Mitigating the intrazonal problem of non-motorized trips in macroscopic travel demand models

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10/2013
☒ ongoing ☐ finished: MM/20YY

Background
Because of the potential environmental, social and health benefits of walking and cycling, non-motorized modes have received increased attention and the need to account for them in travel demand models has long been recognized. However, non-motorized trips are generally short trips, and in macroscopic models, many of them end up in the same traffic-analysis zones. Since the spatial aggregation nature of these models makes it difficult to model intrazonal trips very precisely, the treatment of non-motorized trips in such models is limited.

Two possible ways to mitigate the intrazonal problem for non-motorized modeling include (1) improving the estimation of intrazonal impedances to enhance the estimation of intrazonal trips and (2) refining zone systems to limit the frequency of intrazonal trips.

Aim and Objectives
The research seeks to enhance the capability of macroscopic travel demand models in estimating non-motorized travel demand by finding the most suitable method for estimating intrazonal impedances, and defining an optimal level of resolution for traffic analysis zones.

Estimating Intrazonal Impedances
Over the years, a number of approximate methods have been used for estimating intrazonal impedances. These include the nearest neighbour technique and other methods that relate intrazonal impedances to sizes of zones.
Along with the existing methods, the research proposes and tests the suitability of a new method which uses network nodes as trip ends and calculates the weighted average trip impedance within a zone. Using different centrality measures to assign weights to nodes, different variants of the proposed method are specified. These include base, degree and closeness.

Comparing to a reference case where average intrazonal distances are estimated between building blocks, the results as shown in Figure 1 indicate that the proposed method provides better estimates of intrazonal impedances than the existing methods.

**Finding the optimal level of spatial resolution**

Recognizing the interdependence of network detail and zone resolution, the research uses total network length within a zone to define spatial resolution; and using the quadtree concept, creates a number of variably sized zone systems for different levels of spatial resolution.

After comparing assignment results and the number of generated raster cells for each level of spatial resolution to a reference zone system, the results as shown in Figure 2 indicate that the optimal level of spatial resolution is 600 m network per zone, and that the extra validity achieved by further increases in resolution beyond this level is not worth the cost associated with the resultant number of zones.

**References**


*The research is conducted within the mobil.LAB Doctoral Research Group and is funded by the Hans-Böckler-Foundation*