

**New Hampshire
Housing Production
Model Update**

County and State

April 24, 2009

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HOUSING PRODUCTION MODEL UPDATE 2009 NEW HAMPSHIRE HOUSING FINANCE AUTHORITY

INTRODUCTION

In 2003, a housing demand model was developed to demonstrate a format for regional housing needs analysis in New Hampshire. The model used County level data and projections to illustrate a format adaptable to the needs of Regional Planning Commissions (RPCs). The model focused on projections of year round housing supply needs based on (1) population projections and/or (2) employment projections. The original model has been updated as part of this study.

The goals of the 2009 update included revising baseline data through 2007 and to provide a basis for segmenting the housing production model into elderly (age 65+) vs. non-elderly (under age 65, or primary workforce) components by tenure (owner vs. renter). While part of the population age 65+ remains active within the labor force, this version of the updated employment-based model presumes that most workforce housing demand will be generated by the nonelderly workforce.

During the course of revising the NHHFA housing production models, it became clear that an appropriate breakout of demand would require reasonable assumptions about future household size and housing tenure by age group. If average household size continues to decline (as elderly households become a larger share of total households) a given population may represent more households and therefore higher production needs. The aging of the population may also generate changes in housing tenure. In this update, we introduce a "headship model" that provides a method of anticipating future changes in average household size and tenure by age group.

A. HEADSHIP- TENURE MODEL BY COUNTY

1. Baseline Information

A headship model is based on establishing a ratio between persons within a certain age group and the number of households in the same age group to derive a headship ratio specific to each age cohort. Secondly, housing tenure may also be projected based on detailed age-specific tenure ratios (owner versus renter). Long-term projections of population by age were available from the New Hampshire Office of Energy and Planning (NHOEP) that provide a basis for converting population to household estimates by age and tenure based on age-specific household characteristics.

The group quarters (GQ) population comprises persons living in situations other than independent dwelling units. These living situations may include group homes, assisted living, nursing homes, prisons and other institutional and noninstitutional settings. In the year 2000 decennial U.S. Census, 100% count data were available for breaking out the number of residents under 65 versus 65 and older who live in group quarters. Persons not living in group quarters are living in households. To develop the projections of households, certain assumptions were made about the future growth of the GQ population.

In the illustrations below, Table 1 shows initial setup for population and headship data. Table 2 illustrates base year and a future year projection for Merrimack County.

Table 1 – Base Year Data Setup

HEADSHIP MODEL BASE YEAR DATA							
POPULATION & HOUSEHOLDS BY AGE GROUP FROM US CENSUS OR OTHER BASE YEAR (Alternative: American Community Survey)							
Age Group	Total Population	Total Households by Age of Head	Compute Headship Ratio	Households: Ownership Tenure	Households: Rental Tenure	% Own	% Rent
Under 15			----	----	----	----	----
15-24							
25-34							
35-44							
45-54							
55-64							
65-74							
75-84							
85 & Older							
Total							
Group Quarters Population							
Total							
Under Age 65							
Age 65 & Older							
Population in Households (Total Less GQ Population)		Total Households	----	Owner Households	Renter Households	% Own	% Rent
Total			----				
Under Age 65			----				
Age 65 & Older			----				
Average Number of Persons Per Household (Excludes GQ Pop.)							
Total				<i>Resulting ratios held constant for each age group for projection years</i>			
Under Age 65				<i>Ratios that will change with age group shifts in projection years</i>			
Age 65 & Older							

- a. Arrange total population data by age data according to standardized age groupings (see Table 1).
- b. For the same age groups, enter the number of households within the same age brackets. Note that there will be no household equivalent for the population under the age of 15.
- c. Sum the age groups to show totals and check against known counts of total population and households for the area.
- d. Enter the number of persons living in group quarters (total, number under age 65, and number age 65 and older). This will comprise base year information from the 2000 Census. As an alternative, American Community Survey data may be used where available. BCM Planning review of the data indicates that the ACS sample data may vary significantly from the numbers based on the decennial census.
- e. For each age group (except ages under 15) divide total households by age of head by total population within the same age group, producing a series of headship ratios by age group.
- f. Divide the total number of homeowners by age of head by total households in each age group to derive a homeownership rate for each age group. (The remainder is the percentage of households in renter occupied housing units).

Table 2: Example Using Merrimack County

BASE YEAR DATA - 2000 MERRIMACK COUNTY							
POPULATION & HOUSEHOLDS BY AGE GROUP FROM US CENSUS 2000 (Alternative Source is American Community Survey)							
Age Group	Total Population	Total Households by Age of Head	Compute Headship Ratio	Households: Ownership Tenure	Households: Rental Tenure	% Own	% Rent
Under 15	28,107	---	----	---	----	----	----
15-24	16,890	1,882	0.1114	315	1,567	16.7%	83.3%
25-34	16,902	7,891	0.4669	3,823	4,068	48.4%	51.6%
35-44	24,771	13,077	0.5279	9,364	3,713	71.6%	28.4%
45-54	20,800	11,816	0.5681	9,395	2,421	79.5%	20.5%
55-64	11,832	6,935	0.5861	5,606	1,329	80.8%	19.2%
65-74	8,547	5,278	0.6175	4,236	1,042	80.3%	19.7%
75-84	5,852	3,767	0.6437	2,600	1,167	69.0%	31.0%
85 & Older	2,524	1,197	0.4742	680	517	56.8%	43.2%
Total	136,225	51,843	0.3806	36,019	15,824	69.5%	30.5%
Group Quarters Population							
Total	6,293						
Under Age 65	4,663						
Age 65 & Older	1,630						
Population in Households (Total Less GQ Population)							
		Total Households	----	Owner Households	Renter Households	% Own	% Rent
Total	129,932	51,843	----	36,019	15,824	69.5%	30.5%
Under Age 65	114,639	41,601	----	28,503	13,098	68.5%	31.5%
Age 65 & Older	15,293	10,242	----	7,516	2,726	73.4%	26.6%
Average Number of Persons Per Household (Excludes GQ Pop.)							
Total	2.51	Resulting ratios held constant for each age group for projection years Ratios that change with age group shifts in projection years					
Under Age 65	2.76						
Age 65 & Older	1.49						
FUTURE YEAR PROJECTION: 2015 MERRIMACK COUNTY							
Age Group	Total Population 2015 (NHQEP Projection)	Total Households by Age of Head	2000 Headship Ratio	Households: Ownership Tenure	Households: Rental Tenure	2000 Tenure Owner	2000 Tenure Renter
Under 15	26,967	---	----	---	----	----	----
15-24	19,188	2,138	0.1114	358	1,780	16.7%	83.3%
25-34	20,499	9,570	0.4669	4,637	4,934	48.4%	51.6%
35-44	15,771	8,326	0.5279	5,962	2,364	71.6%	28.4%
45-54	22,562	12,817	0.5681	10,191	2,626	79.5%	20.5%
55-64	29,006	17,001	0.5861	13,743	3,258	80.8%	19.2%
65-74	17,708	10,935	0.6175	8,776	2,159	80.3%	19.7%
75-84	7,084	4,560	0.6437	3,147	1,413	69.0%	31.0%
85 & Older	2,794	1,325	0.4742	753	572	56.8%	43.2%
Total	161,579	66,672	0.4126	47,567	19,106	71.3%	28.7%
Group Quarters Population							
Total	6,293						
Under Age 65	5,472						
Age 65 & Older	1,804						
Population in Households (Total Less GQ Population)							
		Total Households	----	Owner Households	Renter Households	% Own	% Rent
Total	155,286	66,672	----	47,567	19,106	71.3%	28.7%
Under Age 65	128,521	49,852	----	34,890	14,962	70.0%	30.0%
Age 65 & Older	25,782	16,820	----	12,676	4,144	75.4%	24.6%
Average Number of Persons Per Household (Excludes GQ Population)							
Total	2.33	Ratios held constant for each age group for projection years Ratios that changed with age group shifts in projection years					
Under Age 65	2.58						
Age 65 & Older	1.53						

- g. The ratios in steps e. and f. are retained as constants when projecting future households and the tenure split based on population projections by age.
- h. About 40,000 New Hampshire residents live in group quarters, and are therefore not part of the household population defined by the Census or ACS data.¹ In the BCM Planning model, estimates of the 2007 group quarters population were derived from the most recent NHOEP population estimates (which include a GQ subtotal). The age breakdown of the GQ population by age was estimated based on proportions indicated by the 2000 Census, as well as BCM Planning interpretation of the NHOEP group quarters survey for 2007. The facilities generally oriented toward an elderly population (nursing homes, assisted living) may be assumed to include primarily age 65 and older group quarters population versus others (educational institutions, prisons) that may be oriented toward a younger age group.
- i. The 2007 population is based on the NHOEP estimates by County. The 2007 age distribution (percent of population by age) was interpolated based on the expected shift in the age distribution shown in the 2000 Census and the NHOEP projections by County for the year 2010.²
- j. The statewide results in this model are the result of individual county estimates and projections, summed to the State level.

