

**MODELING ANALYSIS  
of  
WILLAMETTE VALLEY  
TRANSPORTATION  
AND LAND USE  
ALTERNATIVES**

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# MODELING ANALYSIS OF WILLAMETTE VALLEY TRANSPORTATION AND LAND USE ALTERNATIVES

## INTRODUCTION

The Willamette Valley Livability Forum facilitated and coordinated a long-range, comprehensive, regional look at the future of land use and transportation in Oregon's Willamette Valley. As part of this effort, state-of-the-art integrated land use and transportation modeling methods were applied to the study of this large region. This analysis will help decision-makers better understand the interdependence and interactions of future land use, economic and transportation alternatives. This report provides a summary of the modeling analysis for the Willamette Valley transportation and land use alternatives considered.

The report is composed of three sections:

- A background of the study and alternative scenarios considered
- A description of modeling assumptions
- A summary of modeling results to date

Appendix A includes a description of the Statewide Model, including a brief description of the theoretical basis of the model, the mechanics of how the model works, and a description of model calibration and testing. Additional information and detailed graphs of modeling results is included in Appendix B. Appendix C lists the members of review and oversight committees for this first application of the statewide model.

## PURPOSE AND BACKGROUND

### Purpose

The Willamette Valley Livability Forum is a voluntary organization of local governments, metropolitan planning organizations (MPOs), business and citizen groups, and state agencies. It was formed to promote dialog and recommend action on regional land use and transportation issues. In 1999, the Forum initiated a long-range, comprehensive, regional look at the future of land use and transportation in the Willamette Valley. This effort brings together three innovative analytical modeling

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<sup>1</sup> The Willamette River Basin has an estimated area of 11,500 square miles. It contains three metropolitan areas and more than 100 cities. About 70 percent of Oregon's population and 75 percent of the state's employment is located in the area.

efforts. The leaders of these studies are partners in the Willamette Valley Livability Forum project. The modeling efforts include:

- Modeling of environmental effects of alternative land use futures by the Pacific Northwest Ecosystem Research Consortium (PNWERC)<sup>2</sup>
- Modeling of economic effects of alternative land use futures on the farming and forestry industries and public infrastructure by the Willamette Valley Alternative Futures (WVAF) project<sup>3</sup>
- Modeling of economic, land use and transportation effects of alternative land use and transportation policies by the Oregon Department of Transportation (ODOT)

## **Background**

The ODOT modeling project involves the application of the recently developed statewide transportation and land use model (statewide model). This project, titled Alternative Transportation Futures (ATF), was funded by a Transportation and Community System Preservation (TCSP) grant from the U.S. Department of Transportation. Direction for development of scenarios to be modeled was provided by an ATF Steering Committee (Appendix C).

In 1996, ODOT, in collaboration with its federal, MPO and state agency partners, started the development of the statewide model as part of its Transportation and Land Use Model Integration Project (TLUMIP). This consortium of agencies and jurisdictions formed the Oregon Modeling Steering Committee (OMSC) to guide development and implementation of modeling in Oregon. A subcommittee of the OMSC, the Statewide Model Application Project (SMAP), provided oversight and recommendations on application of the statewide model (see Appendix C).

The statewide model integrates modeling of economic, land use and transportation interactions in Oregon and Clark County, Washington. This is the first time that an area the size of the Willamette Valley has been modeled to objectively evaluate the interactions of these dynamic elements. It is also the first full application of the statewide model. Information on the performance of the model will be used to improve and expand future model capabilities.

The Willamette Valley Forum study area is shown on Figure 1. Although analysis focused on the Willamette Valley, results from policy actions in the Valley were documented throughout the state and in Clark County.

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<sup>2</sup> The Pacific Northwest Ecosystem Research Consortium consists of the U.S. Environmental Protection Agency, Oregon State University, University of Oregon, and University of Washington. This project has developed three plausible land use futures for the Willamette Valley for the year 2050 and has evaluated them in terms of ecosystem impacts and the economic pressure on water resources.

<sup>3</sup> The Willamette Valley Alternative Futures project is a collaborative research study coordinated by the 1000 Friends of Oregon. It is governed by a Steering Committee with representatives of nonprofit organizations representing agriculture, timber producers, woodlot owners, homebuilders, conservationists, and others. This project is funded by grants from the Hewlett, Compton, Lamb, Bullitt, and Oregon Community Foundations. The project has estimated the long-term consequences of two alternative land use futures for the Willamette Valley on farm and forest productivity and the cost of urban services.

**Figure 1**  
**Willamette Valley Forum Study Area**



### **Alternative Scenarios**

This report presents the results of eight transportation and land use scenarios that have been modeled to date. The scenarios vary with respect to land use, road networks, public transit networks and mileage tax [transportation demand management (TDM)]. The scenarios with their respective policy variables are summarized in Table 1.

The first five scenarios were chosen to test the responsiveness of land use and transportation patterns to various types of public policies. It should be noted that the scenarios do not represent policy proposals but were chosen to represent a range of possible types of policies. The objective was to identify scenarios that have clear differences and that vary from the reference scenario in only one respect. This facilitated the evaluation of results. Upon completion of the evaluation of these five scenarios, two additional scenarios were defined by the ATF Steering Committee that blended elements of the five policies to assess their aggregate effects. An eighth scenario was defined as part of a separate project and blended policies in a third hybrid combination.

**Table 1**  
**Study Scenarios with Policy Variables**

Scenario	Policy Variables			
	Road Network	Transit Network	Mileage Tax (TDM)	Land Use <sup>4</sup>
1. No Action (reference scenario)	No major improvements	No major improvements	No major programs	<i>Historical Trend</i>
2. Highway Emphasis	<i>Major improvements</i>	No major improvements	No major programs	<i>Historical Trend</i>
3. Transit Emphasis	No major improvements	<i>Major improvements</i>	No major programs	<i>Historical Trend</i>
4. Mileage Tax Emphasis	No major improvements	No major improvements	<i>Major program</i>	<i>Historical Trend</i>
5. Compact Development Emphasis	No major improvements	No major improvements	No major programs	<i>Plan Trend</i>
6. Hybrid 1	<i>Only rural improvements</i>	<i>Major improvements</i>	<i>Graduated mileage tax- 10¢ to 20¢</i>	<i>Plan Trend</i>
7. Hybrid 2	<i>Moderate improvements-urban &amp; rural</i>	<i>Moderate improvements</i>	<i>Graduated mileage tax- 5¢ to 10¢</i>	<i>Plan Trend</i>
8. Hybrid 3	<i>Moderate improvements-urban &amp; rural</i>	<i>Moderate improvements</i>	No Major Programs	<i>Historical Trend</i>

## MODELING ASSUMPTIONS

### Assumptions Common to All Scenarios

It was necessary to make certain assumptions relative to data used for the model runs. Several assumptions were common to all scenarios and include:

***Economic and Population Growth.*** The economic and population growth assumptions are the same for all alternatives. Forecasts of incremental changes in final demand were derived from employment and population forecasts developed by the Oregon Office of Economic Analysis (OEA). It is assumed that the model area will grow according to the OEA forecasts regardless of transportation and land costs. It is also assumed that the total employment and population will remain within Oregon and Clark County and will not redistribute to other parts of Washington or other states.

<sup>4</sup> The *Historical Trend* and *Plan Trend* land use names refer to land use scenarios developed by the Willamette Valley Alternative Futures Study and the Pacific Northwest Ecosystem Research Consortium, respectively.

**Trade Relationships.** The input-output (I-O) model that describes trading relationships in the model area (see Appendix A) will not change over time. Although amounts of final and intermediate production are changed in response to economic growth, the amount that each sector consumes from each other as a proportion of its total production will not change.

**Shadow Prices.** The relative differences among zones in public service quality, aesthetics and other factors that affect location choices (shadow prices) are assumed not to change. Although the relative attractiveness of places may change as a result of public or private actions, there is no way to assess how such actions would change the equivalent shadow prices

**Model Calibration Parameters.** The various model calibration parameters will not change over time. Parameters like the monetary value people place on time they spend traveling are very important in modeling travel and location choices. The parameters used in the model are derived and calibrated from existing data.

### **Land Use Assumptions**

The scenarios are based on alternative land use futures drawn from two other studies.

**Historical Trend.** The *No Action*, *Highway Emphasis*, *Transit Emphasis*, *Mileage Tax Emphasis* and *Hybrid 3* scenarios are based on the *Historical Trend* land use scenario developed for the WVAF study. The WVAF prepared a map of developed lands in the year 2050 to represent the *Historical Trend*.

**Plan Trend.** The *Compact Development Emphasis*, *Hybrid 1* and *Hybrid 2* scenarios are based on the *Plan Trend* land use scenario developed by the PNWERC. The PNWERC prepared a series of maps of land use and land cover at 10-year intervals between 1990 and 2050 to represent the *Plan Trend*.

Since land use policy is an important input to the statewide model, it is necessary to provide estimates in the base year of the amount of land on which development is allowed by comprehensive plans. It is also necessary to estimate at each 5-year increment how much land is added to the base year (2000) amount. The WVAF and PNWERC studies provided assumptions of what is actually developed and not what is allowed to be developed. Because Oregon law requires that a 20-year supply of land be maintained within urban growth boundaries, it was assumed that additional land will be zoned at each five-year interval to maintain the required supply. Differences in how lands were mapped by the two studies required some conversions that are explained in Appendix A.

### **Transportation Assumptions**

Different assumptions were made for the different alternative scenarios.

***No Action and Compact Development Emphasis Scenarios.*** These share the same assumptions about the transportation network:

- No substantial increases in highway capacity
- No substantial increases in public transportation service
- No new transportation demand management programs
- The networks are based on existing funded improvements

***Highway Emphasis Scenario.*** This scenario assumes a major highway program. This scenario assumes an investment of from 5 to 10 billion dollars. Highway lanes were added on major roadways in the metropolitan areas and on I-5 and some other intercity highways, subject to some constraints on the total number of lanes<sup>5</sup>. Capacity was added incrementally in 2010, 2020, 2030 and 2040. Under this scenario, by 2040<sup>6</sup>:

- I-5 from Wilsonville to ORE 217 would have 10 lanes.
- The ring roads around Portland (I-205, OR 217, US 26 (west) would have 8 to 10 lanes.
- Many other state highways in the Portland metropolitan area would have 6 lanes
- I-5 in Eugene and Salem would have 8 lanes and other limited access highways in these cities would have 6 lanes
- I-5 between Wilsonville and Salem would have 8 lanes
- I-5 between Salem and Eugene would have 6 lanes
- The Tualatin-Sherwood Connector and the Newberg Bypass would be built, and several portions of rural two-lane highways would be widened to 4 lanes.

***Transit Emphasis Scenario.*** This scenario assumes a major investment in public transportation. It was developed from several planning documents including the 1992 *Oregon Rail Passenger Policy and Plan*, the *Yamhill County Commuter Rail Study*, the *Washington County Commuter Rail Study*, various public informational materials about planned bus rapid transit lines in the Eugene/Springfield metropolitan area, and planning information from Metro about light rail lines studied as part of the Metro area 2040 growth study. The transit network alterations were made in 2010, 2020 and 2035. The estimated costs of these improvements would be from \$5 to 10 billion. Under this scenario, by 2035:

- The light rail system in the Portland metropolitan area would include the planned airport extension and additional rail lines from downtown Portland to Clark County, Clackamas Town Center and Washington Square. They would also include rail lines along Oregon Route 217 and I-205 and from I-5 to I-205 in Clark County.
- The bus rapid transit system in the Eugene/Springfield area would be fully developed. This would include almost 60 miles of bus rapid transit facilities covering most of the metropolitan area.
- Passenger rail service up and down the Willamette Valley would have hourly service at average speeds of about 55 miles per hour.

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<sup>5</sup> The assumed lane constraints were 10 lanes for freeways in metropolitan areas, 8 lanes for freeways outside of metropolitan areas, and 6 lanes for all other highways.

<sup>6</sup> 2035 was used for the latest year because the effects of transportation on land use patterns take time to develop. Improvements in later years would affect ridership and congestion levels but would have much less effect on the distribution of activities.

- Frequent commuter rail service would be provided between McMinnville and Milwaukie (where it connects with light rail); between Salem, Wilsonville and Beaverton; and between Canby and Portland.

***Mileage Tax (Transportation Demand Management) Emphasis Scenario.*** This scenario is intended to illustrate the effects of a major program to reduce travel demand by increasing transportation costs. This was simulated by assuming an extra 20¢ per mile cost for driving on roads in the Willamette Valley. For passenger cars, this would be about a 40 percent increase in the total cost of driving as of the end of 1999<sup>7</sup>.

## MODELING RESULTS

### Evaluation Measures

To focus the outputs from the statewide model, the WVFATF Steering Committee identified the following evaluation measures:

- Distribution of growth in households within the Willamette Valley and surrounding regions
- Distribution of growth in jobs within the Willamette Valley and surrounding regions
- Changes in per capita passenger and vehicle miles traveled in the Willamette Valley
- Changes in per capita passenger and vehicle hours traveled in the Willamette Valley
- Changes in passenger and vehicle travel times in the Willamette Valley
- Changes in auto and truck speeds on urban and rural freeways and arterials in the Willamette Valley
- Changes in auto travel times between selected Willamette Valley cities
- Emissions from vehicles in motion in the Willamette Valley
- Changes in residential and industrial/commercial land prices in the Willamette Valley

### Modeling Results for Alternative Scenarios

A summary of the modeling results for the different scenarios is presented below. Detailed comparative data on the model results are included in Appendix B.

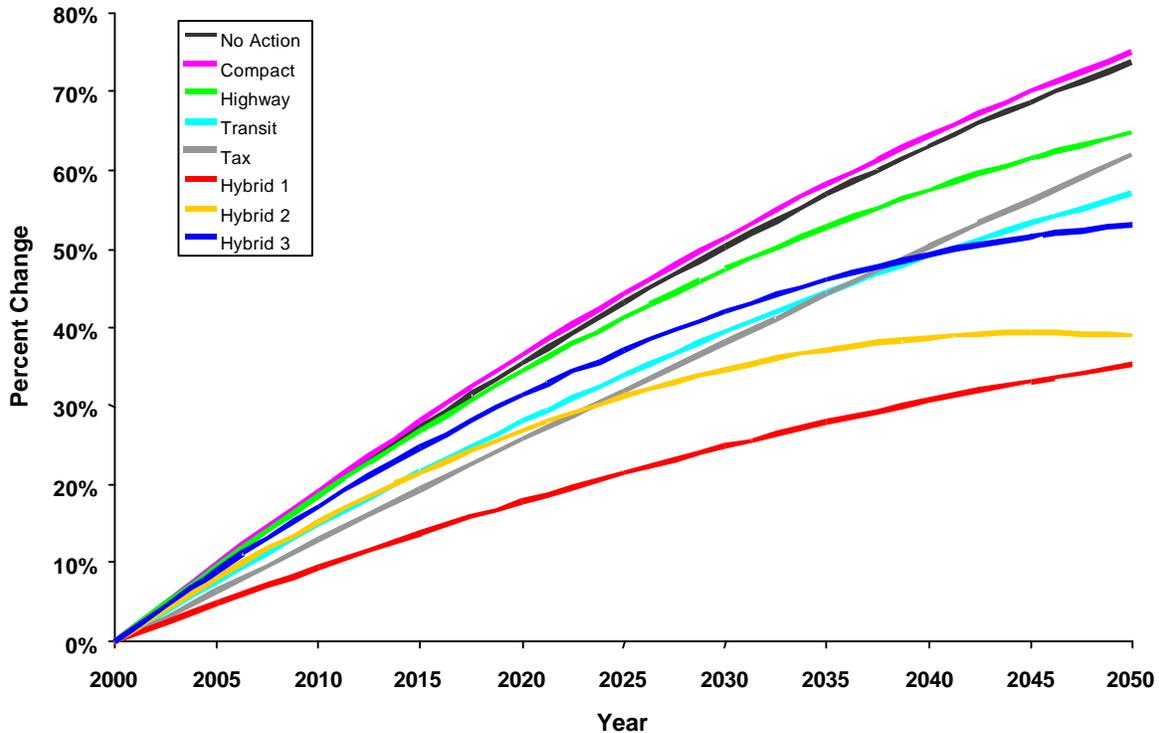
***Congestion will increase and vehicle miles traveled per person will decrease.*** An assumption in the model is that the Willamette Valley population will double by 2050. With this projected population increase, even if major investments were made in highways and public transit, travel delay and traffic congestion will increase. Passenger vehicle miles traveled decreases for all scenarios as a result of this increased congestion. Even so, the transportation policies chosen today can make a difference in just how the transportation system works in the years ahead (Figure 2). For example, the increase in travel time is significantly less for the three hybrids.

