Developing a Dynamic Land-use and Transport Model for Examining Urban Growth and Predicting Future Urban Change†

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Integrated land-use and transport modeling is becoming an increasingly important tool to examine and mitigate the accelerated growth of urban complexity, policy analysis and many other decisions regarding urban infrastructure and transportation investment. In current practice a numbers of land-use modeling tools are available. The relatively common land-use model include Putman's (1983, 2005) gravity-based ITLUP, input-output model like de la Brra's (1989,1984) TRANUS, Hunt and Abraham's PECAS (2003). The micro simulation-based land-use models are Landis and Zhang's (1998) CUF, ILUTE and Waddel's(2003) UrbanSim. The other models include Simmond's (2001, 1999) DELTA, Martinez's (1996) MUSSA and UPlan (Johnston et. al.2003).However, most of the existing modeling techniques have been criticized due to their insufficient theoretical background (Lee 1973 Wegener 2004), aggregate behavior (Wegener 2004, Wilson 1997) and static in nature. Even to date there is a little evidence of accurately simulating and predicting dynamic urban growth at the detailed spatial location of land parcel or household level.

The present study aims to development and application of a dynamic land-use and transport model for the Seoul city. This working paper developed and implemented state of the art UrbanSim integrated land-use and transport model in Yongsan-gu (Seoul). UrbanSim (www.urbansim.org) is a latest open source, software based micro-scale urban growth simulation model, developed and employed in a numbers of cities over the past several years (Waddell 2007) and simulates the development of urban areas including land use, transportation and environmental impacts over periods of twenty or more years under different scenarios (Noth*et al.* 2003).

The principal models are accessibility model, Household location choice and Relocation model, Employment location choice and relocation model, Real estate project choice and Land price model. Economic and Demographic transition are external model as well.

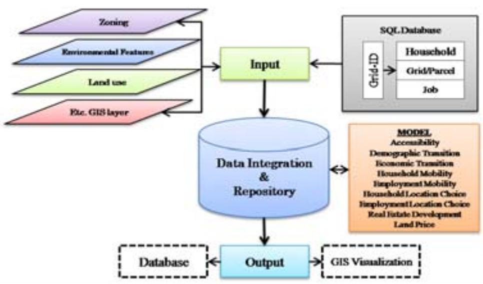

Fig 1. UrbanSim Model Structure

† This work was supported by the National Research Foundation of Korea Grant funded by the Korean Government (NRF- 2009-413-D00001)

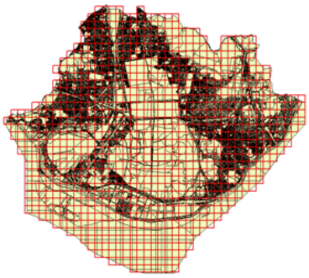

Fig 2. 150/150 meter grid cell.

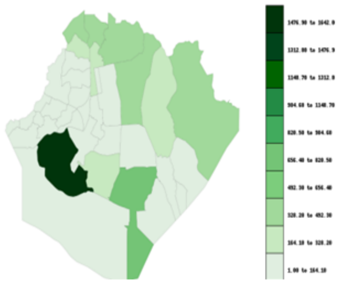

Fig 3. Job Simulation.

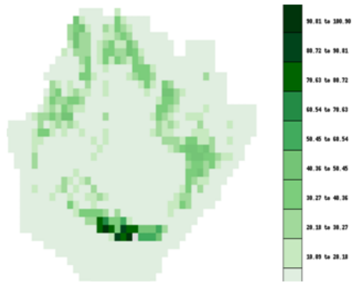

Fig 4. Population Densities 2005

The study area Yongsan-gu was divided into 150/150 meter grid cell. Each land-use characteristics including commercial, residential, industrial and government uses were classified and aggregated into grid cell. The main grid cell table was developed by using cadastral map (1999,2001,2005). Residential and non-residential land values were used as a proxy for land price and uses of commercial square footage and residential units were obtained from Building Register (2002,2003,2005). The contents of household's tables were acquired from the Household Travel Survey (2002, 2005). The employment tables were developed and distributed by following commercial sqft from gird cells table. In addition, Google earth and Daum map had assist in tracking building density, road network and other land-use characteristics to ensure each acquired information place into accurate grid location.

All inputs data to the model were geo-coded and loaded into base year 2005 simulation cache. Before running simulation, each model was estimated separately by using a set of explanatory variables. The base year 2005 simulation was run initially.

Simulation results can be visualized in both map and tabular file. The outputs indicate good model fits however, model transition and prediction for the year 2005~2020 will be carried out in the next level. Besides, including the interesting observations, work needs to be carried out in large scale to whole Seoul area and analyzing very specific cases. This study outcome will eventually assist urban planners, policy-makers, and local authorities to better policy analysis and ease long term decision making process as well as expedite the realization of creating a sustainable city.

References

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[2] Waddle P., 2002), "UrbanSim: Modeling Urban Development for Land Use, Transportation, and Environmental Planning" Journal of the American planning association 68,3.pp 297-314.