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Calculating General Summary Statistics Within Corridor Polygons:

The Corridor Designer Evaluation tools provide a function to calculate general summary statistics on numeric and categorical data from both vector and raster datasets. The types of statistics offered vary depending on the data type and are summarized below. In all cases, statistics are provided in both a dBASE table and a textual report:

FEATURE DATA (Points, Polylines or Polygons) AND STANDALONE TABLES:

- Point Layers, Multipoint Layers and Standalone Tables:
 - Numeric fields: Available stats are:
 - Minimum
 - Maximum
 - Mean
 - Sum
 - Standard Deviation
 - Variance
 - Histogram
 - Text Fields
 - Count (of each unique value)
 - Proportion (of each unique value)
 - Date Fields
 - Earliest Date
 - Latest Date
- Polyline Themes:
 - Numeric fields: Available stats are:
 - Minimum
 - Maximum
 - Mean
 - Mean_WBL (weighted by length of line)
 - Sum
 - Standard Deviation
 - Standard Deviation_WBL (weighted by length of line)

○ Polygon Themes:

- Numeric fields: Available stats are:
 - Minimum
 - Maximum
 - Mean
 - Mean_WBA (weighted by area of polygon)
 - Sum
 - Standard Deviation
 - Standard Deviation_WBA (weighted by area of polygon)
 - Variance
 - Variance_WBA (weighted by area of polygon)
 - Histogram
 - Text Fields
 - Count (of each unique value)
 - Proportion (of each unique value)
 - Area (of each unique value)
- Date Fields
 - Earliest Date
 - Latest Date


RASTER DATA:

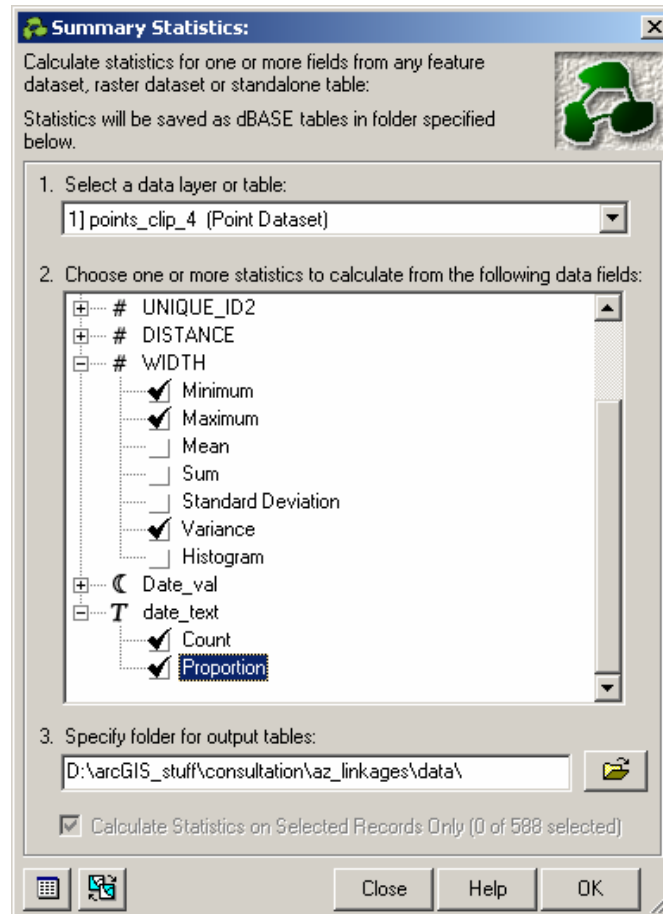
○ Grids with Tables (integer and small floating point grids):

- Numeric fields: Available stats are:
 - Minimum
 - Maximum
 - Mean
 - Median
 - Mode
 - Sum
 - Standard Deviation
 - Histogram
 - Count (of each unique number)
 - Proportion (of each unique number)
 - Area (of each unique number)
- Text Fields
 - Count (of each unique value)
 - Proportion (of each unique value)
 - Area (of each unique value)
- Date Fields
 - Earliest Date
 - Latest Date



○ Grids without tables (generally large floating point grids):



- No table or fields available, so standard statistics include:
 - Minimum
 - Maximum
 - Mean
 - Standard Deviation
 - Histogram

Open the general summary statistics tool by clicking the  button:



The Summary Statistics dialog allows you to calculate a variety of statistics on multiple fields from one of the data layers or tables in your map document. **IMPORTANT:** This function will not automatically clip your dataset to your corridor polygon. This tool will calculate statistics based on the entire dataset, or optionally on the selected features in a vector dataset, so in most cases you will need to clip your dataset prior to running this tool. Please refer to “Using the Clip Tool” (see p. 13) for more information on how to clip datasets.

All feature layers and grids are listed in the drop-down box at the top of the dialog. When you select one of these layers, the large box in the center of the dialog will fill with the available attribute fields and statistics. Attribute field names are prefaced with a symbol indicating whether the field is of type Number (#), Date() or Text ().

If you choose a feature layer (i.e. one composed of points, lines or polygons), and if any of those features are selected, then you have the option to calculate statistics on only the selected set of features by clicking the checkbox near the bottom of the dialog. The checkbox is disabled if no features are selected. You may switch the selection at any time by clicking the  button, and you may easily open and view the table for the current selected dataset by clicking the  button.

NOTE: In many cases, the calculated statistics are weighted by the size of the feature. For example, if you wish to calculate the mean flow rate of two river segments, where the 1st segment is 500m long and has a flow rate of 100, and the 2nd segment is 1000m long and has a flow rate of 10, then the weighted mean flow rate will be calculated as:

$$\begin{aligned}
 \text{Mean Flow Rate} &= \frac{(\text{Seg. 1 Length})(\text{Seg. 1 Flow Rate}) + (\text{Seg. 2 Length})(\text{Seg. 2 Flow Rate})}{(\text{Seg. 1 Length}) + (\text{Seg. 2 Length})} \\
 &= \frac{(500)(100) + (1000)(10)}{500 + 1000} \\
 &= 40
 \end{aligned}$$

In general, weighted statistics are calculated as follows:

Where:

X_i = the value

W_i = the weight (i.e. count, area or length)

Then:

$$\text{Weighted Mean} = \frac{\sum_{i=1}^n X_i W_i}{\sum_{i=1}^n W_i} = \bar{X}$$

