SustainCity
UrbanSim Update

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1. **Alternative Data Schemas and Model Configurations**
2. Sensitivity Analysis to Accessibility Changes
3. Coming soon: 3D Modeling and Visualization

UrbanSim: Start From the Simplest Zonal Configuration

Household Location Models

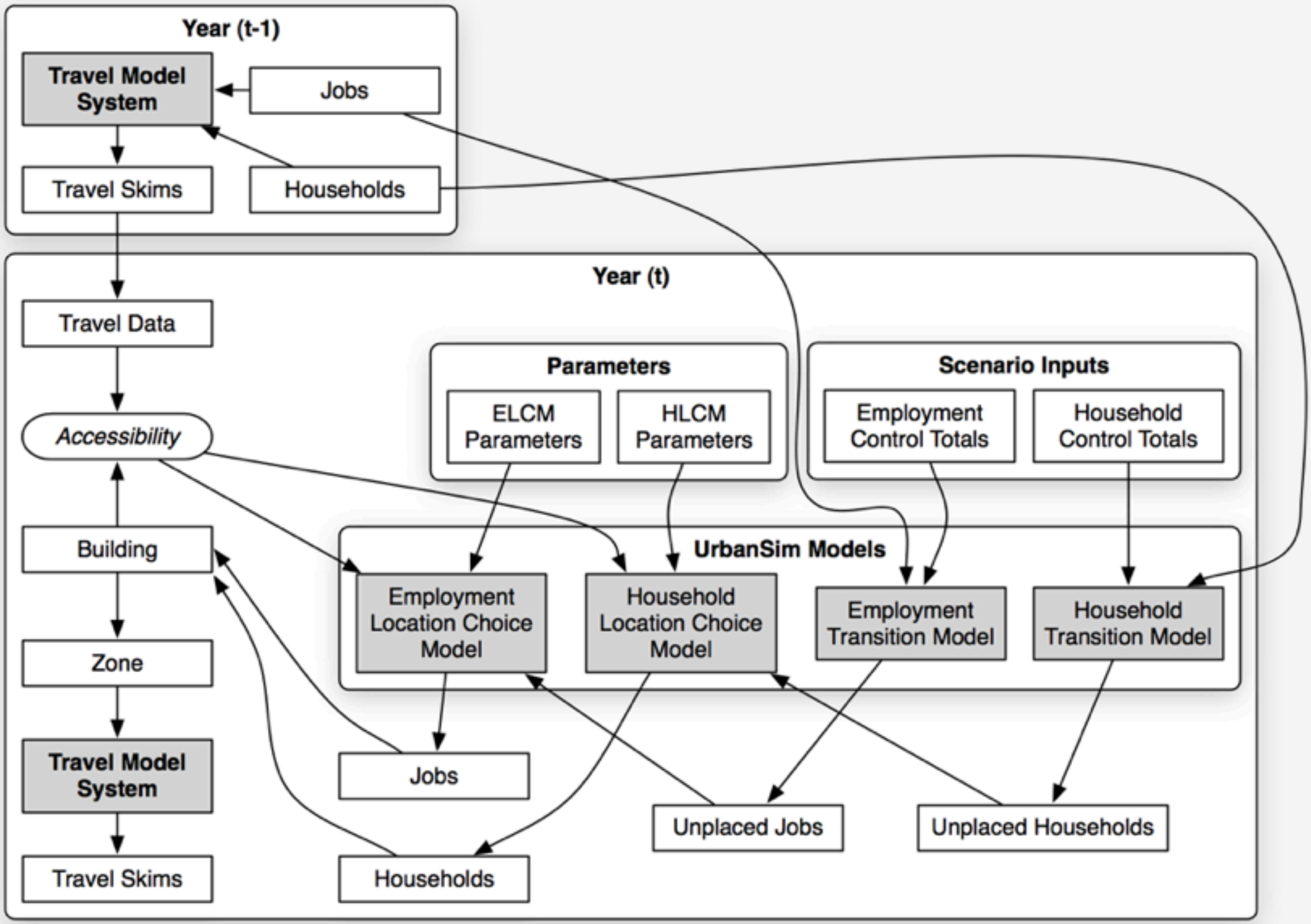
- **Household Transition Model**
- **Household Location Choice Model**

Employment Location Models

- **Employment Transition Model**
- **Employment Location Choice Model**

No representation of supply side of real estate market, or prices. No relocation of agents once placed. Becomes an 'incremental' model, allocating growth.

The Simple Zone Configuration of UrbanSim: In Detail



UrbanSim: Add Relocation Dynamics

Household Location Models

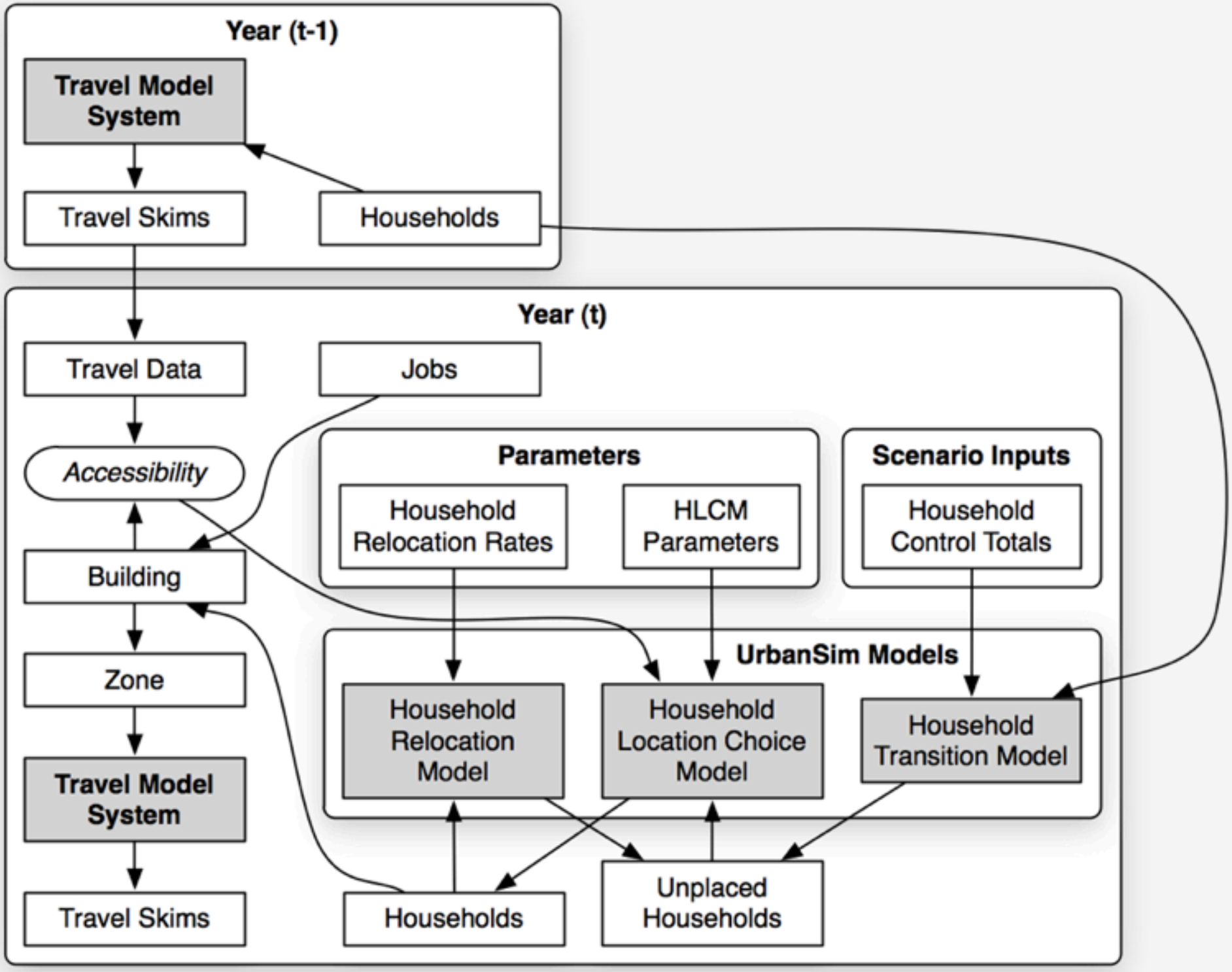
- **Household Transition Model**
- **Household Relocation Model**
- **Household Location Choice Model**

Employment Location Models

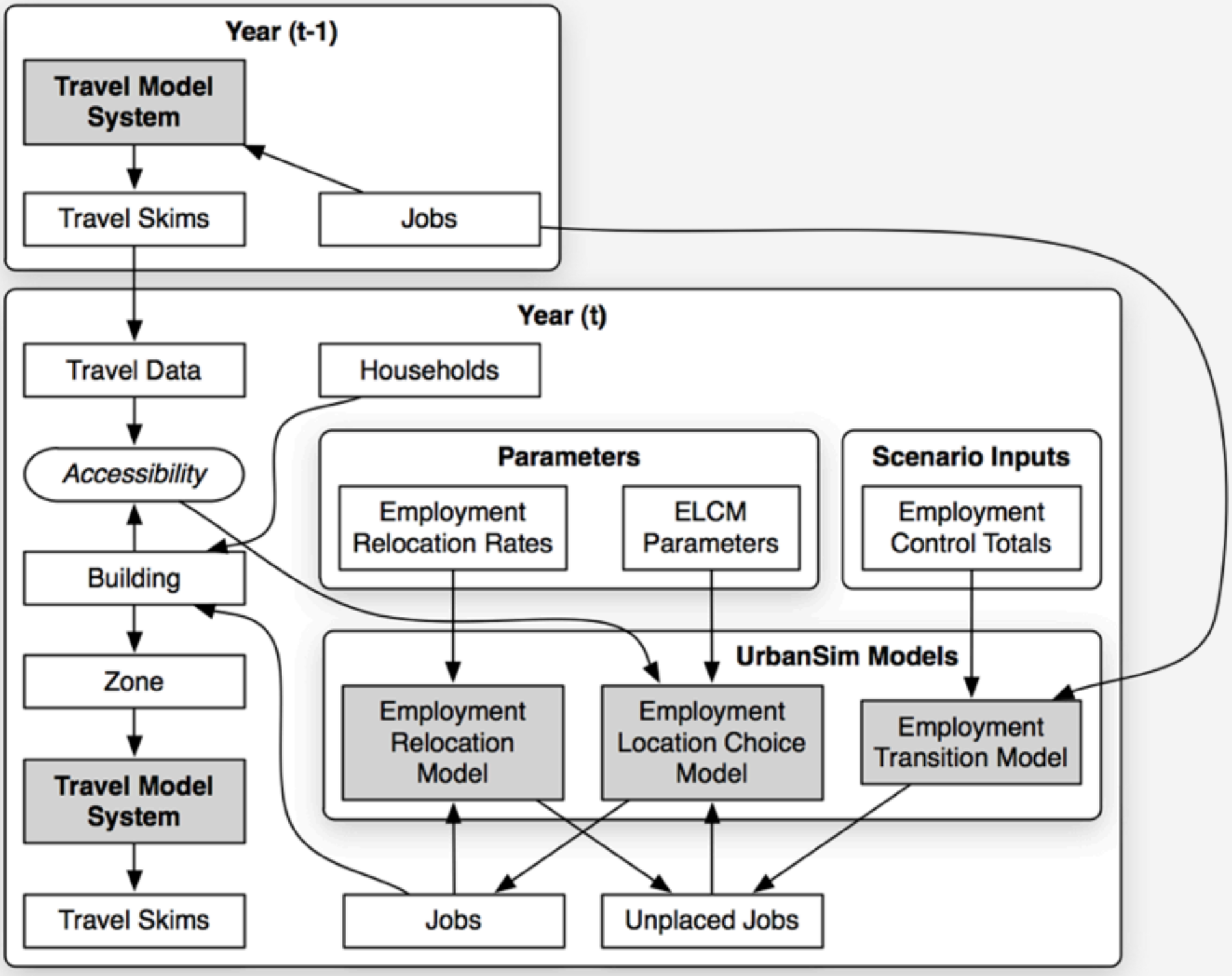
- **Employment Transition Model**
- **Employment Relocation Model**
- **Employment Location Choice Model**

Being used in Research Triangle Park, North Carolina. No representation of supply side of real estate market, or prices. Last resort when there is no data on supply.

