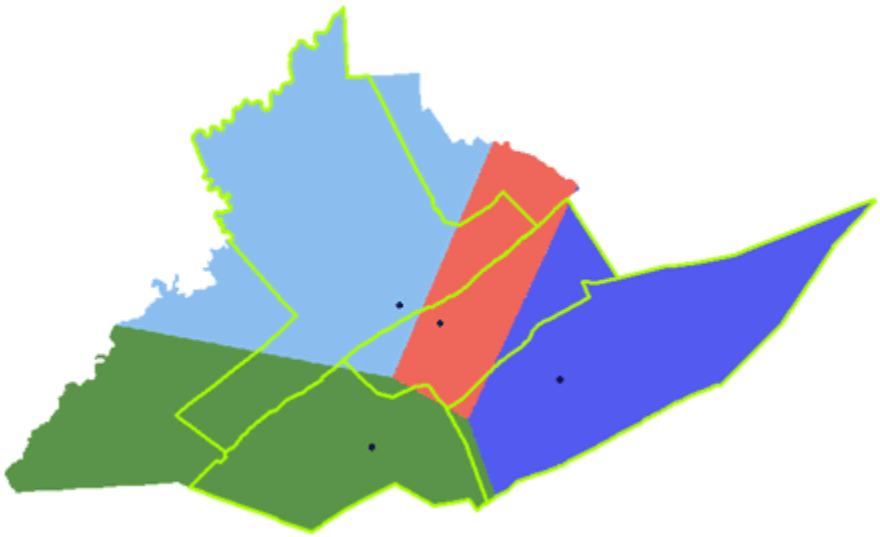
Geography 586 / Project 6 - Surface Analysis / Bruce Kinner

1. Distance Analysis



(Map from the Lesson 6 materials)

- The *straight line distance* operation works by calculating the distance from the center of the raster cell to the points in question (the high schools). The shortest result is chosen for the analysis allocation.
- Another option would be to create multiple distance analyses results (one for each high school) to produce an allocation analysis output. The individual outputs could be analyzed using map algebra. Using a 'min' function and creating contours from the results would be similar to the straight line distance analysis tool in ArcMap.
- The differences between the *straight line distance* allocation and the *actual* allocation of places to school districts are largely the result of topography. The general shape of the districts is similar in both cases. The difference is the angle of the SW to NE boundaries which follow the ridgelines almost exclusively. Additionally, the actual school districts completely contain the civil divisions but without local knowledge it is very difficult to tell which came first and influence the other.

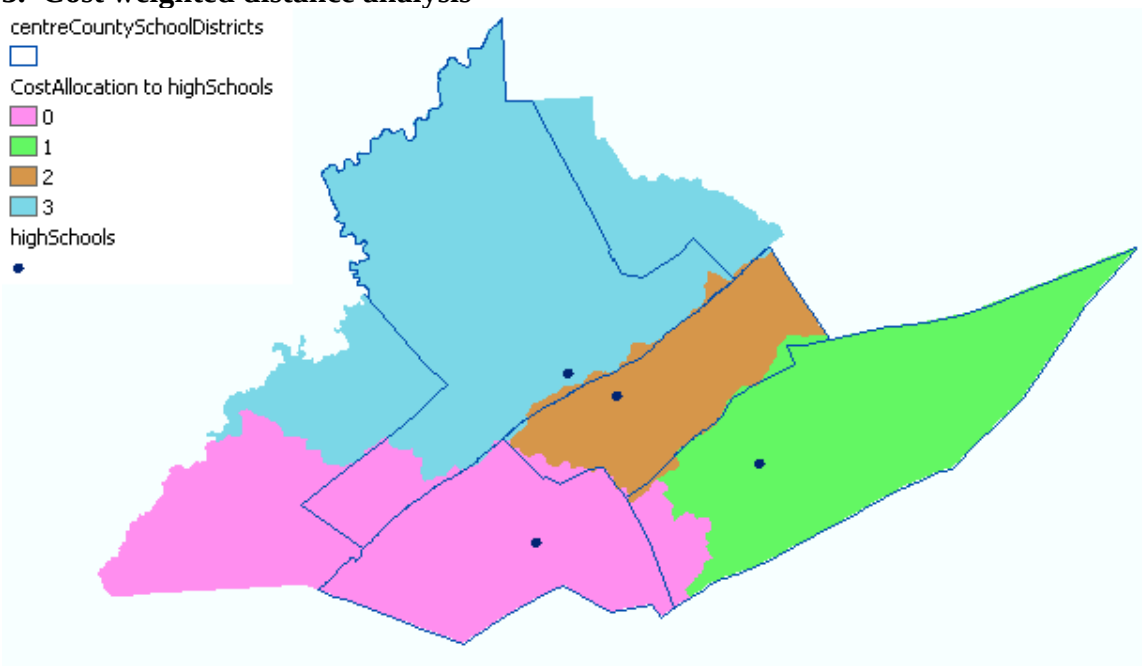
2. Creating the roads raster

In order to create the roads raster the following steps were completed:

- Add a weight column to localRoads. Then set the value to 2.
- Repeat for the majorRoads with the value of 1.
- Reclassify both raster layers to change NoData to the value of 100.
- Finally, in the raster calculator used 'Output = min(localRoads, majorRoads)'.

The 'min' function was used so that any cell with both a major and minor road is counted as a major road.

3. Cost weighted distance analysis



The cost weight distance analysis much more closely resembles the actual school districts. This is especially the case for the north-central (brown) and east (green) districts. However, in the western part of the county the roads have little relationship to the boundaries of the actual districts. This is the nature of Bureaucratic And Dysfunctional 'BAD' analysis (a cousin of MAUP) where the results of analysis must conform to existing regions.

