



TMIP Web Knowledge and Information Exchange:

Scenario Testing
August 7, 2008

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Oregon Department of Transportation

Transportation Planning Section, Transportation Development Division



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Use of Scenarios with the Oregon
Statewide Integrated Model

Becky Knudson, Oregon Department of Transportation

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Outline

- Brief overview of Oregon modeling program
- Statewide Integrated Model 1 case studies
 - Big picture visioning
 - Infrastructure investment
 - Problem definition and investment prioritization
- Statewide Integrated Model 2 development
 - Current phase of performance evaluation

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Overview of Oregon Program

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Integrated Models

- Oregon Modeling Improvement Program (OMIP) established in 1994:
 - Improve modeling practices throughout Oregon
 - Meet new state and federal mandates
 - Provide analysis and information for decision-makers
 - Make ODOT an effective participant in decisions

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Oregon Integrated Model



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Oregon Model Applications Big Picture Visioning

- **Big picture visioning**
 - **Willamette Valley Alternative Futures**
 - **Oregon Transportation Plan**

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Willamette Valley Alternative Transportation Futures



By 2050
Willamette Valley
population will increase
from 2.3 million to nearly 4
million

Oregon's governor initiated
a big-picture brain-storming
on alternative futures for
Oregon's most populous
and agriculturally important
region.

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Willamette Valley Project Approach

- Help decision-makers understand:
 - How different land use and transportation policies are likely to affect land use patterns and state highway congestion
 - Sensitivities of growth patterns and highway congestion to different land use and transportation policies

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Willamette Valley Scenario Descriptions

- Phase 1
 - No-Action (Reference Case)
 - Compact Development
 - Significant Highway Expansion
 - Significant Transit Expansion
 - Transportation Tax
- Phase 2
 - Hybrid 1: Transit vision
 - transit in urban areas, rural highways, graduated tax
 - Hybrid 2 - Balanced Transportation Expansion
 - Moderate transit and highway, minimal graduated tax

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Willamette Valley Findings

- Expanding highway capacity tends to draw people and jobs to outlying areas
- Expanding public transit tends to concentrate jobs in major urban centers and pull population to outlying cities
- Restricting land supply tends to direct more pop/employment growth away from major urban centers to smaller cities
- Effects differ by location characteristics, but not always apparent at the regional level or statewide.

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Oregon Model Applications Big Picture Visioning

- **Big picture visioning**
 - **Willamette Valley Alternative Futures**
 - **Oregon Transportation Plan**

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Oregon Transportation Plan Update

- The Plan is Oregon's long-range multimodal transportation planning document
- Assesses state, regional, and local public and private facilities
- Establishes goals, policies, strategies to address future needs and challenges