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<sup>7</sup> According to an October 11, 1999 press release by the American Automobile Association, the total costs of driving a mid-size car in western states is 49 cents per mile. This includes all ownership and operating costs.

**Figure 2**  
**Average Passenger Travel Time**

(Passenger Hours per 1000 Passenger Miles)



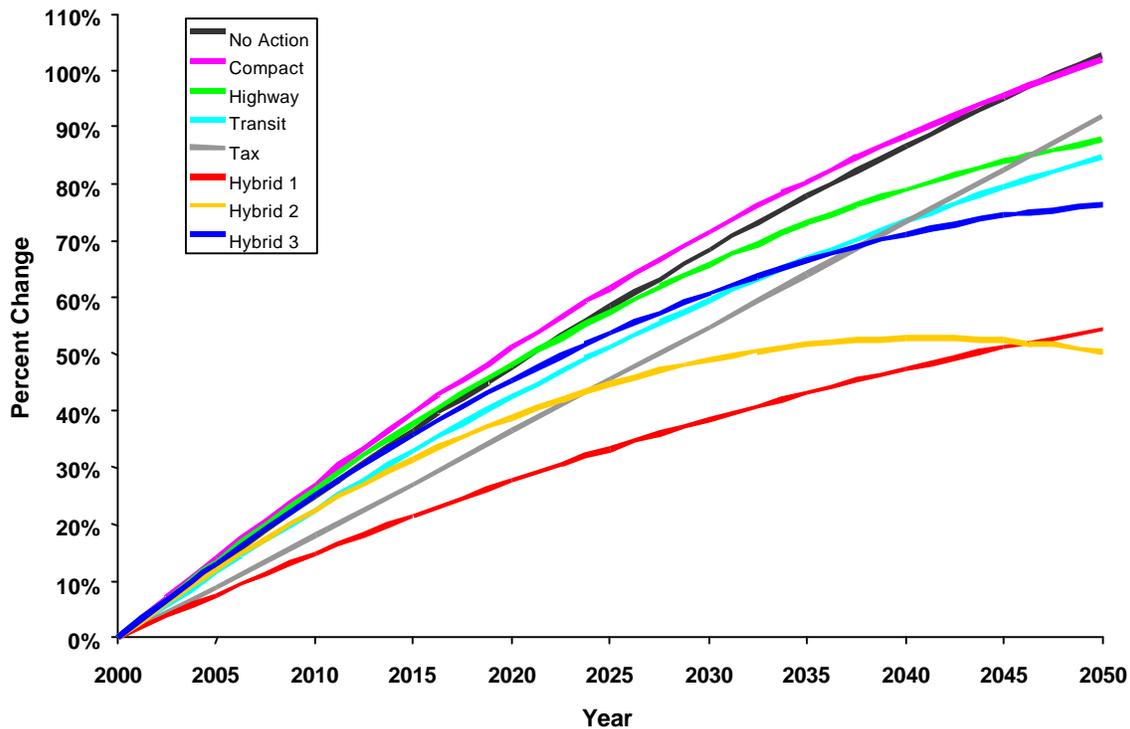
Of the policy choices modeled, city-to-city traffic congestion increases the least when the expansion of highway and transit infrastructure is coupled with taxes to reduce demand. Over the fifty-year period, Hybrid 1 and Hybrid 2 result in the smallest increases in average travel time. Hybrid 3, which does not include the mileage tax, results in a significantly greater increase in average travel time. The Highway scenario, which includes no public transit expansion, has an even greater increase in travel time.

The effect of the policies is different for trucks than passengers. Truck travel times increase more under all scenarios (Figure 3). Moreover, truck travel time increases are mitigated more by highway improvements than are passenger travel time increases.

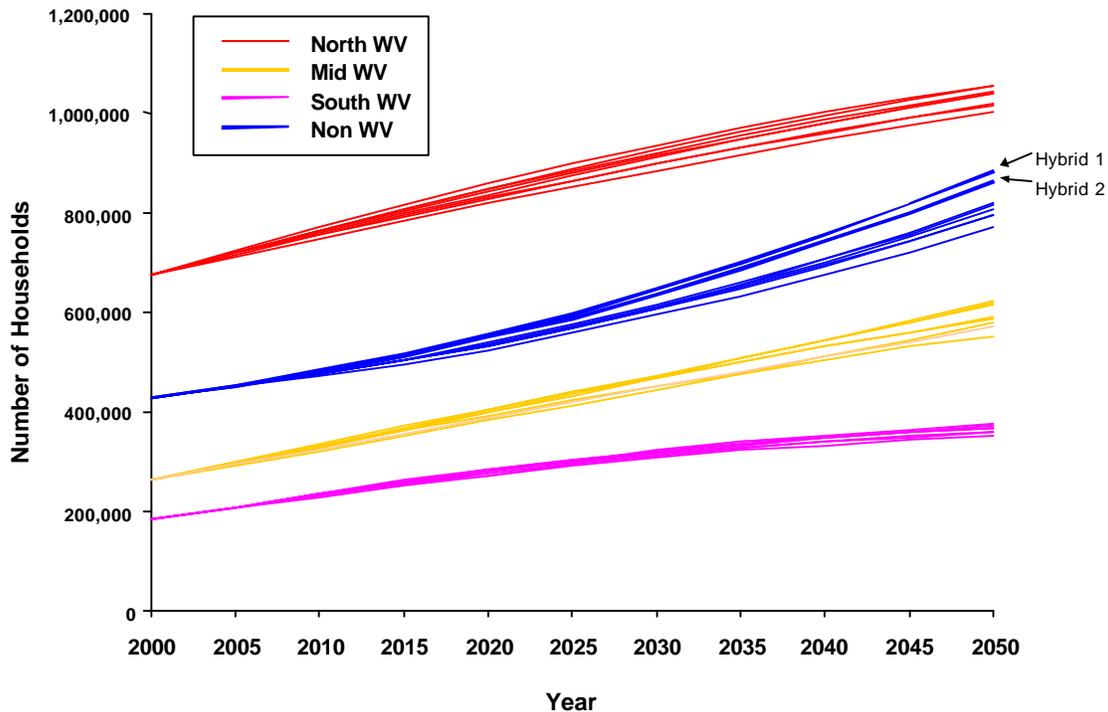
***There is much inertia in the current system.*** Regional growth varies little among scenarios (Figure 4). It will take major shifts in policy over a long period of time to effect significant change because development patterns and travel behavior change very slowly. Modeling shows that, even after projects are constructed and in use, it takes years for transportation projects to manifest themselves in different land use patterns and different levels of travel. Substantial policy shifts can alter overall growth of the Willamette Valley, but because of geographic circumstances and local policies, impacts are seen more strongly at the local level than at a regional level.

**Figure 3**  
**Average Truck Travel Time**

(Truck Hours per 1000 Ton Miles)



**Figure 4**  
**Regional Growth Trends**

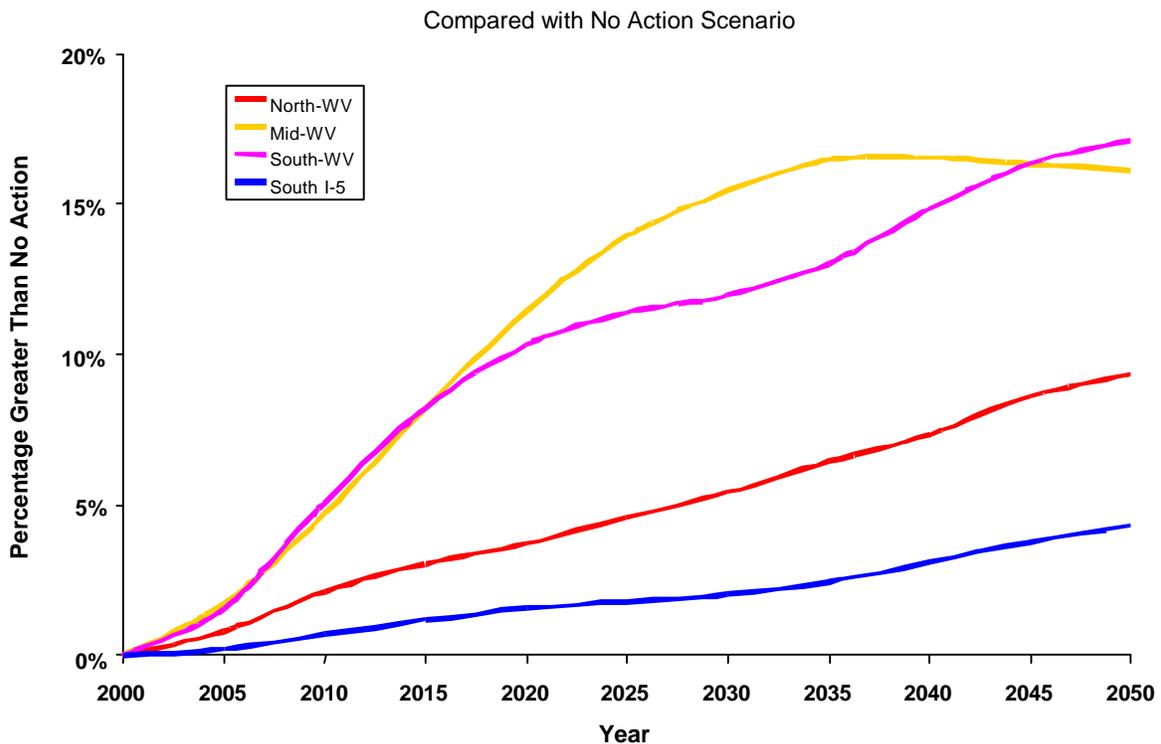


The hybrids show more pronounced differences because of the combinations of economic, transportation and land use elements. It should be noted that the model distributed a fixed population around the state in response to various economic, land use and transportation variables. Realistically, some of the population that moved within the state would leave Oregon completely in response to the policy variables applied.

**Where people and jobs locate is affected by several elements:**

- **Transportation improvements and location.** Highway expansion decentralizes both jobs and housing, while transit expansion centralizes jobs and decentralizes housing. Highway expansion tends to keep growth within the Willamette Valley, while transit expansion and a mileage tax tend to move some growth to areas outside the Valley. Increased mobility by any mode increases the population of metropolitan fringe areas and neighboring cities.
- **Supply of land, which affects land price.** Strong urban growth boundaries influence land use more than they influence travel. The Compact scenario constrains the amount of land available to development, increasing land prices (Figure 5). As a result, land prices within metropolitan areas increase, directing more development to smaller cities and outside the Willamette Valley. This also increases city-to-city and longer distance travel. Hybrid scenarios increase the effects of the compact scenario - the *push* of land prices combined with the *pull* of city-to-city mobility increases the shift of population to smaller cities.

**Figure 5**  
**Residential Land Price Effects of Compact Scenario**

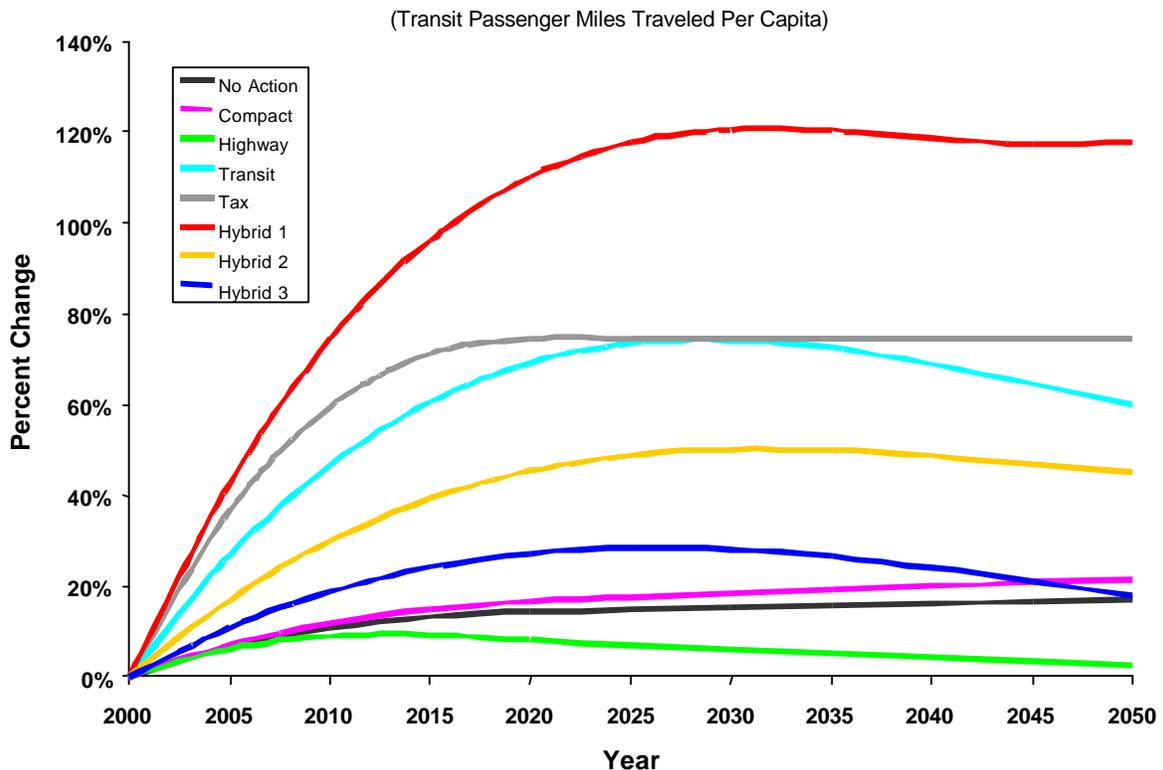


- **Transportation costs.** A mileage tax would increase the cost of private vehicle use in the Willamette Valley and decreases the overall amount of travel in the Valley. It would also shift more development outside of the Valley where there is no tax. This offsets some of the travel reductions within the Willamette Valley.

Growth of areas outside the Willamette Valley is greatest for scenarios that restrict land supply and impose taxes in the Valley (Hybrid scenarios 1 and 2). Adding improved mobility further reinforces movement out of the Valley. In particular, the area south of the Willamette Valley in the I-5 corridor would experience the greatest growth as a result of Hybrid scenarios 1 or 2.

**Transit ridership increases with increases in transit infrastructure, mileage taxes, and restrictions on highway expansion.** Transit service as a percentage of total trips increases most significantly relative to strong investment in public transportation and mileage taxes. (Figure 6).

**Figure 6**  
**Transit Travel**



## **CONCLUSION**

It is clear that different policy choices will have different impacts for the future and that combinations of policies will provide the most significant change.

The results of this project provided several scenarios with very different results. By modeling various combinations of land use, economic and transportation policy options, decision-makers can anticipate events and can adopt policies that will help shape the Willamette Valley for future generations.

