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The Oregon Housing Needs Model

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Oregon has been in the forefront of land-use planning in the United States. It was the first state to use an urban growth boundary (UGB) to direct growth patterns around cities. Since 1973, Oregon has maintained a statewide land-use planning program. A set of 19 statewide planning goals form the foundation for that program. The goals express the state's policies on land use and related topics, such as urbanization, economic development, housing, and natural resources.

Oregon's Statewide Land-use Planning Goal 10 — the housing goal — provides state and local governments with direction and guidance about how to plan for balanced housing opportunities in Oregon communities. A key part of Goal 10 links a community's income characteristics to determining the need for various housing types by price, density, and location throughout the community. (Goal 10 states that "plans shall encourage the availability of adequate numbers of needed housing units at price ranges and rent levels which are commensurate with the financial capabilities of Oregon households and allow for flexibility of housing location, type and density.")

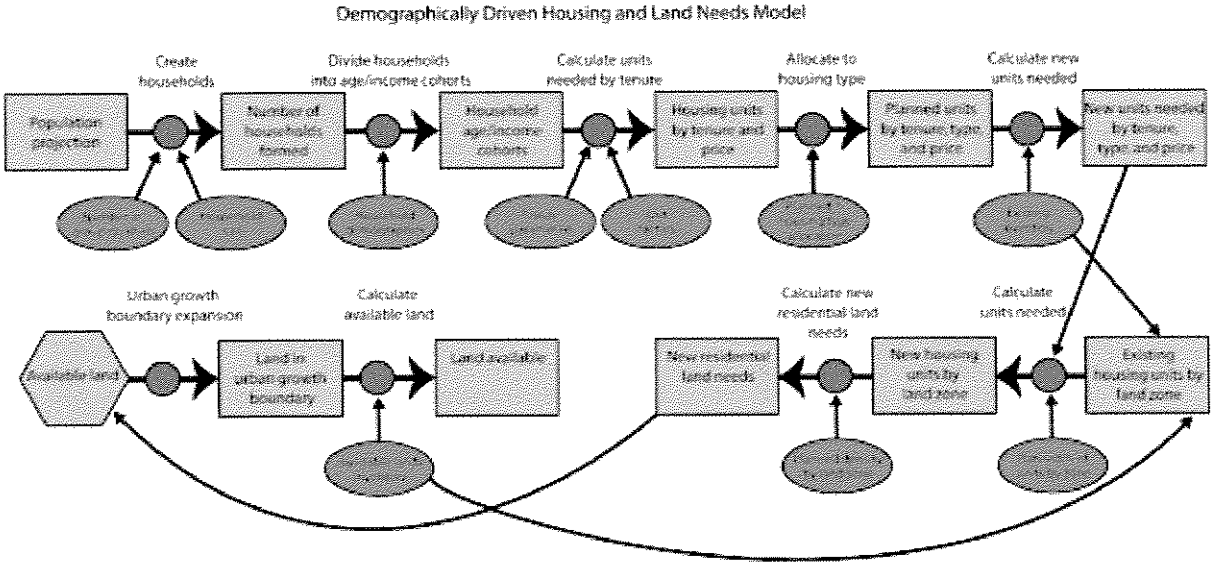
However, many communities have difficulty developing a complete housing needs analysis. Furthermore, methods have varied widely in their capabilities and capacities to incorporate the Goal 10 requirement to factor household income into a housing needs analysis. The consequence has been that many communities' Goal 10 work is based on past market demand and trend lines, instead of current and projected need as the goal requires. In many regions, the new housing supply is a function of what local builders prefer or are able to produce, which may not be what the households in the region actually need, desire, or can afford.

This *PAS Memo* describes a method and model for determining housing and land needed for housing, in accordance with Oregon's statewide land-use planning goals. A study area's current and projected demographics, existing housing inventory, and regional tenure choices drive the model's results. The housing needs model computes needed housing units by tenure (ownership versus rental), price point, and housing type as well as acreage needed by land-use zone. It generates information on current and future unmet housing and land needs and automatically produces tables and graphs of model results for presentation and report uses.

