2009-2010 Final Report

Leonard Transportation Center- Funded Research and Development for

California SB375 Implementation and Integration of Transportation and Land Use Planning

Center for GIS Research, Cal Poly Pomona

Michael Reibel, Principal Investigator

Overview

The just-completed (2009-2010) phase of this project corresponds to the second year of an envisioned three-year initiative on integrated transportation and land use planning supported by the Leonard Transportation Center (LTC) and USDOT, and performed by faculty and staff at Cal Poly Pomona under the leadership of Professor Michael Reibel. In the first phase of the project, Dr. Reibel's team engaged in research regarding local government GIS capabilities for integrated planning and specifically strategic compliance with the new transportation and land use planning mandates of California SB375. SB 375, which affects local agencies and metropolitan (regional) planning organizations (MPOs), requires far more integration of land use planning with transportation planning, and far more geospatial analysis than was previously necessary.

In the 2009-2010 phase, a customized GIS computer application (the Toolkit) has been completed that significantly contributes to optimal SB375 compliance as well as to general local land use and transportation planning integration. A third and final year of the project has been funded by the LTC which will focus on the development and promotion of a training sequence and documentation materials to assist users in deriving maximum benefit from the Toolkit.

The SB 375 GIS Toolkit

The SB 375 GIS Toolkit is designed to offer maximum analytic power with the smallest possible learning curve, while still preserving the reliability of model outcomes and enabling extensive customization by more experienced users. The Toolkit comes loaded with a comprehensive database of relevant urban features pertaining to the six-county region of the Southern California Association of Governments. The user can interactively choose the default data and model parameters or load data and define model parameters for the desired study region. The data must be a 50 m^2 grid with cells coded to existing land cover; model parameters are the acreage to be developed in each of ten defined land use categories.

The land use categories are defined so as to optimize land use density (and particularly residential density) and thus transit use potential per the requirements of SB375. Consequently the land use categories are broken out in considerable detail when it comes to transit-oriented developments (TODs) and other high density use patterns. The categories are, in order of

precedence within the allocation models:

- Mixed Use TODs
- Residential-only TOD
- Non-TOD High Density Mixed Use
- High Impact Commercial
- High Density Residential
- Non-TOD Low Density Mixed Use
- Low Impact Commercial
- Medium Density Residential
- Low Density Residential
- Industrial

Once the data and model growth parameters are set, the region is analyzed and scored as a set of composite attractiveness surfaces that measure the desirability of each location based on a set of local urban and transportation amenities that would be valuable to potential users of the location. The local attractiveness score of each amenity is determined at various distances from each location, and the local composite attractiveness score for each grid cell is the sum of the attractiveness scores for each amenity within range.

Different local amenities have different values for different types of potential land uses: for example, a freeway entrance nearby would be of great value for medium density residential use, but little value (possibly negative value) for a TOD. Therefore the model must compute local composite attractiveness separately for each defined land use type in the model. It should be noted that constructing the tables of attractiveness values for various land uses of various amenities at various distances was one of the most labor intensive phases of the development process, requiring extensive research into the values and distance decay functions of a wide range of urban amenities.

In the model simulation run, the Toolkit allocates land for development according to the optimal sequencing of development and the local composite attractiveness scores. The optimal sequencing of development is the sequence in which the land use categories are listed above: all the growth projected for Mixed Use TODs is allocated first, then all the Residential Only TODs, etc. until the land available for development is exhausted. This can, and does, lead to lower-than desired development of lower density (thus lower priority) uses in a region. Within a given land use class, the remaining available locations with the highest composite attractiveness scores get developed first until all planned growth for that land use type is targeted.

The ultimate aim of SB375 is to channel land use development patterns into higher-density, more mixed-use and less car dependent patterns in order to reduce vehicle miles travelled (VMT) and thus greenhouse gas (GhG) emissions. The Toolkit incorporates tools to calculate the

VMT and GhG associated with the development scenarios that are generated in the simulation runs. Based on the development plan produced by a given simulation run, the Toolkit will estimate changes in Vehicle Miles Traveled (VMT) and Greenhouse Gas emissions (GhG) based on accepted formulas for the extrapolation of transportation behavior from urban development patterns (primarily density and transit availability).

Users can customize the Toolkit simulation to compare multiple development scenarios and their resulting VMT/GhG impacts. They can change the model parameters to alter the growth targets for each land use type and/or they can alter population and employment growth estimates for units of each land use type. Users can also interactively test development scenarios by launching the sketch tools available in the Toolkit and drawing developments on the land use allocation surface. Sketched developments automatically adjust the allocation (subtract from the remaining acreage to be allocated in that category).

Taken together, the ability to perform multiple simulation runs with different growth and density parameters and to interactively and graphically select locations for particular development activity allows users to compare different potential regional growth scenarios, their expected environmental impacts, and their compliance or lack of compliance with GhG reduction targets set by the California Air Resources Board.

Publications (Available)

Reibel, M. 2010. Sprawl fighting GIS tools to be developed by Cal Poly Pomona CGISR. *CSU Geospatial Review,* Spring 2010. California State University GIS Specialty Center, CSU San Francisco.

Reibel M, K Chan, R Willson, CP Trinh. 2009. *Local Government GIS and Geospatial Capabilities: Suitability for Integrated Transportation and Land Use Planning (California SB375)*. Center for Geographic Information Science Research, California State University, Pomona.

Publications (in preparation or under review)

Reibel M, K Chan, R Willson. Integrating Land Use and Transportation Planning: California Senate Bill 375 and the Inland Empire of Southern California. *[target publication: Journal of the American Planning Association]*

Reibel M, D Kim and K Chan. *A GIS Toolkit for Land Use Development Scenario Planning and Optimization*. [target publication: Computers, Environment and Urban Systems]

Reibel M. Changes in the Urban Built Environment and their Effects on Local Land Use Planning. *[target publication: Regional Science and Urban Economics]*

Research and Development Team (Faculty, Staff and Students)

Michael Reibel 

Dr. Reibel is Professor of geography at California State Polytechnic University, Pomona. He is an urban geographer with expertise in geographic information systems (GIS) applications and processes in housing, demographics and transportation. His current research is on improving the scientific basis for land use and transportation planning decisions using GIS. His research has been published in the *American Journal of Public Health, Population Research and Policy Review, Urban Geography* and *Environment and Planning A,* among other journals.

Richard Willson 

Dr. Willson is a highly respected transportation planner and expert on transit oriented developments and their impact on transportation mode choice. He has served as Chair of the Department of Urban and Regional Planning and Interim Dean of the College of Environmental Design at Cal Poly Pomona. His research has been published in *Transportation Research Record*, *Journal of Public Transit, Journal of Public Transportation, Journal of Transportation and Statistics, the Journal of the American Planning Association* and *Regional Science and Urban Economics,* among other journals.

Boykin Witherspoon III

Boykin Witherspoon is the program administrator of the Cal Poly Pomona Center for GIS Research. He is a veteran GIS project manager with special expertise in regulated land use planning procedures and products. He has managed and consulted on large scale GIS enterprise software products for U.S. Federal agencies and major international corporations.

Kelly Chan

Dr. Chan is a veteran PhD level urban planner with particular expertise in GIS applications in transportation and land use planning. He has over 15 years of experience in Geographic Information Systems (GIS) software development, systems design and model building.

James Bellis

James Bellis is an urban planner and a graduate student in Regenerative Studies at Cal Poly Pomona. He is highly skilled in GIS analysis for urban land use and in the determination of distance decay functions for urban amenities.