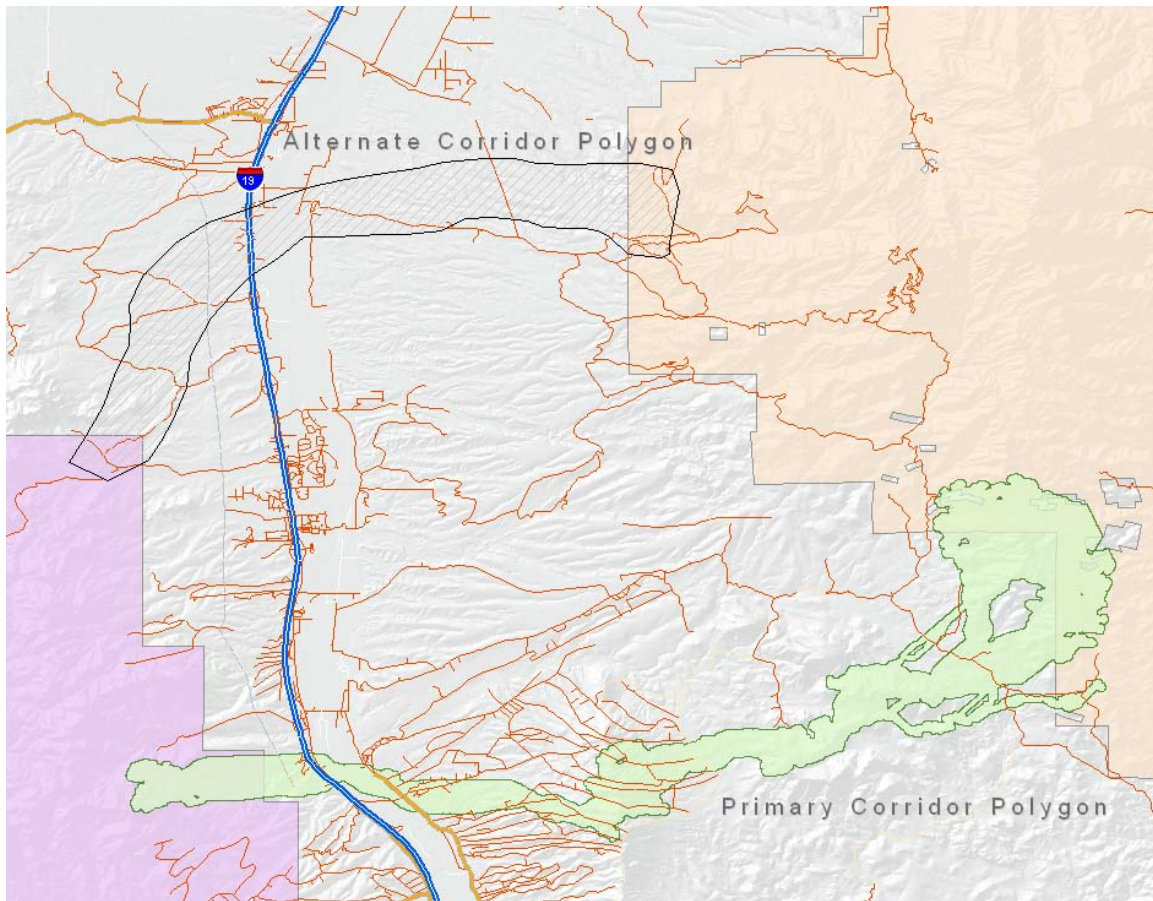
$$\text{Weighted Variance} = \frac{\sum_{i=1}^n W_i (X_i - \bar{X})^2}{\sum_{i=1}^n W_i}$$

$$\text{Weighted Standard Deviation} = \sqrt{\frac{\sum_{i=1}^n W_i (X_i - \bar{X})^2}{\sum_{i=1}^n W_i}}$$

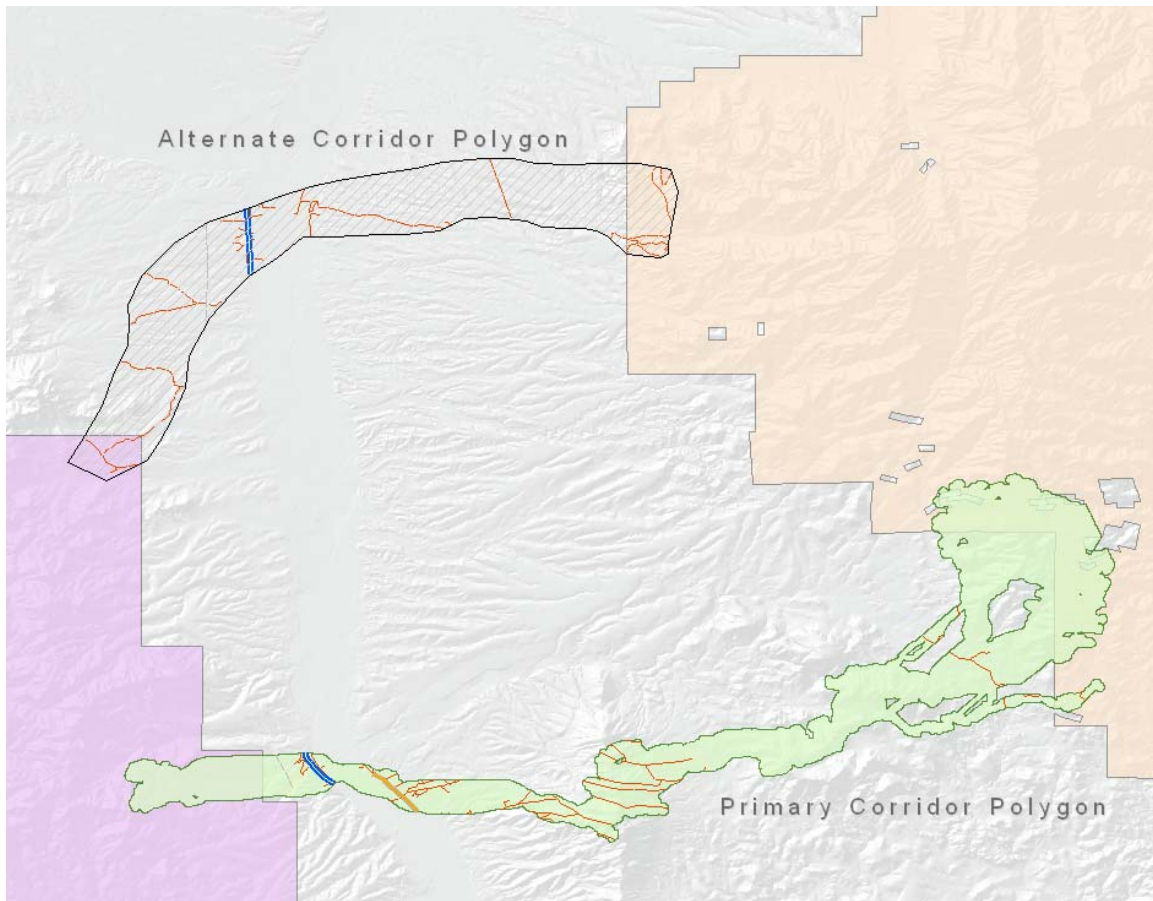
AN EXAMPLE WITH POLYLINE DATA:

Suppose we were interested in the total lengths of different types of roads that existed within our primary corridor polygon¹ and an alternative corridor polygon.

¹ We use the terms *ecologically optimum corridor*, *primary corridor*, *optimum linkage design*, and other similar terms to refer to this “best possible design” against which alternatives are compared. We apologize for our inconsistent terminology.



We must first use the Clip Tool (see p. 13) to clip our road network to both the primary and alternative corridor polygons.



Next, open the summary statistics tool and select the road layer that has been clipped to your primary corridor polygon, as well as the field(s) you wish to analyze and the statistics you wish to generate. In this example, roads are classified in the field “Class_rte”:

Summary Statistics:

Calculate statistics for one or more fields from any feature dataset, raster dataset or standalone table:

Statistics will be displayed in a Report window, and saved in dBASE tables in folder specified below.

1. Select a data layer or table:
 [2] corridor_roads_utm (Polyline Dataset)

2. Choose one or more statistics to calculate from the following data fields:

- ☐ PRETYPE
- ☐ NAME
- ☐ TYPE
- ☐ SUFFIX
- ☐ CLASS_RTE
 - ☒ Count
 - ☒ Proportion
 - ☒ Length
- ☐ RAMP_CLASS
- ☐ FROM_ELEV
- ☐ TO_ELEV
- ☐ HWY_TYPE

3. Specify folder for output tables:
 D:\arcGIS_stuff\consultation\az_linkages\data2\

☒ Calculate Statistics on Selected Records Only (0 of 133 selected)

