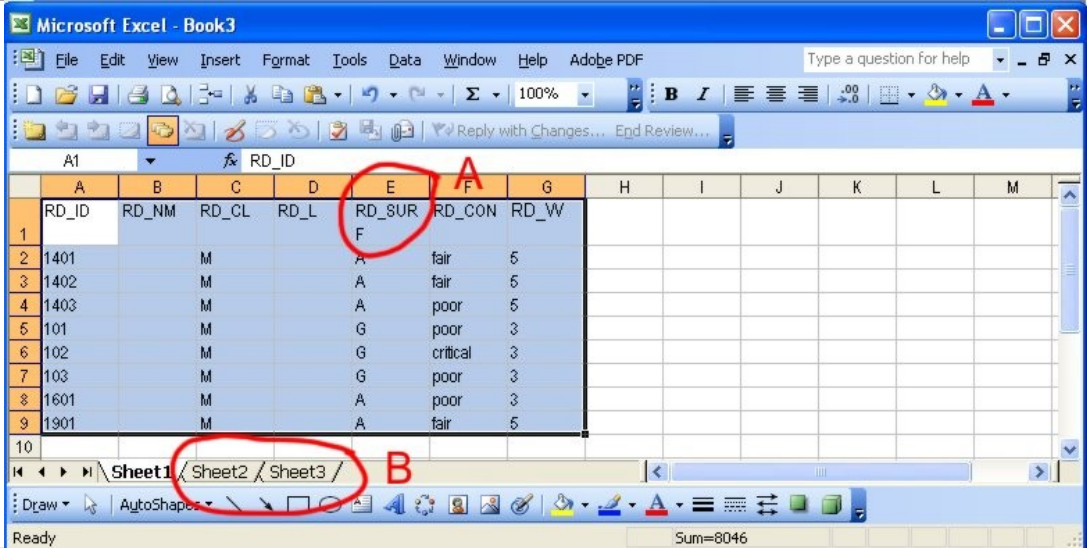
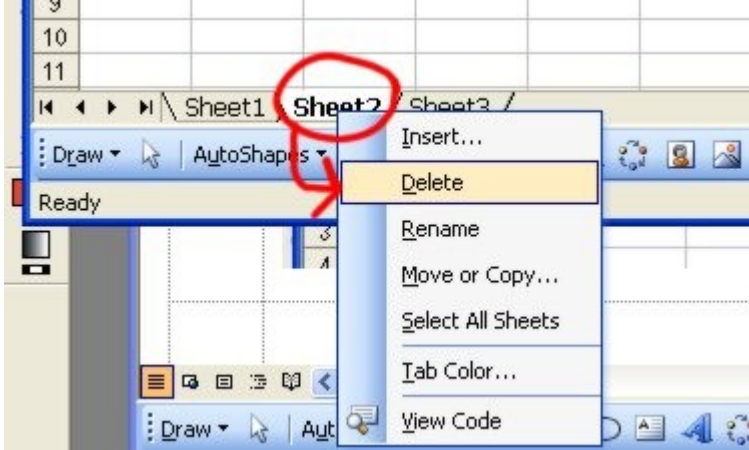
- 5.1 Close ArcMap. Open Excel.
- 5.2 Open the file *IS01\_RdTp2007.xls* found in *C:\HLURB\CLUP\01\_CLUPGIS (Laurel)\02\_IS\*. (See image below where, for example, the road segment with ID

