Components of Inventory Change And Rental Market Dynamics: Portland 1995-2002

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Overview

Housing analysts use two techniques—Components of Inventory Change (CINCH) and rental market dynamics—to look at a housing market at two points in time and explain how the observed changes came about in physical (bricks and mortar) terms. CINCH focuses first on the overall number and then the characteristics of units at different times. Using CINCH methods, analysts answer such question as: "What happened to the x units that disappeared from the housing stock between the beginning and the end of the period?" or "Where did the increase in owner-occupied units come from?" Rental market dynamics, which is really a type of CINCH analysis, focuses on the rental market with particular emphasis on the affordability of rental housing. Using rental market dynamics techniques, analysts answer such questions as: "Have the number of rental units affordable to households with very low incomes increased or decreased over the period?" or "What happened to the units that were affordable to low-income households at the beginning of the period?"

Previously HUD commissioned CINCH and rental market dynamics analyses using the national American Housing Survey (AHS).[1] This report focuses on the Portland metropolitan housing market over the period between 1995 and 2002. It is one of 13 reports based on local American Housing Surveys conducted in 2002; these 13 metropolitan areas were previously surveyed in either 1994 or 1995.

CINCH and rental market analysis have both forward-looking and backward-looking components. In the forward-looking components, analysts start with the housing stock available at the beginning of the period and then, looking at the end of the period, attempt to explain what happened to those units. Possible answers include some units still exist and serve the same market, some units still exist but serve a different market, some units have been demolished or destroyed in natural disasters, or some units are being used for nonresidential purposes. In the backward-looking component, analysts start with the housing stock available at the end of the period and, looking at the beginning of the period, attempt to explain where those units came from. Possible answers include some units existed at the beginning of the period and served the same market, some units existed at the beginning of the period but served a different market, some units were newly constructed over the period, or some units were being used for nonresidential purposes at the beginning of the period. Neither CINCH nor rental market dynamics try to track the experience of a unit over the entire period; both are interested only in the beginning and the end of the period. For example, a housing unit in 1995 may have become a medical office in 1997, but returned to being a housing unit in 2000. CINCH

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[1] See http://www.huduser.org/datasets/cinch.html and
http://www.huduser.org/datasets/ahs/ahsReports.html#2.

would record this unit as having undergone no change over the period from 1995 to 2002. In classical analytical jargon, CINCH and rental market dynamics are *comparative static* analyses.

Ideally one would want to combine the forward-looking and backward-looking analyses to produce a complete accounting that can explain the beginning and the end consistently in terms of units that existed in both periods, losses from the stock over the period, and additions to the stock over the period. The analysis in this report uses the AHS, which is a sample of units at both points in time; and, unfortunately, previous efforts using the AHS have demonstrated that creating sample weights that take both periods into account generates some inconsistent or inaccurate results. For this reason, the most recent analyses have separated the forwarding-looking and backward-looking components. This report will do the same. (Weighting is explained briefly in Appendix B and more fully in a separate paper cited in the Appendix.)

The remainder of this report consists of four sections:

- An explanation of how to read the CINCH tables.

- Two sets of four tables each: a set of forward-looking tables tracing the movement of units from 1995 to 2002 and identifying how units were lost to the housing stock; and a set of backward-looking tables tracing where 2002 units came from and distinguishing between units that were part of the stock in 1995 and units that were additions to the stock since 1995.

- A brief discussion of the rental market dynamics.

- Two rental market dynamics tables, one forward-looking and one backward-looking.

At various places, the discussion points out some of the limitations of these analyses or of using the AHS metropolitan samples for these analyses.

Two appendixes explain how the results were tested and how the weights were created.

How to Read CINCH Tables

Rows and columns serve different purposes in CINCH tables. The rows identify classes of units to be analyzed. The columns trace those units either forward or backward.

The forward-looking tables are concerned with what happened to the 1995 housing stock by 2002. There are three basic dispositions of 1995 units: units that continue to exist in 2002 with the same characteristics (or serving the same market), units that continue to exist in 2002 but with different characteristics (or serving a different market), and units that were lost to the stock.

The backward-looking tables are concerned with where the 2002 housing stock came from in reference to 1995. There are three basic sources of 2002 units: units that existed in 1995 with the same characteristics (or serving the same market), units that existed in 1995 but with different characteristics (or serving a different market), and units that are additions to the housing stock.

Since the essence of the CINCH analysis is in the columns, we will explain the columns in detail.

Columns Common to Both Forward-Looking and Backward-Looking Tables:

- The first and last columns contain the row numbers. The row numbers are identical for the same tables in the forward-looking and backward-looking sets.

Columns A through E set up the analysis and track units that exist in both periods.

- Column A specifies the characteristic that defines the subset of the stock that is being tracked forward or backward in a particular row. For example, row 2 of Table 1 focuses on occupied units; row 15 focuses on units built in 1985 through 1989.

- Column B gives the estimate published in the AHS report for the number of units that satisfy the conditions specified in column A. For example, the 1995 AHS report for Portland counted 655,100 occupied units (column B, row 2, Forward-Looking Table 1); the 2002 AHS report counted 747,800 occupied units (column B, row 2, Backward-Looking Table 1).

- Column C gives the CINCH estimate of the number of units that satisfy two conditions: (a) being part of the housing stock in the relevant year (1995 for the forward-looking tables and 2002 for the backward-looking tables); and (b) satisfying the condition in column A. CINCH uses different weights than those used in preparing the published reports. Therefore, CINCH estimates can differ from AHS estimates for particular subsets of the housing stock. As explained in Appendix B, the weights were created to match AHS published totals for rows 2 through 4 of Table 1. This perfect match will not be true of other rows.[2] In the case of the Portland metropolitan area, the CINCH weights produce population estimates that are very close to the published estimates except for units built after 1989 and owner monthly housing costs less than $500 (both in the backward-looking tables). The CINCH weights also tend to underestimate the number of units with severe physical problems in Backward-Looking Table 2.

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[2] Columns B and C will also match, except for rounding, in row 1 of Table 1 because row 1 is defined as the sum of rows 2 through 4.

- Column D is the CINCH estimate of the number of units from column C that (a) are also part of the housing stock in the *other* year, and (b) continue to belong to the subset defined by column A. For example, column D of row 2 of Forward-Looking Table 1 estimates that 600,810 of the occupied units were occupied in 2002.

