Introducing Human Factors in Pedestrian Crossing Behavior Models
Eleonora Papadimitriou1, Sylvain Lassarre2 & George Yannis1

1 NTUA - National Technical University of Athens, Greece
2 IFSTTAR - Institut français des sciences et technologies des transports, de l'aménagement et des réseaux

Abstract

The objective of the research is the development of pedestrian crossing choice models on the basis of road, traffic and human factors. For that purpose, a field survey was carried out in which a panel of 75 pedestrians were asked to recall 6 short walking trips in two different areas (a low density and a high density area) in the Athens city centre in Greece, allowing to record their crossing behavior in different road and traffic conditions. The same individuals were asked if 1) they are regular pedestrians, their mode choice characteristics, their risks perception and value of time and 2) they are exposed to traffic in Greece. The data used for each pedestrian’s crossing choice behavior were: the road, traffic and crossing scenario data were used to develop mixed logit type models of pedestrian behavior on the basis of risk taking and perception of risk. The resulting models showed that pedestrians’ crossing behavior are significantly affected by road type, traffic flow and traffic control. The questionnaire data were used to estimate human factors components of pedestrian crossing behavior by means of principal component analysis. The results showed that three components of pedestrian crossing behavior emerge, namely a ‘risk-taking and optimism’ component including the tendency to cross at mid-block in order to save time, a ‘risk-avoidance’ component concerning individuals with increased perceived risk of midblock crossing, who also appear to be treated public transportation users, and a ‘pedestrian for pleasure’ component forming together with individuals who do not perform crossing behavior in the three types of behavior and who use the safety crossing facilities available. Although signalized junctions provide pedestrians a protected crossing phase, most of them are seldom incorporated in pedestrian behavior models.

Results

Optimal scaling was applied on the 51 variables of the questionnaire, which were defined as multiple ordinal variables. Three components emerging from the 51 ordinal variables are extracted (eigenvalues>1 criterion). The resulting scales provides an opportunity to the development of pedestrian crossing behavior models. The scale items are presented in Table 1. The table includes the items in their original form, the scores for each item, the overall scores and the significance level.

Discussion

Unlike most existing studies, which either examine only road and traffic parameters and pedestrian demographics, or heavily focus on human factors alone, the present research attempted to examine the interaction between road factors, traffic factors and human factors (pedestrian attitudes, perceptions and preferences) in crossing choice modeling. The basic research hypotheses appear to be largely confirmed. Both fixed and random effects of human factors were found to be significant, although not strongly. However, their contribution to the overall fit of the model is rather small. The method implemented here is an intermediate step towards the introduction of human factors in pedestrian choice models. A two-stage approach was implemented: (i) a principal component analysis to estimate the latent variables “components” and (ii) their scores introduced in the choice model. Only the mean component scores are introduced (i.e. their variance is not included), some measurement errors and inconsistent results may be estimated. As a next step, “integrated choice and latent variables models” can be estimated.

Acknowledgements

This paper is based on a research project implemented with the framework of the Action ‘Innovative Researcher and Technological Expert’ (Athena Research) funded by the European Social Fund and National Resources (Project Code: 42472). The authors acknowledge the support of Jean-Michel Aubry and Marie-Aveline Gard (IFSTTAR, France) for their useful comments and suggestions at earlier stages of this research.