Zone Configuration of UrbanSim: Household-Centric



Zone Configuration of UrbanSim: Employment-Centric



UrbanSim: Add Real Estate Supply and Price

Land Development Models

- Real Estate Price Model
- Residential Development Project Location Choice Model
- Nonresidential Development Project Location Choice Model
- Building Construction Model

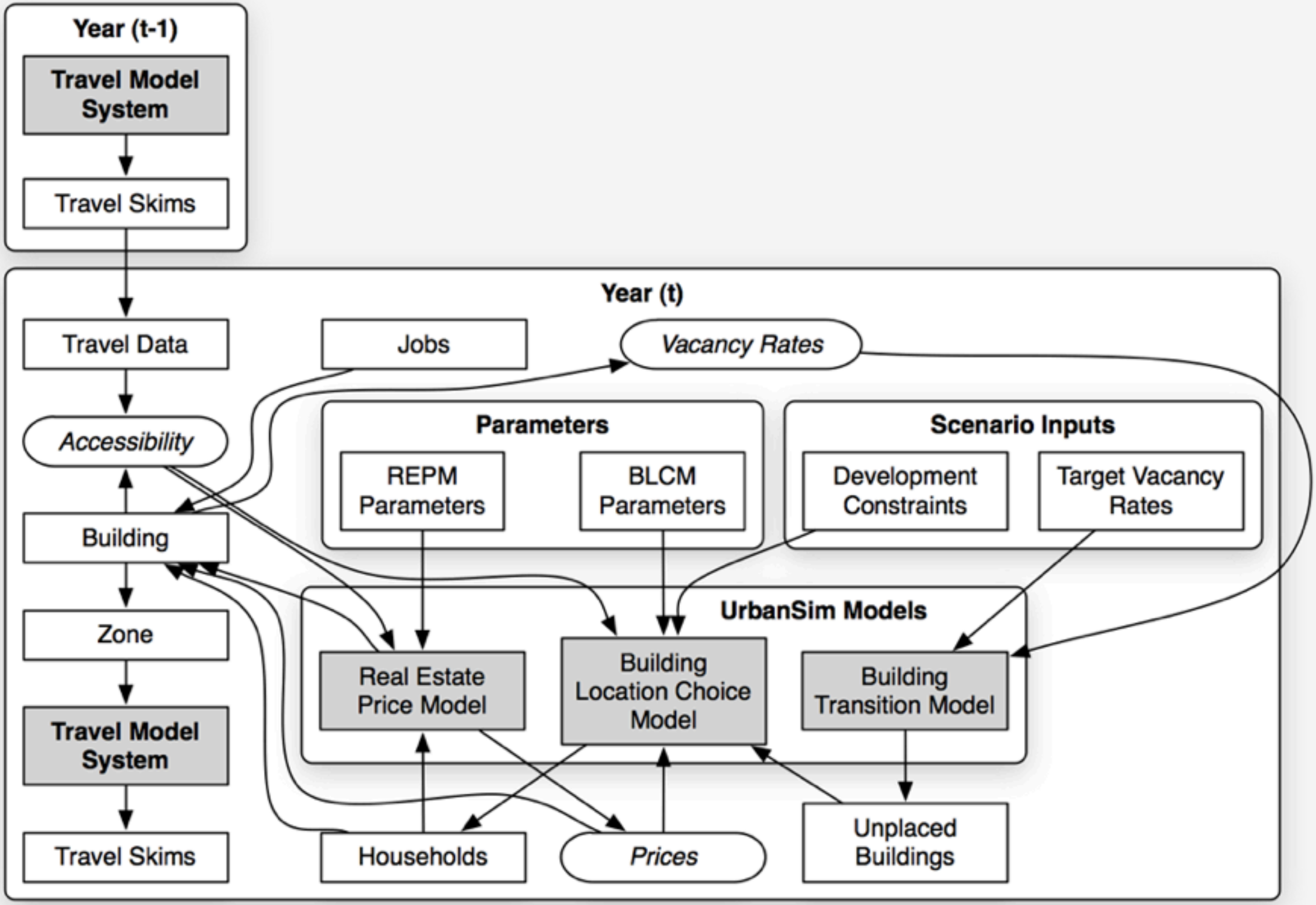
Household Location Models

- Household Transition Model
- Household Relocation Model
- Household Location Choice Model

Employment Location Models

- Employment Transition Model
- Employment Relocation Model
- Employment Location Choice Model

Zone Configuration of UrbanSim: Development-Centric



UrbanSim: Add Labor Market & Workplace

Land Development Models

- Real Estate Price Model
- Residential Development Project Location Choice Model
- Nonresidential Development Project Location Choice Model
- Building Construction Model

Household Location Models

- Household Transition Model
- Household Relocation Model
- Household Location Choice Model

Employment Location Models

- Employment Transition Model
- Employment Relocation Model
- Employment Location Choice Model

Workplace Location Models

- Economic Transition Model
- Home-based Job Choice Model
- Workplace Location Choice Model
- Job Change Model

UrbanSim: Shift From Zones to Parcels as Locations

Land Development Models

- Real Estate Price Model
- Residential Development Project Location Choice Model
- Nonresidential Development Project Location Choice Model
- Building Construction Model

Household Location Models

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Employment Location Models

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Workplace Location Models

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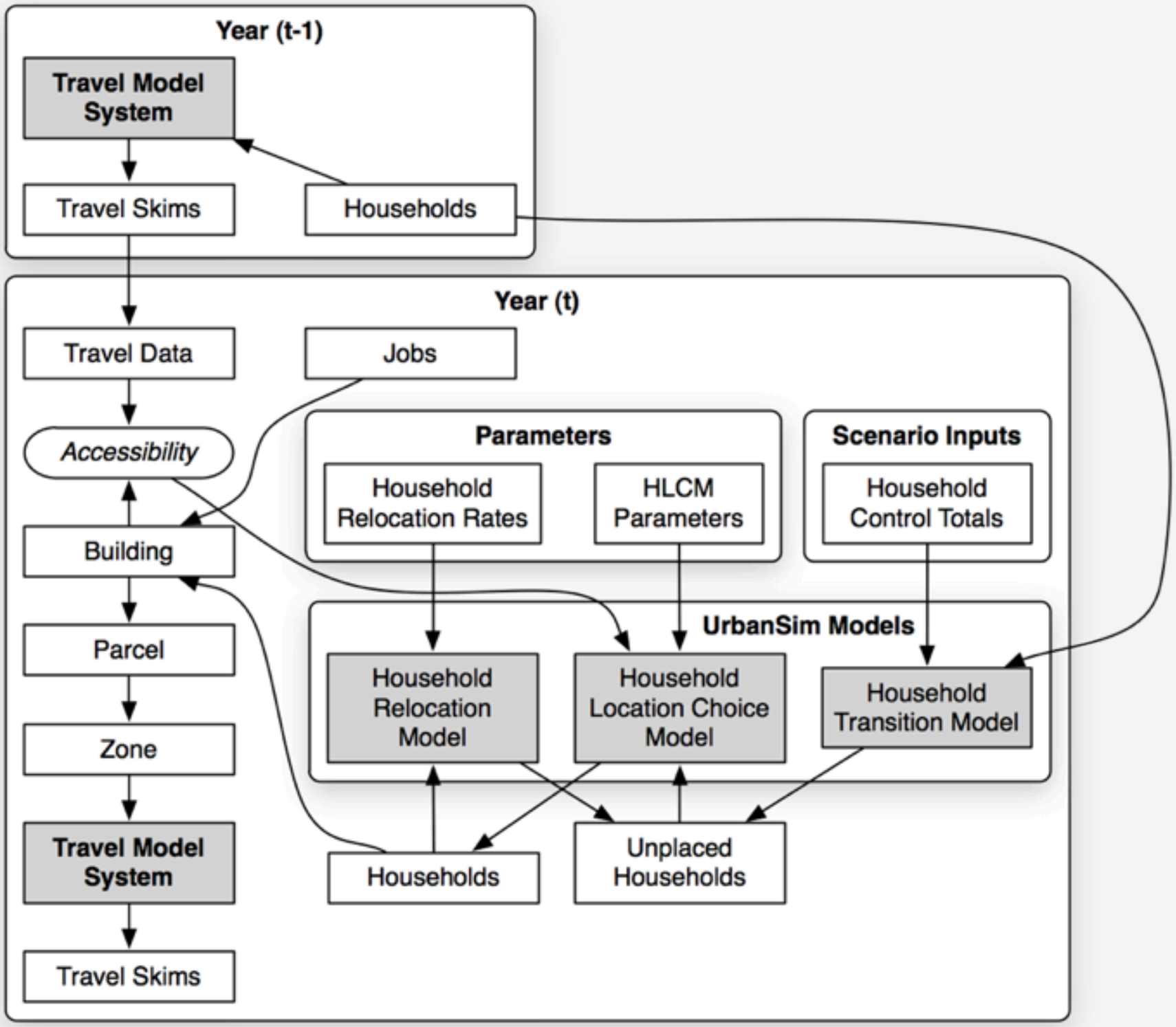
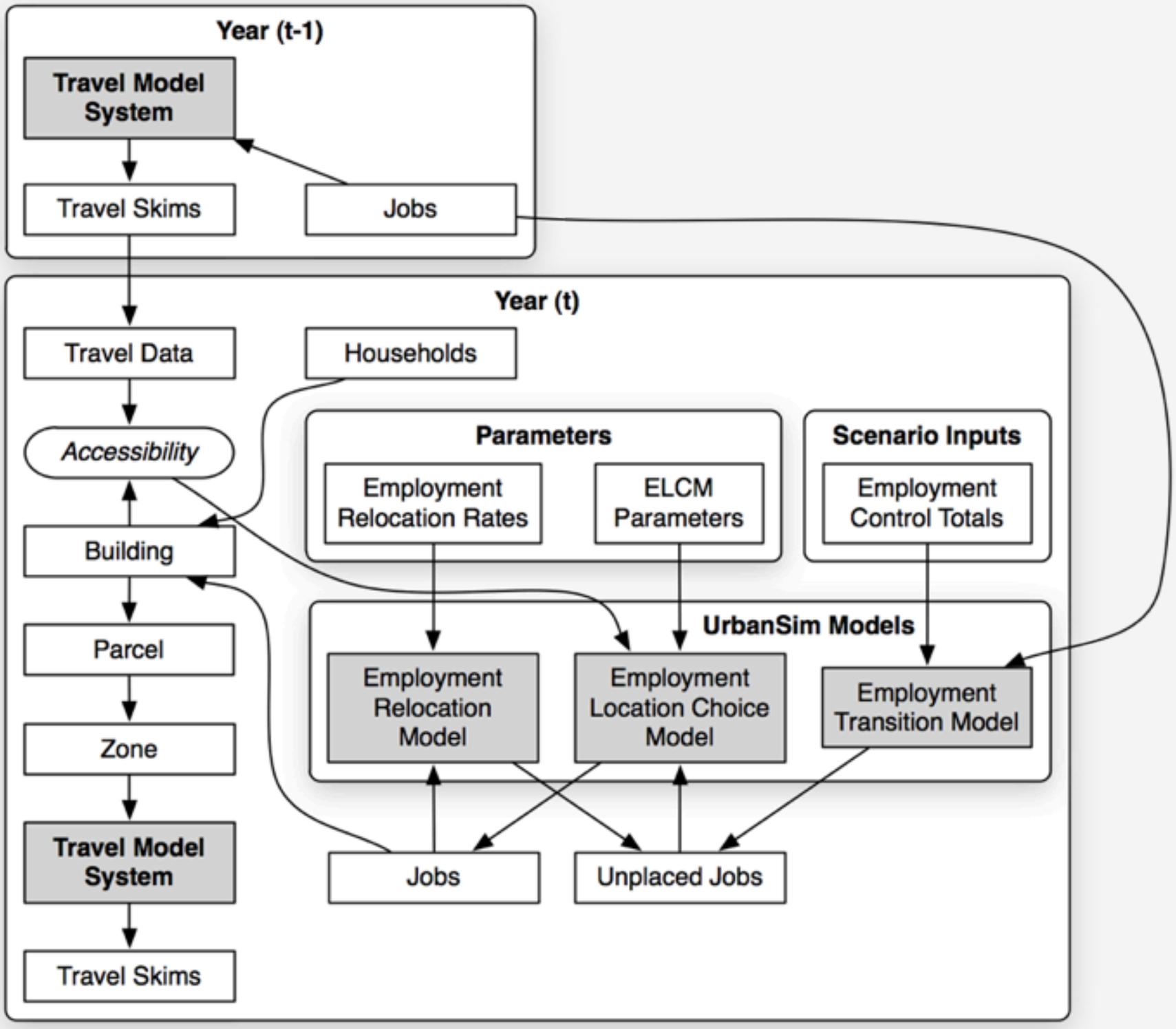
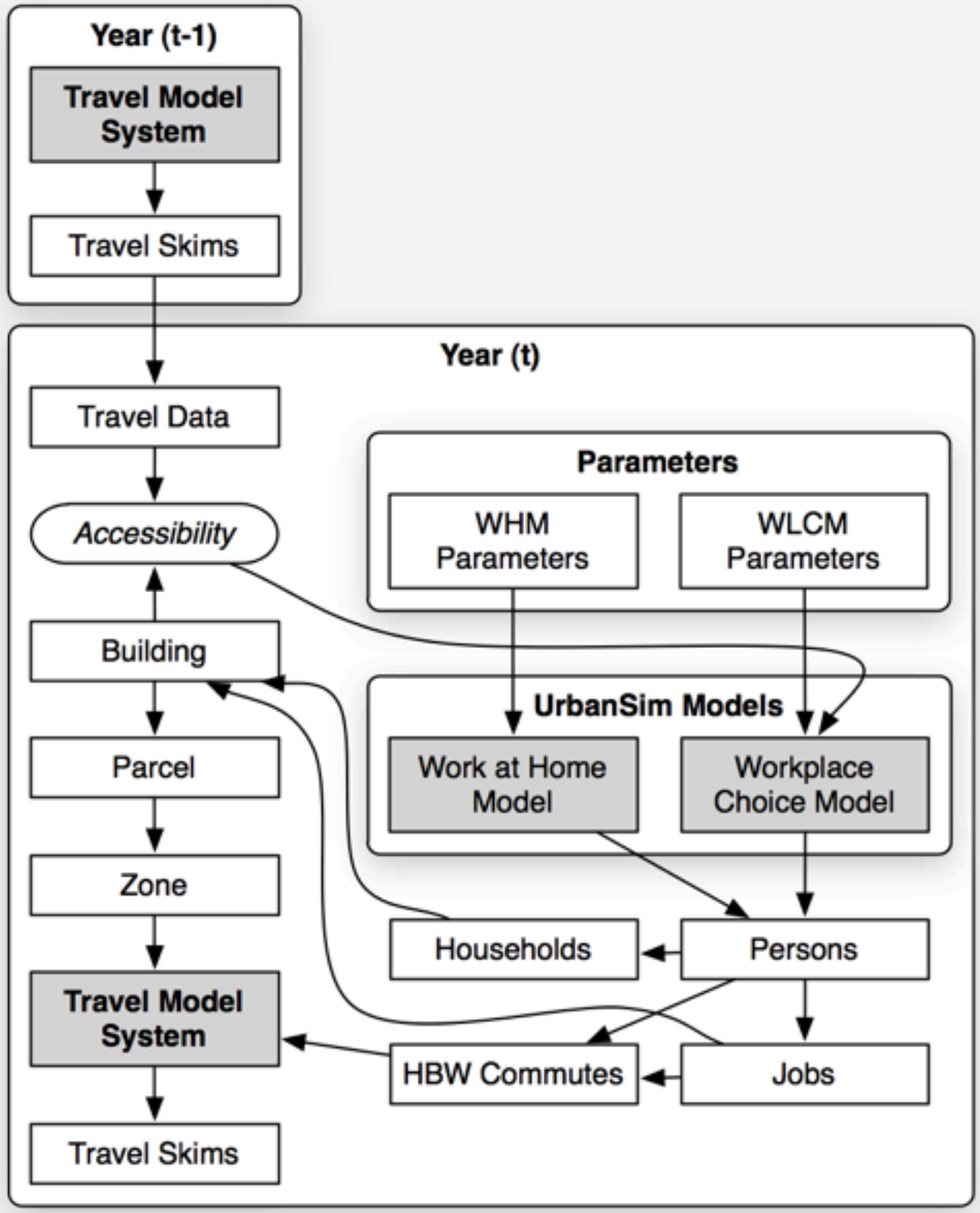
Parcel Configuration of UrbanSim: Household-Centric



