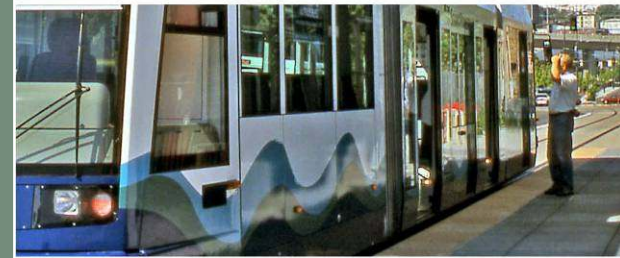


PSRC
COG/MPO Mini-Conference on
Socioeconomic Modeling

**Integrated Land Use and
Activity-Based Modeling in
the Puget Sound Region**

Puget Sound Regional Council
PSRC

August 7th, 2008



Team

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Why do we need integrated disaggregate models?

New Policies in VISION 2040

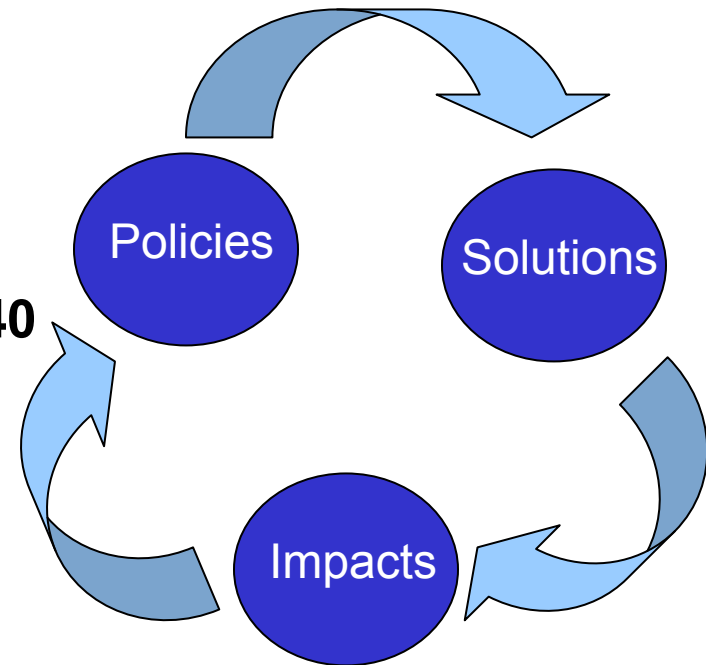
- Environment
- Economy
- Development Patterns
- Public Services
- Transportation
- Housing

