MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

RESEARCH SUMMARY

Development of a Traffic Management Decision Support Tool for Freeway Incident Traffic Management (FITM) Plan Deployment

WHAT WAS THE NEED?

In designing an effective traffic management plan for non-recurrent congestion, it is critical for responsible highway agencies to have some vital information, such as estimated incident duration, resulting traffic queues, and the expected delays. Over the past two decades, despite the popular implementation of incident response programs by most highway agencies, a reliable tool for them to estimate such vital information for traffic management remains unavailable. Using the valuable incident data collected by CHART over the past several years, this project, focused on developing a decision-support tool for freeway incident traffic management.

WHAT WAS THE GOAL?

This research developed a decision support system to assist CHART's engineers/operators in estimating the clearance duration of a detected incident and its resulting impacts on the traffic conditions. The first product from this project is a technical report that details all methodologies and available models for incident traffic management. The second product is a knowledge-based decision software, developed with the I-95 incident data, for the pilot study of estimating the clearance duration of a detected incident in real time.

WHAT DID THE RESEARCH TEAM DO?

In addition to addressing all critical issues associated with highway incident response and traffic management, this study has further developed a knowledge-based system, based on the data collected by Maryland CHART (Coordinated Highway Action Response Team) program between the years 2012 and 2016 for a pilot study. The developed system features its use of interval-based logic (derived from the historical incident response data) for estimating the target clearance duration, and its design of a rule-based structure for convenient update with expertise from field operators. The developed model's sequential computing nature allows the users to revise the estimated clearance duration when additional data become available in the real time incident response process.

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WHAT WAS THE OUTCOME

In brief, the developed knowledge-based model, calibrated with CHART incident data from 2012 to 2016, can achieve more than 85% accuracy after being updated with the data from six additional months in 2017. For example, the estimation accuracy for February 2017 is increased from 77.5% to 85.0% after the update with January 2017 data. The prediction accuracy for March 2017 is increased from 72.7% to 75.8% with the updated information from February 2017 (see Table 1). Further research along this line includes: 1) extending the knowledge-based rules and embedded models to the neighboring highway systems so as to evaluate the developed model's transferability; and 2) developing a convenient update mechanism for experienced field operators/engineers to enrich those rules embedded in the knowledge base with their expertise.

Table 1 Prediction accuracy after the model update with 2017 incident data

Model	Training set	Test set	Additional datasets used for model update					
	2012~2015	2016	Jan. 2017	Feb. 2017	Mar. 2017	Apr. 2017	May. 2017	Jun. 2017
Before updates	79.1% (1549/1958)	74.3% (465/626)	75.8% (25/33)	77.5% (31/40)	72.7% (24/33)	67.7% (21/31)	78.3% (36/46)	79.3% (23/29)
After update with Jan. 2017	79.2% (1550/1958)	74.4% (466/626)	87.9% (29/33)	85.0% (34/40)	72.7% (24/33)	67.7% (21/31)	78.3% (36/46)	79.3% (23/29)
After update with Feb. 2017.	79.8% (1562/1958)	75.7% (474/626)	87.9% (29/33)	95.0% (38/40)	75.8% (25/33)	67.7% (21/31)	78.3% (36/46)	79.3% (23/29)
After update with Mar. 2017	79.8% (1563/1958)	76.0% (476/626)	87.9% (29/33)	95.0% (38/40)	100% (33/33)	67.7% (21/31)	78.3% (36/46)	79.3% (23/29)
After update with Apr. 2017	80.0% (1566/1958)	77.0% (482/626)	87.9% (29/33)	95% (38/40)	100% (33/33)	87.1% (27/31)	78.3% (36/46)	79.3% (23/29)
After update with May. 2017	80.1% (1569/1958)	77.2% (483/626)	87.9% (29/33)	95% (38/40)	100% (33/33)	87.1% (27/31)	93.5% (43/46)	79.3% (23/29)
After update with Jun. 2017	80.2% (1570/1958)	77.2% (483/626)	87.9% (29/33)	95% (38/40)	100% (33/33)	87.1% (27/31)	93.5% (43/46)	93.1% (27/29)

* Numbers in the parenthesis represent "the number of data whose clearance time is correctly estimated by the model / the total number of data"

HOW WILL SHA USE THE RESULTS?

Due to the extensive field analyses conducted, this research has confirmed the need to combat daily non-recurrent congestion with an efficient and effective incident management program for optimal use of available resources and best coordination between all responsible agencies. Previously, due to the lack of statistical analyses on all the factors that affect an incident duration, the SOC operators relied on their personal knowledge and experience to arrive at a conclusion on whether it is beneficial to deploy a FITM detour plan. MDOT SHA will now utilize the data-driven results from this study to make well-informed decisions when deploying FITM plans. Better and faster decision-making will likely help reduce traffic delays and the resulting congestion as well as user costs, which can be extensive when they are caused by a major traffic incident/event.

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