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OTP Scenarios

Reference Scenario

Sensitivity Scenario 1 High Fuel Prices

Sensitivity Scenario 2 Relaxed Land Use Controls

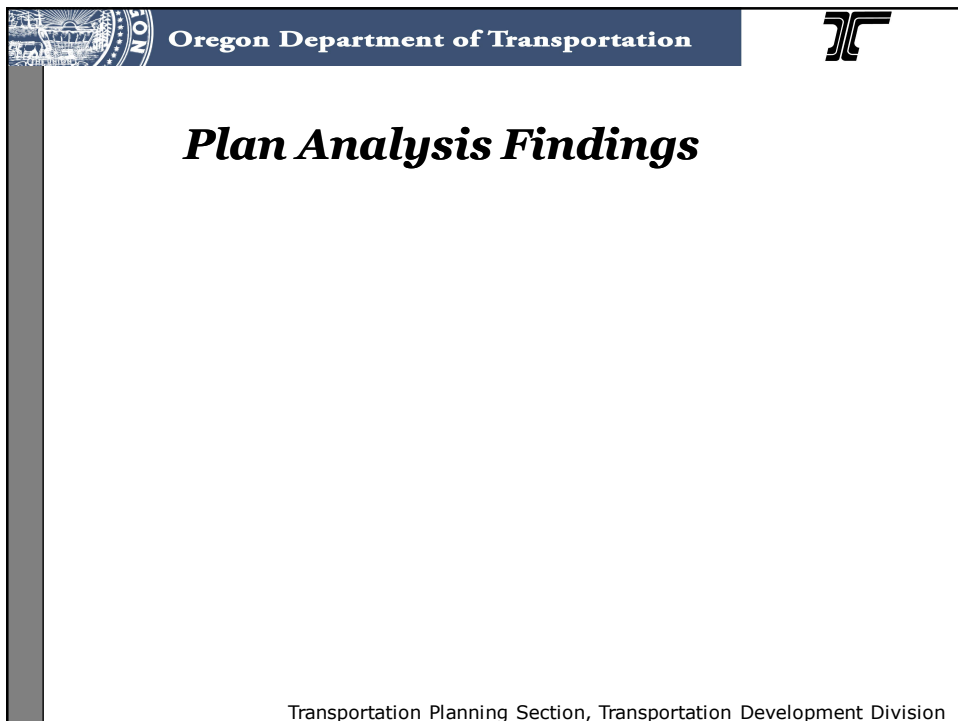
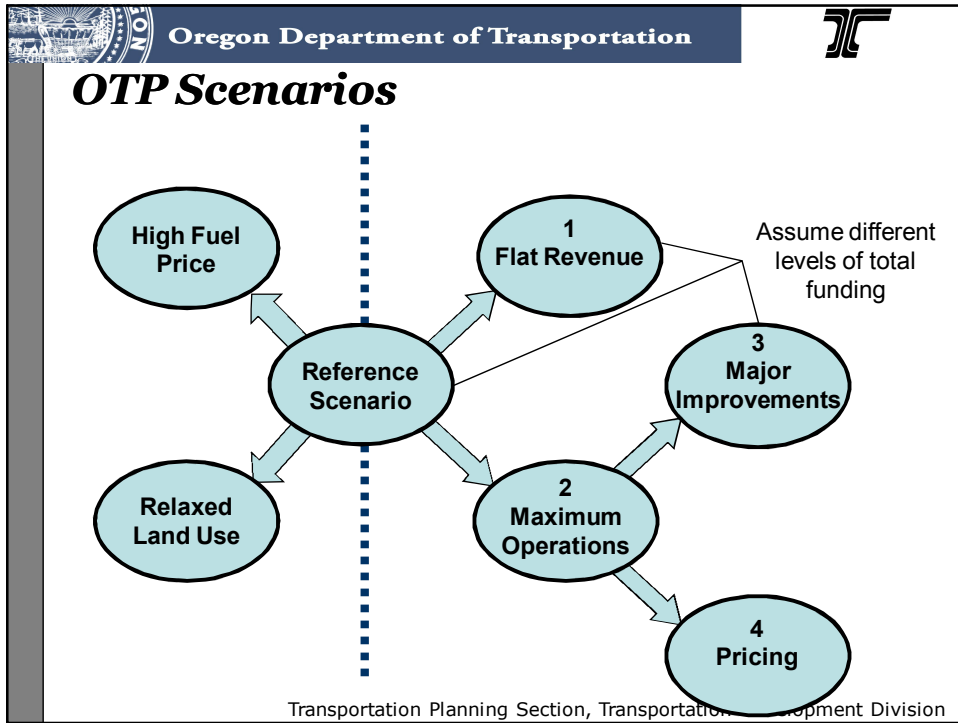
Alternate Scenario 1 Flat Revenue



Alternate Scenario 2 Max Operations & Maintenance
without Pricing

Alternate Scenario 3 Major Improvements



Alternate Scenario 4 Pricing

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OTP Performance Measures	
Performance Criteria	Model Generated Output
Accessibility/ Mobility	
Economic Vitality	
Efficiency & Cost Effectiveness	
Equity	
Reliability/ Responsiveness	
Safety	
Sustainability	
Public Support/Financial Feasibility	

