

American Housing Survey

**Components of Inventory Change and
Rental Dynamics Analysis:
Phoenix, 2002–2011**

Prepared For:

**U.S. Department of Housing & Urban Development
Office of Policy Development & Research**

Prepared By:

**Frederick J. Eggers & Fouad Moumen
Econometrica, Inc.
Bethesda, MD**

**Contract No. C-CHI-01030
Order No. CHI-T0002
Project No. 1053-002**

May 2015

Table of Contents

Executive Summary	iv
1. Introduction	1
2. Special Issues: Phoenix	2
3. Changes to the Housing Stock: 2002–2011	3
4. Components With Atypical Losses or Additions	5
5. Rental Market Dynamics: 2002–2011	11
6. Summary of Housing Market Changes: Phoenix Metropolitan Area, 2002–2011	14
Appendix A: CINCH and Rental Dynamics Methodology	A-1
Appendix B: CINCH and Rental Dynamics Tables	B-1

List of Tables

Table 1: Disposition of 2002 Phoenix Housing Units in 2011	4
Table 2: Sources for 2011 Phoenix Housing Stock	5
Table 3: Sectors Experiencing Atypical Loss Rates in Phoenix, 2002–2011	6
Table 4: Sectors Experiencing Atypical Rates of Addition in Phoenix, 2002–2011	9
Table 5: Summary of Forward-Looking Rental Dynamics for Phoenix.....	12
Table 6: Summary of Backward-Looking Rental Dynamics for Phoenix	13
Forward-Looking Table A: Housing Characteristics, Phoenix.....	B-6
Forward-Looking Table B: Unit Quality, Phoenix	B-9
Forward-Looking Table C: Occupant Characteristics, Phoenix	B-11
Forward-Looking Table D: Income and Housing Cost, Phoenix	B-13
Backward-Looking Table A: Housing Characteristics, Phoenix	B-15
Backward-Looking Table B: Unit Quality, Phoenix	B-18
Backward-Looking Table C: Occupant Characteristics, Phoenix	B-20
Backward-Looking Table D: Income and Housing Cost, Phoenix.....	B-22
Forward-Looking Rental Dynamics Table 1: Counts, 2002–2011, Phoenix (All Numbers in Thousands).....	B-24
Forward-Looking Rental Dynamics Table 2: Row Percentages, 2002–2011, Phoenix	B-24
Backward-Looking Rental Dynamics Table 1: Counts, 2002–2011, Phoenix (All Numbers in Thousands).....	B-25
Backward-Looking Rental Dynamics Table 2: Row Percentages, 2002–2011, Phoenix.....	B-25

List of Figures

Figure A-1: How the Housing Inventory Changes	A-1
-----------------------------------------------------	-----

Executive Summary

Components of Inventory Change (CINCH) is a tool used by housing analysts to study how the housing inventory changes over time. One typically thinks of the housing stock as evolving through two mechanisms—the construction of new units and the demolition of old units. While new construction and losses through demolition and natural disasters are the primary means by which the housing stock changes, CINCH shows that there are other important engines of change.

This report describes how the housing stock in the Phoenix metropolitan area changed between 2002 and 2011, with particular emphasis on affordable rental housing. The study uses data from the American Housing Survey, which collected detailed information on housing units in Phoenix and on their occupants in both 2002 and 2011.

In 2002 the Phoenix metropolitan area contained 1,340,300 housing units, including vacant units. By 2011 the number of housing units had increased to 1,821,700. Part of this increase was due to a redefinition of the metropolitan area that added Pinal County. We estimate that the 2011 count of housing units for the metropolitan area as defined in 2002 would be 1,675,900. This represents an overall increase of 25.0 percent, which translates to an average annual increase of 2.5 percent over the 9-year period.

Between 2002 and 2011, only 14,300 units left the housing stock. Of these, 5,600 are clearly permanent losses—the original unit is gone, and major construction would be required to replace it with a new unit. Another 3,800 are temporary losses—the original unit needs repairs or is being used for other purposes. These units may or may not return to the housing stock. Finally, there were 4,900 units that left the housing stock either permanently or temporarily for “other” reasons, a category that encompasses a wide variety of situations.

