Land Use Model Implementation Issues

PSRC & UrbanSim

COG/MPO Mini-Conference, San Diego
July 16th-17th 2010

Puget Sound Regional Council
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Presentation Overview

- Land Use Model
  - Background
  - Status
- Implementation Challenges & Responses
  - Staffing & Skills
  - Forecasts versus Policy Analysis
  - Integration with Travel Model

Land Use Model Background

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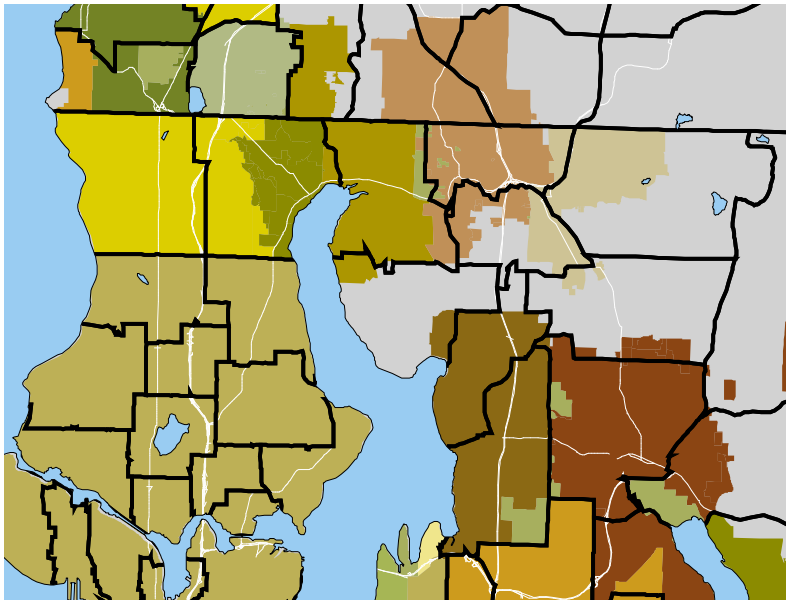
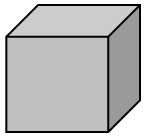
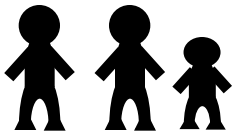
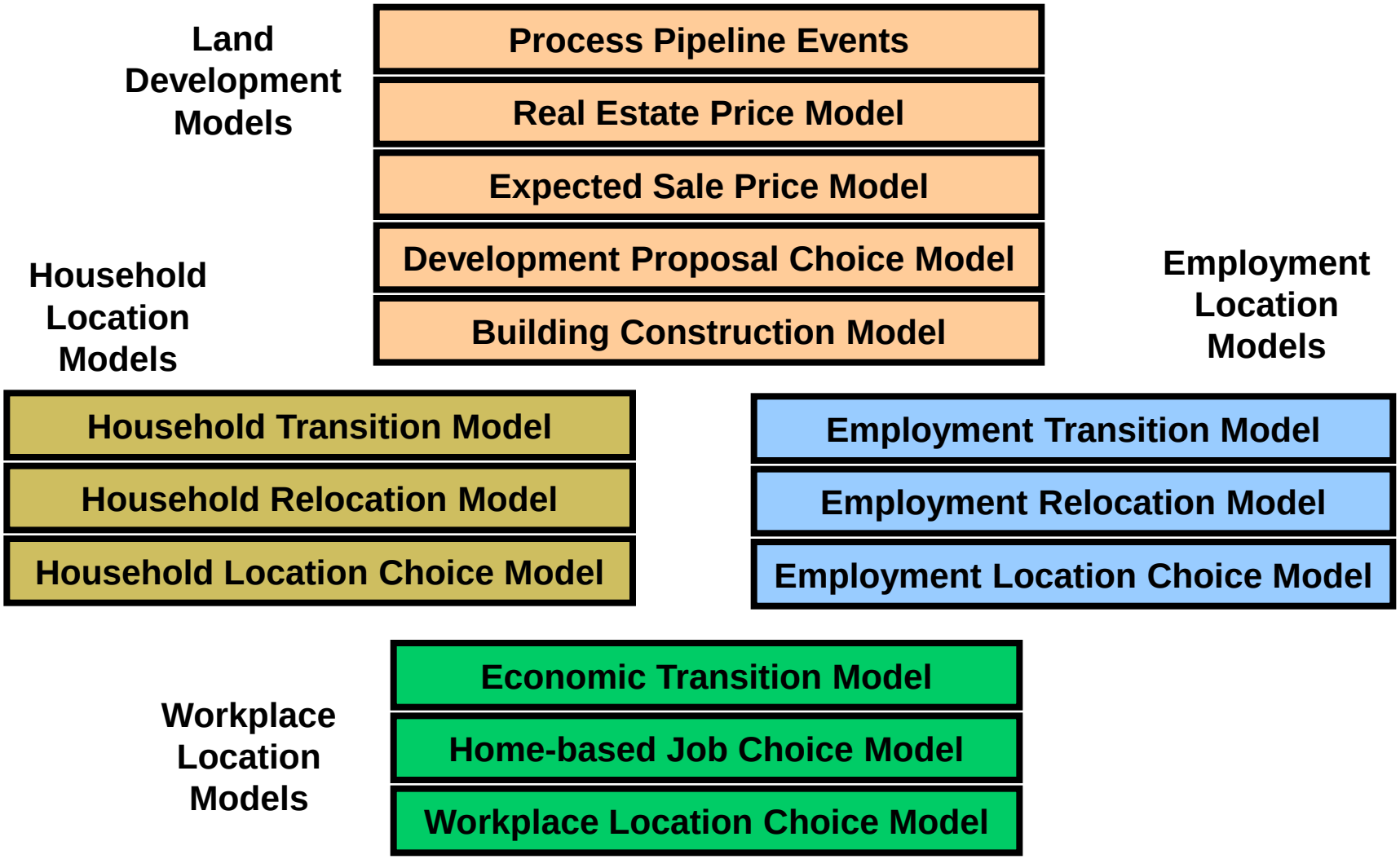
PSRC Land Use Model = Parcel version of UrbanSim

Zones (219 total)