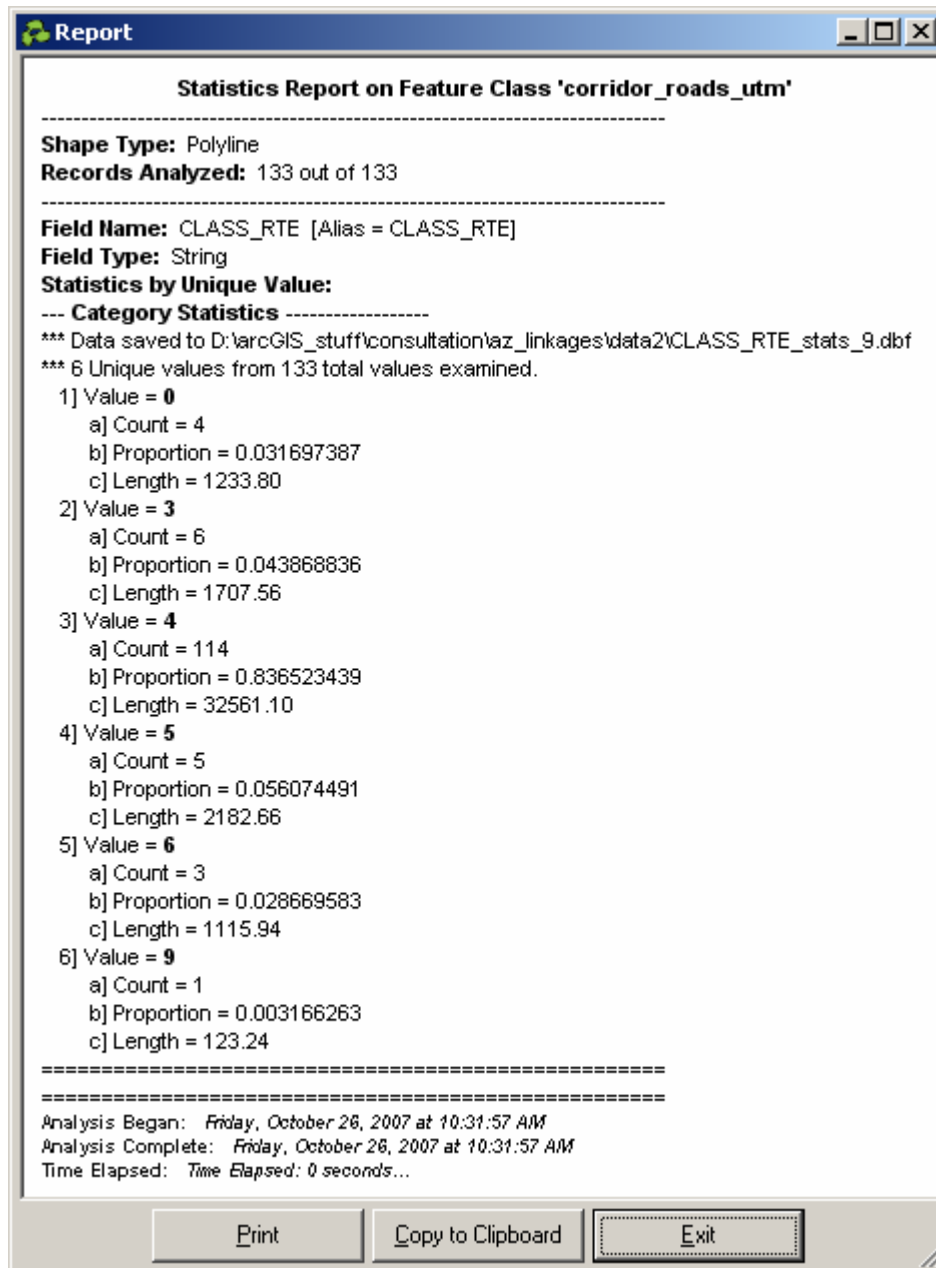
Close Help OK

Click 'OK' and this function will identify all unique "CLASS_RTE" values in the clipped road layer, and tell us the total number, proportion and length of roads in each "CLASS_RTE" class. These statistics are provided in both a table in your Map document and in a text report:

Attributes of CLASS_RTE_stats_3

	OID	Unique_ID	Value	Count	Proportion	Length
▶	0	1	0	4	0.031697	1233.79916
	1	2	3	6	0.043869	1707.564491
	2	3	4	114	0.836523	32561.10372
	3	4	5	5	0.056074	2182.661279
	4	5	6	3	0.02867	1115.943929
	5	6	9	1	0.003166	123.244642

Record: 1 Show: All Selected Records (0 out of 6 Selected) Options



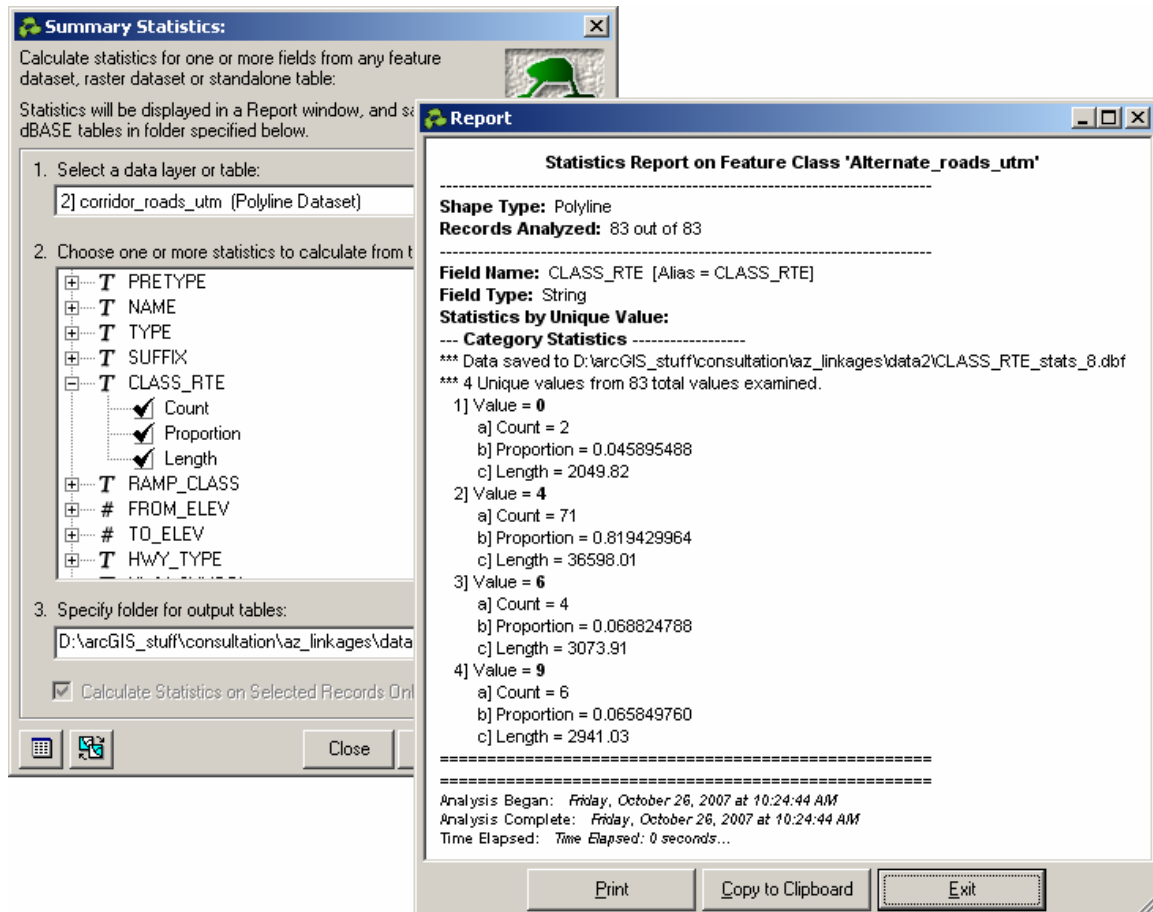
For reference, the “CLASS_RTE” values are defined as follows:

CLASS_RTE Value	Definition
0	Limited Access (Freeway)
3	Major Road
4	Local Road
5	Minor Road
6	Other Road
9	Pedestrian Way

Therefore, our primary corridor contains 1,234m of freeway, 1,708m of major roads, 32,561m of local roads, 2,183m of minor roads, 1,116m of “other” roads, and 123m of pedestrian trails.

