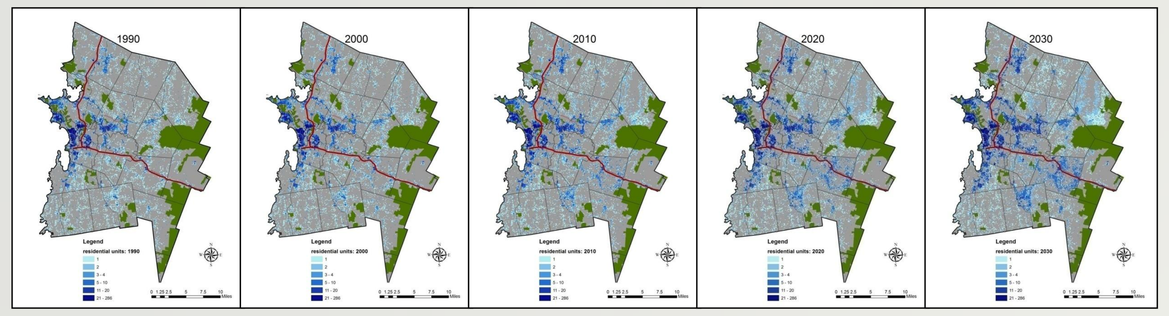

Scenario Analysis with UrbanSim: Enhanced Transportation Infrastructure

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Abstract

A combined land use and transportation model was used to evaluate how two hypothetical road investment scenarios for Chittenden County, VT would affect simulated future land use and transportation patterns in comparison to a baseline scenario. Results indicate that the proposed road investments would have perceptible impacts on Vehicle Miles Traveled but only a slight impact on land use under current population forecasts. However, more significant impacts on land use become apparent if population forecasts increase by 50%.

The UrbanSim Model

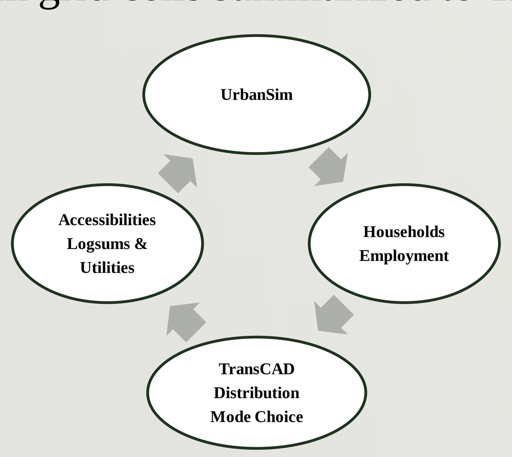
- •Open source model with sub-models for land price, household location choice, real estate development, etc.
- •Aggregate population / employment forecasts (control totals) are given by the user
- •The model allocates forecasted jobs and households to grid cells across the landscape based on model coefficients
- •Accessibility is a key determinant of location choice and development; it is calculated by the travel demand model

Model Estimation

- •Sub-model coefficients are derived from cross sectional and historical data
- •Location choice models use a multinomial logistic choice model to place each new or relocating job, household, or development event
- •Land price model is multiple linear regression based on location effects, policy parameters and neighborhood characteristics.

TransCAD Integration

- •Four-step model: trip generation, trip distribution, mode split and traffic assignment
- •UrbanSim takes accessibilities (logsums) from TransCAD by Traffic Analysis Zone (TAZ) and TransCAD takes land use information from UrbanSim grid cells summarized to TAZ level



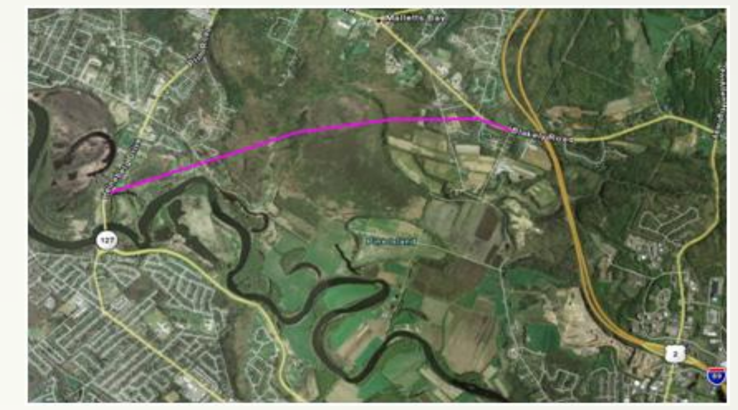
Scenarios

MTP Scenario: Developed by the MPO every five years and serves as the regional long-range transportation plan. Includes projects in 12 towns totaling more than 160 km.