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OTP Performance Measures	
Accessibility/ Mobility Performance Criteria	
<ul style="list-style-type: none"> •Average annual recurring and non-recurring delay per capita <ul style="list-style-type: none"> – average delay, Hh, region; average delay vehicle region •Average travel time per trip (peak, off-peak, by purpose, region, income class) <ul style="list-style-type: none"> –average travel time; average trip distance • Variable passenger transportation user cost as percent of income (by region, income class) <ul style="list-style-type: none"> –Passenger costs as percent of income by income category & region •Percent of trips with viable transit, bicycle and walk options <ul style="list-style-type: none"> –Proportion of trips with transit as choice 	

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OTP Performance Measures

Economic Vitality Performance Criteria

- Change in economic output between alternatives
 - Total statewide production
- Change in employment between alternatives
 - Employment by industry
- Variable passenger transportation user costs as percent of income
 - Total labor income as percent of total transport costs by income group
- Number of workers within 30 minutes of the average job
 - Number of HH (workers) within 30 min by region

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Reference Case – Summary of Impacts

	Passenger Surface Transport	Trucking	Rail Freight	Aviation	Ports
Accessibility	↔	↓	↔	↔	↓
Mobility	↓	↓	↓	↔	↓
Economic Vitality	↔	↓	↓	↔	↓
Effectiveness and Efficiency	↔	↓	↓	↔	↔
Equity	↔	↔	↔	↔	↓
Public Support & Financial Feasibility	↔	↔	↔	↔	↔
Safety	↔	↔	↓	↔	↔
Sustainability	↔	↓	↓	↔	↓

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Oregon Model Applications Infrastructure Investment

- **East/Central Oregon Freeway**
- **Bridge Options/ Investment Prioritization**

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Legislative Directive to Study a New Freeway in Eastern Oregon



The 2001 Legislature asked:
“If a new freeway is constructed in Central or Eastern Oregon, will it divert traffic and development from I-5 in the Willamette Valley?”

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- Simple answer: No
- Modeling analysis showed:
 - Generally increase speed and reduce travel time from border to border
 - May benefit Washington or California more than Eastern or Central Oregon
 - Where access to the Willamette Valley improves, the larger market attracts more growth
- Better question:
 - “What can we do to divert traffic and development from I-5 and the Willamette Valley to Eastern and Central Oregon?”

