

Vector Spatial Analysis: ODOT Pavement Conditions


31 points

OBJECTIVES: Part A: Demonstrate the ability to use **ArcMap** tools to summarize attributes of vector data graphically. More specifically, demonstrate the ability to: 1) display a numeric attribute of a feature in different colors based on the magnitude of the attribute, 2) conduct a simple analysis to summarize an attribute and generate summary statistics of the attribute using other attributes, and 3) combine the two outcomes in a *Layout View*.

Part B: Demonstrate the ability to use **ArcMap** geoprocessing tools to conduct spatial analysis of vector data. More specifically, demonstrate the ability to: 1) use a selection query to isolate features of interest and create a new layer from the selected features, 2) use the *Buffer* and *Dissolve* tools to create buffers around selected features, 3) use the *Intersect* tool to create intersected layers, and 4) use the results to derive a statistic of interest (i.e., determine the total number of crashes that occurred in Oregon during 2011 based on pavement condition).

Part C: Combined objectives of A& B.

DELIVERABLE: A **Word** document with image captures of your work and answers to questions.

NOTE: A block arrow () identifies specific deliverables for this assignment.

-All charts need to have titles, axes labels, units, etc.

-All screen prints copied in MS Word need to have captions/titles, border and centered in document.

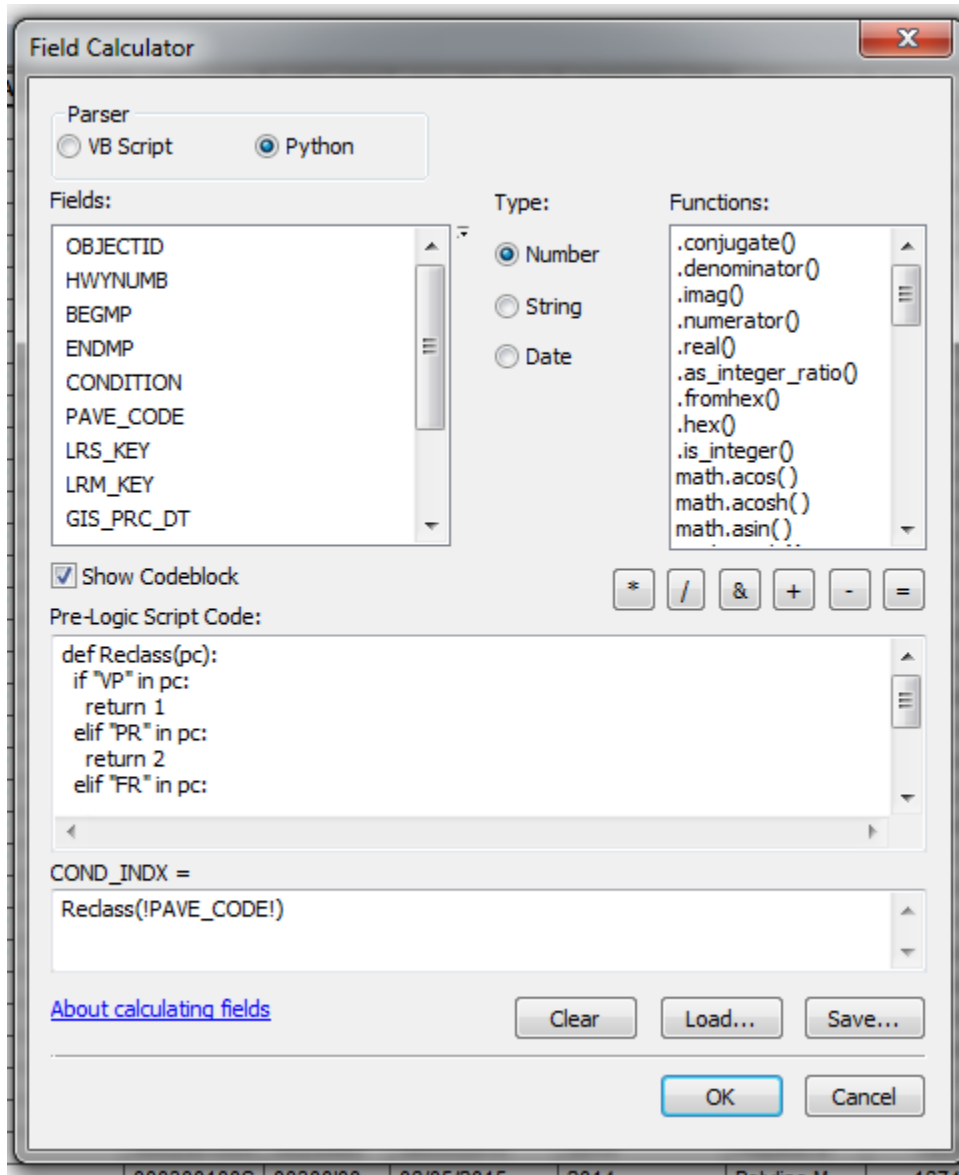
-All documents, images, plots, etc. need to look professional and easy to understand.

