



Analysis of Route Choice for Pedestrian Two-Stage Crossing at a Signalized Intersection

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Abstract

Studying pedestrians' twice-crossing behavior is of great significance to enhance safety and efficiency for pedestrians at signalized intersections. However, limited attention has been paid to analyze and model pedestrians' behavior patterns of twice crossing. The purpose of this paper is to determine pedestrians' route choices for twice crossing at a signalized intersection, focusing on the waiting position (to cross the street) and walking route. A goal-oriented and time-driven model was proposed to analyze pedestrians' twice-crossing behavior at signalized intersections, where the two directions have different pedestrian signal timing. A video-recording method was used to collect field data in order to obtain pedestrian preferences in choosing a walking route. It was found that pedestrians in the two directions present different preferences toward walking route, in waiting position, directional change and route type. The results showed that the proposed model is effective in simulating pedestrian route-choice behavior of twice crossing. This research provides a theoretical basis for identifying pedestrian movement intention, optimizing signal timing, and improving pedestrian infrastructure at signalized intersections.

Keywords: Pedestrian Two-Stage Crossing; Route Choice; Pedestrian Behavior Model; Signalized Intersections.

1. Introduction

Signalized intersections play an important role in the urban road network, many of which are designed with two-stage pedestrian crossing. Studying the characteristics of pedestrian twice-crossing behavior at signalized intersections, meets the needs of developing a "people-oriented" urban traffic system and is of great significance for improving traffic efficiency and pedestrian safety.

In a two-stage crossing, a refuge island is established at the middle of a crosswalk and pedestrian crossings proceed in two steps (pedestrians can wait in the refuge island). Two-stage crossing is an effective measure to increase the pedestrian flow rate and the intersection capacity. By allowing pedestrians to wait halfway, refuge islands separate conflicts in time and place. It is very helpful in the scenarios where elderly or disabled pedestrians cross an intersection.

1.1. Pedestrian Crossing Behavior at Signalized Intersections

Tong et al. [1] analyzed the formation mechanism of pedestrian flow expansion, defined the expansion coefficient, and verified it through the actual pedestrian data. Qu et al. [2] presented the spillover behavior of pedestrian crossing at signalized intersections. Li et al. [3] analyzed the main factors of influencing pedestrian crossing behavior, and proposed traffic organization and control measures by setting refuge islands and optimizing signal timing parameters. Li et al. [4]

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