NOTE: All dBASE statistics tables are opened and saved in your Map document. If you close a table, you can easily find and reopen it by clicking the “Source” tab at the bottom left corner of your Map document. All standalone tables are listed in the “Source” tab. Also, the text report includes the hard drive location of the dBASE table.

For comparison purposes, we now calculate the statistics on the alternative corridor. The steps are identical, except that we now choose the road layer that has been clipped to the alternative polygon:



Summary Statistics:

Calculate statistics for one or more fields from any feature dataset, raster dataset or standalone table:

Statistics will be displayed in a Report window, and saved as dBASE tables in folder specified below.

1. Select a data layer or table:
2] corridor_roads_utm (Polyline Dataset)

2. Choose one or more statistics to calculate from:

- PRETYPE
- NAME
- TYPE
- SUFFIX
- CLASS_RTE
 - Count
 - Proportion
 - Length
- RAMP_CLASS
- FROM_ELEV
- TO_ELEV
- HWY_TYPE

3. Specify folder for output tables:
D:\arcGIS_stuff\consultation\az_linkages\data

☒ Calculate Statistics on Selected Records Only

Report

Statistics Report on Feature Class 'Alternate_roads_utm'

Shape Type: Polyline
Records Analyzed: 83 out of 83

Field Name: CLASS_RTE [Alias = CLASS_RTE]
Field Type: String

Statistics by Unique Value:

--- **Category Statistics** ---

*** Data saved to D:\arcGIS_stuff\consultation\az_linkages\data2\CLASS_RTE_stats_8.dbf

*** 4 Unique values from 83 total values examined.

1) Value = 0
a) Count = 2
b) Proportion = 0.045895488
c) Length = 2049.82

2) Value = 4
a) Count = 71
b) Proportion = 0.819429964
c) Length = 36598.01

3) Value = 6
a) Count = 4
b) Proportion = 0.068824788
c) Length = 3073.91

4) Value = 9
a) Count = 6
b) Proportion = 0.065849760
c) Length = 2941.03

Analysis Began: Friday, October 26, 2007 at 10:24:44 AM
Analysis Complete: Friday, October 26, 2007 at 10:24:44 AM
Time Elapsed: Time Elapsed: 0 seconds...

Attributes of CLASS_RTE_stats_4

OID	Unique_ID	Value	Count	Proportion	Length
0	1	0	2	0.045895	2049.81967
1	2	4	71	0.81943	36598.01311
2	3	6	4	0.068825	3073.905782
3	4	9	6	0.06585	2941.032785

Record: 1 Show: All Selected Records (0 out of 4 Selected) Options

A table helps compare the amount of road by type in each polygon:

Road Class	Primary Corridor (m)	Alternative Corridor (m)
Limited Access (Freeway)	1,234	2,050

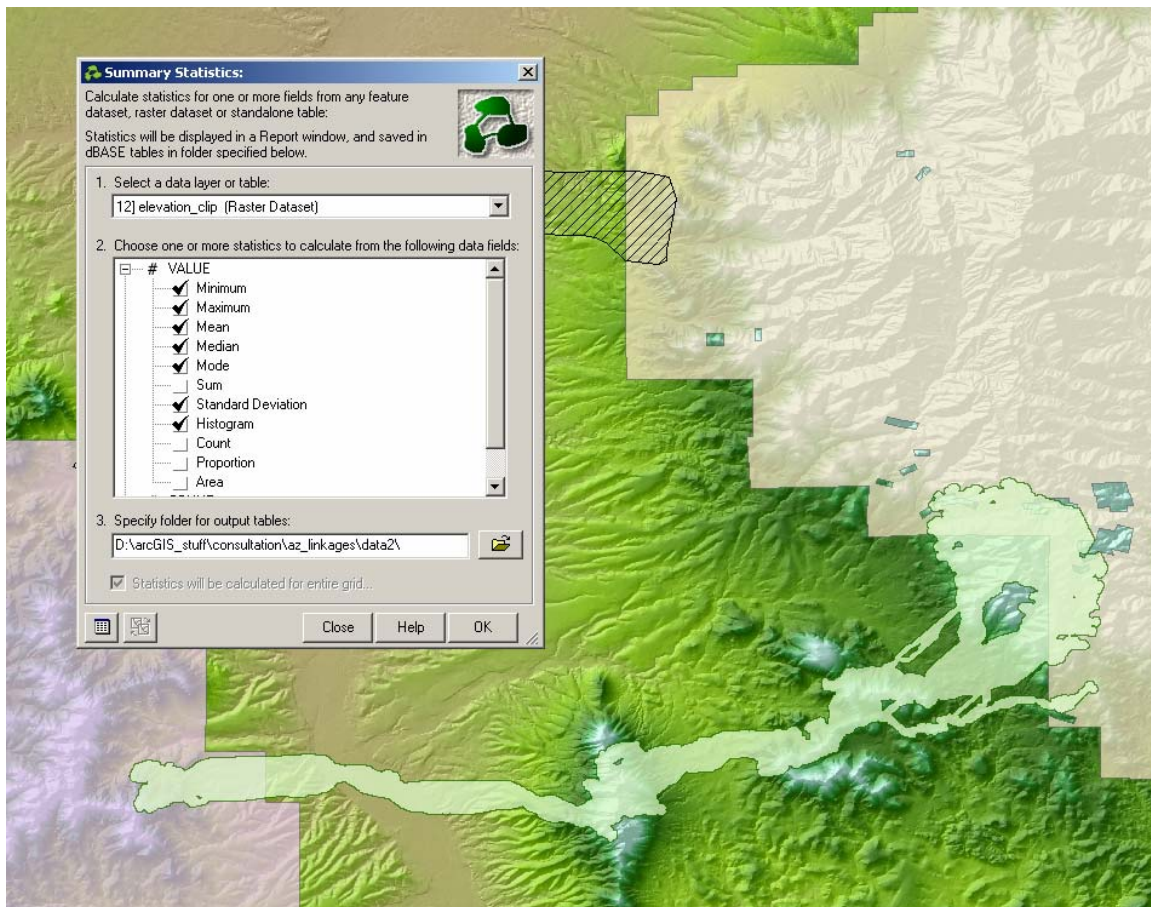
Major Road	1,708	0
Local Road	32,561	36,598
Minor Road	2,183	0
Other Road	1,116	3,074
Pedestrian Way	123	2,941

NOTE: Because all tables are saved in dBASE format, they can also be opened up separately in Excel for more advanced graphing functions.

NOTE: Road lengths (and polygon areas) are calculated according to the actual sizes of the feature. Therefore, if your features are in latitude/longitude coordinates, then your size values will be reported in “degrees” rather than any useful measure. Therefore you are recommended to apply this tool on projected data if you wish to calculate accurate size values.

AN EXAMPLE WITH GRID DATA:

The general statistics tool works equally well with vector and raster data. For example, if we wanted to calculate general statistics and a histogram of elevation values within our primary corridor polygon, we would first clip the elevation grid to the primary corridor polygon using the Clip Tool, and then apply the general summary statistics tool directly to the clipped elevation grid:



General statistics (mean, minimum, etc.) are generated in a separate table from histogram data, so this example will produce two separate tables.