INSTRUCTIONS:

Part A

1. Download **HW4_Pavemt.zip** from the public_html drive and extract the files to your CE202 drive and folder named **HW4_Pavemt** (use 7-Zip > Extract to folder>).
2. Open **ArcMap**, Set Map Document Properties (File—Map Document Properties—select relative paths, then navigate to your data folder, and find/set **Lab_Pavement.gdb** as the default geodatabase). Save project as HW4_Pavemt.mxd. Add the layers: Crashes, Highways, PvmtCond, Rivers, and Counties. Make sure **Counties** is the last layer in the Table of Contents. Change the symbology as desired.
3. Turn off the **Crashes**, **Highways**, and **Rivers** layers for now.
4. Right click the **PvmtCond** layer and select *Open Attribute Table*. Open the drop down menu in the upper left and select *Add Field*. Name the field **COND_INDXX**. In the dialog box, select *short integer* for the type.

5. Right click the field *COND_INDX* and select *Field Calculator*. Select OK for the dialog prompt that asks you if you want to continue outside of an edit session. We want to convert our data to a numeric scale so that it is easier to work with for analysis than text. To do this, we are going to write a short script using the *Field Calculator* gui. Here is a screenshot followed by more detailed instructions. (note that the screenshot cuts off the text needed in the *Pre-Logic Script Code*).



For the parser menu, select Python. Check the “Show Codeblock” box.

In the “Pre-Logic Script Code:” box copy the text below in blue. (Note that this text is case sensitive. Also, the blank spaces at the front of the line are important and need to be consistent. The first line (def Reclass(pc):) should not have any spaces in front. The if and elif lines should have 2 spaces. The return lines should have 4 spaces in front.

```
def Reclass(pc):
    if "VP" in pc:
        return 1
    elif "PR" in pc:
        return 2
    elif "FR" in pc:
        return 3
    elif "GD" in pc:
        return 4
    elif "VG" in pc:
        return 5
```

Then in the COND_INDX = box below, type the following text in blue:

Reclass(!PAVE_CODE!)