In the period between the 2002 and the 2011 AHS surveys, 359,300 units were added to the housing stock. Ninety-six percent of these additions were newly constructed units. The 2011 AHS did track move-ins of mobile homes in Phoenix, a factor that contributed 4,200 units. No units were formed from the conversion or merger of 2002 units. We classified 8,500 units as recovered because these units had been in the housing stock at some point but were classified in 2002 as nonresidential (7,900) or uninhabitable (600). Finally, no units were added in other unclassified ways.

The Phoenix metropolitan area lost 1.1 percent of all 2002 housing units by 2011; additions between 2002 and 2011 represented 19.7 percent of the 2011 housing stock. Losses and additions varied across portions of the Phoenix housing market defined by the characteristics of the unit or its occupants. We observed the following patterns, which were both atypical of the overall housing stock and statistically significant:

- Units in multifamily structures had a higher-than-average loss rate, and the rate was particularly high among units in multifamily buildings with 2–4 units or with 1 floor or 7 or more floors.

- The loss rate was lower among units built in 1985 or later.
- Smaller units (1 or 3 rooms or 1 bedroom) experienced high loss rates, whereas larger units (4 or more bedrooms) had lower rates.
- Loss rates were high among units with severe physical problems, particularly among units lacking complete plumbing or exclusive use of bathroom facilities. Units lacking complete kitchen facilities also experienced high loss rates.
- Units occupied in 2002 by households with Hispanic householders or householders who identified their race as “Other” had high loss rates.
- Units that were owner-occupied in 2002 experienced a low loss rate, but units that were renter-occupied had a high loss rate. Among 2002 rental units, those with low monthly housing costs (less than \$600) and those occupied by low-income households (less than \$15,000) had high loss rates. Among 2002 owner-occupied units, those with high monthly housing costs (\$1,250 or more) and those occupied by high-income households (\$50,000 or more) had low loss rates.
- Single-family detached units had a high rate of addition, while single-family attached units and manufactured houses had low rates of addition.
- Overall, units in multifamily structures experienced a low rate of addition, and low rates were characteristic of units in all multifamily buildings (regardless of the number of units in the building) and units in 1- and 2-story multifamily structures.
- The rate of addition also varied sharply by unit size. As measured by the number of rooms, 6 rooms was the dividing line. Units with fewer than 6 rooms had below-average rates of addition; units with 7 or more rooms had above-average rates. Units with fewer than 3 bedrooms had below-average rates of addition, and units with 4 or more bedrooms had an above-average rate.
- The rate of addition was higher than average among units with wells.
- New additions to the stock were underrepresented among units in 2011 with moderate physical problems. Specifically, units lacking complete kitchen facilities had a low rate of addition.
- Units occupied by households with elderly householders (65 years or older) had low rates of addition. Units occupied by households with children had an above-average rate of addition, while those without children had a below-average rate.
- As separate groups, households in 2011 with American Indian householders had low rates of addition, whereas those with Black or Asian householders had higher-than-average rates.

- The rate of addition was low among units that were renter-occupied in 2011 and, among rental units, particularly low for those occupied by households earning less than \$30,000 and those with low rents (\$350–\$799). Additions were higher than normal among high-cost rentals (\$1,250 per month or more) and those occupied by households earning between \$50,000 and \$99,999.
- The rate of addition among units that were owner-occupied in 2011 was higher than that of all occupied units but not statistically different. Among owner-occupied units, those occupied by lower income owners (less than \$30,000) and those with lower monthly housing costs (less than \$600) had lower rates of addition, while those occupied by high-income owners (\$50,000 or more) and those with high monthly housing costs (\$1,250 or more) had higher-than-average rates of addition.