2. Projections of Households by Age and Tenure

For future year projections, the base year headship and tenure ratios by detailed age group are held constant and applied to the projected population by age group. This process yields an estimated number of households by age of head of household for the projection year. Similar baseline headship and tenure data may also be developed at the RPC level using aggregated municipal data.

Projections of households by age for a future year will first require a projection of total population by age group. Table 2 above illustrated the Merrimack County baseline data and year 2015 estimates derived from the headship-tenure model. Households by tenure are also projected by carrying forward the detailed age-specific tenure ratios derived from the baseline year and applying it to the projection year households by age. (In the example in Table 2, the decennial Census for 2000 is the baseline; alternatively, ACS sample data could be applied.)

3. Group Quarters Population

Note that the NHOEP projections of total population by age include population that may live in group quarters in the future. In order to estimate persons in households by age group and to project future household size, an adjustment is needed to net out the future group quarters population in elderly vs. non elderly age segments. In the BCM Planning model, it is assumed

¹ American Community Survey (ACS) estimates of the group quarters population of NH is about the same as the NHOEP estimate in total, but at the County level its proportionate distribution by age (under 65 vs. 65 and older) is in many cases quite different from the 2000 Census 100% count and BCM Planning estimates for 2007 by age.

² New Hampshire Population Projections for State and Counties 2010 to 2030 – Update November 2006; NH Office of Energy and Planning.

that the GQ population under age 65 will grow at the same rate as the total population in the 15- to 64-year-old cohort.

For the elderly group quarters population, which comprises mostly nursing homes and assisted living, it is assumed that the GQ population age 65 and older will increase at the same rate of growth projected for the age 85 and older population. We have used the 85+ age groups as the index because this comprises the most dependent portion of the senior population, and an age threshold at which frailty increases significantly. An alternative would be to allow the group quarters population to rise with the rate of increase in the 75+ population.

The next step is to sum total households for the age groups under 65 vs. 65 and older. This results in an estimated number of households for both age groups, and ownership vs. rental tenure in each. The number of persons living in households by age is derived by subtracting the group quarters portion of the population assigned to each age group from the total population in that age group.

4. Average Persons Per Household

In order estimate average persons per household in the two age groups, the total number of persons in households (which excludes the GQ estimates) is divided by the number of households in the same age group to yield average persons per household for the under 65 vs. 65+ groups. The result of the projection process is that it provides an independent source for estimating future household size for the elderly and non-elderly groupings. Those estimates are useful in the housing production models to generate future housing demand estimates. In addition, the results provide a basis for predicting the future tenure split between ownership and rental housing demand for both age groups.

While the tables label these outputs as “average household size”, the ratios by age are technically an average based on the number of persons by age group who live in households divided by the total number of persons in that age group. Census data indicates that households headed by a person age 65 or older represent about 90% of all New Hampshire households with at least one person age 65+. The remainder, or 10% of households having a person age 65 or older, represent living situations that include households headed by a person under 65 (such as instances where a senior relative is living with son, daughter, other relative).

5. Other Notes on Model

One of the limitations of the headship-tenure approach is the use of constant tenure ratios by age group. For example, if the ownership market for non-elderly households was overheated in the base year leading and the indicated ownership tenure is higher than the ratio supportable in the future, the model may tend to project too many ownership units. Similarly, if an inadequate rental housing supply for the elderly existed in the base year, and there is pent-up demand for such units, then carrying forward the base year tenure ratios for seniors may underestimate the need for rental housing for the elderly.

Tables 3 and 4 show the long term projections from 2010-2030 for Merrimack County based on the assumptions in the model. Tables 5-7 show the model’s estimates of future household size and tenure ratios for each County from the base years 2000 and 2007 through 2030.

Table 3
Baseline Data for Headship and Tenure Ratios by Age – Merrimack County Example

County	2000 Census	2007 OEP with Interpolated Age Distribution	NHOEP Population Projections November 2006					Baseline Data from 2000 - Headship and Tenure by Age			
			2010	2015	2020	2025	2030	Census Households 2000	2000 Headship Rate by Age (Constant)	Homeowners Census 2000	Census 2000 Ownership Rate by Age (Constant)
Merrimack County			Total Population by Age Group								
Under 15	28,107	26,978	26,948	26,967	28,135	29,155	29,352	---	---	---	---
15-24	16,890	18,607	19,797	19,188	18,293	18,202	19,221	1,882	0.1114	315	0.1674
25-34	16,902	17,327	17,865	20,499	20,964	20,448	19,663	7,891	0.4669	3,823	0.4845
35-44	24,771	19,401	17,170	15,771	17,768	20,559	21,223	13,077	0.5279	9,364	0.7161
45-54	20,800	24,598	26,911	22,562	17,964	16,593	18,873	11,816	0.5681	9,395	0.7951
55-64	11,832	19,770	23,998	29,006	30,020	25,362	20,413	6,935	0.5861	5,606	0.8084
65-74	8,547	10,830	12,145	17,708	23,966	29,326	30,607	5,278	0.6175	4,236	0.8026
75-84	5,852	6,247	6,559	7,084	9,137	13,578	18,399	3,767	0.6437	2,600	0.6902
85+	2,524	2,625	2,725	2,794	2,842	3,141	4,081	1,197	0.4742	680	0.5681
Total	136,225	146,384	154,118	161,579	169,089	176,364	181,832	51,843	0.3806	36,019	0.6948
Total Group Quarters	6,293	7,096	7,489	7,602	7,522	7,498	7,989				
Group Quarters <65	4,663	5,454	5,784	5,855	5,744	5,534	5,437				<i>assume that growth is at same rate as age 15-64 population</i>
Group Quarters 65+	1,630	1,642	1,704	1,747	1,777	1,964	2,552				<i>assume that growth is at same rate as change in 85+ population</i>
Total Persons in Hhlds	129,932	139,288	146,629	153,977	161,567	168,866	173,843				
Under 65	114,639	121,227	126,905	128,138	127,400	124,785	123,308				
65 and Over	15,293	18,061	19,725	25,839	34,168	44,081	50,535				

Table 4
Projection of Households and Homeowners Based on Headship and Tenure Baseline – Merrimack County Example

