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TMIP Web Knowledge and Information Exchange:

Scenario Testing August 7, 2008

Brian Gregor and Becky Knudson
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Land Use Scenario DevelopeR (LUSDR) A Stochastic Land Use Model for Strategic Planning and Risk Assessment

Brian Gregor, Oregon Department of Transportation

Presentation Outline

- Philosophy and rationale for approach
- Background on urban growth study application
- Overview of LUSDR and examples of outputs
- Results by study phase
- Conclusions

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Why Model Land Use Uncertainty?

Land use forecasting in a market economy with limited constraints is an uncertain endeavor.

"If land use modelers could accurately predict the future form of a city, they would all spend their time on real estate speculation, not planning."

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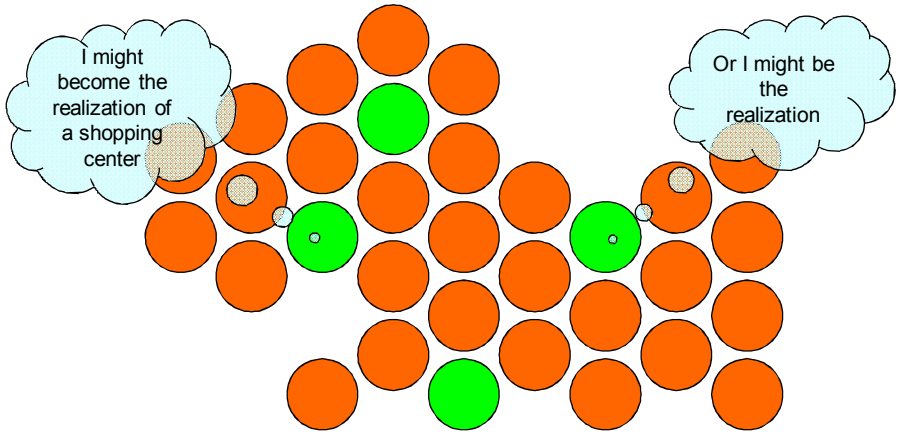
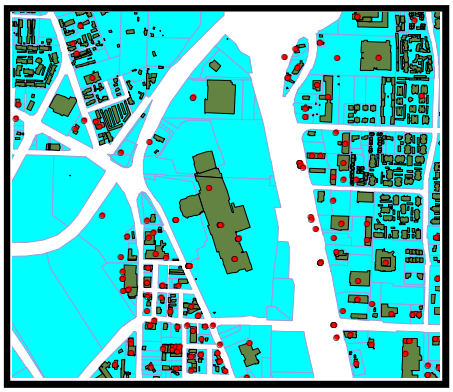
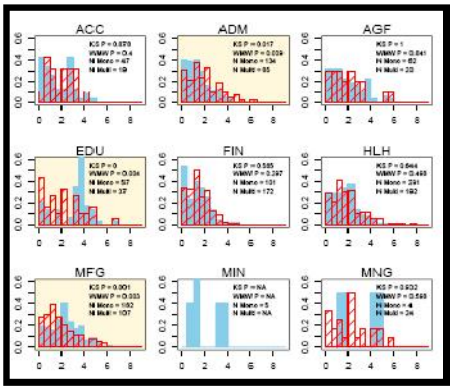
The packaging of activities into developments creates uncertainty



But shopping center employment won't be spread out over all zones meeting shopping center requirements

Example of Retail Cluster





Examples of Employment Establishment Size Distributions

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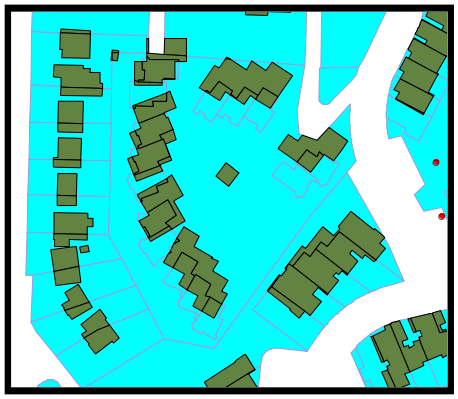
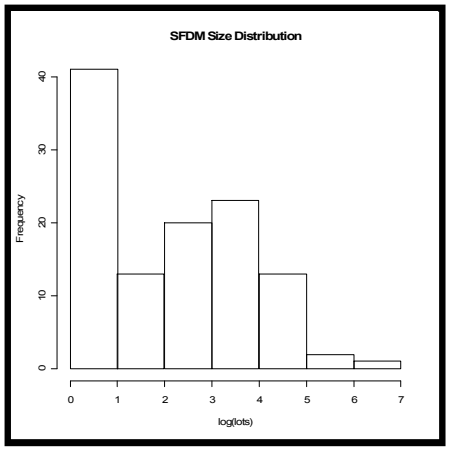


Example of Condo Development

Single Family Moderate Income Development Size Distribution



An approach that explicitly acknowledges uncertainty helps keep the analysis and decision-making process honest.

