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

Technology Transfer Final Report

STRIDE Project E3

Locating and Costing Congestion for School Buses and Public Transportation

Kai Monast
Director, Public Transportation Group
NC State/ITRE

February 2022

DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated in the interest of information exchange. The report is funded, partially or entirely, by a grant from the U.S. Department of Transportation's University Transportation Centers Program. However, the U.S. Government assumes no liability for the contents or use thereof.

ACKNOWLEDGEMENT OF SPONSORSHIP AND STAKEHOLDERS

This work was sponsored by a contract from the Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE), a Regional University Transportation Center sponsored by a grant from the U.S. Department of Transportation's University Transportation Centers Program.

1. Project Description

Roadway congestion creates delays and increased costs for all roadway users, including transit and school buses. When buses are subjected to congestion, operating and capital costs increase, travel time reliability decreases, and the overall competitiveness and attractiveness of these modes decreases. This research integrates three large datasets to create a practitioner tool that allows transportation planners and engineers to model the bidirectional relationship between traffic flow and congestion data (via RITIS) with public transportation (GTFS) and school travel data (Edulog). This practitioner tool will allow for the spatial identification of congestion impacts affecting public transportation and school buses, along with estimates of the costs incurred by these modes resulting from congestion. This methodology will allow practitioners to prioritize locations where treatments will be the most cost-effective and impactful.

Two different sites were chosen for comparison: Pinellas County, FL, a populous, primarily urban county with multiple distinct municipalities and Durham County, NC, a less—populous county with a centralized core that draws passengers from suburban and rural areas on its edges. Both counties have transit agencies and school districts that utilize the appropriate software packages.

By combining these three datasets, the research team was able to determine when and where publicly-funded transportation vehicles are operating and to estimate the delay experienced by each vehicle. The delay costs were then calculated both temporally and spatially, allowing for identification of locations and times where mitigation strategies may be most appropriate.

2. Research Goal

The goal was to develop methodologies that would enable the use of three large datasets in a new web mapping tool.

3. Performance Metrics

Metric	# Completed
OUTPUTS	
Product(s): Number of new or improved tools, technologies, products, methods, practices, and processes created or improved	2
Technical Report: Number of client-based technical reports published	STRIDE Final Report
OUTCOMES	
Body of Knowledge: Number of trainings for transportation professionals	3
Professionals Trained: Number of professionals participating in trainings	48
IMPACTS	
Stakeholders: Number of stakeholders you met with to encourage adoption or implementation of product(s)	8
Adoption/Implementation: Number of incidences outputs of research have been implemented or adopted	5

4. Products

1) Methodology

A methodology was created to merge three different datasets. Steps included

- displaying Edulog data spatially,
- displaying General Transit Feed Specification (GTFS) data spatially,
- merging above datasets with Regional Integrated Transportation Information System (RITIS) data, and
- determining minutes of delay by hour and segment, based on above.

This data was combined to create a spatial and temporal map of congestion on routes throughout the site area described in the product below.

2) Web mapping tool of minutes of delay by mode

Data from the above product were used to create a web mapping tool, which allows the user to examine minutes of delay for transit buses and for school buses at any time of the day, using an expandable map. The map can be accessed via www.transitportal.org/cost_of_congestion.html. For a detailed technical description of the research efforts, see the final report.

5. Who benefits/will benefit from your product?

- Transit Agencies
- School Districts
- Municipalities
- Regional Planners

6. Body of Knowledge & Professionals Trained

1) **Demonstration:** Kai Monast, Ruth Steiner, Kevin Hart, Waugh Wright, Jeremy Scott, Terry Karson, Juan Suarez held a virtual demonstration for staff and leaders at Durham Public Schools, Durham transportation planners as well as GoDurham and GoTriangle public transportation systems on June 9, 2021. The project team reviewed the project and presented results about congestion experienced by school buses and transit buses and estimates of the resultant costs. The web mapping tool was demonstrated, showing the audience how they could utilize it to examine congestion at any location in Durham County at any hour of the day. The audience was very interested and in post-meeting conversations expressed interest in working more with the research team. Seven professionals attended including Mathew Palmer (DPS-Executive Director of Strategic Planning Initiatives), Aaron Cain (Durham Planning Manager), Joe Harris (DPS, Director of Transportation), Brian Fahey (GoTriangle and GoDurham Transit Administrator), Alexander Modestou (DPS, Director of Budget and Data Development), Paul LeSieur (DPS CFO), Julius Monk (DPS COO). Thirty-five professionals attended the webinar live.

