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Title :
The Development of the Pedestrian Crossing Risk Assessment (PedCRA) Model at Signalised Intersections Using Petri Nets Approach

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Accident prediction models are used to estimate accident occurrences related to various identified factors. However, human behavioural factor is always absent from a model parameter since the information is usually unavailable in accident data. This study focused on the development of a model that is capable of integrating the human behaviour, engineering and environmental factors that contribute to pedestrian accident. The developed model can be used to quantify the potential accident risks of pedestrians crossing at signalised intersections in the urban area. Petri Nets π-tool has been applied in this study to achieve integration of behavioural, engineering and environmental factors in assessing the potential risks of crossing pedestrians. Petri Nets is a flexible graphical modelling tool with a strong mathematical basis that is capable of modelling and analysing the system with multiple interactions in pedestrian accident event sequence. Signalised intersections in Kuala Lumpur were used as case studies to predict the risk probability of pedestrian accident occurrences within specific time periods. Site observations were conducted to obtain the pedestrian crossing scenario. The event sequence extracted from this scenario was translated into Petri Nets elements for model formulation. Identified factors were organised into several sub models in the hierarchical model structure. The developed model is called PedCRA (Pedestrian crossing risk assessment) model. Twelve factors were identified as the model parameters and sensitivity analysis was conducted to evaluate the effect of these parameters to the potential pedestrian risk value. The results from this analysis showed that the important parameters are the compliance behaviour of pedestrians, the volume and approach speed of vehicular traffic, the number of lanes and the existence of median. Since the model is designed to only capture an interaction with one approach of the intersections at one time, calibration is required to estimate the risk value for the intersection with 3 or 4 approaches. Validation of the model successfully compared the predicted risk value obtained from the model with the actual risk value obtained from historical accident occurrences at 30 selected signalised intersections in Kuala Lumpur. Chi-Square goodness of fit test indicated that risk values from model and accident data follow the same distribution trend at a 5 percent significance level ($p = 0.05$).