- Column E is the CINCH estimate of the number of units from column C that (a) are also part of the housing stock in the *other* year, but (b) no longer belong to the subset defined by column A. Column E of row 2 indicates that 44,350 units that were occupied in 1995 are still part of the housing stock in 2002 but are no longer occupied. In some cases, the analysis will not allow a unit to change characteristics between the base year and the other year. Examples include type of structure, year built, and number of stories—characteristics that are considered impossible or unlikely to change.

Columns Unique to Forward-Looking Tables

In forward-looking tables, columns F through K track what happened to units that were lost from 1995 to 2002.

- Column F is the CINCH estimate of the number of units from column C that are not in the 2002 housing stock because they were merged with other units or converted into multiple units. Among occupied units, 560 units were lost to mergers and conversions.

- Column G is the CINCH estimate of the number of mobile homes from column C that were moved out during the period. Among occupied units, 1,130 mobile homes were moved out. The AHS does not follow a manufactured housing unit that is moved and, therefore, cannot distinguish between units that are relocated and units that are demolished. It treats all moves as losses.

- Column H is the CINCH estimate of the number of units from column C that became nonresidential at the end of the period. For example, a real estate firm, a tax preparation office, a palm reader, or some other business might buy or rent a house to use for business rather than residential purposes.[3] Among occupied units, 2,060 became nonresidential.

- Column I is the CINCH estimate of the number of units from column C that were demolished or were destroyed by fires or natural disasters by 2002. In this case, 4,690 units were demolished or destroyed.

- Column J is the CINCH estimate of the number of units from column C that by 2002 were condemned or that were no longer usable for housing because of

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[3] If the owner or tenant both lives in a unit and conducts business out of the unit, the AHS considers the unit to be residential. So nonresidential means strictly no residential use.

extensive damage. Among occupied units, no units are no longer usable for housing.

- Column K is the CINCH estimate of the number of units from column C that were lost by 2002 for other reasons. These include units that the Census Bureau eliminated for sampling purposes and other miscellaneous losses. Among occupied units, there were 1,500 units lost for these miscellaneous reasons.

The columns form a closed system. Column C counts the number of units tracked; columns D through K account for all the possible outcomes. Therefore, column C minus the sum of columns D through K always equals zero, except for rounding.[4]

Columns Unique to Backward-Looking Tables

In backward-looking tables, columns F through I track where units came from that are part of the housing stock in 2002, but were not part of the housing stock in 1995.[5]

- Column F is the CINCH estimate of the number of mobile homes from column C that were moved in during the period. Among occupied units, 200 mobile homes were moved in (column F, row 2 of Backward-Looking Table 1).[6] Move-ins are treated as additions to balance the treatment of move-outs as losses.

- Column G is the CINCH estimate of the number of units from column C that had been nonresidential in 1995. Among occupied units, 790 had been nonresidential.

- Column H is the CINCH estimate of the number of units from column C that were newly constructed between 1995 and 2002. Among occupied units, 89,820 units were newly constructed.

- Column I is the CINCH estimate of the number of units from column C that were added by 2002 for other reasons. These include units that were considered temporary losses because occupancy was prohibited in 1995 or the interior of the unit was exposed to the elements, and also units that the Census Bureau considered temporarily lost to the housing stock for reasons "not classified." Among occupied units, 1,190 had been temporarily lost to the stock in 1995.

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[4] The weighted numbers are rounded to the nearest 10. The AHS publication rounds to the nearest 100. We found that rounding to the nearest 10 worked better for the metropolitan sites. The weights were typically in the range of 100 to 300 and in many rows the numbers in columns F through K were small. With a weight of 149, rounding to the nearest hundred would mean that one sample observation would be rounded to 100, two sample observations to 300, and three sample observations to 400. Rounding to the nearest ten results in weighted totals of 150, 300, and 450 for these cases.

[5] This list does not contain a column for units added through mergers and conversions. The Census Bureau did not code the variable that would normally identify mergers and conversions in 2002 (REUAD=7 or 8).

[6] The Census Bureau did not code the variable that would normally identify mobile home move-ins in 2002 (REUAD=4). We estimated these from another variable (NOINT=13).

Table 1

Table 1 focuses on the general housing characteristics of the stock. Row 1 provides the highest level CINCH overview of the stock. For this row, column A specifies no conditions other than being part of the stock in the relevant year.

Rows 2-4 divide the housing stock by use. By Census Bureau definition, the number of occupied non-seasonal units equals the number of households. Because households are the basis for all the analyses in Tables 2 through 4, it is important to get a good starting point for these estimates. For this reason, the weights are designed to match published AHS totals for occupied units, vacant units, and seasonal units.

Rows 5-12 divide the housing stock by type of structure to identify what type of units account for losses.[7] The Census Bureau sometimes suppresses data to protect the confidentiality of respondents. For some metropolitan areas, suppression results in zero estimates for certain multiunit structures in the public data file, whereas the published tables contain estimates for these multiunit classes. Because of suppression, units in structures with 50 or more units are listed in row 10 instead of row 11 in Forward-Looking Table 1 for the Portland metropolitan area.

Rows 13-23 divide the housing stock by year built.[8] The published reports use the categories 1990-1994, 1995-1999, and 2000-2004; we use 1990-1995 and 1996-2002 to isolate units newly constructed since the previous AHS survey.[9] Column I shows that losses due to demolition or disasters were proportionally greatest among units built in the 1930s.

Rows 24-30 and 31-35 divide the housing stock by two different measures of interior space, the number of rooms and the number of bedrooms.[10]

Rows 36-41 focus on multiunit structures only and divide them by number of stories. Column E is forced to be zero and, depending on the metropolitan area, the Census Bureau may suppress information, forcing some rows to be zero. For the 1995 Portland AHS public use file, the Census Bureau reported all units in structures with 3 or more stories in row 39 and reported no units in rows 40 and 41. In general, the published reports contain matching data for row 36 only.

Rows 42-43 divide the housing stock between central cities units and suburban residences to determine how the observed changes vary by location. Eighty-five percent of new

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[7] In general, the CINCH estimates exceed published AHS estimates for single-family detached units and fall short of the published AHS estimates for manufactured homes by roughly equal amounts.

[8] Row 13 is not included in the forward-looking tables, because the 1995 housing stock cannot contain units built after 1995.