Overview of Oregon Model

The Oregon Housing Needs Model uses tenure, household income, housing price, and housing type to assess housing need. The model allows planners and decision makers to test different scenarios quickly and easily against various assumptions about the study area and its future economic development or demographic composition. For each scenario explored, the model generates a series of tables and graphs that represent the projected housing or land needs. A city or region can determine its housing and associated land needs by comparing model projections to the existing housing stock or inventory. This comparison helps to determine the action or policy changes needed to meet the community's current and future housing requirements. Such actions may include making applicable changes to the comprehensive plan, policies, and land-use map, along with any amendments affecting the zoning ordinance, housing programs, implementation strategies, and timetables. The model's parameters can be readily modified for use in other regions of the U.S. by incorporating tenure choices appropriate to the area.

Figure 1



Guiding Principle of Demographics

The model uses the demographics of a study area in conjunction with current regional housing tenure data to calculate housing needs. The model's design relies on identifying demographic variables that are highly correlated with housing need. Research on various demographic variables and their usefulness in predicting housing tenure showed that age of head of household (***Age — A***) and household income (***Income — I***) demonstrated significantly stronger correlation with housing tenure than other variables, such as household size. Therefore, the primary demographic variables used in the model are ***Age*** and ***Income***. In addition to correlating with tenure decisions, household income is the key variable in determining housing affordability. Data on age and income are readily available for each potential study area, which meets another important requirement. The model was designed to use census and other updated data as they become available.

Data gathered during the research phase of the model's development confirmed that dissimilar ***Age/Income (AI)*** cohorts make significantly different housing tenure choices. Analysis of the data established that the use of seven ***Age*** and seven ***Income*** ranges enhanced the sensitivity and accuracy of the model. These ***Age*** and ***Income*** ranges generate 49 ***AI*** cohort groups. More detailed information on this research and model is available at the **Housing Needs Model webpage**.

Assumptions

The model assumes that actual cohort tenure choices partly define housing need; therefore, parameters are derived from the cohort tenure data found in a large regional area. While the local supply of rental versus ownership housing may not be in equilibrium with tenure need in some markets, it is assumed that on a larger regional basis it will be in equilibrium. An examination of Census 2000 data revealed that households in urban areas made significantly different housing decisions than those in rural communities, and the decisions were correlated with community size. However, rural communities that contained a college or were resort-oriented had similar tenure characteristics to urban communities. The model uses different tenure parameters for these categories of Oregon communities:

- Version U, for communities that are either urban, college-oriented, or resort-oriented;
- Version M, for rural communities between 6,750 and 22,500 in population; and
- Version S, for small rural communities under 6,750 in population.

Users outside Oregon may need to adjust model parameters to reflect a region's ***A/I*** cohort tenure choices. The model's design also allows adjustment of income ranges and price points to reflect higher income and cost regions in the United States.

The table below presents the homeownership percentages in the Version U and Version S models, derived from Census 2000 data for Oregon. It illustrates the strong correlation between ***Age*** and ***Income*** in determining tenure choice that is found in all three models, as well as how tenure choices vary by community type for a given ***A/I*** cohort (see highlighted cells).