County	Households by Age Predicted from Constant Headship Rate							Homeowners Predicted by Constant Age-Specific Tenure						
	2000	2007	2010	2015	2020	2025	2030	2000	2007	2010	2015	2020	2025	2030
Merrimack County Households							Homeowners by Age Group							
15-24	1,882	2,073	2,206	2,138	2,038	2,028	2,142	315	347	369	358	341	339	359
25-34	7,891	8,089	8,341	9,570	9,787	9,547	9,180	3,823	3,919	4,041	4,636	4,742	4,625	4,447
35-44	13,077	10,242	9,064	8,326	9,380	10,853	11,204	9,364	7,334	6,490	5,962	6,717	7,771	8,023
45-54	11,816	13,973	15,288	12,817	10,205	9,426	10,721	9,395	11,110	12,156	10,191	8,114	7,495	8,524
55-64	6,935	11,588	14,066	17,001	17,595	14,865	11,965	5,606	9,367	11,370	13,743	14,223	12,016	9,672
65-74	5,278	6,688	7,500	10,935	14,800	18,110	18,901	4,236	5,368	6,019	8,776	11,878	14,535	15,170
75-84	3,767	4,022	4,222	4,560	5,882	8,740	11,844	2,600	2,776	2,914	3,147	4,060	6,032	8,175
85+	1,197	1,245	1,292	1,325	1,348	1,490	1,935	680	707	734	753	766	846	1,099
Total	51,843	57,920	61,979	66,672	71,035	75,059	77,892	36,019	40,928	44,093	47,566	50,841	53,659	55,469
Average Hhld Size	2.51	2.40	2.37	2.31	2.27	2.25	2.23							
Under 65	2.76	2.64	2.59	2.57	2.60	2.67	2.73							
65 and Over	1.49	1.51	1.52	1.54	1.55	1.56	1.55							
CHANGE IN HOUSEHOLDS			2000-10	2010-15	2015-20	2020-25	2025-30	CHANGE OWNER HHlds	2000-10	2010-15	2015-20	2020-25	2025-30	
Change fr. Prior Period			10,136	4,693	4,363	4,024	2,833	Change fr. Prior Period	8,074	3,473	3,275	2,818	1,810	
Avg chg per yr			1,014	939	873	805	567	Avg chg per yr	807	695	655	564	362	

Table 5

Projections of Average Persons Per Household							
All Households							
	2000	2007	2010	2015	2020	2025	2030
Belknap	2.45	2.34	2.29	2.23	2.19	2.17	2.15
Carroll	2.35	2.22	2.17	2.10	2.05	2.02	2.00
Cheshire	2.47	2.33	2.29	2.23	2.20	2.17	2.15
Coos	2.33	2.21	2.18	2.13	2.08	2.03	1.99
Grafton	2.38	2.25	2.20	2.14	2.11	2.09	2.07
Hillsborough	2.58	2.54	2.52	2.47	2.43	2.42	2.41
Merrimack	2.51	2.40	2.37	2.31	2.27	2.25	2.23
Rockingham	2.63	2.53	2.49	2.40	2.33	2.29	2.27
Strafford	2.50	2.39	2.34	2.28	2.24	2.20	2.18
Sullivan	2.41	2.30	2.25	2.19	2.14	2.10	2.07
NH	2.53	2.43	2.40	2.34	2.29	2.26	2.24

Households Headed by Person Under 65							
	2000	2007	2010	2015	2020	2025	2030
Belknap	2.73	2.59	2.52	2.52	2.57	2.65	2.71
Carroll	2.66	2.49	2.43	2.42	2.46	2.56	2.62
Cheshire	2.75	2.59	2.53	2.50	2.52	2.55	2.57
Coos	2.68	2.53	2.48	2.45	2.45	2.49	2.51
Grafton	2.63	2.48	2.42	2.40	2.43	2.49	2.50
Hillsborough	2.81	2.76	2.74	2.73	2.74	2.78	2.83
Merrimack	2.76	2.64	2.59	2.57	2.60	2.67	2.73
Rockingham	2.85	2.77	2.74	2.71	2.71	2.77	2.85
Strafford	2.72	2.59	2.54	2.48	2.46	2.46	2.47
Sullivan	2.72	2.58	2.53	2.50	2.51	2.54	2.55
NH	2.77	2.67	2.64	2.61	2.63	2.67	2.72

Households Headed by Person Age 65+							
	2000	2007	2010	2015	2020	2025	2030
Belknap	1.53	1.55	1.55	1.57	1.58	1.58	1.57
Carroll	1.51	1.53	1.54	1.55	1.55	1.54	1.53
Cheshire	1.49	1.50	1.50	1.52	1.53	1.53	1.52
Coos	1.43	1.45	1.45	1.45	1.46	1.47	1.46
Grafton	1.47	1.49	1.49	1.51	1.53	1.53	1.51
Hillsborough	1.51	1.52	1.52	1.53	1.55	1.55	1.54
Merrimack	1.49	1.51	1.52	1.54	1.55	1.56	1.55
Rockingham	1.54	1.54	1.54	1.55	1.56	1.56	1.55
Strafford	1.51	1.52	1.51	1.52	1.53	1.54	1.54
Sullivan	1.48	1.50	1.50	1.51	1.52	1.52	1.50
NH	1.50	1.52	1.52	1.53	1.55	1.55	1.54

Table 6

Persons Per Household Multipliers - Projected - As Multiple of 2000 Census Averages								
	2007	2008	2009	2010	2015	2020	2025	2030
Belknap	0.952	0.945	0.938	0.932	0.909	0.894	0.883	0.876
Carroll	0.944	0.937	0.930	0.922	0.894	0.874	0.861	0.853
Cheshire	0.946	0.940	0.934	0.928	0.904	0.891	0.881	0.873
Coos	0.952	0.947	0.942	0.936	0.916	0.896	0.874	0.856
Grafton	0.944	0.937	0.930	0.922	0.898	0.886	0.877	0.869
Hillsborough	0.982	0.979	0.976	0.974	0.956	0.943	0.935	0.933
Merrimack	0.960	0.954	0.949	0.944	0.921	0.908	0.898	0.891
Rockingham	0.961	0.955	0.950	0.945	0.912	0.886	0.870	0.863
Strafford	0.954	0.949	0.943	0.937	0.912	0.895	0.881	0.871
Sullivan	0.952	0.946	0.939	0.933	0.907	0.886	0.869	0.856
NH	0.963	0.958	0.953	0.948	0.924	0.906	0.894	0.887

Households Headed by Person Under 65								
	2007	2008	2009	2010	2015	2020	2025	2030
Belknap	0.947	0.940	0.932	0.925	0.924	0.940	0.969	0.992
Carroll	0.938	0.929	0.921	0.913	0.910	0.927	0.963	0.987
Cheshire	0.942	0.935	0.929	0.922	0.911	0.916	0.930	0.935
Coos	0.942	0.937	0.931	0.925	0.913	0.916	0.930	0.935
Grafton	0.940	0.933	0.925	0.918	0.910	0.924	0.944	0.951
Hillsborough	0.984	0.982	0.980	0.977	0.974	0.977	0.990	1.007
Merrimack	0.957	0.952	0.946	0.941	0.933	0.943	0.969	0.990
Rockingham	0.973	0.969	0.966	0.962	0.952	0.952	0.971	1.000
Strafford	0.950	0.943	0.937	0.931	0.910	0.903	0.903	0.908
Sullivan	0.950	0.944	0.937	0.930	0.922	0.925	0.936	0.940
NH	0.964	0.960	0.955	0.951	0.943	0.947	0.964	0.981

Households Headed by Person Age 65+								
	2007	2008	2009	2010	2015	2020	2025	2030
Belknap	1.014	1.014	1.015	1.015	1.028	1.037	1.037	1.027
Carroll	1.017	1.018	1.019	1.020	1.027	1.029	1.024	1.014
Cheshire	1.008	1.008	1.009	1.009	1.018	1.024	1.025	1.018
Coos	1.015	1.015	1.014	1.014	1.018	1.027	1.031	1.026
Grafton	1.011	1.011	1.011	1.012	1.024	1.035	1.037	1.026
Hillsborough	1.009	1.009	1.009	1.009	1.019	1.028	1.030	1.026
Merrimack	1.012	1.013	1.014	1.015	1.029	1.039	1.042	1.036
Rockingham	1.001	1.002	1.003	1.003	1.011	1.016	1.015	1.010
Strafford	1.006	1.005	1.005	1.005	1.010	1.016	1.020	1.019
Sullivan	1.009	1.009	1.009	1.009	1.019	1.024	1.022	1.014
NH	1.009	1.010	1.010	1.011	1.021	1.028	1.029	1.023