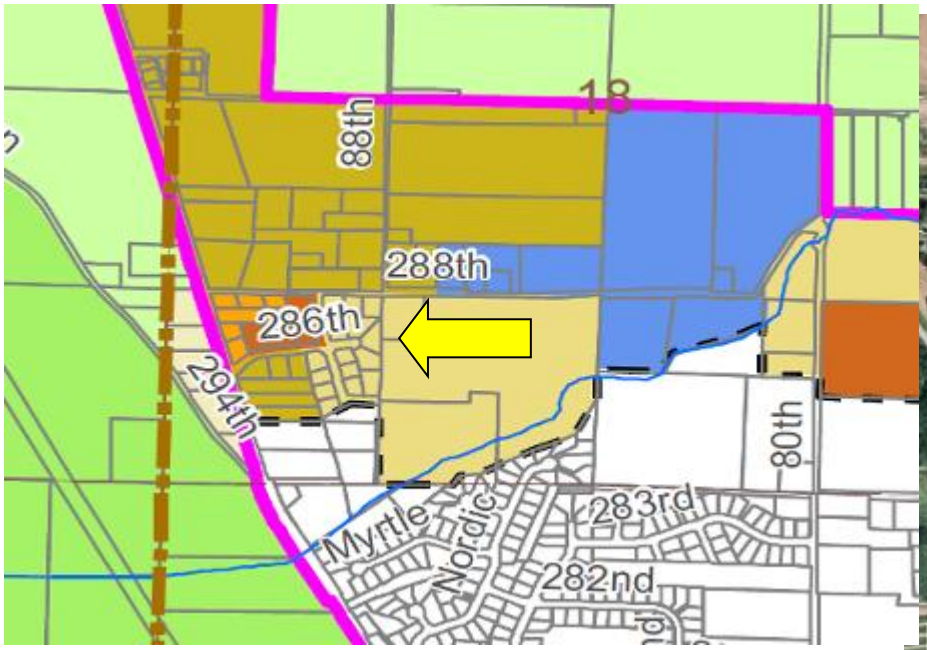
Parcels	Buildings	Households	Persons	Jobs
				
1.18 million parcels	1.0 million buildings	1.28 million households	3.2 million people	1.85 million jobs

Land Use Model Elements



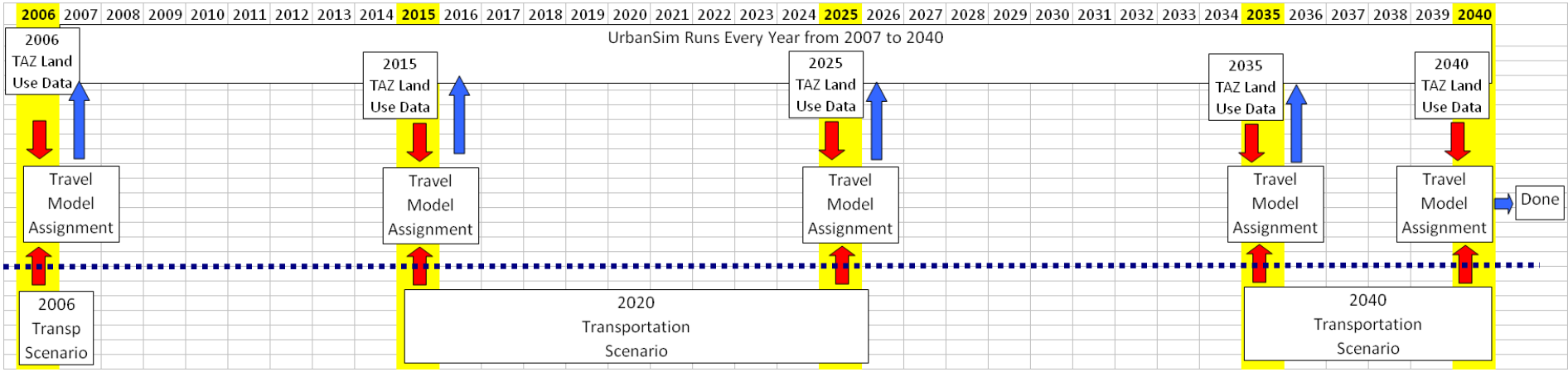
Direct modeling of land use constraints in UrbanSim

- **Direct representation of parcels and development capacity**
  - Example: 19,600 SQFT vacant parcel with comp plan designation calling for 4 to 6 DU/Acre
  - Every parcel must have an assumed DU and FAR constraint



- Land Development Models predict future built status of parcels
- Location Choice Models predict occupancy and use of buildings on parcels

UrbanSim – Full integration with travel model



Model Inputs and Integration	Analysis Year				
	2006 (base)	**2015**	**2025**	**2035**	**2040**
Land Use Model Runs, using accessibilities from:	a previous travel model run for land use model run 2006	2006 travel model for land use model runs 2007 through 2015	2015 travel model for land use model runs 2016 through 2025	2025 travel model for land use model runs 2026 through 2035	2035 for land use model runs 2036 through 2040
Travel Model Runs, using population and employment from:	2006 land use model run	2015 land use model run	2025 land use model run	2035 land use model run	2040 land use model run