# Appendix A

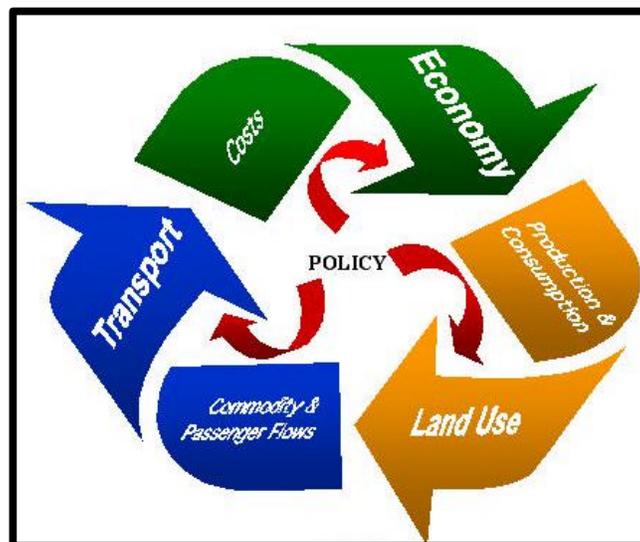
## THE STATEWIDE TRANSPORTATION AND LAND USE MODEL

### BACKGROUND

The statewide model is a set of computer programs and data that describe the relationships between Oregon's economy, land use patterns and transportation flows. This is the only operating model of its kind in the United States that integrates economic, land use and transportation elements and covers an entire state.

Economic, land use and transportation activities interact and are highly interdependent as shown in Figure A-1.

*Figure A-1  
Schematic Representation of the Statewide Model*



As our society becomes increasingly diverse and specialized, the interaction of these activities becomes more important. Methods to analyze the complex ways in which travel behavior, locational preferences, market forces, infrastructure and policies interact become more necessary to inform policy-makers and to maximize private and public investments.

Public policies affect the price of land and the distribution of land uses through regulation. Infrastructure investments likewise drive private investment and business location decisions. The ability to simulate land use and travel behavior and relate this to

economic impacts will lead to better growth management and more efficient and cost-effective use of the transportation system.

## LAND USE CONVERSIONS

The eight scenarios are based on alternative land use futures drawn from two other studies. The *Reference Case*, *Highway Emphasis*, *Transit Emphasis*, *Mileage Tax Emphasis* and *Hybrid 3* scenarios are based on the *Historical Trend* land use scenario developed for the Willamette Valley Alternative Futures (WVAF) study. The WVAF prepared a map of developed lands in the year 2050 to represent the *Historic Trend*. The *Compact Development Emphasis*, *Hybrid 1* and *Hybrid 2* scenarios are based on the *Plan Trend* land use scenario developed by the Pacific Northwest Ecosystem Research Consortium (PNWERC). The PNWERC prepared a series of maps of land use and land cover at 10-year intervals between 1990 and 2050 to represent the *Plan Trend*. Differences in how lands were mapped by the two studies required some conversions that are explained below.

Since land use policy is an important input to the statewide model, it is necessary to provide estimates in the base year of the amount of land on which development is allowed by comprehensive plans. It is also necessary to estimate at each 5-year increment how much land is added to the base year (2000) amount. The WVAF and PNWERC studies provided assumptions of what is actually developed and not what is allowed to be developed. Because Oregon law requires that a 20-year supply of land be maintained within urban growth boundaries, it was assumed that additional land would be zoned at each five-year interval to maintain the required supply.

To accomplish this, the PNWERC maps were used to inventory amounts of land envisioned to be in residential and commercial/industrial uses. This was done for each 10-year increment from 1990 to 2050. From these inventories, 10-year increments were computed and divided in half to calculate 5-year increments. The base year total supply was estimated by adding four 5-year increments to the 1990 supply that had been inventoried for model development and calibration. For each 5-year increment, it was assumed that additional land would be added to the urban growth boundary to replace the amount of land used in that increment. This then simulates a situation where a 20-year supply of land within the urban growth boundaries is always maintained.

In the case of the *Historical Trend* scenario, the mapping only shows the developed area in 2050. It does not distinguish between residential and commercial/industrial uses and does not provide information for intermediate years. Some adjustments were made to the *Historic Trend* and *Plan Trend* 2050 mappings to make them comparable.<sup>1</sup> Then two

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<sup>1</sup> The following adjustments were necessary to make comparable alternatives. Alterations were needed because the two scenarios did not map roadways and developed areas consistently. With regard to roadways, the *Historic Trend* coverage included roadways with other developed lands while the PNWERC coverage identified most major roads separately. To make the coverages consistent in this respect, roads in the PNWERC coverages were combined with other areas identified for residential, commercial and industrial development to reflect gross acreage. Regarding the extent of land development, although the *Historic Trend* scenario is meant to portray more extensive development, in

simplifying assumptions were made. First, it was assumed that the relative proportions of residential and commercial/industrial lands in each zone would be the same for both alternatives. Second, it was assumed that the percentage of the total 1990-2050 increment of development that occurs in each 5-year period is the same for the alternatives. Given these two assumptions, the 1990-2050 increment of development was calculated for the Historic Trend and Plan Trend scenarios for each zone, the ratios of the Historic Trend and Plan Trend increments were calculated for each zone, and the Plan Trend increments for each 5-year period for each zone were multiplied by the corresponding zonal ratios to yield the Historic Trend increments.

The following table summarizes valley-wide totals of residential and commercial/industrial land for the alternatives. (These numbers include the urban equivalent acreage for rural residential development.)

	1990	2050	
		Compact Growth	Historic Trend
Total (sq. miles)	476	626	728
50-year increment (sq.miles)		150	252

The adjusted *Historical Trend* scenario adds 68 percent more land for development than the compact growth scenario between 1990 and 2050 and in total has about 16 percent more land allocated for development.

## MODEL SIMPLIFICATIONS

It is difficult to model economic, land use and transportation elements interactively in a quantitative way that reasonably replicates what is actually happening. That is because the interacting systems are complex and the resources required to measure and analyze the systems are large. Considerations include:

- Oregon is large and has great variation in the distribution of population and employment.
- The Oregon economy is quite diverse and complex.
- The transportation network is expansive, complex and varies considerably across the state.
- There are numerous types of land uses.
- Government policies are numerous and complex.
- Data is limited and requires a coordinated and substantial effort to ensure adequacy, consistency and timeliness.
- Funding for staff and computing time is often limited.

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some locations it does not show development where it is shown in the *Plan Trend* scenario. This includes some existing developed areas and some urban growth boundary expansions. To address this difference, the maximum extent of development under the *Historical Trend* and *Plan Trend* was used.

To address these considerations and to minimize the risks inherent in developing an advanced model, a number of simplifications were made for economic sectors, geographic activity zones, the transportation network, trip schedules and purposes, land use, and certain other factors.

## **Economic Sectors**

The model of the economy and its trading relationships is expressed through 15 sectors. These include the 12 business sectors and 3 household sectors listed in Table A-1. Although this description of economic sectors is very generalized, it includes all economic activities that are tracked by economists

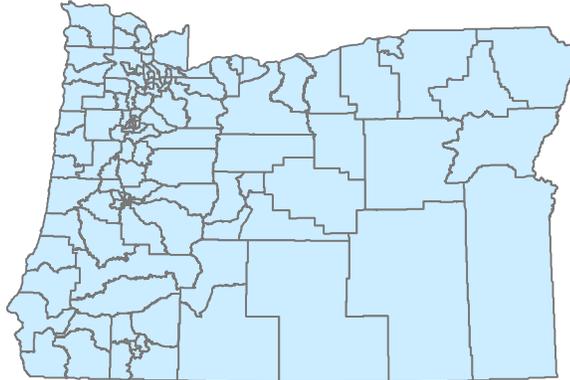
*Table A-1  
Model Economic Sectors*

<b>Symbol</b>	<b>Description</b>
AGFF	Farms, Forests, Fisheries
CONS	Construction, Mining
OMFG	Food Processing, Non-metallic Minerals, Metals, Other
WOOD	Lumber and Wood Products, Pulp and Paper
PRNT	Printing and Publishing
TECH	Machinery and Equipment, High Tech, Transport Equipment
TCPU	Transport, Communications and Utilities
WLSE	Wholesale
RETL	Retail
FIRE	Finance, Insurance, Real Estate
SERV	Lodging, Personal/Business/Health Services, Amusements, Organizations
GOVT	Education, Other Government
HHLo	Low Income Households
HHMi	Medium Income Households
HHHi	High Income Households

## **Geographic Activity Zones**

All activities in the modeled geographic area (Oregon and Clark County, Washington) are grouped into a set of 122 zones (Figure A-2). Over half of these 122 zones (67) are located in whole or in large part in the Willamette River Basin. About half of these zones (35) are within or include significant portions of metropolitan urban areas. Areas external to Oregon and Clark County are represented by 25 external zones.

**Figure A-2**  
**Geographic Activity Zones**



### **Transportation Network**

The modeled transportation network is simplified in several respects:

- Auto, bus, passenger rail and truck freight are represented in the model. Air travel and rail freight are not included. The absence of air travel and rail freight is not likely to have much effect on the results of the Willamette Valley study since average travel distances for air and rail freight trips extend considerably beyond the Willamette Valley.
- Modeling of bus transportation is simplified by ignoring route constraints within metropolitan areas (except for bus rapid transit in the Eugene/Springfield metropolitan area). Buses are assumed to travel on the entire modeled road network in metropolitan areas subject only to prevailing roadway speed conditions and minimum wait times.
- The road network includes only state highways and urban arterials, which includes the large majority of travel<sup>2</sup>.

### **Trip Schedules and Purposes**

To simplify the almost infinite number of possible trip schedules and purposes, daily trips were categorized as one of the following:

- Trips made from home to work and back by low, medium and high income households (3 categories)
- Other work-related trips other than commuting or goods transportation (e.g., trips between businesses)
- Recreation trips made from the home
- Other trips made from the home (e.g., to and from the home and stores, schools, churches etc.)

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<sup>2</sup> According to 1997 data from the Highway Performance Monitoring System, approximately 75% of urban vehicle miles traveled (VMT) and 81% of rural VMT occurs on interstate highways and other arterials.

- Other trips made from locations other than home (e.g., to shopping from a recreation destination, restaurant from work)
- Truck freight (e.g., all goods movement by truck)

## **Land Use**

Only two land use categories are modeled - residential and commercial/industrial land. All residential land use is considered urban residential land. Rural residential land is represented as an equivalent low-density urban use.<sup>3</sup> Likewise, there is no explicit modeling of multifamily residential land apart from other urban residential land.

## **Other Factors**

The model does not explicitly account for a variety of factors that affect the desirability of locating in various places. These include factors like the quality of public services, views and other aesthetic considerations. These are computed as a set of equivalent zonal cost constants called “shadow prices” that are calculated during model calibration. Because public service quality, aesthetics and other like quantities are not explicitly modeled, it is not possible to estimate how changes in these attributes would affect land use and transportation.

## **HOW THE MODEL WORKS**

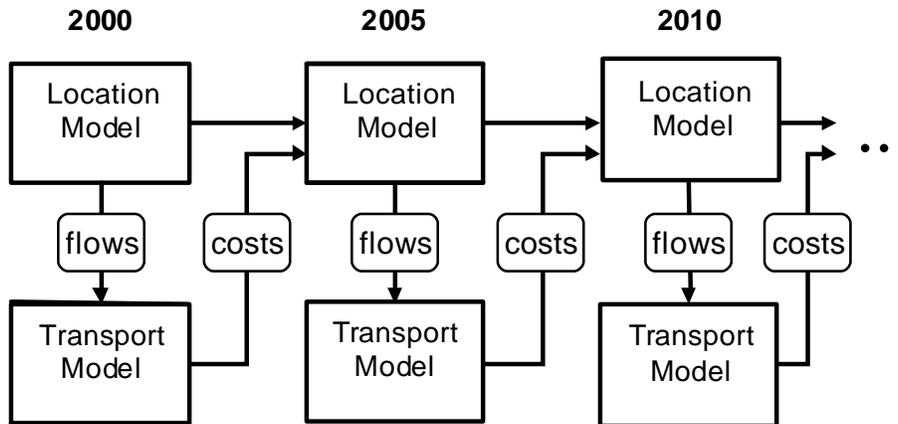
The Statewide Model is a set of computer programs that are run in a linked fashion to simulate changes in the distribution of activities<sup>4</sup> and travel over time. It is implemented in the TRANUS modeling package with some functions being carried out in Excel spreadsheets. The two primary elements of the Statewide Model are a location model and a transportation model. The location model allocates growth among zones and simultaneously determines the amount of trade occurring between zones by economic sector. The transportation model converts the trade flows into trips, apportions the trips among modes, and assigns the trips to the road and transit networks. Figure A-3 shows how these programs are linked to simulate changes over time. For each time period, the location model determines the location of activities and the transactions between them. Another program converts the transactions into transportation flows. The transportation model then takes the transportation flows and calculates trip generation by trip type, apportions the trips between modes, and assigns the trips to the road and transit networks. It simultaneously determines the travel costs between zones. The resulting travel costs are then passed to the activity model for the following time period. More detailed descriptions of the location and transportation models follow.

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<sup>3</sup> For example, if rural residential development were not allowed and people in rural areas were to move into the city, it is assumed that the average lot size they would occupy would be one-quarter acre.

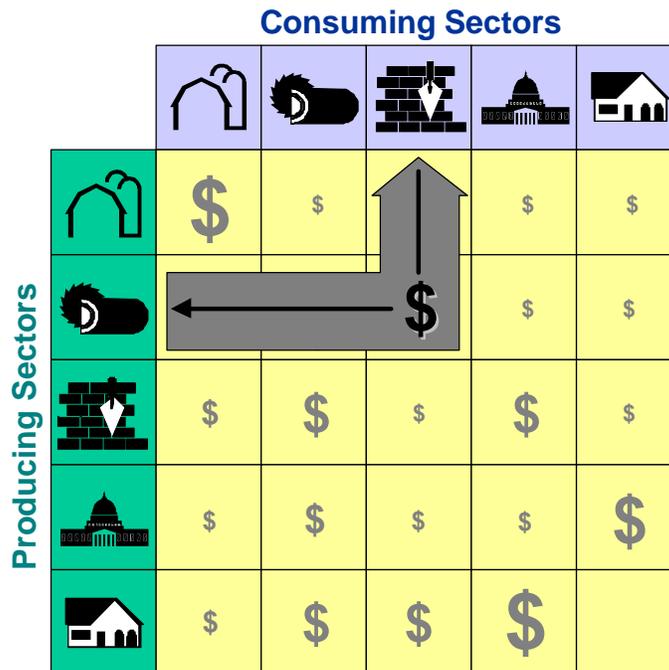
<sup>4</sup> Activities refers to the industrial and household sectors listed in the previous section.

**Figure A-3**  
**Sequence of Activity and Transportation Modeling**



The location model incorporates a model of the study area economy. It is like an economic input-output (I-O) model that includes a spatial dimension. I-O models represent the trading relationships between sectors of the economy. Each sector of the economy produces goods and services that are consumed by other sectors of the economy. Products flow in one direction, dollars in the opposite direction. This is illustrated in figure A-4.

**Figure A-4**  
**Schematic Representation of and Input-Output Model**



Some of the goods and services that are produced are purchased by other economic sectors for use in their production processes and are called intermediate production. Other goods and services are exported from the area or are sold to private individuals or government. These are not used to produce other goods or services and are called final production. Every increase in final goods production induces a chain of intermediate goods production. For example, the production of houses by a construction company requires the production of lumber by a sawmill, which requires the production of saws and other machinery. I-O models track these production and consumption relationships and allow induced demand to be calculated from changes in final demand. The Statewide Model is based on an I-O model produced by IMPLAN. This is a system of software and data sets originally developed by the U.S. Forest Service for policy analysis and now maintained by the Minnesota IMPLAN Group, Inc.