Table 7

Homeownership Rate (Holding Age-Specific 2000 Tenure Rates Constant)							
All Households							
	2000	2007	2010	2015	2020	2025	2030
Belknap	74.1%	75.9%	76.6%	77.4%	77.8%	77.6%	77.2%
Carroll	77.8%	79.9%	80.7%	81.4%	81.9%	82.0%	81.8%
Cheshire	70.8%	71.4%	71.6%	71.9%	72.5%	72.8%	72.9%
Coos	71.2%	72.5%	73.0%	73.5%	73.8%	73.6%	73.2%
Grafton	68.6%	70.1%	70.7%	71.4%	72.1%	72.6%	72.6%
Hillsborough	64.9%	65.9%	66.3%	66.2%	66.2%	66.0%	65.9%
Merrimack	69.5%	70.7%	71.1%	71.3%	71.6%	71.5%	71.2%
Rockingham	75.6%	76.9%	77.4%	77.5%	77.5%	77.4%	77.2%
Strafford	64.5%	65.6%	66.0%	66.8%	67.3%	67.9%	68.2%
Sullivan	72.0%	73.3%	73.8%	74.4%	74.8%	74.9%	74.8%
NH	69.7%	70.9%	71.5%	71.8%	72.0%	72.0%	71.9%

Households Headed by Person Under 65							
	2000	2007	2010	2015	2020	2025	2030
Belknap	72.1%	74.2%	75.1%	75.2%	74.9%	74.1%	73.4%
Carroll	74.6%	77.1%	78.1%	78.0%	77.3%	76.2%	75.4%
Cheshire	68.8%	69.2%	69.4%	69.2%	69.2%	69.2%	69.2%
Coos	70.3%	72.0%	72.8%	73.3%	73.3%	72.6%	72.2%
Grafton	65.5%	67.1%	67.7%	67.5%	67.1%	66.7%	66.7%
Hillsborough	64.0%	65.1%	65.5%	65.1%	64.6%	64.2%	63.9%
Merrimack	68.5%	69.8%	70.3%	70.0%	69.7%	69.0%	68.6%
Rockingham	74.8%	76.1%	76.7%	76.3%	75.9%	75.4%	74.9%
Strafford	62.0%	63.3%	63.8%	64.4%	64.5%	64.6%	64.5%
Sullivan	70.0%	71.4%	72.0%	72.1%	72.0%	71.7%	71.5%
NH	68.2%	69.5%	70.1%	69.8%	69.4%	68.9%	68.5%

Households Headed by Person Age 65+							
	2000	2007	2010	2015	2020	2025	2030
Belknap	80.6%	81.1%	81.3%	82.3%	82.5%	81.9%	81.1%
Carroll	74.6%	77.1%	78.1%	78.0%	77.3%	76.2%	75.4%
Cheshire	78.1%	78.4%	78.5%	79.1%	79.3%	79.1%	78.5%
Coos	73.6%	73.5%	73.6%	74.0%	74.5%	74.7%	74.1%
Grafton	80.1%	80.4%	80.6%	81.1%	81.3%	81.0%	80.3%
Hillsborough	69.0%	69.4%	69.6%	70.4%	70.6%	70.4%	70.0%
Merrimack	73.4%	74.0%	74.3%	75.4%	75.8%	75.6%	74.8%
Rockingham	79.4%	80.1%	80.3%	80.8%	80.8%	80.6%	80.1%
Strafford	75.5%	75.6%	75.6%	76.0%	76.2%	76.3%	76.2%
Sullivan	78.3%	78.6%	78.7%	79.3%	79.4%	79.1%	78.5%
NH	75.7%	76.3%	76.5%	77.4%	77.7%	77.5%	77.0%

In general, the application of 2000 Census-based headship ratios to the projection years predicts a decline in the average household size for the under 65 households and a stable to slightly increasing average household size among age 65+ households. The application of age-specific tenure ratios, given the forecast of growth within the senior population, results in a gradual increase in the ownership rate resulting primarily from the changing age mix of the population.

As a test of the model, BCM Planning set up the headship model using the average of 1990 and 2000 headship rates and tenure ratios by age. The resulting model produced a relatively little change in the overall statewide results.

In another version of this model, BCM Planning substituted ACS headship and tenure ratios and ACS group quarters estimates by age (3-year averages for 2005 to 2007) for each County as the baseline. The effect of using this data as the baseline was found to boost the ownership ratio for the base year up by more than 4 percentage points higher than the 2000 Census 100% data indicated for that year. While this rapid percentage point shift toward ownership tenure is possible, historical data indicates that it does not fit historical patterns of a more gradual shift due to age distribution of the population.

If the ACS baseline is accurate, it suggests that: (1) average household size increased slightly from 2000 to 2005-07; (2) that there was an unprecedented rise in the homeownership rate between 2000 and 2005-07; and (3) that the number of renter households in the State declined by 9,500 to 14,000 households in the same period. (See Table 8 for a comparison of 2000 Census to 2005-2007 ACS data on households and tenure.) Therefore, the application of ACS data will tend to create a 2007 baseline that has a larger household size, and a higher homeownership rate. When applied to projected population by age, the ownership ratio rises during the projection period, but will be based on a starting point for ownership tenure that is considerably higher than that of the decennial Census for 2000.

It is possible that the ACS may be under-representing the sample of renters, which may in turn account for the ACS estimates that show a slightly higher average household size for 2007 compared to the average in 2000. The ACS data appears contrary to the expected trend of declining household size.

6. Application of Results to Production Model

The following elements of the headship-tenure model were transferred to the housing production model for its population-based housing demand estimates. These variables include:

- Estimates of group quarters vs. household population by age
- Average household size, households headed by persons under 65.
- Tenure split for households under 65
- Average household size for households headed by persons age 65+.
- Tenure split for age 65+ households.

In the population-based projection of the production model, the tenure ratios are applied individually to the elderly and the nonelderly household groups. Total homeowners and renters are then summed from the results of each age group.

In the employment-based elements of the production model, the estimates for the age 65+ portion of housing demand are held constant based on the headship-tenure results. However, the projections of demand by nonelderly households (under 65) change depending on assumptions of future employment growth.

Table 8

Tenure of Households	2000 Census	ACS 2005-2007 Three-Yr Avg	ACS 2007 1-Yr Avg	Indicated Change From 2000 to 3-Yr Avg	Indicated Change 2000 to 2007
Total Households					
Belknap	22,459	23,909	no data	1,450	---
Carroll	18,351	19,269	no data	918	---
Cheshire	28,299	29,687	29,539	1,388	1,240
Coos	13,961	14,267	no data	306	---
Grafton	31,598	32,536	33,328	938	1,730
Hillsborough	144,455	149,761	152,397	5,306	7,942
Merrimack	51,843	55,379	55,009	3,536	3,166
Rockingham	104,529	113,033	112,421	8,504	7,892
Strafford	42,581	45,177	45,354	2,596	2,773
Sullivan	16,530	17,653	no data	1,123	---
State of NH	474,606	500,671	501,505	26,065	26,899
Owner Households					
Belknap	16,634	18,298	---	1,664	---
Carroll	14,278	15,380	---	1,102	---
Cheshire	20,049	21,609	21,310	1,560	1,261
Coos	9,942	10,251	---	309	---
Grafton	21,677	23,134	24,145	1,457	2,468
Hillsborough	93,748	105,148	107,166	11,400	13,418
Merrimack	36,019	40,312	39,986	4,293	3,967
Rockingham	78,992	89,154	90,423	10,162	11,431
Strafford	27,458	30,289	32,160	2,831	4,702
Sullivan	11,903	12,745	---	842	---
State of NH	330,700	366,320	371,658	35,620	40,958
Renter Households					
Belknap	5,825	5,611	no data	-214	---
Carroll	4,073	3,889	no data	-184	---
Cheshire	8,250	8,078	8,229	-172	-21
Coos	4,019	4,016	no data	-3	---
Grafton	9,921	9,402	9,183	-519	-738
Hillsborough	50,707	44,613	45,231	-6,094	-5,476
Merrimack	15,824	15,067	15,023	-757	-801
Rockingham	25,537	23,879	21,998	-1,658	-3,539
Strafford	15,123	14,888	13,194	-235	-1,929
Sullivan	4,627	4,908	no data	281	---
State of NH	143,906	134,351	129,847	-9,555	-14,059
Ownership Rate				Indicated Percentage Point Change in Ownership Rate	
Belknap	74.1%	76.5%	---	2.5%	---
Carroll	77.8%	79.8%	---	2.0%	---
Cheshire	70.8%	72.8%	72.1%	1.9%	1.3%
Coos	71.2%	71.9%	---	0.6%	---
Grafton	68.6%	71.1%	72.4%	2.5%	3.8%
Hillsborough	64.9%	70.2%	70.3%	5.3%	5.4%
Merrimack	69.5%	72.8%	72.7%	3.3%	3.2%
Rockingham	75.6%	78.9%	80.4%	3.3%	4.9%
Strafford	64.5%	67.0%	70.9%	2.6%	6.4%
Sullivan	72.0%	72.2%	---	0.2%	---
State of NH	69.7%	73.2%	74.1%	3.5%	4.4%