UrbanSim – Implementation Status

Supported MTP Update, Transportation 2040

- Integrated with travel model
- Comparative analysis

Model Improvement

- Refining many ‘placeholder’ decisions

Ready for Use in Forecasting: CY 2011

- Scenario Analysis to follow

Implementation Challenges, Responses

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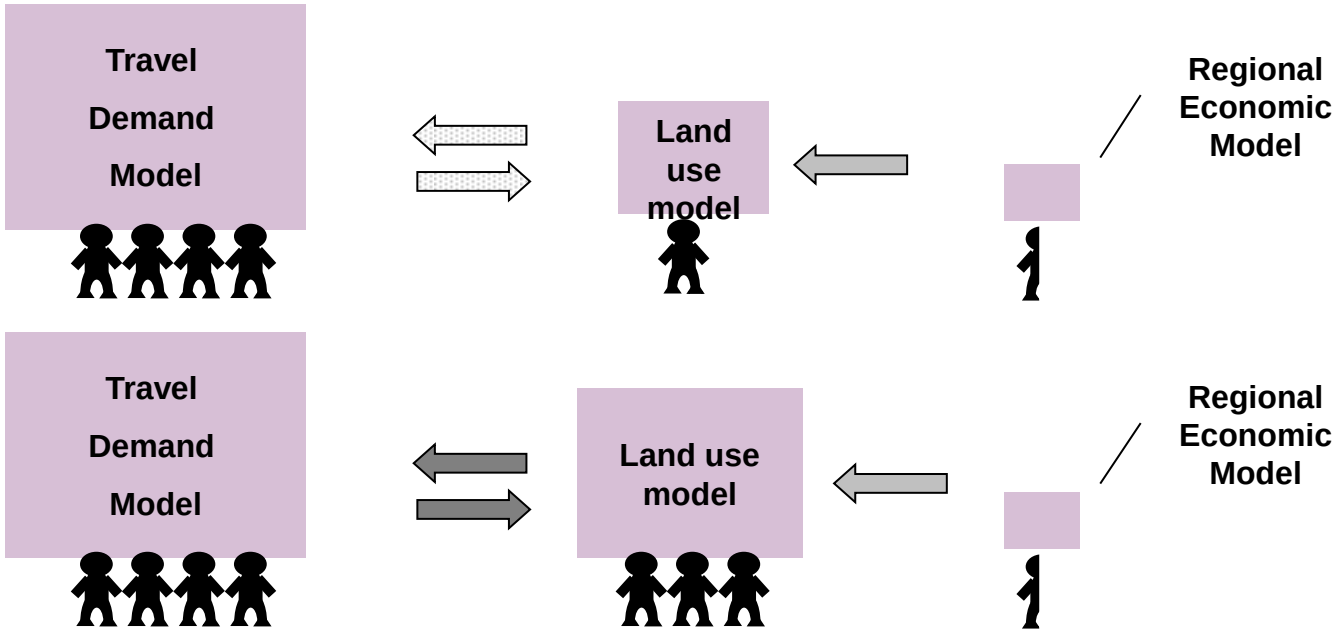
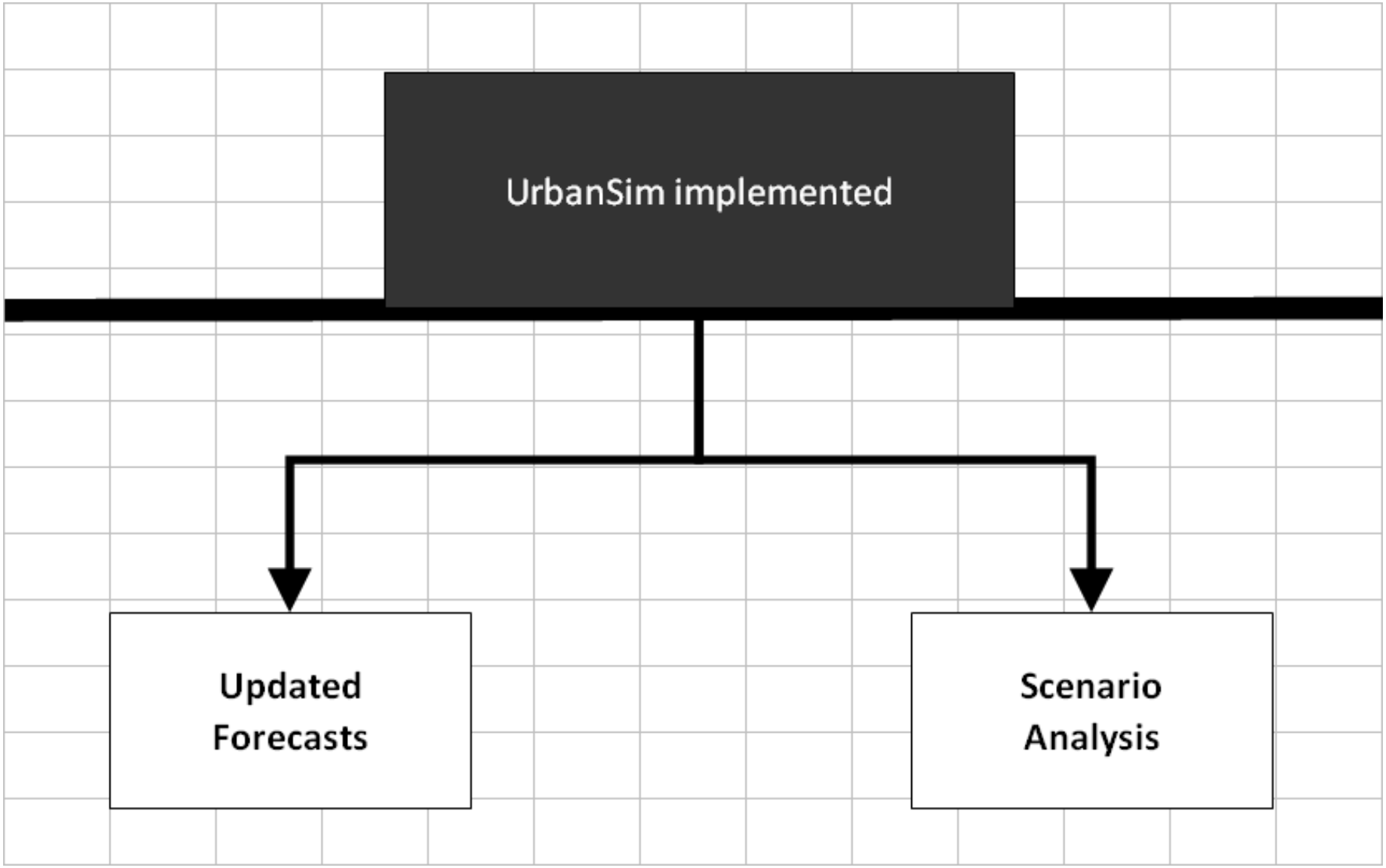
Land Use Modeling staffing

- Land use model complexity increased – staffing needs to keep pace
- Coordination / Interaction between modeling staffs (one group)
- Technical skill sets – software & programming
  - What software is each model using?
  - In-house knowledge for troubleshooting, modifying, and adding model components and sub-models



Uses of UrbanSim



New definitions of PSRC Forecasts, New Products [Prelim]

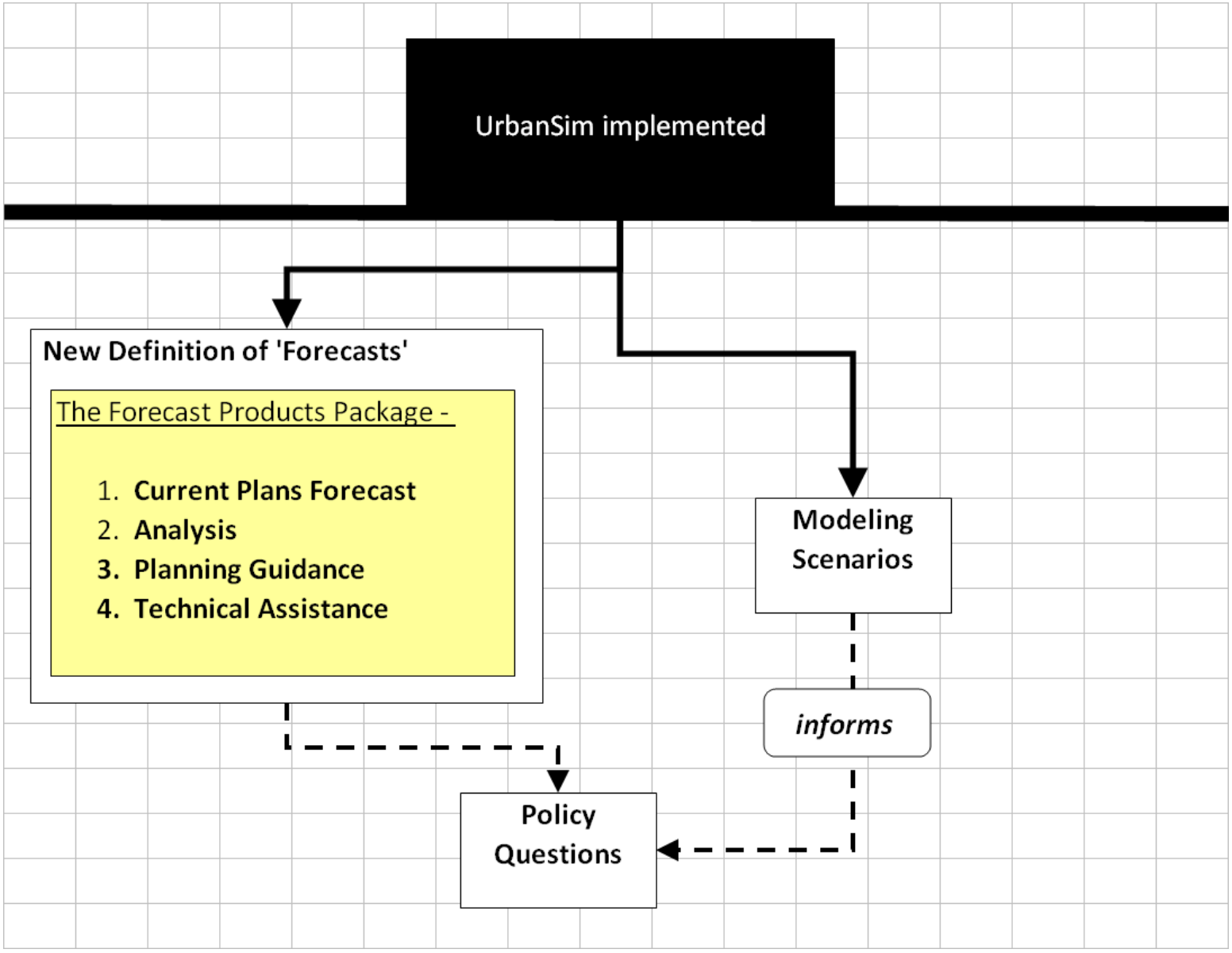
- Current Plans Forecast:
  - Population, households, employment
  - Zone, Regional Geography, City & County geographies likely
  - Inputs and assumptions (development constraints, assumed developments, etc.)