[9] We use REUAD=3 and not year built to identify new construction. For this reason, there are units built after 1995 that are not considered new construction. In addition, year built is obtained from the respondent interview and may be inaccurate.

[10] Because of small sample sizes in the losses and additions columns, we combined room categories that the published reports list separately.

construction occurred in the suburbs. Rows 44-45 divide the housing stock by whether or not the occupants have moved in within the last two calendar years to determine if certain units consistently have high turnover and to see if high turnover units are more susceptible to loss.

Table 2

This table pertains to issues related to the physical quality of units. Row 1 repeats the analysis from row 2 in Table 1. All the subsequent rows are based on row 1.

Rows 2-3 look at whether the units have complete kitchens; that is, have an installed sink with piped water, a mechanical refrigerator, and built-in burners for the exclusive use of the occupants. Rows 4-5 look at whether the units have complete plumbing facilities; that is, hot and cold piped water, a flush toilet, and a bathtub or shower inside the structure for the exclusive use of the occupants. Rows 6-8 look at each of these requirements separately. In the 1995 AHS, the published reports separate out the "exclusive use" category; in the data used for this report, these units show up in row 8. Rows 2-3, 4-5, and 6-8 attempted to separate out good units from the least desirable units, based on kitchen and bath equipment, to compare how they changed over the period.

Rows 9-13 pertain to how units obtain water and dispose of sewage.

Rows 14-19 look at units with serious problems. Rows 15-19 identify specific types of serious deficiencies. Row 14 counts the units having one or more of these deficiencies. Rows 20-25 look at units with moderate problems. Rows 21-25 identify specific types of deficiencies. Row 20 counts the units having one or more of these deficiencies.[11] These rows are in the analysis to answer two questions: whether poor-quality units in one year are also poor-quality units in the other year, and whether poorer quality units are more likely to be lost. Both the forward-looking and backward-looking analyses indicate that there is little continuity over the 7 years with respect to having serious physical problems. Approximately 3 percent of the units with serious problems in 1995 had serious problems in 2002, and approximately 2 percent of the units with serious problems in 2002 had had serious problems in 1995. Little continuity was shown in the forward-looking analysis for moderate problems. Approximately 9 percent of the units with moderate problems in 1995 had moderate problems in 2002, and approximately 6 percent of the units with moderate problems in 2002 had had moderate problems in 1995. Approximately 1 percent of the units had serious problems in either year, and fewer than 3 percent had moderate problems in either year.

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[11] For definitions of serious and moderate problems see pages 998 and 999 of the AHS Codebook, version 1.77, at http://www.huduser.org/intercept.asp?loc=/Datasets/ahs/AHS_Codebook.pdf.

Table 3

This table pertains to the characteristics of occupants. Row 1 repeats the analysis from row 2 in Table 1. All the subsequent rows are based on row 1.

Rows 2-3 look at the age of the householder. Rows 4-5 look at whether the household includes children. Rows 6-11 look at the race or ethnicity of the householder. Rows 12-14 look at three possible sources of household income. In all cases, the analysis seeks to determine how stable the occupancy characteristics are over time, and what part of the market was served by units that lost between 1995 and 2002.

Table 4

Table 4 pertains to tenure, income, and housing costs. Row 1 repeats the analysis from row 2 in Table 1. All the subsequent rows are based on row 1.

Rows 2-4 focus on tenure to determine the extent to which units change tenure characteristics and whether rental or owner-occupied units are more likely to be lost. Rental units in Portland were five times as likely to be lost due to demolition or disasters as owner-occupied units (1.5 percent versus 0.3 percent). New construction was divided among the owner-occupied stock and the rental stock in almost the exact proportions of their share of occupied housing.

Rows 5-11 contain a partial rental dynamics analysis.[12] Row 5 identifies non-market units, a class that includes subsidized units and units provided for no cash rents; for example, units given to maintenance or management personnel or to relatives. The remaining rows divide market rental units into affordability classes. In defining affordability, the analysis sets boundaries for each class based on the highest rent a household in an income group could afford without spending more than 30 percent of its monthly income on rent. Ideally there would be six categories in each metropolitan area:

- Extremely-low-rent units (rents affordable to households with incomes equal to 35 percent of area median family income).

- Very-low-rent units (rents not affordable at 35 percent, but affordable at 50 percent of area median family income).

- Low-rent units (rents not affordable at 50 percent, but affordable at 65 percent of area median family income).

- Moderate-rent units (rents not affordable at 65 percent, but affordable at 80 percent of area median family income).

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[12] The rental dynamics analysis is partial because it traces movement out of, but not into, particular rental classes. Tables A and B in the final section of this report contain a complete rental dynamics analysis.

- High-rent units (rents not affordable at 80 percent, but affordable at 100 percent of area median family income).

- Very-high-rent units (rents not affordable at 100 percent of area median family income).

For most metropolitan areas studied, the number of categories is fewer than six, because the Census Bureau had to place an upper limit on the rents reported in the public-use data to protect the confidentiality of respondents. In Portland, there are only five classes, with high-rent and very-high-rent units grouped into one class.

Rows 12-16 track rental units by household income; rows 22-26 track owner-occupied units by household income.[13]

Rows 17-21 identify owner-occupied units by total monthly housing costs.[14]

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[13] Because of small sample sizes in the losses and additions columns, we combined income categories that the published reports list separately.

[14] Because of small sample sizes in the losses and additions columns, we combined cost categories that the published reports list separately.