B. HOUSING PRODUCTION MODEL WITH AGE & TENURE SPLIT

This section will summarize the update of the housing production model originally prepared in 2003. As with the original model, the model contains three different future scenarios, now updated to show changes from a 2007 base year to a 2015 projection year. As with the original model, the updated format shows three scenarios for estimating production needs (one is population driven, the other two are partially driven by inputs on employment growth). All three projections are now modified to estimate components of demand from elderly (age 65+) vs. non-elderly (under 65) households.

1. Population-Based Component

The population-based housing need estimates are based on the headship ratios and tenure ratios that were derived in the headship model description above. The estimates of household growth are driven directly by the NHOEP population projections by age group, applied to the headship-tenure model. The population-based projections are independent of employment growth assumptions. The application of the population and headship estimates in the production model are illustrated in the outline in Table 9 below.

Table 9

PROJECTION USING POPULATION, HEADSHIP AND TENURE RATIOS BY AGE											
1	Total Population by Age Group (NH OEP County Population Projections by Age, or independent estimate)										
2	Re-aggregate to standard age group categories per base year data										
3	Multiply headship ratio by number of persons in age group (for population groups 15 or older) = future households by age										
4	Multiply tenure ratios by age group by projected households in age group = owner and renter households by age group										
5	Project future GQ population by age: Under age 65: assume growth at same rate as age 15-64 year old population Age 65+: assume growth at same rate as change in age 75+ or age 85+ population Compute total as sum of under 65 and 65+ population										
6	Sum the number of households (and homeowners and renters) by age group under 65 and 65+										
7	Estimate average persons per household by age group Non-Elderly: $[(\text{Population under age 65}) - (\text{GQ population under 65})] / \text{Households under 65}$ Elderly: $[(\text{Population age 65+}) - (\text{GQ population 65+})] / \text{Households age 65+}$ Total: $[(\text{Total population}) - (\text{GQ population})] / \text{Households}$										
8	Use resulting estimates of elderly/non elderly households directly, or Use outputs of headship model in other projection models: Future year average persons per household, overall or < 65 vs. 65+ Future Tenure ratios overall or by age < 65 vs. 65+										
9	Headship-based estimates using the 2005-2007 ACS data will yield a much higher ownership rate for 2007 and consequently higher ownership ratios in the projection years if substituted for 2000 Census Data from SF1										
Notes:											
a	The resulting projections will show gradual decline in average household size for non-elderly; slight increase for elderly										
b	Age-based projections of housing tenure gradually raise the overall ownership rate based on an aging population										
c	A portion of the elderly population that is not in group quarters lives with households headed by persons in age groups under 65 (such as an elderly parent living in a son's or daughter's household). Therefore, actual average household size for the elderly will be slightly lower than the ratio of "average persons per household" for that age group.										
<table border="0"> <tr> <td>U. S. Census data for 2000 (New Hampshire) indicates the following:</td> <td>NH Total</td> </tr> <tr> <td>Households with 1 or more persons age 65+ in 2000:</td> <td>101,849</td> </tr> <tr> <td>Households headed by a person age 65+</td> <td>91,398</td> </tr> <tr> <td>Indicated non-elderly households with 1+ persons 65+</td> <td>10,451</td> </tr> <tr> <td colspan="2"><i>Households headed by person age 65+ equals 90% of all households having 1 or more persons age 65+</i></td> </tr> </table>		U. S. Census data for 2000 (New Hampshire) indicates the following:	NH Total	Households with 1 or more persons age 65+ in 2000:	101,849	Households headed by a person age 65+	91,398	Indicated non-elderly households with 1+ persons 65+	10,451	<i>Households headed by person age 65+ equals 90% of all households having 1 or more persons age 65+</i>	
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Households with 1 or more persons age 65+ in 2000:	101,849										
Households headed by a person age 65+	91,398										
Indicated non-elderly households with 1+ persons 65+	10,451										
<i>Households headed by person age 65+ equals 90% of all households having 1 or more persons age 65+</i>											

2. Employment-Based Housing Production with Age & Tenure Split

The other two projections are based in part on employment growth as a basis to project demand from non-elderly households. The employment-based projections are tied only to the nonelderly portion of the housing need projection, while the elderly demand component is held constant for based on the population-headship method. The following reviews the assumptions of each of the major elements of the employment-based portions of the production model. As of April 2009, the most recent annual baseline data on employment based variables reflect 2007 estimates. The base year 2007 data for Counties used in the production model included:

NH Employment Security Data:

- Private sector covered employment
- Government employment
- Resident labor force

NHOEP Data

- Total population
- Group quarters population
(with BCM Planning estimates of its breakdown by age)

American Community Survey Data

- Working residents age 16+
- Number and percent working outside County of residence

The model contains employment data for 1990, 2000 and 2007 from New Hampshire Employment Security (private sector covered employment, government employment, and the total of the two). Each area's share of the state total is also illustrated in the County sheets. New Hampshire Employment Security data were also used to document the estimated labor force population for 1990, 2000, and the 2007 base year.

The principal driver in the employment-based projections is the ratio of households headed by persons under the age of 65 to the total labor force population estimated as of 2007. This ratio is held and applied to the employment projection for the County to estimate future labor force and households under age 65.

U.S. Census data was used to illustrate the number of working residents of each county age 16 and older with subtotals shown as to the number working within the county or outside the county. For 2007, this information has been updated using ACS estimates. As ACS data is not available for every county for the 1-year estimate for 2007, the three-year average ACS figure for 2005 to 2007 was used to indicate the number of working residents in each County, and the percent of those working residents commuting to locations outside of their resident county.

Two employment projections are shown in the model: (1) County employment at a constant share of the State total; and (2) the County absorbing a share of projected State growth from 2007-2015 at its long term share of the State's growth from 1990-2007. It would also be possible to relate this to a different period or a more recent share of employment growth, but short-term shares of growth may not reflect long-term relationships between the variables. The Merrimack County example shown was based on a statewide employment growth rate averaging 1% per year (total growth of 8% over the 8-year projection period of 2007-2015).

