The importance of transportation systems cannot be over stated, they are used on a daily basis, and they have impacts not just on the built environment but on social constructions as well. Transportation modes and systems influence society. They affect the perception of community, the vitality of local economies, and the built urban environment. The importance of transportation systems in urban areas is widely understood and cannot be understated. The impact that transportation systems have on urban areas is equally important, unfortunately the impact that transportation systems have on people and place are not as widely understood. Recently a community business group in Aberdeen, WA proposed rerouting highway traffic, which currently runs through Aberdeen's downtown business district. The plan proposed moving traffic from Wishkah St. one block north to Market St. Historically highway placement in urban areas has been problematic. Common side effects of highways include displacement of people (often poor and minority people), urban decay, and risks to personal safety and health. Taking these considerations into account I wanted to find out if there was a better route that the highway could take.

Urban highway development has a long and controversial history. Beginning in the 1920's most planners realized that existing surface streets would not be able to handle increasing automobile traffic (Brown, Morris and Taylor, 2009, p. 166). Ideas began to develop for a network of urban freeways. These early freeway plans were developed by cities and recognized urban concerns (Brown, et al 2009, p. 167). Early urban freeways were designed to be small, limited access roads (Brown, et al 2009. p. 167). Urban planners' intent here was to spread traffic out rather than concentrate it in a few unfortunate sections of the city (Brown, et al 2009. p. 167). Ultimately decisions regarding urban highway development did not remain under local jurisdiction. With the Great Depression and World War II municipal governments found funding

highway development difficult, while at the same time automobile ownership was increasing (Brown, et al. 2009, p. 168). Local governments were funding the early highway system largely from property taxes, however property values plummeted during the Great Depression. Local governments were faced with decreasing revenues and increasing demand for automobile infrastructure. The state and federal governments had the ability to impose sales taxes beginning in 1919 a gasoline tax started implementation (Brown, et al, p. 169). Local governments found financing a highway system increasingly difficult. With the gasoline tax state and federal governments had a stable source of revenue that was tied to automobile use (Brown, et al, 2009, p. 169). Local governments began to gain access to these funds, however using state and federal funds for highways meant that decisions regarding design and placement of the highway had to be left to state and federal highway engineers, whos goals in many cases were not congruent with those of local planners (Brown, Morris and Taylor, 2009, p. 170).

Once state and federal engineers began their "single-minded devotion… to pouring concrete" in urban areas, challenges and conflicts pertaining to highway policy followed (Mohl, 2009, p. 675). In 1956 the interstate highway program really took off, between 1956 and 1967, 300,000 households were displaced by federal highways (Altshuler and Luberoff, 2003, p. 83). In 1958 the federal "highway program became the largest single source of aid to the states" (Altshuler and Liberoff, 2003, p. 82). In 1964 2,612 miles of urban expressways had been constructed, with an additional 1,600 under construction (Altshuler and Luberoff, 2003, p. 83). Highways were being painfully incorporated in the existing urban fabric at an alarming rate. Placement of highways in cities is anything but random, many authors say that highways take the path of least resistance (Altshuler and Luberoff, 2003, p. 83-84). This statement is deceptive in that it likens that path a highway might take to that of a river, implying nature and innocence.

The fact is there was nothing natural or innocent regarding the placement of highways in cities. Altshuler and Luberoff (2003) state “local elites were often eager to use the highway program as an instrument of slum clearance” (p. 84). Highways were deliberately placed directly over poor neighborhoods. Robert Moses was notorious for using his highways as a device for slum clearance. At one point when speaking of slums Moses states “the more of them that are wiped out the healthier Baltimore will be in the long run” (quoted in Mohl, 2004, p. 689). Because of these tactics displacement of urban residents and longer lasting impacts from the placement of urban highways was and are not felt evenly across social classes, poor and minority residents bear the brunt of the highway burden.

The use of highways as a slum clearance device in many cases was self-defeating. Ironically the same highway projects that were being used for slum clearance were an instrument in slum creations themselves as Gantz (2010) notes even mentioning the possibility of a highway could cause disinvestment in the areas surrounding the proposed plan (p. 238). Jacobs (1961) notes that highway projects tend to create borders in urban neighborhoods, they detract from the use of the city and make surrounding areas less interesting (p. 336-339). Jacobs (1961) notes that around many of these border areas the city suffers from disinvestment and blight and as distance from the border increases the city tends to become lively again (p. 336-339). The possibility or presence of an urban highway can result in neighborhood decay.