Table: Homeowner Percentage Tenure Parameters by Age of Head of Household and Household Income

Version U

Income\Age	15-24	25-34	35-44	45-54	55-64	65-74	75+
<$10k	2.9%	7.9%	16.0%	25.0%	43.0%	46.1%	40.0%
$10<20k	3.6%	12.7%	25.0%	37.0%	47.0%	61.0%	56.2%
$20<30k	6.0%	16.6%	36.0%	45.0%	54.0%	73.2%	67.1%
$30<40k	7.9%	23.9%	48.0%	53.7%	60.0%	74.4%	70.1%
$40<50k	10.8%	32.9%	58.1%	62.4%	80.0%	91.0%	84.0%
$50<75k	22.5%	49.9%	72.0%	82.9%	88.6%	92.1%	91.2%
$75k+	32.0%	75.0%	83.0%	92.0%	96.0%	97.0%	93.0%

Version S

Income\Age	15-24	25-34	35-44	45-54	55-64	65-74	75+
<$10k	7.4%	30.9%	32.1%	40.4%	59.2%	64.9%	63.2%
$10<20k	17.0%	36.4%	40.1%	55.7%	66.4%	74.9%	73.9%
$20<30k	24.9%	40.1%	52.0%	70.1%	73.0%	89.9%	83.9%
$30<40k	35.1%	48.2%	64.1%	75.1%	83.1%	91.9%	86.9%
$40<50k	40.9%	57.0%	73.0%	80.1%	89.1%	93.0%	87.9%
$50<75k	44.8%	75.0%	84.0%	86.1%	92.1%	94.5%	88.0%
$75k+	49.2%	86.0%	87.9%	91.1%	94.1%	95.0%	88.0%

Source: Parameters derived from Census 2000 data taken from Summary File 3

Another principal assumption of the model flows from Oregon's Statewide Planning Goal 10, which requires housing "price ranges and rent levels be commensurate with the financial capabilities of Oregon households." In other words, housing should be affordable. (A housing affordability guideline is that the proportion of a household's income spent on rent or mortgage payments and other housing expenses should not exceed 30 percent; if it is, the household is classified as "cost burdened.") The seven ***Income*** ranges in conjunction with the 30 percent limit on housing costs determined the model's price ranges and rent levels used to calculate the housing units needed at each price point. Price points for housing units are calculated so that housing costs consume no more than 30 percent of the household's income. Thus, a household with $60,000 in income can afford to pay $60,000 x 30% / 12 = $1,500 per month for housing. This assumption generates a range of monthly housing costs "affordable" for each ***AI*** cohort.

Monthly rent ranges are calculated for each ***Income*** category after subtracting estimated utility costs. Ownership price points are calculated for each ***Income*** category and reflect the typical housing costs associated with owning a home. The price ranges for ownership units in the model can be automatically adjusted to reflect projected levels of mortgage interest rates during the study period. Interest usually constitutes a significant portion of ownership costs. Also the price one can afford to pay for a housing unit

is inversely related to the mortgage interest rate on that unit. The model's ownership price points reflect the potential variation in housing prices that would be affordable for each ***Income*** range as a result of three possible scenarios of mortgage interest rates — low, historical average, or high — corresponding to rates of 6 to 12 percent over a planning time frame. These rates result in affordable price ranges of approximately two and a half to three times annual household income. Thus 2.5 and 3 times annual income factors are used to determine two of the three affordable ownership price ranges for ownership units. The average historical interest rate is used to arrive at a third ownership price range.

Goals Behind the Model's Design

The following goals were kept in mind when designing the model:

- The model structure should be built around individual modules for each analytical component through the use of Excel templates.
- Model modules should handle all calculations and require minimum input by user.
- Data needed to drive the model must be available.
- Data gathering requirements for each locality should be minimized.
- Parameters in the model should be easy to update and modify.
- The model should be a user-friendly tool for city staff or interested parties.
- The model should allow users to easily test out different growth scenarios.
- The model should automatically produce tables and graphs that can be used as printed material for public dissemination of model results.
- The model should reflect local conditions and characteristics.
- The model should work for any size community and location.
- The model should accommodate interaction with other planning goals.
- The model should be flexible and have a variety of uses beyond satisfying Goal 10.

The resulting model resides in an Excel file that has up to 21 worksheets containing 19 templates, 11 graphs, and miscellaneous tables. The model examines housing and land needs for two time periods — an analysis of current housing needs and an analysis of estimated housing and land needs based on a planning period end date.