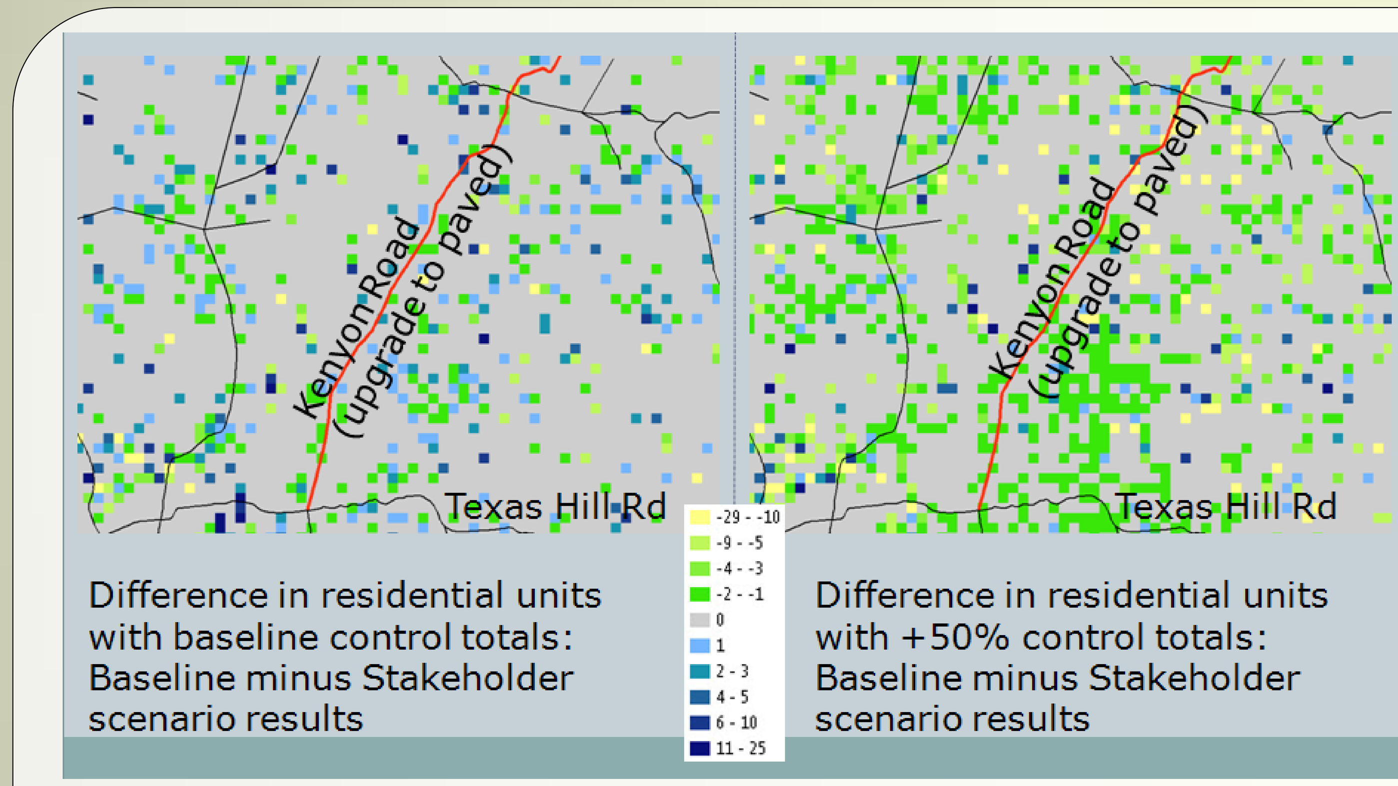
Stakeholder Scenario: Developed by local and state planners, academics, industry and NGO representatives in a planning workshop co-sponsored by the UVM Transportation Research Center. Eleven improvements were included in the final scenario, including 6 new roads, four new Interstate interchanges and one road surface upgrade.

Baseline Scenario: Current Chittenden County road network.

Sensitivity to Changing Control Totals: Residential and employment control totals were increased by 50% over the baseline 2030 estimates to test effects of a large population influx on the same set of alternative road networks.



