Configurational Spatial Modelling of Detailed Large-Scale Vehicle Network: A Case Study of the Nantes Conurbation

Alain Chiaradia, Bill Hillier, Alan Penn, Noah Raford
Space Syntax Limited, UK.
a.chiaradia@spacesyntax.com.

Abstract

Past research has shown that 'configurational' road network modelling can be a powerful tool for forecasting vehicular flows in dense urban environments. It has been shown that road networks strongly influence the pattern of flows through quantifiable properties of the network integration, where spatial accessibility and effective road width account for the majority of the variance in flows from street to street ($r^2 = 0.8$). These studies suggest that rates of vehicular movement along road segments are the direct outcome of the location of those segments in the network as a whole, and that this is especially the case in the fine structure of dense urban grids. To date, most such studies have focused on high-density urban environments. The present paper examines the relationship between network configuration and vehicular traffic in the context of large, low-density suburban conurbations. The case of Nantes, France is used, which covers an extent of $250km^2$ - including a 12 km diameter orbital motorway, several surrounding communities, and more than 650,000 inhabitants. It was found that correlation with vehicular flow increased in Nantes with every step upwards in radius, peaking r^2 0.8 at radius-n.

The findings of this paper were unanticipated because automated vehicular counts were available only on main, trunk, and feeder roads, resulting in a data set that was biased towards high integration segments. Such data sources have traditionally been thought to be unsuitable for syntactic analysis because they exhibit less variation in configurational measures than would be found in denser areas. Adequate distribution of configurational values is therefore necessary to achieve reasonably descriptive correlations. The results of this study suggest that integration can still be a powerful predictor, even in low-density environments with sparse configurational data. The paper concludes with a discussion of recent activity-based modelling systems used in travel demand forecasting. Both fixed and dynamic road network accessibility and land use representations are discussed, and the implications of a configurational network understanding for travel demand management (TDM) strategies and travel control measures (TCM) are put forth.

Literature

Bloch, A., (2003) Modélisation des déplacements urbains de voyageurs, Guide des pratiques. Setec - Centre d'études sur les réseaux, les transports, l'urbanisme et les constructions publiques (CERTU), Ministère des Transports, du Logement du Tourisme et de la Mer.

Du Crest T., Bougnol J., Héaulme J., (1999) Zones et établissements générateurs de trafic. Recueil de données de compatage, Centre d'études sur les réseaux, les transports, l'urbanisme et les constructions publiques (CERTU), Ministère des Transports, du Logement du Tourisme et de la Mer.

Hillier B. (1999) Centrality as a process: accounting for attraction inequalities in deformed grids, *URBAN DESIGN International* 4(3&4), p. 107-127.

Penn A., Hillier B., Banister D., Xu J. Configurational modelling of urban movement networks, *Environment & Planning B*, Planning and Design 1998, vol. 25, p. 59-84.

Ortuzar J. de Dios, Willumsen L. G. (2001) Modelling Transport, Wiley, 2001

Ortuzar J. de Dios, Hensher D., Diaz Sergio Jara, (1998) Travel Behaviour, Research : updating the state of the play. Pergamon.

Marshall, S. (2003) Route Structure analysis, in: *Conference Proceedings European Transport Conference*, Strasbourg, France.

van Nes, A. (2002) *Road building and urban change, the effect of ring roads on the dispersal of shop and retail in western European towns and cities*, Doctoral Thesis, agricultural University of Norway, Department of land Use and Landscape Planning.

Wiel, M., (1999) La transition urbaine, le passage de la ville pédestre à la ville motorisée, P. Mardaga, Liège.

US Department of Transportation, (2000) Activity-Based Modelling System for Travel Demand Forecasting, Travel Model Improvement Program, on going.