The Statewide Model adds a spatial dimension to the I-O model. In addition to calculating total induced production for the model area, it determines where the induced production is most likely to occur. This is done through a chain of computations that consider cost of producing and consuming the goods and services in different zones. Production/consumption costs are in turn affected by land prices and transportation costs. The chain starts with forecasts of the growth of final production for all goods and services by each economic sector for the analysis period (5-year increment). These forecasts were derived from population and employment forecasts developed by the Oregon Office of Economic Analysis (OEA).<sup>5</sup> The forecasted increments of final demand are then allocated to zones based on the proportions of the total sector production in each zone and the price of production in each zone. The model component that does this was calibrated from 1990 and 1995 economic data. After the growth of final demand is allocated by zone, the statewide model computes induced production and allocates that to zones based on the cost of production in each zone. The zonal production costs depend on the cost of consuming intermediate production from other zones, which depends on transportation costs. It also depends on the cost of consuming land in the zone that depends, in turn, on supply of land in the zone and the aggregate demand for using it. The model cycles through numerous iterations of calculating induced production by economic sector, allocating the production among zones, determining if land constraints exist, and adjusting prices. This goes on until the change in prices from one cycle to the next is very small.

The results of the location model are the allocation of annual production in dollars by economic sector to each zone. Annual production in dollars is converted to employees based on current labor productivity rates by sector (\$/employee) and households (\$/household). The location model also produces a set of annual dollar flows of goods

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<sup>5</sup> The process of forecasting final demand started with the extrapolation of recent changes in employment by economic sector. The results were modified based on national economic trends, such as the growth of service industries relative to other industries, and state employment forecasts. Then, final demand was incrementally increased while monitoring resulting modeled population increases to arrive at a total population forecast that is consistent with the long-range OEA forecast. It should be noted that although the resulting population forecast matches that of the OEA closely, the forecast of employment is high. That is to be expected because the economic model is static and therefore does not anticipate changes in labor productivity. The OEA forecasts, on the other hand, are based on trends that implicitly account for increasing labor productivity. This difference is not significant, however, because the study's purpose is to compare the relative effects of policy alternatives, not to forecast future conditions.

and services by zone and by economic sector. These flows are converted by another program into transportation flows (for example, tons of freight movement).

The transportation model takes the transportation flows, assigns them to paths and computes transportation costs. It does this through several steps. First, a set of possible pathways between each pair of zones must be determined for each type of trip and each mode of travel. The model identifies six distinct pathways for each combination of zones, trip type and mode<sup>6</sup>. As pathways are determined, the cost of traveling each of them is computed. The cost includes the amount and value of travel time, distance-related costs (e.g. tolls and distance fares), and transfer costs. Next, the model calculates the number of trips of each type to convey each transportation flow. This trip generation component of the transportation model considers trip generation as a function of the cost of travel (elastic trip generation). For example, a family located in a more remote location will make fewer shopping trips to purchase the same amount of goods than will a family located in a more accessible area. In this way, the model considers how increased costs due to congestion can suppress trip making and how new facilities that reduce travel costs can induce trip making.

Following trip generation, trips are split among modes and assigned to the pathways determined previously. In the statewide model, the modal structure is simplified, consisting only of passenger and freight modes. Once mode splits are determined, trips are assigned to pathways based on the relative costs of traveling by each of the paths. The resulting assignment of trips is then evaluated to determine levels of congestion and how congestion affects travel costs. This results in a recalculation of travel costs for each of the paths. The program then cycles back to the trip generation step to refigure trip generation rates based on the recalculated travel costs, then to mode split again, then trip assignment and back to recalculation of travel costs. This cycle is repeated over and over until there is very little change in trip assignments from one cycle to the next.

The results of the transportation analysis are tables of trips and costs between zones by mode and type. Another program converts these tables into interzonal costs that the activity model uses for the following period of analysis.

## MODEL DEVELOPMENT

The statewide model was calibrated and validated <sup>7</sup> using data from 1990 and 1995. This included data from the following sources:

- IMPLAN Model
- Oregon truck survey
- Oregon household travel surveys

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<sup>6</sup> The model can be set up to determine more pathways, but as more pathways are added, the time of computation increases. Six produces reasonable results.

<sup>7</sup> Model calibration is the process of using data to establish the various mathematical equations that replicate observed behavior. Model validation is the process of comparing model outputs against data to determine how well the model replicates aggregate measurements of behavior.

- State employment records
- Highway and local road inventories
- County assessment records
- Land sales records
- Metro (Regional Land Inventory System) data
- Statewide zoning
- Census

The calibration of the model was a highly iterated process because of the interrelated nature of the model components. Three major cycles of calibration and testing were involved with numerous iterations within each during the initial development of the model. These included:

- Initial base year (1990) calibration
- Initial 1990-1995 calibration and validation
- Long-range application including recalibration and validation during the study in order to include the passenger rail transportation and update the road network

The initial base year calibration focused on determining the right set of parameters for replicating the distribution of activities, passenger trip generation, and truck freight trip generation. The target for calibration of activity distribution was to match measured production by zone at reasonably close prices and reasonably small shadow prices with no observable biases in the shadow prices. Calibration targets for transportation were to match total trips and average trip length for each transportation demand category within +/- 20percent of measured values, match target passenger trips by sub-state area within +/- 20 percent, and to match average weekday counts along major intercity corridors within +/- 20 percent.

After calibration of the base year was completed, the focus turned to application of the model for the 1990 to 1995 increment of time and the adjustment of model parameters as necessary to replicate observed changes. Global increments of final production were input, the activity and transportation models run, and model results compared to target values. The primary criteria for evaluation of the model were:

- Closely matching the actual increments of change in households and employment by sector for each zone
- Matching target passenger trips by sub-state area within +/- 20 percent
- Matching the expected change in passenger trips by sub-state area within +/- 20 percent
- Matching 1995 truck and auto average weekday counts along major intercity corridors within +/- 20 percent

Finally, during the applications of the model, the long-range results of the alternatives were evaluated to make sure that reasonable results were being obtained, for example, that land prices respond to supply constraints and that travel patterns respond to congestion.

# Appendix B

## STATEWIDE MODEL RESULTS

### INTRODUCTION

The graphs presented in this report address the performance measures derived from the outputs of statewide model runs for eight different land use and transportation policy scenarios. The eight scenarios and their characteristics are as follows:

#### *No Action*

- No major improvements to the transportation system
- Land in the Willamette Valley is urbanized at historical rates

#### *Compact*

- No major improvements to the transportation system
- Land in the Willamette Valley is urbanized at rates assumed in comprehensive plans

#### *Highway*

- Major expansions of urban and rural highways in the Willamette Valley
- Land in the Willamette Valley is urbanized at historical rates

#### *Transit*

- Major expansion of Willamette Valley urban and intercity public transportation services
- Land in the Willamette Valley is urbanized at historical rates

#### *Mileage Tax*

- No major improvements to the transportation system
- Willamette Valley auto and truck travel is taxed at 20 cents per mile
- Land in the Willamette Valley is urbanized at historical rates

#### *Hybrid 1*

- Major expansions of rural highways in the Willamette Valley
- No urban highway expansions
- Major expansion of Willamette Valley urban and intercity public transportation services
- Willamette Valley auto and truck travel taxed at 10 cents per mile increasing to 20 cents
- Land in the Willamette Valley is urbanized at rates assumed in comprehensive plans

#### *Hybrid 2*

- More moderate expansions of urban and rural highways in the Willamette Valley

- More moderate expansions of Willamette Valley urban and intercity public transportation
- Willamette Valley auto and truck travel taxed at 5 cents per mile increasing to 10 cents
- Land in the Willamette Valley is urbanized at rates assumed in comprehensive plans

### *Hybrid 3*

- Like Hybrid 2 except no added auto and truck taxes and
- Land in the Willamette Valley is urbanized at historical rates <sup>1</sup>

This report documents modeling results according to the following measures established in consultation with the Alternative Transportation Futures Steering Committee:

- Distribution of growth in households within the Willamette Valley and surrounding regions
- Distribution of growth in jobs within the Willamette Valley and surrounding regions
- Changes in per capita passenger and vehicle miles traveled in the Willamette Valley
- Changes in per capita passenger and vehicle hours traveled in the Willamette Valley
- Changes in passenger and vehicle travel times in the Willamette Valley
- Changes in auto and truck speeds on urban and rural freeways and arterials in the Willamette Valley
- Changes in auto travel times between selected Willamette Valley cities
- Emissions from vehicles in motion in the Willamette Valley
- Changes in residential and industrial/commercial land prices in the Willamette Valley

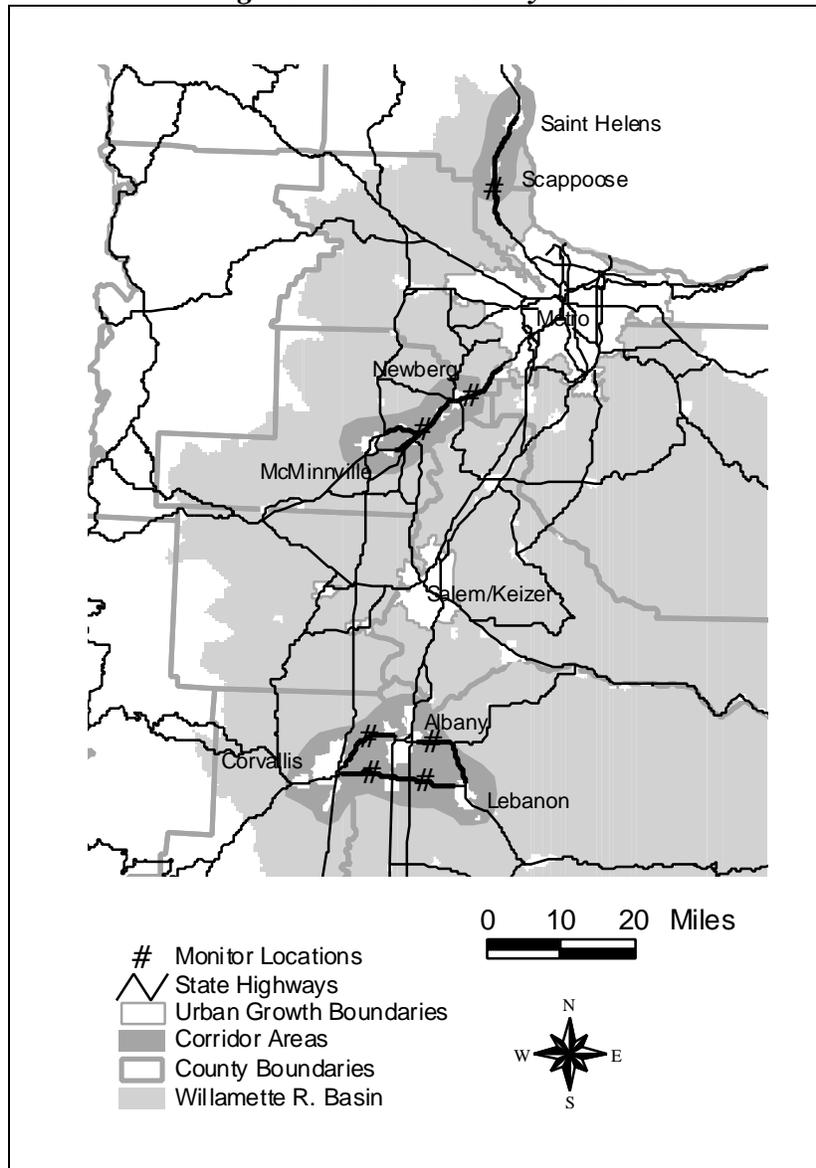
The report also presents results for three corridors in the Willamette Valley. Whereas most of the results are averages for the Willamette Valley or large portions of the Willamette Valley, the corridor results profile differences for nine communities and the corridors that connect them to each other and larger metropolitan areas. These corridors were chosen to illustrate the related land use and transportation effects of the different scenarios. One or more pages of graphs are presented for each of these performance measures listed above. Each page also includes a description of the performance measure and notes on the major features of the graphs.

Figure 1 shows the corridor study areas, communities studied and approximate location of places for which transportation results were extracted.

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<sup>1</sup> This scenario was developed as the base case for a study of an Eastern Oregon freeway mandated by the Oregon Legislature in HB3090.

**Figure 1. Corridor Study Areas**



## **INTERPRETING THE RESULTS**

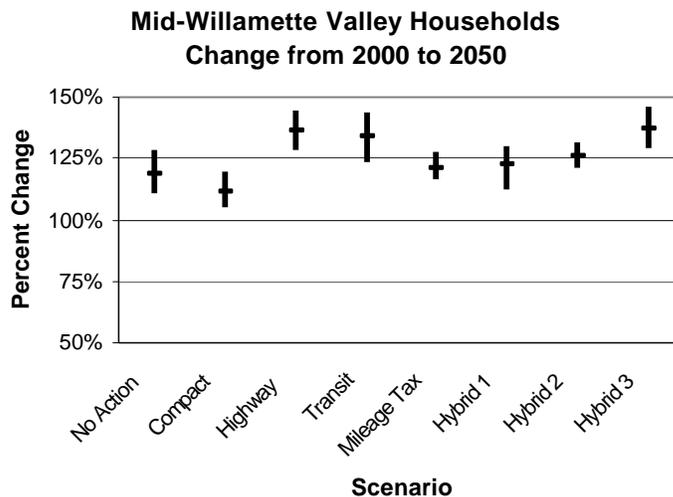
A few words are in order on how the model results and the representations of the results shown in these graphs should be interpreted.

The statewide model simulates travel and business and household location changes at 5-year intervals. For each time interval, the travel simulation represents the types and amounts of travel resulting from the business and household location simulation for that interval. The location simulation, though, is based on the zone-to-zone travel costs coming from the travel simulation in the previous time interval. This is done to represent

the time lag that typically occurs between the time when location decisions are made and when they actually take place.

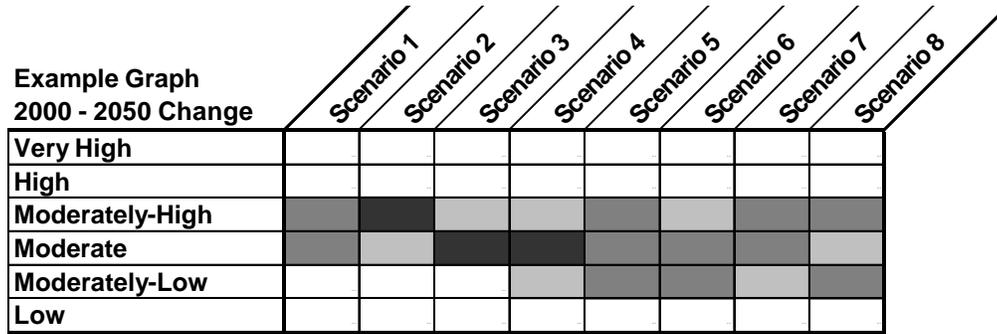
One result of this time lag, however, is that model results can vary significantly from one time period to the next. Graphs of some model outputs have a sawtooth appearance. Although the results all show clear trends, there can be considerable variation around the average trend lines. This variation is also influenced by differences among the scenarios regarding the timing of changes to the supply of land and the transportation system. It is necessary to take this variation into account when representing the model results. Otherwise comparisons made only on the basis of average trends could have the effect of overstating differences between scenarios that are not very significant.

Following is an example of a graph that shows how the trends and variation around the trends are shown. The example graph shows the percentage change in the number of households in the Mid-Willamette Valley from 2000 to 2050. (100% means a doubling, for example.) The scenarios are labeled across the bottom of the graph. The results for each scenario are represented by a bar and a crosshatch in the center of the bar. The crosshatch represents the average 50-year trend. The bars represent the amount of variation around the trend. When comparing scenarios, first look at how much the bars overlap. If the bars overlap a lot, differences in the trends are not very significant. If the bars overlap little, then differences in the trends are significant.



Graphs like the preceding one are primarily used to show results that are averaged for the Willamette Valley or fairly large portions of the Willamette Valley or state. They are not used to illustrate results for individual zones or corridors because it would be imprudent to do so given the structure and calibration of this 'first generation' statewide model. This model has a small number of zones and a fairly sparse transportation network. It has been calibrated to reasonably match observed behavior at an aggregate level (such as matching the observed number of passenger trips by sub-state region), but not to match observations for all zones and all locations on the transportation network.

