STRIDE | Southeastern Transportation Research, Innovation, Development and Education Center

Technology Transfer Final Report

STRIDE Project A4

Addressing Unpredictable Sources of Congestion

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THE STRIDE CENTER

The STRIDE Center is the 2016 USDOT Region 4 (Southeast) University Transportation Center (UTC) housed at the University of Florida Transportation Institute (UFTI). Our mission is to develop novel strategies for Reducing congestion. The Center has nine partners, representing seven states in the Southeastern U.S. The UFTI and its partners in the STRIDE Center are recognized leaders at state, regional, national, and international levels. The STRIDE Center is focused on assembling and integrating research projects throughout the region in a way that maximizes contributions to solving current and future transportation problems as well as strengthening expertise and developing new technologies. For more information see https://stride.ce.ufl.edu/.

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1. Project Overview

Incident management strategies for unpredictable congestion rely on information concerning the sources and impacts of those events. Their impacts, in addition to congested roadways, constitute disrupting freight movements and occurrences of secondary crashes. In this study, we assessed the state-of-the-practice methods of deploying incident management strategies and investigated areas for improvement. We also developed a framework for detecting secondary crashes on interstate corridors.

We conducted two case studies using traffic operational and incident data to address these issues. The Alabama study focuses on assessing the state agency's service patrol deployment criteria and the North Carolina study mainly deals with the secondary crash detection framework. In the first one, we analyzed travel time and delay data to assess the need for incorporating temporal factors and those related to land-use type and freight demand level when assessing service patrol needs. In the second one, we developed and evaluated a tool for detecting secondary crashes, which are vital in determining service patrol needs.

2. Research Goals

- To review the current practices adopted by different transportation agencies to manage unpredictable sources of congestion on freeways
- To develop frameworks to support the planning and monitoring of strategies that address unpredictable sources of congestion
    - To assess the current performance of an interstate corridor in terms of non-recurrent congestion using a state-of-the-practice method
    - To incorporate the impacts of congestion on freight movement into service patrol-need assessments
    - To develop and test a method for detecting potential primary-secondary incident pairs

3. Findings

- Recent TSMO plans show significant interest by state agencies in investigating new technologies to handle unpredictable congestion. However, the benefits gained by different agencies by implementing various strategies are still unknown. A first step for determining their warrant and effectiveness for a corridor is to assess the incident occurrence rate and how much of that could be mitigated through such strategies.
- Crash/incident reporting criteria and data sources influence the outcome of the primary-secondary incident pair detection. Depending on the data source, the percentage of potential primary-secondary pairs with confirmed congestion in between varied from 61% to 76%.
- The IMAP service patrol deployed by NCDOT at the study site was found to be justified according to the incident-factor (IF)-based method developed by ALDOT.
- Travel time and delay cost add new dimensions to the currently-used metric—especially since the latter accounts for the impacts on freight movements.

4. Performance Metrics

Metric	# Completed
OUTPUTS	
Product(s): An algorithm for detecting secondary crashes	1
Technical Report: Number of client-based technical reports published	STRIDE Final Report
OUTCOMES	
Body of Knowledge: Number of trainings for transportation professionals	1 webinar scheduled to be held on April 19, 2023
Professionals Trained: Number of professionals participating in trainings	TBD
IMPACTS	
Stakeholders: Number of stakeholders you met with to encourage adoption or implementation of product(s)	3
Adoption/Implementation: Number of incidences outputs of research have been implemented or adopted	1

5. Products

1. **An algorithm for detecting the potential primary-secondary incident pairs using NCDOT's Traveler Information Management System (TIMS) data**
2. **An algorithm for detecting the potential primary-secondary crash pairs using NCDOT's archived crash data**
3. **Criteria for the deployment of service patrol vehicles that consider passenger vehicle and truck volumes, TOD, day of week, and seasonal needs.**

The products detect secondary incidents on freeways by using incident location and time data from archived database(s). The algorithms leverage the spatiotemporal relationship of consecutive incidents happening on a corridor. Transportation planners and engineers can improve congestion management by using the algorithms to prioritize locations that are prone to secondary incidents for service patrol deployment.

