Linking Transport And Land Use Planning: The Microscopic Dynamic Simulation Model Ilumass

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Biography

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Introduction

All cities in Europe struggle with the problems of urban sprawl and traffic congestion, yet mostly with little success. It is increasingly becoming clear that market forces will continue to lead to ever more dispersed, energy-wasteful urban settlement patterns. Land-use policies like the promotion of higher-density, mixed-use urban forms more suitable for public transport become necessary. But only a combination of land-use policies and transport policies promoting public transport and containing the private automobile can limit further urban dispersion and free metropolitan areas from their increasing auto-dependency. It is therefore necessary to develop modelling approaches in which the two-way interaction between transport and land use is modelled (Alvanides et al., 2001).

The Microscopic Dynamic Model Ilumass

The project ILUMASS (Integrated Land-Use Modelling and Transportation System Simulation) aims at embedding a microscopic dynamic simulation model of urban traffic flows into a comprehensive model system that incorporates changes of land use, the resulting changes in activity behaviour and in transport demand, and the impacts of transport on the environment (Wegener 1998). The results of the policy scenarios will contribute to the knowledge about feasible and successful policies and policy packages to achieve sustainable urban transport (Claramunt et al., 2000).

The innovation of this approach is a continuous microscopic transformation of land use, activity and transport demand, and environmental impacts. First, a synthetic population is generated. The design of the land-use model takes into account that the collection of individual micro data (i.e. data which because of their micro location can be associated with individual buildings or small groups of buildings) or the retrieval of individual micro data from administrative registers for planning purposes is neither possible nor, for privacy reasons, desirable. The land-use model therefore works with synthetic micro data, which can be retrieved from generally accessible public data. The synthetic population consists of households and persons that make activities, firms that provide workplaces and that offer goods or services, and buildings for residential, commercial, or public use. Since the synthetic micro data are statistically equivalent to real data a microsimulation model can run with synthetic data.

The activity generation model, which replicates and forecasts time dependent O-D-matrices (input for the traffic flow model), is based on the microsimulation of the individual activity scheduling process. For each simulated person – one person stands for a defined number of people of the synthetic population – the daily/weekly sequence of different activities and trips is generated. In a first step for each person an individual activity repertoire is generated, which contains a set of activities and their characteristic attributes for execution e.g. duration, frequencies, priorities and period of time (preferred start/end time) including an individual set of possible locations. In a second step, based on a skeleton schedule (routine or habitual activities), the different activities of the repertoire are put together in an individual activity programme. The modelling of this activity scheduling process underlies a lot of decisions (long-, mid- and short-term), about which activity has to be scheduled next, how to perform the activity, and how to solve conflicts which may occur between different activities and trips during the scheduling process. Therefore an empirical database is build up, which contains initial information on different activity attributes on time, space and mode as well as parameters describing the planning related attributes such as flexibility, variability and routines. The activity generation model is integrated in an iterative modelling process and linked with information about accessibility of locations and travel times and therefore it is directly connected to the land-use and traffic flow simulation (Schäfer et al., 2001).

The microscopic traffic flow model establishes the connection between the infrastructure of the city and the individual activity behaviour. In that step of the model, the planned trips are realized taking their interaction into account. As a result you get information about the practicability of the planned trips. That information is used in an iteration process in which plans are rescheduled leading to an equilibrium situation in which all plans are feasible. In addition to this short-term feedback you get the environmental impact of the traffic which can be used to influence long-term plannings of the simulated individuals.

The result is a comprehensive model system incorporating changes of land use, the resulting changes in activities and in transport demand, and the impacts of transport on the environment. Study region for tests and first applications of the model is the urban region of Dortmund consisting of the city of Dortmund and 25 surrounding communities with a population of about 2.6 million. After its completion the integrated model is to be used for assessing the impacts of potential transport and land-use policies for the new land-use plan of the city of Dortmund.

ILUMASS is a joint research project of institutes of the German universities of Aachen (Department of Urban and Transport Planning), Bamberg (Institute of Theoretical Psychology), Dortmund (Institute of Spatial Planning), Cologne (Centre of Applied Informatics), and Wuppertal (Institute of Urban Studies and Sustainable Infrastructure Planning) under the co-ordination of the Institute of Transport Research of the German Aerospace Centre (DLR) in Berlin.

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