Term Project Proposal
Applications of ArcGIS in Transportation Planning
(Analysis of Downtown Austin Network as case study)
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Introduction

Depending on technical issues, growth rate, and available funding, building a road should take between 5 and 21 years from start to completion. The major phases in building a road include a feasibility study, obtaining initial funding, planning, design, purchasing right-of-way, and construction. Obtaining initial funding is critical in moving a road project from the Long-Range Transportation Plan (LRTP) to the Transportation Improvement Plan (TIP), where the project can then proceed through a planning process that involves environmental mitigation, traffic forecast, permit application, and public involvement.

Analysis of different possible scenarios and find the best efficient solution is critical to obtain required fund at each level. One of the tools for analyzing is Geographic Information Systems (GIS), which widely have been used in the field of Transportation. GIS for Transportation named GIS-T by the American Association of State Highway and Transportation Officials, has been used for diverse purposes:

- From modeling travel demand
- From analyzing the annual capital improvement plans to identifying noise regulation violations around airports
- From improving transit service throughout rejuvenated urban centers to planning scenic byways in recreational areas

GIS provides a framework to inform models, such as those used to forecast travel demand and plan capital improvements, and to support strategic decision-making. In addition, GIS applications for making environmental evaluations can shed light on the consequences of various transportation alternatives.

The purpose of this term project is to investigate applications of ArcGIS in transportation planning in more depth by analyzing downtown Austin network. The use of GIS for preparing input data for optimization algorithms improves the practical applicability of such algorithms in the field of transportation planning. Vehicle Routing Problems (VRPs) are a widely investigated class of problems in combinatorial optimization, and include many transportation tasks. In general, a VRP consists of a set of customers that must be served via a fleet of vehicles, each of which leaves from and returns to a central depot. The type of VRP determines whether customers have goods delivered to them, are
transported from one location to another, or are served in some other way. For this project, as a case study, I will try to analyze the downtown Austin network. The case study will focus on analyzing the network changes during the construction and work zone with the base network to see how it will effect on other streets traffic situation. For instance, if we have incident on 2nd St. how it will effect on downtown network. By having this information we will be able to find best traffic detour plans.

**Data Sources and Descriptions**

The model inputs in this study include a 2004 network that covers Travis, Williamson, and Hays counties and was originally developed by the Capital Area Metropolitan Planning Organization (CAMPO). The input data is available in text format and includes directional link peak hour attributes, which is used in directional peak period traffic analysis. The input file contains of nodes and links to represent street network. The data provided in this input file include tail node number, head node number, directional peak hour capacity of the link, length of the links, free flow travel time, geographical information for each node, and beta and alpha parameters that are used in the Bureau of Public Roads (BPR) function for calculating real travel time respect to traffic flow.

As transportation engineers and researchers, we support this process by developing and running models which predict the impact of potential projects or policies for instance, in Austin, what would be the impact on city traffic and emissions be if an extra lane was added on I-35? If an incident happens on one arterial road in downtown? If streetcar lines are installed downtown? In this way, the benefits of projects can be compared with their costs, and funding and implementation priorities established. Suppose there is a network of highways and transit systems and a proposed addition. We first want to know the present pattern of traffic delay and then what would happen if the addition were made.

To answer these questions analysis of transportation network is required. To analyze Austin network, we need to assign trips to each path. Traffic assignment concerns the selection of routes (alternative called paths) between origins and destinations in transportation networks. The output of assignment model is list of all links in the network and their corresponding traffic volume after loading with their travel time. In this term project I used Visual Interactive System for Transport Algorithms (VISTA) to assign the traffic in to the network.

The VISTA is a comprehensive dynamic traffic assignment (DTA) system that integrates data warehousing and traffic analysis for transport applications via a client-server implementation. (1) One of the advantages of this algorithm predicting travel demand and supply by incorporating more behaviorally realistic methodologies. And it is an Internet-based geographic information system (GIS) and incorporated it into the system
framework. This equipped VISTA with the unique feature of being accessed over the Internet via web browser, CORBA interface or Java GIS.

The output of VISTA will provide us the data we need for analyzing the network by ArcGIS. I defined different scenario to analyze the impact of incident and work zone on Austin downtown network. At this point I have all my input data for ArcGIS to analyze the effect of changes on the network.

**Description of Study Area**

As briefly described previously, this study’s main objective is to reduce traffic congestion downtown Austin and provide a safer environment for those who live, study, and work near downtown. The first step to achieve this objective is to evaluate existing traffic conditions within an area of interest but expanded to include considering the effect of incident and working zone on the network. Therefore, a study area defined for this study is constrained by Loop 1 to the west, US 183 to the north, IH 35 to the east, Cesar Chavez Street to the south.

Initially, three different scenarios are defined. These scenarios include:

1. Scenario 1: Incident happens on east bound of 2nd Street (Between Colorado St. and Congress Ave.) and drivers are not aware of road closure.

2. Scenario 2: There is a work zone on east bound of 2nd Street (Between Colorado St. and Congress Ave.) and drivers are aware of road closure.

3. Scenario 3: There is a work zone on east bound of 2nd Street (Between Colorado St. and Congress Ave.) and half of drivers are aware of road closure.

These three scenarios will later be compared with the base scenario. Following sections describe development of different scenarios.