Uncertainty surrounds most decisions regarding the future.

People who hold strong opinions about what should be done will tend to pick the assumptions and information which support their desired outcome.

Laying all of the information on the table facilitates open and honest debate on public decisions.

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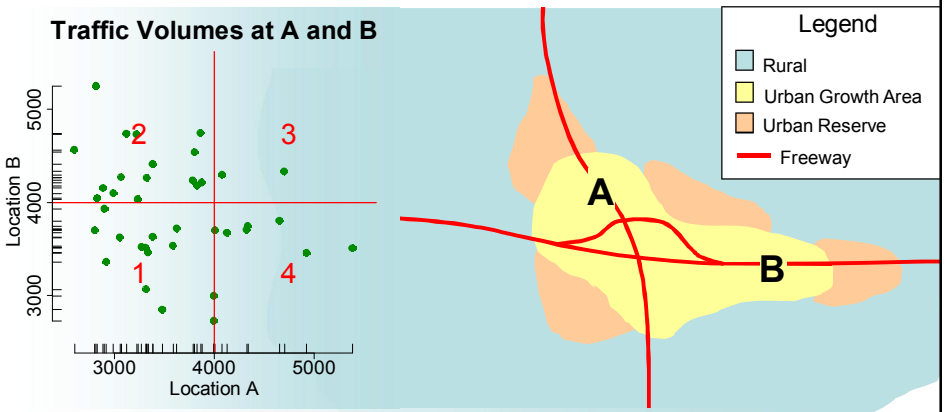
Uncertainty Is Informative



- B is more likely than A to need widening.
- What are the characteristics of scenarios requiring widening, and not requiring widening?

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Background on Urban Growth Study Application

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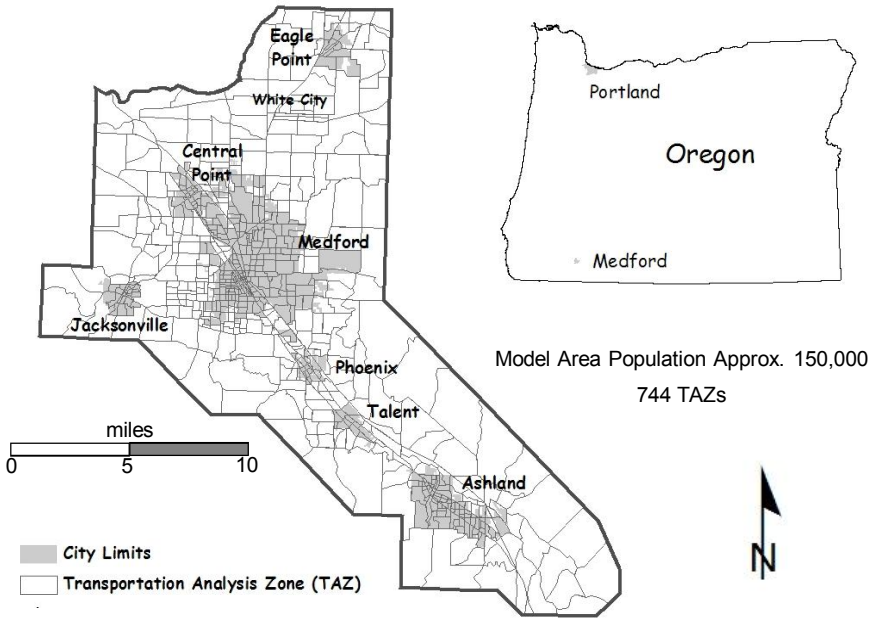
Regional Problem Solving (RPS) for the Greater Bear Creek Valley

- Area located within the planning boundary of the Rogue Valley MPO in Southwestern Oregon.
- Insufficient land within urban growth boundaries to accommodate growth as it has occurred in the past.
- Competition among jurisdictions for growth.
- Concerns about impacts of growth on productive farm lands.
- Regional problem solving process focuses on collaborative decision-making among local and state representatives.

Rogue Valley MPO Model Area



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Regional Problem Solving (RPS)

- Growth plan is based on an assumed doubling of the population in the region.
- Local governments identified areas desired to be included in urban reserves and the desired residential, commercial and industrial splits.
- Study questions:
  - What are the impacts on the transportation system?
  - Any fatal flaws?
  - Where will network improvements be needed?

Need for Land Use Model and Genesis of LUSDR

- Travel demand model requires fairly specific inputs at the TAZ level of employment by sector and households by size, income and age of head.
- Developing employment and household allocations through a consensus process would be very time consuming.
- The general nature of the growth policies for urban reserve areas and the very long planning time frame creates a high level of uncertainty.

