Proposed Public Transportation Route for Waterville, Maine

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Introduction:
There is a significant population of residents in Waterville who also work in the city. Most of these residents walk to their workplace and around town, which takes a great deal of effort and time on their part. Other residents drive themselves around town, which adds traffic, carbon emissions, and has other negative impacts on the township. Currently, there is a public bus transportation route. However, it is not effective enough to meet the needs of the population. The city of Waterville and our research team hope to find where a route for public transportation system would run in order to optimize ridership and efficiency. Ridership in this situation refers to the amount of people who would best benefit from an efficient public transportation system.

Methods:
We used Network Analyst to find the optimal routes in the city. The Network Analyst tool calculates optimal routes, using existing street data, based on the input of stops, barriers, and impedances. Population density was manipulated as an impedance to run the tool.

Ridership needed to be identified. To show the areas in Waterville that would most benefit from a public transportation system, certain data needed to be taken into consideration. We initially wanted to use population density and land parcel size to evaluate ridership throughout the city, but this data was not compatible with Network Analyst. Our research team decided that, based on census data provided by City Hall and discussions with city officials, high population density would be squared with an area of high ridership. Consequently, the population data needed to be attributed to the road layer. A detailed explanation of the creation of the Street Population Density (StreetsDen) and the creation of the geodatabase and network dataset with which Network Analyst was run can be found in Figure 1.

Points of interest were derived based on more discussions with the city officials, which constituted the stops. Three different groups of points of interest were created into the North, West, and South routes. Network Analyst was then run for each of the designated routes.

Fig 1. Creating the Geodatabase and Network Dataset

New File Geodatabase

New Feature Dataset

Import

Definition of Coordinate System

New Network Dataset: selected roads and intersections

Connectivity: Intersect Tool: Population and Parcel Size Cloud

Address Attributes: Pop Den Imp, usage

Intersect Tool: Pop Den Imp, usage

Run Intersect Tool: Spatial Analyst

Figures of Interest: Pop Den Imp

Creation of Network Dataset, SRTM elevation

Results:
Population Density – As suspected the population density for the year 2000 was higher in the Downtown, Southern, and Northern areas.

Street Density – By intersecting the population density by block and the roads layers, the new StreetsDen layer accurately shows the population densities on the roads layer.

Routes – Two different sets of routes were found: one with the shortest length between the selected stops and one that favored higher population density. All six routes created did not run a complete loop. Rather, once the final stop was reached, we propose that the bus should turn around and follow the same path back to the hub, as advised by the city consultant. As suspected, the three routes based on street density run longer and the three routes based on length followed had a more direct path to the final point of interest. Total time of each route was found based on the assumption by the city officials that all roads are 25 mph.

Discussion:

Difficulties – Our first plan was to utilize the parcel size layer with the population density data. We attempted to standardize the data, and weight the two attributes differently in order to emphasize population density over land parcel size and were eventually able to create an adequate union of the two attributes (we called this “ridershup”). However, when we tried intersecting the roads with the new ridership, the population and parcel size data had blank areas that were the roads within the city. The intersect tool could not be used properly since there were no data values attributed to these areas. While the roads overlapped the population and parcel size data in some sections, the resulting intersect showed us bits and pieces of the overall road system that we had intended to create. Our final method rejected the land parcel size data in favor of population density to derive ridership. Our largest problem, now, has to do with map projections. As our metadata notes, these different projections were used. Even though there was a discrepancy in the data, ArcMap was able to project all layers in a congruent manner. After a failed attempt at manually re-projecting all data layers to the same coordinate system, we judged this attempt superfluous and accepted ArcMap’s method as sufficient.

Recognizing regarding routes – We discovered that a key road was missing in the data that connects the hub to an adjacent street. We were able to edit the roads layer to reflect reality so that ArcMap now recognizes this and has analyzed accordingly. However, other important roads are also missing in the data. For our map, this means that some stops on our routes do not reach the points of interest because the street data did not exist for all roads. We would like to note these so that we may acknowledge any time discrepancies between our analysis and potential reality: Wal-Mart, JFK, Plaza, and Hannaford and K-Mart Plaza. Also, we would like to note that we have not included walks at stops in our proposed route times.

Conclusions – Our analysis shows ideal public transportation routes for the city of Waterville based on population density. We acknowledge that this is not a complete plan for a public transportation system, only what we have concluded to be the optimal routes. If we were to improve on this study, we would include revised street data that recognized speed limits, one-way streets, and feasibility of bus maneuverability.

We hope that this study will be helpful in implementing a future public transportation system that could serve the people of Waterville.