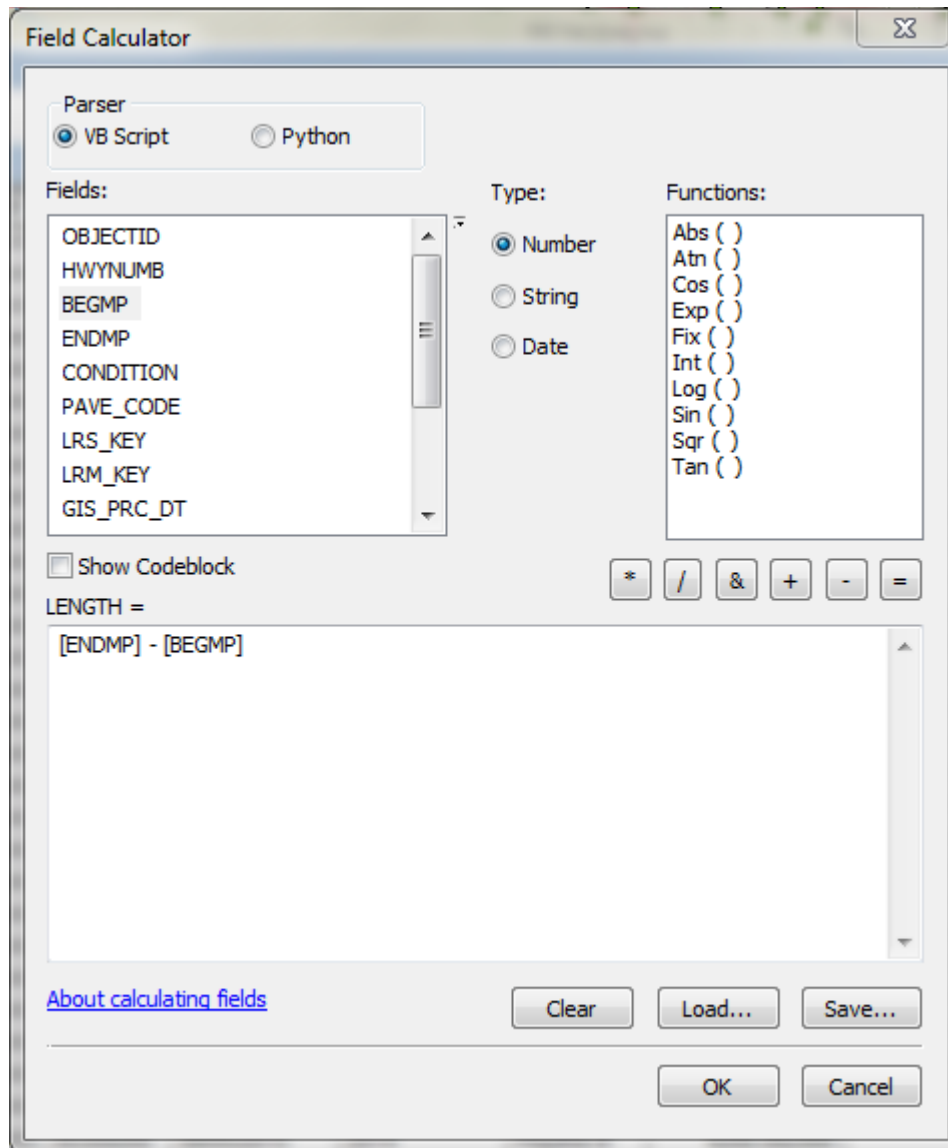
Select ok and your attribute table should have a value of 1 in *COND_INDX* for very poor pavements, 2 for poor, 3, for fair, 4 for good, and 5 for very good. How many records are there for each COND_INDX?



(1pt). (TIP: select by attribute)


6. Repeat the process of adding a field to the **PvmtCond** layer. Call this field LENGTH and set its type to float. Do a field calculation for this layer similar to what you did before. This time, however, select the VBscript option. Subtract the BEG_MP field from the END_MP field. (Use the tools as you would for a SQL query). A screenshot is provided below to help you. What are the units of the length values that are calculated in this field? **(1pt)**










7. Open the *Layer Properties* dialog for the **PvmtCond** layer. Select the *Symbology* tab and do the following:
 - a. Select *Quantities > Graduated colors* in the *Show:* list.
 - b. Select *COND_INDX* from the drop-down list in the *Fields Value* frame.
 - c. Select a color ramp of your choice from the *Color Ramp:* drop-down list. Note how the symbol colors change in the grid below the drop-down list. Note also that color ramps with several different colors (not those with one color at several levels of saturation) provide better distinction between the individual symbol colors. Typically fields that have a ranking – such as “good to poor” use palettes with one or more transitional colors (blue to violet, or green to red) rather than random discrete colors. The selections of colors help the reader understand there is a ranking in data values.


- d. Select APPLY but do not close nor select OK. This will allow you to review your selection of colors and symbols. Look at the Table of Contents for this layer – It has the field: COND_ INDX and has values of 1.0000, 2.0000, 3.0000, etc. This is not very informative. Let's change the labels. To do this –select the "Label" Heading and type the labels show below to corresponding values.

Color Ramp: 

Symbol	Range	Label
	1.00000	Very Poor
	1.00001 - 2.00000	Poor
	2.00001 - 3.00000	Fair
	3.00001 - 4.00000	Good
	4.00001 - 5.00000	Very Good

Under the Symbol Heading select this to change the line weight of all to "2." Double click with mouse on colored lines and change line weight to "2."