- Analysis – always accompanies Current Plans Forecast
  - Compare Current Plans forecasts versus Regional Growth Strategy objectives

- Planning Guidance – what future land use assumptions to use for:
  - Plan updates
  - Meeting certification requirements (e.g. consistency)
  - Other local planning studies

- Technical Assistance to local jurisdictions

Longer-Term: UrbanSim Scenario Modeling [Prelim]



Travel Model Integration and Sensitivity

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Accessibility Measures – passed to UrbanSim

Zone-based, measured to a downtown location

- Generalized Cost to Seattle CBD, HBW AM SOV
- Generalized Cost to Bellevue CBD, HBW AM SOV

Zone-based

- Average Travel Time, Trip-weighted, AM, SOV, HBW
- Jobs within 30 minutes travel time, AM, SOV

Person-based, Home to Work Zones

- Network distance from Home to Work
- Log Sum, HBW AM from Home to Work

Accessibility – Model Blocks

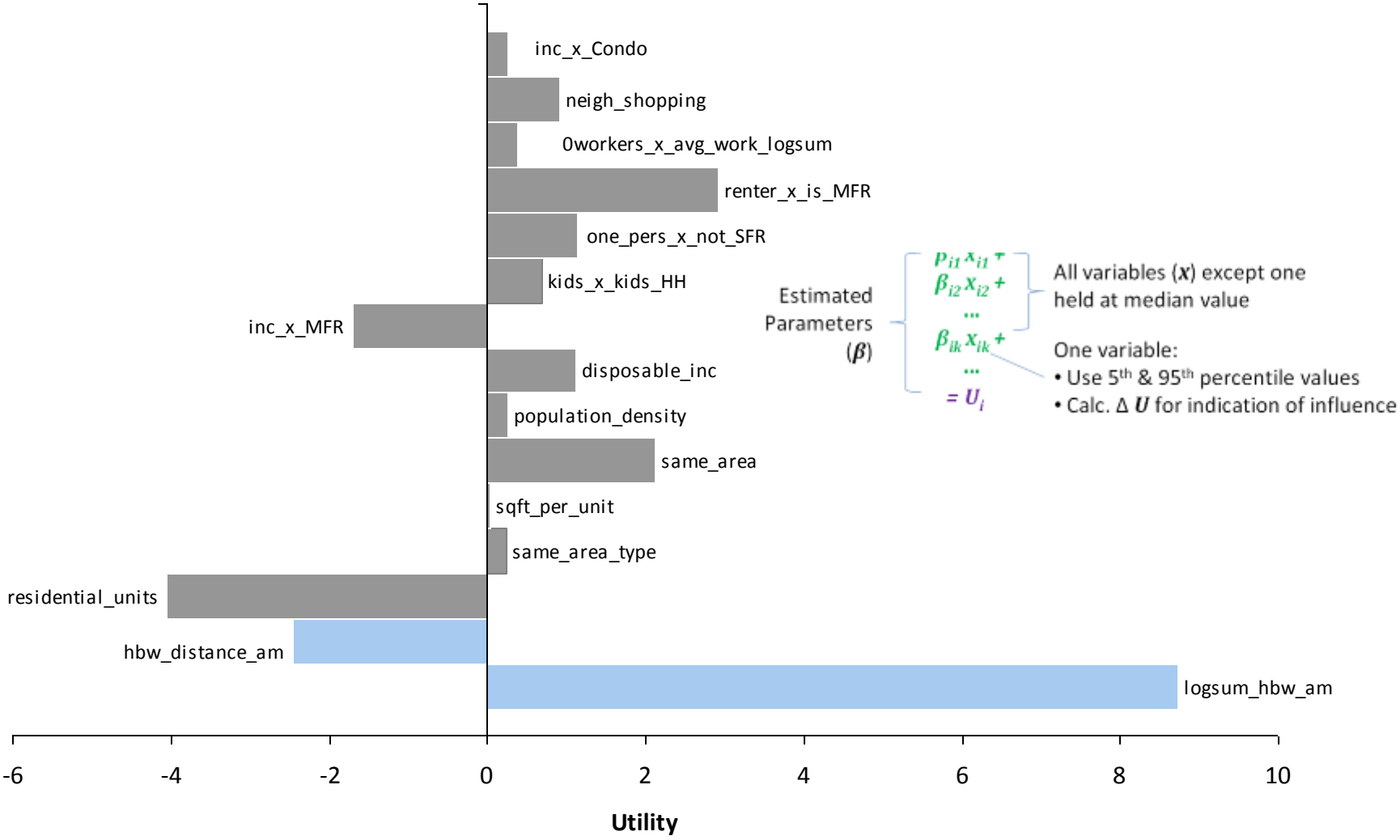
		UrbanSim Models			
	Accessibility Measure	Real Estate Price(1)	Household Location Choice	Employment Location Choice(1)	Workplace Location Choice
Zone-Based , Origin Zone to Location					
	Generalized Cost HBW AM SOV to Seattle CBD	16	--	7	--
	Generalized Cost HBW AM SOV to Bellevue CBD	--	--	9	--
Zone-Based, Origin Zone to All Other Zones					
	Average trip-weighted Travel Time, HBW AM SOV,	15	--	7	--
	Jobs within 30 minutes time, AM SOV	12	--	17	--
Person-Based, Home to Work Zones					
	Network Distance from Home to Work	--	X	--	X
	Logsum of HBW AM Trip	--	X	--	X
Grid Cell-based, Proximity to Roadways					
	Distance to Highway	4	--	13	--
	Distance to Arterial	1	--	14	--

