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TGIS 414

Final Project

Assessing Senior Citizen Livability in Dyes Inlet Neighborhoods:

Elder Livability Index and Walkable Bus Stops

As of 2009 there were 112 million households in the United States and a full 23% contained a resident 60 years of age or older (Pynoos, et al., 2009). Providing suitable housing for this demographic can alleviate some chronic health problems know to be caused by poor housing conditions such as obesity, asthma, diabetes, and other ailments (Jacobs, et al., 2009). Ensuring a safe home for elders not only increases their individual chances for quality of life but in turn funnels less dollars from tax payers in Medicare/Medicaid expenditures.

Home ownership is the main source of wealth for elders, who nationally enjoy a home ownership rate of 78%, however, inability to maintain one's home due to age related ailments can result in greatly diminished value (Struthers, 2005). Ensuring that elder's homes are maintained, therefore, ensures that future expenditures have a greater chance of being paid for out of pocket as there is a ample pool of resources from which to draw. It is estimated that as of 2006 six hundred to eight hundred billion dollars was tied up in the equity of older American's homes (Nishita & Pynoos, 2006). Beyond the physical condition of one's home, where it is geographically situated can also be an indicator of successful aging. Social isolation, which can be the result of lack of transportation, has been associated with, "... mental illness, distress, dementia, suicide, and premature death" (Hawthorne, 2006, p. 522). As such, this project asserts that dedicated transit are essential to elder health and that to be accessible they must be within a quarter mile of a residence (O'Sullivan 1996).

This analysis seeks to locate areas to receive greater attention from local officials when allocating social services and to assist elders in locating neighborhoods suitable to thier needs.

To this end the analysis will locate areas that contain: housing stock that is old/aging, areas where the assessed value of the home is low, area poverty levels, and areas where those 60 years of age and older reside. These four elements make up the Risk Assessment Index this analysis will utilize when disseminating needs of elders in the Dyes Inlet area. Locating the cross-section of these demographics and housing variants will at once demark areas in need of services and provide locations to elders searching for livable neighborhoods. Finding suitable distances from bus stops is also an integral portion of this analysis and elder health. Insuring reliable transportation routes can increase independence and quality of life for elders.

Planning Process

Originally, an important tenant of my project was to assess to what degree the infrastructure of the City of Bremerton was supporting the needs of senior citizens living in the area. To this end I wanted to gauge the access seniors had to public transit via bus stops, if there were sidewalks present to take seniors to these bus stops, and if these routes would take seniors to medical centers or senior centers. After this was accomplished I planned on rasterizing census data to determine where the most at risk seniors were located within the City of Bremerton based on: marital status, senior density, and seniors living in poverty. The outputs of these two processes would show where the most at risk seniors were located and what areas of the City seniors required better access to public transportation.

I encountered both improvements and disappointments when implementing my project. First of all, when trying to spatially designate the area I would be studying, the City of Bremerton, I found it difficult to determine what area I would deem ‘Bremerton’. I began to scale my data within the official city limits but those limitations were to abstract and cut across census boundaries I intended on using. It was decided, therefore, to extract a study area based off

of census tracts and to broaden the scope from the City of Bremerton to the lands surrounding Dyes Inlet, which the City is also an inhabitant of. In terms of collecting data this change in geographic locale came with negative outcomes and benefits. Now the census areas I would be studying would not have their boundaries split by the City limits boundary, which would have resulted in a misrepresentation of the demographic data. Now, however, the primary source of my data would be limited to the Kitsap County GIS Department rather than the combination of the City of Bremerton and County GIS resources I had hoped on using.

Kitsap County data proved to be a bit sparser than I had hoped for and, with exception, the representatives that I spoke to did not seem able to locate the data I was hoping for. The sidewalk information I had hoped to procure does not exist with the County or local municipalities, also there was only incomplete data on the bus stops located within Kitsap. The County's public transit provider, Kitsap Transit, had only demarked bus stops that were regularly serviced which meant that the majority of existing bus stops would be absent from any analysis I would hope to accomplish. On a more positive note, the bus stops that were included were the stops that were regularly serviced, so an argument could be made that an analysis of these stops could be more relevant than an analysis of bus stops which are serviced infrequently.