NOTE: You can perform various functions on the symbols by right-clicking on the grid and selecting an option from the pop-up menu (e.g., *Flip Symbols*, *Reverse Sort Order*, *edit Properties of All Symbols...*, etc.).

- e. Click the *OK* button to close the *Layer Properties* dialog. SAVE file.
- f. Review the pavement conditions for the state. What is the condition of pavement for Highway 34 (HWYNUMB = 033) East of the OSU campus? **(1pts)**
- g. Open the **PvmtCond** attributes table and note the field names and attribute values. Right-click on the *CONDITION* field name, select *Summarize...* from the menu, and do the following:
- Ensure *CONDITION* is selected in the top drop-down list,
 - Expand *COND_INDX* in the tree and check the *Average* box,
 - Expand *LENGTH* in the tree and check the *Sum* box,
 - Change the name of the file and the path but keep the extension of the file (.dbf). Note: if you are saving a dbf file it needs to be outside of the ArcMap Geodatabase. Thus, you will have to change the file format to *.dbf. Click OK.
 - Once the operation has finished, click *Yes* in the dialog asking, "Do you want to add the result table in the map?"
- h. Open the newly created table, expand the *Table Options* menu (i.e., click on  in the upper left portion of the table), select *Create Graph...*, and do the following:
- Set *Graph type:* as *Pie*
 - Do not change *Layer/Table:*
 - Set the *Value field:* to *Sum_LENGTH*
 - Set the *Sort Field:* to *Average_COND_INDX* and *Descending*

- Set the *Label field*: to *CONDITION*
- Set the *Color*: to *Palette* and select the palette of your choice
- Click the *Next* button and edit *Title*: in *General graph properties* and *Title*: in *Graph legend* as desired (e.g., **Summary of Pavement Conditions** and **RD Centerline Miles**, respectively).
- Right-click the newly created graph and note that you can select *Properties...* to edit the properties you just established. Select *Add to Layout* from the pop-up menu.

NOTE: The graph window can now be closed. If closed, it can be viewed again by selecting *View* from the *Main Menu*, highlighting *Graphs*, and selecting the name of the graph you just created (at the bottom of the menu).

- Switch to *Layout View*, arrange the layers to show pavement conditions and counties. Thematic map as you see fit. Add the graph. Include
 - *Appropriate Title*
 - *A Legend* for the map
 - *A Scale bar*
 - *A North Arrow*



- Obtain an image capture of the *Layout View* (using the **Windows Snipping Tool** or preferably by **doing a File-Export Map**), and then copy and paste it into a **Word** document. Insert a caption/ title, border around screen capture and center on document. **Ensure that all text can be easily read.** (5 pts)

Objective Part B - Determine if there is a correlation between accidents and pavement condition.

- Use a query to select all features from the **PvmtCond** layer with a Condition of 'very poor.'
- Right-click on the **PvmtCond** layer, mouse over *Selection*, and choose (click on) *Create Layer From Selected Features*. Rename the new layer **PC_VP** (or whatever you want> right click on layer > [properties > General> rename Layer Name. Do not use spaces in new layer name). The remainder of these instructions will use **PC_VP** as the name of the layer. Clear the selection you have. Open attribute database and make sure new layer only has VP conditions. If ArcMap is "Buggy" export correct selection and save as a new shape in your HW 4 folder. Note: shape files (*.shp cannot be saved inside a geodatabase - *.gdb).
- Create a 420-foot buffer around the selected features:
 - Select *Buffer* from *Geoprocessing* in the *Main Menu*
 - Select **PC_VP** (or whatever you named your layer) from the *Input Features* drop-down list
 - Change the name of the *Output Feature Class* (but not the path) to **PC_VPBuff420**.
 - Type 420 in the *Linear unit* text box (under *Distance [value or field]*) and ensure the drop-down list shows *Feet*. Make note of the default setting listed in the *Dissolve Type (optional)* drop-down list, and then click the *OK* button.