Both distance analysis methods suggest a NW to SE trend to the boundary between the west (blue) and south (pink) districts. Of course the actual districts have a pattern with the opposite angle. The political nature of bureaucracies, especially school districts, can make implementing the analysis shown here quite difficult. This will be discussed further in the final section.

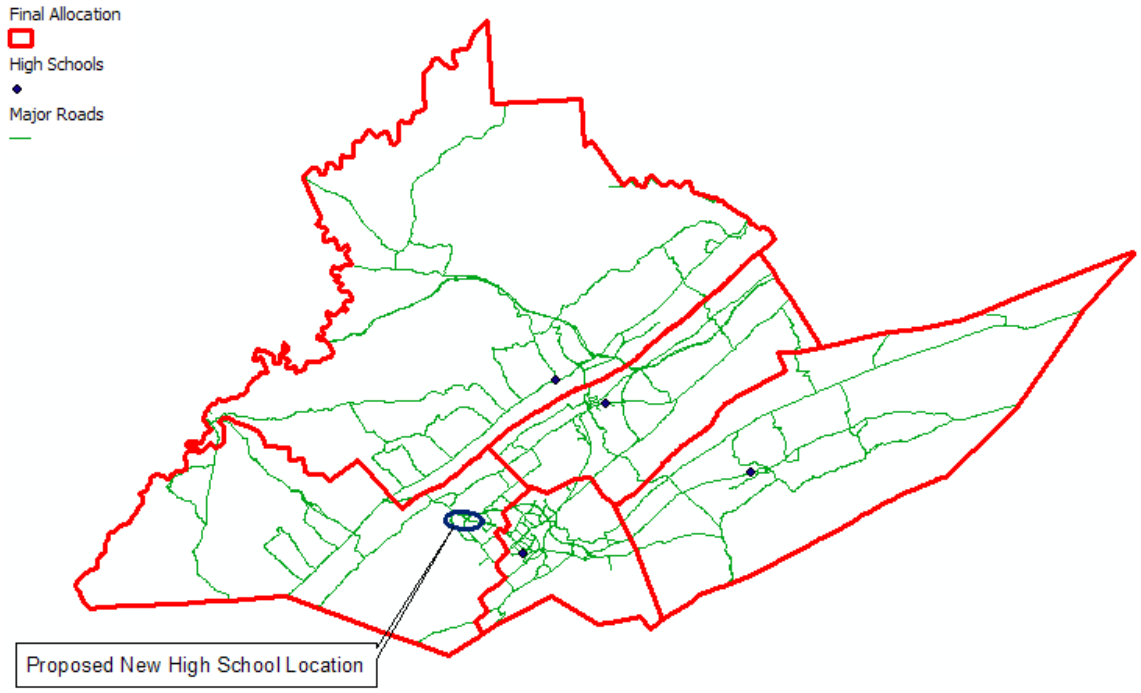
4. Estimates of the number of the school age children (by point-in-polygon method)

	Actual	Cost-Weighted	New (shown below)
North-Central	3487	3487	3487
East	2236	2236	2236
South	8484	9239	4692
West	2181	3231	3231
Unallocated	1805	0	0
New	0	0	4547

Since we know the actual school districts and the civil division boundaries are congruent, point in polygon is sufficient for this calculation for the actual districts. It also avoids the projection/datum and polygon overlap issues. First, the cost allocation layer was converted to polygon features. Then a selection of the population points inside each polygon was performed and the summary statistics tool in ArcMap returned the above results. The same method was

used to estimate the cost-weighted and new districts as well. The assumption is new districts will likely be drawn under the same parameters as the existing ones (another example of 'BAD') so the results of the zonal statistics tool do not provide any additional clarity in this respect.

5. Final Analysis



My solution to the location of a new high school consists of one main caveat - make as few changes as possible to existing districts. If school districts in Pennsylvania are anything like in Iowa this is the political reality. People become highly emotional and non-rational about this subject.

Therefore my solution also considers another political reality. New school districts are rarely if ever created. New schools are built by existing districts that have outgrown existing space and decide an additional school of the same type in a different geographical location would support the district better than an expansion or new building where the old one will have a different use (likely for another grade level).

Fortunately, I believe both these considerations complement the analysis done on this project. We have seen the current boundaries exist partly due to topography and the cost-weight analysis shows they are very efficient from a travel standpoint except for in the western part of the county. Therefore it is justified on both political and analytical ground to maintain the north-central and east districts as-is.

The recommended solution would be for the south (State College) district to build a second high school within the district. While the final map shows some changes to the boundary between the south and north-west districts this isn't a requirement for the recommended solution. The

unallocated areas in the actual districts could remain separate or be consolidated into the large districts. The number of students in the south-west area in question does not significantly alter the results. The location of the new school takes into consideration the major roads and the fact the population center of the new 'district' is heavily weighted to the east. It would be possible to create a population weight along with the distance one to achieve a more precise location but the chance of available land at that exact spot is small. Hence, a region of optimal location is given instead.

In conclusion, this proposed solution has precedence in a very similar situation. In 1968, the Iowa City, Iowa school district opened a second high school on the city's west side. Of course, Iowa City is also a college town with very similar demographics to State College. West High School has enjoyed substantial academic and athletic success in subsequent years answering the questions as to the result of 'splitting' the talent. It will be interesting to see if this is remembered as Iowa City begins to discuss whether or not a third high school is needed in the near future!