The presence of highways in urban environments can result in health and safety concerns as well. Though much remains to be understood in this area, correlations between high traffic areas and detrimental health effects are apparent Wu and Batterman (2006) note that there is an increase in mortality rates and proximity to high traffic areas (p. 457). Vehicular traffic has been linked to cardiopulmonary related deaths and respiratory disease including asthma (Wu and

Batterman, 2006, p. 457). Additionally there appear to be increased risks of disease when residents are in close proximity to truck traffic (Wu and Batterman, 2006, p. 457). Buzzard, Clark and Guffey (2009) conducted a study to examine pedestrian exposure to vehicle exhaust using a mannequin with sampling equipment located in the mouth to simulate the air intake of an adult standing next to a road. They also took the same mannequin head off of the body and placed it in a stroller in order to simulate the air intake of an infant or small child (Buzzard Clark and Guffey, 2009). They note that diesel truck emissions are more much more likely to be in a person's respiratory system especially a child because diesel trucks emit their exhaust towards the curb (Buzzard, Clark and Guffy, 2009, p. 11). Additionally they note that children are more at risk because their mouth and nose are much closer to the source of diesel truck emissions (Buzzard, Clark, and Guffey, 2009, p. 11). These findings provide medical backing to Aberdeen's desire to create a more pedestrian friendly downtown.

This project is founded on an argument that highways can and do produce negative impacts on urban neighborhoods and people. Additionally that minority residents, those without political power are more at risk and bear the burden of highway placement in cities. The project also shows that by taking local considerations into account negative impacts on urban residents can be mitigated. As my research has shown socioeconomic status plays a factor in determining the placement of urban highways, for my project I wanted to take this into consideration. Unfortunately the smallest scale that census income data is available is in the block group scale, this proved to be too large of a scale for Aberdeen (a small city) to provide any meaningful results. For my census data I had to use the block scale, this scale for privacy concerns shows little more than the population for each block. The original goal of the project was to reroute highway traffic away from Aberdeen's downtown commercial center taking socioeconomic

status, location of people and creating a walkable downtown commercial district into account. However the project soon expanded to look at impacts that the highway is having across the city.

This project born out of an internship I had with the Grays Harbor Council of Governments. The council presented me with several possible projects, after consideration I choose to look at the issue of rerouting highway traffic in Aberdeen. The early planning process was accomplished is small groups as well as the class as a larger whole this is where the general processes that I would need to accomplish were hashed out such as creating rasters and network analysis. Initially I had planned to do a much more extensive network analysis portion, later I realized that this was not necessary, and reduced the network analysis to creating service areas around the park and school points. The major milestone in the planning process was creating the workflow, I was able to follow this throughout the entire process with only minor alteration.

Initially I planned to use census 2010 data for my project, as this would have provided the most recent results. However census 2010 data is not entirely online yet and its format is slightly different from the previous data. Though overcoming the differences in formatting should not have been a problem, the lack of any pertinent data being available was. For this reason I fell back to census 2000 data. I collected data from the census including tigerline files and block files. I was able to easily dissolve the tigerline streets in Aberdeen making distinctly separate streets for north, south, east, and west. This was important for my analysis as these sections of the city are distinctly different from each other and all the resulting analysis data would be joined to the dissolved street layer. From the Grays Harbor county website I got a street file, hydrology file, city limits, and parcel data for Grays Harbor. I selected by attributes the city of Aberdeen from the city limits file and clipped all of this data. I then selected all the census blocks within Aberdeen and joined the census demographic data. From WAGDA I got a

