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

Technology Transfer Final Report

STRIDE Project F

Integrated Implementation of Innovative Intersection Designs

May 16, 2017 - November 16, 2018 &

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Nagui Rouphail, Ph.D.

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1. Project Description

Continuous Flow Intersections (CFIs), also known as Displaced Left-turn intersections (DLTs) have grown in popularity primarily due to the reduced number of signal phases for vehicles. However, due to its large footprint and unconventional displaced left-turn movement, pedestrians and bicycles experience unique challenges at this type of intersection.

This study evaluated the performance of pedestrian-bicycle crossing alternatives at Continuous Flow Intersections (CFI). Three CFI crossing alternatives were tested: Traditional, Offset, and Midblock crossings. In total, 24 alternative scenarios were generated by incorporating two bicycle path types, two right-turn control types, and two CFI geometry types. These scenarios were analyzed through microsimulation on the basis of stopped delay, travel time, and number of stops.

Simulation results revealed the Offset crossing alternative incurred the least stopped delay for all user types. The Traditional crossing generated the least number of stops. The exclusive bicycle path performed better than the shared-use path in most cases. However, these general trends may vary significantly at the route-level analysis. When compared with an equivalent standard intersection, aggregated results showed significant improvement for all CFI crossing types with respect to travel time and stopped delay, but the standard intersection had an equal or fewer number of stops. Future research includes incorporating pedestrian-bicycle safety, comfort, and the relative effects of these crossing alternatives on vehicular operations. An additional analysis on Reduced Crossings IU-Turn (RCUT) intersections found that a reduction of the number of conflict points found in RCUT was beneficial to all roadway users including, motor vehicle traffic, pedestrians, bicyclists, and transit users.

2. Performance Metrics

Metric	# Completed
OUTPUTS	
Product(s): Number of new or improved tools, technologies, products, methods, practices, and processes created or improved	1
Technical Report: Number of client-based technical reports published	1 (STRIDE Final Report)
OUTCOMES	
Body of Knowledge: Number of trainings for transportation professionals	1 (STRIDE webinar)
Professionals Trained: Number of professionals participating in trainings	55 participants 62 YouTube views
IMPACTS	
Stakeholders: Number of stakeholders met with to encourage adoption or implementation of product(s)	2
Adoption/Implementation: Number of incidences outputs of research have been implemented or adopted	None thus far

3. Product

Microsimulation models of Continuous Flow Intersections

a) Non-Technical Description

Developed 24 microsimulation models of different CFI (Continuous Flow Intersection) geometries and pedestrian-bicycle crossing facilities. The microsimulation work done in this project could be utilized by private practice for implementation of timing for all users at a CFI. The simulations include various timing plans for three alternative CFI designs (traditional, midblock, and offset) and include considerations for on and off-road bicyclist. These models could also be used in a 'street view' or 'drive through' mode to show the public how the designs such as these look from the perspective of the pedestrian or bicyclist.

b) Technical Description

Twenty-four alternative scenarios were developed using PTV VISSIM 10.0 simulation tool. Four key factors, namely the pedestrian-bicycle crossing type, vehicular right-turn control type, CFI geometry, and bicycle path type were varied to create these alternative scenarios. Pedestrian-bicycle speed were calibrated using field data collected by a past study from six standard intersections. The simulations include various timing plans for three alternative CFI designs (traditional, midblock, and offset) and include considerations for on and off-road bicyclist. Cycle lengths and other signal timing parameters for each scenario were optimized using a linear programming tool.

4. Body of Knowledge & Professionals Trained

1) STRIDE webinar, October 23, 2019 - Chris Cunningham, PE, MSCE, Director, Highway Systems (ITRE) and Ishtiak Ahmed, NCSU, Evaluation of Pedestrian and Bicycle Options at Continuous Flow Intersections (55 participants, 62 YouTube views)
2) Plans were for Dr. Nagui Rouphail present and accepted paper at the International Symposium on Highway Geometric Design in Amsterdam, Netherlands in June 2020. Conference cancelled and postponed to June 2021 due to COVID-19.

5. Stakeholder Engagement

MEETING DETAILS		NARRATIVE DESCRIPTION
STRIDE representative	*Ishtiak Ahmed, PhD student*	The project team presented the findings from this project in the North Carolina Department of Transportation Research and Innovation Summit.
Date of Activity	*5/7/19*	
Type of Activity	*Demonstration*	
Location	*Greensboro, NC*	
Stakeholder(s)	*North Carolina Department of Transportation*	
STRIDE representative	*Ishtiak Ahmed, PhD student*	The project team presented the findings from this project in the North Carolina Section of ITE's Midyear Meeting.
Date of Activity	*5/30/19*	
Type of Activity	*Demonstration*	
Location	*Wilmington, NC*	
Stakeholder(s)	*North Carolina Section of ITE*	

STRIDE representative	*Ishtiak Ahmed, PhD student*	The project team presented the findings from this project in the 99th Annual Meeting of Transportation Research Board.
Date of Activity	*1/13/2020*	
Type of Activity	*demonstration*	
Location	*Washington, D.C.*	
Stakeholder(s)	*Transportation Research Board*	

6. Adoption/Implementation

NCHRP 07-25 project - The results from the STRIDE project were not directly integrated into the 07-25 work as their deadlines did not align. The work for 07-25 was provided to the NCHRP panel in February prior to the results from this (somewhat) parallel effort. The STRIDE projects is a supplement to 07-25 which could later be integrated in any updates.

7. Broader Impacts

- The primary known impact are decreased cost (compared to the grade separated options) and improved efficiency and operations for vehicles. By providing additional guidance for the other two primary modes (pedestrians and bicyclist), the CFI's use in practice should increase.
- The adoption of CFIs should increase as the pedestrian and bicyclist accommodations are given additional considerations. This is usually one of the primary downfalls of the CFI because it is considered in urban and suburban areas where pedestrian and bicycle activity are most prevalent.
- The results were not added in NCHRP 07-25 because the timing did not align. However, the results have been provided through publication and presentation. Future updates to CFI guidance should include these findings as they are available in the literature now.

Many intersection designs are selected for vehicular operational benefits with little-to-no consideration for pedestrian and bicycle impacts. This is due in part to the lack of information regarding crossing designs and their impact on pedestrians and bicyclists. The results of this project provide such guidance broken down by crossing design. With this research, engineers can work to minimize the delays and therefore minimize the unsafe behavior of pedestrians and bicyclists crossing against the indication. This impact can be measured by the number of CFIs implemented with pedestrian and bicycle facilities.