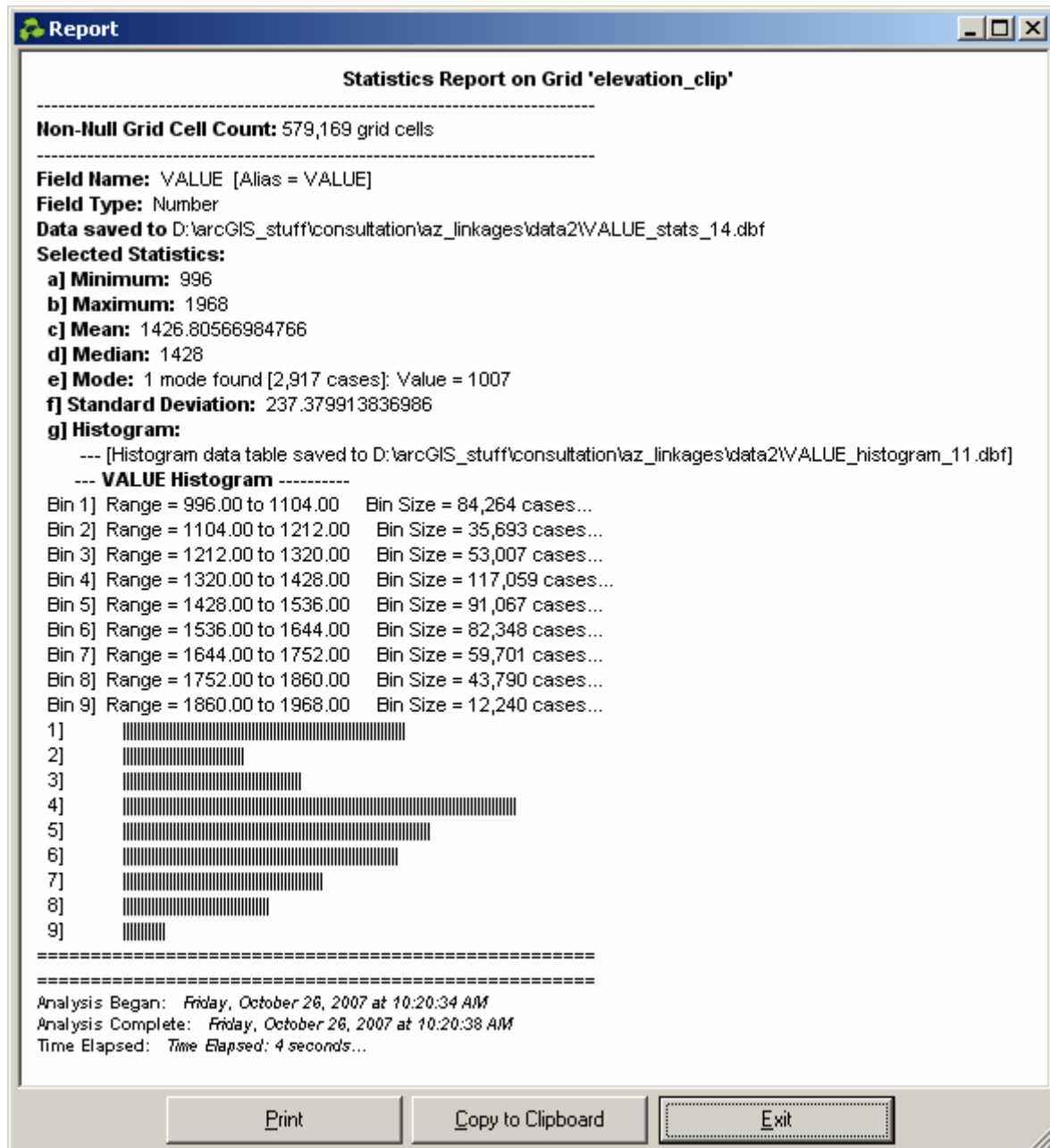
Attributes of VALUE_stats_7							
OID	Unique_ID	Minimum	Maximum	Mean	Median	Mode_Strng	St_Dev
0	1	996	1968	1426.80567	1428	1 mode found [2,917 cases]: Value = 1007	237.379914

Record: 1 Show: All Selected Records (0 out of 1 Selected) Options

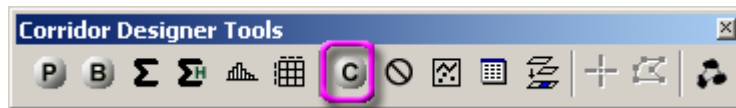
Attributes of VALUE_histogram_7					
OID	Bin_ID	Bin_Start	Bin_End	Bin_Count	
0	1	996	1104	84264	
1	2	1104	1212	35693	
2	3	1212	1320	53007	
3	4	1320	1428	117059	
4	5	1428	1536	91067	
5	6	1536	1644	82348	
6	7	1644	1752	59701	
7	8	1752	1860	43790	
8	9	1860	1968	12240	

Record: 1 Show: All Selected


All statistics will be provided in a single text report:

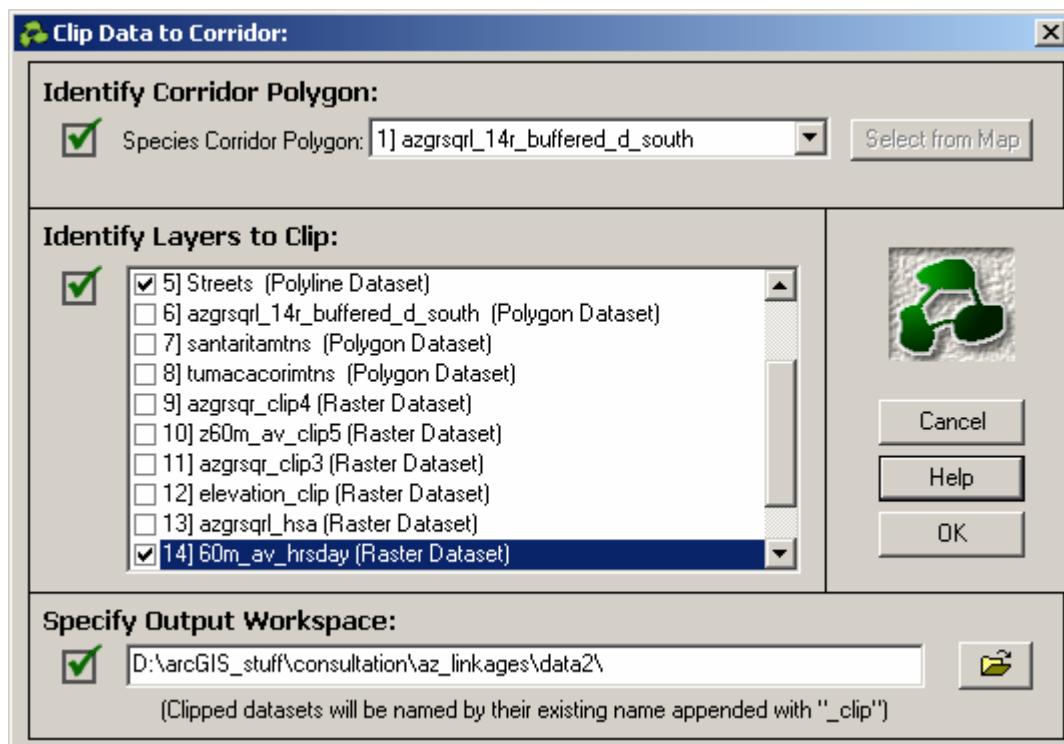


Using the Clip Tool



The Corridor Designer Evaluation tools include functions to calculate a large variety of statistics on vector and raster data, including a specialized tool intended specifically for habitat suitability grids. However, these tools require that the vector or raster datasets be clipped to the polygon or area of interest before using them. The statistical tools themselves analyze the entire dataset and do not automatically clip the datasets as part of the analysis. Therefore we have provided a tool specifically designed to clip both raster and vector datasets to polygons.

Click the  button to open the “Clip Data to Corridor” dialog:



You must identify 3 parameters before the “OK” button will become enabled:

- 1) The polygon to clip to,
- 2) The layers to clip, and
- 3) The folder to save the new clipped datasets to.

As you identify each parameter, you will see green checkmarks appear in the respective boxes.