The 2002 rental stock in Phoenix was on the borderline between affordable and not affordable. Of the 440,200 rental units in 2002, 189,700 were extremely low rent or very low rent units. In addition, 58,100 units were non-market; that is, they were either assisted or offered for no cash rent. These three categories accounted for 56.3 percent of the 2002 rental stock. The three highest rent categories comprised 5.1 percent of the rental stock. Moves to a less affordable category (sometimes called gentrification) exceeded moves to a more affordable category (sometimes called filtration)—34.6 percent of all 2002 units compared to 10.4 percent. By 2011, 22.7 percent of the rental units in 2002 were no longer in the rental stock. The largest proportion of these losses was due to changes in tenure.

The rental stock in Phoenix was less affordable in 2011 than in 2002. Of the 647,800 rental units in 2011, 156,600 were extremely low rent or very low rent units. In addition, 47,000 units were non-market; that is, they were either assisted or offered for no cash rent. These three categories accounted for 31.4 percent of the 2011 rental stock. The three highest rent categories comprised 15.7 percent of the rental stock. Moves from a more affordable category (sometimes called gentrification) exceeded moves from a less affordable category (sometimes called filtration)—26.2 percent of all 2011 units compared to 7.9 percent. Of the rental units in 2011, 41.1 percent were not rental in 2002. The largest proportion of these gains was due to changes in tenure.

Components of Inventory Change and Rental Dynamics Analysis: Phoenix, 2002–2011

1. Introduction

This report describes how the housing stock in the Phoenix metropolitan area changed between 2002 and 2011, with particular emphasis on affordable rental housing. The study uses data from the American Housing Survey (AHS), which collected detailed information on housing units in Phoenix and on their occupants in both 2002 and 2011.¹

As part of its Components of Inventory Change (CINCH) program, the U.S. Department of Housing and Urban Development (HUD) has funded, for a number of years, similar studies of metropolitan areas to document changes in the American housing stock. These studies have traditionally included an assessment of changes in the rental housing market called rental dynamics. This paper is one of 29 metropolitan CINCH studies based on the information provided by the 2011 AHS.²

CINCH reports present both forward-looking analysis (what happened to the 2002 units by 2011) and backward-looking analysis (where the 2011 units came from in terms of 2002).³ This paper repeats the analysis contained in the most recent CINCH and rental dynamics studies, but its organization differs from that of previous reports.

- Section 2 discusses data and related issues that affect the CINCH and rental dynamics analysis for Phoenix.
- Section 3 explains the changes in the housing stock between 2002 and 2011 in terms of losses to the housing stock through demolitions or the other ways units can leave the housing stock and additions through new construction and other means.
- Section 4 looks at components of the housing stock that experienced losses or additions markedly different from the overall patterns of losses and additions.
- Section 5 breaks the rental housing stock into eight affordability categories and tracks what happened to units in each of those categories between 2002 and 2011.

¹ Since 1973, the U.S. Department of Housing and Urban Development (HUD) and the Census Bureau have conducted an extensive survey of the American housing stock called the American Housing Survey (AHS). The AHS has two components: a national survey that, since 1985, has collected data every 2 years on the entire U.S. housing stock and a metropolitan component that, since 1985, has collected data at various times on the housing stock of 45 metropolitan areas. Both the national and metropolitan components use the same sample of housing units in successive surveys, making it possible to observe changes in units over time. The initial samples have been augmented in later years to account for units added by new construction or other means.

² HUD also funds CINCH studies of survey-to-survey changes in the national stock. At the national level, the Rental Dynamics studies are published separately. For a complete list of all CINCH studies, see <http://www.huduser.org/portal/datasets/cinch.html>.

³ The forward-looking analysis was previously presented to HUD in December 2013. The data needed to produce the backward-looking analysis did not become available until after the allowed period of performance of the contract under which the previous report was completed.

- Section 6 summarizes the changes to the housing stock of the Phoenix metropolitan area between 2002 and 2011.

The paper concludes with two appendices that contain analyses and data found in the body of previous CINCH reports.

- Appendix A explains the CINCH and rental dynamics methodologies.
- Appendix B contains the detailed CINCH and rental dynamics tables found in previous reports.