New Solutions in Transportation 2040

- Demand Management
- Operational Solutions
- Tolling/pricing

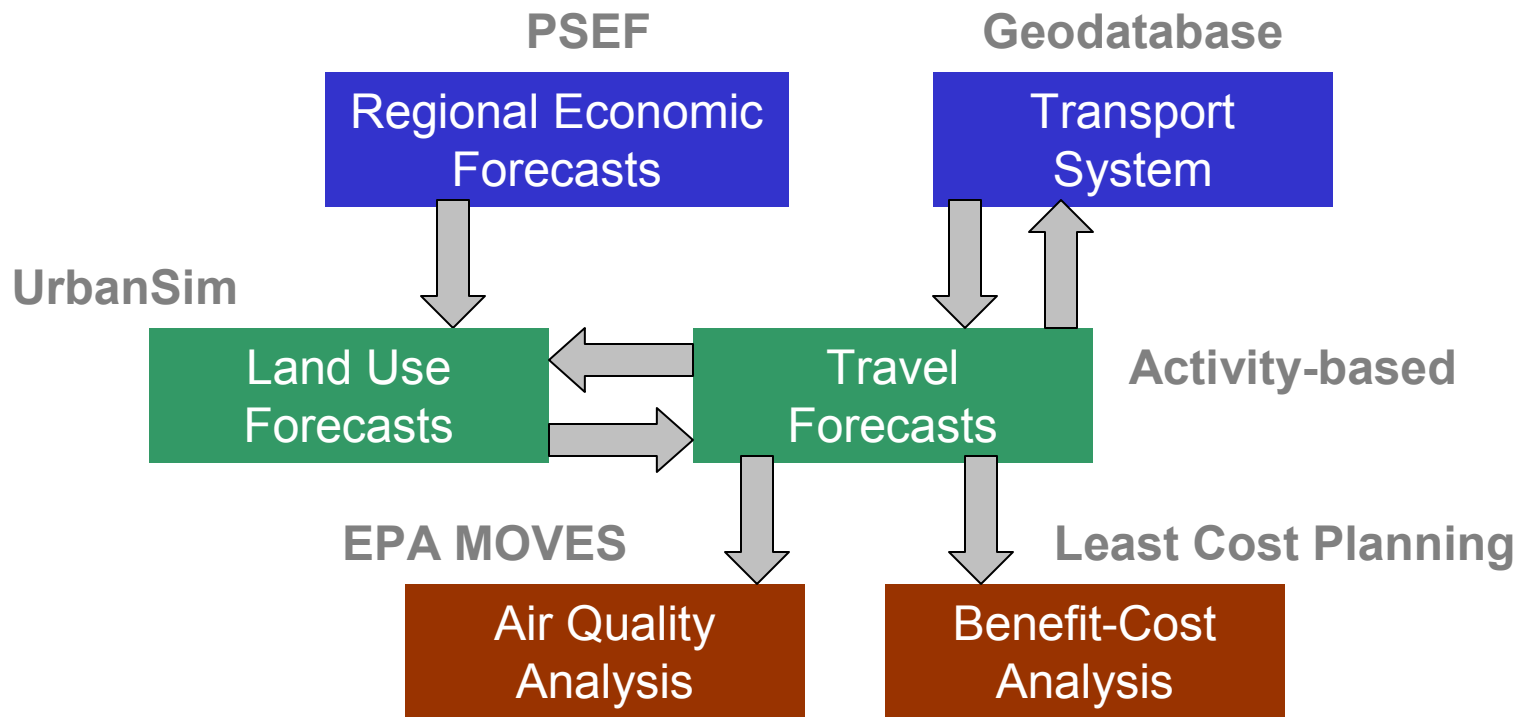
New Impacts to be Measured

- Transportation Efficiency
- Growth Management
- Economic Prosperity
- Environmental Stewardship
- Quality of Life
- Equity



PSRC Integrated Modeling Framework

Simulates persons and households at a parcel level



Why the Move to UrbanSim

Current models (DRAM and EMPAL) restricted in using plans as inputs

- DRAM / EMPAL uses gross measures of acres of land
- No density limitations or variations in/out of Urban Growth Area
- Limited feedback / interaction with the travel models

Expanded and more flexible forecast output

- Can fit forecasts to different geographies such as Regional Growth Centers
- Annual forecasts instead of 10-year increments
- Greater forecast detail:
 - *More individual household variables*
 - *19 Job sectors instead of 5*
 - *Built data (new units, SQFT)*
 - *Additional 'dollar sign' data*

Micro-simulation supports next generation of travel demand models

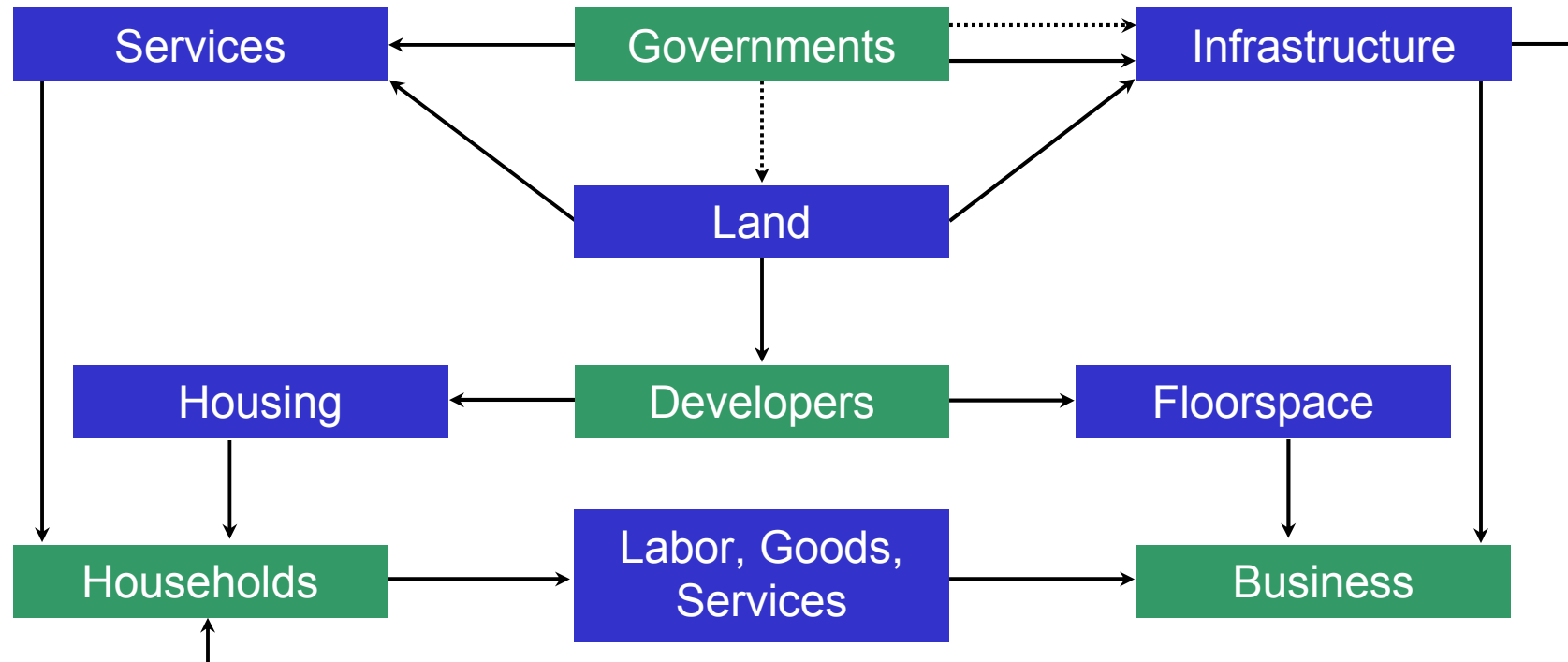
- Modeling individual households and persons, activities instead of trips