The model can be used for evaluating the direction and relative magnitude of the effects of the different land use and transportation policies on individual zones and transportation network links, but the results need to be communicated in a way that represent their relative precision. This has been done using graphs such as the following:



Each column in the graph corresponds to one of the eight alternative scenarios. Each row corresponds to six levels of change. These levels generally correspond to percentage changes as shown in the following table for quantities that are increasing over time (such as job growth).

Very High	Greater than 200% growth over 50 years
High	Around 200% growth over 50 years
Moderately-High	Around 150% growth over 50 years
Moderate	Around 100% growth over 50 years
Moderately-Low	Around 50% growth over 50 years
Low	Less than 50% growth over 50 years

For quantities that are decreasing over time, such as traffic speeds, the following table applies:

Low	No decrease
Moderately-Low	Around 0% decrease over 50 years
Moderate	Around 25% decrease over 50 years
Moderately-High	Around 50% decrease over 50 years
High	Around 75% decrease over 50 years
Very High	Greater than 75% decrease over 50 years

The shading in each box of the graph shows the degree to which each level describes the amount of change for a scenario. A blacked box means “mostly”. A medium gray box means “partly”. A light gray box means “slightly”. Usually more than one box is

marked because there is some variation in the results and the results do not fall squarely within one category. For example, in the graph above for Scenario 1, both the “Moderate” and “Moderately-High” boxes are shaded medium gray. This means that the change for this scenario is partly moderate and partly moderately-high. In other words, about in the middle of these two levels. Scenario 2, in comparison, is mostly moderately-high and slightly moderate. It therefore is a little higher than Scenario 1. Scenario 3 is mostly moderate and slightly moderately high, so it is a little lower than Scenario 1. Scenario 4 is a little lower yet because it is also slightly moderately low. Its central tendency is “Moderate”, but there is variation around that central measure. Scenario 5’s central tendency is also moderate, but this scenario varies more than Scenario 4. Scenarios 6 and 7 show examples that have central values that are a little more and a little less than Scenario 5. Finally, Scenario 8 shows an example where there is considerable variation in the results so that the darker gray shows up at the top and bottom. Only a couple of results show this pattern.

## Distribution of Growth in Number of Households

This section shows rates of household growth in three portions of the Willamette Valley and in surrounding areas. Note that:

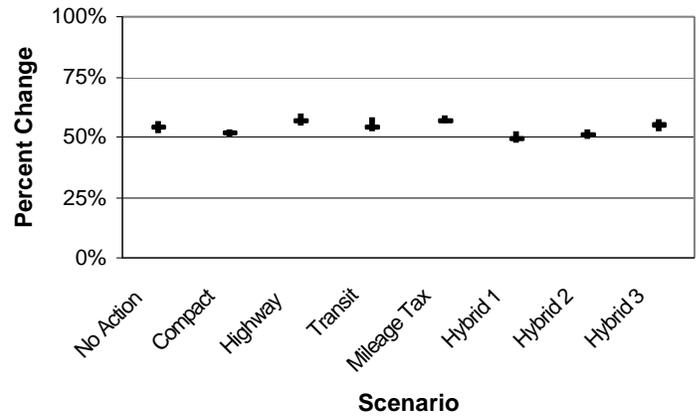
- \* Growth of the North Willamette Valley with its large base of households varies little among scenarios.

- \* Growth of the Mid-Willamette Valley varies more. Expanded transportation infrastructure appears to produce more growth, while restricted land supplies and taxes appear to limit the rate of growth.

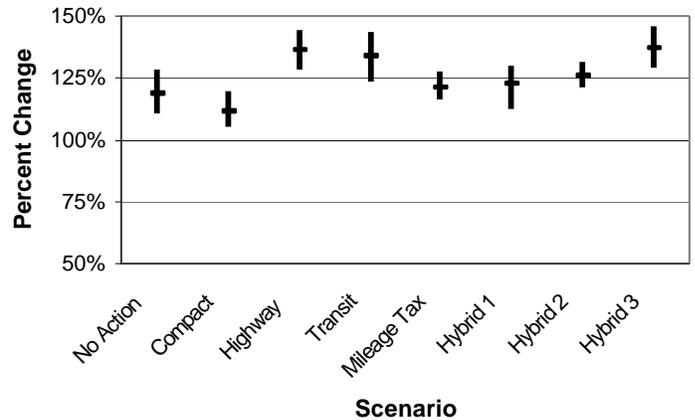
- \* Growth in the South Willamette Valley is less affected by transportation and land use policies.

- \* Clark County also shows relatively little variation, probably because Portland Metropolitan area growth varies so little. The Transit scenario and the Hybrid 1 scenario (which includes a strong transit component) both slightly increase the rate of growth.

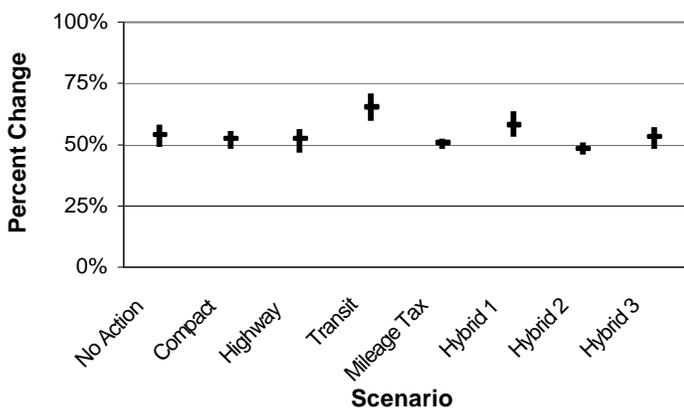
**North Willamette Valley Households  
Change from 2000 to 2050**



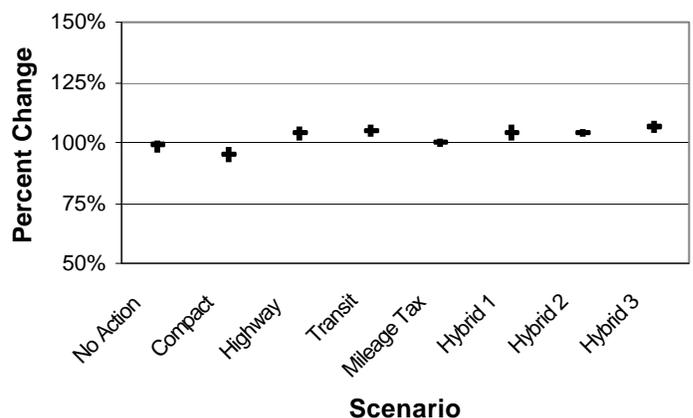
**Mid-Willamette Valley Households  
Change from 2000 to 2050**



**Clark County Households  
Change from 2000 to 2050**



**South Willamette Valley Households  
Change from 2000 to 2050**



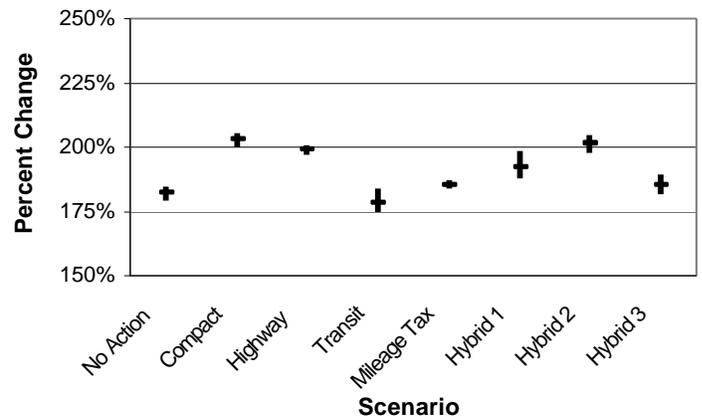
## Distribution of Growth in Number of Households (cont.)

\* Growth of the North Coast area (which includes Columbia County) is greater with restricted Willamette Valley land supplies, increased taxes and highway expansions.

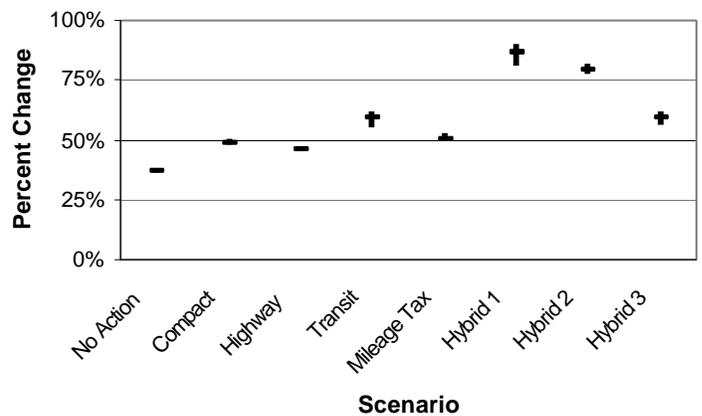
\* The South I-5 area also shows significant variation in household growth with the greatest growth occurring with the Hybrid scenarios.

\* The growth of Central and Eastern Oregon is affected by restrictions in Willamette Valley land supply, taxes and infrastructure expansion. Growth is greatest for the Hybrid 1 and 2 scenarios that combine these elements.

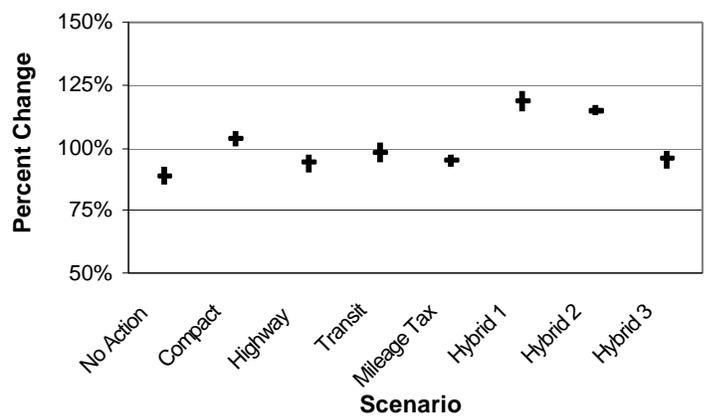
**North Coast Households  
Change from 2000 to 2050**



**South I-5 Area Households  
Change from 2000 to 2050**



**Central & Eastern Oregon Households  
Change from 2000 to 2050**



## Distribution of Growth in Number of Jobs

This section shows rates of job growth in three portions of the Willamette Valley and in surrounding areas. Note that:

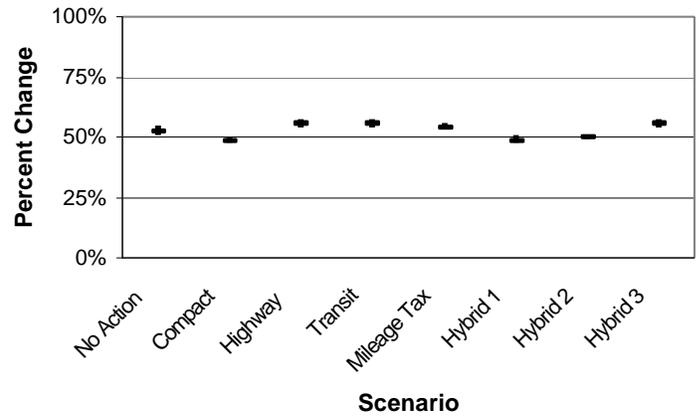
- \* Job growth in the North Willamette Valley with its large employment base varies little among scenarios. The scenarios with restrictive land supplies (Compact, Hybrid 1 & Hybrid 2) have less growth than the other scenarios.

- \* More variation in job growth can be seen for the Mid-Willamette Valley. Infrastructure expansions and taxes appear to increase growth. Restricted land supplies appear to reduce growth.

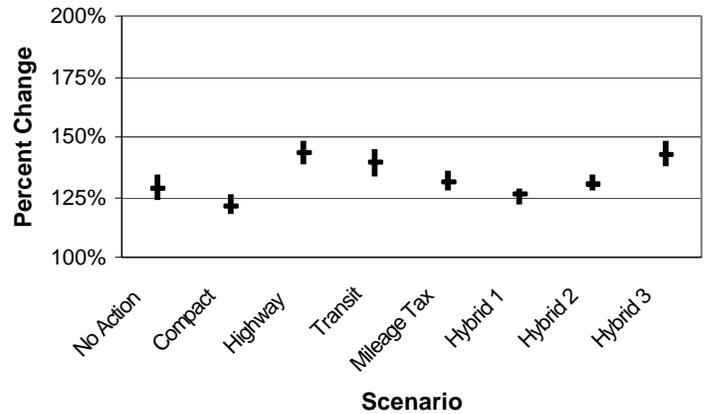
- \* South Willamette Valley job growth varies little among scenarios.

- \* Job growth in Clark County is greatest with the scenarios which expand the public transit infrastructure the most (Transit and Hybrid 1).

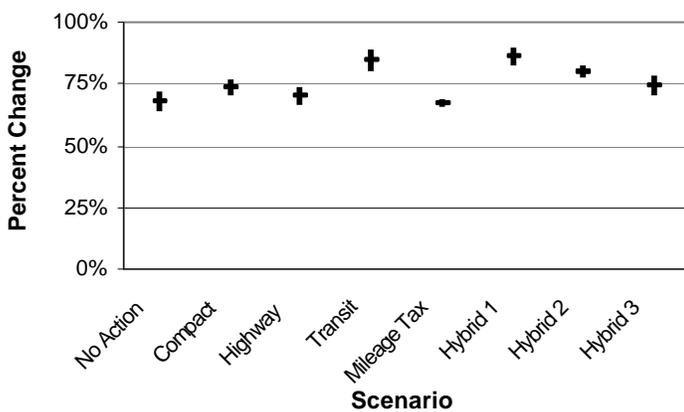
**North Willamette Valley Jobs  
Change from 2000 to 2050**



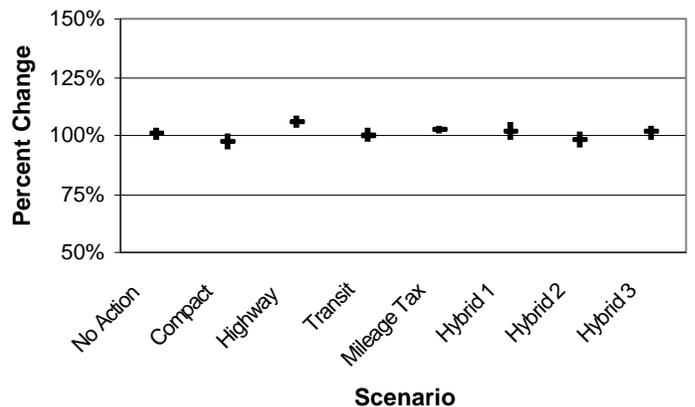
**Mid-Willamette Valley Jobs  
Change from 2000 to 2050**



**Clark County Jobs  
Change from 2000 to 2050**



**South Willamette Valley Jobs  
Change from 2000 to 2050**



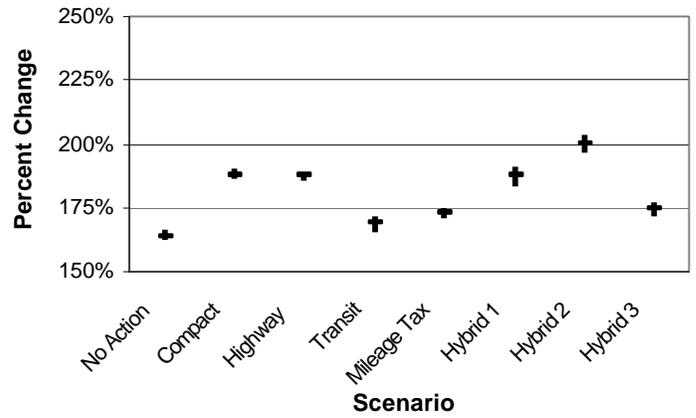
## Distribution of Growth in Number of Jobs (cont.)