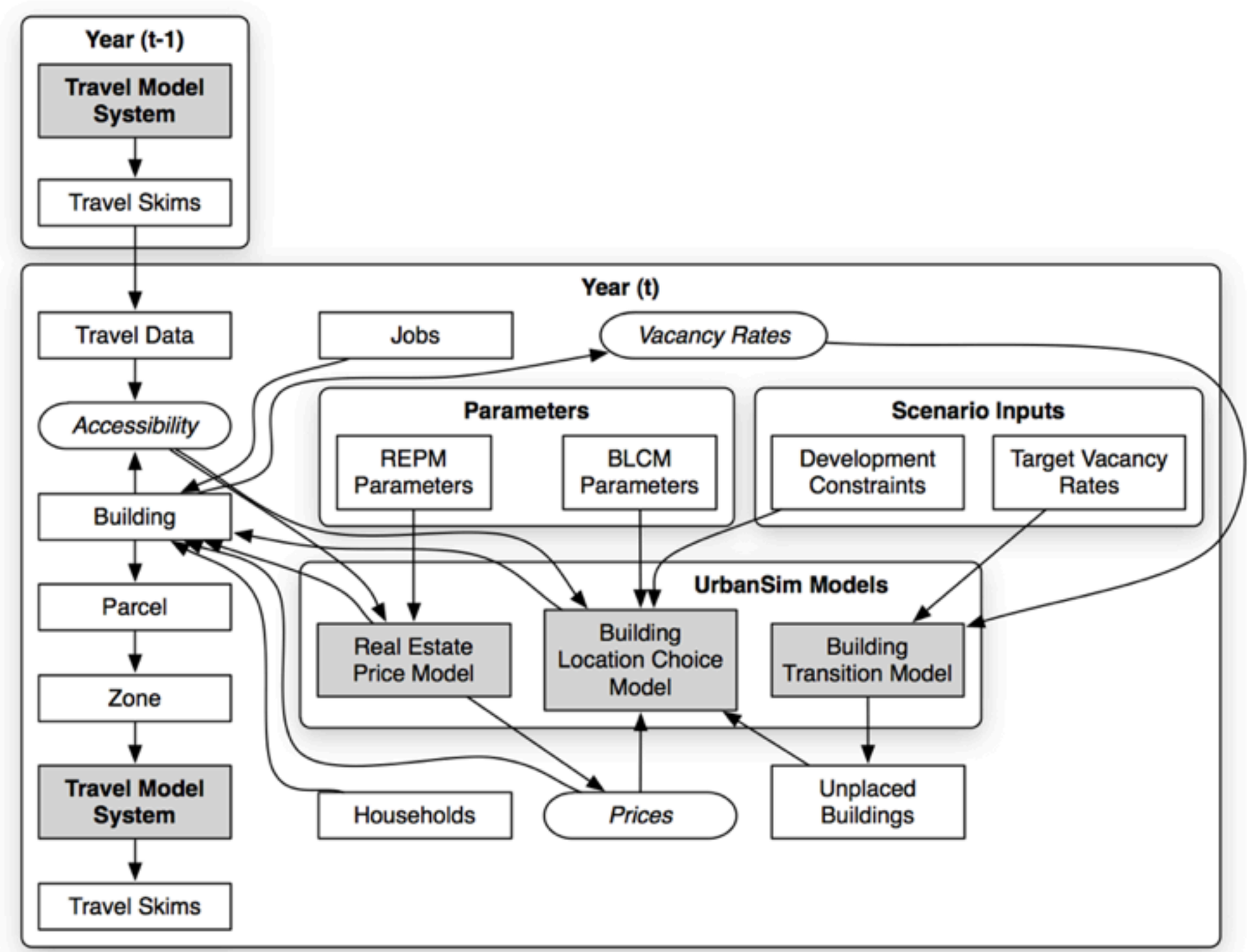
Parcel Configuration of UrbanSim: Employment-Centric



Parcel Configuration of UrbanSim: Worker-Centric



Parcel Configuration of UrbanSim: Land-Centric



UrbanSim: Alternative Development Models

Land Development Models

- Process Pipeline Events
- Real Estate Price Model
- Expected Sale Price Model
- Development Proposal Choice Model
- Building Construction Model

Household Location Models

- Household Transition Model
- Household Relocation Model
- Household Location Choice Model

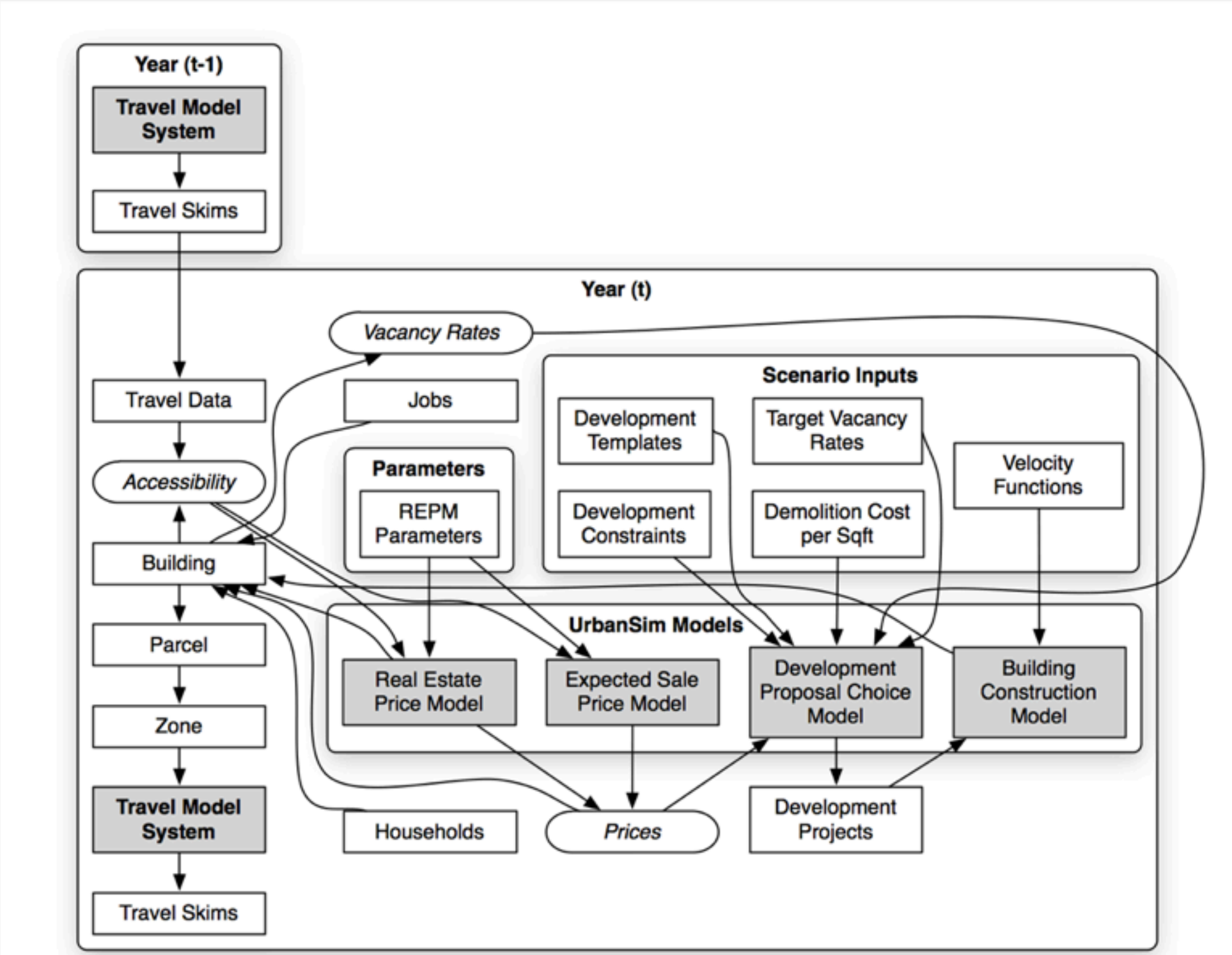
Employment Location Models

- Employment Transition Model
- Employment Relocation Model
- Employment Location Choice Model

