Micro-Level Land Use Simulation for Estimating Demands on Urban Infrastructure

Hsi-Hwa Hu (Southern California Association of Governments)
Do Kim (California State Polytechnic University - Pomona)
Simon Choi (Southern California Association of Governments)

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SCAG Overview

- 6 counties – Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura
- 191 cities
- 38,000 square miles
- 18 million residents
Background

- SCAG supports subregions and local governments to develop their Sustainable Communities Strategy (SCS), which is the requirements from SB 375.
- SCAG has developed Sustainability Tool (ST), a GIS based sketch planning tool that helps local planners develop land use strategies.
- ST displays instant results estimating the future urban infrastructure including VMT, water, and land.
Land Use Scenario Simulation Approach

- A scenario is an internally consistent view of what the future might turn out to be - one possible future outcome.
- Scenario defines range of possible future condition.
- Land use - transportation planning scenario practice emerged in the 1990s.
Micro-Level Land Use Simulation

- Parcel is the finest unit of urban space.
- Urban space is composed with a variety of different parcels.
- It is possible to quantify the development potentials of each parcel by modeling physical conditions of the parcel.
SCAG Sustainability Tool (ST)

- A customized GIS application that supports the creation of land use scenarios by composing and allocating development types
- Calculating the extents of socio-economic impacts generated by the allocated development types
- Comparing the land use scenarios using performance measures such as water/electric consumption, VMT, and BMI
Work Flow of ST

Input Data
- Base Parcel Shapefile (Base.shp)
- SCAG Prototypical land use types (SCAG_DevTypes.dbf)
- TAZ Shapefile (TAZ.shp)

Scenario Design
- Sub-setting
  - Subset.dbf
- Updating

Land Use Type Calibration /Creation

Land Use Allocation

Performance Measures

User Inputs
- Scenario Names
- Local Parking Requirements
- Control Totals

Creating
- Scenarios.dbf

Scenario Allocation Summary Table
- Scenario Allocation Summary Table (ScenarioName_Sim.dbf)

Scenario Parcel shapefile
- Scenario Parcel shapefile (ScenarioName.shp)

Summarizing
- CompTable.dbf

Copy/Creating
- Export Table (*.dbf)
Input Data

- A study area parcel layer
- SCAG’s standardized land use types
- A TAZ layer
Scenario Design

- **User Inputs**
  - Scenario names
  - Local parking requirements
  - Control total (optional)

- **Parcel type selection**
  - Select applicable parcel types from the standardized land use types.
## SCAG’s Standardized Land Use Types

<table>
<thead>
<tr>
<th>Categories</th>
<th>Types</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Residential</td>
<td>Single Family</td>
<td>2.4 du/ac</td>
</tr>
<tr>
<td></td>
<td>Multi Family</td>
<td>13.1 du/ac</td>
</tr>
<tr>
<td>Employment</td>
<td>Commercial</td>
<td>26.1 emp/ac</td>
</tr>
<tr>
<td></td>
<td>Office</td>
<td>130.7 emp/ac</td>
</tr>
<tr>
<td>Mixed Use</td>
<td>Industrial</td>
<td>13.1 emp/ac</td>
</tr>
<tr>
<td></td>
<td>Mixed Use</td>
<td>15.3 du/ac</td>
</tr>
<tr>
<td></td>
<td>Mixed Use</td>
<td>91.5 emp/ac</td>
</tr>
</tbody>
</table>
Land Use Type Calibration/Creation

- Make adjustment on the selected land use types in a way that they fit with local circumstance
- Add new land use types
Parcel Design Example

- A 7 story mixed used parcel
  - 3 story residential
  - 1 story office
  - 1 story retail
  - 2 story underground parking
  - Surface parking (30%)
  - Open space (10%)

![Parcel Design Example Diagram]
Development Type Allocation

- Allocate land use types to the scenario parcel files
- During this process, all of the allocated data is summarized and stored into a table
Allocation Example
Performance Measure

- Compare the performance measures of the scenarios
  - Development acres
  - Dwelling units
  - Population
  - Employment
  - BMI

- Estimate the future urban infrastructure
  - Water consumption
  - Electric consumption
  - Parking deficiency
  - VMT
Example of ST Application
- The City of El Monte Scenario Simulation -
City of El Monte

Approximately 11 miles east from downtown Los Angeles
Two Scenarios

- **TOD (Transit Oriented Development)**
  - Mixed use infill development around El Monte Transit Center which is located adjacent to downtown El Monte

- **Trend**
  - Residential-oriented development following the accessibility to major highways surrounding the city
TOD Scenario

Population: 8,917
Dwelling Units: 4,954
Employments: 7,010
Trend Scenario

Population: 8,983
Dwelling Units: 4,894
Employments: 7,141
Performance Measures

- Development Acres
- Populations
- Employments
Performance Measures
Performance Measures
Conclusion

- ST provides a platform that local governments develop customized land use strategies.
- ST also facilitates the integration of local land use strategies into a regional level.
- ST bridges the extents of land use with the demands on urban infrastructure such as road, water, and electricity.
- In the future, it is necessary to calibrate models for performance measure.