SELECTING THE CLIPPING POLYGON:

You have several options for selecting a corridor to clip to. You may:

- 1) Select a polygon layer from the map, IF that layer contains only a single polygon feature.
- 2) Select a single polygon from an existing polygon layer.
- 3) Select an existing polygon graphic.

4) Draw a new polygon graphic.

The drop-down list box at the top of the dialog lists all polygon layers currently in the active frame of your map document. If any of these contains only a single polygon, then you may simply select that layer and be done. However, the clipping tool is designed to work with a single polygon so you will receive an error message if you have multiple polygons in that polygon layer.

If you need to select a single polygon from a polygon layer, or if you need to select or draw a polygon graphic, then choose the option “Select by clicking on map”. This will enable the button “Select from Map”, from which you can access an interactive tool to directly select or draw your polygon. For more information on using the interactive polygon selection tool, please refer to “Selecting or Drawing Polygons” (see p. 15).

NOTE: This tool will not let you use several separate polygons for your clipping boundary. If you wish to use several polygons for this purpose, you will need to combine them into a single entity first. We have a separate stand-alone tool available which will do this function, available for free download at http://www.jennessent.com/arcgis/shapes_graphics.htm (see especially the discussion of the “Combine Features” tool).


IDENTIFYING THE LAYERS TO CLIP:

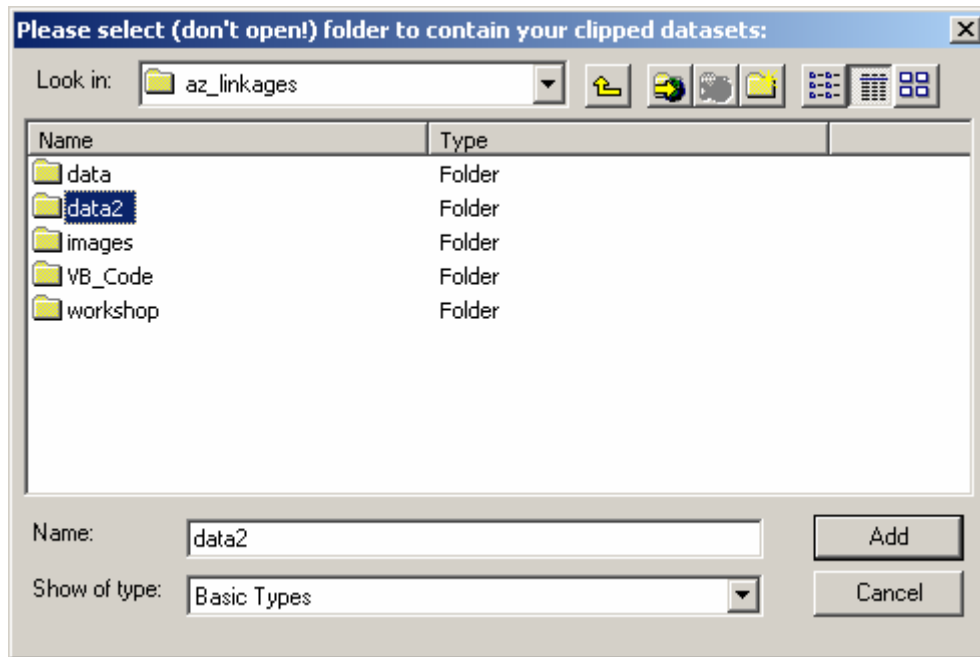
Select one or more layers to clip. Layers should be selected by clicking the check boxes to the left of each layer name.

This function will check to make sure the layers actually intersect the polygon before clipping them, and will also make sure the polygon is projected to the same coordinate system as the clip layer before the clip is executed. Therefore all clipped datasets will be in the same projection as the original dataset.

SPECIFY OUTPUT WORKSPACE:

Finally, make sure the clipped datasets are saved to the correct workspace. All clipped datasets will be named according to the layer name, appended with “_clip”. In the case of clipping grids, new grid dataset names will also conform to grid naming rules (i.e. ≤ 13 characters, no spaces and does not start with a number).

If you need to select a different folder to save clipped datasets to, then click the  button to open the standard ArcGIS file browser folder:



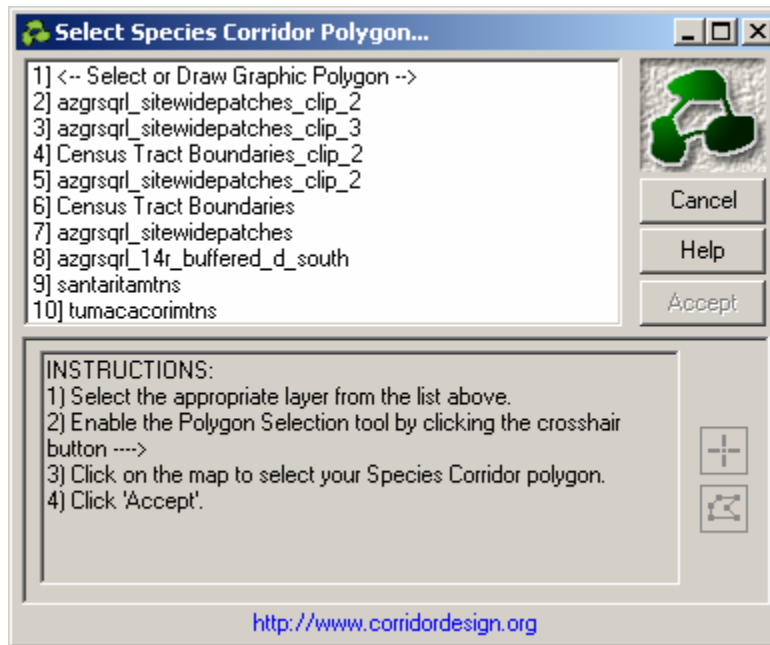
IMPORTANT: Do not open the folder you wish to select. Simply click on it once to select it, then click the “Add” button.

NOTE: This tool is an improvement over the standard ArcGIS clipping tools, in that it works equally well on raster and vector data and handles multipart polygons and polygons with holes or islands, or even multiply nested holes and islands. When clipping grids, it also maintains the full raster attribute table provided that there was one to start with. Finally, it will clip to non-standard shapes such as circles, ellipses and polygons containing curved segments.

NOTE: If you used a graphic polygon to clip with, and if you wish to save your graphic into a new polygon shapefile, you can use the “Create Shapefile” tool to do so (see p. 20).

Selecting or Drawing Polygons:

Four functions allow the user to do something based on a selected polygon graphic or polygon feature, and therefore all three tools needed a way to select or draw that polygon. The Patch Analysis, Bottleneck Analysis, Cross-Tabulation Table and Clip tools all provide access to the following dialog:




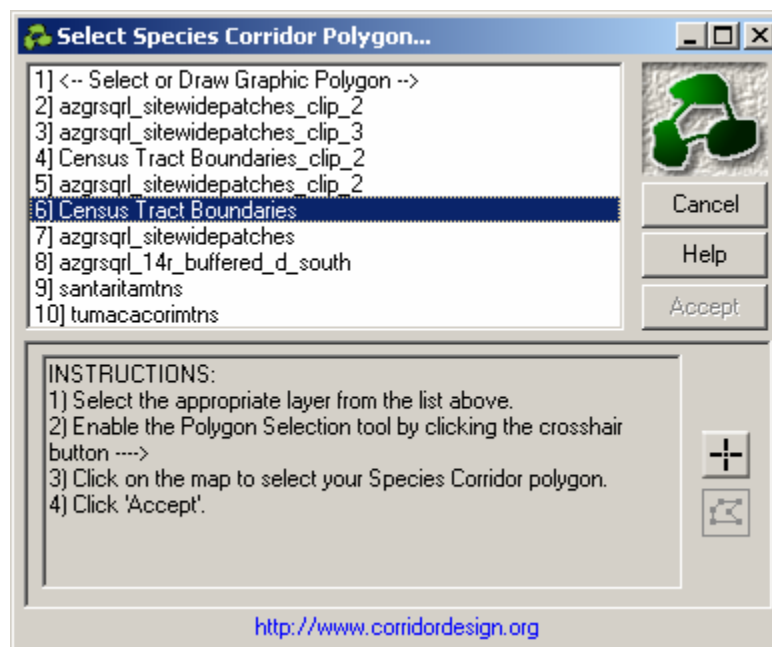
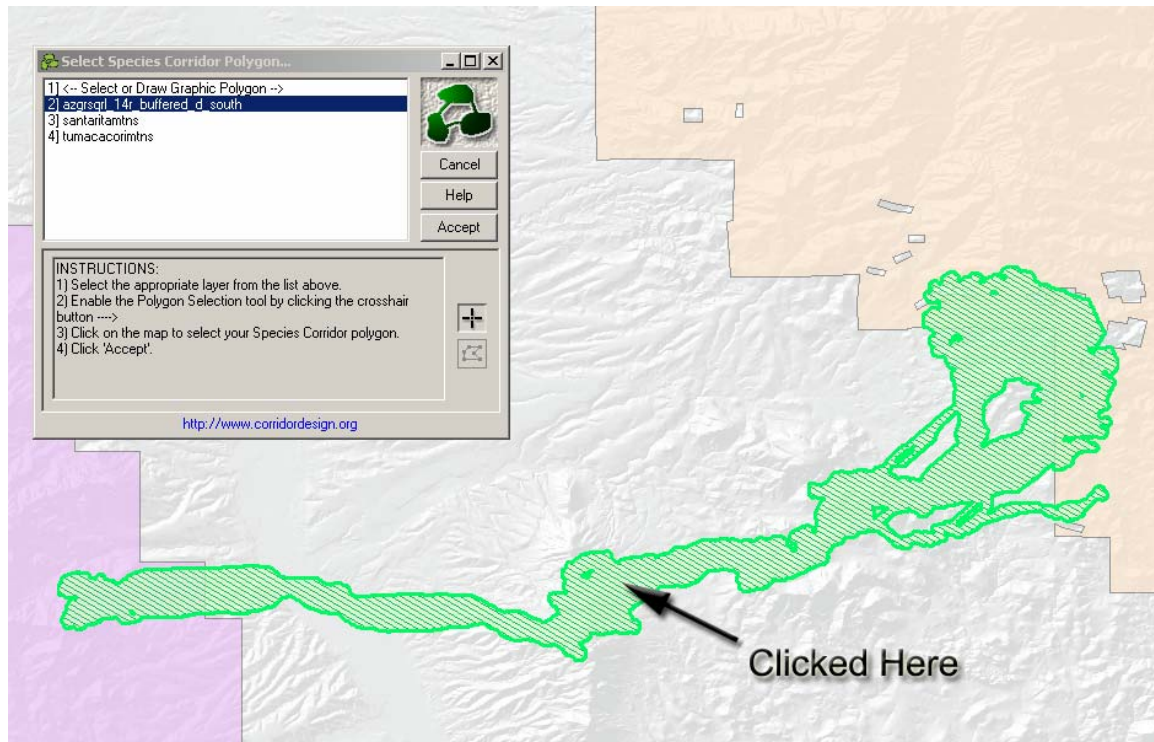
NOTE: The title of this dialog will change depending on whether the user is searching for a corridor polygon or a wildland block.



This dialog allows you to:

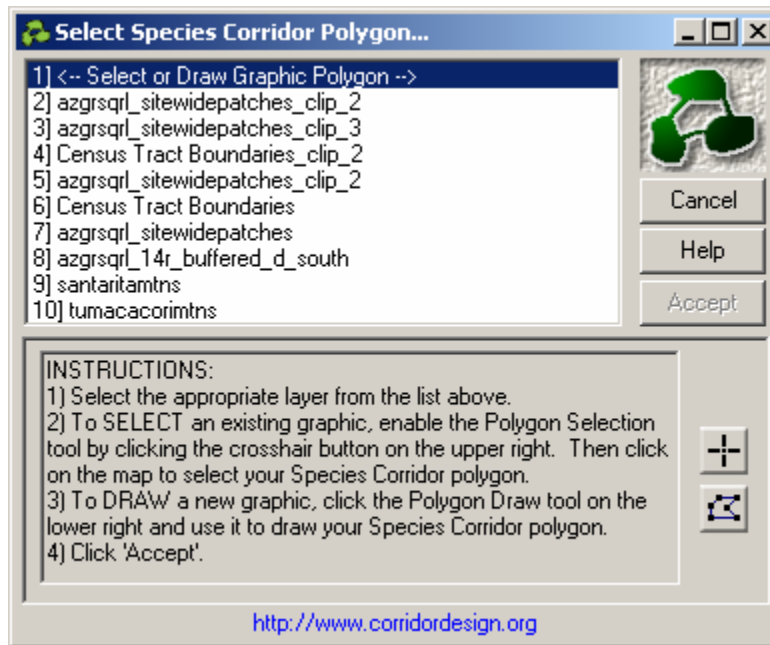
1. Select a single polygon from a polygon feature layer, or
2. Select a single graphic polygon, or
3. Manually draw a graphic polygon on the screen.

If you select a polygon theme from the list at the top of the dialog, then the “Select Polygon”

button  will become enabled and the corresponding tool will become enabled on the Corridor Designer toolbar. Click this button and then select a polygon from the theme. After you click on a polygon, it will turn a green color with a crosshatch fill:

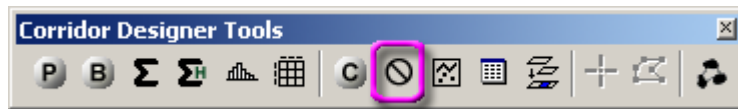


You may also select or draw graphic polygons, rather than selecting polygons from a polygon layer. If you select the first item in the list, “Draw or select graphic polygon”, then both the “Select Polygon”  and “Draw Polygon”  buttons will become enabled. Use the appropriate button to either select or draw a graphic polygon. Note that the instructions change if you select this option:



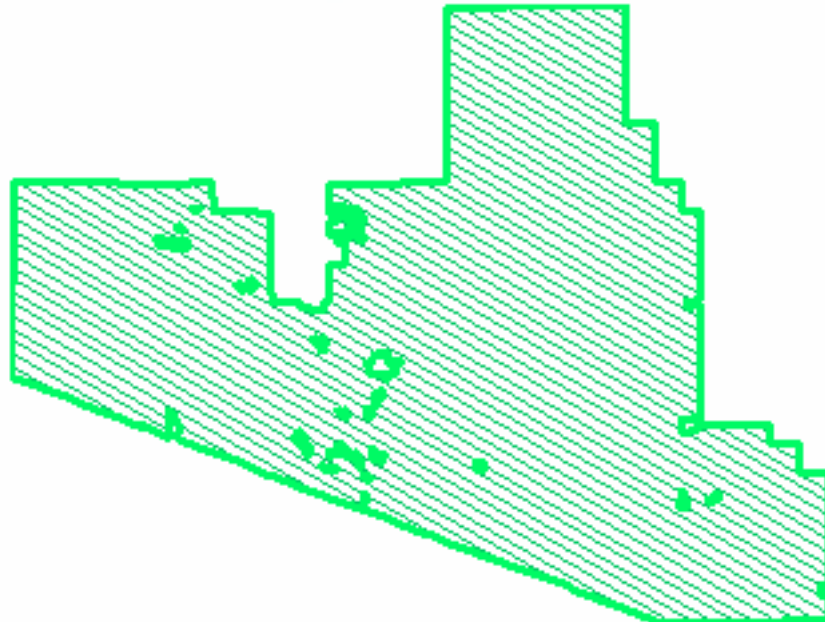
In all cases, selected polygons will be shaded green with a crosshatch pattern. If any of these graphics remain in your view after you no longer need them, you can quickly clear them out using the “Delete Corridor Designer Graphics” tool (p. 19). You may also convert any graphics to a shapefile using the “Create Shapefile” tool (p. 20).