\* Job growth in the North Coast area is increased by the expansion of transportation infrastructure and by land supply restrictions in the Portland Metropolitan area.

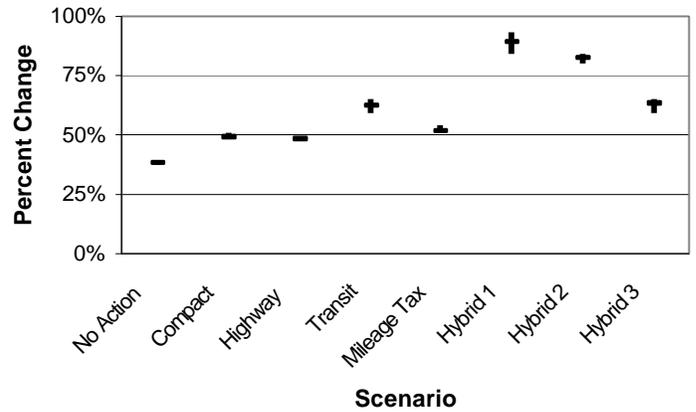
\* Job growth in the South I-5 area is increased by all policies that alter land use or transportation policies. Hybrids 1 and 2 that combine transportation expansions with taxes and restricted land supplies in the Willamette Valley increase job growth the most.

\* Job growth in Central and Eastern Oregon follows a pattern similar to the South I-5 area.

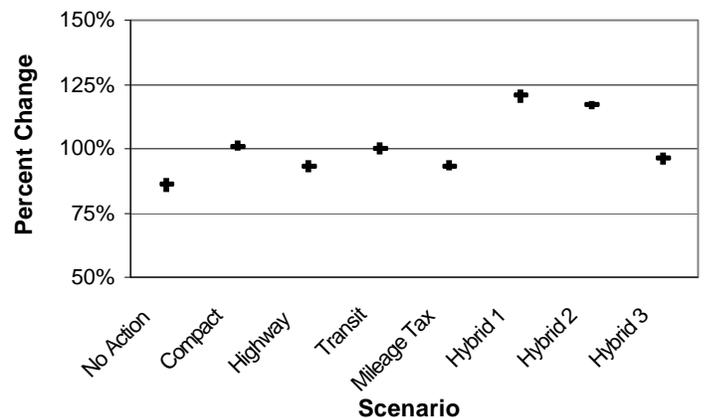
**North Coast Employees  
Change from 2000 to 2050**



**South I-5 Area Employees  
Change from 2000 to 2050**



**Central & Eastern Oregon Employees  
Change from 2000 to 2050**

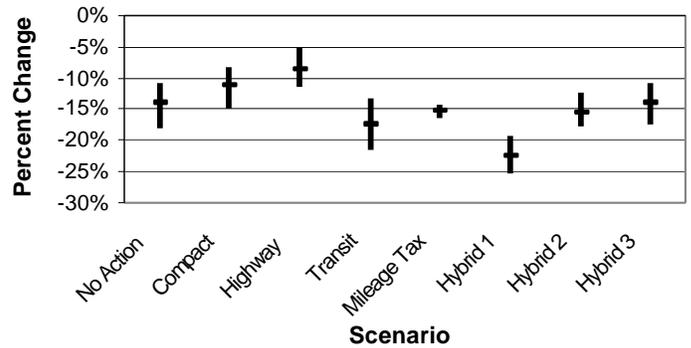


## Willamette Valley Passenger Miles Traveled

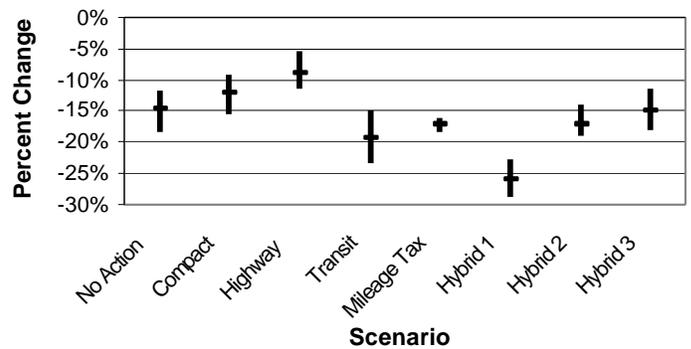
Passenger miles is a measure of the number of people traveling and how far they travel. For example, 10 people each traveling 100 miles equals 1000 passenger miles. Total passenger miles are divided by population to get a per capita rate. This measure and all of the other transportation measures only account for travel between model zones, which in many instances corresponds to travel between cities. The measures do not include short trips in or between neighborhoods. Note that:

- \* Automobile travel declines under all scenarios.
- \* Changes in total passenger miles and automobile passenger miles are very similar.
- \* There are some small, but noticeable declines in auto travel relative to total passenger travel for the Transit, Mileage Tax, Hybrid 1 and Hybrid 2 scenarios. These correspond to the much greater percentage increases in transit travel for these scenarios.
- \* The Highway scenario reduces auto and passenger travel the least.
- \* The No Action, Compact, Highway, and Hybrid 3 scenarios have fairly similar results for transit travel. The scenarios which include a tax and/or a large expansion of transit service increase transit travel the most.

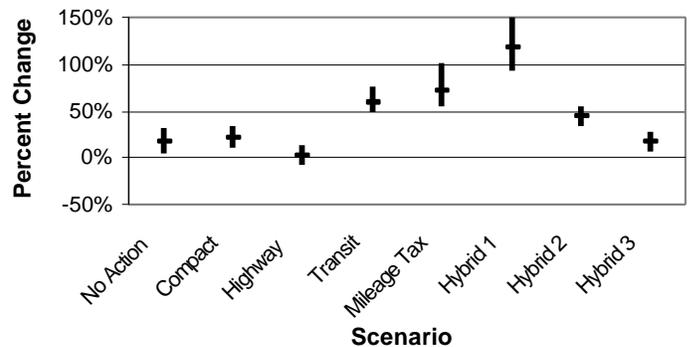
**Per Capita Total Passenger Miles Traveled  
Change from 2000 to 2050**



**Per Capita Auto Passenger Miles Traveled  
Change from 2000 to 2050**



**Per Capita Transit Passenger Miles Traveled  
Change from 2000 to 2050**



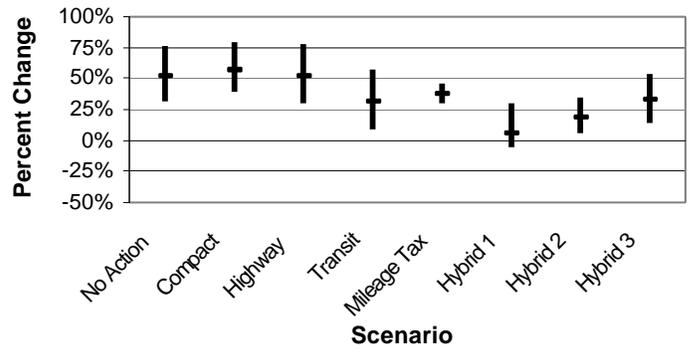
## Willamette Valley Hours Traveled

Hours traveled is a measure of the number of people or vehicles traveling and how much time they travel. For example, 100 vehicles each traveling for 2 hours equals 200 vehicle hours. Total passenger or vehicle hours are divided by population to get a per capita rate. Transportation and land use policies can change the total amount of time spent traveling by changing the amount of congestion in the peak periods and the duration of the peak periods. These results only reflect changes in peak period congestion, not the peak period duration. Note that:

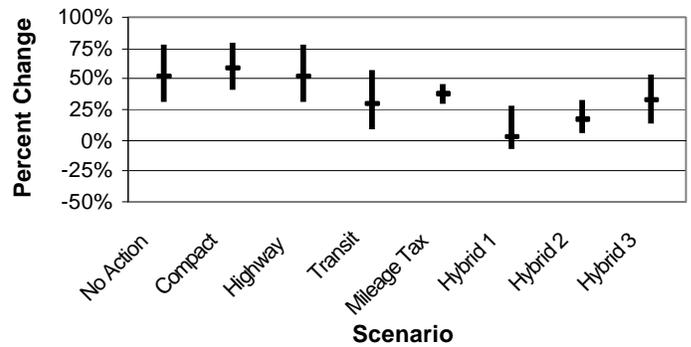
\* The graphs for passenger and auto hours are alike. The No Action, Compact and Highway scenarios are fairly similar and show greatest increase. The Transit, Mileage Tax and Hybrid 3 scenarios are similar and show next greatest increase. The Hybrid 1 scenario shows the least increase and Hybrid 2 is in between.

\* There are noticeable differences in auto and truck hours overall. Truck hours increase more than auto hours. For truck hours, the Highway scenario results are more like the Transit and Hybrid 3 scenarios and less like the No Action and Compact scenarios, as is the case with auto hours. Hybrids 1 and 2 have about the same effect on truck hours of travel.

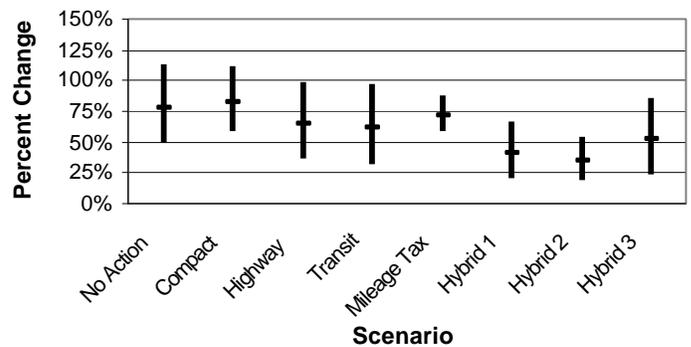
**Per Capita Passenger Hours Traveled  
Change from 2000 to 2050**



**Per Capita Auto Hours Traveled  
Change from 2000 to 2050**



**Per Capita Truck Hours Traveled  
Change from 2000 to 2050**



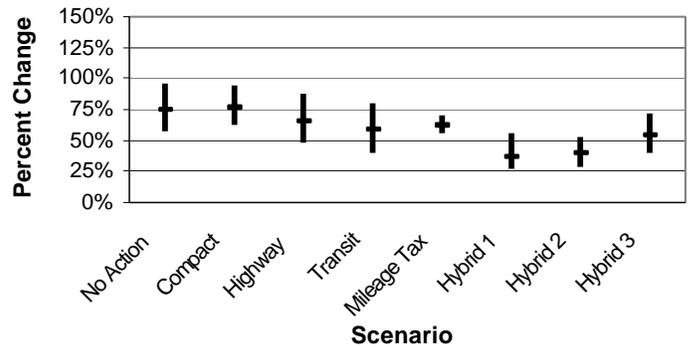
## Willamette Valley Travel Rates

Travel rates measure the amount of time required to move people or goods a specified distance. For example, the average travel rate for 100 trucks each carrying 10 tons of freight a distance of 100 miles in two hours would be 200 truck-hours per 1000 ton-miles. (An increase in the travel rate means a decrease in the average speed.) Transportation and land use policies can change travel speeds in peak and off-peak periods. These results only reflect changes in peak period travel speeds. They do not reflect the peak period duration or off-peak travel speeds. Note that:

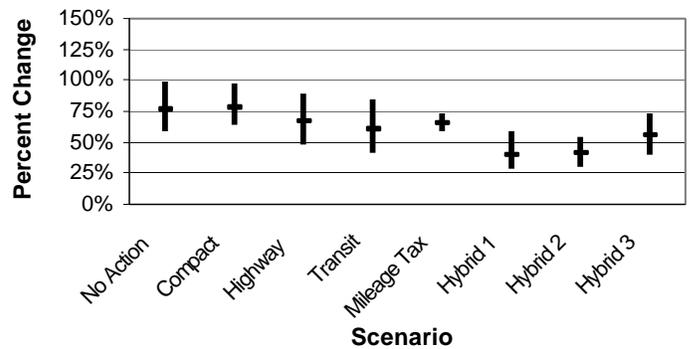
\* There is very little difference in changes in per capita passenger and auto travel rates. The No Action and Compact scenarios are fairly similar and show the greatest increase. The Highway, Transit, Mileage Tax and Hybrid 3 scenarios are similar and show next greatest increase. Hybrids 1 and 2 show the least increase in average travel time.

\* Truck travel rates show a greater increase than auto travel rates, but the positions of the scenarios relative to each other are about the same.

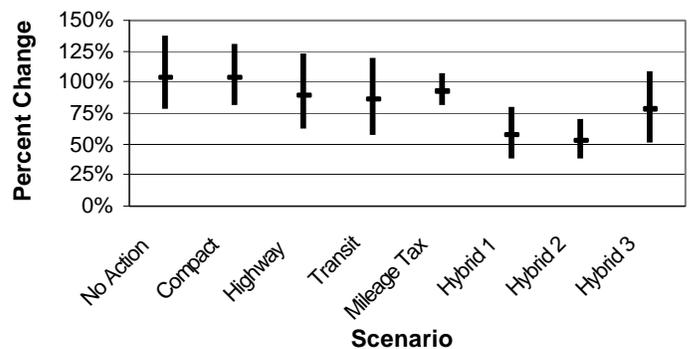
**Passenger-Hours per 1000 Passenger-Miles  
Change from 2000 to 2050**



**Auto-Hours per 1000 Auto-Miles  
Change from 2000 to 2050**



**Truck-Hours per 1000 Ton-Miles  
Change from 2000 to 2050**



## Willamette Valley Urban and Rural Travel Speeds

The graphs on this page show changes in average peak hour speeds for automobiles and trucks on urban and rural freeways and arterials. Note that:

\* Speeds during congested times decrease for all of the scenarios.

\* In urban areas, Hybrids 1 and 2 show the least decline in congested speeds followed by the Highway and Hybrid 3 scenarios. The other scenarios perform much like the No Action scenario in this respect.

\* Auto and truck speed reductions are much the same.

\* The model results for rural speeds are more variable than the results for urban speeds (more boxes are colored in for most scenarios). This is probably due to the smaller number of roads connecting zones.

\* The hybrid scenarios, especially Hybrid 1, show the least declines in congested rural auto and truck speeds.

\* The Highway scenario results in less reduction of truck speeds than auto speeds in rural areas.

\* The Compact scenario results in the greatest reduction of rural freeway and arterial speeds.

Urban Fwy. & Arterial Auto Speed Reduction 2000 - 2050 Change	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Low								
Moderately-Low								
Moderate	■	■	■	■	■	■	■	■
Moderately-High	■	■	■	■	■	■	■	■
High								
Very High								

Urban Fwy. & Arterial Truck Speed Reduction 2000 - 2050 Change	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Low								
Moderately-Low								
Moderate	■	■	■	■	■	■	■	■
Moderately-High	■	■	■	■	■	■	■	■
High								
Very High								

Rural Fwy. & Arterial Auto Speed Reduction 2000 - 2050 Change	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Low								
Moderately-Low						■	■	■
Moderate	■	■	■	■	■	■	■	■
Moderately-High	■	■	■	■	■	■	■	■
High	■	■	■	■	■	■	■	■
Very High								

Rural Fwy. & Arterial Truck Speed Reduction 2000 - 2050 Change	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Low								
Moderately-Low		■				■	■	■
Moderate	■	■	■	■	■	■	■	■
Moderately-High	■	■	■	■	■	■	■	■
High	■	■	■	■	■	■	■	■
Very High								

## Auto Travel Times to Portland

The graphs on this page show changes in the average congested automobile travel times between Portland and the cities of Salem, McMinnville and Eugene. Note that:

\* The effect of the scenarios on travel time depends on the origin and destination of travel.