(1) – Number of submodels that contain the measure in current specifications, there are 18 sub-models in the Real Estate Price Model, and 17 in the Employment Location Choice Model

Relative Influence of Variables - HLCM

Household Location Choice Model

Adj. Likelihood ratio: 0.419



Sensitivity Tests

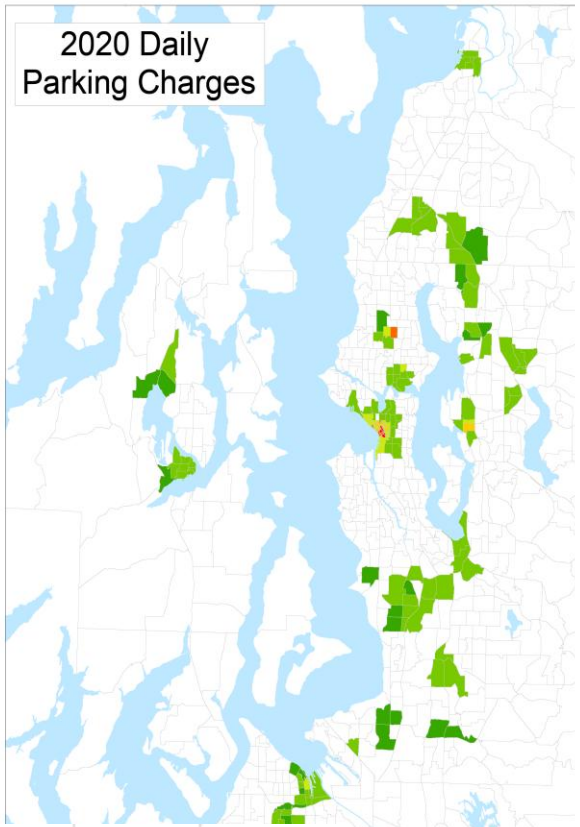
Base Case Scenario

- Transportation Networks (2020, 2040)
- Modest investments in roads and road-based transit
- Near-term voter-approved rail transit extensions
- Very limited tolling (two bridge crossings)
- No real growth in vehicle operating costs
- Modest real growth in parking costs

Alternative Scenarios

- Lower parking costs in selected neighborhoods (zones)
- Higher vehicle operating costs forecast
- Major extensions of rail transit
- Major investments in highway capacity

Alternatives

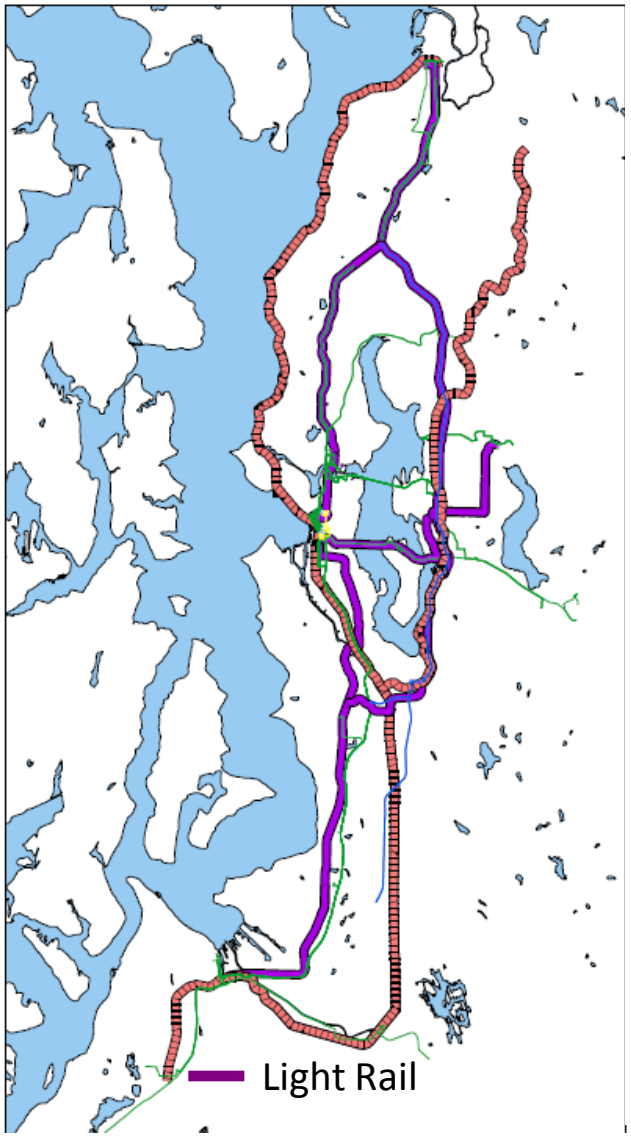


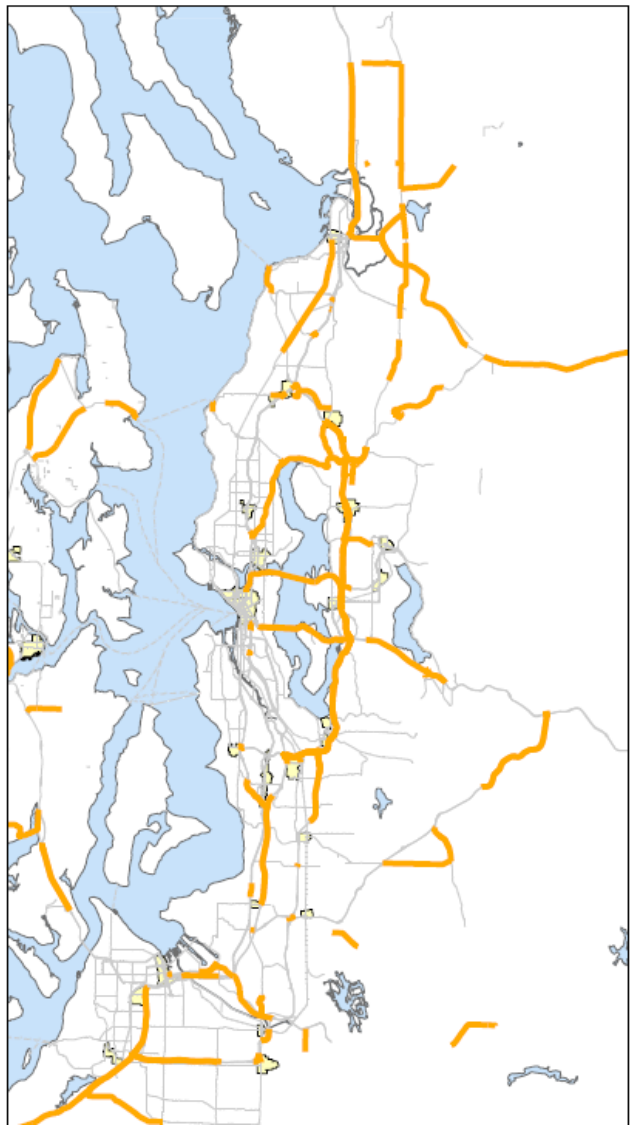
Legend

Centers TAZs Parking Charges

Daily 2020

- $1.47 - $5.00
- $5.01 - $10.00
- $10.01 - $15.00
- $15.01 - $20.00
- $20.01 - $25.00
- $25.01 - $29.18