Using the Model for Current Housing Needs Analysis

There are five steps in the model for determining current housing need.

- Calculate the current housing status and total number of housing units needed for the planning period.

To do this, input the following data into the model:

- Population estimates
- Number of people in group quarters
- Number of occupied housing units or number of households
- Average household size
- Desired vacancy rate for the study area

- Calculate the number of households in each ***AI*** cohort for the study area.

Census data are used to calculate the percentages of the city's households in the 49 ***AI*** cohorts. The model uses percentages to represent the ***AI*** cohorts of each city. Percentages facilitate easy adjustments for projection of different population estimates and time frames within that city and for comparisons to other communities. This approach allows users to quickly test different future scenarios by varying the estimated population and/or the percentage distribution of the 49 ***AI*** cohorts.

- Calculate the total number of affordable units by tenure and price point using tenure parameters.

The model uses tenure parameters for each ***AI*** cohort derived from regional census data to represent the probabilities of either being a renter or homeowner. Based on the tenure parameters, the model allocates those households in each ***AI*** cohort to an indicated number of rental and ownership units at the price point that is affordable for the cohort's ***Income*** range. The model then adjusts each of the 49 cohort numbers of ownership units to reflect that some homeowners have paid off their mortgages and therefore can "afford" a higher priced unit than their income would otherwise indicate. Census data were used to determine the percentage of households in each cohort that owned their homes free and clear. The model aggregates the units for each different price point to arrive at the total units that renters and owners can afford.

- Adjust numbers of units needed by price point to reflect household factors.

The model recognizes that some households choose to live in a unit at a lower price point than the one they can afford. When households make this choice, they remove those units from the supply of units needed for those households that can afford only that price point. Therefore, adjustment factors to the indicated number of housing units that can be afforded at each price point are used in this part of the model to arrive at the final estimate of needed housing units. These adjustment factors represent the percentage of households who can afford the cost level that the model places them into but choose a lower cost unit (**Out Factor**) offset by households who can afford a higher cost unit but have chosen this cost level (**In Factor**). In the model the number of Out Factor households at each cost level generates the number of In Factor households at the next lowest cost level. The user in each study area determines the adjustment factors for each price point that would represent local tendencies although base line adjustment factors reflect input from various sources.

An additional offsetting variable to the **Out Factor** is the estimated number of units rented to households that can afford only those units by receiving tenant-based subsidies. For example, Section 8 vouchers pay the difference between market rent and what the tenant can afford. The total units for this factor at each relevant price point represents the estimated number of households that pay only this amount of rent out of personal funds with the balance of the market rent coming from the tenant subsidy.

- Compare the existing housing inventory with current housing units needed by tenure and price point.

This step determines whether current needs are being met, and if not, where and how large are the gaps. Each community needs to develop its own data on current housing inventory to complete this step. Data sources include county assessor records, census information, and community surveys.

Model Housing Types

The model uses five housing categories to sort the existing unit inventory. Each housing type can be owner or renter occupied. The five categories are:

- Single Family Units: Either site built or manufactured single-family dwellings on their own lot.

- Manufactured Dwelling Park Unit: A single-family dwelling unit located in a rental park.
- Duplex Unit: A two-family dwelling unit located on its own lot.
- Triplex or Quadplex Unit: A three or four-family dwelling unit.
- 5+ Multifamily Unit: Dwelling units in buildings with five or more units per building.

The use of these five categories facilitates housing needs assessments by housing type. Because each category is typically associated with specific land-use zones, they also guide land-use planning. Future need for housing units by housing type, determined in the next model module, drives the calculation of land needed based on the planned density of the land-use zones associated with each housing type.