Open-source, collaborative approach

- Created at UW, other MPOs implementing and researching improvements

UrbanSim Modeling Process

UrbanSim is an integrated planning and analysis of urban development, incorporating the interactions between land use, transportation, and public policy.

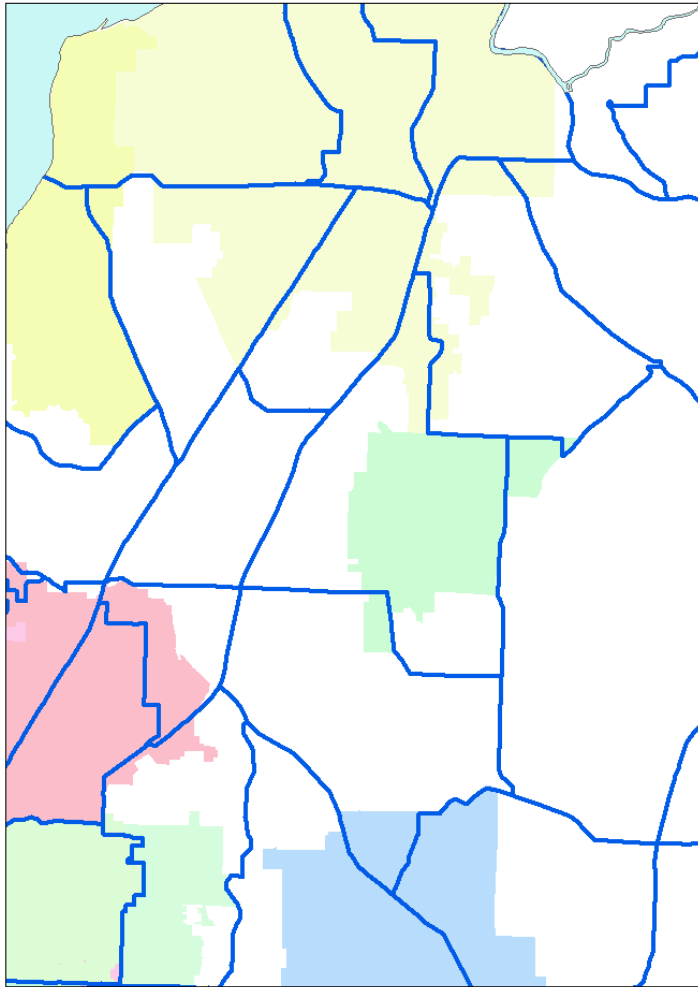


————> Flow of consumption from supplier to consumer.

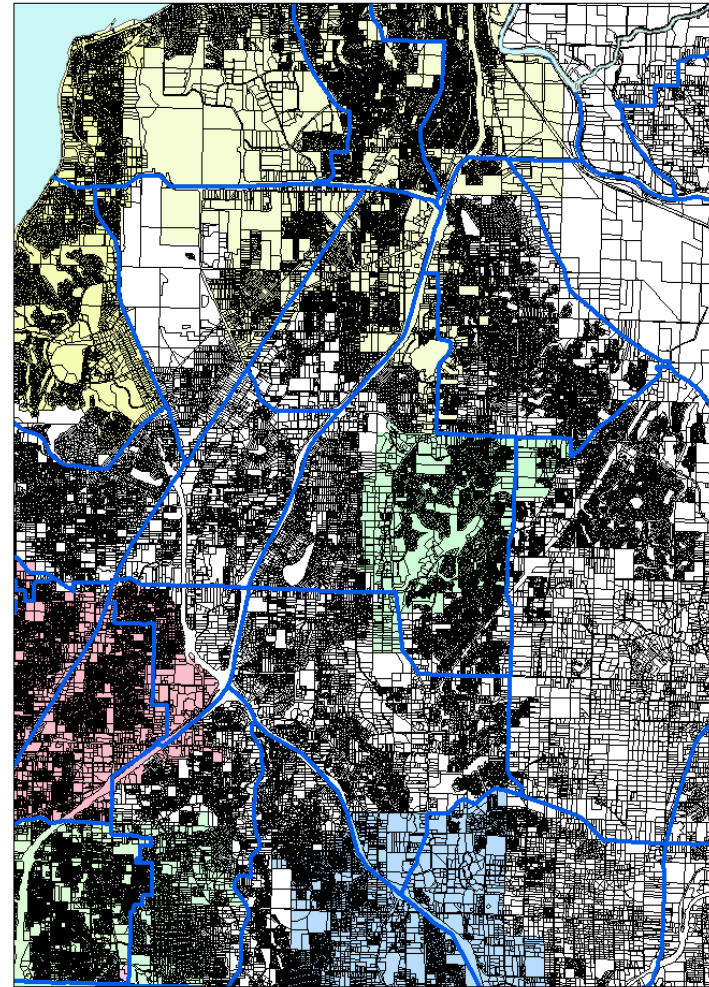
.....> Regulation or pricing.