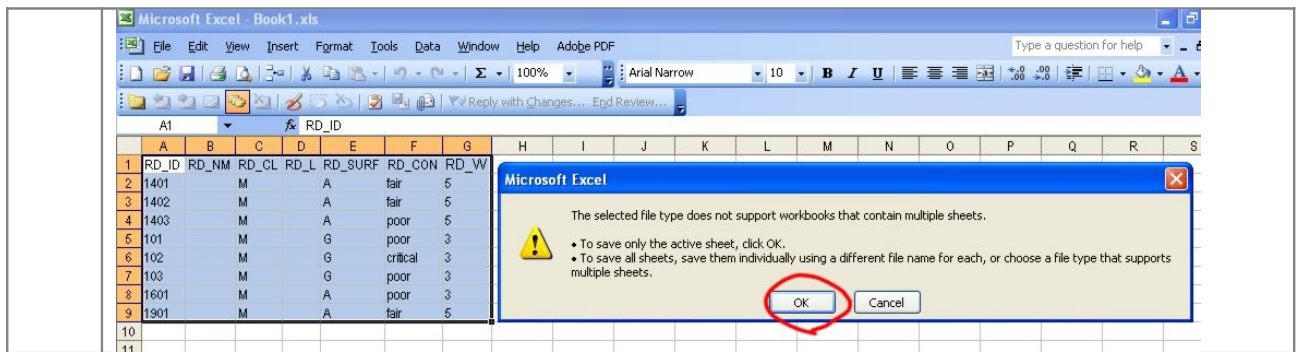
101 is municipal road, has a gravel surface and is in a poor condition.



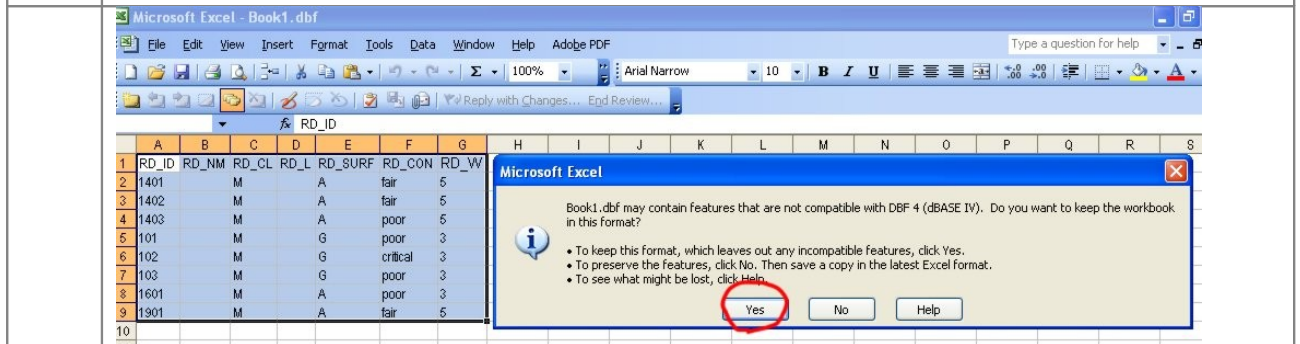
5.3 Select (highlight) the cells that will be found in the dBase file. (Place the cursor in cell B2 and drag it to cell H12.) From the excel menu bar, select **Edit > Copy**.

5.4 Open a new file. (Go to **File > New** then select *New empty document*.) Place the cursor in cell A1 and select **Edit > Paste**. See image below.

