TJHSST Senior Research Project
Simulating Traffic Congestion on Route 1
2009-2010

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1 Purpose

The purpose of this project is to create a realistic modeling of the traffic flow on Route 1 in Alexandria, VA. Currently, Route 1 has trouble with traffic congestion during rush hours, when many people use it to commute to their workplaces. My project is a two part project: first I will create an accurate model of the traffic congestion on Route 1, based on traffic count data from the Virginia Department of Transportation. Then, I will use different methods of alleviating traffic, for example adding an extra lane, making public transport more accessible, creating traffic light free intersections, or round-abouts, to determine which method would be the best to decrease the amount of congestion on Route 1. The ultimate goal of this project is to create a viable and implementable solution to the traffic congestion problem on Route 1.

2 Background Research

I have done extensive research into how to simulate traffic as well as preliminary research into traffic management solutions. I reviewed the TJ senior research projects from 2008-2009 which dealt with the simulation of traffic including: Craig Haseler's, Timmy Galvin's, and Paul Wood's. From their projects, as well as viewing some applets on the web, I decided that the best language to use in my project would be Java. I decided to then re-immerse

myself in Java and did some research into the Java language in the Java API, as well as looking at the graphics unit in the regular computer science curriculum, to get a feel again for how the code works. I then did some research on the ACM database, and found an article on traffic congestion and traffic management solutions. This article will help me in the more advanced aspect of simulating the decisions of drivers. In addition, the article had many factors with which to determine the cost to each driver of each traffic management decision. I hope to incorporate some of these factors into my calculations. I also did research online into the various ways congestion is alleviated around the world. In Europe a new idea is naked intersections or in other words, intersections with no traffic lights or stop signs. This method is based on the fact that drivers will slow down when they reach the intersection and will follow etiquette and allow people whose turn it is to go through the intersection to do so. Another idea that is very popular is to designate a lane for public transportation only. This allows the regular traffic lanes to be more free-flowing, because one lane does not suddenly stop when the bus stops to pick someone up. Finally there are the older solutions which are adding a lane or converting to the European favored round-a-bout. Both of these methods have already been proven successful in other situations, but may not be in my simulation.

3 Procedure

My plan is to split the project into separate pieces, which I will complete one at a time, test, and then move onto the next piece. The first piece of the project I am working on is the graphics part, because it will be the easiest part for me to finish and will be a good way to re-introduce myself to Java. This includes creating the road system to an accurate scale, creating the cars, having them behave as actual cars, having the cars interact with each other, and creating realistic traffic lights at intersections. This part will be tested mostly through an eye test, in other words is the car acting like a normal car would, are the cars a safe distance apart and are they avoiding each other, are the traffic lights on the road accurately timed, and does the car move to the correct lane to turn off the road and does it turn off the road realistically. Once I have completed this part of the project, I will begin the data part of the project. This will incorporate reading in the traffic count data from the VDOT data I found, using the data to create an accurate visual

representation of what is happening on the road, then producing an output of the cost per driver in using the road. This part can be tested by comparing the visual simulation to the reality on Route 1, as well as comparing the cost output to what the visual representation seems to say. Finally, I will begin to code in the various ways the road can be improved. These will be based on user options, allowing the user to create the system they want. This will ensure that the each method can be tested separately as well as together with other solutions, for example creating an extra lane and making intersections round-a-bouts in the same simulation. This section cannot be completely tested, because it is the more theoretical aspect of the project. Although the code can be tested to make sure the cars react to the different systems correctly, there is no real life situation with which to compare the results.

4 Expected Results

By the end of the project I expect to have an accurate model of the current traffic situation on Route 1, as well as viable solutions to the congestion problem. I expect to determine the best course of action to alleviate the traffic through my program. With this result the project will be of great value not only to the people working on a solution to Route 1's congestion, but also to similar road situations around the world that are experiencing the same problems as Route 1. Also the residents of Alexandria who use Route 1, like myself, will find great value in this project as it informs them on how changing the way Route 1 flows would affect their travel times and other factors. The results can be presented in a visual format showing the current situation on Route 1, and then an option menu to determine which traffic management decision to use. This way the project demonstrates its accuracy as well as showing why the recommended solution is being recommended.