UNIVERSITY OF WASHINGTON, TACOMA

Term Paper

Alternative Transportation

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Term Paper

Alternative transportation is a mode of travel other than private cars, such as walking, bicycling, rollerblading, carpooling and transit. Many higher learning institutions want to solve transportation problems by creating a modal shift away from automobiles. (Bond & Steiner, 2006) However, there are just a number of colleges succeed. In fact, most universities have alternative transportation connections; however, this option is not the most popular options in most campuses. Universities are the ideal site for testing the results of transportation policy changes, as they usually have control over road network, parking facilities and land uses (Balsas, 2003).

Automobiles have a great impact on environment and it cost a lot to the school. According to Tolley (1996), by reducing car commuting to campuses, there will be demonstrable and tangible benefits. For example, a "greener" campus can already be used by the school as an advertisement, which will affect student's choice, especially when environmental problems are becoming a more popular topic in schools. Making the campus "car-free", will attract media attention and potentially become a little more famous nationwide. Tolley also mentioned car commuting makes drivers experience high levels of stress, breathe in more polluted air, and not exercise. Reducing car usage can also help reducing health problems. In United States, experts agree the reason to obesity is that the environment of driving (Hill, Wyatt, Reed & Peters, 2003). Americans do not exercise enough because of their high dependency on automobiles, and they are more likely to have obesity and get ill. By reducing car commuting in campuses, students have more chance to burn calories through walking and cycling.

Parking facilities are draining resources from the school. There are basic costs to parking, for example hiring attendance and security guards, administrative cost and maintenance fees.

Many universities are subsidizing student parking. It is being done by providing free parking, under-cost parking and discount parking (Tolley, 1996). Tolley also suggests it is unfair to students who do not drive to school as they do not get to have the same amount of resources. The parking structures prevent schools from further development. Since colleges usually have control over land use and roads, they can change policies that suit them the most (Bond and Steiner, 2006). For example, colleges can change parking policies so that commuting by automobile will be reduced, or colleges can change the land use policy of existing parking structure to an academic building. By doing so, colleges can increase classroom numbers and accept more new students. Tolley (1996) also suggest colleges to change existing parking structures to transit facilities, because it can discourage the use of automobile and encourage the use of alternative transportation in the same time.

University of Washington Tacoma (UWT) is located in the downtown area of Tacoma in Washington. Tacoma is a mid-sized city within the metropolitan of the greater Seattle. Tacoma has a population of 199,600 and its metropolitan has a population of 3,344,813 in 2010. UWT is an urban commuter campus where most students do not live close to campus, also dorm is not available although the nearby Court 17 provides a small amount of student housing. UWT has 3331 enrolled students in 2010. Of that number, 17.3 percent are graduate students and 82.7 percent are undergraduates with an additional 191 faculty members. There are about 3500-4000 commuters from UWT every day.

The case study will use GIS tools to demonstrate how alternative transportation can be set up in UW Tacoma. Given 3 scenarios to show how carpool, vanpool and transit will work under TDM strategies. The objective is to provide information and a prediction for UW Tacoma to see

how alternative transportation will be like. The goal for this case study is to let colleges understand with the help of GIS tool, colleges can predict how their alternative transportation system will work.

Transportation demand management (TDM) is a way to solve transportation problems supported by a number of scholars. TDM is a term for strategies and programs that promote transport resources being used efficiently. The goal is to improve the transport options, provide incentives to encourage more efficient transport usage, more accessible land use patterns, planning reforms and various support programs (Litman, 1999, 2003).

The methodology of this case study involved a series of geospatial analysis to show how UWT can make use of alternative transportation. Student data are collected from the Office of Institutional Research and Planning of UWT; Geospatial data (GIS data) is collected from a wide range of sources including Washington Sate Geospatial Data Archive (WAGDA), University Libraries of UW, King County Department of Assessments, Pierce Transit, and Sound Transit.

Carpool site.

This analysis is based on the following scenario: UW Tacoma set up mandatory policy suggested by TDM strategies, students who live close to carpool sites have to carpool to go to school. Given there are 2485 students who live within the boundaries of King and Pierce County, I created multiple carpool meet up sites where students can form carpool there while leaving their vehicles there. First, park and ride lots, and Pierce and King County parcel data that includes land use types were downloaded from WAGDA and King County Department of Assessments. Existing park and ride lots are then classified as a carpool site. Through multiple

"select by attribute" and "export data", parcels that have the potential of being a carpool site were left. By that time, there are about 1600 and 1800 parcels in Pierce and King County each. Since there are too many potential carpool sites, "select by attribute" was then used again to eliminated parcels with names that are most likely not a parking lot: for example, Bank of America and Bus Depot. With 300 parcels left in each county, I then look at them one by one to see if the parcel meets the following requirements: big parking lots, big box retail or well-known places, not too close with existing park and ride lots. In the end, 229 carpool sites are chosen. Next, network analysis was performed to identify the sites' service area. Road layers of Pierce and King County were downloaded from WAGDA, by using "merge" tool, they were connected. After eliminating overlapping roads, transforming map class to speed limits, and eliminating railroads, KPNetwork was created in order to perform network analysis. By using "Create Service Area", ArcGIS was able to identify service areas within 1 (green), 5 (yellow) and 10 minutes (red) (fig.1).

