Traffic Analysis

Letter of Explanation

Phase IIB Deliverable

19. Model For Detecting the Location and Predicting the Duration of Incidents on the Network

EECS - ITS LAB - FT96 - 080

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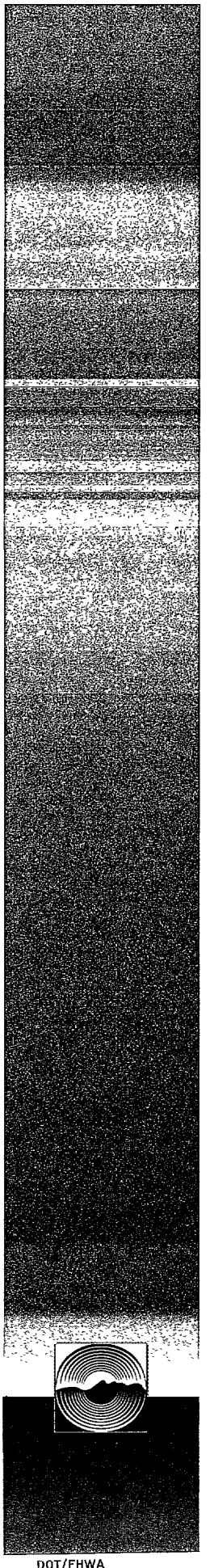

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Letter of Explanation

FAST-TRAC Phase IIB Deliverable

#19 **Model For Detecting the Location and Predicting the Duration of Incidents on the Network**

by

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Model for Detecting the Location and Predicting the Duration of Incidents on the Network

Introduction

An assessment of the aggregate regional benefits of ATMS and ATIS system deployment depends on two factors. The first is a technique for determining the reduction in delay and travel time for incidents of varying severity. This issue is being addressed in other tasks of the project evaluation study.

The second is a method for determining the frequency and location of incidents in the network. This task was designed to summarize how others had addressed this issue and to determine whether data exists in this study area to develop a reliable algorithm for estimating incident frequency. If data were available, a model was to be built to predict the location, frequency and duration of incidents on the surface street network in the City of Troy. After review of the data sources discussed in the pages to follow, the conclusion was reached that the information required to build a model to predict the frequency and duration of incidents is not available for the study area.

Literature Review

While there were several studies conducted to determine the frequency, type and duration of incidents on freeways, no empirical studies of these variables on a surface street network were found in the literature. The only data available were from a study conducted in Dallas for the Texas DOT. This study used a survey to estimate the frequency and duration of incidents and simulation modeling to estimate the delay caused by each incident.'

Officials were asked to list the different kinds of incidents that occur on their arterials, ranging from minor incidents such as stalled cars to a complete closure of the roadway. They were also asked to estimate the duration of each type of incident. Frequency data were created from the survey responses and incident types that had similar effects were grouped according to the effect they had on the roadway. The seven groups developed from the survey, along with the cause of the incident are shown in Table 1.

Table 1: Incident Types in Dallas

Group	Incidents Covered
Mid-block, lane closure	disabled vehicle on roadway, minor accident on roadway, police activity. minor flooding, debris in roadway
Mid-block, 2-lane closure	major accident on roadway, water line break, major flooding
Intersection. 1 -lane closed on two approaches	disabled vehicle, minor accident
Intersection, Z-lanes closed on two approaches	major accident
Complete roadway closure	railroad crossing. gas leak, hazardous material spill
Signal on flash	signal controller knocked down, controller problem resulting in signal on flash, power failure, pole down
Signal out of synchronization	controller malfunction resulting in incorrect timing plan, communication interruptions traffic slow down due to bad weather

To simulate the impact of these incidents, a six lane divided two-way arterial with separate left turn lanes at several major and minor streets were modeled in Traf-Netsim. The simulation was then run to see the effect of the incidents on delay. The simulation results showed the following effects of the different type of incidents:

1. Session 35: Incident Management; User Benefits from an Arterial Incident Detection and Response System; Paul M. Luedtke and Joseph T. Short

Mid-Block Lane Closure

The closure of one lane on a 3-lane arterial has little or no effect on stops, delays or fuel consumption. On the other hand, a 2-lane closure has a serious impact, and traffic needs to be diverted from the incident to avoid congestion.