\* Between Salem and Portland, auto travel time does not vary much between the scenarios. It increases the least with the Highway, Transit, Hybrid 2 and Hybrid 3 scenarios. It increases the most with the No Action, Compact, Mileage Tax, and Hybrid 1 scenarios.

\* McMinnville to Portland congested travel times vary considerably between scenarios. Travel time increases the least with Hybrids 1 and 2. It increases the most with the No Action, Compact and Highway scenarios.

\* Auto travel time between Eugene and Portland increases the least with the three Hybrid scenarios. It increases the most for the Compact and No Action scenarios. The values shown for Hybrid 1 result from some large increases in travel time in 2045 and 2050.

Salem-Portland  
Auto Travel Time  
2000 - 2050 Change

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High	■	■				■		
Moderate	■	■	■	■	■	■	■	■
Moderately-Low	■	■	■	■	■	■	■	■
Low								

McMinnville-Portland  
Auto Travel Time  
2000 - 2050 Change

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High	■	■	■					
Moderate	■	■	■	■	■	■	■	■
Moderately-Low	■	■	■	■	■	■	■	■
Low								

Eugene-Portland  
Auto Travel Time  
2000 - 2050 Change

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High	■	■						
Moderately-High	■	■	■					
Moderate	■	■	■	■	■	■	■	■
Moderately-Low	■	■	■	■	■	■	■	■
Low								

## Auto Travel Times to Salem

The graphs on this page show changes in the average congested automobile travel times between Salem and the cities of Albany, Corvallis and Eugene. Note that:

\* The effect of the scenarios on travel time depends on the origin and destination of travel.

\* The three Hybrid scenarios show the smallest increases in travel time between Albany and Salem. The highway scenario shows the next smallest increase. All of these scenarios include major I-5 expansions. The Compact and No Action scenarios show much greater increases.

\* Travel times between Corvallis and Salem do not show as much variation as the travel times between Albany and Salem. This may be a reflection that none of the scenarios included major highway improvements between Corvallis and Salem other than on I-5. Transit service is improved, however, in the ORE 99W, OR 34 and US 20 corridors with the Transit and Hybrid scenarios. The combination of I-5 expansion and transit service improvements may account for the better performance of the Hybrid scenarios.

\* The three Hybrid scenarios also show the smallest time increases for travel between Eugene and Salem.

Albany-Salem  
Auto Travel Time  
2000 - 2050 Change

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High	■	■						
Moderately-High	■	■	■	■				
Moderate	■	■	■	■	■	■	■	■
Moderately-Low			■		■	■	■	■
Low			■		■	■	■	■

Corvallis-Salem  
Auto Travel Time  
2000 - 2050 Change

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High	■	■	■					
Moderately-High	■	■	■	■				
Moderate	■	■	■	■	■	■	■	■
Moderately-Low					■	■	■	■
Low					■	■	■	■

Eugene-Salem  
Auto Travel Time  
2000 - 2050 Change

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High	■	■						
Moderate	■	■	■	■	■	■	■	■
Moderately-Low			■	■	■	■	■	■
Low			■	■	■	■	■	■

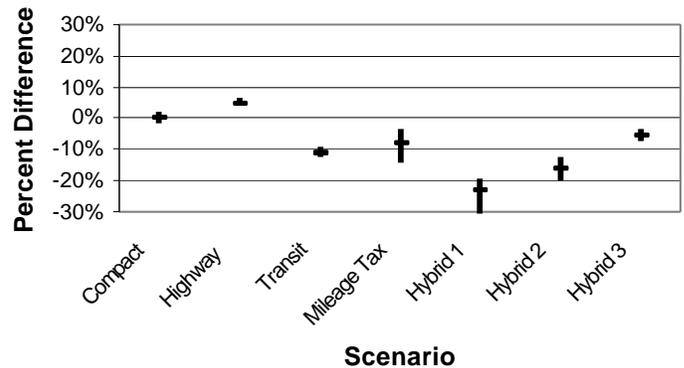
## Emissions from Vehicles in Motion

Emissions of air pollutants from motor vehicles occur as a result of several factors including incomplete combustion when vehicles are started cold, evaporation of fuel from hot engines and from fuel tanks, and emissions while the vehicle is in motion. The following graphs compare the scenarios with the No Action scenario on the basis of emissions while vehicles are in motion. The base of comparison is different from preceding graphs. These graphs show percentage differences from the No Action scenario in 2050 rather than percentage changes from 2000 to 2050. This is done because emissions were calculated using present rates per vehicle mile of travel by speed. These rates will undoubtedly be reduced by some unknown amount over the next 50 years with advancements in pollution control technology. Note that:

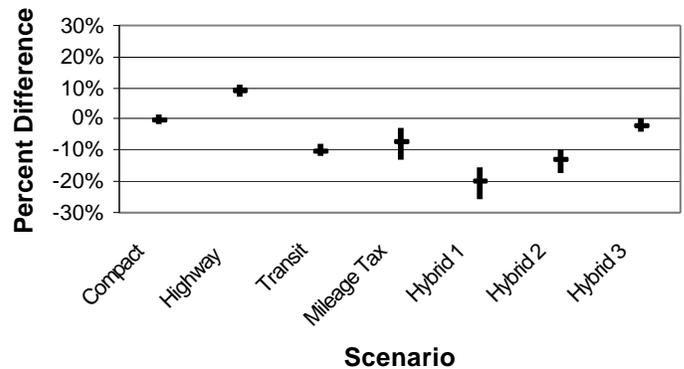
\* The Highway scenario generates more pollutants than the No Action scenario for all pollutants. This is probably a result of the larger amount of vehicle miles traveled with this scenario.

\* Hybrid 1 has the greatest decrease in pollutants relative to the No Action scenario. This scenario has the largest decrease in vehicle miles traveled.

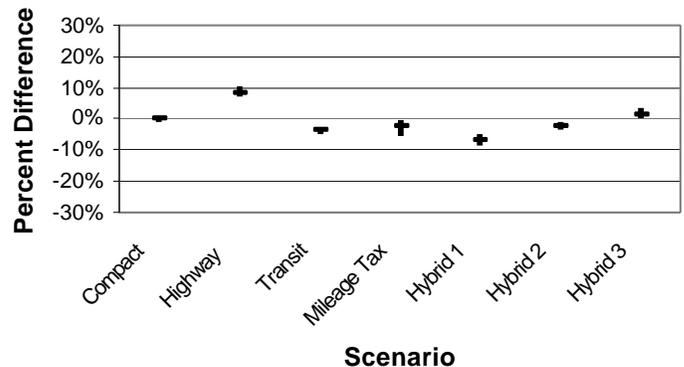
**2050 Volatile Organic Compounds Emissions Comparison with No Action Scenario**



**2050 Carbon Monoxide Emissions Comparison with No Action Scenario**



**2050 Oxides of Nitrogen Emissions Comparison with No Action Scenario**



## Changes in Residential Land Prices

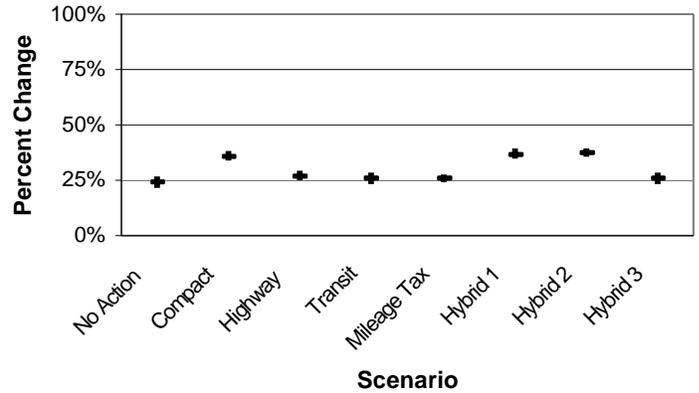
The statewide model adjusts residential land prices over time based on supply and demand changes. Residential land prices, in turn, affect the location of households. The graphs on this page show land prices for three portions of the Willamette Valley. Note that:

\* Land prices increase more and vary more in the Mid- and South Willamette Valley areas than in the North Willamette Valley.

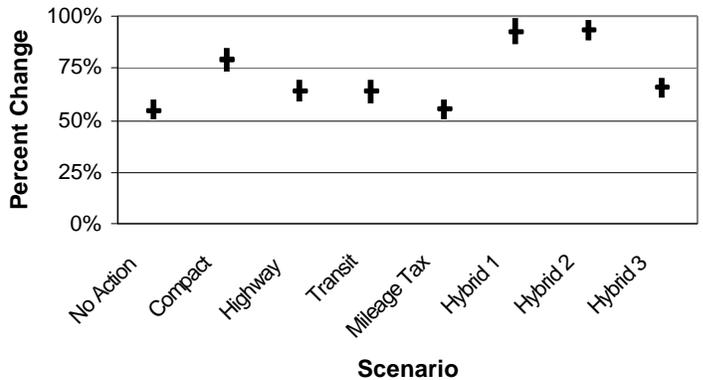
\* The most significant factor affecting land price is the supply of urbanizable land. Prices increase the most for the scenarios with more restricted urban land supplies.

\* Transportation differences result in very little difference in residential land prices in the North and South Willamette Valley areas but do noticeably affect prices in the Mid-Willamette Valley. Transportation scenarios that increase transportation infrastructure cause higher prices. This is likely the result of the increased demand due to greater household growth in the Mid-Willamette Valley under these scenarios. Improvements to transportation infrastructure make the Mid-Willamette Valley more accessible to Portland markets and make it more desirable to locate there. A slight rise in prices for these scenarios can also be seen for the South Willamette Valley, but since this area is much further away from Portland, the effect is much smaller.

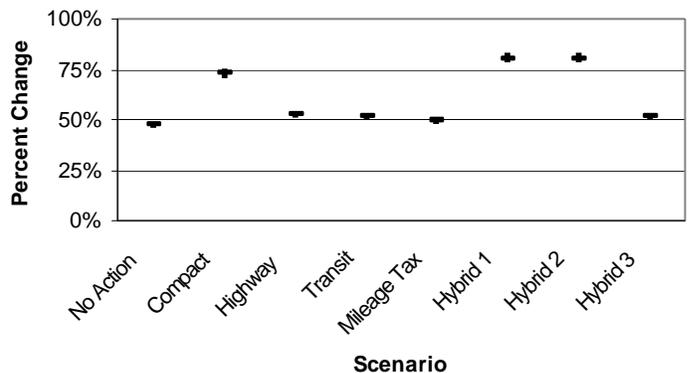
**North Willamette Valley Residential Prices  
Change from 2000 to 2050**



**Mid-Willamette Valley Residential Prices  
Change from 2000 to 2050**



**South Willamette Valley Residential Prices  
Change from 2000 to 2050**



## Changes in Commercial/Industrial Land Prices

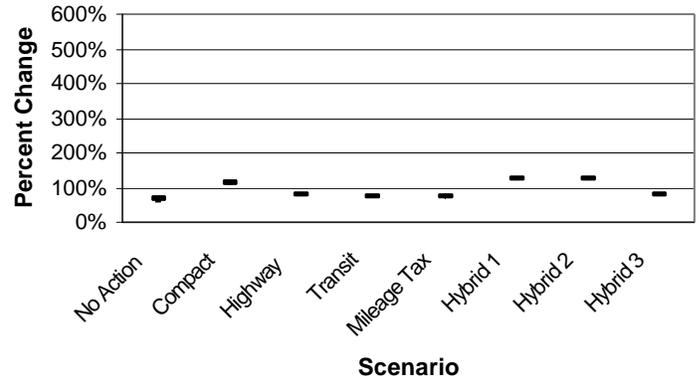
The statewide model also adjusts commercial and industrial land prices over time based on supply and demand pressures. This affects the location of employers. The graphs on this page show commercial/industrial land prices for the Willamette Valley. Note that:

\* Overall patterns are similar to residential prices. Supply constraints have the most effect on prices.

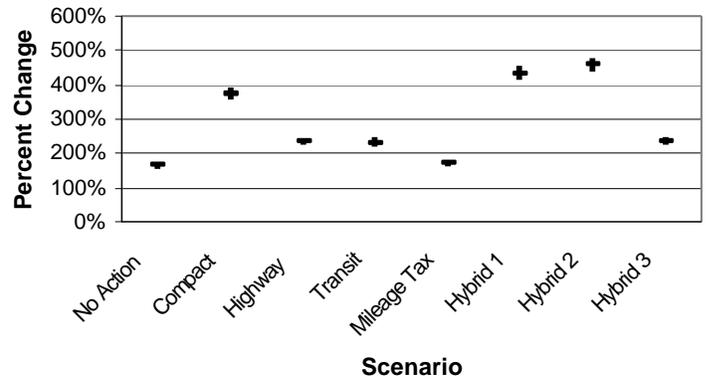
\* Commercial/industrial land price increases are much greater than residential price increases.

\* Transportation improvements that increase accessibility to the Mid- and South Willamette Valley areas increase the number of employers locating in those areas and thus the demand for and price of commercial and industrial land.

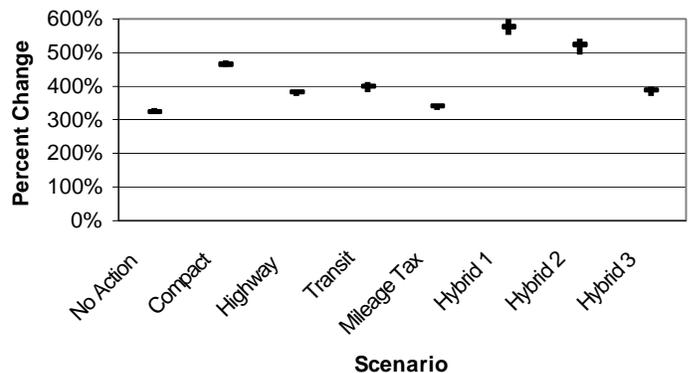
**North Willamette Valley Com./Ind. Prices  
Change from 2000 to 2050**



**Mid-Willamette Valley Com./Ind. Prices  
Change from 2000 to 2050**



**South Willamette Valley Com./Ind. Prices  
Change from 2000 to 2050**



## Households and Jobs in US 30 Corridor

The graphs on this page show differences in household and job growth in the Scappoose and St. Helens areas. Note that:

\* Household growth in the Scappoose area, which is nearer to Portland, is less affected by the different policies than household growth in the St. Helens area.

\* For most scenarios, household growth equals or exceeds job growth. This indicates that some of the differences in residential growth are a result of the differences in the attractiveness of these communities to people who hold jobs in the Portland metropolitan area. The Mileage Tax scenario has the lowest household growth in St. Helens. The relatively long distance and high tax would create a substantial cost to commuters from that area. Hybrid 1 may have a lower growth rate than Hybrid 2 because of the higher taxes in Hybrid 1.

\* Highway expansions appear to increase job growth in these communities; perhaps because the cost of moving freight would be less.

\* The Compact Scenario also increases relative job growth. Higher land prices in the Portland metropolitan area may make Scappoose and St. Helens more attractive to business.

Scappoose Area Household Growth 2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate	■	■	■	■	■	■	■	■
Moderately-Low								
Low								

St. Helens Area Household Growth 2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High	■	■	■	■	■	■	■	■
Moderate	■	■	■	■	■	■	■	■
Moderately-Low								
Low								

Scappoose Area Job Growth 2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High	■	■	■	■	■	■	■	■
Moderate	■	■	■	■	■	■	■	■
Moderately-Low								
Low								

St. Helens Area Job Growth 2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High	■	■	■	■	■	■	■	■
Moderate	■	■	■	■	■	■	■	■
Moderately-Low	■	■	■	■	■	■	■	■
Low								

\* Job growth is a little less under the transit scenario. This may be because transit service helps to centralize job growth in the metropolitan area.

## Land Price Trends in the US 30 Corridor

Land price trends in Scappoose and St. Helens follow the supply constraints and household and job demands. Note that:

\* Residential prices vary little in Scappoose as is the case with household growth. Hybrid 2 differs most. This scenario has the most household growth and has a constrained land supply.