Using the Model for Future Housing Needs Analysis

To determine the future housing needs for a planned population size, model users estimate the demographic composition of that population (by projecting the future ***AI*** cohort percentages) and make assumptions regarding their housing type choices by price point. Projecting the future ***AI*** cohort percentages represents the most challenging task in using the model. Factors such as aging of the population, changes in the composition of the local economy, and jobs/housing balance issues should be considered. The model assumes a constant dollar for income and price factors, thereby eliminating the need to account for inflation and different planning periods. Inputting the future ***AI*** cohort percentages automatically produces the number of future total units indicated by price point and tenure. Once future ***Out Factors*** are entered, the model calculates the future total units needed by price point and tenure.

Groups With Special Housing Needs

The Comprehensive Housing Affordability Strategy (CHAS), a component of the Consolidated Plan submitted to HUD, requires a housing needs assessment of persons with special needs. Persons in the below groups may or may not be low income, but each faces special housing problems that should be addressed as part of a complete community housing assessment:

- At Risk Youth, Homeless or Runaways
- Elderly, Frail
- Families, Large (with more than five members)
- Farmworkers
- Homeless/At Risk of Homelessness
- Households, Single Parent
- Persons Released from Correctional Institutions
- Persons Infected with AIDS-HIV
- Persons Recovering from Drug/Alcohol Abuse
- Persons with Developmental Disabilities
- Persons with Physical Disabilities
- Persons with Psychiatric Disabilities
- Teen Parents
- Victims of Domestic Violence/Other Abuse

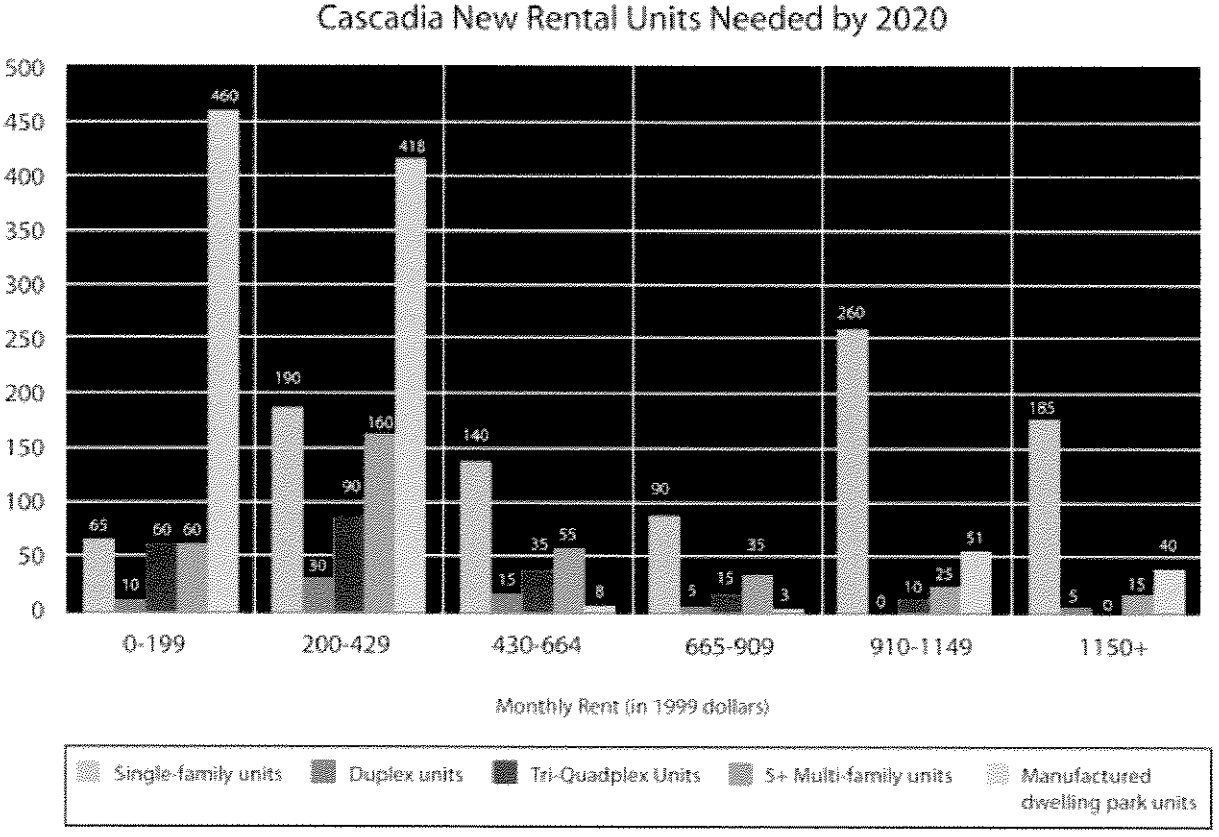
The model addresses senior housing through templates and graphs summarizing the rental units needed for the two age cohorts 65 to 74 and 75 and older by price point. This information can help identify the number and types of housing needed for seniors in the study area such as retirement-oriented housing and assisted living units.