**Table 10 – Production Model Example
(Sheet 1 of 2)**

MERRIMACK COUNTY	1990	2000	Change 1990 to 2000	2007 Estimate	Change 2000-2007	2015 Employment Based Projection 1	2015 Employment Based Projection 2	2015 Population Based NHOSP Projection
Covered Private Sector Employment in Area (NHDES)	42,508	55,199	12,691	57,629	2,430			This column is based on the age-headship-tenure module assumptions, using NHOEP County population projections by age. That model produces long term estimates of household size by age group and tenure split by age (<65 and 65+)
Percent of State Total	9.9%	10.4%	12.8%	10.6%	17.0%	Employment Assumptions		
Government Employment in Area (NHDES)	12,014	15,222	3,208	16,441	1,219	Constant Share	Growth Share	
Total Private + Government Employment	54,522	70,421	15,899	74,070	3,649	79,996		
Percent of State Total	11.0%	11.6%	14.4%	11.8%	15.0%			
Labor Force Population (NH Employment Security)	60,263	75,473	15,210	80,539	5,066	86,982	88,492	
Ratio: Labor Force Population to Private & Govt Employment	1.105	1.072		1.087	Constant:	1.087	1.087	
Ratio-Census Working Residents/NHES Labor Force	1.003	0.923		0.940	Constant:	0.940	0.940	
Number of Working Residents Age 16+ (Census defined)	60,446	69,676	9,230	75,682	6,006	81,737	76,476	
Work in County	42,031	48,051	6,020	50,934	2,883	55,009	51,468	
Work Outside of County	18,415	21,625	3,210	24,748	3,123	26,728	25,008	
Percent Commute Out of County	30.5%	31.0%		32.7%	Constant:	32.7%	32.7%	
Ratio Private Covered Employment Per Resident Household	0.95	1.06		1.00				
Ratio Total Population Under 65 to Labor Force	1.75	1.58		1.57	Derived:	1.53	1.53	
Ratio Households < 65 to Labor Force Population	0.59	0.55		0.57	Constant:	0.57	0.57	
Population & Households Under Age 65								
Total Persons Under 65	105,428	119,302	13,874	126,681	7,379	133,388	135,602	133,993
Group Quarters Population	3,047	4,663	1,616	5,454	791	5,855	5,855	5,855
Population in Households	102,381	114,639	12,258	121,227	6,588	127,533	129,747	128,138
Average Household Size (<65)	2.87	2.76		2.65		2.57	2.57	2.57
Households Headed by Person Under 65	35,718	41,601	5,883	45,695	4,094	49,617	50,478	49,852
Homeowners	24,619	28,503	3,884	31,895	3,392	34,732	35,334	34,896
Renters	11,099	13,098	1,999	13,800	702	14,885	15,143	14,956
Ownership Tenure %	68.9%	68.5%		69.8%		70.0%	70.0%	70.0%
Rental Tenure %	31.1%	31.5%		30.2%		30.0%	30.0%	30.0%
Population & Households Age 65+								
Total Persons Age 65+	14,577	16,923	2,346	19,703	2,780	27,586	27,586	27,586
As Percent of Total Population	12.1%	12.4%		13.5%		17.1%	16.9%	17.1%
Group Quarters Population Age 65+	1,276	1,630	354	1,642	12	1,747	1,747	1,747
Population in Households - Age 65+	13,301	15,293	1,992	18,061	2,768	25,839	25,839	25,839
Households Headed by Persons 65+	8,877	10,242	1,365	11,955	1,713	16,820	16,820	16,820
Percent of Total Households	19.9%	19.8%		20.7%		25.3%	25.0%	25.2%
Average Household Size (65+)	1.50	1.49		1.51		1.54	1.54	1.54
Homeowners Age 65+	6,469	7,516	1,047	8,847	1,331	12,682	12,682	12,682
Renters Age 65+	2,408	2,726	318	3,108	382	4,138	4,138	4,138
Ownership Tenure % (65+)	72.9%	73.4%		74.0%		75.4%	75.4%	75.4%
Rental Tenure % (65+)	27.1%	26.6%		26.0%		24.6%	24.6%	24.6%
Total Population	120,005	136,225	16,220	146,328	10,103	160,974	163,188	161,579
Group Quarters Population	4,323	6,293	1,970	7,096	803	7,602	7,602	7,602
Population in Households	115,682	129,932	14,250	139,232	9,300	153,372	155,586	153,977
Average Household Size	2.59	2.51		2.42		2.31	2.31	2.31
Total Households	44,595	51,843	7,248	57,650	5,807	66,437	67,298	66,672
Homeowners	31,088	36,019	4,931	40,742	4,723	47,414	48,017	47,579
Renters	13,507	15,824	2,317	16,908	1,084	19,023	19,281	19,093
Ownership Tenure %	69.7%	69.5%		70.7%		71.4%	71.3%	71.4%
Rental Tenure %	30.3%	30.5%		29.3%		28.6%	28.7%	28.6%

3. Steps in the Employment-Based Projections

The employment models begin with a projection of total private and government employment in the County. In the above model, a statewide average growth rate of 1% per year (8% over 8 years) has been assumed. County employment in 2015 is then estimated based on its 2007 share of the State total, or that it will absorb a net change in State employment growth equivalent to its 1990-2007 share of change.

The estimated labor force population in 2007 is based on NH Employment Security data. The proportionate relationship between labor force population and total private and government employment in 2007 is calculated. The 2007 ratio is carried forward a constant to the future projection year.

ACS data is used to estimate the number of working residents age 16 or older in 2007 and this estimate its ratio to the New Hampshire labor force in 2007 is calculated. The 2007 ratio is carried forward in the projection. From this, the estimated number of working residents age 16 or more as defined in the Census or ACS is projected to 2015. The percentage of working residents who commute to locations outside of the County is projected using the 2007 around commuter ratio. (That ratio has been defined in this model based on the American Community Survey data). A comparison of ACS data to the prior two decennial Census figures is shown in Table 11 below.

Table 11

Percent of Working Residents Age 16 or Older Working Outside Area of Residence				
Area	1990 Census	2000 Census	ACS 2005-2007 Three-Yr Avg	ACS 2007 1-Yr Avg
Belknap	29.3%	32.6%	33.8%	n.a.
Carroll	19.0%	23.9%	22.5%	n.a.
Cheshire	21.4%	23.2%	23.3%	23.4%
Coos	10.6%	17.3%	18.5%	n.a.
Grafton	15.7%	18.1%	18.0%	18.8%
Hillsborough	25.3%	28.4%	31.0%	30.8%
Merrimack	30.5%	31.0%	32.7%	34.1%
Rockingham	48.7%	47.1%	46.2%	44.9%
Strafford	38.2%	41.2%	45.3%	44.9%
Sullivan	32.5%	37.4%	37.9%	n.a.
State of NH	16.7%	15.7%	16.2%	15.9%

Finally, the key driver in the model is the ratio of households headed by persons under the age of 65 in relation to the total labor force population in 2007. The ratio is held constant for the projection year to estimate the number of households under the age of 65 in the projection year.

Once the number of households headed by persons under age 65 is projected, a tenure split is allocated based on the headship model results developed earlier. The population living in households for the under 65-year-old group is estimated based on the projected average household size for that age group as indicated by the headship model. (Average household size times number of households under 65 yields total persons in households for this age group). To this is added the estimate group quarters population for the age group, which has been held constant from the headship model.

Table 12

EMPLOYMENT-BASED PROJECTION MODEL WITH AGE & TENURE SPLIT

In this model, households headed by persons under age 65 are projected based on changes in the number of persons employed in the area. Different assumptions about employment growth will yield alternative housing projections for the under-65 household segment. The projections for the elderly household component of total demand are held constant based on a population-based projection model and added to the non-elderly household component derived from employment assumptions.