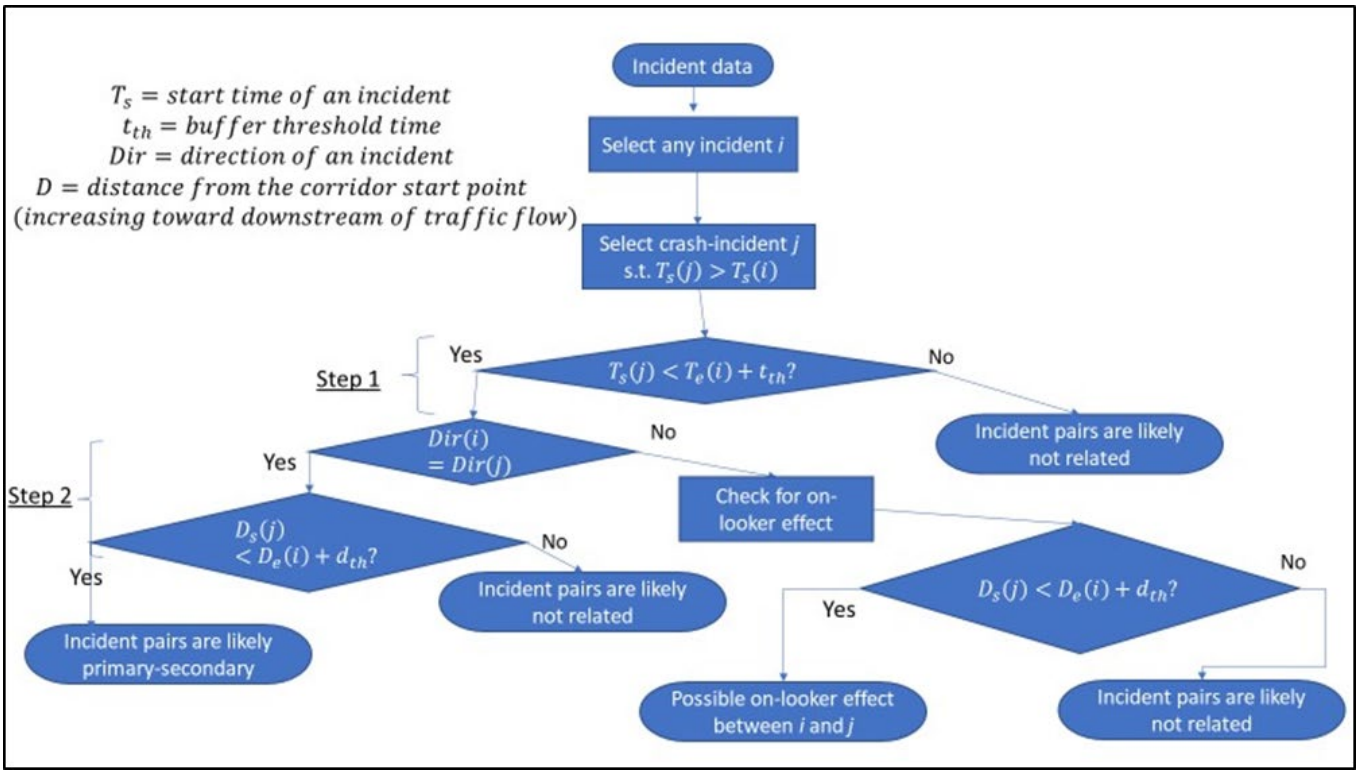

Figure 1: : Algorithm for detecting potential primary-secondary incident pairs

6. Who benefits/will benefit from your product(s)?

- Traffic operators
- Transportation planners
- Service patrol operators

7. Body of Knowledge & Professionals Trained

1) STRIDE Webinar: "Addressing Unpredictable Sources of Congestion" presented by Chris Cunningham, ITRE-NCSU; Ishtiak Ahmed, ITRE-NCSU; Andrew Sullivan, University of Alabama at Birmingham is scheduled for April 19, 2023.

8. Journal Publications, Conference Presentations, & Posters

UAB MSCE candidate Charles Agusiobo successfully defended his master's thesis based on research for this project. "Developing Criteria for the Deployment of ASAP Service Patrols"

9. Stakeholder Engagement

MEETING DETAILS		NARRATIVE DESCRIPTION
STRIDE rep.	Thomas Chase	The NCSU team met with NCDOT on an adjacent topic area for another project where multiple limitations in the non-STRIDE project were identified. These topics were recorded
Date of Activity	10/13/2020	
Type of Activity	phone meeting	
Location	--	

MEETING DETAILS		NARRATIVE DESCRIPTION
Stakeholder(s)	Jennifer Portanova, State Systems Operations Engineer, NCDOT	as potential case study scopes for the STRIDE project. Notably, the impact of debris removal on congestion, the reduction in secondary crashes, and statewide measures for incident-related congestion were identified.
STRIDE rep.	Thomas Chase	The NCSU team again met with NCDOT on an IMAP project where the issue of debris removal and other secondary benefits of IMAP activities were discussed as a needed follow-on research effort.
Date of Activity	2/4/2021	
Type of Activity	phone meeting	
Location	--	
Stakeholder(s)	Jennifer Portanova, State Systems Operations Engineer, NCDOT	
STRIDE rep.	Andrew Sullivan (UAB) Rod Turochy (Auburn)	Met with ALDOT TSMO group to discuss current programs they have underway to address congestion and areas of interest they would have for the STRIDE project. We discussed the ASAP vehicle assistance program in great detail, as this is an area of interest for them right now**.**
Date of Activity	June 3, 2021	
Type of Activity	phone meeting	
Location	--	
Stakeholder(s)	Chris Hilyer (State TSMO Administrator, ALDOT) and Brett Sellers (State TSMO Group, ALDOT)	
STRIDE rep.	Ishtiak Ahmed (NCSU)	The team met with NCDOT Traffic Safety Unit twice. The team presented the case study scope in the first meeting and requested safety data. The TSU provided a crash dataset and GIS shapefile. The second meeting was held to review these datasets and the proposed analysis methodology.
Date of Activity	8/30/2021 and 9/8/2021	
Type of Activity	phone meeting	
Location	--	
Stakeholder(s)	Tim Nye (Traffic Safety Project Engineer, NCDOT)	
STRIDE rep.	Andrew Sullivan (UAB) and Charles Agusiobo (UAB/ALDOT)	The team met with ALDOT State TSMO Administrator to discuss progress and needs regarding ASAP deployment criteria. Mr. Sellers indicated ALDOT is very interested in the new criteria for ASAP deployment, particularly a methodology that allows them to consider freight impacts, TOD variations, and seasonal needs for service. He provided additional data from ALDOT databases.
Date of Activity	March 4, 2022	
Type of Activity	in-person meeting	
Location	UAB	
Stakeholder(s)	Brett Sellers (State TSMO Administrator, ALDOT)	

10. Adoption/Implementation

ALDOT is reviewing the methodology for potential application to state ASAP programs.

11. Broader Impacts

The models developed under this project are transferrable to other states or municipalities.