Forward-Looking Table 1: Structural and Location Characteristics – All Housing Units

	A Characteristics	B Published numbers	C Present in 1995	D 1995 units present in 2002	E Change in character-istics	F '95 units affected by conversion /merger	G '95 mobile homes moved out	H '95 units changed to nonresidential use	I '95 units lost through demolition or disaster	J '95 units badly damaged or condemned	K '95 units lost in other ways	
1	**Total Housing Stock**	702,600	702,600	690,900	0	560	1,300	2,590	5,040	0	2,200	1
	Occupancy Status											
2	Occupied	655,100	655,100	600,810	44,350	560	1,130	2,060	4,690	0	1,500	2
3	Vacant	46,700	46,700	7,740	37,210	0	180	530	350	0	700	3
4	Seasonal	800	800	270	530	0	0	0	0	0	0	4
	Units in Structure											
5	1, detached	457,800	467,640	461,510	0	0	560	1,680	3,160	0	730	5
6	1, attached	35,700	35,960	35,590	0	0	0	0	190	0	180	6
7	2 to 4	44,700	46,000	45,070	0	380	0	550	0	0	0	7
8	5 to 9	39,600	41,100	40,170	0	0	0	0	750	0	180	8
9	10 to 19	47,000	47,080	46,890	0	190	0	0	0	0	0	9
10	20 to 49	18,500	35,180	34,440	0	0	0	360	380	0	0	10
11	50 or more	17,800	0	0	0	0	0	0	0	0	0	11
12	Mobile Home/trailer	41,400	29,660	27,230	0	0	740	0	560	0	1,130	12
	Year Built											
14	1990-1995	83,300	82,170	81,980	0	0	0	0	0	0	190	14
15	1985-1989	51,200	49,230	48,670	0	0	0	190	190	0	190	15
16	1980-1984	37,000	36,310	35,950	0	0	190	0	0	0	180	16
17	1970-1979	196,600	195,000	192,010	0	190	560	360	1,310	0	560	17
18	1960-1969	87,000	87,760	85,890	0	0	190	550	560	0	560	18
19	1950-1959	74,400	75,420	73,210	0	0	180	1,110	740	0	180	19
20	1940-1949	56,100	57,530	56,410	0	0	0	0	940	0	180	20
21	1930-1939	26,200	26,300	25,010	0	190	190	0	740	0	180	21
22	1920-1929	37,900	38,710	38,150	0	0	0	380	190	0	0	22
23	1919 or earlier	53,000	54,190	53,630	0	190	0	0	380	0	0	23

Forward-Looking Table 1 (continued): Structural and Location Characteristics – All Housing Units

	A Characteristics	B Published numbers	C Present in 1995	D 1995 units present in 2002	E Change in character-istics	F '95 units affected by conversion /merger	G '95 mobile homes moved out	H '95 units changed to nonresidential use	I '95 units lost through demolition or disaster	J '95 units badly damaged or condemned	K '95 units lost in other ways	
	Rooms											
24	1 – 4 rooms	198,300	194,890	154,920	34,030	560	360	740	2,980	0	1,290	24
25	5 rooms	122,100	122,470	55,080	65,170	0	380	190	1,130	0	540	25
26	6 rooms	128,800	129,040	53,870	74,420	0	190	190	190	0	190	26
27	7 rooms	104,600	106,200	41,490	63,410	0	190	930	190	0	0	27
28	8 rooms	72,900	73,790	23,680	49,360	0	190	190	380	0	0	28
29	9 rooms	46,900	46,450	9,520	36,550	0	0	190	190	0	0	29
30	10 rooms or more	28,900	29,760	11,440	17,950	0	0	180	0	0	190	30
	Bedrooms											
31	None	13,400	12,210	5,620	6,030	190	0	190	190	0	0	31
32	1	77,700	77,190	63,900	11,060	380	0	190	1,110	0	550	32
33	2	212,100	209,630	174,020	30,790	0	550	740	2,240	0	1,290	33
34	3	271,800	273,600	226,140	44,100	0	560	1,300	1,310	0	180	34
35	4 or more	127,600	129,970	104,750	24,480	0	190	180	190	0	190	35
36	**Multiunit Structures**	167,600	169,350	166,570	0	560	0	910	1,130	0	180	36
	Stories in Structures											
37	1		17,760	17,390	0	0	0	380	0	0	0	37
38	2		96,290	94,640	0	560	0	350	560	0	180	38
39	3		55,300	54,550	0	0	0	190	560	0	0	39
40	4 to 6		0	0	0	0	0	0	0	0	0	40
41	7 or more		0	0	0	0	0	0	0	0	0	41
	Metro Status											
42	In central cities		203,310	200,900	0	190	0	930	1,300	0	0	42
43	In suburbs		499,290	490,000	0	380	1,300	1,660	3,740	0	2,200	43
	Mover Status											
44	Moved in last 2 years		171,570	49,950	117,130	560	380	1,130	1,880	0	560	44
45	Not a recent mover		483,530	415,280	62,810	0	750	940	2,810	0	940	45

Forward-Looking Table 2: Condition of Unit – All Occupied Units

	A Characteristics	B Published numbers	C Present in 1995	D 1995 units present in 2002	E Change in character-istics	F '95 units affected by conversion /merger	G '95 mobile homes moved out	H '95 units changed to nonresidential use	I '95 units lost through demolition or disaster	J '95 units badly damaged or condemned	K '95 units lost in other ways	
1	**Occupied Units**	655,100	655,100	600,810	44,350	560	1,130	2,060	4,690	0	1,500	1
	Kitchen											
2	With complete kitchen	650,600	650,790	589,030	52,010	380	1,130	2,060	4,690	0	1,500	2
3	Lacking complete kitchen facilities	4,500	4,310	1,180	2,950	190	0	0	0	0	0	3
	Plumbing											
4	With all plumbing facilities	650,800	650,550	592,910	48,080	380	1,130	2,060	4,500	0	1,500	4
5	Lack some plumbing	3,000	4,550	200	3,980	190	0	0	190	0	0	5
6	No hot piped water	0	190	0	0	190	0	0	0	0	0	6
7	No bathtub/shower	1,300	1,560	200	1,180	190	0	0	0	0	0	7
8	No flush toilet	700	3,960	200	3,390	190	0	0	190	0	0	8
	Water											
9	Public/private water	594,700	588,850	536,090	44,890	560	560	2,060	3,380	0	1,310	9
10	Well	56,900	62,710	51,420	9,230	0	560	0	1,310	0	190	10
11	Other water source	3,400	3,540	2,160	1,380	0	0	0	0	0	0	11
	Sewer											
12	Public sewer	528,000	526,530	481,330	38,450	560	560	1,690	2,630	0	1,310	12
13	Septic tank/cesspool	126,900	128,370	85,940	39,240	0	560	380	2,060	0	190	13
14	**Severe Problems**	5,900	6,100	200	5,160	190	190	0	380	0	0	14
15	Plumbing	4,300	4,550	200	3,980	190	0	0	190	0	0	15
16	Heating	900	780	0	590	0	190	0	0	0	0	16
17	Electric	400	390	0	390	0	0	0	0	0	0	17
18	Upkeep	700	780	0	590	0	0	0	190	0	0	18
19	Hallways	0	0	0	0	0	0	0	0	0	0	19
20	**Moderate problems**	14,000	13,530	1,180	11,790	0	190	0	380	0	0	20
21	Plumbing	400	0	0	0	0	0	0	0	0	0	21
22	Heating	600	590	0	590	0	0	0	0	0	0	22
23	Kitchen	3,600	4,310	1,180	2,950	190	0	0	0	0	0	23
24	Upkeep	9,300	9,980	390	8,840	0	380	0	380	0	0	24
25	Hallways	200	0	0	0	0	0	0	0	0	0	25

