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TIGRIS XL land-use model

Using the TIGRIS XL model to predict transport and land-use developments

Abstract

The TIGRIS XL land-use model is a simulation model that can help urban planners by providing projections of land-use developments and transport demand under different spatial and transport scenarios.

The model is capable of handling demographic and macroeconomic developments and spatial policies in terms of infrastructure investments and land-use planning scenarios. Greater flexibility exists in constructing land-use scenarios with various combinations of measures, e.g., housing production targets for the region, exclusion of green belt areas from urban development, level of government influence or specific demolition rates.

Finally, the model is used to evaluate the spatial economic impacts of potential transport and spatial planning policies. Though this model was originally developed for the Netherlands, the concept of the model is generic and can be adapted for application to urban regions in other countries as well.

Over the last decades it has become clear that the problems of ongoing transport growth in urbanized regions, like congestion and environmental externalities, cannot be solved by conventional transport measures alone. A wider approach, incorporating the urban/regional system and its interactions with transport, is needed to manage and facilitate transport demand efficiently and minimise its negative externalities.

Land-use and transport interaction models are appropriate instruments to forecast land-use responses to transport change. Such models are dynamic in structure, and iterate between transport and land-use components to simulate how the system evolves over time. The integrative approach provides consistent transport demand projections under different macro economic and spatial planning scenarios.

TIGRIS XL is a land-use model, which is fully integrated with the National Transport Model (NMS) of the Netherlands and was used in the UK in the development of a Generic Urban Model (GUM). Its comprehensive modular structure provides greater flexibility towards the modelling of important spatial processes and the implementation of different spatial policies.

Model structure

The model incorporates four specific land-use components including modules for: demography; land-use and real estate market; housing market; and labour market.

Demographic module

This module addresses the transition processes of the population and households. It simulates ageing of the population, birth and deaths, and migratory flows.

Land-use and real estate market module

Accounting for changes in land-use, buildings, office space and houses, this module addresses both brown field and green field developments. The level of market regulations when modelling land-use changes can be varied between a regulated land-use planning system to a free market.

Housing market module

This module simulates household migration with a decision to move or stay, and a conditional subsequent residential location choice. A wide set of explanatory variables is used in the choice models, such as household characteristics, neighbourhood amenities, prices and accessibility. Travel accessibility is taken from the transport model in the form of accessibility measures founded in micro economic utility theory (combining mode and destination choices), providing a direct linkage between the two models. Separate models have been estimated by household type by using the Dutch housing market survey (over 100,000 respondents) as primary source.