UrbanSim Geography

DRAM / EMPAL: Forecast Zones


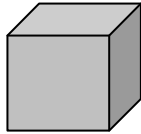
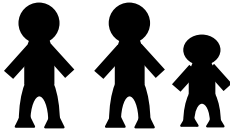




UrbanSim: Individual Parcels



Primary UrbanSim Databases

Five primary inputs and outputs

Parcels	Buildings	Households	Persons	Jobs
				
Parcel id	Building id	Household id	Person id	Job id
Zones, cities, zip code, etc.	Parcel id	Building id	Household id / Job id (if worker)	Building id
1.18 million parcels	1.0 million buildings	1.28 million households	3.2 million people	1.85 million jobs

UrbanSim 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

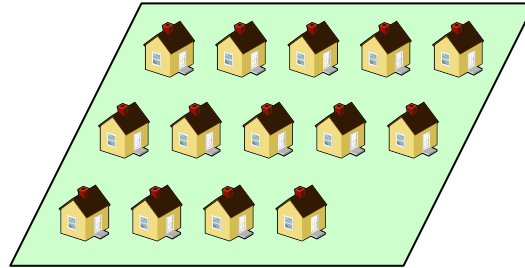
Home-based Job Choice Model

Workplace Location Choice Model

Job Change Model

How Land Development is Modeled

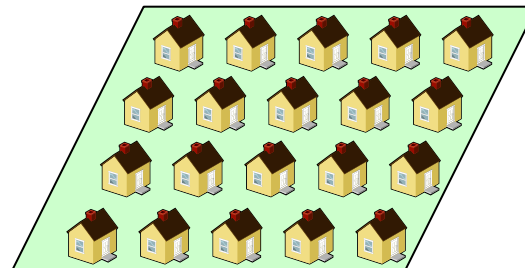
Template #1



Units Per Acre.....6
 Total Units.....14
 Min Parcel size.....87,000 SQFT
 Max Parcel size....350,000 SQFT
 Land Use.....SF Resid
 ROI:\$440,000