Forward-Looking Table 3: Household Characteristics – All Occupied Units

	A Characteristics	B Published numbers	C Present in 1995	D 1995 units present in 2002	E Change in character-istics	F '95 units affected by conversion /merger	G '95 mobile homes moved out	H '95 units changed to nonresidential use	I '95 units lost through demolition or disaster	J '95 units badly damaged or condemned	K '95 units lost in other ways	
1	**Occupied units**	655,100	655,100	600,810	44,350	560	1,130	2,060	4,690	0	1,500	1
	Age											
2	Under 65	529,300	528,860	448,620	71,800	560	940	2,060	4,130	0	750	2
3	65 or older	125,900	126,240	77,300	47,440	0	190	0	560	0	750	3
	Children											
4	Some	232,100	233,900	122,430	107,160	190	750	1,130	2,060	0	190	4
5	None	423,000	421,200	315,980	99,600	380	380	940	2,630	0	1,310	5
	Race/Origin											
6	White	613,900	614,110	534,070	70,470	560	1,130	1,880	4,500	0	1,500	6
7	Hispanic	16,500	17,280	5,060	12,030	0	0	0	190	0	0	7
8	Non-Hispanic	597,400	596,830	508,240	79,210	560	1,130	1,880	4,310	0	1,500	8
9	Black	11,400	11,380	4,910	6,290	0	0	0	190	0	0	9
10	Other	29,800	29,600	14,830	14,590	0	0	190	0	0	0	10
11	Total Hispanics	22,200	21,990	8,400	13,410	0	0	0	190	0	0	11
	Income Source											
12	Wages and salaries	505,200	505,190	409,330	87,420	560	1,130	2,060	3,940	0	750	12
13	Welfare or SSI	26,900	25,710	4,910	20,230	190	190	0	190	0	0	13
14	Social security or pension	170,700	169,500	99,010	68,800	0	190	0	560	0	940	14

Forward-Looking Table 4: Market Dynamics and Affordability – All Occupied Units

	A Characteristics	B Published numbers	C Present in 1995	D 1995 units present in 2002	E Change in character-istics	F '95 units affected by conversion /merger	G '95 mobile homes moved out	H '95 units changed to nonresidential use	I '95 units lost through demolition or disaster	J '95 units badly damaged or condemned	K '95 units lost in other ways	
1	**Occupied units**	655,100	655,100	600,810	44,350	560	1,130	2,060	4,690	0	1,500	1
	Tenure											
2	Owner occupied	424,000	423,550	380,210	39,780	0	380	750	1,130	0	1,310	2
3	Percent own occupied	64.7%	64.7%	63.3%	NA	0.0%	33.6%	36.4%	24.1%	NA	87.3%	3
4	Renter occupied	231,100	231,550	170,510	54,660	560	750	1,310	3,560	0	190	4
	Rental Affordability											
5	Non-market		29,080	12,770	15,370	190	190	0	380	0	190	5
6	Extremely low rent		27,070	12,770	13,550	0	190	190	380	0	0	6
7	Very low rent		87,090	46,360	38,110	380	190	380	1,690	0	0	7
8	Low rent		49,050	10,610	37,130	0	190	380	750	0	0	8
9	Moderate rent		25,700	3,000	21,950	0	0	380	380	0	0	9
10	High to very high rent		13,550	3,930	9,630	0	0	0	0	0	0	10
	Renter Hsd Income											
12	Less than $20,000	81,300	82,470	29,710	51,070	560	0	190	940	0	0	12
13	$20,000 to $34,999	72,100	72,180	17,480	52,450	0	560	190	1,500	0	0	13
14	$35,000 to $59,999	56,000	55,690	13,360	40,270	0	0	940	940	0	190	14
15	$60,000 to $99,999	18,400	18,050	2,160	15,520	0	190	0	190	0	0	15
16	$100,000 or more	3,300	3,140	200	2,950	0	0	0	0	0	0	16
	Owner Monthly Housing Costs											
17	Less than $499	147,600	147,940	72,730	72,580	0	380	0	1,130	0	1,130	17
18	$500 to $699	62,900	63,370	7,460	55,350	0	0	380	0	0	190	18
19	$700 to $999	101,300	102,880	16,890	85,800	0	0	190	0	0	0	19
20	$1,000 to $1,499	79,200	79,840	29,960	49,700	0	0	190	0	0	0	20
21	$1,500 or more	33,000	29,520	18,960	10,560	0	0	0	0	0	0	21
	Owner Hsd Income											
22	Less than $20,000	63,000	60,040	19,590	38,940	0	0	0	560	0	940	22
23	$20,000 to $34,999	92,600	92,950	20,530	72,040	0	190	0	0	0	190	23
24	$35,000 to $59,999	119,100	122,530	34,080	87,320	0	190	380	380	0	190	24
25	$60,000 to $99,999	101,300	100,700	33,690	66,450	0	0	380	190	0	0	25
26	$100,000 or more	47,900	47,340	25,930	21,410	0	0	0	0	0	0	26

Backward-Looking Table 1: Structural and Location Characteristics – All Housing Units