Expectations

- Short-run substitution will minimize the magnitude of cost changes reflected in long-run (location) choices
- Some modest correlation between a composite measure of zonal accessibility and the outputs of the land use model (population, households, employment, work trip locations)
- Higher transportation costs should result in lower site values, and vice versa
- A resorting by willingness to pay for sites may dominate the location choices

Results

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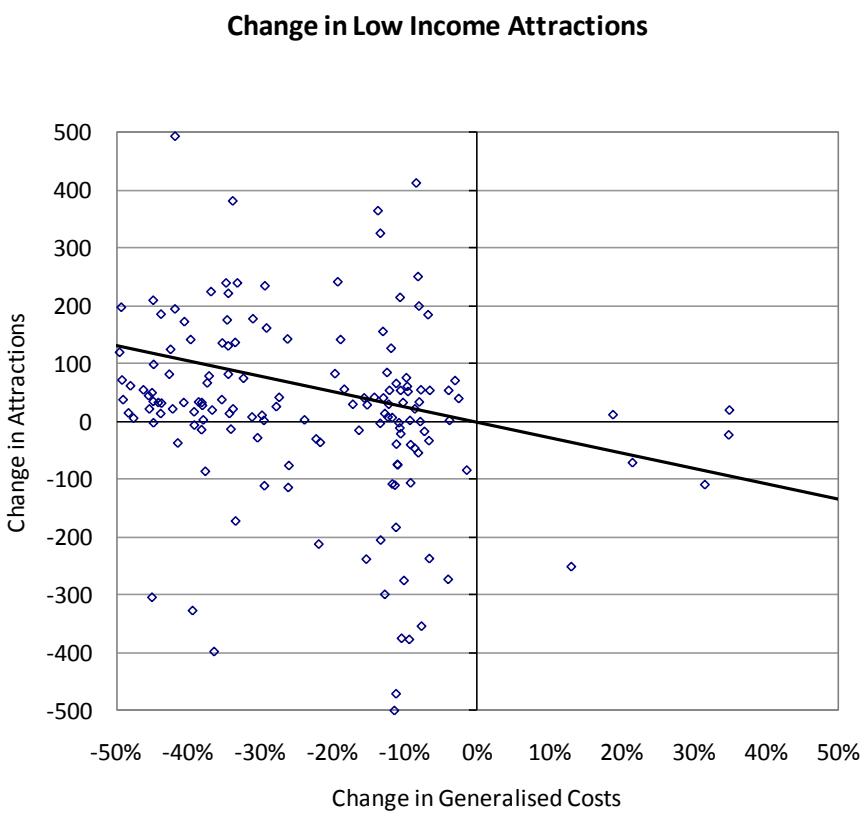
Selected Travel Model Statistics

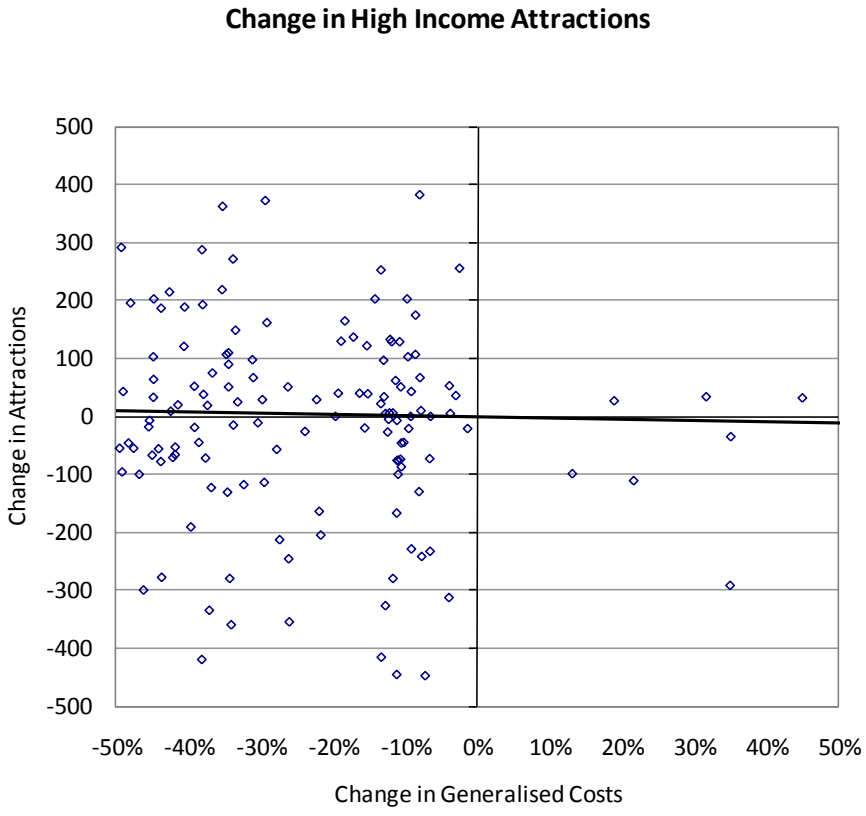
Selected Measures - Travel Model	Base Scenario	Lower Parking Costs	Higher Vehicle Operating Costs	Rail Transit Extension	Highway Capacity
Daily Vehicle Trips	12,207,370	12,282,986	11,871,396	12,211,586	12,261,469
Daily Transit Trips	818,805	772,862	832,134	841,256	814,995
Daily Walk and Bike Trips	2,272,961	2,258,358	2,560,918	2,257,955	2,201,591
Daily VMT	105,976,212	106,312,470	94,195,933	106,185,529	109,787,866
Daily Average Vehicle Speeds	38	38	38	38	40
Trip Lengths					
HBW	13.0	12.9	12.4	13.0	13.1
HBShop	4.5	4.5	3.9	4.5	4.7
HBOther	5.6	5.6	4.9	5.7	5.9