\* In St. Helens, both the Compact and Hybrid 2 scenarios have notably higher residential land price increases. These scenarios have constrained land supplies and the Hybrid 2 scenario has a relatively higher household growth rate. Although the Transit and Hybrid 3 scenarios also have relatively high growth rates, they have more generous land supplies.

\* Industrial and commercial land prices in the Scappoose area are higher for the Compact and Hybrid 2 scenarios. Prices do not increase as much for Hybrid 1, which also has a compact land supply, but this scenario has lower demand.

\* Commercial/industrial land prices in St. Helens grow most under the Compact and Highway scenarios. These scenarios also have the greatest job growth. Prices for the Compact scenario, which has less land available than the Highway scenario, grow at a slightly higher rate.

Scappoose Area Res. Price Growth 2000 - 2050	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

Scappoose Area I&C Price Growth 2000 - 2050	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

St. Helens Area Res. Price Growth 2000 - 2050	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

St. Helens Area I&C Price Growth 2000 - 2050	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

## Travel Trends in the US 30 Corridor

Travel in the US 30 corridor reflects differences in the growth of jobs and households and the effect of public transportation services on travel.

\* The Highway scenario, which has the highest rates of job growth in both St. Helens and Scappoose and relatively high household growth, has the greatest increases in passenger and auto passenger growth.

\* The Transit scenario and the Hybrid scenarios, all of which have major transit service expansions, show lower auto passenger growth than total passenger growth.

\* The slightly higher truck freight growth for the Compact and Highway scenarios reflects the greater job growth for these scenarios. The slightly lower truck freight growth for the Transit and Hybrid 1 scenarios reflects the lower job growth for these scenarios.

US 30 Passenger Growth 2000 - 2050	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

US 30 Auto Psngr. Growth 2000 - 2050	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

US 30 Trk. Freight Growth 2000 - 2050	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

## Households and Jobs in the OR 99W Corridor

The graphs on this page show differences in household and job growth in the Newberg and McMinnville areas. Note that:

\* Household growth in the Newberg area is greatest with the Transit and Hybrid 1 and 2 scenarios, while household growth in the McMinnville area is relatively high with the Highway and Hybrid 3 scenarios as well. The differences between the areas may be due to the differing effects of highway expansions on accessibility to the Portland area.

\* Land constraints and highway improvements appear to be related to greater job growth in Newberg and McMinnville.

\* Mileage taxes appear to limit job growth.

\* Limits on land supply in the Portland metropolitan area under the Compact and Hybrid 1 and 2 scenarios would increase the attractiveness of business expansion in nearby cities. Newberg, being closer to markets, should be more attractive than McMinnville for this shifted job growth.

\* With the exception of Hybrid 1 for McMinnville, all scenarios that expand highways also expand job growth.

**Newberg Area Household Growth 2000 - 2050**

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate	■	■	■	■	■	■	■	■
Moderately-Low	■	■	■	■	■	■	■	■
Low								

**Newberg Area Job Growth 2000 - 2050**

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High		■	■	■	■	■	■	■
Moderate	■	■	■	■	■	■	■	■
Moderately-Low	■	■	■	■	■	■	■	■
Low								

**McMinnville Area Household Growth 2000 - 2050**

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High			■	■	■	■	■	■
Moderate	■	■	■	■	■	■	■	■
Moderately-Low	■	■	■	■	■	■	■	■
Low								

**McMinnville Area Job Growth 2000 - 2050**

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High		■	■	■	■	■	■	■
Moderate	■	■	■	■	■	■	■	■
Moderately-Low	■	■	■	■	■	■	■	■
Low								

\* Hybrid 1 may not have this effect in McMinnville because this scenario also includes a high mileage tax. Because Newberg is closer to Portland, the tax would not be as big a deterrent to job growth. Notice that Hybrid 2, which has a lower tax than Hybrid 1, has more job growth in Newberg and that Hybrid 2 has less job growth in McMinnville than Newberg.

## Land Price Trends in the OR 99W Corridor

Changes in land prices in the Newberg and McMinnville areas reflect land supply constraints and differences in growth. Note that:

\* In the Newberg area, the Compact, Hybrid 1 and Hybrid 2 scenarios have more constrained residential land supplies and also have larger increases in price. The Transit scenario does not have constrained supply, but experiences higher residential growth, like Hybrid 1 and Hybrid 2.

\* In the McMinnville area, the price differences among scenarios are much smaller. It may be that the supply of residential land assumed in all cases may be large enough to support growth without large price increases.

\* Changes in commercial and industrial land prices are larger and vary among scenarios to a greater degree. They also show the effects of differences in supply constraints and in demand.

\* In the Newberg area, commercial/industrial land prices increase more for all the scenarios that have supply constraints and scenarios that experience greater growth.

Newberg Area  
Res. Price Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

Newberg Area  
I&C Price Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

McMinnville Area  
Res. Price Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

McMinnville Area  
I&C Price Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

\* In the McMinnville area, although the jobs increase the most with the Highway scenario, prices do not grow more than with the Compact and Hybrid 2 scenarios because the Highway scenario has a larger land supply. This may also explain the difference between Hybrid 2 and Hybrid 3.

### Travel Trends in the OR 99W Corridor East of Newberg

Travel trends in the OR 99W corridor east of Newberg reflect differences in growth of households and jobs in Newberg and McMinnville. Note that:

\* Scenarios with higher household or job growth in Newberg or McMinnville have higher passenger and freight travel.

\* Hybrids 1 and 2 have slightly higher passenger growth than auto growth, whereas the Highway scenario and Hybrid 3 scenario have the same growth of passengers and auto passengers.

\* Freight growth is greater with the Highway and Hybrid scenarios. These scenarios also experience higher job growth. In addition, these scenarios all include highway expansions which would make OR 99W and OR 18 more attractive freight routes to other areas of the state.

\* Although the Compact scenario increases job growth relative to the No Action scenario, it does not show corresponding increases in truck traffic. This may occur because the combination of restricted land supplies in the Portland area and highway congestion encourage growth of businesses which serve primarily the local markets.

99W E. of Newberg  
Passenger Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

99W E. of Newberg  
Auto Psngr. Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

99W E. of Newberg  
Trk. Freight Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

## Travel Trends in the OR 99W Corridor East of Dayton

Travel trends in the OR 99W corridor east of Dayton junction reflect differences in growth of households and jobs in McMinnville. Increases in truck freight movements may also be a result of changes in the desirability of using the route to serve transportation of people and goods to other parts of the state. Note that:

\* The scenarios that have larger increases in households or jobs in McMinnville also have larger increases in passenger flows.

\* The increase in passenger travel in the corridor may also reflect increases in the desirability of the corridor for longer-distance travel relative to other corridors.

\* Transit service appears to make marginal differences in auto passenger travel versus total passenger travel. A slight decrease can be seen in the case of Hybrid 1 which combines a high level of transit services and high auto taxes.

\* The larger increases in truck traffic with the Highway and Hybrid scenarios may be due to the increased desirability of OR 99W and OR 18 as a longer-distance truck route as well as the expansion of companies which ship products out of the area.

99W E. of Dayton  
Passenger Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

99W E. of Dayton  
Auto Psngr. Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

99W E. of Dayton  
Trk. Freight Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

\* The Mileage Tax scenario might result in an increase in freight movement relative to the No Action scenario (even though it does not increase jobs relatively) because trucks will shift routes in response to taxes on travel. OR 99W and OR 18 might have an advantage over some other routes for reducing travel distance and thereby reducing mileage costs.

## Households in the US 20/OR 34 Corridor

The graphs on this page show differences in household growth in the Corvallis, Albany and Lebanon areas. Note that:

\* The rate of household growth in the Corvallis area is most affected by land supply constraints. All of the scenarios that constrain land supplies have the lowest growth rates.

\* The lower growth rates with the limited land supply scenarios in Corvallis do not appear to cause higher growth rates in Albany or Lebanon. Instead, in Albany there is little variation among scenarios and the Hybrids have higher growth rates. In Lebanon the higher growth rates are with all of the scenarios which expand highways or transit services.

\* The residential growth that does not occur in Corvallis with the scenarios having more constrained land supplies may instead be going to other areas of the Willamette Valley or the state. The Corvallis area also has less growth of jobs under these scenarios, so both jobs and households may be locating out of the area.

Corvallis Area  
Household Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High	Dark	Light	Light	Light	Light	Light	Light	Light
High	Dark	Light	Light	Light	Light	Light	Light	Light
Moderately-High	Light	Dark	Light	Light	Light	Dark	Light	Light
Moderate	Light	Light	Light	Light	Light	Light	Light	Light
Moderately-Low	Light	Light	Light	Light	Light	Light	Light	Light
Low	Light	Light	Light	Light	Light	Light	Light	Light

Albany Area  
Household Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High	Light	Light	Light	Light	Light	Light	Light	Light
High	Light	Light	Light	Light	Light	Light	Light	Light
Moderately-High	Light	Light	Light	Light	Light	Light	Light	Light
Moderate	Light	Light	Light	Light	Light	Light	Light	Light
Moderately-Low	Light	Light	Light	Light	Light	Light	Light	Light
Low	Light	Light	Light	Light	Light	Light	Light	Light

Lebanon Area  
Household Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High	Light	Light	Light	Light	Light	Light	Light	Light
High	Light	Light	Light	Light	Light	Light	Light	Light
Moderately-High	Light	Light	Light	Light	Light	Light	Light	Light
Moderate	Light	Light	Light	Light	Light	Light	Light	Light
Moderately-Low	Light	Light	Light	Light	Light	Light	Light	Light
Low	Light	Light	Light	Light	Light	Light	Light	Light

## Jobs in the US 20/OR 34 Corridor

The graphs on this page show differences in job growth in the Corvallis, Albany and Lebanon areas. Note that:

\* The patterns are generally similar to those for household growth.

\* In Corvallis, the scenarios that constrain land supply the most reduce the rate of job growth relative to the No Action Scenario. The Mileage Tax scenario reduces it slightly and the Transit scenario increases it slightly.

\* The Transit scenario also increases job growth in Albany and Lebanon, as do all of the Hybrid scenarios (which contain substantial transit components).

Corvallis Area  
Job Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

Albany Area  
Job Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

Lebanon Area  
Job Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

## Residential Land Price Trends in the US 20/OR 34 Corridor

Residential land prices respond to supply constraints and demands. The scenarios with more constrained land supplies all have elevated land prices compared to the No Action scenario. The Transit scenario and Hybrids, which have more job and residential growth, also have elevated residential land prices compared to the No Action scenario.

Corvallis Area  
Res. Price Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

Albany Area  
Res. Price Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

Lebanon Area  
Res. Price Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

### Commercial/Industrial Land Price Trends in the US 20/OR 34 Corridor

Commercial and industrial land prices also reflect land supplies and land demands. Note that:

\* Prices are elevated where land supplies are constrained (Compact, Hybrid 1 & Hybrid 2 scenarios).

\* Prices are also elevated where transportation infrastructure is expanded.

Corvallis Area  
I&C Price Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High		■	■	■		■	■	■
High								
Moderately-High				■				
Moderate								
Moderately-Low								
Low								

Albany Area  
I&C Price Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High						■	■	
Moderately-High		■	■	■	■	■	■	■
Moderate	■	■	■	■	■	■	■	■
Moderately-Low	■							
Low								

Lebanon Area  
I&C Price Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High		■				■	■	
Moderately-High		■	■	■	■	■	■	■
Moderate	■	■	■	■	■	■	■	■
Moderately-Low	■							
Low								

## Travel Trends in the US 20/OR 34 Corridor West of Albany

Even though the scenarios have noticeably different effects on household and job growth, there are few differences in travel. This might indicate that changes, especially in Corvallis where the growth differences are acting on a larger base, are more due to shifts into and out of the area, rather than shifts between Corvallis, Albany and Lebanon. The graphs on this page show travel west of Albany. Graphs on the following page show travel east of Albany. Note that:

\* There are almost no differences in passenger and auto passenger travel west of Albany. The Highway scenario has slightly higher passenger growth than the other scenarios.

\* There are more differences in freight travel among the scenarios. Some of these may be due to an internal shifting of jobs. Lebanon and Albany both have more job growth with the Hybrid 1 and Hybrid 2 scenarios while Corvallis has less. This may account for less growth in truck freight west of Albany and slightly more growth east of Albany, at least for Hybrid 1.

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
20&34 W. of Albany Passenger Growth 2000 - 2050								
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
20&34 W. of Albany Auto Psngr. Growth 2000 - 2050								
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
22 W. of Salem Trk. Freight Growth 2000 - 2050								
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

### Travel Trends in the US 20/OR 34 Corridor East of Albany

\* There is little difference in passenger travel east of Albany. The Transit and Hybrid 3 scenarios have slightly higher growth.

\* There is a little more difference in freight travel and some of this may be due to an internal shifting of jobs. Lebanon and Albany both have more job growth with the Hybrid 1 and Hybrid 2 scenarios while Corvallis has less. This may account for less growth in truck freight west of Albany and slightly more growth east of Albany, at least for Hybrid 1.

20&34 E. of Albany  
Passenger Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

20&34 E. of Albany  
Auto Psngr. Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

20&34 E. of Albany  
Trk. Freight Growth  
2000 - 2050

	No Action	Compact	Highway	Transit	Mileage Tax	Hybrid 1	Hybrid 2	Hybrid 3
Very High								
High								
Moderately-High								
Moderate								
Moderately-Low								
Low								

## **Appendix C**

# **STATEWIDE MODEL APPLICATION PROJECT OVERSIGHT**

### **ALTERNATIVE TRANSPORTATION FUTURES STEERING COMMITTEE**

The Alternative Transportation Futures (ATF) project is one of three studies being conducted for consideration by the Willamette Valley Livability Forum (WVLF) in its discussions on the future of land use and transportation in the Willamette Valley. A Steering Committee composed of WVLF members provided oversight and guidance for development of the ATF project. Following are the members of the ATF Steering Committee:

Joan Baker	Environmental Protection Agency
Richard Brandman	Metro
Susan Brody	Oregon Transportation Commission
Jon Chandler	Oregon Building Industries Association
Mike Gotterba	Mid-Willamette Area Commission on Transportation
Craig, Greenleaf	Oregon Department of Transportation
Chris Hagerbaumer	Oregon Transportation Reform Advocated Network
Bob Hall,	Oregon Highway Users Alliance
Gary Johnson	Oregon Department of Transportation, Region 2
Robert Liberty	1000 Friends of Oregon
Robin McArthur-Phillips	Governor's Office
Mike Propes	Polk County Board of Commissioners
Anna Russo	Department of Land Conservation and Development
Tom Schwetz	Lane Council of Governments

### **STATEWIDE MODEL APPLICATION PROJECT**

In 1996, ODOT started development of the statewide model as part of its Transportation and Land Use Model Integration Project (TLUMIP). As part of this program, the Federal Highway Administration, six state agencies and four MPOs formed the Oregon Modeling Steering Committee (OMSC) to guide development and implementation of modeling in Oregon. A subcommittee of the OMSC, the Statewide Model Application Project (SMAP), provided oversight and recommendations on application of the statewide model for the ATF project. Following are the members of the SMAP:

Bill Upton	OMSC/ODOT
Dick Walker	OMSC/Metro
Bud Reiff	OMSC/Lane COG

Mike Jaffe	OMSC/Mid-Willamette Valley COG
Bart Benthul	OMSC/Rogue Valley COG
Nick Forety	OMSC/FHWA
Peter Watt	Willamette Valley Forum
Lynn Peterson	1000 Friends of Oregon
Dave Parisi	I-5 Trade Corridor & I-5 Corridor Study/The Duffy Co.
Brian Gregor	ODOT TPAU - Analysis
Brian Dunn	ODOT TPAU - Analysis
Doug Hunt	Parsons Brinckerhoff
Pat Costinett	Parsons Brinckerhoff
Michal Wert	MW Consulting