Vacant
Parcel

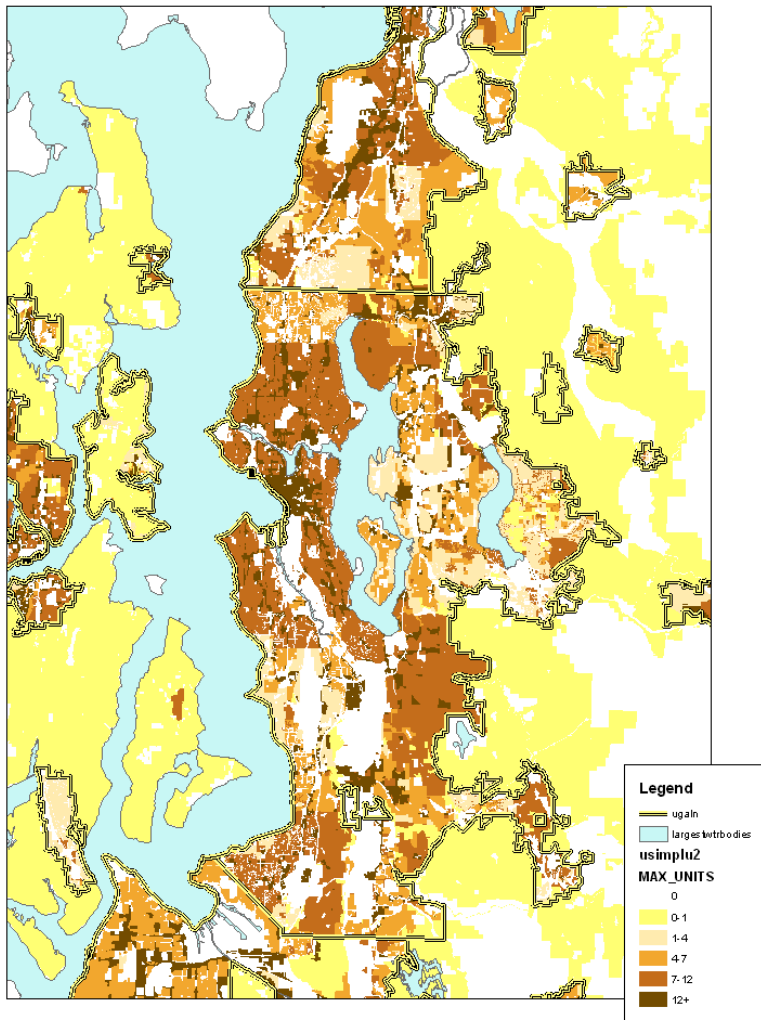
Template #2



Units Per Acre.....8.5
 Total Units.....20
 Min Parcel size.....87,000 SQFT
 Max Parcel size....283,000 SQFT
 Land Use.....SF Resid
 ROI:\$536,000

How Land Use Plans Are Modeled

Example of Max Units per Acre



Land use plans converted to an overlay in GIS containing:

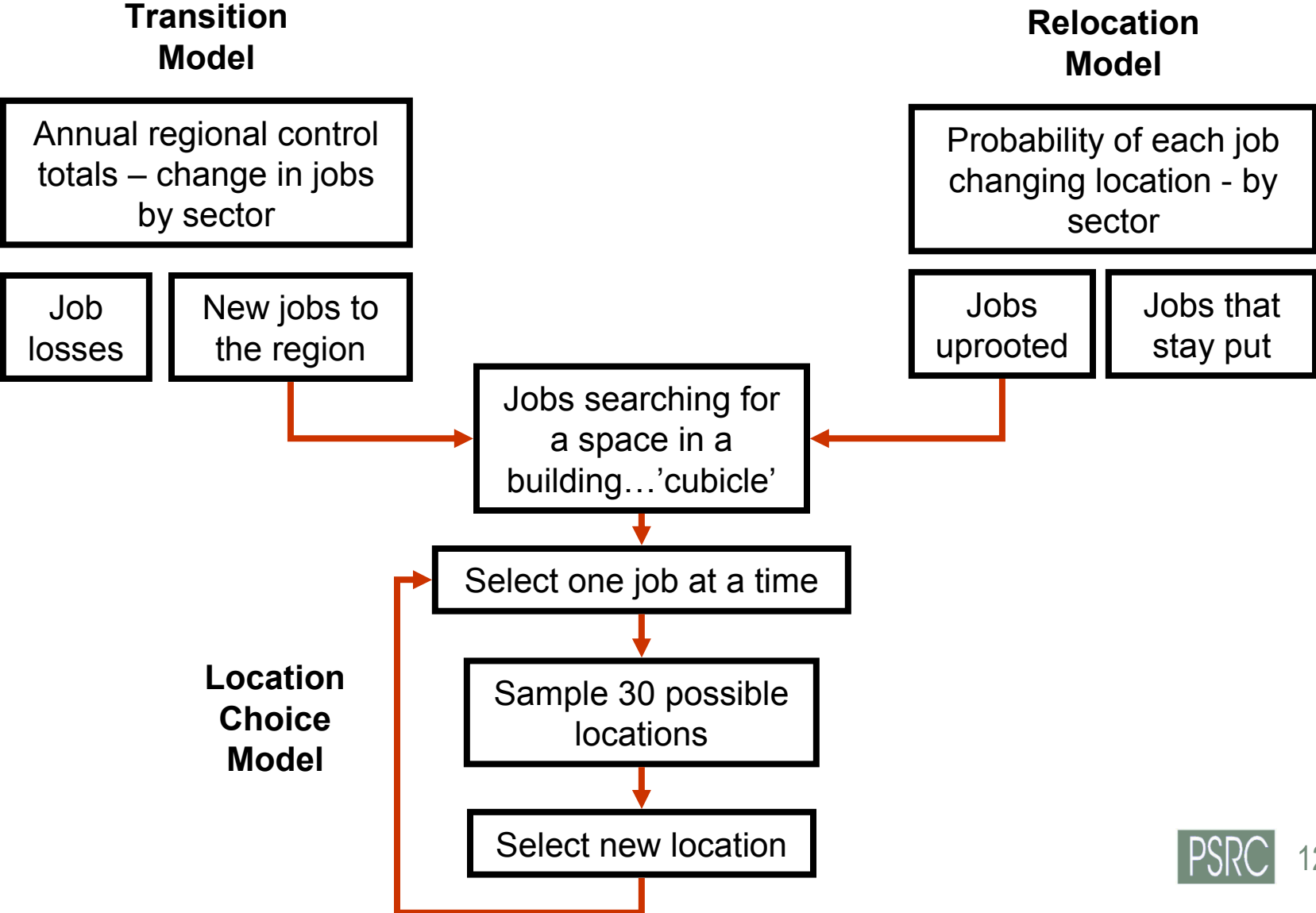
- Min and Max Housing Units (per Acre)
- Min and Max Floor Area Ratio