Workplace Location Models

- Economic Transition Model
- Home-based Job Choice Model
- Workplace Location Choice Model
- Job Change Model

Parcel Configuration of UrbanSim: Land-Centric



Configuration of UrbanSim Models at Parcel Level

Model	Household Location Choice	Employment Location Choice	Real Estate Development
Agents	Households Locating in Year t (new or moving)	Businesses Locating in Year t (new or moving)	Development Projects Selected in Year t
Choice Set Type	Residential Buildings	Non-residential Buildings	Parcels
Filter on Choice Set	At least 1 vacant unit	Sufficient vacant sqft for business	Sufficient development capacity under Comprehensive Plan
Sampling of Alternatives in Estimation	1 Chosen, 30 Random Alternatives	1 Chosen, 30 Random Alternatives	N/A

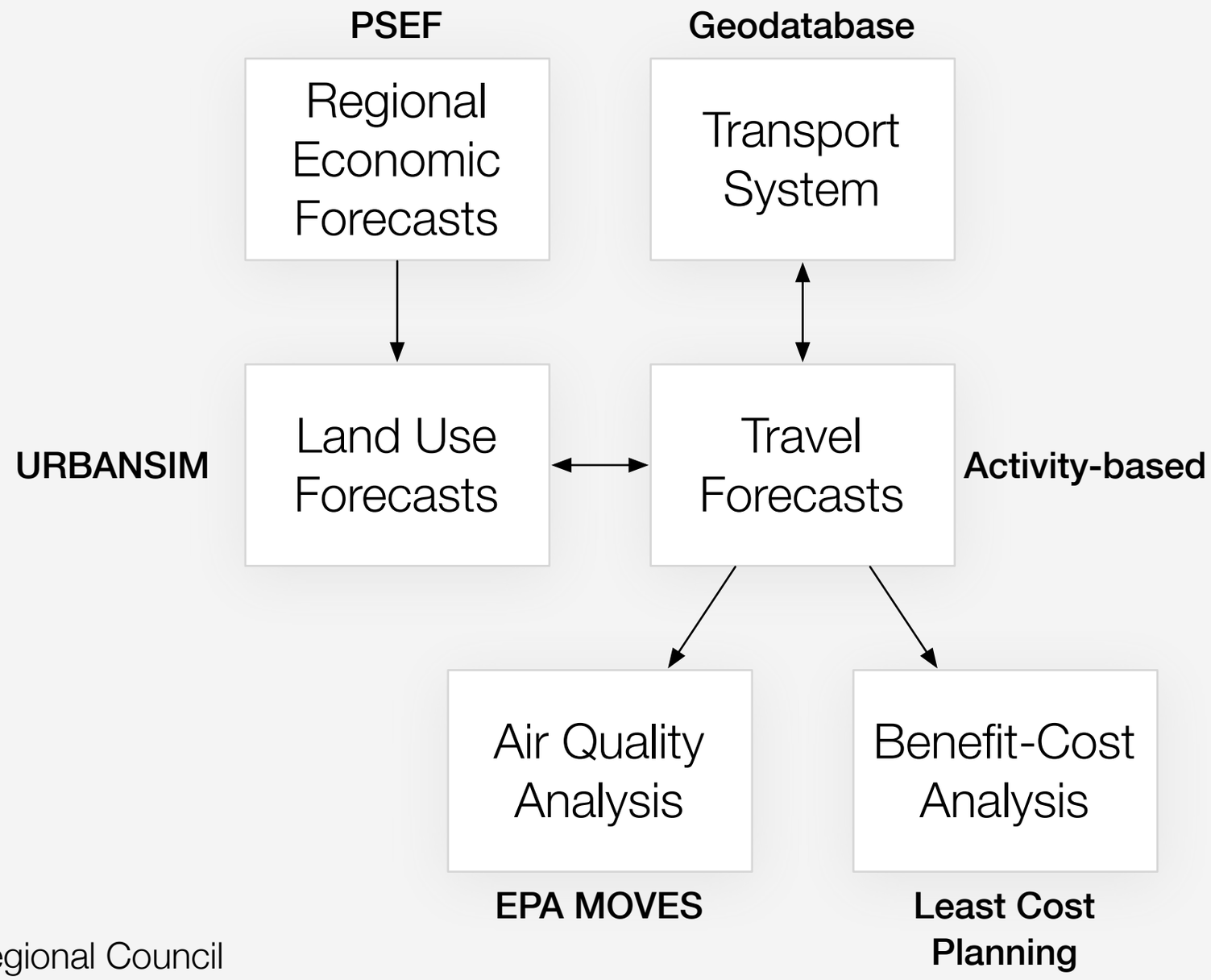
Configuration of UrbanSim Models at Parcel Level

Model	Household Location Choice	Employment Location Choice	Real Estate Development
Submodels for Separate Estimation/ Application	N/A	Employment Sectors (NAICS-based)	Building Types
Choice Algorithm	Capacity Constrained	Capacity Constrained	Capacity Constrained
Principal Variables in Utility Function	Income of Household Housing Price Parcel Land Area Unit Square Feet Building Year Built Units on Parcel Jobs in Zone Households in Zone Job Access by Mode	Building Type Price per Square Foot Parcel Land Area Building Year Built Zonal Jobs by Sector Businesses in Zone Households in Zone Avg Income in Zone Job Access by Mode	Price per Square Foot Land Area Avg Income in Zone Households in Zone Businesses in Zone Access by Mode to Jobs

1. Alternative Data Schemas and Model Configurations
2. **Sensitivity Analysis to Accessibility Changes**
3. Coming soon: 3D Modeling and Visualization

PSRC Integrated Models

Simulates persons and households at a parcel level



Source: Puget Sound Regional Council

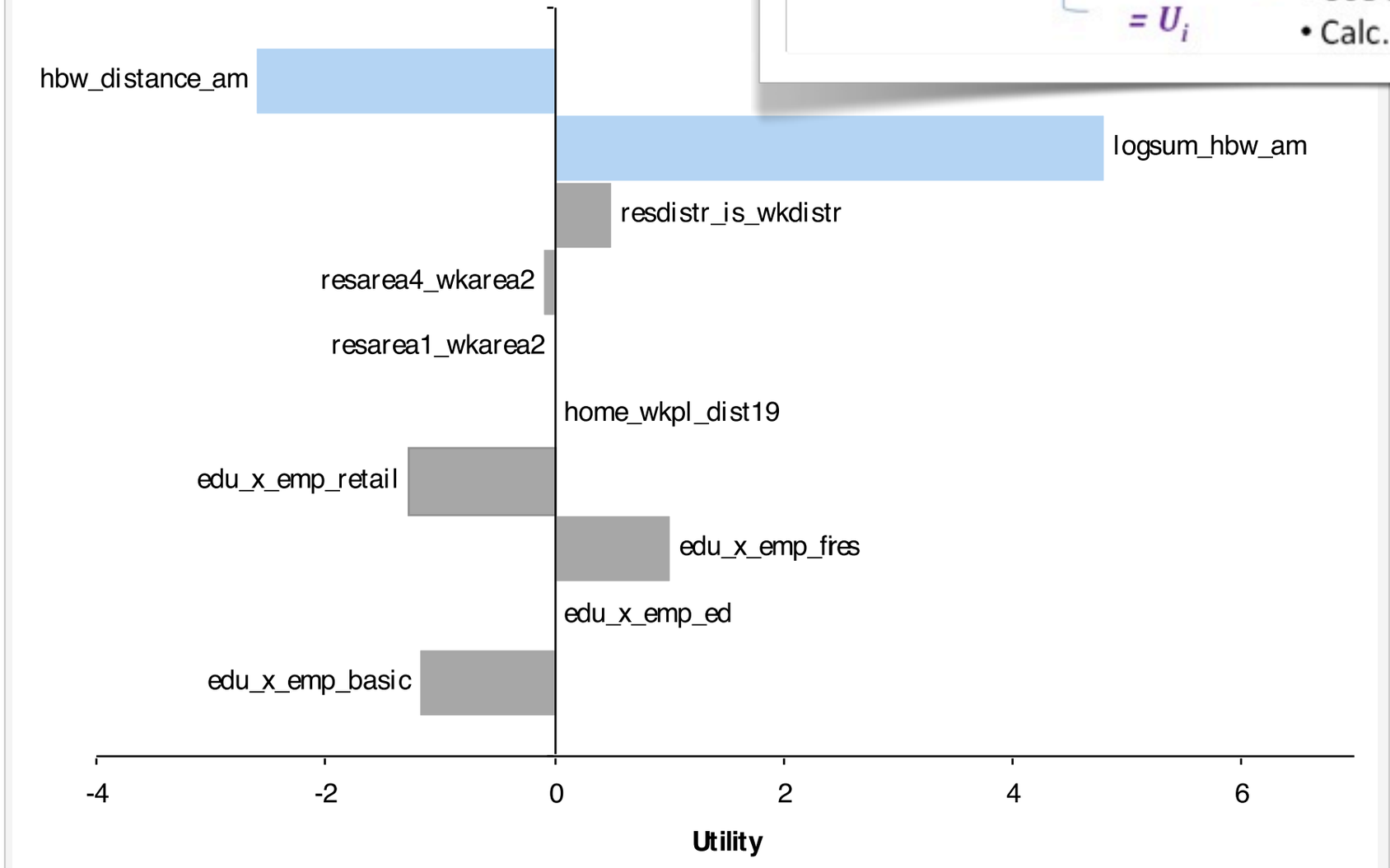
Sensitivity Analysis: Relative Influence of Variables

Estimated Parameters (β)

$\beta_{i1} x_{i1} +$
$\beta_{i2} x_{i2} +$
...
$\beta_{ik} x_{ik} +$
...
$= U_i$

All variables (x) except one held at median value

One variable:
- Use 5th & 95th percentile values
- Calc. Δ U for indication of influence