National economic conditions shaped in important ways the changes observed in this report. The 2002–2011 period encompassed a vigorous expansion (November 2001 to December 2007), included the recent harsh recession (December 2007 to June 2009), and ended with a period of lackluster recovery.

2. Special Issues: Phoenix

Metropolitan areas are composed of counties or townships that are interrelated economically. The Office of Management and Budget periodically adjusts the composition of metropolitan areas as the economic relationships among counties change. In some cases, the AHS retains the metropolitan boundaries in effect when the original metropolitan sample was drawn; in other cases, the AHS will adjust the original sample to correspond to the new definition of the metropolitan area. A change in sample boundaries will affect the interpretation of CINCH analysis and its precision. The absolute sample size available to study changes between surveys determines how reliably the observed changes are measured.

Geography

In 2002 the Phoenix metropolitan area contained 1,340,300 housing units, including vacant units. By 2011 the number of housing units had increased to 1,821,700. Part of this increase was due to a redefinition of the metropolitan area that added Pinal County. Using the American Community Survey (2011, 5-year data) at the county level, we estimate that the 2011 count of housing units for the metropolitan area as defined in 2002 would be 1,675,900. This represents an overall increase of 25.0 percent, which translates to an average annual increase of 2.5 percent over the 9-year period.

The change in the geographical definition of Phoenix affects the interpretation of the information presented in this report. Our analysis applies only to that portion of the metropolitan area that was common to the Phoenix metropolitan area as defined in both 2002 and 2011, but the application to the common area is not precise, as explained in Appendix A.

Sample size

Both CINCH and rental dynamics require that, if a sample unit is in both the 2002 and 2011 housing stock, it must be interviewed in both surveys to be included in the analysis. Other

analytical requirements also limit effective sample size. There are 2,062 sample units that were common to the 2002 and 2011 AHS Phoenix surveys and satisfied all the analytical requirements.⁴ Between 2002 and 2011, 59 sample units in the common area meeting the analytical requirements were lost to the stock; thus, the forward-looking analysis is based on a maximum of 2,121 sample units. Between 2002 and 2011, 581 sample units meeting the analytical requirements were added to the AHS survey to represent additions to the stock throughout the metropolitan area as defined in 2011; thus, the backward-looking analysis is based on a maximum of 2,643 sample units. In the forward-looking analysis, the average weight of a sample unit is approximately 632 units; in the backward-looking analysis, the average weight of a sample unit is approximately 689 units.

Data reliability

All CINCH analysis relies on two AHS variables: NOINT (why there was no interview), which, among other things, explains why a unit is temporarily or permanently out of the stock, and REUAD (why unit added), which explains why a sample unit entered the sample. Both variables require some detective work on the part of Census Bureau staff, and the longer the period between surveys, the more difficult the detective work. At the national level, the AHS data are collected every 2 years, so it is relatively easy to determine why a unit has been removed from or added to the sample. In the case of Phoenix, 9 years separate the 2011 sample from the 2002 sample. As a result, explaining the loss or addition of sample units is very challenging. This report is part of a series that compares the housing stock in 2011 to the housing stock of 7 metropolitan areas in 1998, 12 metropolitan areas in 2002, 8 metropolitan areas in 2004, and 2 metropolitan areas in 2009. We compared the pattern of changes across the 29 areas studied in these reports to the changes recorded between 2009 and 2011 at the national level. With respect to losses, the patterns are reasonably similar except for the role played by the movement of mobile homes. Mobile home move-outs are much more important in explaining losses at the national level. At both the national and metropolitan levels, the “other” category accounts for one-fifth to one-quarter of the losses. With respect to additions, new construction accounts for 72 percent of all additions at the national level but 94 percent at the metropolitan level. We suspect that data issues downplay the importance of “means other than new construction” at the metropolitan level.