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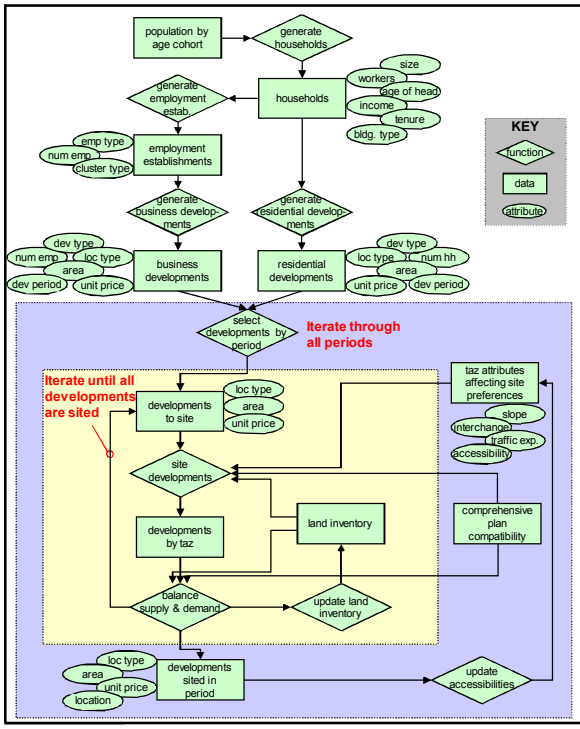
Overview of LUSDR and Examples of Outputs



Creating Synthetic Households, Employment Establishments and Developments

•Start with exogenous projection of population by age cohort.

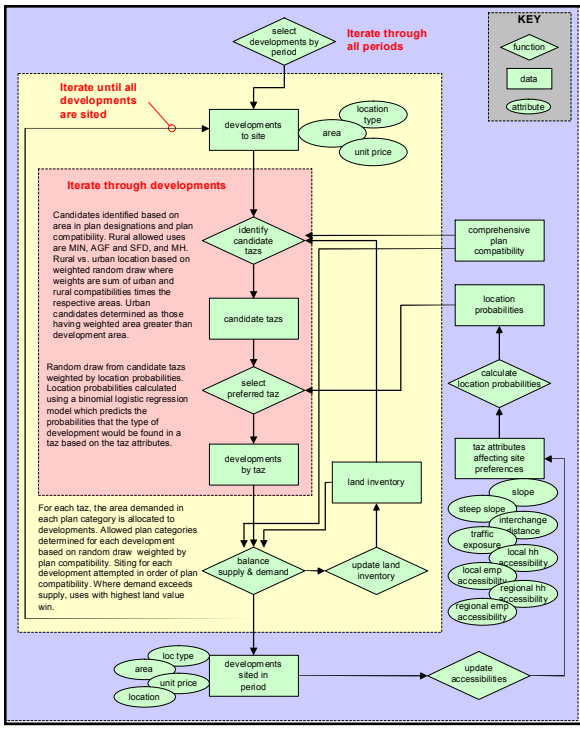
• Generate households by size, workers and age of head by sampling from PUMS cross tabulations.

• Add household income, residential tenure and building type by applying successive decision tree models.

• Calculate employment from household workers.

• Generate employment establishments (sample from size distributions by 2-digit NAICS).

• Generate residential and business developments by sampling from size distributions for each type and randomly allocating households and employment establishments of the appropriate type.



Locating Developments

•Randomly allocate developments to periods and then successively locate development in each period.

• Site each development by:

– Identifying a set of candidate TAZs: availability of buildable land with compatible zoning.

– Selecting a TAZ from the candidate set using a logit location model.

• Balance land supply and demand based on relative willingness to pay for development types. Update land inventory.

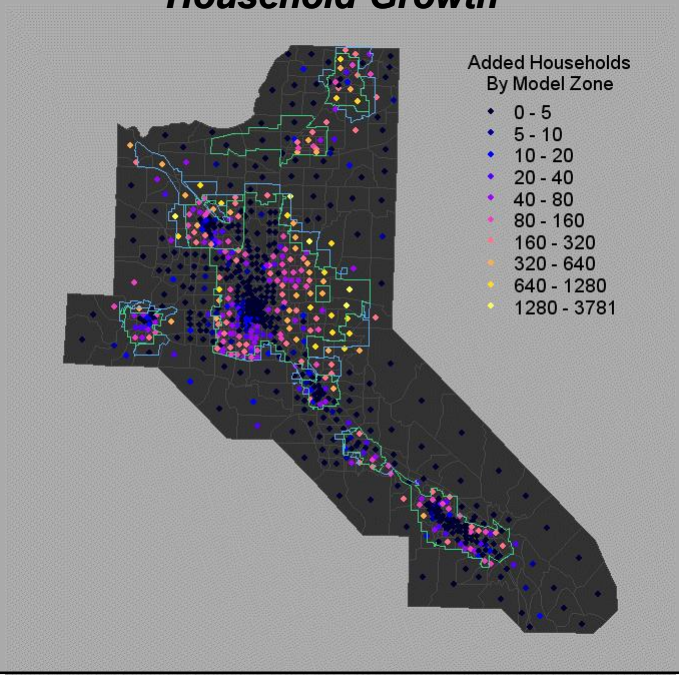
• Continue process for developments that could not find a location until all are successfully sited.

