Developing Trip Generation Model for Mixed-Use Building in Dhaka

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Abstract

Travel demand forecasting is the prerequisite to transportation system design and policy planning. Trip generation comes first in the four-step travel demand forecasting process. Generally, Trip generation for land use is estimated using the Institute for Transportation Engineers (ITE) trip generation manual, developed in the USA context. Trip rates from the ITE manual are not fully applicable in Bangladesh as there are noticeable differences in socio-economic characteristics and road infrastructures. Moreover, the ITE manual provides trip rates for single-use buildings, underestimating trips by non-motorized vehicles (NMV) and pedestrians. Recently, mixed-use buildings (a combination of residential, commercial, or institutional functions into one building) have become prominent in Dhaka – the capital city of Bangladesh. In recent years, a few studies have started addressing the ITE manual's weakness in Dhaka. Ahmed et al. estimated peak hour trip rates for six land use categories: residential, commercial, educational, healthcare, office, and garment manufacturing. Rahman et al. and Uddin et al. studied the trip generation rate for commercial land use. Mamun et al. estimated trip attraction rates of shopping centers having shops, offices, and restaurants—however, Mamun et al. developed a trip generation model only for shopping malls. Javed et al. established a model for estimating trip rates considering the shopping center as a single-use building. It can be noted that none of the above studies considered mixed-use buildings per se. To determine the impact of mixed-use buildings on transportation demand and roadway capacity, this study aims to develop trip generation rates for mixed-used buildings, i.e., the buildings that host different facilities such as shops, restaurants, hospitals, banks, and educational institutions concurrently. Surveys are conducted to collect primary data for this study. The data collected during the survey can be grouped into two primary categories. The first questionnaire survey of the business owners is conducted to collect data about the functional characteristics of the selected mixed-use sites. The information collected during this survey includes Gross Floor Area (GFA), parking space, number of employees, number of seats (for restaurants), number of beds (for hospitals), freight vehicle ownership, and peak hours of the business. Second, the vehicle and pedestrian counts at all entry and exit points of the selected sites, and vehicle occupancy information is gathered through observational and intercept surveys. The vehicle count data is collected during the peak hours of the business. After data collection, a model is developed to analyze and predict trip generation rates for the selected sites. Different analytical approaches, such as linear regression and weighted average, are compared for data analysis. The estimated trip rates are checked against the values provided in the ITE manual and Ahmed et al. The developed model might need to be calibrated to increase the predictive accuracy and decrease the anomaly with the observed data. The developed model can be used as an effective tool to establish trip generation rates for mixed-use buildings in the context of densely populated developing countries like Dhaka. The estimated trip generation rates will help transportation planners forecast the future trip generation of the proposed mixed-use buildings. This is crucial for the transportation impact assessment of major development projects.

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