FUTURE YEAR PROJECTED EMPLOYMENT FOR STATE (Private Covered + Government)

X REGIONAL % SHARE OF FUTURE YEAR EMPLOYMENT
(BASED ON SHARE OF STATE EMPLOYMENT OR SHARE OF GROWTH)

= PROJECTED EMPLOYMENT IN COUNTY OR REGION (Private + Government)

X RATIO OF LABOR FORCE TO EMPLOYMENT IN BASE YEAR

= AREA LABOR FORCE IN PROJECTION YEAR

X RATIO OF WORKING RESIDENTS (CENSUS OR ACS BASED) TO LABOR FORCE IN BASE YEAR

= ESTIMATED NUMBER OF WORKING RESIDENTS IN FUTURE YEAR

X PERCENT OF WORKING RESIDENTS EMPLOYED WITHIN THE AREA IN BASE YEAR (CENSUS OR ACS)

= NUMBER OF WORKING RESIDENTS EMPLOYED WITHIN THE AREA
(used later in model to estimate total vs local worker housing needs)

TOTAL NUMBER OF WORKING RESIDENTS FUTURE YEAR (LINE 6)

X RATIO OF HOUSEHOLDS UNDER AGE 65 TO WORKING RESIDENTS AGE 16+ LIVING IN REGION

= PROJECTED HOUSEHOLDS UNDER AGE 65

X AVG HOUSEHOLD SIZE FUTURE YEAR (From headship model or other source)

= PERSONS IN HOUSEHOLD FOR UNDER 65

+ PROJECTED GROUP QUARTERS POPULATION UNDER 65

= TOTAL POPULATION UNDER 65

PROJECTED HOUSEHOLDS UNDER AGE 65

X OWNERSHIP TENURE RATIO FOR HOUSEHOLDS <65

= HOMEOWNER HOUSEHOLDS UNDER AGE 65

+ PROJECTED ELDERLY OWNERS AGE 65+
(From Headship model or other separate projection for elderly)

= TOTAL HOMEOWNER HOUSEHOLDS ALL AGES

/ 0.99 (Maintain 1.0% vacancy reserve)

= UNITS AVAILABLE TO OWNERS

+ REPLACEMENT NEEDS DEFINED AS
(0.05% PER YEAR X NUMBER OF YRS PROJECTED
X BASE YEAR OWNERSHIP STOCK) - (1)

= FUTURE YEAR OWNER SUPPLY

NET PRODUCTION NEEDS IN PROJECTION PERIOD

OWNERS

FUTURE YEAR OWNER SUPPLY

(-) (BASE YEAR OWNER OCCUPIED + VACANT FOR SALE)

= PRODUCTION NEED - OWNERSHIP (2)

X TENURE RATIO FOR HOUSEHOLDS UNDER 65

= RENTER HOUSEHOLDS UNDER 65

+ PROJECTED ELDERLY RENTERS AGE 65+

= TOTAL RENTER HOUSEHOLDS ALL AGES

/ 0.96 (Maintain 4% vacancy reserve)

= UNITS AVAILABLE TO RENTERS

+ REPLACEMENT NEEDS DEFINED AS
(0.10% PER YEAR X YEARS PROJECTED
X BASE YEAR RENTAL STOCK) - (1)

= FUTURE YEAR RENTER SUPPLY

RENTERS

FUTURE YEAR RENTER SUPPLY

(-) (BASE YEAR RENTER OCCUPIED + VACANT FOR RENT)

= PRODUCTION NEED - RENTAL (2)

(1) This is equivalent to ratio of replacing approximately 1% of the baseline housing stock of ownership units in a 20-year period and 2% of the rental stock over a 20-year period.

(2) The subtotal of supply needs required to meet the proportion of need generated by employment within the County can be estimated by applying the percentage of working residents employed within the County to the total production need estimates

NOTE: The vacant housing stock that is categorized as seasonal, vacant but not available for sale or rent, or sold/rented but awaiting occupancy is excluded from the base year and the projection. These units are not part of the Census-defined vacancy rate.

The total of group quarters plus population and households equals total persons under age 65. For the age of 65+ numbers of persons in households, all of the data is derived directly from the headship model, and does not vary with the employment growth inputs.

Total population, households, group quarters population, and households by owner and renter tenure are then derived by adding the age 65+ and the under age 65 components of the projections. Average household size for all households is based on the resulting composite elderly and non-elderly population, households and total household count. The steps in the employment based components of the production model are outlined in Table 12 below.

Once the future households have been projected using the employment-based methods and/or the population-based headship method, final adjustments are made by adding an estimated number of vacant for sale units and vacant for rent units that would be needed to meet desired vacancy rates. For the purposes of the model, we have assumed a 1% rate for ownership units and a 4% rate for rental units.

Finally, a small allowance has been added for reserves for replacement. This is lower than the estimates used in the original model due to the concerns that the model is over-projecting the number of units lost through the deterioration or demolition. An average annual percentage is assumed for these projections at .05% per year for ownership housing and .10% per year for rental housing. This is equivalent to ratio of replacing approximately 1% of the baseline housing stock of ownership units in a 20-year period and 2% of the rental stock over a 20-year period.

Total housing supply needs indicated by the three projections are then computed by adding total households (owner and renter units) based on projections by tenure, plus allowances for a vacancy reserve and small allowance for replacement of housing stock. Variations in the estimated employment growth rate for the County or area will produce different levels of housing production needs for the non-elderly demand components of the employment-based projections, but the population-based forecast and the elderly portion of demand estimates in the employment based projections remain constant. The model yields a range of estimates of the total net housing production needs for owner vs. rental tenure; seasonal or second home growth is not projected by the model.

Once the model has been used to estimate total households in the future projection year, estimates of household income distribution by owner and rental tenure and/or cost burden information may be used to estimate housing needs for particular income groups, such as workforce housing segments or other groups based on a "band of income" approach. This method can provide reasonable estimates of the portion of future housing needed to accommodate various income brackets indexed to the area median family income (AMFI). Data for estimating these segments will be provided in separate materials prepared by NHHFA.

C. EMPLOYMENT BASED MODEL WITH TENURE SPLIT ONLY

This section summarizes the simpler, original model presented in 2003, with updates. It does not contain a breakdown of households by age, but instead relies on general relationships between employment, labor force, and total population. The basic structure of the model is summarized below in Table 13, and results of the model based on a statewide employment growth rate of 1% per year are shown for Merrimack County in Table 14.

Table 13

EMPLOYMENT-BASED PROJECTION MODEL	
1	FUTURE YEAR PROJECTED EMPLOYMENT FOR STATE (Private Covered + Government)
2	X REGIONAL % SHARE OF FUTURE YEAR EMPLOYMENT OR
3	SHARE OF STATE EMPLOYMENT GROWTH 1990-2007)
4	= PROJECTED COVERED EMPLOYMENT FOR FUTURE YEAR
5	X RATIO OF LABOR FORCE TO EMPLOYMENT IN 2007
6	= ESTIMATED LABOR FORCE IN FUTURE YEAR
7	X RATIO OF (CENSUS-BASED WORKING RESIDENTS AGE 16+) TO (LABOR FORCE IN 2007)
8	= WORKING RESIDENTS AGE 16+ IN FUTURE YEAR
9	X PERCENT WORKING OUTSIDE COUNTY
10	= NUMBER OF WORKING RESIDENTS EMPLOYED OUTSIDE THE COUNTY (used later in model to estimate total vs local worker housing needs)
11	LABOR FORCE IN FUTURE YEAR (FROM LINE 6)
12	X RATIO OF POPULATION TO LABOR FORCE IN 2007
13	= PROJECTED POPULATION FUTURE YEAR
14	(-) FUTURE YEAR ESTIMATE OF GROUP QUARTERS POPULATION
15	= POPULATION IN HOUSEHOLDS
16	/ ESTIMATED AVERAGE HOUSEHOLD SIZE IN FUTURE YEAR (FROM HEADSHIP MODEL OR OTHER ESTIMATE)
17	= NUMBER OF HOUSEHOLDS IN FUTURE YEAR
14	X OWNER/RENTER TENURE PERCENTAGES IN FUTURE YEAR (HEADSHIP MODEL OR OTHER ESTIMATE)
15	= HOMEOWNERS = RENTERS
16	/ 0.99 (Maintain 1.0% vacancy reserve) / 0.96 (Maintain 4% vacancy reserve)
17	= UNITS AVAILABLE TO OWNERS = UNITS AVAILABLE TO RENTERS
18	+ REPLACEMENT NEEDS DEFINED AS
19	(0.05% PER YEAR X NUMBER OF YRS PROJECTED X BASE YEAR OWNERSHIP STOCK) (0.10% PER YEAR X YEARS PROJECTED X BASE YEAR RENTAL STOCK)
20	= FUTURE YEAR OWNER SUPPLY - (2) = FUTURE YEAR RENTER SUPPLY - (2)
21	NET PRODUCTION NEEDS IN PROJECTION PERIOD
22	OWNERS RENTERS
23	FUTURE YEAR OWNER SUPPLY (from above) FUTURE YEAR RENTER SUPPLY (from above)
24	(-) (BASE YEAR OWNER OCCUPIED + VACANT FOR SALE) (-) (BASE YEAR RENTER OCCUPIED + VACANT FOR RENT)
	= PRODUCTION NEED - OWNERSHIP = PRODUCTION NEED - RENTAL
	PRODUCTION NEED - OWNERSHIP (2) = PRODUCTION NEED - RENTAL (2)
	<i>(1) This is equivalent to ratio of replacing approximately 1% of the baseline housing stock of ownership units in a 20-year period and 2% of the rental stock over a 20-year period.</i>
	<i>(2) The subtotal of supply needs required to meet the proportion of need generated by employment within the County can be estimated by applying the percentage of working residents employed within the County to the total production need estimates</i>
	<i>NOTE: The vacant housing stock that is categorized as seasonal, vacant but not available for sale or rent, or sold/rented but awaiting occupancy is excluded from the base year and the projection. These units are not part of the Census-defined vacancy rate.</i>