	A Characteristics	B Published numbers	C Present in 2002	D 2002 units present in 1995	E Change in character-istics	F '02 mobile homes moved in	G '02 units derived from nonresidential use	H '02 units added by new construction	I '02 units added from temporary losses	
1	**Total**	811,700	811,800	705,410	0	200	1,150	103,500	1,540	1
	Occupancy Status									
2	Occupied	747,800	747,800	616,500	39,310	200	790	89,820	1,190	2
3	Vacant	61,500	61,500	7,550	39,690	0	350	13,550	350	3
4	Seasonal	2,500	2,500	160	2,210	0	0	140	0	4
	Units in Structure									
5	1, detached	529,500	537,840	474,470	0	200	380	62,190	590	5
6	1, attached	50,300	51,340	40,310	0	0	0	11,030	0	6
7	2 to 4	54,800	57,190	51,580	0	0	200	5,420	0	7
8	5 to 9	39,300	39,460	34,400	0	0	200	4,860	0	8
9	10 to 19	46,700	46,790	38,270	0	0	0	8,520	0	9
10	20 to 49	27,300	25,380	18,330	0	0	0	7,060	0	10
11	50 or more	24,800	24,940	19,560	0	0	180	4,250	950	11
12	Mobile Home/trailer	39,000	28,870	28,490	0	0	200	180	0	12
	Year Built									
13	1996-2002	Incldd in 14	94,070	5,620	0	0	0	88,450	0	13
14	1990-1995	208,200	102,020	86,370	0	0	400	15,060	200	14
15	1985-1989	52,900	53,040	52,640	0	200	0	0	200	15
16	1980-1984	39,300	39,600	39,220	0	0	200	0	180	16
17	1970-1979	172,400	175,500	175,320	0	0	0	0	180	17
18	1960-1969	90,800	91,470	91,090	0	0	180	0	200	18
19	1950-1959	75,300	77,910	77,710	0	0	0	0	200	19
20	1940-1949	56,900	59,360	59,160	0	0	0	0	200	20
21	1930-1939	25,900	26,280	26,080	0	0	0	0	200	21
22	1920-1929	40,700	41,690	41,310	0	0	380	0	0	22
23	1919 or earlier	49,400	50,880	50,880	0	0	0	0	0	23

Backward-Looking Table 1 (continued): Structural and Location Characteristics – All Housing Units

	A Characteristics	B Published numbers	C Present in 2002	D 2002 units present in 1995	E Change in character-istics	F '02 mobile homes moved in	G '02 units derived from nonresidential use	H '02 units added by new construction	I '02 units added from temporary losses	
	Rooms									
24	1 – 4 rooms	226,900	224,740	157,410	40,720	200	750	24,720	950	24
25	5 rooms	154,800	154,290	56,370	77,630	0	200	19,900	200	25
26	6 rooms	151,500	151,840	55,290	79,030	0	200	17,120	200	26
27	7 rooms	117,900	118,140	42,460	63,380	0	0	12,300	0	27
28	8 rooms	85,300	86,560	24,270	47,430	0	0	14,850	0	28
29	9 rooms	38,600	38,810	9,730	21,450	0	0	7,430	200	29
30	10 rooms or more	36,900	37,420	11,700	18,540	0	0	7,170	0	30
	Bedrooms									
31	None	8,100	7,710	5,740	940	0	0	1,030	0	31
32	1	92,900	90,700	64,890	14,680	200	550	9,430	950	32
33	2	228,900	229,520	177,740	27,920	0	200	23,650	0	33
34	3	316,500	315,880	231,390	41,200	0	200	42,490	590	34
35	4 or more	165,300	168,000	107,270	33,630	0	200	26,890	0	35
36	**Multiunit Structures**	192,900	193,760	162,130	0	0	570	30,110	950	36
	Stories in Structures									
37	1		27,020	26,060	0	0	0	960	0	37
38	2		101,160	88,550	0	0	570	11,490	550	38
39	3		49,200	33,700	0	0	0	15,100	400	39
40	4 to 6		10,360	8,310	0	0	0	2,050	0	40
41	7 or more		6,020	5,510	0	0	0	510	0	41
	Metro Status									
42	In central cities		220,670	205,140	0	0	400	14,940	200	42
43	In suburbs		591,130	500,270	0	200	750	88,560	1,350	43
	Mover Status									
44	Moved in last 2 years		171,360	51,250	79,970	0	200	39,750	200	44
45	Not a recent mover		576,440	422,080	102,500	200	590	50,070	990	45

Backward-Looking Table 2: Condition of Unit – All Occupied Units

	A Characteristics	B Published numbers	C Present in 2002	D 2002 units present in 1995	E Change in character-istics	F '02 mobile homes moved in	G '02 units derived from nonresidential use	H '02 units added by new construction	I '02 units added from temporary losses	
1	**Occupied Units**	747,800	747,800	616,500	39,310	200	790	89,820	1,190	1
	Kitchen									
2	With complete kitchen	736,600	736,800	604,400	41,120	200	590	89,290	1,190	2
3	Lacking complete kitchen facilities	11,100	11,000	1,210	9,070	0	200	530	0	3
	Plumbing									
4	With all plumbing facilities	742,100	742,560	608,380	42,530	200	790	89,470	1,190	4
5	Lack some plumbing	5,600	5,240	200	4,690	0	0	350	0	5
6	No hot piped water	400	200	0	200	0	0	0	0	6
7	No bathtub/shower	1,000	600	200	400	0	0	0	0	7
8	No flush toilet	1,600	1,210	200	1,010	0	0	0	0	8
	Water									
9	Public/private water	692,200	681,530	550,080	42,930	200	590	86,530	1,190	9
10	Well	52,700	62,940	52,760	7,000	0	200	2,980	0	10
11	Other water source	2,900	3,330	2,220	810	0	0	310	0	11
	Sewer									
12	Public sewer	645,600	646,020	493,890	67,270	200	590	83,070	990	12
13	Septic tank/cesspool	102,100	101,780	88,190	6,450	0	200	6,750	200	13
14	**Severe Problems**	10,100	9,270	200	8,720	0	0	350	0	14
15	Plumbing	5,600	5,240	200	4,690	0	0	350	0	15
16	Heating	4,300	3,630	0	3,630	0	0	0	0	16
17	Electric	200	200	0	200	0	0	0	0	17
18	Upkeep	400	400	0	400	0	0	0	0	18
19	Hallways	0	0	0	0	0	0	0	0	19
20	**Moderate problems**	20,200	20,830	1,210	18,540	0	200	880	0	20
21	Plumbing	2,300	2,620	0	2,620	0	0	0	0	21
22	Heating	1,100	1,210	0	1,210	0	0	0	0	22
23	Kitchen	9,900	11,000	1,210	9,070	0	200	530	0	23
24	Upkeep	7,000	7,810	400	7,050	0	0	350	0	24
25	Hallways	600	600	0	600	0	0	0	0	25