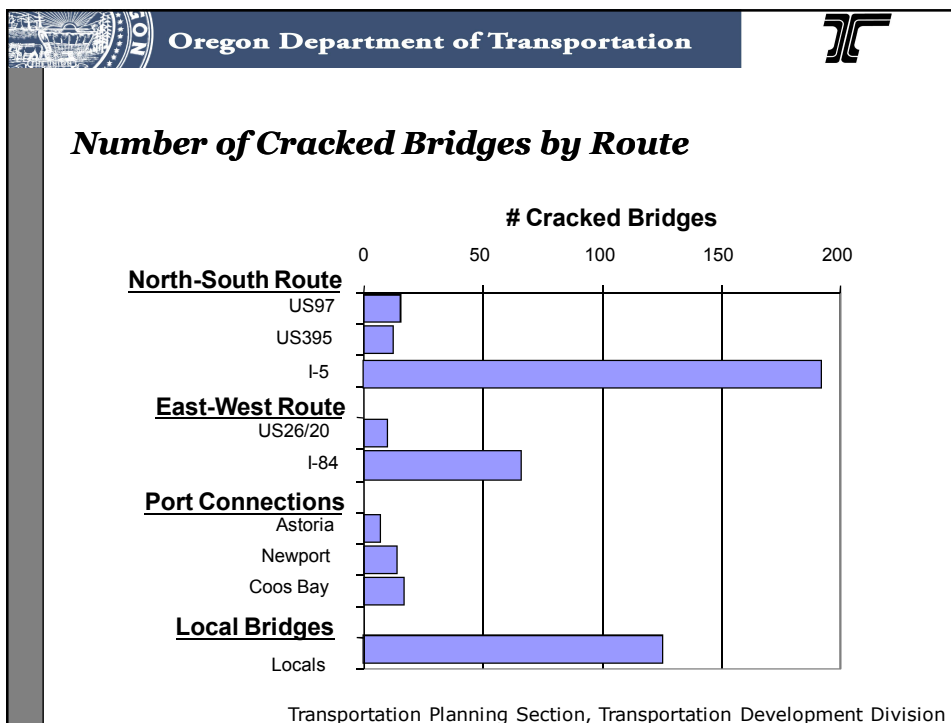
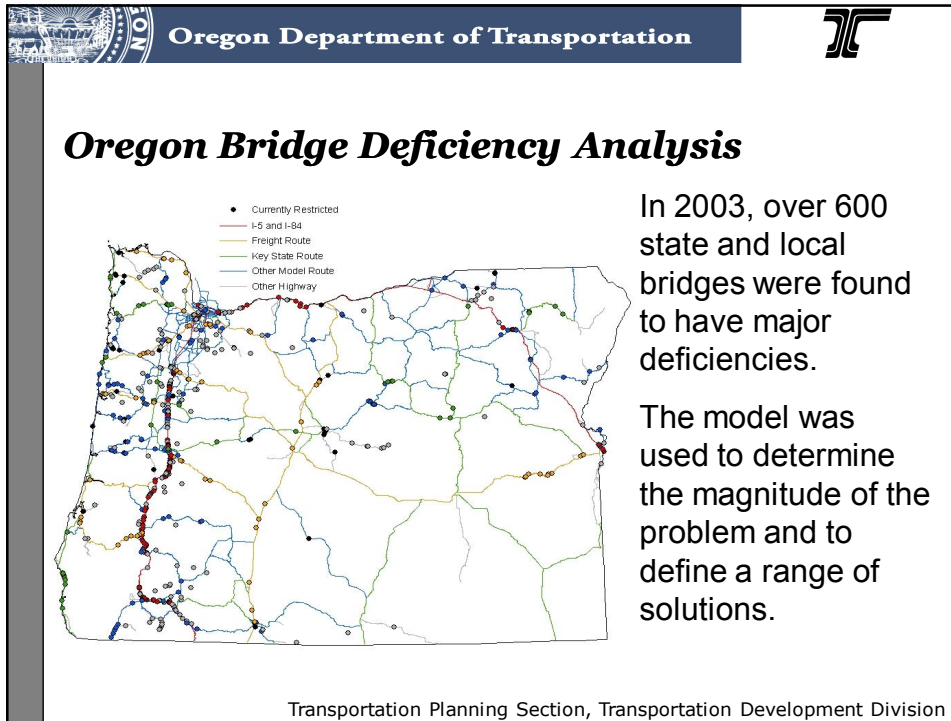
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Oregon Model Applications Infrastructure Investment

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Bridge Analysis Results

- Model served to illuminate the root issue
- Wasn't an engineering problem
- Economic impacts were the issue
- Effects varied by region
- Scenarios used to evaluate proposed solutions and reveal economic impacts
- Final solution avoided 90% of economic impacts of "Do Nothing" approach for nearly half the cost

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Scenario Representation of Future

- Modeling showed no immediate crisis, but large loss of future jobs and production with no action
- Regional and industry impacts defined constituent issues
- Model results helped to clearly define the problem & build a staged solution
- ODOT changing from "worst first" to "corridor analysis"

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Phase 2 Statewide Model Development

- Develop a model with more detail
 - Transport: modes, freight
 - Industry: commodity,
 - Land Use: floor space industries
 - Households: income/size/ worker occupation
- Use a modular form to accommodate model improvements
- Add features desired for analysis

