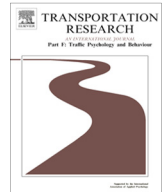


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Estimating preferences for different types of pedestrian crossing facilities



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ABSTRACT

This paper reports the results of a study to understand the preferences of pedestrians towards using different types of road crossing facilities. A preliminary qualitative study found that people's perceptions about crossing facilities are shaped by aspects such as safety, convenience, crossing time, accessibility, and personal security. The main quantitative study consisted of a stated preference survey implemented in three neighbourhoods in English cities near busy roads. Participants were first asked to indicate how comfortable they felt using different types of crossing facilities. Footbridges and underpasses were systematically rated below signalised crossings. Participants were then asked to choose between walking different additional times to use certain types of crossing facility or avoid crossing the road altogether. The analysis of the choices using a mixed logit model found that on average participants are willing to walk an additional 2.4 and 5.3 min to use a straight signalised crossing and avoid using footbridges and underpasses, respectively. Women and older participants were willing to walk longer additional times to avoid those facilities. Participants only avoid crossing the road if the additional time to use straight signalised crossings is at least 20.9 min. The estimated values for the willingness to walk were slightly smaller when using a conditional logit model. The study provides information that is useful for policy decisions about the frequency and the type of pedestrian facilities provided to cross busy roads.

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1. Introduction

The major shift from non-motorised to motorised forms of urban transport that occurred during the 20th century throughout the world has led to traffic dominance of urban streets. As a result, pedestrians became the most vulnerable road user group. An estimated 275,000 pedestrians die every year globally as a result of traffic collisions (WHO, 2015). Roads are also physical and psychological barriers to the movement of pedestrians, with negative impacts on accessibility and social inclusion (Appleyard, Gerson, & Lintell, 1981; Anciaes, Jones, & Mindell, 2016). Transport and urban planners have increased their efforts to rehabilitate the cities for pedestrians during the present century, but they are constrained by the legacy of road networks that exclude or limit provision for non-motorised modes of transport (Illich, 1974). The construction or improvement of pedestrian crossing facilities often become the main alternative to mitigate the impacts of roads on pedestrians, when solutions such as reducing traffic levels or lowering speed limits meet with social and political resistance due to their impact on the accessibility of users of private and public motorised transport.

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However, the provision of crossing facilities does not necessarily improve the ease of crossing busy roads. There is evidence that some types of facilities are generally disliked by pedestrians, which leads to a high incidence of informal road crossing behaviour, away from crossing facilities (Demiroz, Onelcin, & Alver, 2015; Obeng-Atuah, Poku-Boansi, & Cobbinah, 2017; Sinclair & Zuidgeest, 2016) and even to an aggravation of the perceived barrier effect of the road (James, Millington, & Tomlinson, 2005). The assessment of schemes to build new crossing facilities or improve existing ones and the decision on their optimal location along busy roads requires, therefore, an understanding of the preferences of pedestrians regarding different types of crossing facility.

This paper estimates preferences for different types of crossing facilities in terms of pedestrians' willingness to walk to access them. The study commenced with a preliminary stage using focus groups and in-depth interviews to understand perceptions about different types of facilities. The information collected at that stage informed the design of the main stage, a stated preference survey of residents from the catchment areas of three busy roads in England (in London, Birmingham, and Southend-on-Sea), that were perceived to lack a sufficient number of pedestrian crossing facilities. This paper reports the results of two exercises included in this survey: one where participants rated four different types of crossing facilities, and another where they chose between different alternative crossing facilities and varying walking times to access them.

The rest of the paper is organised as follows. Section 2 is a review of the theoretical and empirical background for this study. Section 3 reports the main conclusions of the preliminary qualitative study and the implications for the design of the main survey. Section 4 describes the three study areas and the sampling process. Sections 5 and 6 report the results of the rating and stated preference exercises in the main survey, and Section 7 concludes the paper with a summary and recommendations for policy and future research.

2. Background

The decisions taken by pedestrians about where to cross a road usually involve trade-offs between safety and convenience (Sharples & Fletcher, 2001; Rankavat & Tiwari, 2016). The option of crossing away from designated crossing facilities increases the risk of vehicle–pedestrian collision but is often chosen because it is the quickest and most direct way to reach the other side (Demiroz et al., 2015). The preference for particular facilities also depends on their design and maintenance, which are associated with perceptions about crime and concerns about aesthetics and hygiene (Sharples & Fletcher, 2001; James et al., 2005; Sinclair & Zuidgeest, 2016). Choices may also be explained by personal or contextual factors such as habit (Räsänen, Lajunen, Alticafarbay, & Aydin, 2007), the lack of alternatives (Sinclair & Zuidgeest, 2016), and the location of the crossing facilities relative to the direction of the trip (Yannis, Golias, & Papadimitriou, 2007).

Signalised crossings (Fig. 1a and b) are usually safer than uncontrolled crossings, but may involve detours and delays to the trip due to additional waiting and walking times. In a study in China, 25% of respondents stated they were not willing to use signalised crossings, 60% of them stating time losses (including walking to access the crossing and waiting for the red time) as the main reason (Tanaboriboon & Jing, 1994). Detours and delays are particularly relevant in the case of staggered crossings, where the crossing is completed in two stages (with a time delay) and the crossings on each carriageway are not aligned (Fig. 1b).

Grade-separated crossing facilities, such as footbridges and underpasses (Fig. 1c and d) tend to be safe in terms of vehicle–pedestrian collision but are almost universally disliked, due to the time and effort required to use them, and issues of personal security. This is confirmed in many recent studies in different countries, such as James et al. (2005) in the UK, Räsänen et al. (2007) in Turkey, Mfinanga (2014) in Tanzania, Tao, Mehndiratta, and Deakin (2010) in China, Rankavat and Tiwari (2016) in India, and Villaveces et al. (2012) in Colombia. Some groups such as women and older people are particularly averse to using grade-separated crossing facilities, especially at night time (Rankavat & Tiwari, 2016; Tanaboriboon & Jing, 1994).

The extensive literature on pedestrian crossing behaviour has used a wide variety of methods, including self-completed questionnaires (Bernhoft & Carstensen, 2008), personal interviews (Hine, 1996), video surveys (Sisiopiku & Akin, 2003), pedestrian tracking (Papadimitriou, 2012), experiments (Granié, Brenac, Montel, Millot, & Coquelet, 2014), GIS analysis (Lassarre et al., 2012), and revealed preference analysis (Olszewski & Wibowo, 2005). Most studies found that long waiting times and elements that decrease safety, accessibility, and personal security influence road crossing behaviour, route choice, and the propensity to walk.

Advances in choice modelling techniques have increased the use of stated preference surveys to study pedestrians' choices for crossing locations and types of facilities. This method is based on surveys where participants choose from hypothetical alternatives, defined by several attributes. The choices are then related to the attribute levels using statistical models, from which the willingness to trade marginal changes in the attributes can be derived (Bateman et al., 2002).

Stated preference surveys can be applied to elicit preferences among alternative measures that might be provided to improve the ease of crossing the road. The most radical and most effective of these measures is to build a road tunnel, so that pedestrians can walk 'over' the road, at grade. This scenario was studied by Grisolia, López, and Ortúzar (2015), who modelled the preferences for burying a road taking into consideration the cost of the project and the types of land use on the surface (paved square or garden) and the existence of street furniture and Closed Circuit Television (CCTV). The ease of crossing can also be improved by traffic calming measures or by the reallocation of road space. For example, Garrod, Scarpa, and Willis (2002) estimated preferences for traffic calming measures in terms of cost and reductions in traffic speed,

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