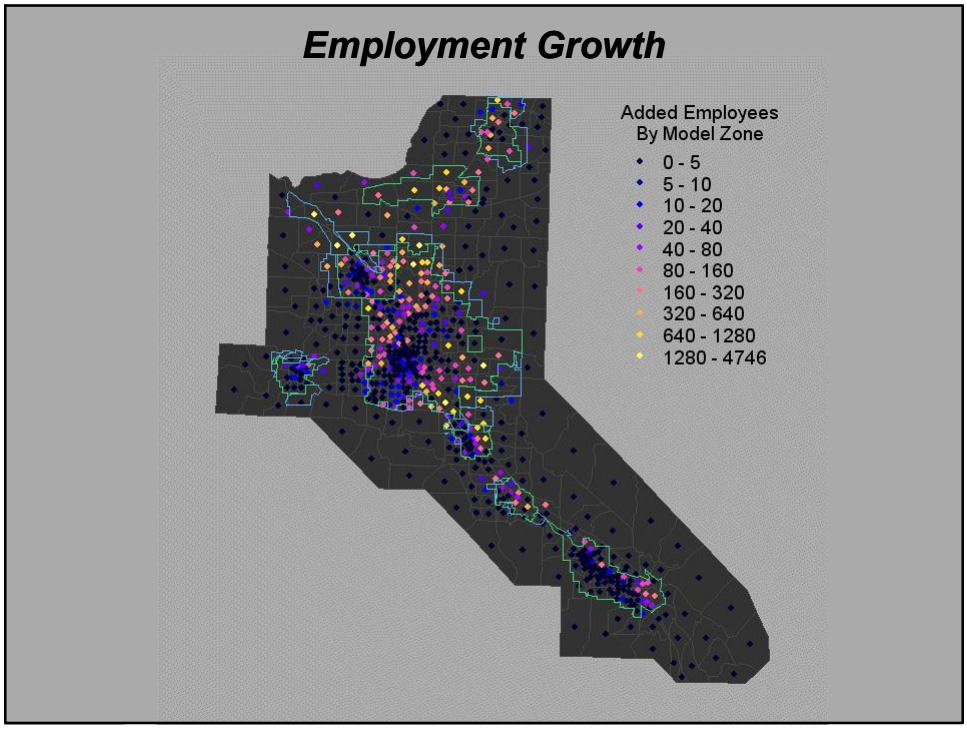
• Update accessibilities for next period of development siting.

