The Evolution of Computer-Based Planning Tools

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The use of computer models in the planning of land use and transportation and for the analysis of urban housing markets has a long and variable history. One pioneering application of a large-scale computer model that linked land use and urban transportation was the 1960 Chicago Area Transportation Study. It used a spatially disaggregated model that included a detailed transportation network and embodied the classic land use, trip generation, modal choice, and network assignment steps of urban transport planning.

Applying a more analytic approach to predicting land use patterns, an influential model formulated by Ira Lowry for Pittsburgh in 1964 used economic base theory to distribute export-oriented economic activity. This was followed by the allocation of residences and population-serving employment within the metropolitan area to derive work and shopping trip patterns.

More attention to spatially disaggregated models of urban housing markets followed in the early 1970s in the form of the Urban Institute Housing Model (representing decadal housing market changes) and the National Bureau of Economic Research Urban Simulation Model (a microanalytic model annually projecting the behavior of 85,000 households identified by workplace and residential locations). Both models were used to analyze the impact of housing allowance programs and were applied more for policy analysis than planning.

In the late 1970s, the focus turned to the development and application of sketch planning models, particularly in transportation. While these models were still spatially disaggregated, they used tens instead of hundreds of traffic zones, and transport networks were represented in less detail. Such models were adapted to represent transport-related outcomes beyond network flows, including vehicular emissions, exposure of populations to air pollution, vehicle miles of travel, and energy consumption. These smaller models migrated from mainframe computers to personal computers in the 1980s, easing their application. Their data needs were still great, but many of them made more systematic use of available spatially disaggregated census data, aiding the transfer and calibration of models among locations.

In the past two decades, the advent of geographic information systems (GIS) and the development of software to visually display data in three dimensions have been transforming the use of computers in planning. GIS-compatible data are now available from satellites, census sources, and government agencies. Local municipalities have moved rapidly to combine their data on property records with data on crime, transport, and demographics, and such municipal data files are often available on the web. While the availability of GIS data has clearly increased, variations in formats, definitions, and coverage can make it challenging to combine information from different sources into a unified data set for a metropolitan region.

The use of three-dimensional displays of spatially disaggregated data has transformed the presentation of data and model results. These techniques, including 3D maps at the metropolitan level and the ability to "fly through" a street or neighborhood at the project level, facilitate community consultation. They also make it much easier for nonspecialists to understand and participate in the process and interpret the results of alternative planning scenarios.

Along with the advances in data and its presentation, computer software has become easier to use and more widely available on open source platforms. While the codes of many earlier computer-based planning tools have been available in the public domain, using them generally has required high-level programming skills. As more of these tools are presented in user-friendly formats and integrated with other modules, the use of computer-based methods to compare and contrast alternative development scenarios will be more accessible than ever. Indeed, many planning agencies are now able to use scenario planning tools to produce alternative possible futures that provide a foundation for discussions and public consultations to identify which outcomes are desirable and which are to be avoided.

As reported elsewhere in this issue of *Land Lines*, the Lincoln Institute is supporting the use of various types of planning tools for research and evaluation on the effectiveness of policies intended to improve land development outcomes.