Integrating Visibility, Parking Restriction, and Driver's Field View for Enhancing Pedestrian Crossing Safety

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ABSTRACT

Pedestrians at a marked but unsignalized pedestrian crossing (Ped-Xing) must be made visible to drivers in the approaching traffic at a sufficient distance away from the crossing, and this distance is needed for stopping a vehicle before the leading Ped-Xing edge to avoid a potential traffic collision. In this paper, an exact analytic framework is established to integrate driver's field view, driver's perception-reaction, lighting condition, and parking restriction at a Ped-Xing for enhancing traffic operational safety. The size of the no parking zone by the Ped-Xing is determined exactly using equations derived from this framework. Additionally, this study sheds the light on mid-block Ped-Xing installation, which should be discouraged if parking is permitted alongside a street. Furthermore, additional visibility improvement measures at the unsignalized Ped-Xings may be needed for enhancing safe traffic operations at the crossings.

1. INTRODUCTION

Pedestrian crossing (Ped-Xing) has been widely installed in urban or suburban areas at signalized intersections, unsignalized intersections, and mid-blocks between intersections. Pedestrian traffic movement at signalized intersections is at least in part coordinated by signals. In this paper, we focus our study on those Ped-Xings which aren't controlled by traffic signals. In the absence of traffic signals, safe pedestrian crossing relies mainly on the pedestrian visibility at a crossing and the stopping sight
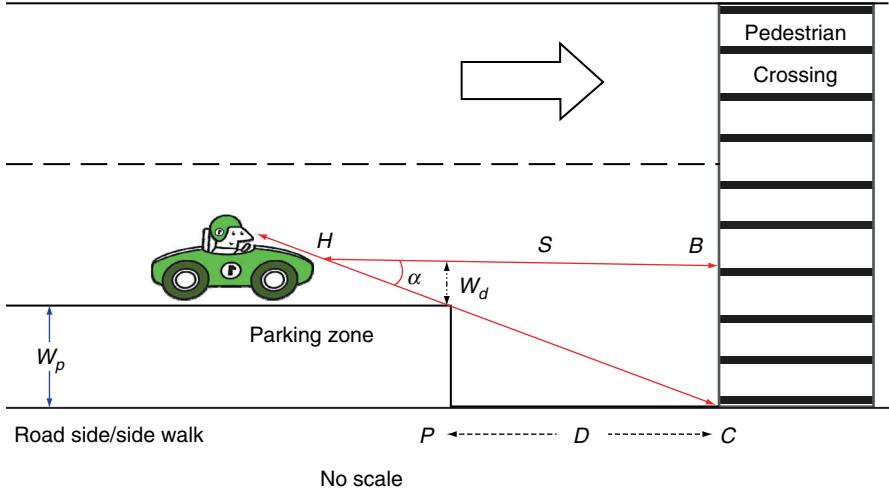
Figure 1.   Schematic plan view of parking and pedestrian crossing

distance provided to halt a conflicting traffic movement before the edge of the crossing to avoid a traffic collision. If street parking isn't allowed, the pedestrian visibility at the crossings will depend mostly on lighting conditions and driver's field view and attention to his/her changing surroundings. When parking is allowed, a parked vehicle may partially or completely block a driver's view of a pedestrian on one side of the crossing. In connection with the Ped-Xing safety, one may question the appropriate distance D between the leading edge of Ped-Xing and the parking zone as sketched in Figure (Fig.) 1. The unsignalized Ped-Xing safety will be explored in details on a setting similar to that shown in Fig. 1 with one-way traffic; for a two-way street, one can simply rotate Fig. 1 counterclockwise 180 degree around the axis perpendicular to the plan view to image the opposite traffic.

2. FORMULATION

A plan view with a vehicle approaching a Ped-Xing is shown in Fig. 1 with one type crossing stripes, and different crossing designs have been used to fit in-situ needs in practices [1]. No parking stalls are drawn inside the parking zone because the zone width varies with the angle of parking. Moreover, only two traffic lanes are drawn as an example in Fig. 1, and one can always add more lanes when needed. Parameters D, W_p, and W_d represent, respectively, the longitudinal length of the no parking zone between the leading Ped-Xing edge and the allowed parking zone, the width of the painted parking zone, and the lateral distance between the driver and the outside edge of the parking zone. Since the pedestrian must be made visible to the driver, the following geometric requirement must be met:

$$\frac{D}{S} = \frac{W_p}{W_p + W_d} \tag{1}$$