

## ABSTRACT

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Title: Pedestrian-Vehicle Interactions at Semi-Controlled Crosswalks: Explanatory Metrics and Models.

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A large number of crosswalks are indicated by pavement markings and signs but are not signal-controlled. In this study, such a location is called “semi-controlled”. In locations where such a crosswalk has moderate amounts of pedestrian and vehicle traffic, pedestrians and motorists often engage in a non-verbal “negotiation”, to determine who should proceed first.

3400 pedestrian-motorist non-verbal interactions at such semi-controlled crosswalks were recorded by video. The crosswalk locations observed during the study underwent a conversion from one-way operation in Spring 2017 to two-way operation in Spring 2018. This offered a rare opportunity to collect and analyze data for the same location under two conditions.

This research explored factors that could be associated with pedestrian crossing behavior and motorist *likelihood of decelerating*. A mixed effects logit model and binary logistic regression were utilized to identify factors that influence the likelihood of pedestrian crossing under specific conditions. The complementary motorist models used generalized ordered logistic regression to identify factors that impact a driver’s *likelihood of decelerating*, which was found to be a more useful factor than *likelihood of yielding to pedestrian*. The data showed that 56.5% of drivers slowed down or stopped for pedestrians on the one-way street. This value rose to 63.9% on the same street after it had been converted to 2-way operation. Moreover, two-way operation eliminated the effects of the presence of other vehicles on driver behavior.

Also investigated were factors that could influence how long a pedestrian is likely to wait at such semi-controlled crosswalks. Two types of models were proposed to correlate pedestrian waiting time with various covariates. First, survival models were developed to analyze pedestrian wait time based on time-to-first-event analysis. Second, multi-state Markov models were introduced to

correlate the dynamic process between recurrent events. Combining time-to-first-event and recurrent events analyses addressed the drawbacks of both methods. Findings from the before-and-after study can contribute to developing operational and control strategies to improve the level of service at such unsignalized crosswalks.

The results of this study can contribute to policies and/or control strategies that will improve the efficiency of semi-controlled and similar crosswalks. This type of crosswalk is common, so the benefits of well-supported strategies could be substantial.

*Keywords:* Crossings; Pedestrian-Motorist Interaction; Pedestrian Wait Behavior