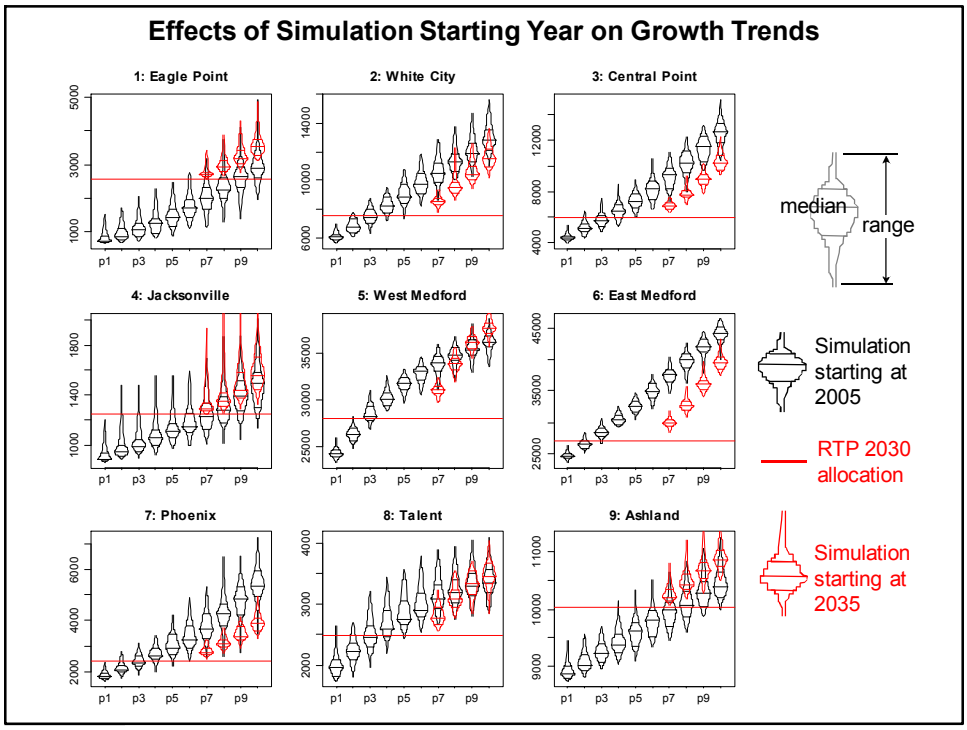
Apartment
Location Probabilities

Retail Group
Location Probabilities

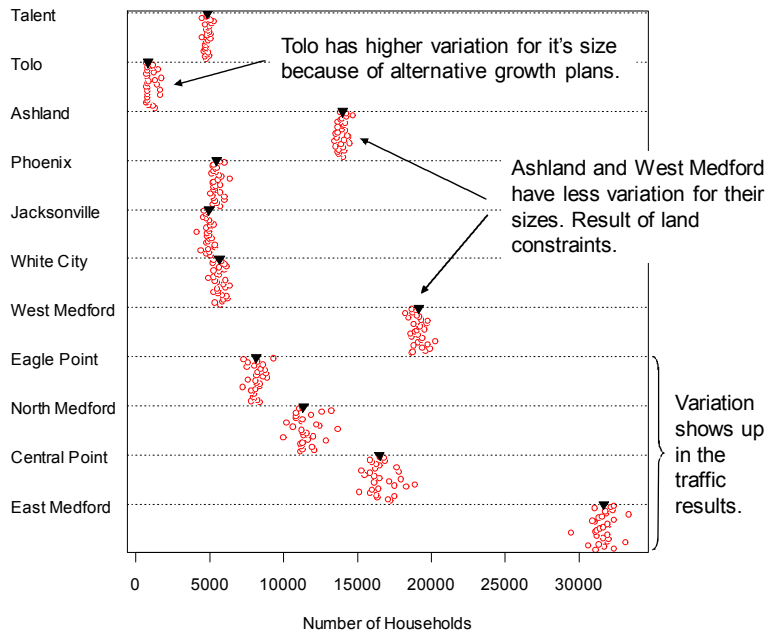
Household Growth




Employment Growth
Added Employees
By Model Zone
0 - 5
5 - 10
10 - 20
20 - 40
40 - 80
80 - 160
160 - 320
320 - 640
640 - 1280
1280 - 4746


Effects of Simulation Starting Year on Growth Trends
1: Eagle Point
2: White City
3: Central Point
4: Jacksonville
5: West Medford
6: East Medford
7: Phoenix
8: Talent
9: Ashland
p1
p3
p5
p7
p9
median
range
Simulation starting at 2005
RTP 2030 allocation
Simulation starting at 2035

Dot Plot of Households by District Ordered by Absolute Variation



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Results by Study Phase

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Three Study Phases

- Phase 1: Examine the transportation effects given the transportation network in the regional transportation plan.
- Phase 2: Compare the results for a more expanded transportation system.
- Phase 3: Evaluate effects for 15 combinations of transportation and land use.

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1st Stage Modeling

- Completed land use modeling.
- Completed transportation modeling on 30 land use scenarios using the RTP transportation network.

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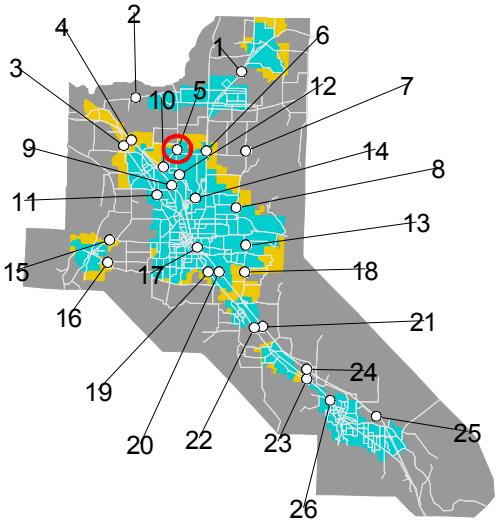
General Transportation Results

- Region-wide VMT, travel time, and freeway travel vary very little: 2-3%
- Region-wide total delay, employment accessibility and transit accessibility more substantially:
  - Delay: 35%
  - Jobs accessible within 10 minute drive: 9%
  - Jobs served by public transit: 7%