Model Handshake – Current Setup

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

Source: Puget Sound Regional Council

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

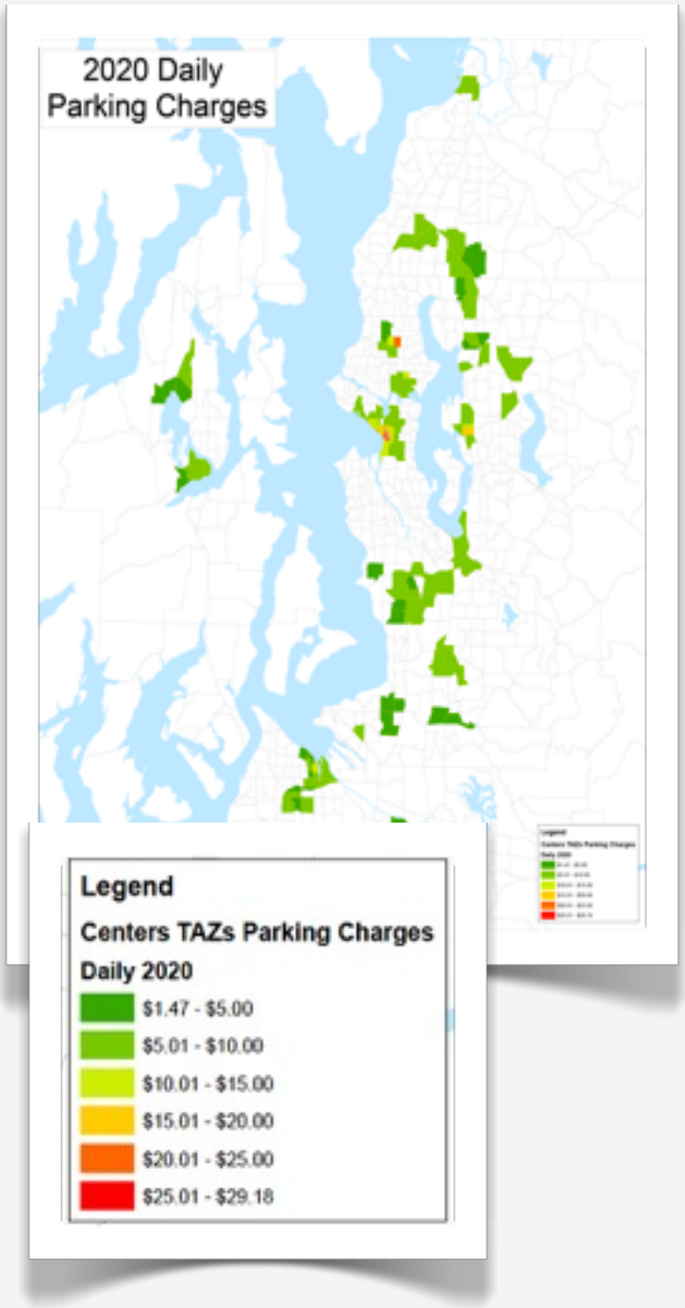
Source: Puget Sound Regional Council

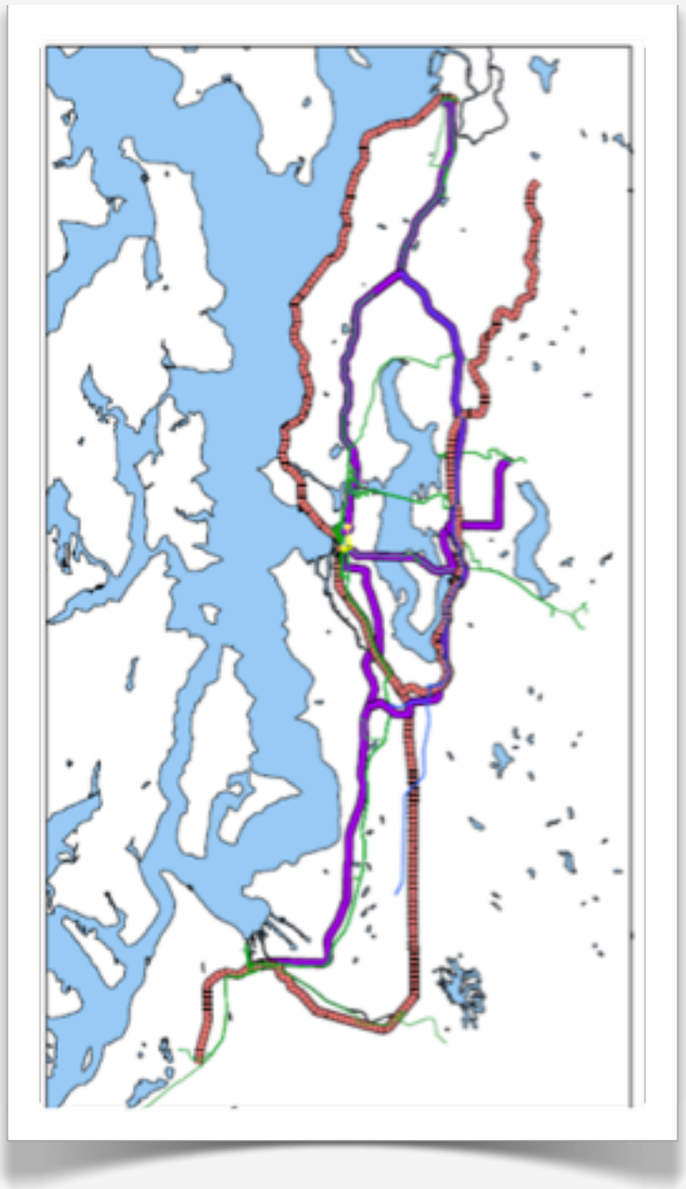
Sensitivity Tests

- 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

Source: Puget Sound Regional Council

Alternatives





Source: Puget Sound Regional Council

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