Accurate information about these populations can help decision makers focus on those groups that most need assistance. This information will be useful in determining groups with a severe need for assistance. Some of these populations have special housing needs that should be taken into account when allocating the future housing types needed in the model. The facts can be used to educate others and advocate for support. Once the housing study is complete, this information can be used to prioritize the community's affordable housing efforts.

Planning the Housing Types Needed

The principal planning effort involved in using the model is in determining the appropriate allocation of housing types by price point and tenure to meet the identified housing needs for that community. This allocation process uses percentage distributions of the five housing types as the means to allocate the needed units (see Figure 2). The model uses a color scheme in which orange cells represent labels or data descriptors, green cells contain numbers produced by the model, and white cells are for user inputted data. Completing the inventory template in the earlier steps displays the percentage distribution of existing units, which can serve as a guideline for this allocation.

Figure 2



Once the planned housing unit allocation percentages are entered, the model automatically calculates the number of new units needed by price point, tenure, and housing type, to bring the market into balance with the projected need at the end of the planning period. The model summarizes the new needs by housing type, which can then be used by the community in land-use planning and housing policy decisions. An example of one of the graphs produced by the model is shown in figure 3.

Figure 3

Calculation of Additional Land Needed by Land Use Type ©

Buildable Lands Inventory for Housing									
	LDSF	MDSF	HDSF	MDP	LDMF	MDMF	HDMF	MU	Total
Current UGB Acres	354.0	1620.0	345.5	95.6	104.0	98.6	28.5	10.4	2,656.6
Acres in Use	317.8	1,306.0	286.5	67.7	70.1	61.1	20.9	10.4	2,140.5
Constrained Acres	3.5	16.2	1.9	0.0	3.2	0.8	1.6	0.0	27.2
Available Acres	32.7	297.8	57.1	27.9	30.7	36.7	6.0	0.0	488.9
Current Acres %	13.3%	61.0%	13.0%	3.6%	3.9%	3.7%	1.1%	0.4%	100.0%
Acres in Use %	14.8%	61.0%	13.4%	3.2%	3.3%	2.7%	1.0%	0.5%	100.0%
Available Acres %	6.7%	60.9%	11.7%	5.7%	6.3%	7.5%	1.2%	0.0%	100.0%
Existing Units per acres in Use	3.60	4.85	5.95	7.02	11.70	15.38	22.01	5.77	5.58

Land Needed by Land Use Type									
	LDSF	MDSF	HDSF	MDP	LDMF	MDMF	HDMF	MU	Total
Acres Needed	135.5	520.9	110.7	44.0	48.4	45.5	9.0	2.2	916.1
New Acres Needed	102.8	223.1	53.6	16.1	17.7	8.8	3.0	2.2	427.2

The model includes a module that estimates land needed for housing needs identified in the previous templates. The land-use module employs the community's housing inventory and buildable lands inventory for the data needed by the module. The model calculates the percent of existing housing inventory by housing type and land-use type. These numbers serve as the basis for the principal planning application of the model's land-use module — determining the appropriate allocation of housing types to land-use zones to meet the identified housing needs for that community. The model allocates new housing units needed to the appropriate land-use zones by percentage. Based on the planned density for each land-use zone, the model calculates the land needed for the new housing and determines whether additional land is needed for each land-use zone. Figures 4 and 5 illustrate segments of the templates used in the model.