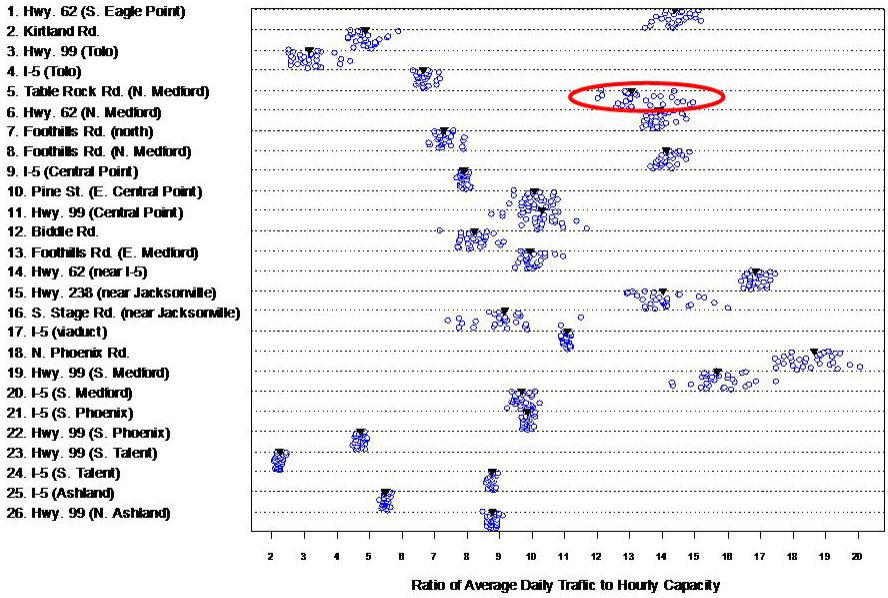
Traffic Monitor Sites



1. Hwy. 62 (S. Eagle Point)
2. Kirtland Rd.
3. Hwy. 99 (Tolo)
4. I-5 (Tolo)
5. Table Rock Rd. (N. Medford)
6. Hwy. 62 (N. Medford)
7. Foothills Rd. (north)
8. Foothills Rd. (N. Medford)
9. I-5 (Central Point)
10. Pine St. (E. Central Point)
11. Hwy. 99 (Central Point)
12. Biddle Rd.
13. Foothills Rd. (E. Medford)
14. Hwy. 62 (near I-5)
15. Hwy. 238 (near Jacksonville)
16. S. Stage Rd. (near Jacksonville)
17. I-5 (viaduct)
18. N. Phoenix Rd.
19. Hwy. 99 (S. Medford)
20. I-5 (S. Medford)
21. I-5 (S. Phoenix)
22. Hwy. 99 (S. Phoenix)
23. Hwy. 99 (S. Talent)
24. I-5 (S. Talent)
25. I-5 (Ashland)
26. Hwy. 99 (N. Ashland)

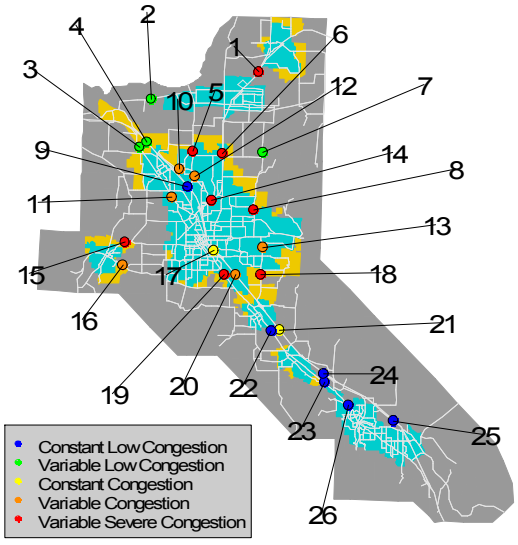
NOTE: Although these locations are shown as points, they represent all sections of roads that have the same number of lanes and similar amounts of traffic.

Dot Plot of Congestion at Traffic Monitor Sites



NOTE: Although these locations are shown as points, other portions of roadways with the similar traffic and the same number of lanes can be expected to have similar congestion. These results do not show congestion at interchanges or intersections.

Variability and Severity of Congestion at Traffic Monitor Sites



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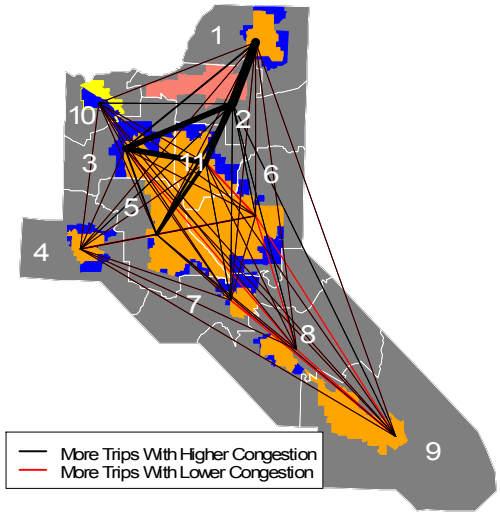
District Flows Corresponding to High and Low Congestion At Monitor Station 5



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2nd Stage Modeling

- An enhanced road network was developed by the technical advisory committee.
- Transportation modeling was done on the enhanced road network for the same land use growth scenarios modeled previously.
- Results were compared with previous transportation model runs.

