

Title: CROSSWALKS AT ROUNDABOUTS - EFFECTS OF PEDESTRIAN GUARD RAILS ON UTILIZATION

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Abstract:

General background: Pedestrian injury is one of main concerns in road safety (Hamed, 2001; Gandhi & Trivedi, 2007; Retting, Ferguson & McCartt, 2003; Sispoku & Akin, 2003). After drivers and passengers, pedestrians are the largest group of road users killed or injured in traffic accidents (Johnston & Pearce, 2007).

One of the main areas where pedestrians are the most vulnerable is road crossing. In Israel, many crossroads do not give precedence to pedestrians, making road crossing distressing and dangerous (Cohen, 2008). One method of reducing accidents is turning crossroads into roundabouts, forcing drivers to adjust their speed. This reduces accidents involving pedestrians by about 75% (Sze & Wond, 2007). Roundabouts have become common in Israel in recent years. Beer-Sheva, Israel's sixth largest city (over 200,000 residents), has 122 roundabouts. At roundabouts, pedestrians usually cross at crosswalks on the roads (arms) of the roundabout usually with guard rails along the sidewalks. In Israel, there are no guidelines to determine the need and the length of guard rails at roundabouts.

The rate of pedestrian accidents on road sections with guard rails is generally significantly lower than in places without guard rails (Retting et al., 2003; Zhang, Hill & McDonald, 2007). The guard rails direct the pedestrians to safe crossing areas (Retting et al., 2003).

The goal of this research is to examine the effects of guard rails at roundabouts and the conflicts that may arise. For that purpose we classified urban roundabouts using factors such as: the number of crosswalks on the arms and the existence of guard rails on the various arms. Then we examined pedestrian behavior at crosswalks at representative roundabouts and checked the influence of guard rails on their behavior.

Method: In the first stage of the study, we systematically analyzed all 122 roundabouts in Beer-Sheva. The following factors were used to classify roundabouts: presence or absence and number of crosswalks, volume of traffic entering the roundabout (according to the Beer-Sheva urban travel model, 2005), width and number of lanes entering and leaving the roundabout and within the roundabout, presence or absence of pedestrian guard rails and pedestrian central crossing refuge. The second stage of the study was an observation of ten representative roundabouts (7 of them in Beer-Sheva), with each observation studying two arms with over 60 pedestrians crossing per hour. Each arm was observed three times for one hour each, and the number of pedestrians crossing at the crosswalk or elsewhere was counted. Other factors noted: the presence or absence of guard rails (their length and position), the type of road entering the roundabout (one or two lanes, with or without central separation barrier) and conflicts resulting from the presence or absence of guard rails near the crosswalks. Overall the study included 20 arms and 60 hours of observation.

Results: An analysis of the roundabouts in the first stage showed that over 70% of the arms leading to roundabouts have two crosswalks (with separation between the entering and leaving lanes, where pedestrians can safely stop during their crossing). In 91% of roundabouts there were guard rails on all the arms. In 85% of roundabouts, drivers cannot turn right freely on all the arms

without entering the roundabout.

The observation in the second stage included typical roundabouts, with 80% having pedestrian guard rails on the sidewalk, and 80% had no direct right turn.

The percentage of pedestrians not crossing on the crosswalks was between 9%-76%. This variance can be explained by the volume of traffic, the presence or absence of guard rails, the structure and the view of the road surrounding. Where there was no guard rail and no central separation between lanes, many pedestrians crossed without using the crosswalks keeping their original walking route. Analysis of the observation revealed that high traffic volumes cause more pedestrians to use the crosswalk. The guard rails seem to lead the majority of pedestrians to cross at the crosswalks relatively to sidewalks without guard rails. Few conflicts were found concerning pedestrian crossing around roundabouts: Pedestrians walking on the road alongside the guard rails and diagonal crossing outside the crosswalk.