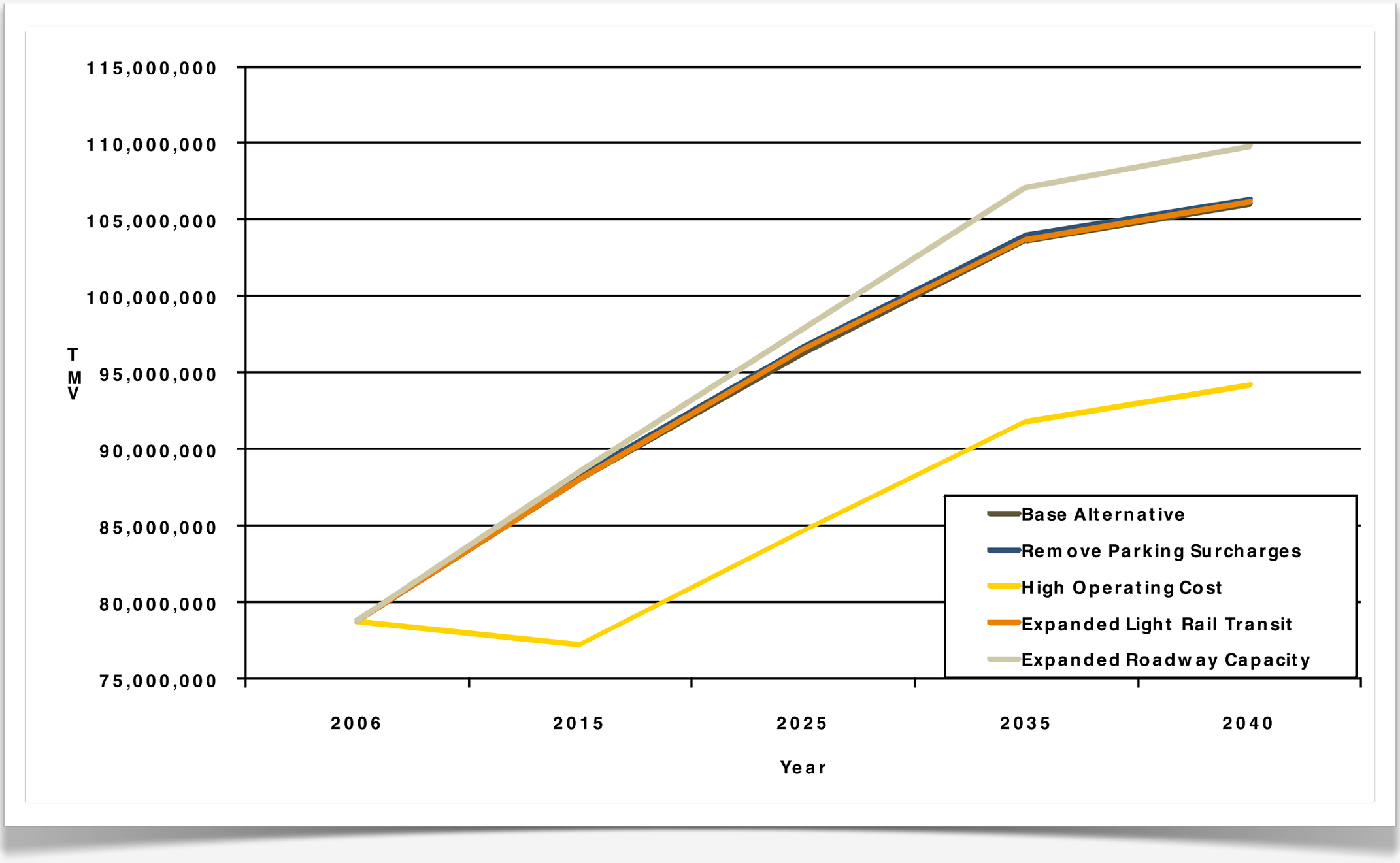
Source: Puget Sound Regional Council

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

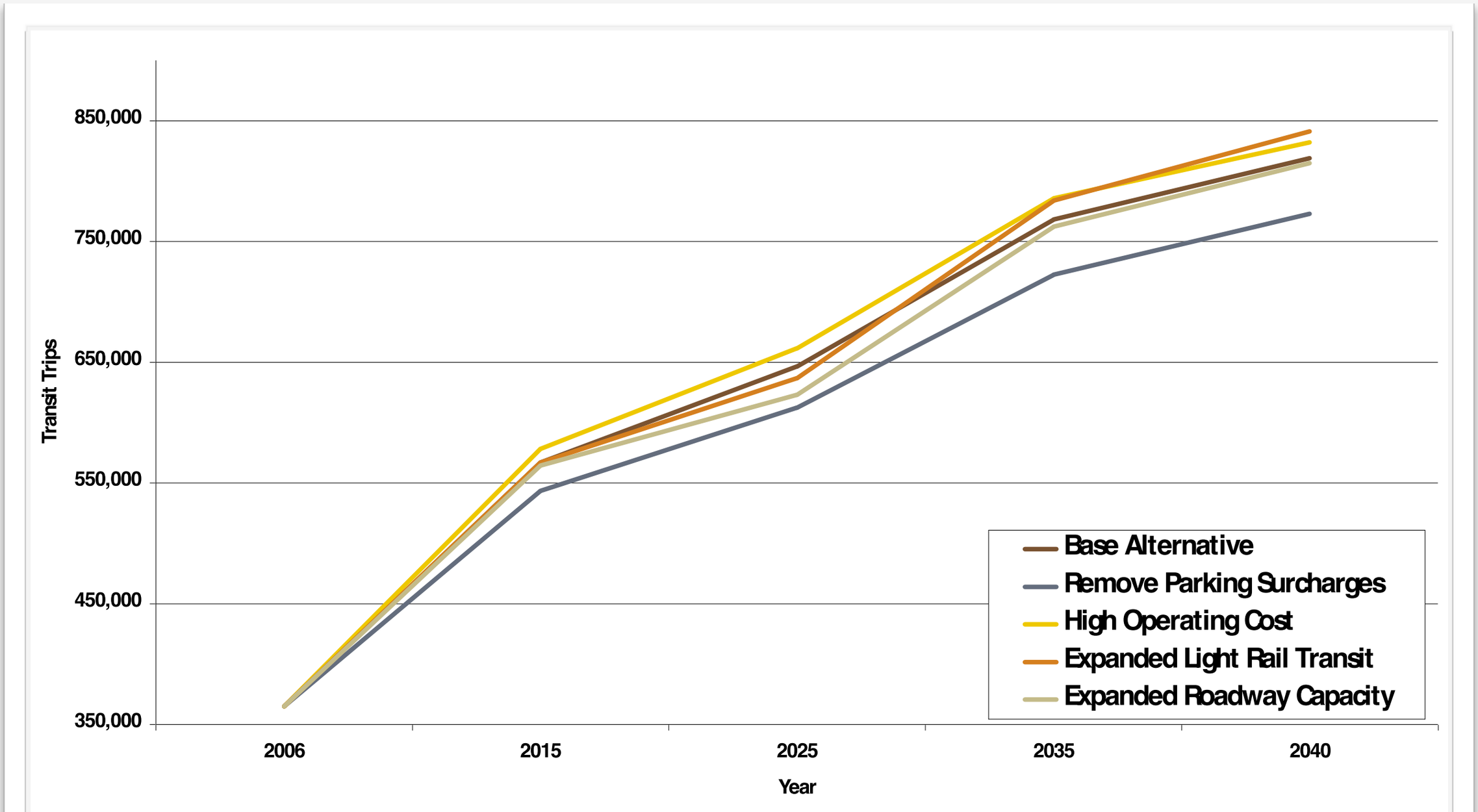
Source: Puget Sound Regional Council

VMT



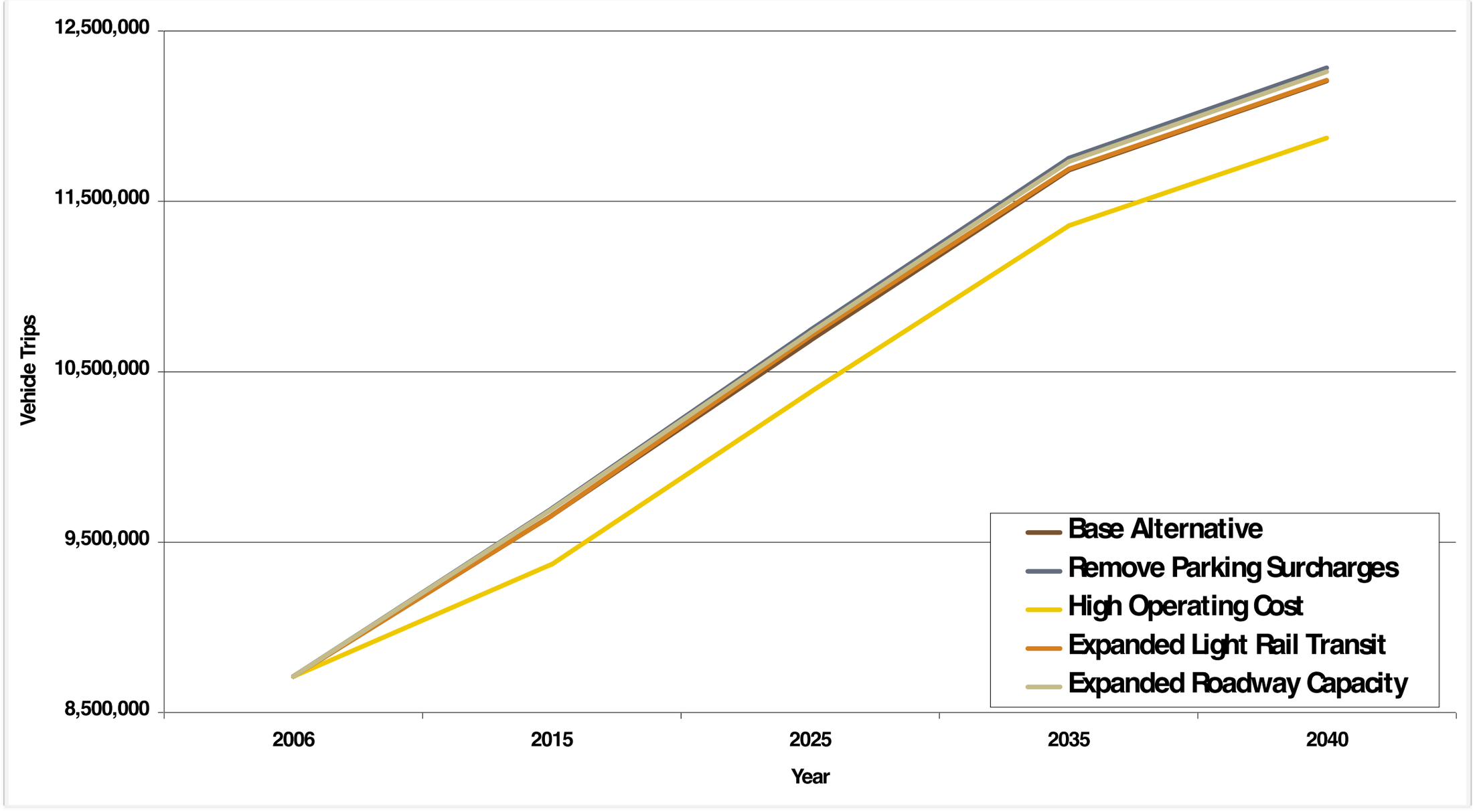
Source: Puget Sound Regional Council

Transit Trips



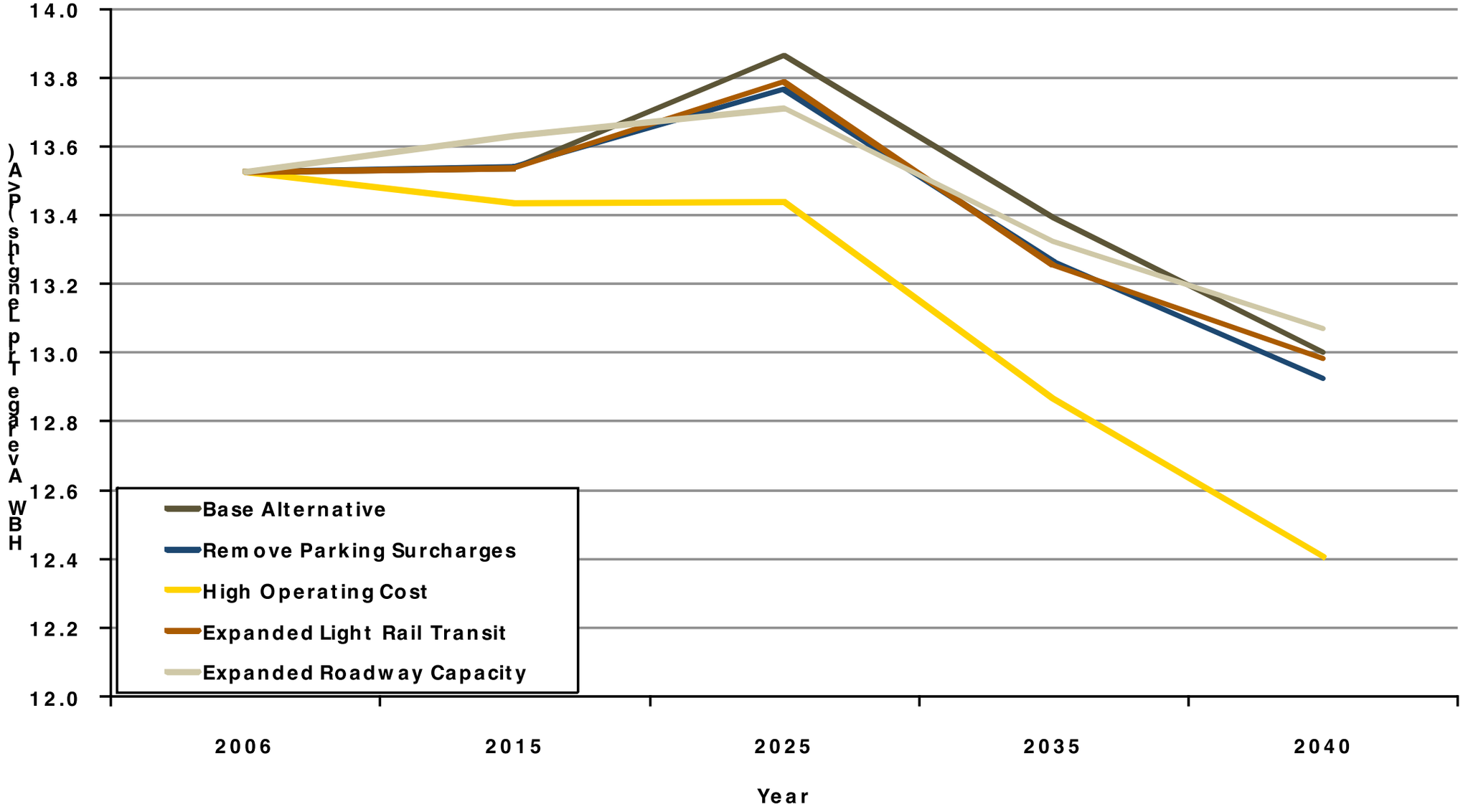
Source: Puget Sound Regional Council

Vehicle Trips



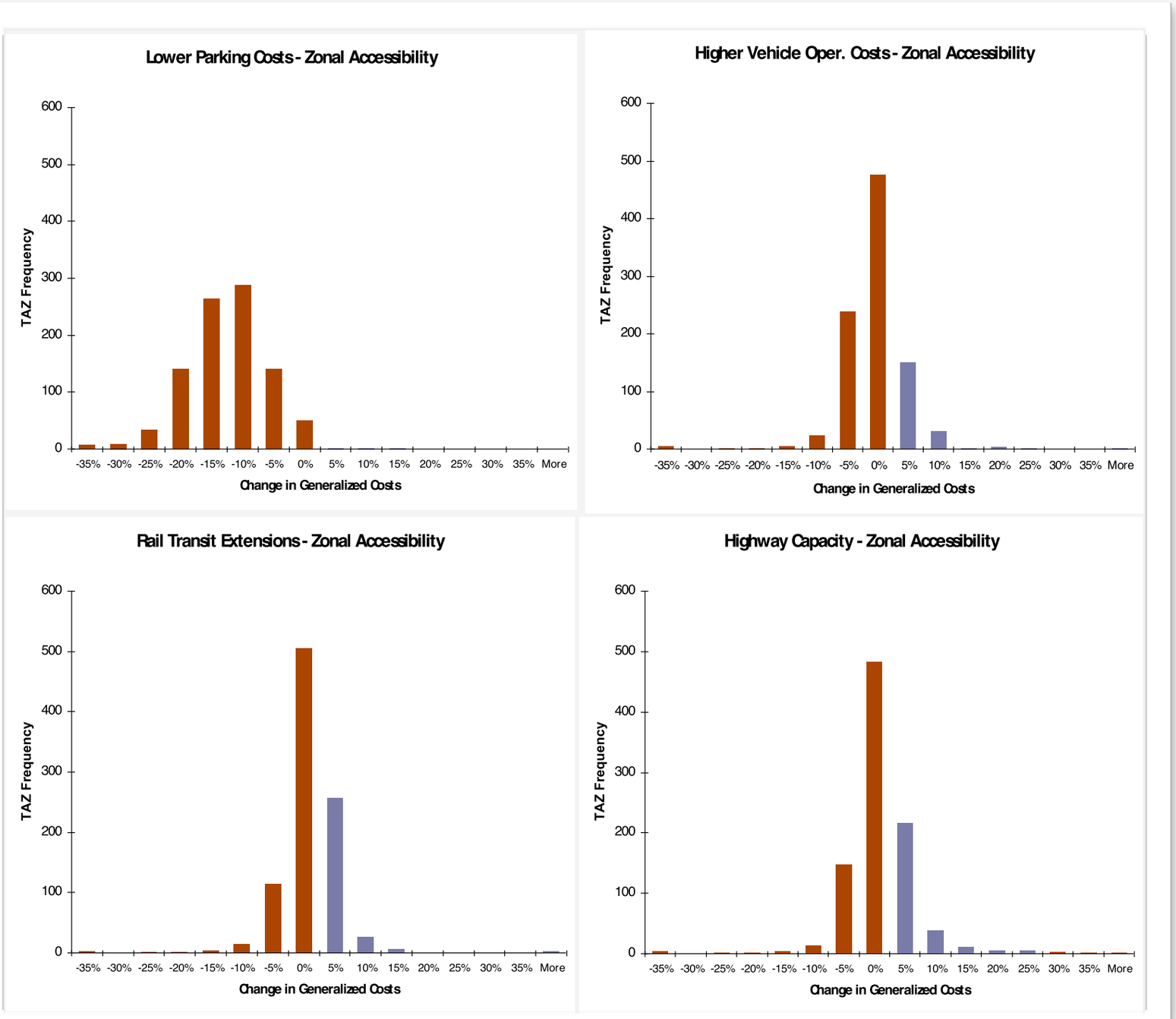
Source: Puget Sound Regional Council