Every parcel assigned to a specific part of the GIS overlay:

- Constraints transferred to parcels

Household and Employment Location Models

Using Employment as the example



Scenario and Alternative Analysis

Land use plan assumptions:

- Type of development (residential, commercial,...) and density

Transportation system:

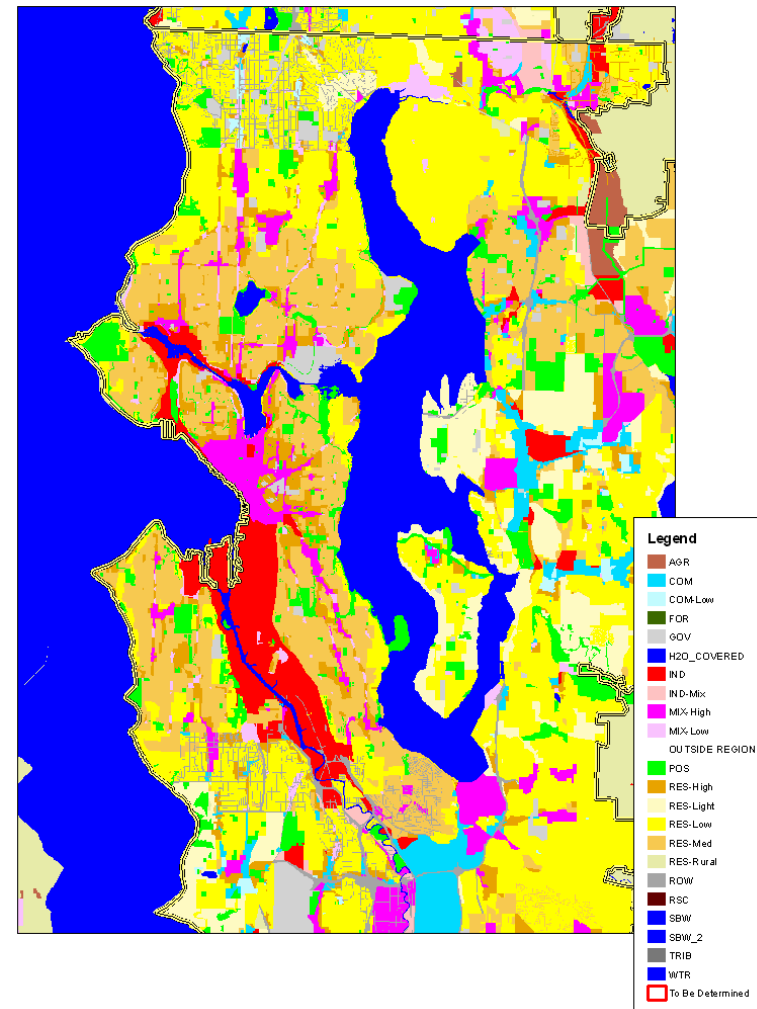
- Accessibility measures from zone to zone, jobs 10-30 minute travel times

Critical area buffers:

- Restrictions on parcels near streams, wetlands, slopes, shorelines, floodplains, etc.

Planned / Pipeline Developments:

- Predetermine number of housing units, non-residential SQFT on parcels, year



Why the move to Activity Models

Current models (trip-based) do not represent transportation strategies well

- Demand management strategies need linked activities (tours)
- System management strategies need vehicle simulations
- Tolling strategies require distributed values of time