Backward-Looking Table 3: Household Characteristics – All Occupied Units

	A Characteristics	B Published numbers	C Present in 2002	D 2002 units present in 1995	E Change in character-istics	F '02 mobile homes moved in	G '02 units derived from nonresidential use	H '02 units added by new construction	I '02 units added from temporary losses	
1	**Occupied units**	747,800	747,800	616,500	39,310	200	790	89,820	1,190	1
	Age									
2	Under 65	619,800	621,240	460,330	75,790	200	590	83,730	590	2
3	65 or older	127,900	126,560	79,320	40,360	0	200	6,090	590	3
	Children									
4	Some	250,700	254,200	125,630	86,620	0	200	41,350	400	4
5	None	497,200	493,600	324,220	119,330	200	590	48,460	790	5
	Race/Origin									
6	White	672,800	673,870	548,010	49,380	200	590	74,490	1,190	6
7	Hispanic	25,400	25,310	5,190	16,880	0	0	3,240	0	7
8	Non-Hispanic	647,400	648,550	521,510	53,820	200	590	71,240	1,190	8
9	Black	16,200	15,530	5,040	7,860	0	0	2,630	0	9
10	Other	58,700	58,410	15,220	30,290	0	200	12,700	0	10
11	Total Hispanics	39,600	39,680	8,620	26,150	0	0	4,910	0	11
	Income Source									
12	Wages and salaries	602,200	603,800	420,020	103,000	200	590	79,390	590	12
13	Welfare or SSI	30,400	30,190	5,040	22,170	0	0	2,980	0	13
14	Social security or pension	176,900	174,330	101,590	60,420	0	200	11,130	990	14

Backward-Looking Table 4: Market Dynamics and Affordability – All Occupied Units

	A Characteristics	B Published numbers	C Present in 2002	D 2002 units present in 1995	E Change in character-istics	F '02 mobile homes moved in	G '02 units derived from nonresidential use	H '02 units added by new construction	I '02 units added from temporary losses	
1	**Occupied units**	747,800	747,800	616,500	39,310	200	790	89,820	1,190	1
	Tenure									
2	Owner occupied	497,600	495,110	390,130	42,930	200	400	60,850	590	2
3	Percent own occupied	66.5%	66.2%	63.3%	NA	100.0%	50.0%	67.7%	50.0%	3
4	Renter occupied	250,200	252,690	174,960	47,770	0	400	28,970	590	4
	Rental Affordability									
5	Non-market		27,370	13,100	11,090	0	0	2,980	200	5
6	Extremely low rent		42,380	13,100	27,410	0	200	1,660	0	6
7	Very low rent		108,520	47,570	50,590	0	200	10,160	0	7
8	Low rent		45,230	10,880	27,160	0	0	7,180	0	8
9	Moderate rent		16,890	3,070	9,880	0	0	3,940	0	9
10	High to very high rent		12,300	4,030	4,840	0	0	3,040	400	10
	Renter Hsd Income									
12	Less than $20,000	74,900	75,410	30,490	37,340	0	200	7,180	200	12
13	$20,000 to $34,999	69,300	69,420	17,940	44,290	0	0	6,790	400	13
14	$35,000 to $59,999	67,000	68,840	13,710	46,910	0	200	8,020	0	14
15	$60,000 to $99,999	28,200	28,290	2,220	21,770	0	0	4,310	0	15
16	$100,000 or more	10,800	10,730	200	7,860	0	0	2,670	0	16
	Owner Monthly Housing Costs									
17	Less than $499	139,400	124,240	74,630	43,390	200	0	5,830	200	17
18	$500 to $699	42,400	44,930	7,660	34,620	0	0	2,450	200	18
19	$700 to $999	61,900	60,050	17,330	39,610	0	0	3,110	0	19
20	$1,000 to $1,499	136,400	136,860	30,740	83,600	0	200	22,120	200	20
21	$1,500 or more	117,500	129,020	19,450	82,040	0	200	27,340	0	21
	Owner Hsd Income									
22	Less than $20,000	55,800	52,650	20,110	30,130	0	0	2,410	0	22
23	$20,000 to $34,999	72,700	72,190	21,060	45,300	200	0	5,430	200	23
24	$35,000 to $59,999	107,000	106,080	34,970	57,700	0	0	13,010	400	24
25	$60,000 to $99,999	147,600	148,550	34,570	92,020	0	200	21,770	0	25
26	$100,000 or more	114,500	115,630	26,610	70,600	0	200	18,220	0	26

Rental Market Dynamics[15]

Table A expands the analysis in rows 5-11 in Forward-Looking Table 4 into a full rental dynamics analysis by examining in more detail what happened to the units in each row. In particular, the "present in 2002" and "change in characteristics" columns (column D and E in the CINCH tables) are disaggregated into the following options: each of the other rent affordability columns (new columns *D* through *J*), owner-occupancy (new column *K*), and vacant or seasonal status (new column *L*). The remaining columns (columns F through K in the CINCH tables) are collapsed into a "Lost to stock" column (new column *M*). Table B does the same for the analysis of rows 5-11 in Backward-Looking Table 4, with column *M* being additions through new construction and column *N* being additions from other sources.[16] Because the Census Bureau put a cap on the rents it reported for Portland in 1995, we cannot distinguish between units in the high-rent and very-high-rent categories, and therefore have collapsed these two categories into one category, high-to-very-high-rent units (column *J*).

Table A shows that there were 231,550 rental units in the Portland metropolitan area in 1995. In 2002, 61,040 of these units were no longer rental; 28,090 were owner-occupied, 26,570 were either vacant or being used seasonally, and 6,380 had been lost to the stock. Taken as a proportion of the units in 1995, movement into owner-occupancy was concentrated among the moderate-rent and the high-to-very-high-rent categories, and losses to the stock were spread evenly across all the rent categories except high-to-very-high-rent units.

Table B shows there were 252,690 rental units in the Portland metropolitan area in 2002, of which 77,740 were not rental units in 1995. The new units came from units that had been owner-occupied (22,580), units that had been vacant or in seasonal use (25,200), newly constructed units (28,970), and other additions (990). Most of the formerly owner-occupied units went to the very-low-rent and low-rent categories; most of the newly constructed rental units went to the very-low-rent and low-rent categories.