HBW Average Trip Lengths



Source: Puget Sound Regional Council

Changes in Access Costs – AM Productions

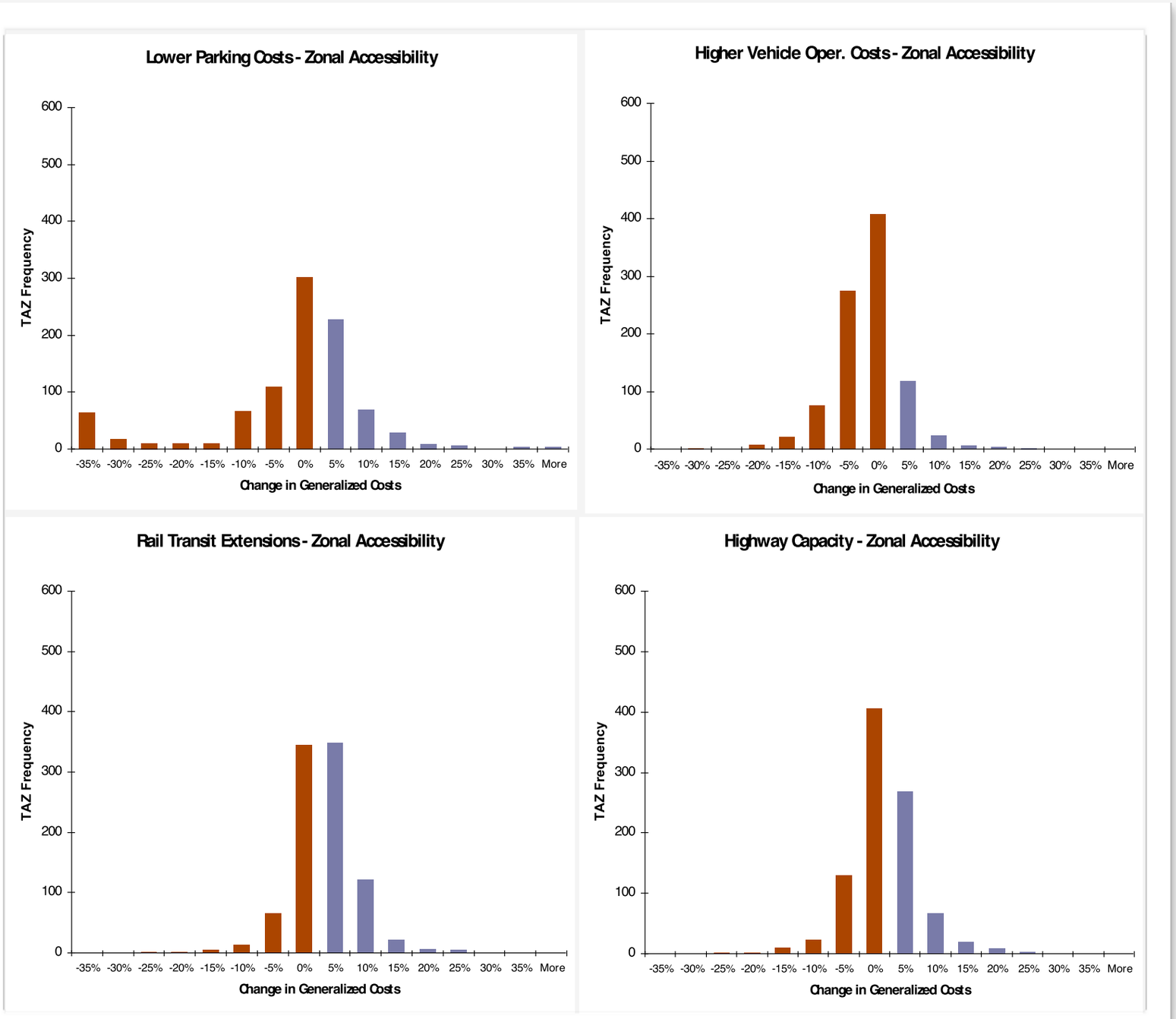


Access Improvement

- A drop in generalized costs of auto travel
- Trip weighted average from each zone to all other zones

Source: Puget Sound Regional Council

Changes in Access Costs – AM Attractions



Access Improvement

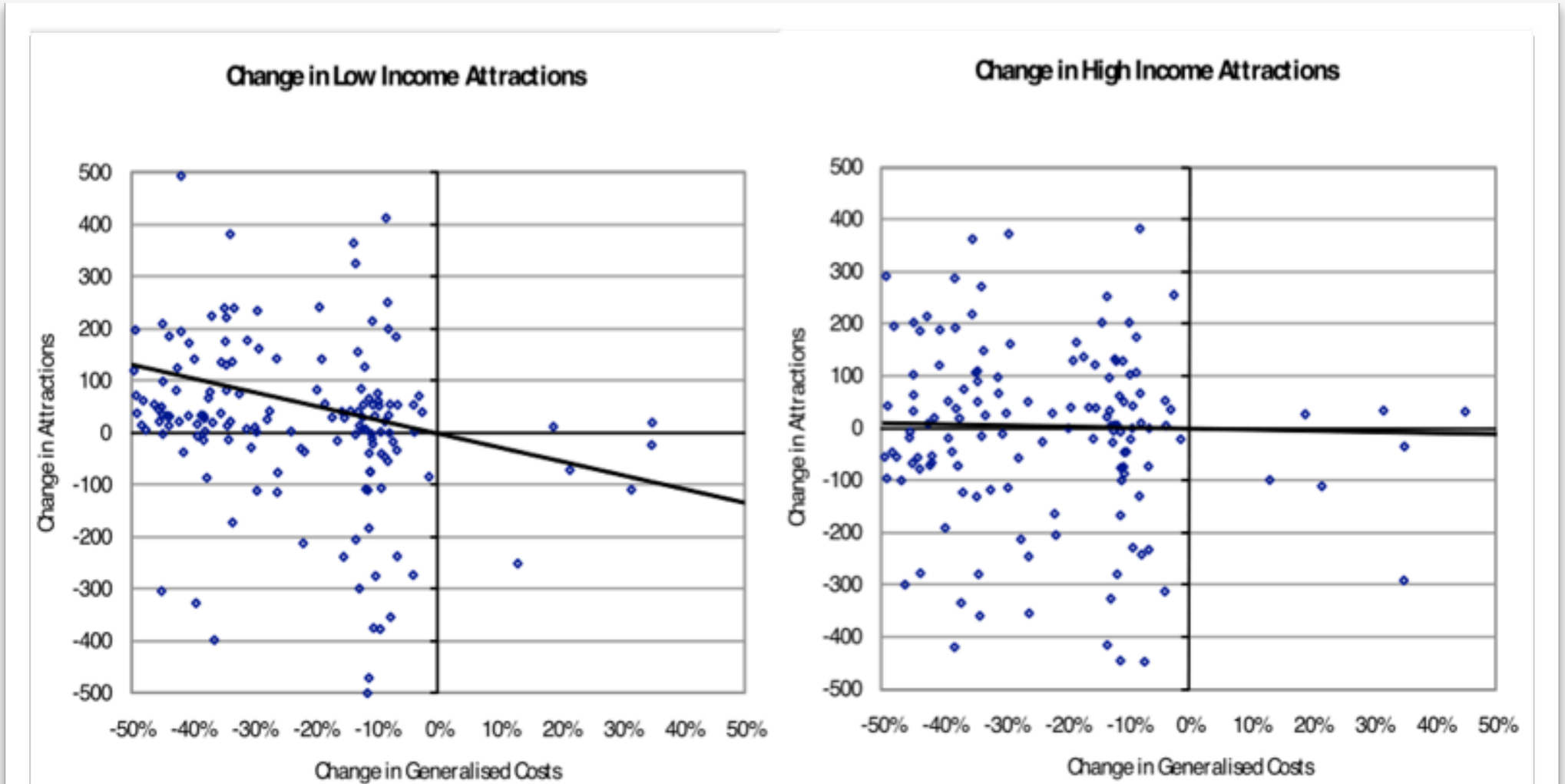
- A drop in generalized costs of auto travel
- Trip weighted average from each zone to all other zones