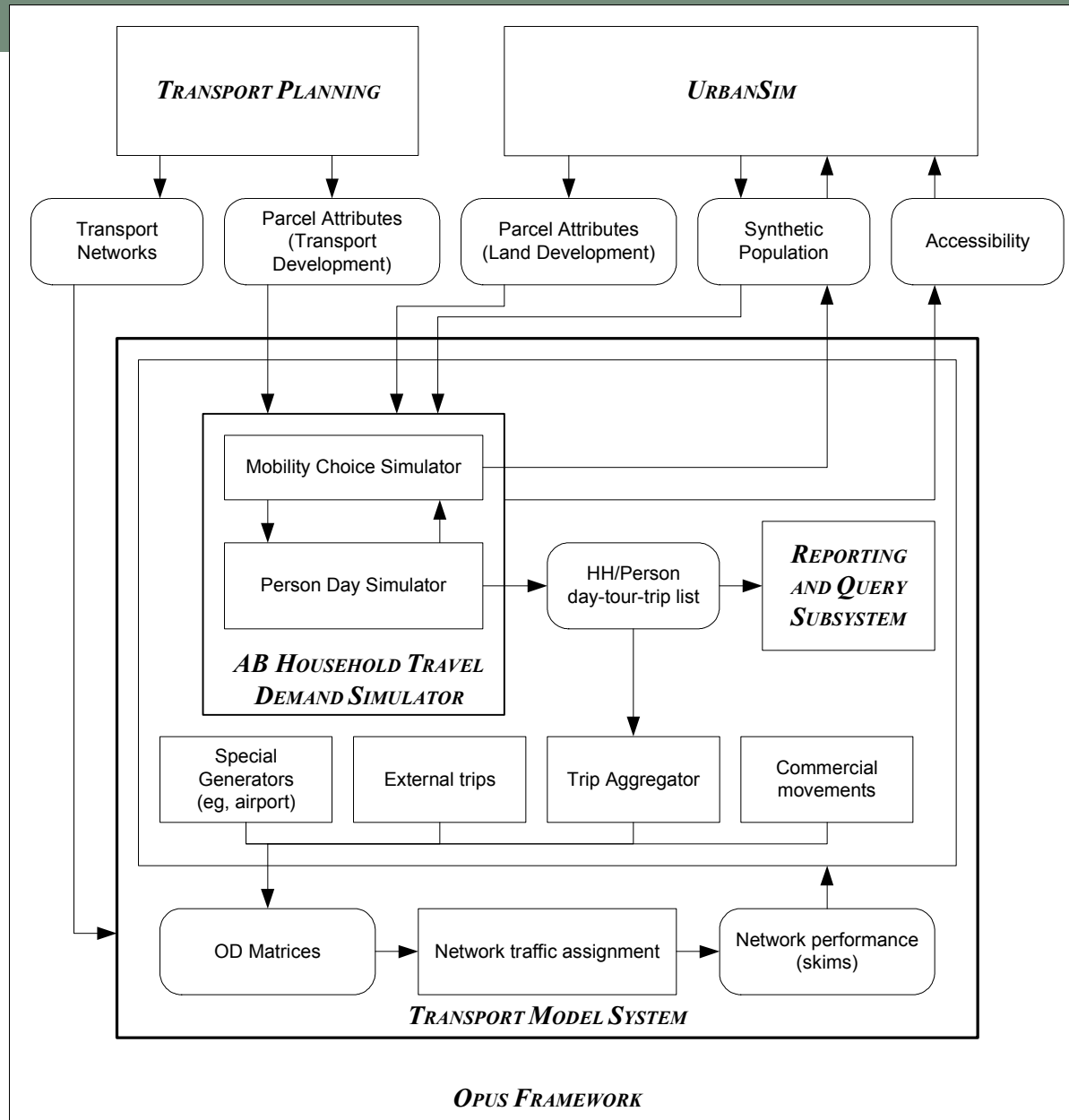
Expanded and more flexible forecast output

- Can distribute benefits and costs for equity analysis
- Greater forecast detail (trips, tours, stops, temporal and spatial detail)

Micro-simulation supports next generation of operational models

- Modeling individual vehicles for operational and air quality analysis

Model Design for Integrated Activity Models



Activity Model Structure

Mobility and Day-level Models

	Model Name	Level	What is predicted
	Mobility models		
1.1	Regular mode to work	Worker	Mode used to work at least 80% (other %?) of time
1.2	Auto Availability	Household	Number of autos available for use by members of the household
1.3	Auto type (optional)	Vehicle	Type of vehicle
1.4	Transit pass (optional)	Person	Availability and type of transit pass
	Day-level models		
2.1	Household day pattern (optional)	HH-day	Whether pattern is (1) work or school on tour, (2) other on tour, or (3) at home all day for all persons in household
2.2	Household joint tour generation (optional)	HH-day	Number and purpose of joint tours in the household
2.3	Joint tour participation (optional)	HH-day	Persons on each joint tour
2.4	Person day pattern	Person-day	0 or 1+ tours for 7 activity purposes. 0 or 1+ stops for 7 activity purposes. 0 or 1 for work only at home (optional)
2.5	Exact Number of Tours	Person-day	For purposes with 1+ tours, 1, 2 or 3 tours.