Washington State base map, though I didn't need this in my final analysis. After the census demographic data was joined to the block shapefile I was able to interpolate three rasters of population density (total population, child population 0-14, and elderly population 65+). I then pulled in my parcel data, from this data I interpolated another three density rasters (commercial properties, residential properties, and industrial properties) I didn't use the industrial raster in my final analysis. The next step was to get addresses for all the schools and parks in Aberdeen. With this information I geocoded all of the schools and parks, I then ran a network analysis on these points (1,3, and 5 minute walk time). I then rasterized the service areas assigning each area a score, the one minute area got a score of three, the two minute area a score of two and the five minute area a score of one. After this I reclassified the rasters into four classes with the highest density areas receiving a score of four and descending to the lowest density with a score of one. Then I buffered the Aberdeen streets with a twenty foot buffer. Now with seven raster layers each classified according to distance or proximity I brought in the buffered street layer and ran zonal statistics as a table on each raster. The zonal statistics as a table produced a table for each layer, I joined these with my Aberdeen streets layer and kept the mean value for each street. After the mean values were all in the same table I added these values together. The streets with the low values are suitable for highway traffic, the streets with high values have too many negative impacts to be good routes for highway traffic.

This project was a response to community business interest in Aberdeen to reroute traffic one block north of its current route from Wishkah St. to Market St. Upon hearing of the proposal I had doubts about its effect on communities and businesses along Market St. Taking my concerns into consideration along with the communities' interest in making the downtown a more pedestrian friendly environment I choose to find out how good the many possible routes

would be through the city of Aberdeen. I found that the proposed route would in fact have an impact on many residents as well as schools and parks, which tend to be more concentrated in the northern parts of the city. My analysis found that moving the current route one block south to State St. would be the best route given the variables taken into account. This is interesting in that after most of my analysis was completed I found a proposal from the Washington Department of Transportation to turn almost the exact route that I proposed into a new truck route, to divert large vehicles out of the downtown. This would have the effect of increasing the walkability of the downtown, while preserving the current passenger vehicle route. I consider portions of the current route to be important to preserve because in my analysis I found a strip of commercial development that follows the route of the highway, this development is more of a strip type of development with things like McDonalds and small local businesses that I believe depend on the highway traffic for their business. If passenger vehicles were to use my proposed route businesses along this strip would likely be harmed. However moving truck traffic out of downtown and into the industrial sections of the city would likely benefit the commercial downtown, it would benefit residents that live along the current route as well as pedestrians in the downtown core, and it would likely have little effect on the strip of commercial development.

The population of Aberdeen is largely composed of minority residents with this project I hoped to extend the benefits of GIS analysis to individuals who may not have proper representation or knowledge to conduct a GIS analysis. Elwood (2006) states that “financial, temporal, and experience and skill barriers” are all hindrances to using GIS software (p. 695). Elwood (2006) notes that GIS is not accessible to particular social groups, this was a concern of mine during this project I intended to give a voice to these populations (p. 694). Harris and Hazen (2006) note that mapping is an extension of a form of power and knowledge (p. 101) by

taking these populations into consideration in my analysis I was hoping to extend this power to these populations.

References

Altshuler, A. A., & Luberoff, D. (2003). *Mega-projects: the changing politics of urban public investment*. Washington, D.C.: Brookings Institution Press ;.

Buzzard, N. A., Clark, N. N., & Guffey, S. E. (2009). Investigation into pedestrian exposure to near-vehicle exhaust emissions. *Environmental Health, 8,* 13-26. Retrieved March 8, 2011, from the Ebsco Host database.

Elwood, S. (2006). Critical issues in participatory GIS: deconstructions, reconstructions, and new research directions. *Transactions in GIS, 10*(5), 693-708.

Gratz, R. B. (2010). *The battle for Gotham: New York in the shadow of Robert Moses and Jane Jacobs*. New York: Nation Books.

Harris, L. M., & Hazen, H. D. (2006). Power of maps: counter mapping for conservation. *ACME: An International E-Journal for Critical Geographies, 4*(1), 99-130.

Jacobs, J. (1961). *The death and life of great American cities* . New York: Random House.

Mohl, R. A. (2004). Stop the road: freeway revolts in American cities. *Journal of Urban History, 30*(5), 674-706. Retrieved April 30, 2011, from the GeoBASE database.

Schuurman, N., Cinnamon, J., Cooks, V. A., & Hameed, S. M. (2009). Pedestrian injury and the built environment: and environmental scan of hotspots. *BMC Public Health, 9*, 233-242.

Wu, Y., & Batterman, S. A. (2006). Proximity of Schools in Detroit, Michigan to automobile and truck traffic. *Journal of Exposure Science and Environmental Epidemiology, 16,* 457-470.