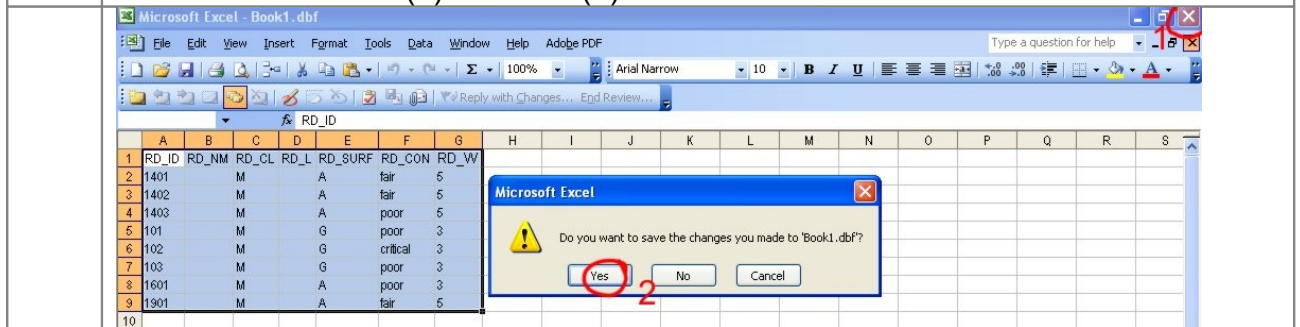
	
<p>5.5</p>	<p>The head column must be in one line in dBase format. Select the cells constituting the column head (A1:G1). From the menu bar select <b>Format &gt; Column &gt; AutoFit Selection</b>.</p>
<p>5.6</p>	<p>Only one sheet is allowed in dBase. Remove <i>Sheet 2</i> by right-clicking on the <b>Sheet2</b> tab and selecting <b>Delete</b>. (See image below.) Repeat this procedure on <i>Sheet 3</i>:</p>
	
<p>5.7</p>	<p>Select only the cells with data (A1:G9). Select <b>File &gt; Save as...</b></p>
<p>5.8</p>	<p>In the Save As window, browse for the folder <b>C:\HLURB\CLUP\01_CLUPGIS(Laurel)\02_IS\</b> and type the File name <b>IS01_RdTp2007.dbf</b>. From the Save as type menu list, select the <b>DBF 4 (dBASE IV) (*.dbf)</b> option. Click <b>Save</b>.</p>
<p>5.9</p>	<p>Now a couple of alerts will appear one after each other. Simply click <b>OK</b> to the alert as below:</p>



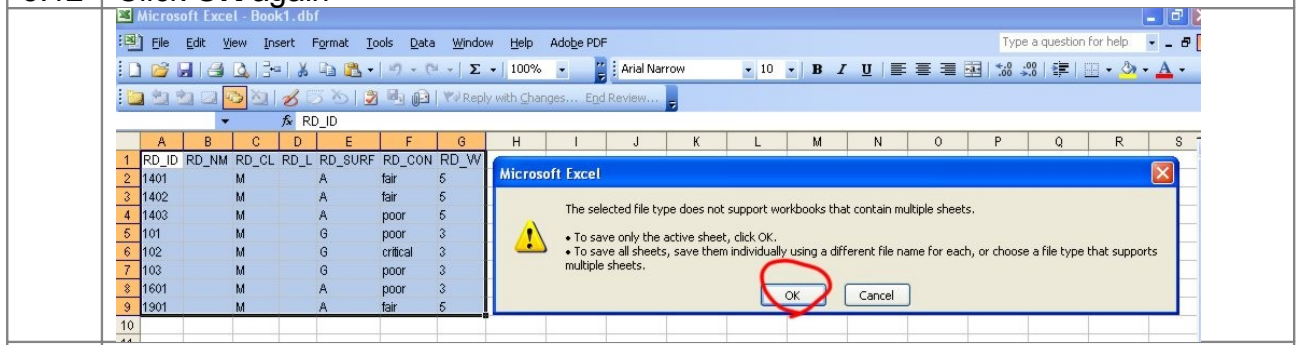
5.10 Click **Yes** to the alert below:



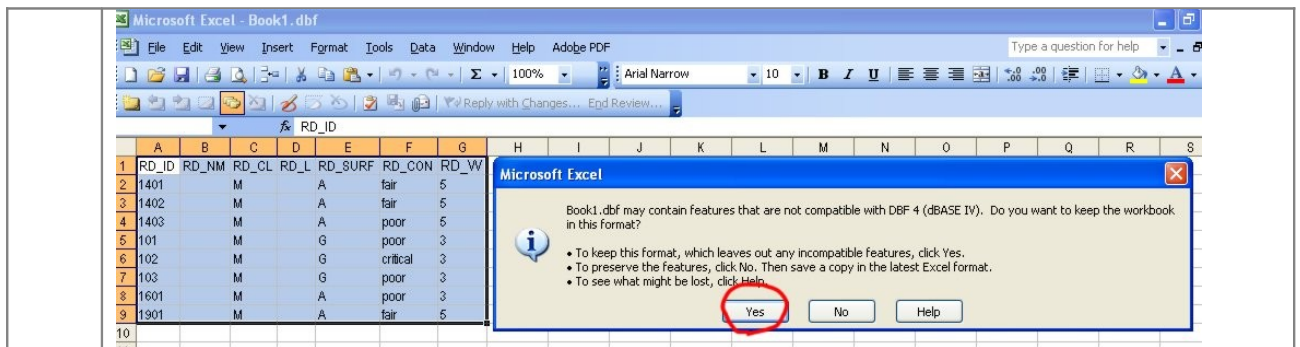
5.11 Click the **exit** button (1) and **Yes** (2) below.



5.12 Click **OK** again



5.13 Finally, click **Yes**.



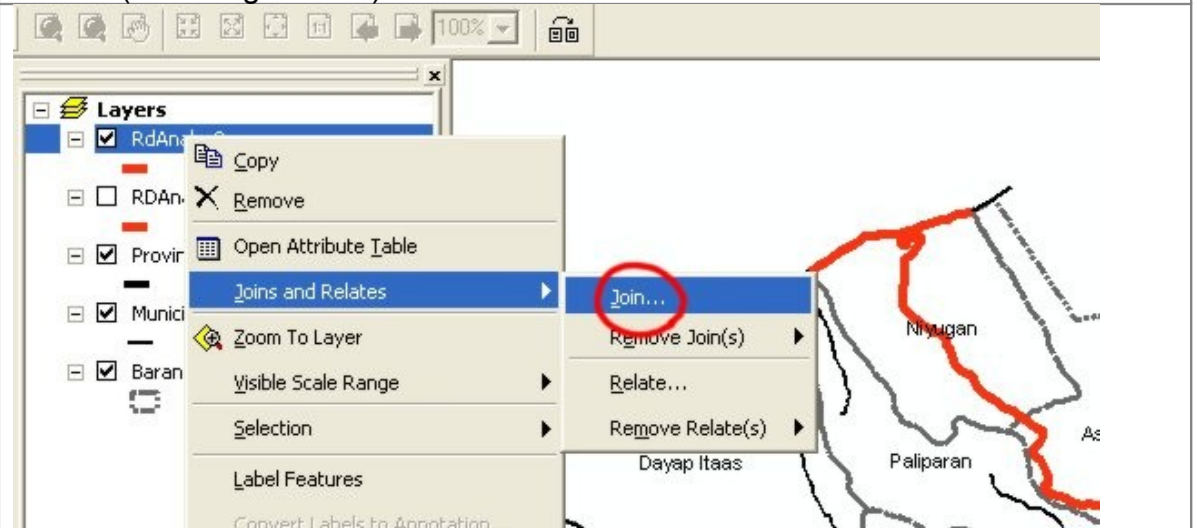
5.14 Close Excel.

*It's always recommended to have Excel closed when you work with ArcGIS.*  
*If you want to revise a .dbf file you should close ArcGIS before you open Excel.*