The major difference between the employment-based projection presented earlier is that this simpler version omits the under 65 vs. 65 and older age split, and that it projects population (rather than households) based on the historic relationship between employment and total population. Population in households is derived from subtracting an estimate of the future group quarters population. Future household size and household tenure split are based on the results of the headship model (other assumptions could be substituted).

Table 14

MERRIMACK COUNTY	1990	2000	Change 1990 to 2000	2007 Estimate	Change 2000-2007	2015 Employment Based Projection 1	2015 Employment Based Projection 2	2015 Population Based Using NHOSP Projection
Covered Private Sector Employment in Area (NHDES)	42,508	55,199	12,691	57,629	2,430			This column is based on the age-headship-tenure module assumptions, using NHOEP County population projections by age. That model produces long term estimates of household size by age group and tenure split by age (<65 and 65+)
Percent of State Total	9.9%	10.4%	12.8%	10.6%	17.0%	Employment Assumptions		
Government Employment in Area (NHDES)	12,014	15,222	3,208	16,441	1,219	Constant Share	Growth Share	
Total Private + Government Employment	54,522	70,421	15,899	74,070	3,649	79,996	81,384	
Percent of State Total	11.0%	11.6%	14.4%	11.8%	15.0%			
Labor Force Population (NH Employment Security)	60,263	75,473	15,210	80,539	5,066	86,982	88,492	
Ratio: Labor Force Population to Private & Govt Employment	1.105	1.072		1.087	Constant: 1.087	1.087	1.087	
Ratio-Census Working Residents/NHES Labor Force	1.003	0.923		0.940	Constant: 0.940	0.940	0.940	
Number of Working Residents Age 16+ (Census defined)	60,446	69,676	9,230	75,682	6,006	81,737	76,476	
Work in County	42,031	48,051	6,020	50,934	2,883	55,009	51,468	
Work Outside of County	18,415	21,625	3,210	24,748	3,123	26,728	25,008	
Percent Commute Out of County	30.5%	31.0%		32.7%	Constant: 32.7%	32.7%	32.7%	
Ratio Private Covered Employment Per Resident Household	0.95	1.06		1.00				
Ratio Total Population to Labor Force	1.99	1.80		1.82	Constant: 1.87	1.87	1.87	
Ratio Households to Labor Force Population	0.74	0.69		0.72	Derived:	0.71	0.71	
Total Population	120,005	136,225	16,220	146,328	10,103	162,748	165,573	161,579
Group Quarters Population	4,323	6,293	1,970	7,096	803	7,602	7,602	7,602
Population in Households	115,682	129,932	14,250	139,232	9,300	155,146	157,971	153,977
Average Household Size	2.59	2.51		2.42		2.31	2.31	2.31
Total Households	44,595	51,843	7,248	57,650	5,807	67,178	68,401	66,672
Homeowners	31,088	36,019	4,931	40,742	4,723	47,927	48,800	47,566
Renters	13,507	15,824	2,317	16,908	1,084	19,251	19,602	19,106
Ownership Tenure %	69.7%	69.5%		70.7%		71.3%	71.3%	71.3%
Rental Tenure %	30.3%	30.5%		29.3%		28.7%	28.7%	28.7%
Vacant Housing Stock								
Vacant for Sale Units	764	332	-432	412		484	493	480
Vacant for Rent Units	1,927	460	-1,467	686		802	817	796
Vacant-Rented/Sold - Awaiting Occupancy	205	230	25	n.c.		not projected		
Vacant-Occasional Use, Seasonal, Migratory	2,772	2,892	120	n.c.		not projected		
Other Vacant Units	607	487	-120	n.c.		not projected		
Total Vacant/Seasonal/Occ Use Units	6,275	4,401	-1,874	n.c.		not projected		
Total Housing Units	50,870	56,244	5,374	n.c.		not projected		
Vacancy Rate Ownership	2.4%	0.9%		1.0%		1.0%	1.0%	1.0%
Vacancy Rate Rental	12.5%	2.8%		3.9%		4.0%	4.0%	4.0%
Vacancy Rate Total	5.7%	1.5%		1.9%		1.9%	1.9%	1.9%
Add Replacement for Deterioration, Demolition - Ownership						165	165	165
Add Replacement for Deterioration, Demolition - Rental						141	141	141
Add Replacement for Deterioration, Demolition - Total						305	305	305
			1990-2000	2007		2015	2015	2015
Housing Supply Available for Year-Round Occupancy	1990	2000	Change	Estimated	Tenure	Housing Supply 1	Housing Supply 2	Housing Supply 3
Total Ownership Stock Except Sold, Not Occ.	31,852	36,351	4,499	41,154	Owner	48,576	49,457	48,211
Total Rental Units Except Rented, Not Occ.	15,434	16,284	850	17,594	Renter	20,194	20,559	20,043
Total Stock Occupied or Available	47,286	52,635	5,349	58,748	Total	68,770	70,016	68,254
					Net Production Need 2007-2015			
					Tenure	Housing Supply 1	Housing Supply 2	Housing Supply 3
					Owner	7,422	8,304	7,058
					Renter	2,600	2,965	2,449
					Total	10,022	11,269	9,506
					Subtotal: Need for Residents Working in County			
					Owner	4,995	5,588	4,750
					Renter	1,750	1,995	1,648
					Total	6,745	7,584	6,398

D. STATEWIDE RESULTS OF PRODUCTION MODELS

1. Population-Based Model Using NHOEP Projections

Average Units Per Year (2007-2015)		For Residents Employed within NH
Total	8,681	7,274
Owner	6,753	5,659
Renter	1,928	1,615

2. Employment Based Model, Employment Growth at 1% Per Year, with Age-Tenure Split

Average Units Per Year (2007-2015)		For Residents Employed within NH
Total	8,909 to 8,991	7,466 to 7,534
Owner	6,938 to 7,039	5,814 to 5,898
Renter	1,952 to 1,970	1,636 to 1,651

3. Employment Based Model, Employment Growth at 1% Per Year (No Age Split)

Average Units Per Year (2007-2015)		For Residents Employed within NH
Total	8,831 to 8,918	7,400 to 7,474
Owner	6,819 to 6,939	5,715 to 5,815
Renter	1,980 to 2,012	1,659 to 1,686

Statewide results shown above are based on the sum of individual County-level projections. The employment based projections above reflect the assumption of an annual average growth rate of 1% per year in employment. Higher or lower rates of employment growth will produce different results in total housing supply requirements related to assumptions about workforce expansion. The employment growth rate of 1% per year was selected for illustration purposes because resulting projections of housing supply needs are most comparable to the results indicated by the independent population-based growth model.