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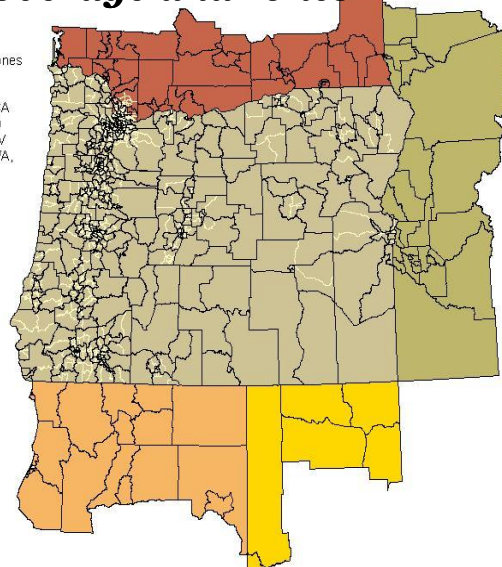
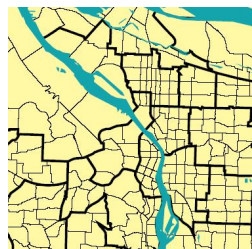


SWIM2 model coverage and zones


36 Oregon counties
39 "halo" counties

Alpha Zones
Beta Zones
Oregon
Halo - CA
Halo - ID
Halo - NV
Halo - WA,


2,950 alpha zones
519 beta zones



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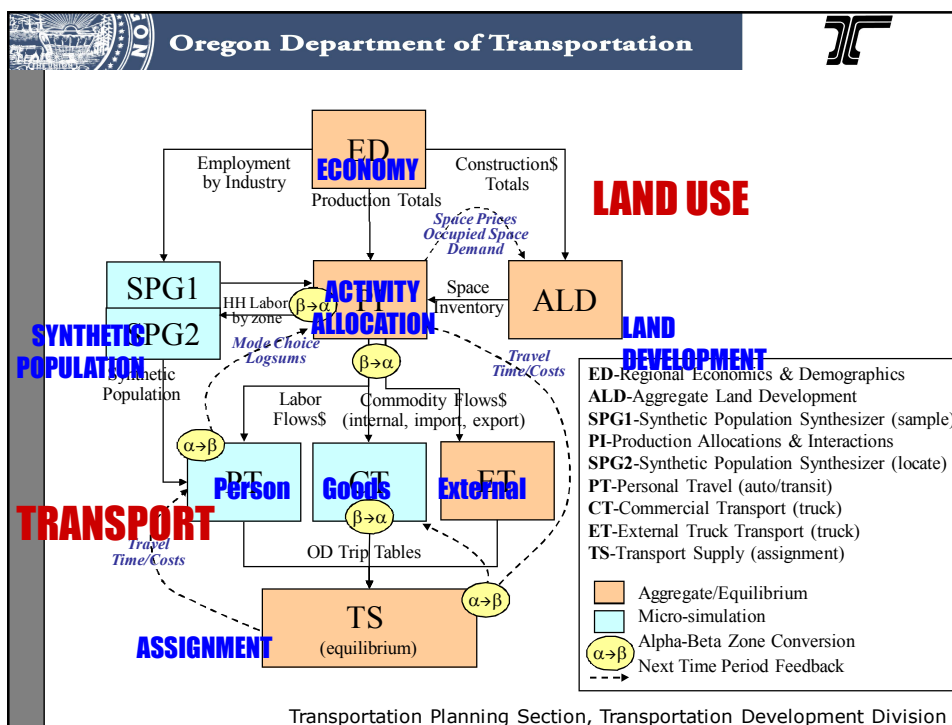
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Categories

- **Activities**
 - 18 Household income/size categories
 - 20 Industry sectors + 19 by space type
- **Commodities**
 - 42 SCTG Goods Commodities
 - 8 Labor occupations, 15 Services
 - 19 Floorspace types
- **Modes**
 - Auto: Drive Along, Shared Ride (2, 3+)
 - Urban Transit: Portland, Eugene, Medford, Salem, Corvallis
 - Intercity Transit: Air, Amtrak Rail, Intercity Bus
 - Non motorized: Walk, Bike
 - Freight: 5 truck weight classes + Air, Rail, Water, Pipeline
- **Road Network**
 - Roughly 40,000 links

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Model Calibration

- **Stage 1:** Statistical Parameter Estimation
- **Stage 2:** Calibrate Modules in Isolation
- -- Full Model Integration --
- **Stage 3:** Full Model Calibration
 - 1998 Base Year
 - 1998-2006 initial over time
 - 1990-2000 compare to 2000 targets
 - Model performance evaluation

