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論　文　内　容　の　要　旨

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This research has been placed in a milieu where existing methods on modeling vehicular traffic volume were hampered by data, cost and technical know-how constraints, especially in developing countries. To overcome those constraints, this study developed an alternative approach to model vehicular traffic volume on road segments by a network centrality-based simulation. The proposed model utilizes betweenness (BC) and closeness (CC) centrality to capture 'pass-by' and 'origin-destination (O-D)' trips respectively. The study introduced 'path distance' variable to capture topological and mobility characteristics of roads, 'trip length-based moving boundary' to eliminate edge effect, and a growth factor to capture socio-economic changes. The study proposed 'aggregated-zonal-level centrality' variable, to capture inter-zonal and intra-zonal closeness; and relative-aggregated-closeness centrality variable, to capture the attractiveness of the destination zone compare to the zone of origin. The proposed approach has been validated internally and externally, in three Sri Lankan case cities. Further, the study discussed the applicability of the proposed approach as a strategic planning and investment tool with reference to three demonstrations. The study compared and contrasted the advantages and disadvantages of the proposed approach with a comparison to the existing methods. Furthermore, the study developed 'centrality spectrums' and 'tailor-made guidance' which describes application options of the proposed approach per the data availability.

The results revealed that centrality values computed based on the proposed path distance recorded higher R^2 value compare to the centrality values computed based only on the topology of the road network. The model is on a par with the international standards (R^2>0.85,MdAPE<30% and RMSE<30%) and able to predict future traffic volume as accurate as the multi-step demand modeling. The mode can be caliberated by using little amount of actual observation points (N<40). Further, the findings of this research revealed the ability of modelling the volume of generation at aggregated zonal level by utilizing 'aggregated-zonal-closeness-centrality'(R^2>0.85,MAPE<25%); and the trip distribution between zones by utilizing 'relative closeness-centrality between trip destination zone and trip origin zone' (r=0.674,p<0.01). Findings of this study indicated that the proposed approach is a capable tool to estimate and predict traffic volume and predict traffic volume of road segments based on new road scenarios. The proposed approach requires only road network data and able to implement by using publicly available network analysis software. In the proposed approach BC and CC are outputs of traffic volume model which simulates pass-by and O-D trips respectively. Thus it replaces all four stages of the traditional transport model; particularly its applicability is prominent in data scarcity (land use, trip data) and cost-constraint situations. The research contributes to the transport engineering and planning applications by developing a strategic, cost-effective and technically efficient approach which can utilize as a planning and decision-making tool to model traffic volume in planning road networks.