Traffic Data Analysis and Route Optimization

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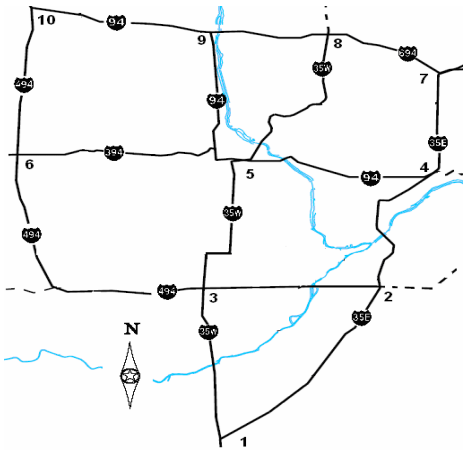
INTRODUCTION

For most people, traffic is one of the most time consuming activities of daily life. Especially, as the size of an urban area gets larger so does the size of the freeway networks connecting essential points in a city. Consequently, the need for knowing the route, which connects any two origin-destination pair with the minimum travel time, arises. In developed countries, where extensive Intelligent Transportation System (ITS) applications are utilized, this information can be supplied using real-time data that comes from many detectors. In the present study, it is argued that the traffic stream parameters for a specific freeway network are ergodic; hence, by means of a long term past data analysis it is possible to extract information regarding the travel times. A case study is implemented using past data collected in a part of the freeway network in Twin Cities, Minnesota. Within the context of this study, it is aimed at adopting an algorithm that yields the optimum route, the criterion being the travel time.

METHODOLOGY

Traffic volume and density values used for this study come from the freeway network shown below.



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There exists hundreds of detectors over the entire network. For this study, however, a subset made up of 30 detectors, which best represent the characteristics of the road sections they are located on, are selected. It is assumed, also, that there are totally ten nodes over this network to and from which travelling is possible. By processing the data, the space mean speeds and corresponding travel times on each path are obtained by means of Greenshield's (linear) speed-density model. Assuming that the traffic parameters are time dependent, the travel times are computed disaggregating time domain into seven days and each day into five hourly segments. Following the identification of the traffic stream parameters for each road, Floyd's algorithm is adopted in order to determine the routes resulting in the minimum travel time connecting any two nodes of the city network.

RESULTS

The developed algorithm returns the optimum route between two specified nodes along with the corresponding travel time and distance. The obtained results show consistency with the travel time predictions provided by the ITS based algorithm which makes use of real time data. It is also observed that for some nodes, the optimum route may show variation depending on the day and hour on which the travel is realized.

CONCLUSION

Despite the fact that, this algorithm has not been tested and verified for all the paths in this specific network which is the subject matter of this study, and across different networks, it may still be argued that long term past data analysis is a reliable tool to estimate the traffic stream characteristics of a network and consequently is a good basis for travel time predictions. Since traffic shows a dynamic behavior, in order to enhance the reliability of this methodology, the data used for the analysis could be updated at a specified time interval which is characterized by factors such as change in route capacity or number of vehicles occupying the existing roads.

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