



A demand-based methodology for planning the bus network of a small or medium town

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Abstract

This work aims at developing a demand-based methodology for designing the bus network of a small or medium town. The proposed modelling tool adopts a multi-agent objective function which evaluates performance in the context of different stakeholders: the surplus of travellers (car and bus users); the bus service provider's revenues and operation costs. This approach was applied to an existing bus network, serving Trapani, which is a medium town in the south of Italy (Sicily), with 100000 inhabitants. The bus-based public transport system attracts only about 5% of commuter trips within Trapani (source: National Institute of Statistics, 2005). This paper reports on an analysis of the application of the proposed multi-agent modelling tool to two planning scenarios: the first is *short-term* and characterized by a budget constraint (slight changes in the availability of drivers and vehicles) and the second *long-term* with new investments in new buses to improve services and increase patronage. In both cases, the impact of the recent car park charging policy launched by the local administration was considered.

The decision variables for the optimisation procedure were route, service frequency and capacity of each bus line. A *random utility model* was employed to forecast the mode choices for trips within Trapani and the travel demand-supply equilibrium was obtained using the *DUE (deterministic user equilibrium) assignment algorithm*, for private transport, and the *hyperpath network loading algorithm*, for public transport.

The optimisation procedure led to a more efficient bus network characterized by increase in bus frequencies and a better performance in terms of reduced travel time, especially for trips bound for the "old town" in the morning. In addition, a higher number of origin-destination pairs were served, at the expense of the need to interchange between the inner more frequent and the outer less frequent services. This implied that the number of transfers from one bus line to another significantly increased.

Keywords: Urban public transport; Bus network design; Park pricing; Mode choice simulation.

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