



# SCHOLARLY PUBLICATIONS

## School of Civil Engineering

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**Title:** Pedestrian crash risk analysis using extreme value models: New insights and evidence

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**Abstract:** Facilitating proactive pedestrian safety management, the application of extreme value theory (EVT) models has gained popularity due to its extrapolation capabilities of estimating crashes from their precursors (i.e., conflicts). However, past studies either applied EVT models for crash risk analysis of autonomous vehicle–pedestrian interactions or human-driven vehicle–pedestrian interactions at signalised intersections. However, our understanding of human-driven vehicle–pedestrian interactions remains elusive because of scant evidence of (i) EVT models’ application for heterogeneous traffic conditions, (ii) appropriate set of determinants, (iii) which EVT approach to be used, and (iv) which conflict measure is appropriate. Addressing these issues, the objective of this study is to investigate pedestrian crash risk analysis in heterogeneous and disordered traffic conditions, where drivers do not follow lane disciplines. Eleven-hour video recording was collected from a busy pedestrian crossing at a midblock location in India and processed using artificial intelligence techniques. Vehicle-pedestrian interactions are characterised by two conflict measures (i.e., post encroachment time and gap time) and modelled using block maxima and peak over threshold approaches. To handle the non-stationarity of pedestrian conflict extremes, several explanatory variables are included in the models, which are estimated using the maximum likelihood estimation procedure. Modelling results indicate that the EVT models provide reasonable estimates of historical crash records at the study location. From the EVT models, a few key insights related to vehicle–pedestrian interactions are as follows. Firstly, a comparison of EVT models shows that the peak over threshold model outperforms the block maxima model. Secondly, post encroachment time conflict measure is found to be appropriate for modelling vehicle–pedestrian interactions compared to gap time. Thirdly, pedestrian crash risk significantly increases when they interact with two-wheelers in contrast with interactions involving buses where the crash risk decreases. Fourthly, pedestrian crash risk decreases when they cross in groups compared to crossing individually. Finally, pedestrian crash risk is positively related to average vehicle speed, pedestrian speed, and five-minute post encroachment time counts less than 1.5 s. Further, different block sizes are tested for the block maxima model, and the five-minute block size yields the most accurate and precise pedestrian crash estimates. These findings demonstrate the applicability of extreme value analysis for heterogeneous and disordered traffic conditions, thereby facilitating proactive safety management in disordered and undisciplined lane conditions.



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