Looking at both tables, we see that the overall number of rental units grew by approximately 20,000 between 1995 and 2002. The number of extremely-low-rent and very-low-rent units combined grew from approximately 115,000 in 1995 to approximately 150,000 in 2002.

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[15] This rental dynamics analysis differs from previous analyses in two ways: we do not adjust rents for bedroom sizes and we do not adjust area median family income for inflation.

[16] These tables use all the AHS observations for which we have relevant rent data, including observations where the Census Bureau provided an estimate of contract rent when the respondent did not provide an answer to the rent question. These observations are said to have "allocated" rents. The Watson-Eggers paper cited in footnote 1 studied the effect of allocations on rental dynamics analysis. They found that unallocated data show less dispersion. In their study of the six metropolitan areas surveyed as part of the national AHS, they found that the proportion of rental units that remain in the same rent category increased for all categories except non-market, where the proportion decreased slightly. There also appeared to be less movement of more than one rent category.

Table A: Forward-Looking Rental Dynamics Analysis

Forward looking	*C* Number in 1995	*D* Non-market in 2002	*E* Extremely low rent in 2002	*F* Very low rent in 2002	*G* Low rent in 2002	*H* Moderate rent in 2002	*J* High to very high rent in 2002	*K* Owner-occupied in 2002	*L* Vacant or seasonal in 2002	*M* Lost to stock
Non-market	29,080	12,770	4,130	3,930	1,570	0	0	2,950	2,800	940
Extremely low rent	27,070	1,570	12,770	3,540	980	0	390	3,140	3,930	750
Very low rent	87,090	3,730	15,320	46,360	4,130	590	0	4,910	9,430	2,630
Low rent	49,050	1,380	390	20,820	10,610	1,380	200	7,070	5,890	1,310
Moderate rent	25,700	1,180	200	1,180	8,790	3,000	790	6,880	2,950	750
High to very high rent	13,550	200	200	590	390	3,540	3,930	3,140	1,570	0
Column sum	231,550	20,820	33,000	76,420	26,470	8,500	5,300	28,090	26,570	6,380

Table B: Backward-Looking Rental Dynamics Analysis

Backward looking	*C* Number in 2002	*D* Non-market in 1995	*E* Extremely low rent in 1995	*F* Very low rent in 1995	*G* Low rent in 1995	*H* Moderate rent in 1995	*J* High to very high rent in 1995	*K* Owner-occupied in 1995	*L* Vacant or seasonal in 1995	*M* New construc-tion	*N* Other additions
Non-market	27,370	13,100	1,610	3,830	1,410	1,210	200	1,410	1,410	2,980	200
Extremely low rent	42,380	4,230	13,100	15,720	400	200	200	3,830	2,820	1,660	200
Very low rent	108,520	4,030	3,630	47,570	21,370	1,210	600	5,240	14,510	10,160	200
Low rent	45,230	1,610	1,010	4,230	10,880	9,020	400	5,640	5,240	7,180	0
Moderate rent	16,890	0	0	600	1,410	3,070	3,630	3,230	1,010	3,940	0
High to very high rent	12,300	0	400	0	200	810	4,030	3,230	200	3,040	400
Column sum	252,690	22,980	19,750	71,960	35,680	15,520	9,070	22,580	25,200	28,970	990

Appendix A – Internal and External Checks

For the CINCH analysis, we performed two tests of internal consistency:

- For each row, we tested whether the sum of possible outcomes (columns D though K in the forward-looking analysis and columns D through I in the backward-looking analysis) equaled the number of units present in the base year. In every case, equality was achieved except for differences created by rounding.

- Throughout the tables, various sets of rows are related to each other. For example, the year-built rows (13-23) in Table 1 are a disaggregation of the total stock in row 1. Similarly, rows 6 (Whites), 9 (Blacks), and 10 (Other race) in Table 3 are a disaggregation of row 1 (occupied households). In these cases, there should be equality between the parent row and the sum of the break-out rows for all columns except D and E. The difference between column D in the parent row and the sum of column D for the break-out rows should equal the negative of the difference between column E in the parent row and the sum of column E for the break-out rows. In every case, equality was achieved except for differences created by rounding.

Column B provides an external check of how well the CINCH weighting performed. In general, the CINCH estimates are within 5 percent of the AHS published totals and many of the CINCH estimates are very close to the AHS estimates. We have footnoted two places where our coding does not seem to produce the same results as the published estimates. We observed that the correspondence between the CINCH and published estimates were closer in the slower growing metropolitan areas. We also noticed that the CINCH weighting tends to underestimate the number of units built since 1989 and the number of Hispanic households.

Appendix B – Weighting

CINCH separates the AHS samples in 1995 and 2002 into three components: units that exist and are part of the housing stock in both years (SAMES), units that are part of the 1995 housing stock but are not part of the 2002 housing stock (LOSSES), and units that are not part of the 1995 housing stock but are part of the 2002 housing stock (ADDITIONS). ADDITIONS are split into NEW CONSTRUCTION and RECOVERIES (structures that existed in 1995 but were not in the housing stock).

Because CINCH looks at various subsets of the housing stock, we need to know the characteristics of units and their occupants. Therefore, we can use only those SAMES observations that were interviewed in both years. For the same reason, we can use only those LOSSES that were interviewed in 1995 and those ADDITIONS that were interviewed in 2002.

For the forward-looking analysis, we started with the AHS pure weights and used the AHS weighted count in 1995 of SAMES to create weights for the interviewed SAMES. We used the AHS weighted count in 1995 of LOSSES to create weights for interviewed LOSSES. We then adjusted the weights of SAMES and LOSSES to equal the AHS published totals for occupied units, vacant units, and seasonal units in 1995.

For the backward-looking analysis, we started with the AHS pure weights and used the AHS weighted count in 2002 of SAMES to create weights for the interviewed SAMES. We used the AHS weighted counts in 2002 for NEW CONSTRUCTION and for RECOVERIES to create weights for interviewed NEW CONSTRUCTION and interviewed RECOVERIES. We then adjusted the weights for SAMES, NEW CONSTRUCTION, and RECOVERIES to equal AHS published totals for occupied units, vacant units, and seasonal units in 2002.

The logic behind the weighting and the procedures used to create the weights is explained in *Weighting for CINCH and Rental Dynamics Analysis*.