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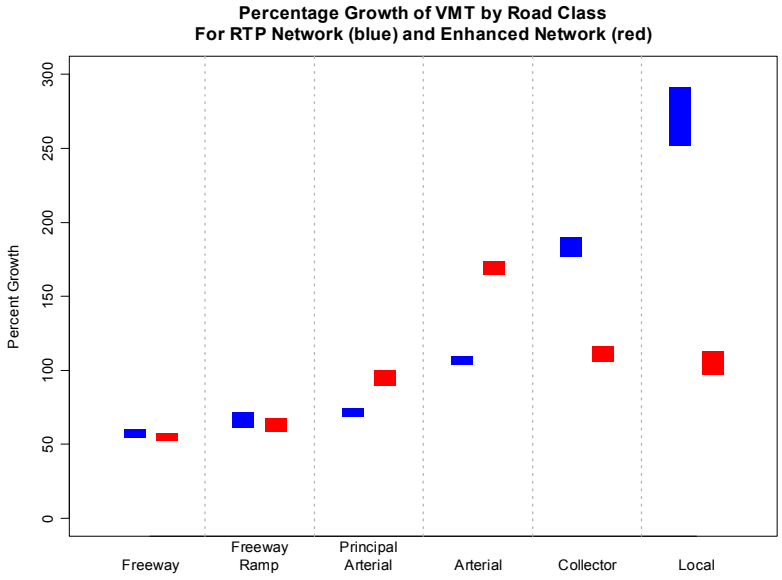

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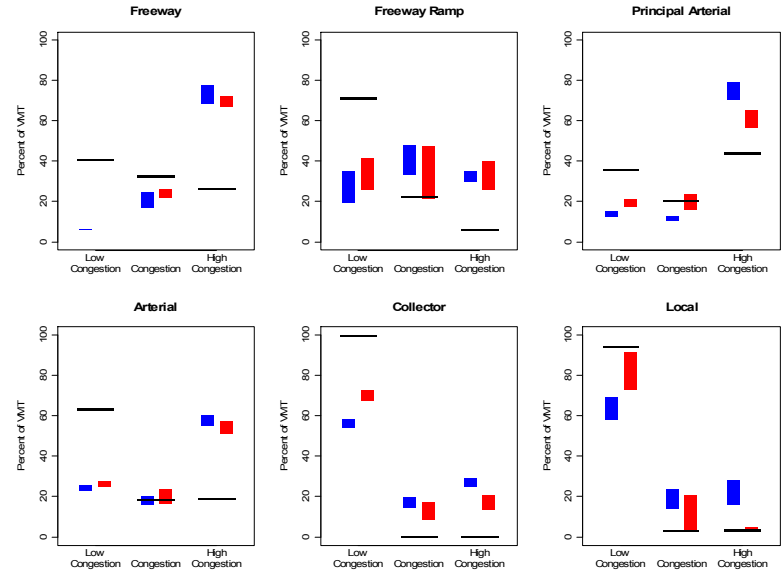

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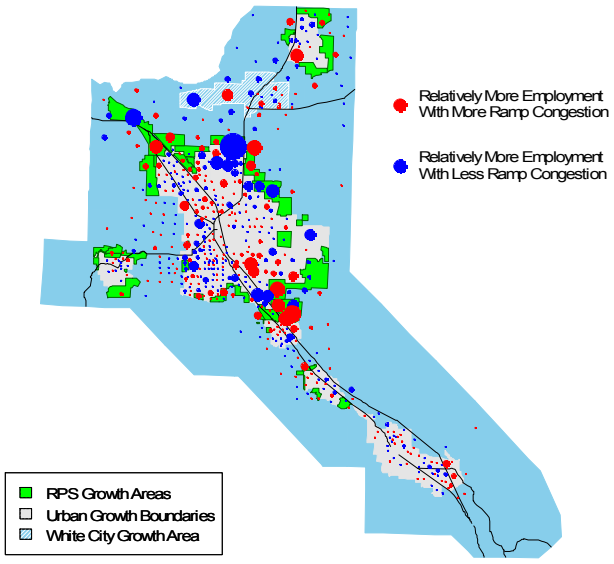
Employment Growth Tendencies
Related to Enhanced Network Freeway Ramp Congestion



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3rd Stage Policy Scenario Modeling

- Land Use
  - No Policy Change
  - Nodal Development
  - Regional Attractor
- Transportation
  - RTP Road & Transit Networks
  - Enhanced Roads & RTP Transit
  - High Capacity Roads & RTP Transit
  - Enhanced Roads & High Cap. Transit
  - High Cap. Roads & High Cap. Transit