Results

"Select by location" was used to come up with the following results: 186 students are living within 1 minute drive to the closest carpool site, 1450 students are living between 1-5 minutes drive to the closest carpool site, 207 students are living between 5-10 minute drive to the closest carpool site. Since not all cars will carry 5 students, it was determined that about 550 vehicles will be traveling to school a day. It eliminates about 1800 vehicles per day, assuming all students drive one vehicle. Although such policy is not being set up or considered yet, but the case study showed illustrate what are needed for UW Tacoma to have a successful carpool policy.

Vanpool

This analysis is based on the following scenario: UW Tacoma provide vanpools for all students. Students who live outside 5 minutes drive from UW Tacoma are eligible to take the van home so that they can pick other students up along the way to school. Using "Create Service Area" tool from ArcGIS, it was determined that 340 students are living outside 5 minutes drive from UW Tacoma. By using KPNetwork created before, "Routing Problem Analysis" was performed. It will automatically calculate and determine the best way to allocate vans and pick up routes. Vans are set up with the following variables: 0.46 per mile distance cost, which is suggested by Transit Development Plan of Pierce Transit; maximum capacity of 15 in each van, and maximum time limit as 90 minutes.

Results

The results from ArcGIS showed 1888 locations are available for pick up. 258 vans are needed to pick up 2472 students in 1888 locations. The total length travel by all vans is 4243.8 miles per trip, about 9000 miles for round trip per day. Total distance cost for one way trip is $1952 and about $4000 for round trip per day. In average, each student has to pay less than $2 for vanpool rental a day. Since gas is divided among passengers, and assuming each van has 12 MPG fuel economy, the total gas needed is 706 gallon a day. Assuming gas a $3 per gallon, $2118 will be spend on gas per day, which is only less than $1 per student. The total cost for each student is about $3 dollars a day, less than $50 per month when only having 4 days of school. UW Tacoma will have to create mandatory policy mentioned in TDM in order to make it work. UW Tacoma can reserve in-campus parking to vanpool vehicles only. In the same time, UW Tacoma can collect fees from tuition so that students do not have to pay for vanpool rental.

Although distance cost is collected and calculated for maintenance expenditure, UW Tacoma has to realize that this case study did not put the cost of vehicles and extra maintenance fees into consideration.

Transit

As previous arguments suggesting unlimited transit will encourage the use of alternative transportation and enhance local development, the following analysis will find out how transit services should be routed in order to service students who live within 2 miles from UW Tacoma campus. The scenario is UW Tacoma will provide transit service and will cover areas with its 2 miles radius. By using "buffer" tool and "select by location", it is determined that 167 students are living with 2 miles from UW Tacoma. By using "closest facility analysis", ArcGIS determined 104 stops from existing Pierce Transit bus stops are needed. 4 Routes are needed in order to satisfy the requirement that total time has to be within 30 minutes.

Results

The reason to only analysis area within a 2 mile radius from UW Tacoma is because the purpose of this analysis is to show what UW Tacoma can do in terms of their first step. This analysis showed how many buses and time are needed. Due to technical issues, it is not possible to calculate the cost of have 4 transit routes and the economic impact to the surrounding. Meanwhile, the cost to purchasing and maintaining its service is not being calculated in the analysis due to shortage of information and data. Fig.3 showed the most efficient routes for UW Tacoma.

Lesson

GIS technology can be used as a tool to demonstrate the results of policy changes from colleges. In this case, considering TDM strategies and some arguments mentioned above, GIS technology is able to provide geospatial analysis to determine the best sites for carpool, the best routes for vanpools and transit. In the same time, it also provides a short summary of some of its cost and time needed, and the amount of students that can be serviced and not serviced. Although the case study was not able to calculate the actual cost and actual benefits of alternative transportation in UW Tacoma, those cost and benefits can be calculated by creating indexes and requirements. For example, colleges can determine wages expenditure on transit services by adding a wage index per hour in the routes' attribute table. It will then be calculated the total wage cost while performing network analysis. Also, data can be updated by colleges, they can update their analysis by simply perform the same network analysis with the same network but an updated student data. That will help colleges to understand what should be done. For example, certain bus stops may not be needed anymore as no current students live there anymore. The maps will not accurately reflect the truth if the data are not up to date. This case study may fall short on qualitative research as the case study was not able to find out the social impact to the communities. Further research is needed to interrogate knowledge for people to understand more and explore relationships between production and information, politics and ideas (Robbins, 2003). Also, it may also help making the project more accurate by inviting college students to give ideas of how alternative transportation should be like. Participatory GIS will better reflect what people want (Dennis, 2006). This case study can be seen as an ice-breaker for colleges, especially UW Tacoma, to set up alternative transportation. It reflects the results from some TDM strategies. It also successfully located the demographic on student's location, making

colleges easier to determine places that need alternative transportation the most. In the end, this case study proves if polices are made, alternative transportation can work in UW Tacoma. Colleges can use GIS to further investigate the impact of alternative transportation system to their colleges.

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