Figure 4

Projected Distribution of New Housing by Land Use Type©

Single family units	All units	% in LDSF	% in MDSF	% in HDSF	Total %
Lower priced	1,776		70%	30%	100%
Mid priced	507	15%	75%	10%	100%
Higher priced	1,276	25%	70%	5%	100%
Total	3,558	11.1%	70.7%	18.2%	100%
Existing distribution	N/A	11.5%	69.5%	19.0%	100%

Duplex units	All units	% in LDSF	% in MDSF	% in HDSF	% in LDMF	% in MDMF	% in HDMF	Total %
Lower priced	289	20%	25%	5%	40%	10%		100%
Mid priced	48	25%	20%	5%	40%	10%		100%
Higher priced	32	30%	20%		45%	5%		100%
Total	369	21.5%	23.9%	4.6%	40.4%	9.6%	0.0%	100%
Existing distribution	N/A	18.1%	27.5%	2.9%	33.3%	18.1%		100%

Figure 5

Future Housing Units Planned By Housing Type©
Existing Units Plus New Units Added
For Cascadia as of 2020
Scenario Historical 1

Rental							
Rent	Needed units	Single family units	Manufactured dwelling park units	Duplex units	Tri-quadplex units	5+ Multi-family units	Total units
0-199	1,006	5.0%	4.0%	13.0%	13.0%	65.0%	100.0%
		50	40	131	131	654	1,006
200-429	1,363	20.0%	5.0%	12.0%	16.0%	47.0%	100.0%
		273	68	164	218	641	1,363
430-664	1,245	33.0%	2.0%	18.0%	19.0%	28.0%	100.0%
		411	25	224	232	349	1,245
665-909	1,138	44.0%	1.5%	15.5%	18.0%	21.0%	100.0%
		501	17	176	205	239	1,138
910-1149	1,070	53.0%	0.0%	16.0%	19.0%	12.0%	100.0%
		567	0	171	203	128	1,070
1150+	528	83.0%	0.0%	4.0%	5.0%	8.0%	100.0%
		439	0	21	226	42	528
Totals	6,350	2,240	150	887	1,020	2,053	6,350
Percentage		35.3%	2.4%	14.0%	16.1%	32.3%	100.0%

Summary of Model Uses to Date

While the model was originally developed to help Oregon cities address Oregon's Housing Goal 10 in their periodic review task to justify any expansions of their Urban Growth Boundaries, many other uses have surfaced, including:

- State agencies: preparation of Consolidated Plans
- Public housing authority: assessment of housing needs within their service area
- Counties: define their housing needs and develop a housing plan
- Housing developers and sponsors: identifying unmet housing needs in a market area
- Economic development agencies: analysis of workforce housing needs for areas with anticipated major employment growth
- U.S. Department of Agriculture's Rural Development staff: prioritize identified cities for targeting housing projects
- Housing agencies: assessment of neighborhood housing market viability for proposed projects
- Councils of government: addressing consolidated planning areas

Richard Bjelland is the Oregon Housing and Community Services state housing analyst. For more information on the model, please contact him at 503-986-0983 or richard.bjelland@hcs.state.or.us.

Resources

Bjelland, Richard. 2004. " *The Housing/Land Needs Model: A Housing and Land Needs Analysis Methodology and Model.*"

Salem, Ore.: Oregon Housing and Community Services Department.

Oregon Housing and Community Services website, Oregon Housing Needs Model.