To compensate for the data I was lacking I attempted to broaden the number of variables included in my original project idea. In order to make my analysis more complex I would perform a neighborhood analysis of the Dyes Inlet area and perform a Network Analysis on the arrival times of emergency response vehicles to in the area. I planned to attain the boundary lines for Dyes Inlet Neighborhoods from Windermere Real Estate's web site, which supplies maps indicating neighborhood boundaries.

Methods and Implementation

To begin the implementation phase of my project I first created a File Geodatabase and two Feature datasets in ArcCatalog. One feature dataset would be used to store all the data I would be downloading from various sources while the other would contain data that I had altered for the analysis in some way, this would. This would ensure that any data I downloaded would be projected with the geographic coordinate system I had chosen, and by keeping my data separated I always had an original set of data to fall back on. Throughout the analysis I would use the NAD 1983 HARN StatePlane Washington South FIPS 4602 feet geographic coordinate system. I then imported all of the datasets previously downloaded from Kitsap County and the US Census into my Feature Dataset.

Using a combination of the Create Feature Class option and Editor Toolbar I created the following feature classes: a base map of Dyes Inlet polygon, a set of 51 points to represent bus stops, and 16 neighborhood polygons that populated the Dyes Inlet base map. To accomplish this, a feature class had to be created for each of the variables using Create Feature Class located in ArcToolbox/Data Management where each was designated as a point, line, or polygon. The feature classes, which were essentially blank, were then loaded into the Editor Toolbar and then an outline was manually created to reflect the intended areas of analysis. The Dyes Inlet base map was created by drawing an outline around census tracts surrounding Dyes Inlet. The bus stops were located using a map found on the Kitsap Transit web site and then were transposed into one feature class. Each of the 16 neighborhoods required a separate feature class to be created and the boundary lines for the neighborhoods were ascertained from a Windermere real estate website.

From the data I collected I created four separate expressions that illustrated select information about the selected area surrounding Dyes Inlet using Block and Block Group data from the US Census and parcel data from Kitsap County. The Parcel and Census data were both prepared in similar ways, the difference being that the Census data first had to be prepared in Microsoft Excel before entering it into ArcMap. I was interested in expressing 4 attributes among the three datasets: from the Census Block I chose population information to locate those over sixty, from the Census Block Group I chose the attribute corresponding with those living in poverty, and from the parcel data I used both the year the home was built and its assessed value. From the parcel dataset I used the Select by Attribute tool to extract buildings that were labeled as residential and created a new data table by exporting that information; this eliminated any commercial buildings from the analysis. Both the tabular data retrieved from the Census Bureau and Kitsap County needed to be joined to the corresponding shapefiles provided by the institutions. From this point I entered ArcToolbox Analysis Tools and chose Extract/Clip from the options menu. Then, using the Dyes Inlet base map I had previously fashioned, I created new shapefiles that represented only the data existing in my selected area, including: streets, parcel data, Census Blocks, Census Block Groups, and water bodies.

Once the data had been scaled down to my geographic locale I entered each of the shapefiles Properties dialogue and accessed the Symbology tab where under the Quantities section I changed the value to what I intended to express. I then used the Classify feature to create 4 categories based off of the data's natural breaks with the exception of the poverty attribute for which I chose Quantile. This was necessary because there was no data represented for one of the income designations when expressing the information using Natural Breaks. Once the shapefiles had been properly symbolized they needed to be converted into rasters in order to

perform further analysis. To do this in ArcToolbox I entered the Conversion Tools section and chose the Polygon to Raster selection. The data was now expressed in a stretched continuum typically associated with raster data so I needed to reclassify the groupings if I wanted four distinct categories. To do this in ArcToolbox I entered the Spatial Analysis section and then Reclass/Reclassify. Within the Reclassify dialogue I ordered the classification method according to Natural Breaks (with the exception of poverty), erased the four numbers associated with the categories, and added 'High' and 'Low' to the two polar opposites of the data representation. From this point I created a 'Risk Index' that combined the outputs of all four of the rasters into one expression that denoted areas in good standing and areas of concern. According to the attribute they were meant to measure, the four individual rasters rated the frequency of the attribute on a scale of one to four. The Risk Index, therefore, was rated on a scale of one to sixteen because it is a combination of the four datasets.