**6 Joining the dBase File to the Shapefile**

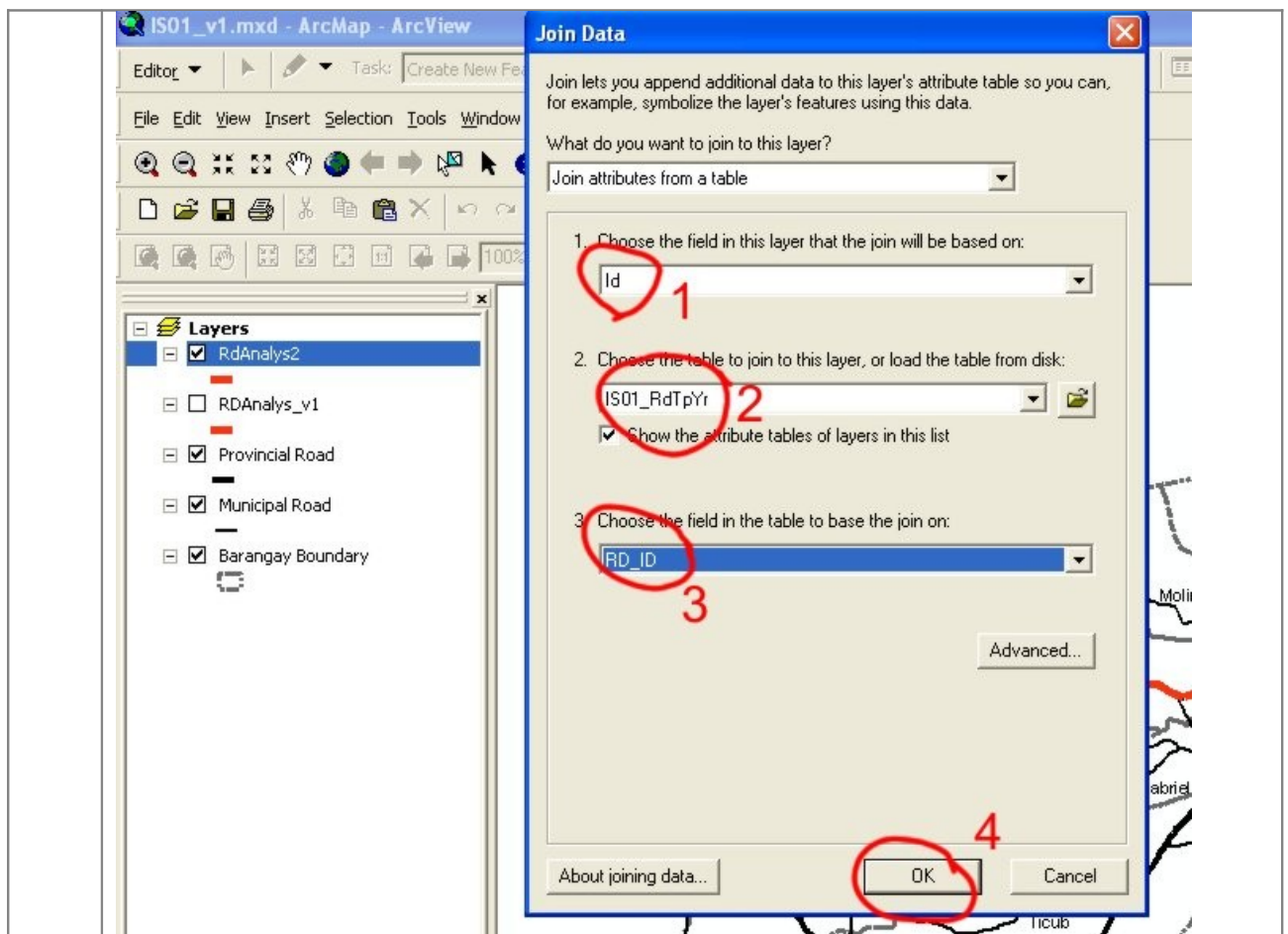
6.1 Open ArcMap and the map document *road\_analysis\_v1*.