- ➡ e. Open the attribute table for the **PC_VPBuff420** layer and record the number of crashes (no. of records), and total length (in miles) of pavement in a new table in your **Word** document (i.e., Pavement Condition, Number of Crashes, total length (use Statistics function on field). *Note: new buffered layer is a polygon and does not have a new length column added but the field "Length" is copied from original layer to the new buffered layer. (1pt)*

i. Example: MS Word


<i>Pavement Condition</i>	<i>No. of Crashes</i>	<i>Total Length (mi.)</i>	<i>No. Crashes/Mile</i>

4. Create an intersect layer using the **Crashes** and **PC_VPBuff420** layers by selecting *Intersect* from *Geoprocessing* in the *Main Menu*, adding the **Crashes** and **PC_VPBuff420** layers as the *Input Features*, name output as **Crash_VP**.
5. Add another field to your table in Word document called "Number of Crashes" and record the number of records in **Crash_VP**
6. Add another field to your **Word** table called "**Number of Crashes/mile**". Populate it with the number of crashes divided by the length of pavement of very poor condition.
7. Repeat steps 1-6 above for the "poor". Use a consistent naming convention by using something in place of VP for the new file names. (e.g., PC_PR for pavement condition poor). Be sure to fill in the values your table in your Word document for every step.
8. Copy the table to MS excel and create a histogram that shows the number of crashes vs. ALL the pavement condition (sorted in progression from very poor to very good). Format the histogram to look nice. (TIP: To create the histogram in MS excel, select all your data, select "insert" from main menu and select "Insert column or bar chart".)
9. Create a second histogram showing the number of crashes/mile vs. the pavement condition (sorted in progression from very poor to very good). Format the histogram to look nice.
- ➡ 10. Place both histogram charts in your Word document and answer the following questions (**5pts**).
 - a. Which histogram makes the most sense to study the influence of pavement condition on accidents? Why? (1.5pts)
 - b. Discuss any findings and correlations observed in the histograms.(1.5pts)
 - c. What are some limitations\assumptions to this approach? (1pts)
 - d. What other factors besides pavement condition play a role in accidents? In other words, what other data sources would be helpful to have for a more thorough analysis? (1pts)
- ➡ 11. Go to the layout tab to produce a map showing the crashes (colored by pavement condition similar to the scale used in Part A for the pavement condition layer) across the state of Oregon. This map should be fully formatted (e.g. legend, north arrow, scale). (**5pts**)

Objective Part C - Determine if there is a correlation between accidents, streams, and other factors.

1. Query/process the data to extract accidents along Interstate 5 (HWYNUMB =001) and Highway 99W (HWYNUMB = 091) within 500 feet of a stream/river - Generate pie charts to summarize the statistics listed below (a and b). Copy and paste pie charts into your **Word** document. **(4pt)**

To create the pie chart you need to do following steps:

- a) Apply the “Select by attribute” tool and “HWYNUMB = '001' OR HWYNUMB = '091'” as the condition to select both highways. Then create a layer from selected features.
- b) Apply geoprocessing buffer tool to create buffer around the river
- c) Apply geoprocessing intersect tool on “buffered river” from the previous steps and “Crashes” layers
- d) Apply geoprocessing intersect tool on the result of step “a” and “c”. The result will show you the total crashes based on defined criteria.
- e) Open the attribute table of the created layer in “d” , right click on the field of “LGT_COND_L” and select summarize.
- f) Open a newly added table in the Arcmap, then select create graph by clicking on  (in the upper left portion of the table), select *Create Graph*. Select graph type as “Pie”, value field as “Count_LGT_COND_L”, sort fill as “LGT_COND_L” and label field as “LGT_COND_L” and color as “Palette”.Add appropriate title for the graph and its legend. The created graph will show you the summarize of number of crashes for each lighting conditions.
- g) Repeat the step “e” and “f” for the field of “RD_SURF_ME” to create a graph for number of crashes for each road surface condition.

2. ***Ensure that all text can be easily read.***

- a. Number of crashes for each lighting condition (e.g., darkness, daylight, etc.) stored in the Crashes dataset **(1.5pts)**
- b. Number of crashes for each road surface condition (e.g., dry, wet, ice, etc.) stored in the Crashes dataset **(1.5pts)**

3. Use Microsoft Visio to create a flowchart to show your methodology to extract the features (e.g. crashes) in part C1. **(5pts)** HINT: Look at the data to determine which field(s) to summarize, and then use similar procedures listed above in Part A to generate the graph(s).