ISSN: 2513-2504

Trips-in-Motion Time Matrix to Identify Time Windows as an Input for Time-of-Day Modelling

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Time-of-Day (ToD) modelling is an additional step to the conventional four-step Travel Demand Models (TDMs). ToD models are developed to obtain more detailed outputs over the temporal dimension, specially focusing the metropolitan level where need more demand management solutions. With this additional step, daily (24-hour) travel demand is distributed into a discrete number of time-windows. Simulation of the peak period is one of the major concerns in ToD modelling. Traditionally, the trip allocation into time-windows is based on departure-time, arrival-time or temporal mid-point of individual trip timing. Even though the past studies have applied either one of above trip timings, the major drawback of this was not considering the total trip duration. The trips-in-motion concept is applied to estimate the actual trips/vehicles traversed within a particular time window, where the concept follows a more logical approach of capturing the entire trip duration compared to the three time stamps above. The objective of this paper is to identify the most precise starting-time stamps that maximize the trips that fall within a given time-window and minimizes the trip-tailing associated with it. A time-matrix was introduced to apply the trips-in-motion concept to meet these objectives and all trips were allocated to the time matrix based on departure and arrival time stamps of each trip. Time-matrix represented the entire day (24-hour) and the time window represented a few cells of the matrix. Then, all door-to-door trips were evaluated according to four criteria which reflect the objectives of the study. Finally, the precise starting-time stamps for time windows were selected that comply with all four criteria. The 2013 database of Colombo Metropolitan Region Transport Masterplan (ComTrans) was analysed using Bentley Cube Voyager transport demand modelling software. First, we distinguished morning, mid-day and evening peak periods. Then, the most precise starting timestamps of two-hour time windows were selected for each peak, as 6:30 A.M., 01:30 P.M. and 05:00 P.M. respectively. Further, it was estimated that 52% of door-to-door trips are traversed only these time windows. The above results are similar those of the ComTrans peak-periods, which reported 7 - 8 A.M., 1 - 3 P.M. and 5 - 7 P.M. as peak periods in which 55% of daily trips took place. The study was further extended to motorized transfers of trips, which account for only 78% of door-to-door trips. The results were the same as for door-to-door trips. The proposed method paves a rational approach to derive time windows to represent peak characteristics and are consistent with previously defined values. Therefore, this study has developed a systematic approach to identify time-windows as an input for ToD based modelling. The above results were limited

to two-hour time windows and also the passenger modes were neglected, but there are provisions to test such scenarios. It is recommended to study further the shift in peak periods with the change in time of demand which would be the behavioural change most expected to occur post COVID-19.

Keywords: *Time of day, Travel Demand Model, Time-Window, Trips-in-motion***,** *Time-Matrix*