Delete Corridor Designer Graphics:



Several of the Corridor Designer Evaluation functions create graphics on the screen. For example, the Clip tool and the Polygon Selection tool both produce polygons with a particular fill pattern:

**Selected Polygon will turn green
with diagonal crosshatch:**



The bottleneck and patch distance tools will also produce distinctive graphics.

This button simply clears out any CorridorDesigner-produced graphics, leaving any other user-created graphics untouched.

Create New Shapefile:



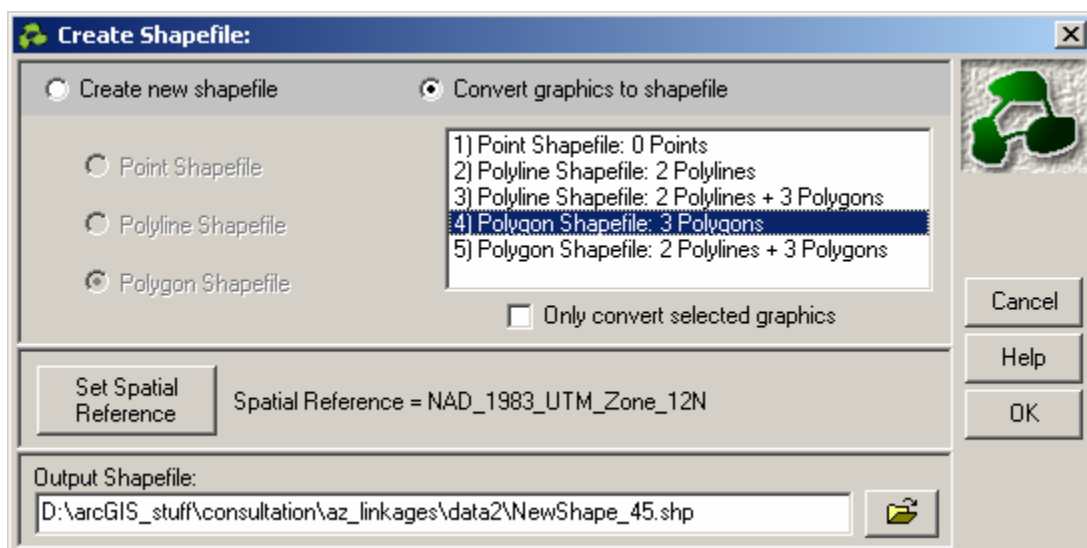
This function allows you to either create a new empty shapefile or convert graphic shapes to a shapefile. You may create either point, polyline or polygon shapefiles with this tool.

- Polygon shapefiles will include attribute fields for [Unique_ID] and [Area].
- Polyline shapefiles will include attribute fields for [Unique_ID] and [Length]
- Point shapefiles will include attribute fields for [Unique_ID], [X_Coord] and [Y_Coord].

NOTE: If you are converting graphics to a shapefile, and if those graphics have names (right-click the graphic and check the properties to see if it has a name), then these names will also be added to the attribute table in a [Name] field.

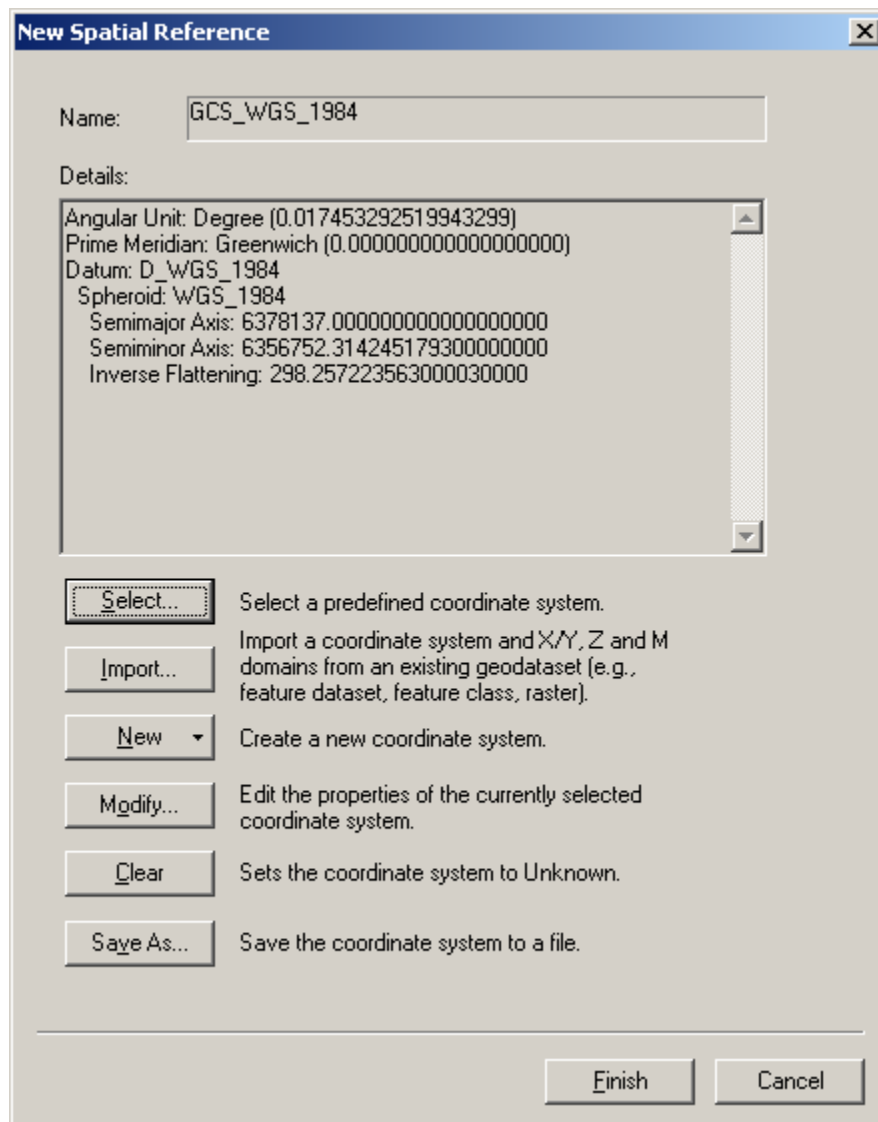
This function also allows you to convert polyline graphics to polygons, or polygon graphics to polylines, if you wish. When opened, the tool will examine your map to see how many point, polyline or polygon graphics are available, and whether any of them are selected. The tool will show you how many of each type are available to convert. If you attempt to create a shapefile from existing graphics when there are no graphics to convert, you will be notified of this and asked if you would like to try a different shape type.

NOTE: Certain linear or areal graphic shapes are not technically polylines or polygons. Polygons that are defined by a circle or elliptic arc are not really “polygons” in the sense that they are not composed of a series of straight-line segments. This is also true for linear features that are constructed of Bezier curves. It is not possible to add true curves such as circles, ellipses or Bezier curves to a polyline or polygon shapefile, so this function will convert these shapes to standard polygons or polylines before adding them to the shapefile. It does this by generating 200 evenly-spaced points along the length or perimeter of the curve, and connecting these points with straight segments. Therefore, if the original graphic feature is composed of true curves, then the actual shape in the shapefile will be slightly different than the original feature.



You must set a spatial reference for the new shapefile. If your map has a spatial reference set, then the map spatial reference will be the default value. You may easily change the spatial

reference by clicking the “Set Spatial Reference” button and identifying the spatial reference you want:



NOTE: This function adds the new shapefile to map, but does not delete existing graphics so you may not see the new shapefile when the shapes lie behind the graphics.