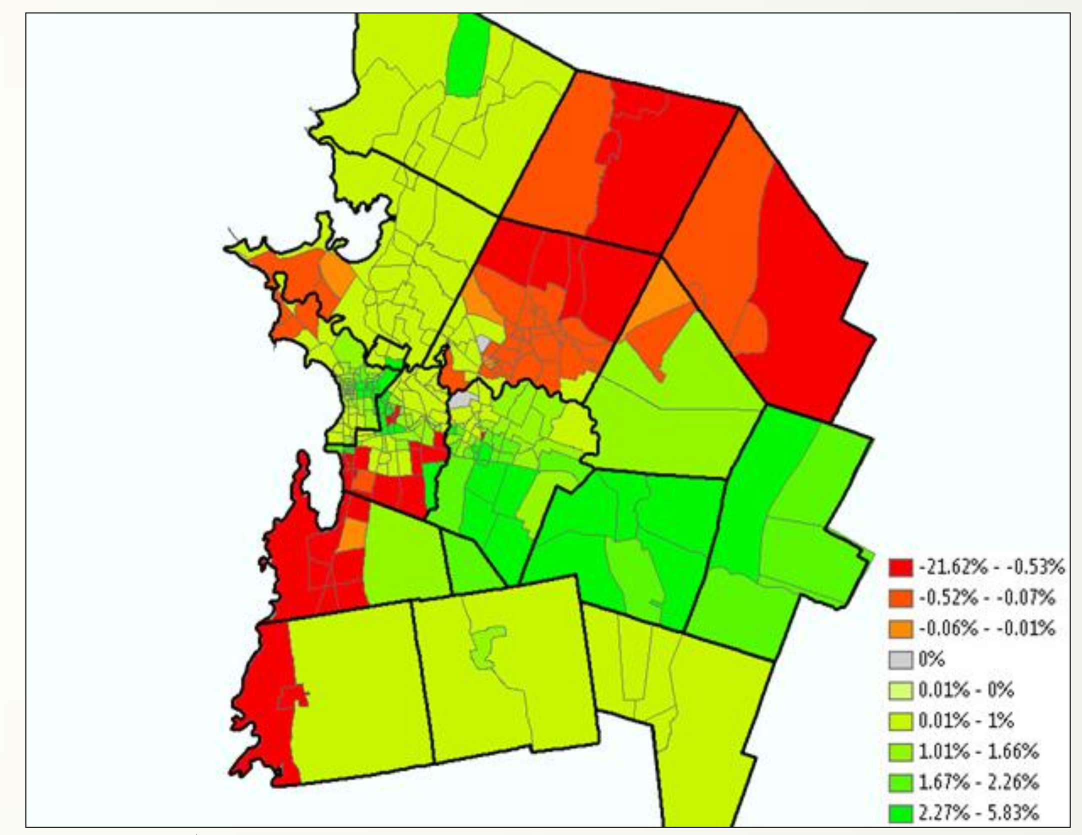
Results



Difference in residential units with baseline control totals: Baseline minus Stakeholder scenario results

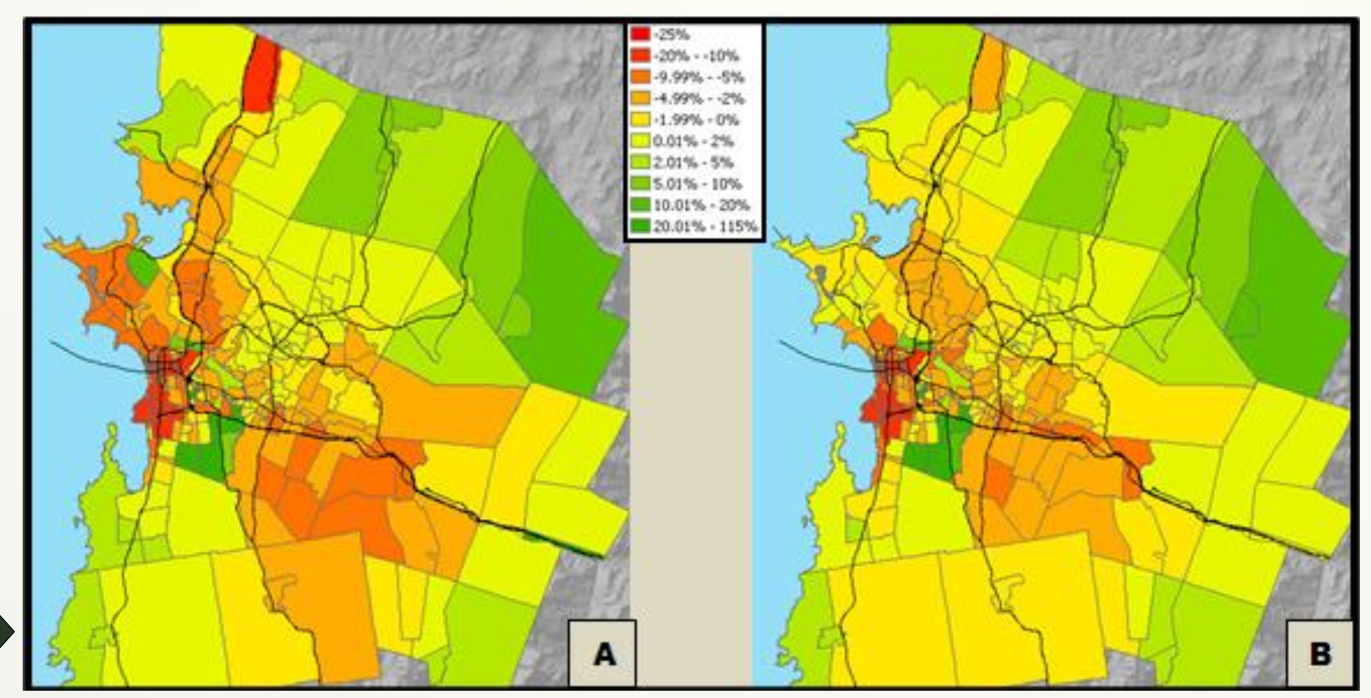
Difference in residential units with +50% control totals: Baseline minus Stakeholder scenario results