Lower Parking Charges

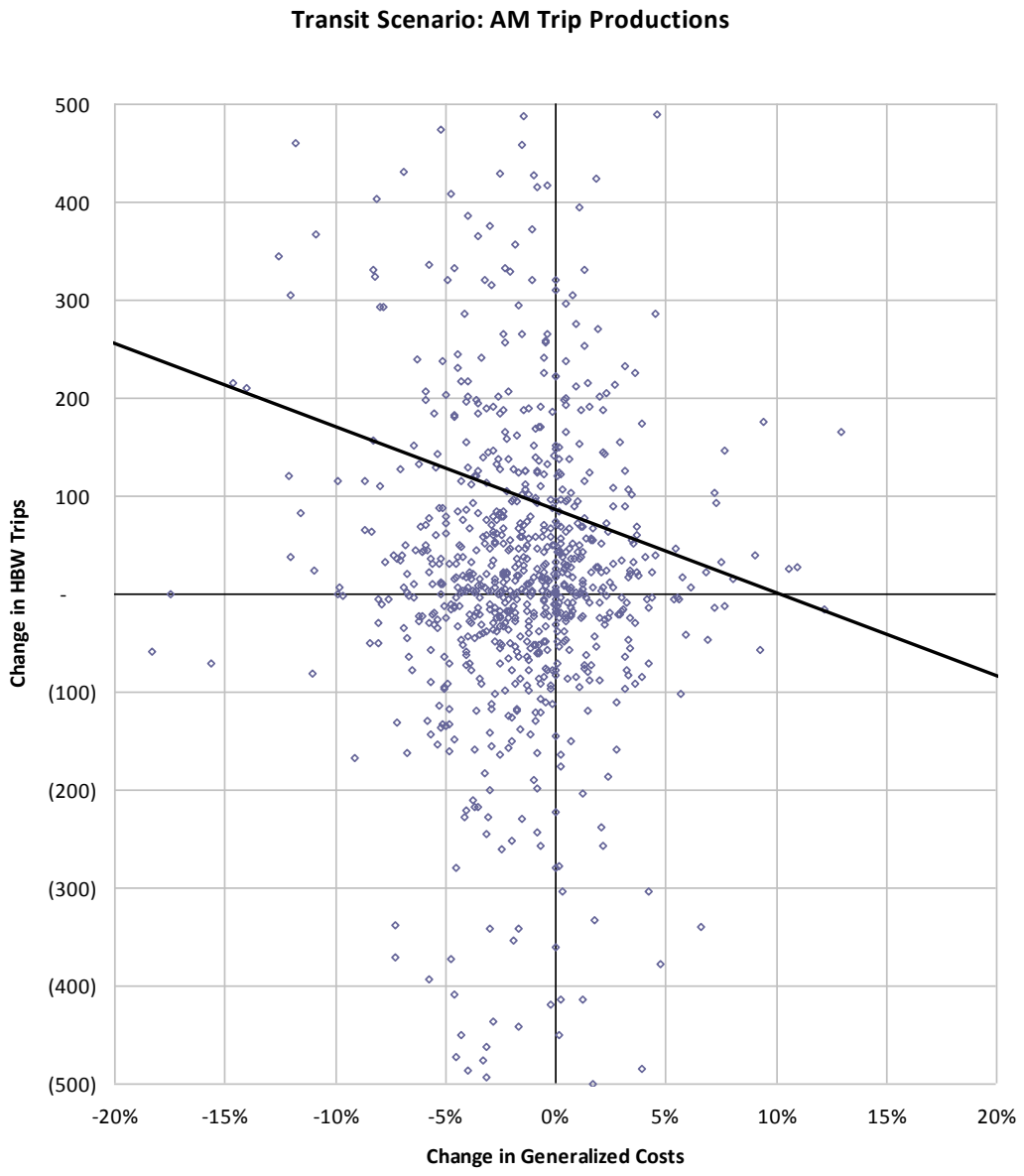
Workplace Location Choice

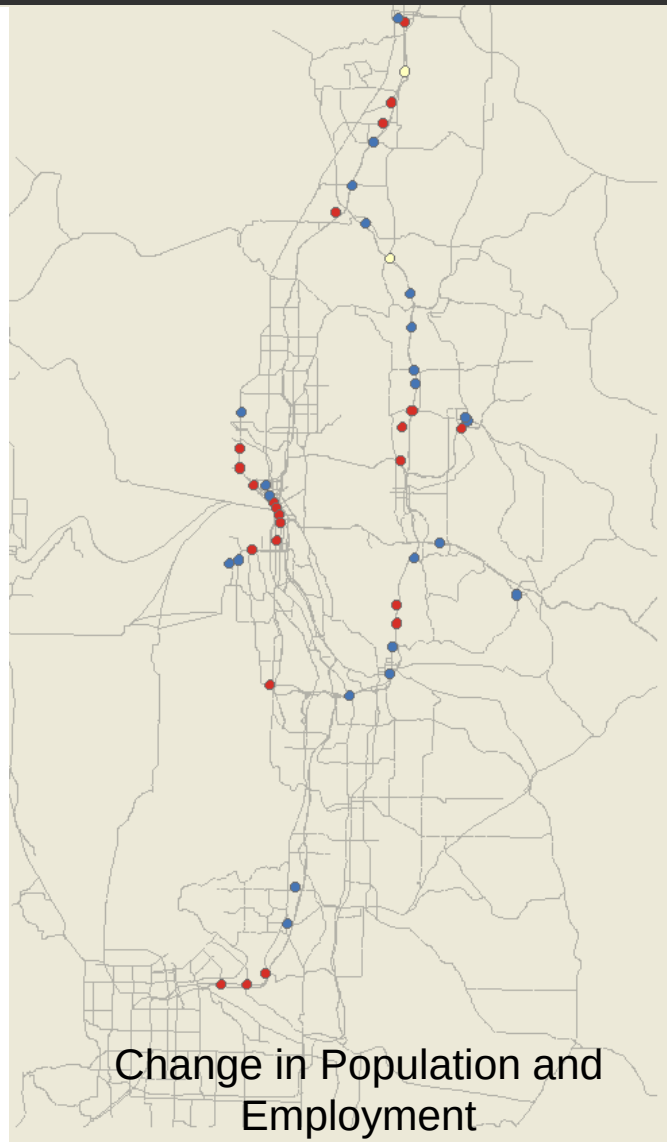
- Trip attractions increase in zones with lower parking costs
- Income sensitivity