Labour market module

This module models the changes in number of jobs

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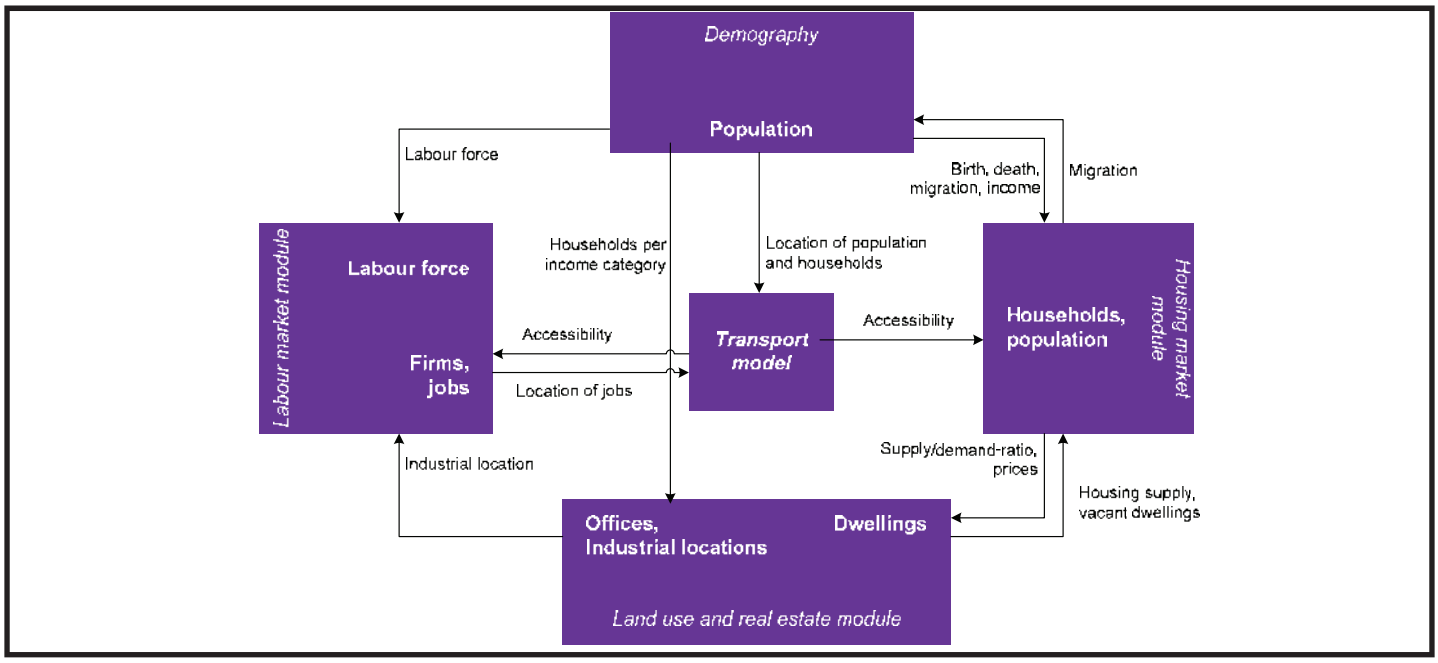
Figure 1: TIGRIS XL land-use model structure



by sector and changes in the workforce at a detailed geographical level. Separate models have been estimated from time series data (1986–2000) for seven economic sectors to account for preferences in location among sectors.

Application

The TIGRIS XL model has been developed for the Transport Research Centre in the Netherlands to evaluate a variety of transport and spatial policies. Examples of the application of TIGRIS XL for policy issues include:

- Assessment of the long-term impacts of transport policies on the spatial distribution of residents and jobs;
- Assessment of the effect of alternative land-use policies on the transport system, including the assessment of a free or regulated land-market, which addresses the responses of non-government actors like residents and firms on spatial developments;
- Developing an instrument to develop and test integrated policy packages, including land-use, infrastructure and pricing policies.

TIGRIS XL is currently being applied to the evaluation of a number of alternatives for the new A18 highway in the Netherlands. Consideration is given to transport, spatial economic, and housing market effects.

Though the model was originally developed for the Netherlands, the concept of the model is generic and can be adapted for application to other urban regions in other countries. An example of such an application of the TIGRIS XL model is the implementation of the approach in the development of a Generic Urban Model (GUM) for the UK Department for Transport. In this case TIGRIS XL can interact with the Central Leicestershire Transport Model.

Acknowledgments

The TIGRIS XL model has been developed by RAND Europe and its partners BureauLouter and Spiekermann & Wegener for the Transport Research Centre in the Netherlands.

Further reading

Zondag, B., Pieters, M., Schoemakers, A. (2004) `Waarom verhuizen we? En waar gaan we dan naar toe?´ Paper presented at the Colloquium Vervoersplanologisch speurwerk: http://www.vervoersplanologischspeurwerk.nl/cvspdfdocs/cvs0408.pdf [in Dutch].

Zondag, B., De Jong, G. (2005) `The development of the TIGRIS XL model: A bottom-up approach to transport, land-use and the economy.´ Paper presented at the *Economic Impacts of Changing Accessibility* conference at Napier University from 27th to 28th October 2005: http://www.tri.napier.ac.uk/Events/Freight/Abstracts/zondagdeJong.pdf.

Zondag, B., Pieters, M. (2005) `Influence of accessibility on residential location choice,´ *Transportation Research Record: Journal of the Transportation Research Board,* 2005. No. 1902, TRB, National Research Council, Washington, D.C., pp. 63–70.