Residential Units (Grid-cell level results): Blow-up showing the simulated effects immediately around one proposed roadway improvement from the stakeholder scenario. Colored cells indicate a difference between the baseline and scenario results.



Accessibility (TAZ level results): Red (negative numbers) indicate better accessibility in the Stakeholder Scenario as of 2030 as compared to the Baseline Scenario.

Vehicle Miles Traveled (TAZ level results): Red (negative numbers) indicate higher VMT under the alternative scenario than the Baseline Scenario for (A) the MTP Scenario and (B) the Stakeholder scenario



Conclusions

•With higher control totals, alternative scenarios differed significantly from baseline land use patterns at multiple spatial scales for a number of land use and transportation metrics.

•Vehicle Miles Traveled varied from the baseline model at every spatial scale from local to regional.

•Commercial and residential land use patterns were especially susceptible to the stakeholder network changes.

•Baseline control totals affected land use patterns at finer spatial scales, while the increased control totals scenarios resulted in variation over greater distances.

•Existing residential and non-residential densities, available vacant and undeveloped space for all land use categories and the price of land are all likely to play a role in influencing regional land use and transportation patterns.

Scenario Effects

Grid cell scale

	Baseline Control Totals					Control Totals + 50%				
	500	1000	1500	2000	2500	500	1000	1500	2000	2500
Commercial sq ft							*	**	**	*
Industrial sq ft								*	*	
Commercial jobs							*	**	**	*
Industrial jobs										
Residential units						***	***		*	
Vacant commercial sq ft			*	*						
Vacant industrial sq ft		**		**	*	**		*	**	**
Vacant residential units		**				*				

Table of outputs with statistically significant differences between the baseline and Stakeholder scenarios at the grid-cell level.

Traffic Analysis Zone Scale

	Baseline Control Totals			Control Totals + 50%		
	All TAZs	Stakeholder TAZs	Stakeholder + adjacent TAZs	All TAZs	Stakeholder TAZs	Stakeholder + adjacent TAZs
Commercial sq ft						
Industrial sq ft						
Residential units				***	**	***
Vacant commercial sq ft						
Vacant industrial sq ft						
Vacant residential units		*		***		***
Population				***	**	***
Vehicle hours traveled						
Vehicle miles traveled	***	**	***	***	**	***

Table of outputs with statistically significant differences between the baseline and Stakeholder scenarios at the TAZ level, with subsets including all TAZs, TAZs with proposed projects and the former plus neighboring TAZs.

Asterisks indicate significant differences at the 90%(*), 95% (**), and 99% (***) confidence levels.

Next Steps

Other Scenarios:

- •Development Constraints
- •Micro-scale transportation network (e.g. new lanes, turning rules, ITS, speed limits)
- •Public Facility Placement
- •Infrastructure (e.g. sewer, water, electricity)

Three-Way Model:

Add routing micro-simulator using TRANSIM to update accessibilities on the same 5-year intervals as the TransCAD

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