Activity Model Structure

Tour-level and Trip-level Models

	Model Name	Level	What is predicted
	Tour-level models		
3.1	Tour Destination	Tour	Tour destination
3.2	Work-Based Subtour Generation	Work Tour	Number and purpose of any subtours made during a work tour
3.3	Tour Main Mode	(Sub)Tour	Main tour mode
3.4	Tour vehicle (optional)	Auto Tour	Vehicle used for tour
3.5	Tour Time of Day	(Sub)Tour	The 30-minute time period arriving and the 30-minute time period leaving primary destination
	Trip/stop-level models		
4.1	Intermediate Stop Generation	Half Tour	Number and activity purpose of any intermediate stops made on the half tour, conditional on day pattern
4.2	Intermediate Stop Location	Trip	Location of each intermediate stop
4.3	Trip Mode Choice	Trip	Trip mode
4.4	Trip Departure Time	Trip	Departure time within 30 min. periods
4.5	Park-and-Ride lot choice (optional)	Trip	Park-and-ride lot for transit-auto-access trip

Incremental Approach to Implementation of Activity Models

Develop activity generator

- Assess changes in trip-making from tolling and growth management strategies
- Assess impacts on climate change and transportation efficiency

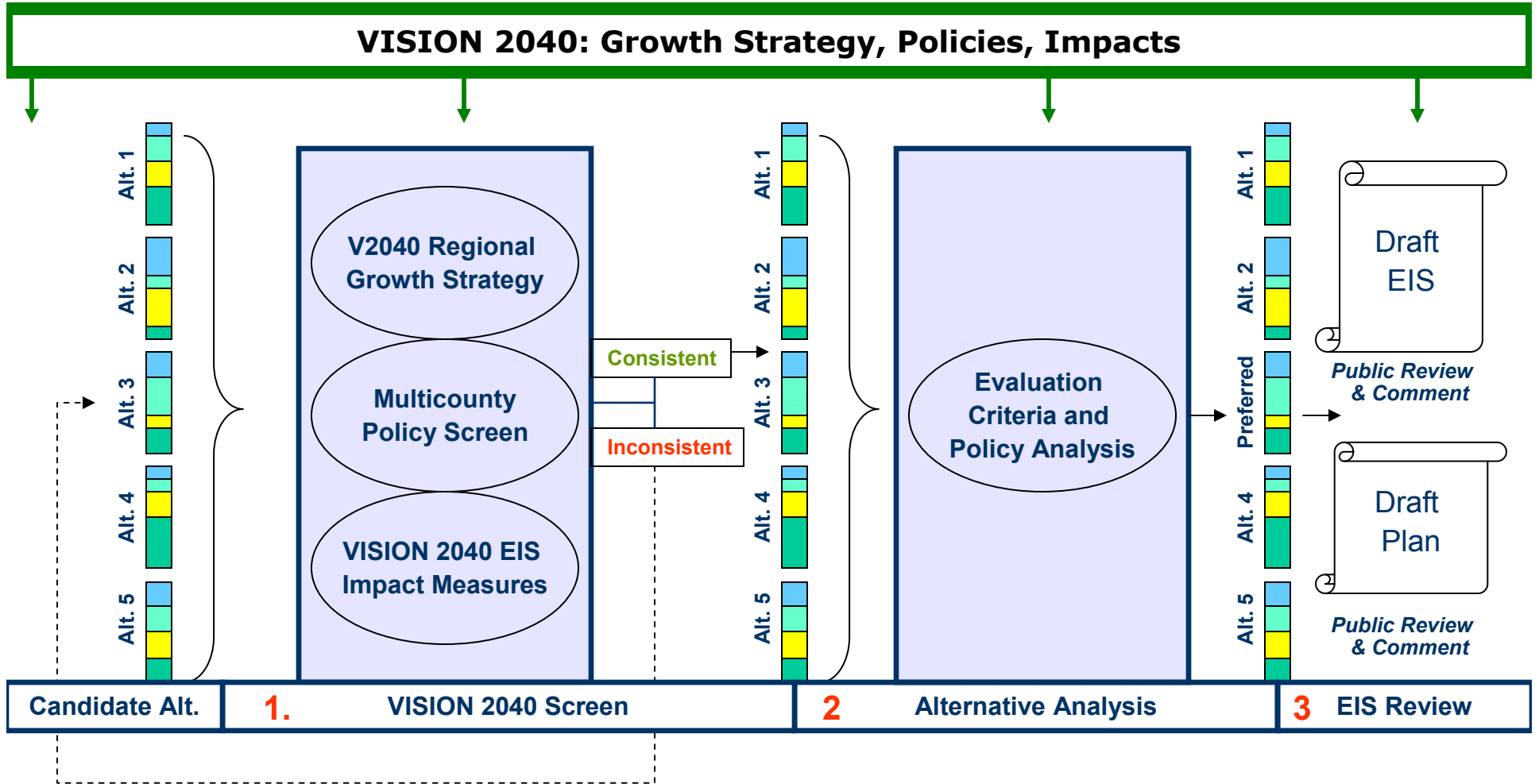
Link with current trip-based models

- Necessary to use in current transportation plan update
- Validation of activity generator with current models

Complete remaining activity model components

- Destination choice
- Mode choice
- Time of day

Transportation 2040 Alternatives Development: Analysis, Environmental Review



UrbanSim Implementation Timeline