6.2 In the table of content, right-click on *RdAnalysis* and select **Joins and Relates > Join...** (see image below).



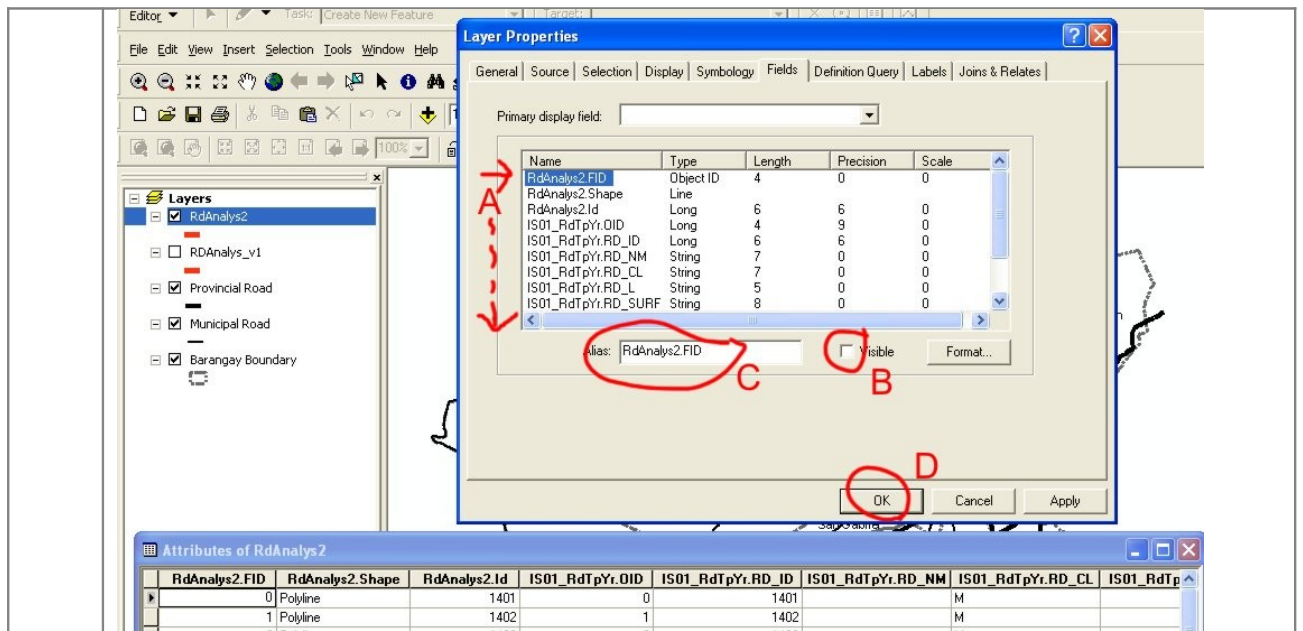
6.3 The *Join Data* window appears. (See image below.) You should have the following settings:

1. 'Id' was the column head where you inserted the unique Ids for the road segments
2. 'IS01\_RdYr' is the name of the dBase table you have prepared that contains the attribute information of the road segments.
3. **RD\_ID** is the name of the column where the unique ID have been inserted
4. Click **OK**.



## 7 Viewing the Result of the Analysis

- 7.1 Open the attribute table for the *RdAnalysis* layer. As you can see, the columns from the dBase table have been intergrated.
- 7.2 To make the table easier to read we need to hide some columns and give proper alias. Open the *Layer Properties* window and go to the **Fields** tab.
- 7.3 Place the cursor on the first row (*RDAnalysis.FID*). This is ArcGIS's column with little information value for us. Therefore, unselect the *Visible* box. (See image below.)



7.4 Repeat step 7.3 for the consecutive fields. If a field is selected visible, you should assign a more understandable *Alias*.

Set the following fields to be visible and assign the respective alias:

**IS01\_Rd\_ - 'Road Segment ID'**

**IS01\_Rd\_ - 'Road Classification'**

**Etc...**

You have completed the exercise! Well done.

*You can now think of different ways to present the analysis. Test the "interactive presentation" by using the Identify tool on the Rd\_analysis layer. Since you've set the fields display properties above and thus reduced redundant and unnecessary information, the result will be fairly easy to interpret for a "normal" computer user.*