2) **Demonstration:** Kai Monast, Ruth Steiner, Kevin Hart, Waugh Wright, Jeremy Scott, Terry Karson, Juan Suarez held a virtual demonstration for staff and leaders at Pinellas County Schools, Pinellas Suncoast Transit Authority, and local transportation planners on June 9, 2021. The project team reviewed the project and presented general results about congestion experienced by school buses and transit buses and estimates of the resultant costs. The web mapping tool for Durham County

was demonstrated, showing the audience how they could utilize it to examine congestion at any location at any hour of the day. The audience was very interested and in post-meeting conversations expressed interest in working more with the research team. Six professionals attended including Tony Langhorne (PCS), Chelsea Favero (Pinellas County MPO), Autumn Westerman (Pinellas Suncoast Transit Authority PSTA), Heather Sabush (PSTA), Joe Camera (PCS), T. Mark Hagewood (PCS)

3) **STRIDE Webinar**: Kai Monast, Ruth Steiner, and Jeremy Scott presented research results to a national audience (35 participants) consisting of practitioners and researchers on August 4, 2021. The presentation covered the project scope, data, methodology, and results, culminating in a demonstration of the web-mapping application. The audience was engaged and had many follow-up questions as well as requests for more information.

7. Stakeholder Engagement

MEETING DETAILS		NARRATIVE DESCRIPTION
STRIDE Rep.	Kai Monast, Kevin Hart, Waugh Wright	The project team has had ongoing communications, in person, on phone, and by email, with Durham Public Schools, primarily with their strategic planning office but also with their school bus routing team. The stakeholders were excited by the possibility of reducing the impact of congestion upon their school buses, by improving routing and other means, once the study is complete.
Date of Activity	On-going	
Type of Activity	in-person meeting	
Location	Durham	
Stakeholder(s)	Mathew Palmer, Director, Strategic Planning Initiatives, Durham Public Schools (DPS)	
STRIDE Rep.	Kevin Hart	The ITRE liaison with Edulog, Kevin Hart has on-going communication with Edulog, about downloading and processing the data for this project, in addition to other projects he conducts with the company.
Date of Activity	On-going	
Type of Activity	phone meeting	
Location		
Stakeholder(s)	Edulog staff	
STRIDE Rep.	Ruth Steiner Kevin Hart	STRIDE Researchers met online with PCS Staff to review and obtain their data submission for this project. PCS Provided an equivalent descriptive report of all Bus Routes, Runs, Stops, Arrival Times, Total Loads and Paths of Travel for all planned school bus routes. ITRE Staff also assisted PCS Staff in obtaining the XY Coordinates of School Bus Stops through the password protected executable provided by Edulog as part of this project.
Date of Activity	June 22, 2020	
Type of Activity	phone meeting	
Location	Zoom	
Stakeholder(s)	Pinellas County Schools (PCS) Tony G. Langhorne Field Operations Supervisor Transportation	

STRIDE Rep.	Kai Monast	This meeting was to discuss the project and our data needs from the Durham, NC transit agency, GoDurham.
Date of Activity	1/7/21	
Type of Activity	other - please describe	
Location	Durham (virtual)	
Stakeholder(s)	Brian Fahey, Transit Administrator, GoDurham	

8. Adoption/Implementation

1) Methodology

The methodologies are intended to allow transit systems, school districts, municipalities, and related stakeholders determine congestion "bottlenecks," streets or areas where buses and other vehicles face high congestion. While the results are directly relevant to Durham Public Schools, the GoDurham and GoTriangle transit agencies, Pinellas County Schools, and Pinellas Suncoast Transit Authority, it is hoped that future research will further refine these methodologies to make them less cumbersome, so that more districts and transit agencies are able to use them on their own.

2) Web mapping tool of minutes of delay by mode

This tool will be directly used by stakeholders in Durham and Pinellas Counties, but it is hoped that future research will allow it to be used more widely.

9. Broader Impacts

The impact of these products will be to allow school districts, transit agencies, and municipalities to determine where and when their buses and other vehicles face high congestion and what the resultant costs are. This will allow these entities to search for solutions to reduce the amount of congestion, such as changing routes or times, adding special lanes, signal prioritization, etc. Furthermore, regional planners can use these results to prioritize their general congestion mitigation efforts.

The travel time saved will be able to be calculated using the exact same methods. This means that agencies will be able to determine the amount of direct costs saved (e.g., operations costs) and well as hours of time saved for both students and transit passengers.