

## ABSTRACT

Debnath Mithun, MSCE, Purdue University, May 2024. Crash Potentials of Transportation Network Companies from Large-scale Trajectories and Socioeconomic Inequalities.

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Transportation Network Companies (TNCs) have increased significantly over the last decade, changing the urban mobility dynamics by shifting people from other modes of transportation, potentially affecting safety. This research utilized the twenty-eight days of high-quality and large-scale GPS-based trajectories of Uber vehicles to determine the critical surrogate safety measures (SSMs). To determine the potential traffic conflict and safety from SSMs, this research determined the SSMs based on evasive actions. In addition, this research also utilized real-world historical crash events, traffic flow, road conditions, and congestion index to explore the relationship between critical SSMs and accidents. Additionally, this research extends to assess the socioeconomic inequalities from the perspective of increased TNCs and accidents.

The results indicate that the increased TNCs have increased the critical SSMs' likelihood of crashes. Harsh braking events, harsh acceleration, and harsh deceleration contribute to fatal accidents, whereas, harsh deceleration is dominant for injury, pedestrian, fatal, pedestrian risk, bicyclist, bicyclist accident risk, and motorist accidents. Also, jerk events contribute more to injury accidents, severe accident risks, and motorist accident risks. In addition, we identified that spatial heterogeneity prevails for different SSMs and accidents. The results also show that Manhattan performed the worst for all accidents, especially for vulnerable road users (VRUs). Injury and motorist accidents are more pronounced in Queens and Brooklyn, whereas, Queens performed badly for the total number of accidents, and Manhattan and Brooklyn were found to be higher in pedestrian and motorist accidents. Also, we find the existence of inequality in the increase in accidents and critical SSMs, and Manhattan is higher in inequality, especially in upper Manhattan. Moreover, individuals disadvantaged from low socioeconomic status and those living in deprived areas are experiencing more inequality from accidents and critical SSMs due to increased TNCs and accidents. The findings of this research may help to get a holistic understanding of the road safety situations due to increased TNCs and help the policymakers and authorities to make informed decisions to develop a transportation system prioritizing all road users.