Source: Puget Sound Regional Council

Lower Parking Charges

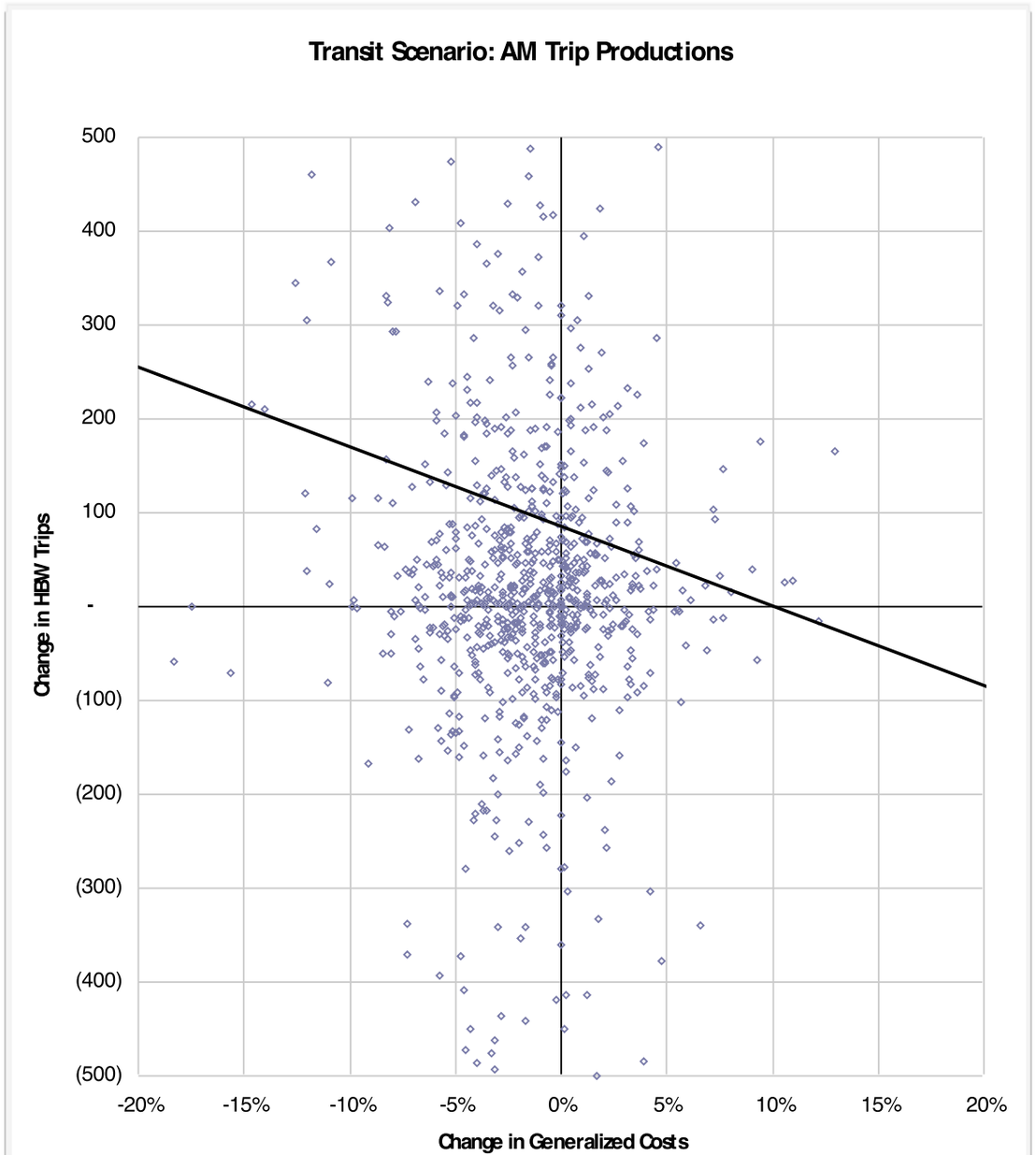
Workplace Location Choice

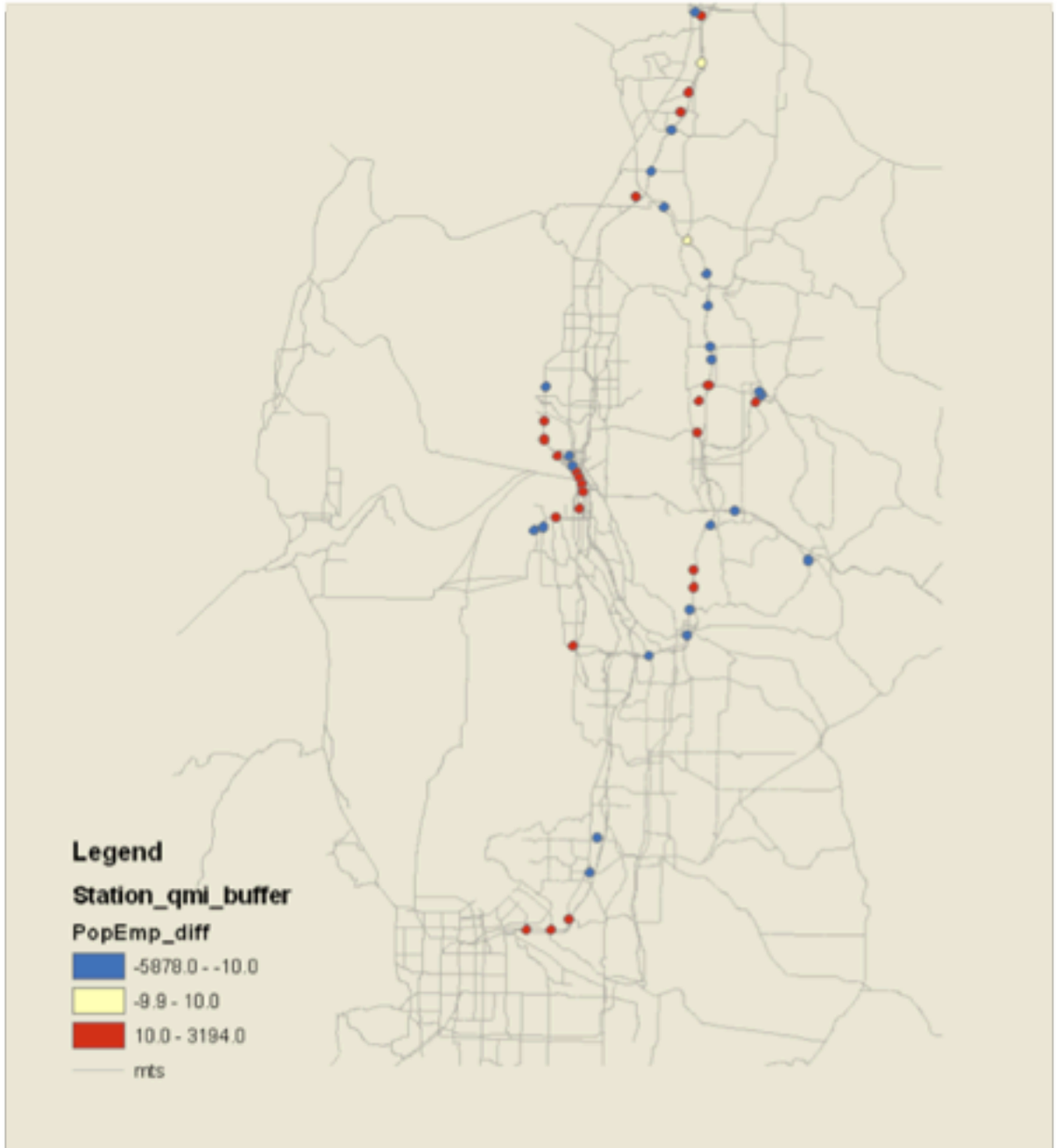
- Trip attractions increase in zones with lower parking costs
- Income sensitivity



Source: Puget Sound Regional Council

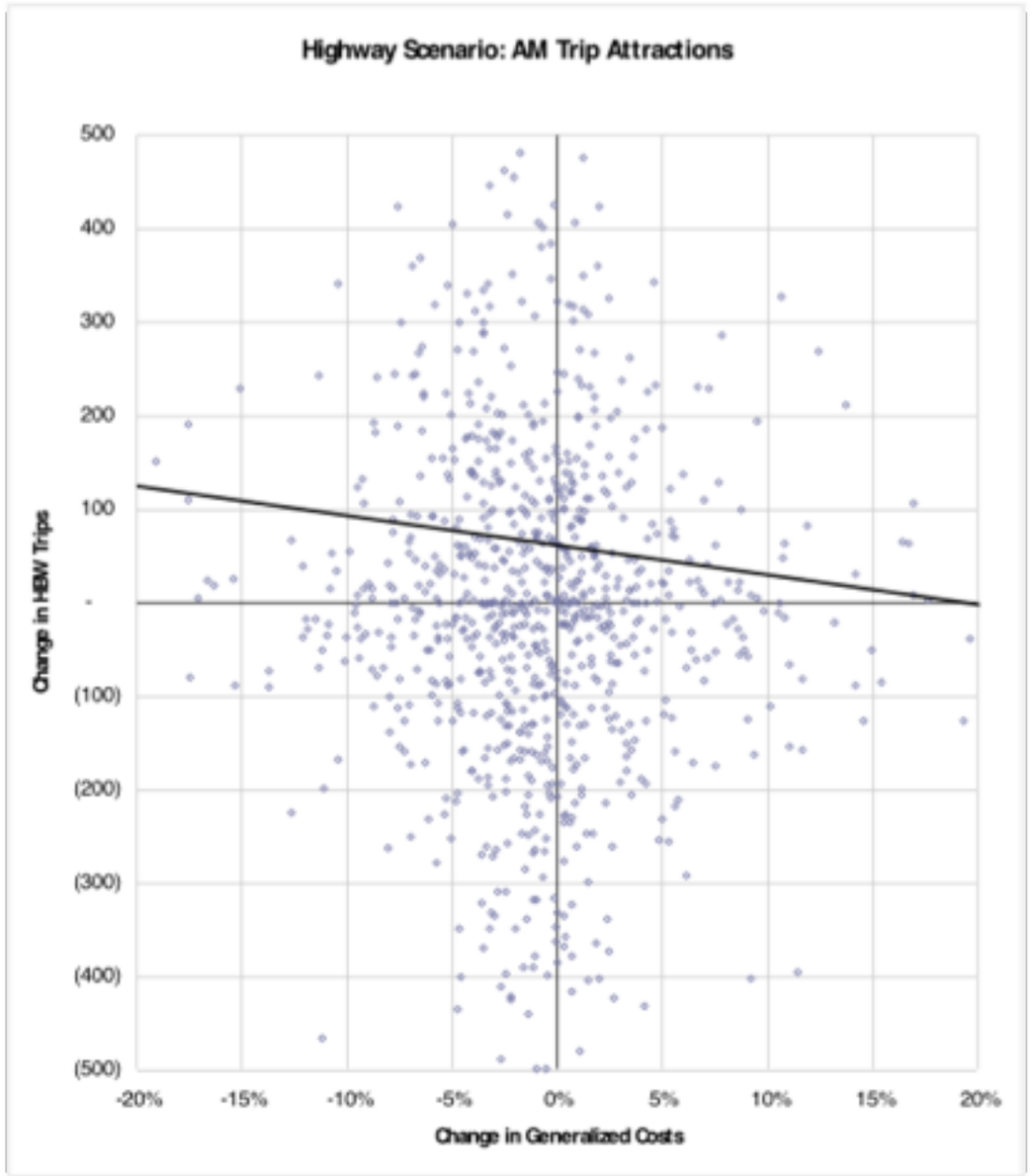
Rail Transit Extensions

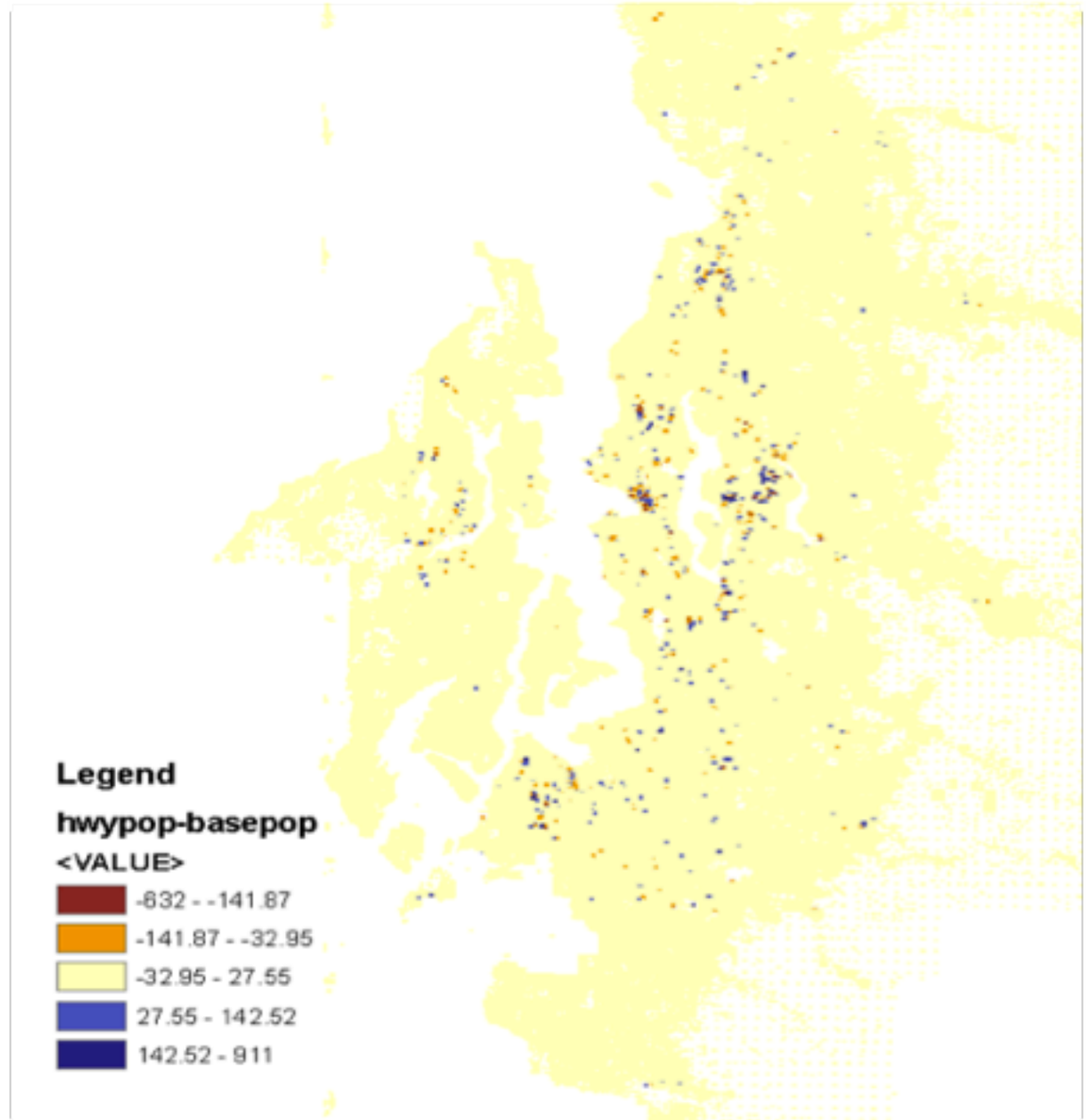




Source: Puget Sound Regional Council

Increased Highway Capacity





Source: Puget Sound Regional Council

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

Source: Puget Sound Regional Council

1. Alternative Data Schemas and Model Configurations
2. **Coming soon: 3D Modeling and Visualization**

Initial Version of UrbanSim 3D Visualization

New Projects: 3D Visualization and Scenario Building

- New $900K NSF grant to integrate 3D geometric modeling and visualization with UrbanSim behavioral modeling
- New $100K Scenario Builder project to create more intuitive way to create scenarios

Other News

- New installer for 4.3 stable release to be done soon
- Database schema generator and data loading tools in testing stage
- Database Browser and Editor now in testing stage
- Ongoing work on new estimation methods - not close to usable yet

Graphical User Interface for UrbanSim Databases