Rail Transit Extensions

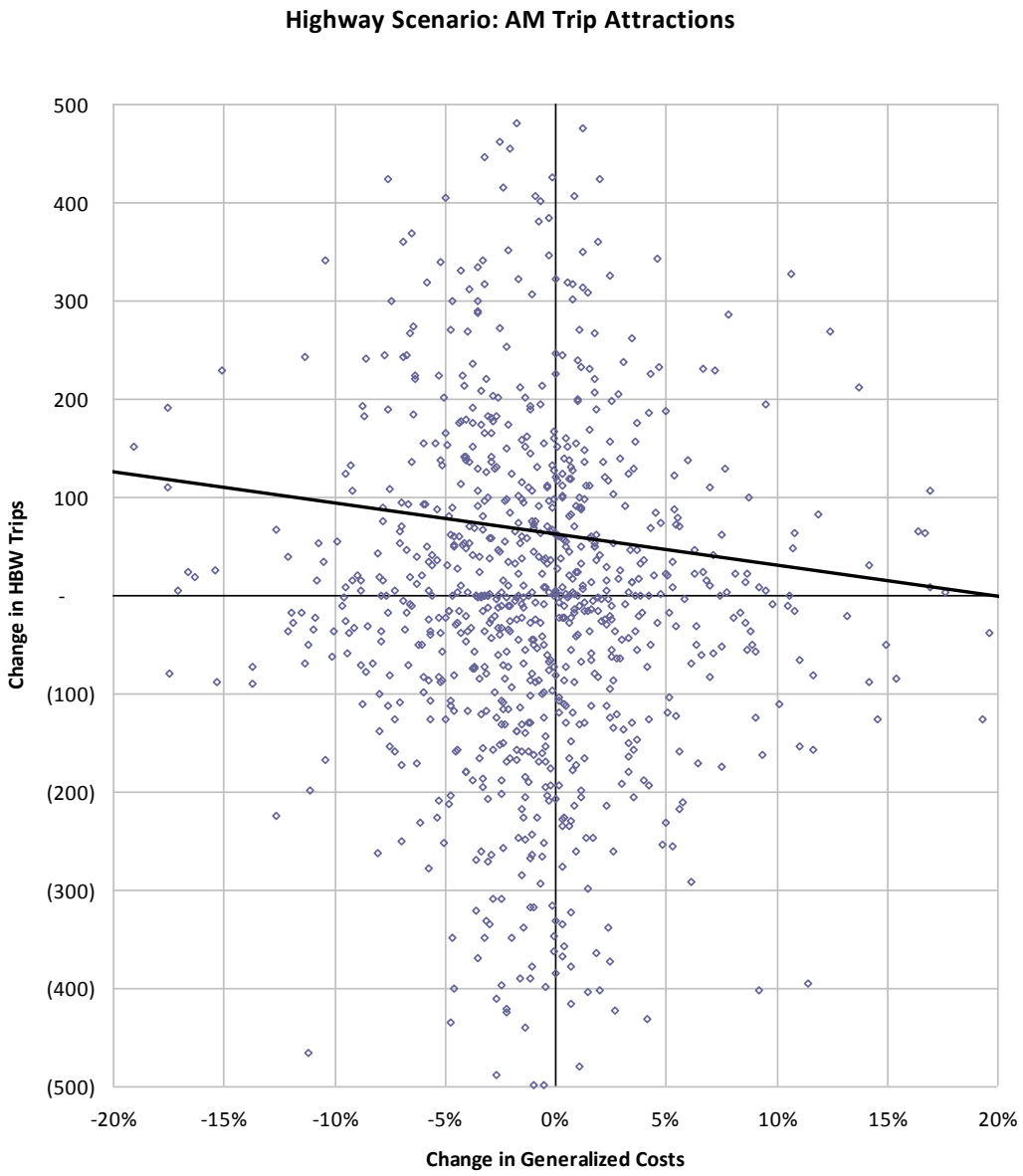


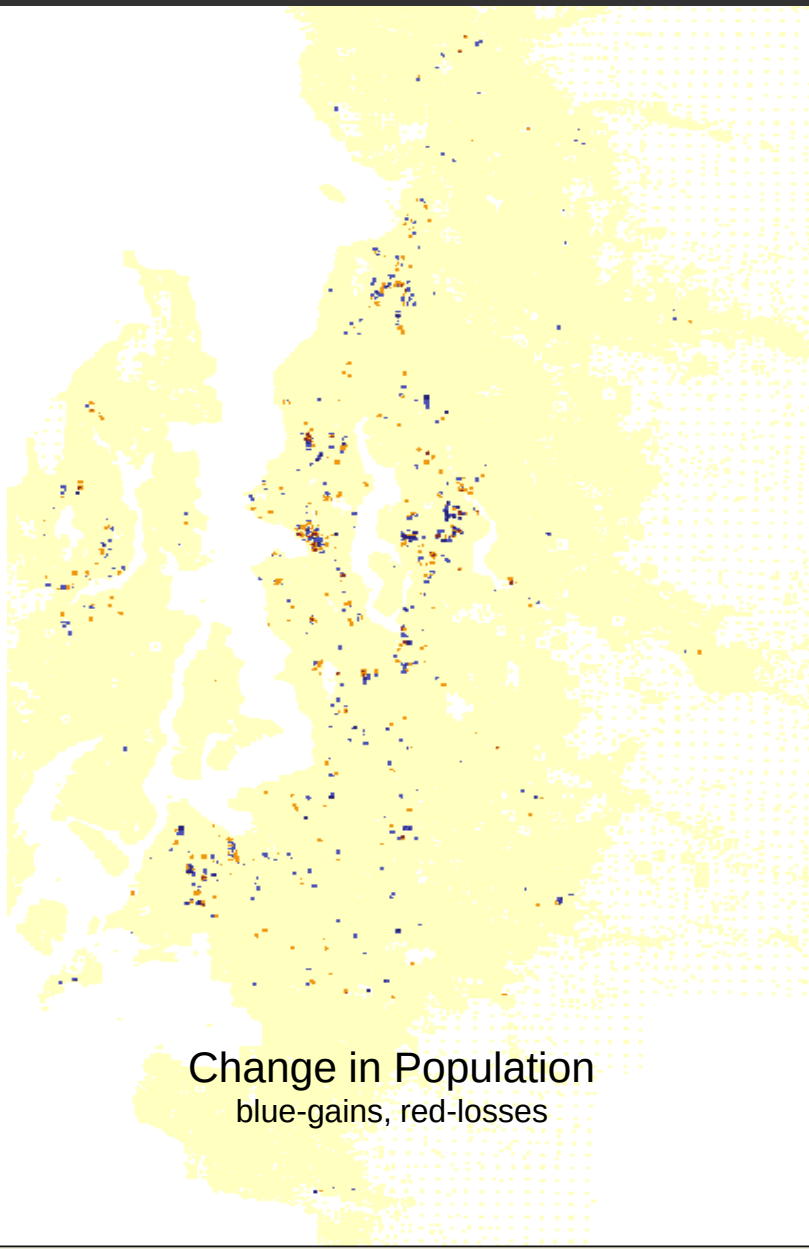


Change in Population and Employment

red-gains, blue-losses

Increased Highway Capacity





Change in Population
blue-gains, red-losses

Findings

Land Use Response to Transportation Scenarios

- A modest response is in line with theoretical expectations
- Accessibility measures from the travel model do change across scenarios and reflect route and destination choices (and to a more limited degree mode choice).
- Short-run substitution and activity sorting across sites likely limits the effects on development capital
- The influence of access on site values is probably a central feature in proper simulations. We have not explicitly evaluated site values

Future Directions

Accessibilities Variables

- Revisit the zonal composite variables used in the real estate price and employment location choice models
- Changes to real estate price model to more fully reflect scale of demand and accessibility
- A revised zone structure (from 938 to over 3,500) should reduce aggregation problems
- Activity-based travel model development will open up numerous opportunities for disaggregate access measures

Revisit Integration Structure

- Frequency of travel model runs (currently every 10 forecast years)
- Activity-based model development will necessitate a different approach (interaction between long-run and short-run choices)

Other Miscellaneous Thoughts

Data Assembly

- What is load-bearing and what is more forgiving?
- Draft database to support Alpha / Beta models, then refine base year data?

Placeholder

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