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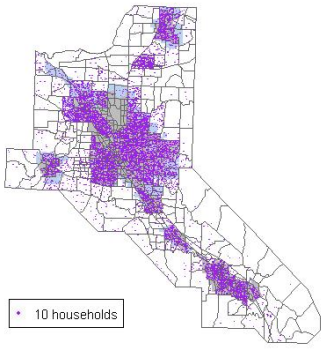
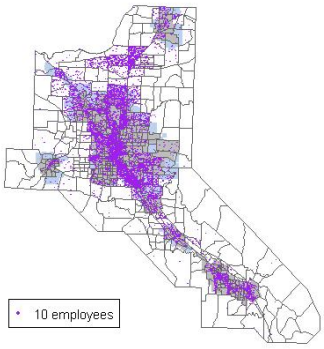
No Policy Change Land Use

No Policy Change Scenario Households



Note: The dots are shown spread thoughout each TAZ in which growth is allowed.
me scattered rural development, the actual locations would be only within UGBs or identified gr

No Policy Change Scenario Employment



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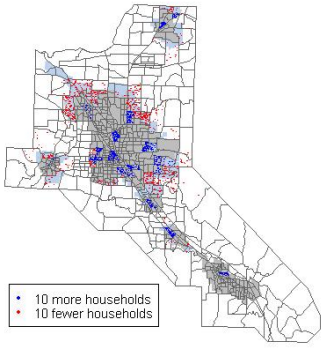
Nodal Development Land Use

Household Difference
Nodal Development vs. No Policy Change



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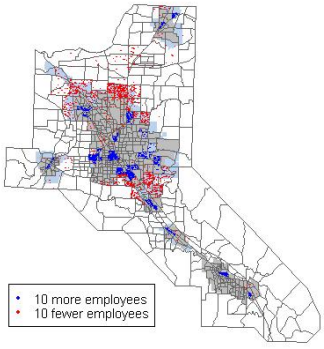
Employment Difference
Nodal Development vs. No Policy Change



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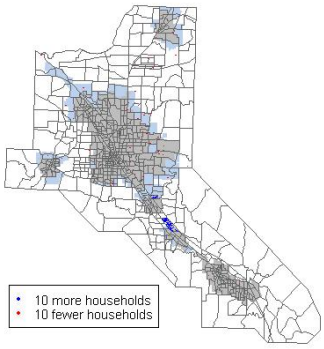
Regional Attractor Land Use

Household Difference
Regional Attractor vs. No Policy Change



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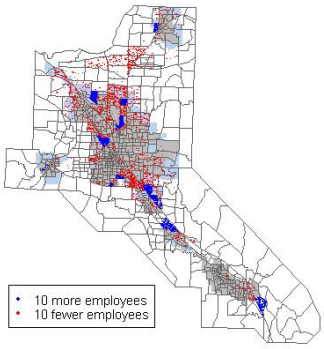
Employment Difference
Regional Attractor vs. No Policy Change



Note: The dots are shown spread thoughout each TAZ in which growth is allowed. The actual locations would be only within UGBs or identified growth areas.

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Average Peak Hour Trip Length

Transportation Scenarios	Land Use Scenarios		
	No Policy Change	Nodal Development	Regional Attractor
RTP Network / Low Transit	4.0	3.8	4.0
Enhanced Network / Low Transit	4.0	3.8	4.0
High Capacity Network / Low Transit	4.1	3.8	4.1
Enhanced Network / High Transit	3.9	3.7	3.9
High Capacity Network / High Transit	4.0	3.8	4.0

No Policy Change and Regional Attractor Scenarios have the same trip lengths

Average Peak Hour Trip Length

Transportation Scenarios	Land Use Scenarios		
	No Policy Change	Nodal Development	Regional Attractor
RTP Network / Low Transit	4.0	3.8	4.0
Enhanced Network / Low Transit	4.0	3.8	4.0
High Capacity Network / Low Transit	4.1	3.8	4.1
Enhanced Network / High Transit	3.9	3.7	3.9
High Capacity Network / High Transit	4.0	3.8	4.0

Nodal Development Scenario trip lengths are 5-7% shorter

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Conclusions

Conclusions

- LUSDR is an effective model for developing a plausible set of land use allocations based on general policy inputs.
- The land use allocations developed by LUSDR can be used as pivot points to rapidly develop allocations that represent other growth policies.
- Considering multiple land use outcomes does NOT create confusion in the decision-making process.

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Conclusions

- Variation in land use patterns can substantially affect localized transportation system operation and some aspects of overall transportation system performance.
- Considering variability helped with the evaluation of the severity of problems.
- Learning about the relationships between the land use patterns and their effects is challenging. More experience and tools are needed.