Intersection Lane Closure

For this scenario,-the right-most eastbound and northbound lanes were closed within 200 feet of the intersection. Closure of even 1 -lane caused significant delay and increased fuel consumption.

Complete Roadway Closure

The complete closure of the roadway, not surprisingly, produced the most significant impact. For as long as the roadway is closed, delay, fuel consumption and stops increase dramatically. Although the delay increased proportional to the time the road was closed, fuel consumption and stops decrease, due to increased congestion resulting in vehicles not moving.

Signal on Flash

Due to the fact that every vehicle must stop, and then proceed, stops, delay and fuel consumption increase for this type of incident.

Signal out of Synchronization

The effects of a traffic signal which was set at a half cycle out of synchronization showed no effects on fuel and delay, although the number of stops increased slightly.

Economic Analysis

An estimate of the economic benefits of reducing the duration of incidents (based on the estimates of incident frequency and duration obtained in the survey) was made. The analysis assumed that delay has a value of $10 per vehicle hour, fuel costs $1 per gallon, and stops have a value of 1.4 cents. Table 2 shows the benefits of various reductions in incident duration. To the extent that the estimated frequency of each type of incident was reasonable, the value of even a modest decrease in incident duration has a significant economic impact.

Table 2: Economic Benefits from Incident Reduction (Dollars per Year)

Cost Component	Reduction in Incident Duration (%)			
	5	10	20	30
Delay	3,806,967	7,542,027	15,954,654	24,598,104
Stops	52,978	104,077	213,788	324,682
Fuel	179,935	355,085	783,590	1,233,860
Total	4,039,880	8,001,189	16,952,022	26,156,646

Troy Data

The analysis of the impact of ATIS and ATMS systems on delay and duration of congestion, completed as a separate task in this evaluation study, showed that these parameters are determined by the location and time the incident occurred (so the volumes can be determined), the number of lanes blocked by the incident, and the length of time the lane blockage existed. Therefore, an attempt was made to identify a source of these data upon which to base a model to predict the frequency and duration of incidents, rather than to base the analysis on a survey similar to the one done in Dallas.

Various sources of information were investigated to determine if one, or a combination of sources could be used to obtain the necessary data. The result of this investigation is described below.

City of Troy Police Department

The police department maintains a record of the time an incident (accident) is reported, the time the officer responded, and the time the officer left the scene. There is no record of the number of lanes closed or of the time the accident was cleared, and the lanes were reopened. The traffic engineers office had no independent data, but relied on the police reports for any analysis of incidents.

Oakland County Sheriff

The sheriff's office maintains the same information on accidents they investigate. They investigate fewer accidents than the city police, and thus their file is much smaller.

Michigan Emergency Patrol (MEP)

The Michigan Emergency Patrol is a voluntary organization supported by AAA. They receive and provide information on road conditions, accidents and blockages to the news media and the police agencies. The roadway conditions can be reported by cellular phones, CB's or by their helicopters which cover the metropolitan Detroit area looking for incidents. The data is processed via a PC, and all the information is stored in the form of hard copy print-out sheets.

Most of the information available through MEP is on freeway accidents, blockages, and closures. There was very little information available on the streets in the City of Troy, and again, the time the incident occurred and the time it was cleared was not available.

Metro Traffic Reports

The data available from Metro Traffic is similar to the MEP data. A detailed review of one week's reports failed to identify even one incident on the streets in the City of Troy. Since we know there are an average of 30 accidents per week on the arterial street system in Troy, this means the Metro Traffic is not a reliable data source.

Michigan Department of Transportation (MITS-CENTER)

The Department of Transportation keeps records of accidents on freeways and major urban arterials in the Detroit Metropolitan area. This data is coded into a database file and is easily accessible. The information available from these files includes the time of the accident as reported by the investigating officer, the cause of the accident, lane and ramp information, the location of the accident, weather conditions, number of vehicles involved, and whether trucks were involved. The time the incident was cleared is not available.

Conclusion

Following this review of data sources, the conclusion was reached that the information required to build a model to predict the frequency and duration of incidents is not available for the study area. Thus, the systemwide impact of the incident management capability of SCATS and Ali-Scout will have to be based on estimates of incident frequency derived from other sources. Possibilities include a survey of city and county officials, as was done in Texas, or data from the probe vehicles currently being used in the route guidance assessment.

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