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Stage3 Calibration results

- **Key Base-year Measures are reasonable**
 - Activity forecasts (ED)
 - Activity Location/quantity (PI)
 - Labor and Goods Flows (PI)
 - Trip Lengths (PI+PT+CT)
 - Trip Rates (PT)
 - Traffic Count Comparisons (TS)
- **Ready for scenario testing**

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Scenario Testing Goals

- Test policy levers
- Push the model
- Train agency staff
- Improve data management/archiving
- Automate output processing
- Develop visualization tools

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Begin testing in three basic areas

1. Added highway capacity
2. High travel costs
3. Stochastic variability

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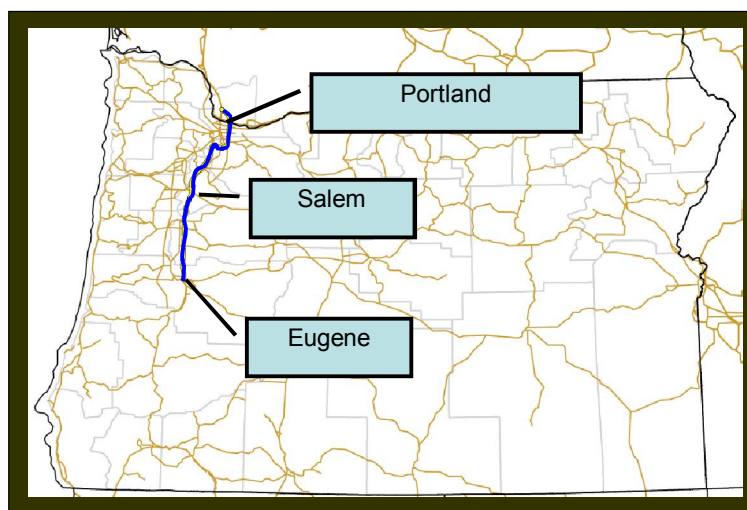
Test 1: Add Highway Capacity

- Add 4+ lanes I-5 Eugene through I-205 to WA
- A Priori Expectations:
 - Reduced travel times
 - More growth in urban Willamette Valley
 - Greater dispersion of HH
 - More long distance commuting
 - Lower land prices in Portland, higher in outlying areas
- Results:
 - Growth: HH, employment
 - Floor space: price
 - Travel: time,

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Test 1: Add Highway Capacity



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Test 2: High Cost Test

- Travel cost ten times higher than 1990
- A Priori Expectations:
 - More compact urban development
 - Less intercity commuting
 - Portland attract larger proportion of economic activity
 - Higher land prices in Portland
- Results:
 - Growth: HH location and income, workers, employment
 - Floor space: price
 - Travel: time, trips,

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Major Findings

- Successfully ran multiple scenarios over time
- Initial look: results seem reasonable
 - In multiple dimensions
 - Direction
 - Further investigation of magnitudes
- Boise takes on role of “urban competitors”

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Major Findings cont'd

- Higher travel costs caused growth in central Willamette Valley more than Portland
- Adding capacity had limited effect statewide
- Micro-simulation variations are small at statewide level

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What Went Well

- Oscillations not problematic
- Transition to Agency operation and analysis
- Hardware worth the effort
- Careful organization of file structure worth effort
- Building off of reference case
 - Creating consistent reference case is challenging

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Challenges...

- Response to capacity change seems small
- Reaching convergence in later years in high travel cost scenario
- Fixed economy – brought into focus given Boise response
- Tools to digest model outputs
- Runtime reduction
- Never enough time...
 - 30 year runs changed to 12 years
 - Five truck classed reduced to two
 - Delay several calibration tasks
 - Agency staff assigned to other projects

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Next Steps

- Review results at greater detail
 - Spatially
 - Categorically
- Less extreme travel cost increase
- Expand visualization tools
- Run times
- Further calibration
- Real world policy application
- Feedback to economy

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This is only the beginning...

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