I utilized Network Analyst for three portions of my project: distance from bus stops, emergency response times, and distance between bus stops and hospitals and senior centers. The process for the three was very similar and was accomplished using the same network. I first created a new Feature Dataset in ArcCatalog in order to separate my network from the rest of my data. I then created a Network Dataset within the new Feature Dataset and populated it with: streets, hospitals, bus stops, the Dyes Inlet base map, and fire stations. I then exited ArcCatalog and entered ArcMap to run my network. I entered Network Analyst/Make Service Area Layer in ArcToolbox and added my network, set the distance (quarter mile from bus stops or a ten minute drive from fire stations), and changed the units to miles. I then added locations (bus stops, hospitals, or fire stations) in the Add Locations option and then ran the network three times, one for each of the three outputs.

To determine the percentage of neighborhood lands that were within a quarter mile of a bus stop I performed an Intersect operation for each neighborhood. In the ArcToolbox/Analysis Tools section I selected Overlay/Intersect and once completed entered the attribute table for each of the new neighborhood shapefiles created. I ran statistics on the intersect field to determine the total amount of land covered within a quarter mile of bus stations and then divided that by the total amount of land within the neighborhoods borders to retrieve a percentage.

Results

Of the three Network Analysis run only one yielded results that would be included in my final map layout. The analysis performed for emergency response vehicles proved that all areas would be reached within a ten minute time by emergency response vehicles leaving fire stations. The analysis run on the distance of hospitals and senior centers from bus stops showed that there was a bus stop directly present on each medical and senior center within the service area. Both the response time and bus stop distance findings were encouraging new but did not warrant further attention and thus were dropped from my project. The third analysis proved much more compelling as it showed that the average coverage within neighborhoods of bus stops within a quarter mile was only 12.6%. As seen in Table A on page 10, the West Bremerton neighborhood claimed the highest coverage of public transportation within a quarter mile of bus stops with 36%, while Sherman Heights was the only neighborhood to claim a 0% score.

Once my Risk Index was completed I was able to run Zonal Statistics for each of my neighborhoods to determine an average score accrued of 9.18 out of 16. As seen in Table B on page 10, the University Point Neighborhood received the best score according to the Risk Index with a low of 7.15, while West Bremerton received the worst score of 11.29. I was not surprised by the findings as I had hypothesized that: the housing stock in the area was fairly old, there

would be a fair amount of poverty in areas with older housing stock, and that the value of housing would have a correlation with the two previous variables.

It is interesting to point out that there is nearly a perfect inverse when comparing the top and bottom scores between the two tables. As seen from the Risk Index, the University Point neighborhood has the lowest occurrence of the variables involved (those living in poverty, sixty and over population, old stock housing, and low values for homes)it is interesting, therefore, that it would boast next to no public transportation. This may be because these services are not needed in this area due to its perceived affluence, when they could be placed in more suitable areas. West Bremerton, on the other hand, contains the highest occurrence of the at risk population according to the Risk Index and had the most transportation coverage. This seems to be a case of good transportation coordination from Kitsap Transit because the organization is supplying services to those who most need them. Of all at risk neighborhoods it is my opinion that Sherman Heights be the recipient of the most immediate attention from local officials. Sherman Heights ranked tenth on the Risk Assessment Index and last for walkable bus stops. While there are neighborhoods experiencing more intense risks according to the Index the complete lack of public transportation could very well lead to social isolation.

Table A: Public Transportation Coverage Within Quarter Mile Neighborhood Ranking		
Rank	Neighborhood	Percent
1	West Bremerton	36%
2	East Bremerton	28%
3	Silverdale	24%
4	Tracyton	20%
5	Manette	20%
6	West Hills	18%
7	Erlands Point	15%
8	Rocky Point	11%
9	Esquire Hills	10%
10	Fair Grounds	10%
11	University Point	4%
12	Chico	4%
13	Illahee	3%
14	Kitsap Lake	3%
15	Pine Crest	2%
16	Sherman Heights	0%

Table B: Risk Index Neighborhood Ranking		
Rank	Neighborhood	Risk Index
1	University Point	7.15
2	Tracyton	7.31
3	Silverdale	7.85
4	Erlands Point	7.97
5	Esquire Hills	8.39
6	Illahee	8.46
7	Rocky Point	8.79
8	Chico	9.18
9	Fair Grounds	9.41
10	Sherman Heights	9.57
11	Manette	9.65
12	Kitsap Lake	9.97
13	Pine Crest	10.28
14	East Bremerton	10.57
15	West Hills	11.04
16	West Bremerton	11.29

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