3. Changes to the Housing Stock: 2002–2011

Losses between 2002 and 2011

One typically thinks of the housing stock evolving through two mechanisms: the construction of new units and the demolition of old units. While new construction and losses through demolition and natural disasters are the primary means by which the housing stock changes, CINCH shows that there are other important engines of change.

⁴ The 2002 AHS surveyed 5,056 units in the Phoenix metropolitan area; 2,772 of these units were in the 2011 AHS public use file (PUF). Of the 2,284 sample units no longer in the survey, 414 were legitimate temporary or permanent losses to the housing stock and were considered for the analysis. The remaining 1,870 cases are coded as “sample reduction for the current survey year” with no further explanation.

Table 1 reports that, between 2002 and 2011, only 14,300 units left the housing stock.⁵ Of these, 5,600 are clearly permanent losses—the original unit is gone, and major construction would be required to replace it with a new unit. Another 3,800 are temporary losses—the original unit needs repairs or is being used for other purposes. These units may or may not return to the housing stock. Finally, there were 4,900 units that left the housing stock either permanently or temporarily for “other” reasons, a category that encompasses a wide variety of situations.

Table 1: Disposition of 2002 Phoenix Housing Units in 2011⁶

Present in 2002	1,340,300
2002 units present in 2011	1,326,000
Units no longer in the stock	14,300
2002 units lost due to conversion/merger	400
2002 house or mobile home moved out	200
2002 units lost through demolition or disaster	5,000
Permanent losses	5,600
2002 units changed to nonresidential use	2,000
2002 units badly damaged or condemned	1,800
Temporary losses	3,800
2002 units lost in other ways	4,900

Demolitions and natural disasters accounted for 5,000 of the permanent losses, while mergers and conversions contributed another 400 permanent losses. “Conversion” is the terminology used in the AHS for the splitting of a unit into two or more units. The movement of a mobile home or house is considered a permanent loss because a housing unit is the combination of land and capital. While movement preserves the capital, it dissolves the union of capital and land that formed the original unit; therefore, the movement of a mobile home is considered a permanent loss. The 2011 AHS survey in Phoenix did track mobile home move-outs, a factor accounting for another 200 losses.

Sometimes houses are used for business purposes. Such commercial use or the use of a house for a group home is considered a change to a nonresidential use. Badly damaged units may be repaired, left in an unusable state, or demolished.

Appendix B contains four forward-looking tables that break the overall stock into more than 100 subgroups, such as single-family detached houses or units occupied by Black householders in 2002. For each subgroup, these tables detail how many of the 2002 units in that subgroup are in the same subgroup in 2011, have moved into another subgroup, or have left the stock and how they left the stock. Section 4 looks across the Appendix B forward-looking tables and focuses on those subgroups that lost an unusually high or an unusually low number of units over the 2002–2011 period.

⁵ With the caveats noted in Appendix A, this analysis applies to the area common to both the 2002 and 2011 definitions of the metropolitan area.

⁶ Numbers may not add consistently due to rounding. Counts were rounded to the nearest hundred.

Additions between 2002 and 2011

Table 2, together with the backward-looking Appendix B tables, provides a great deal of information on additions to the housing stock between 2002 and 2011.⁷

Table 2: Sources for 2011 Phoenix Housing Stock⁸

2011 housing stock	1,821,500
2011 units present in 2002	1,462,200
Total additions to stock	359,300
Units added by new construction	346,700
House or mobile home moved in	4,200
Units added by conversion/merger	0
New or reconstructed units	350,900
Units added from nonresidential use	7,900
Units added from temporary losses	600
Recovered units	8,500
Units added in other ways	0

In the period between the 2002 and the 2011 AHS surveys, 359,300 units were added to the housing stock. Ninety-six percent of these additions were newly constructed units. The 2011 AHS did track move-ins of mobile homes in Phoenix, a factor that contributed 4,200 units. No units were formed from the conversion or merger of 2002 units.

We classified 8,500 units as recovered because these units had been in the housing stock at some point but were classified in 2002 as nonresidential (7,900) or uninhabitable (600). Finally, no units were added in other unclassified ways.

Appendix B contains four backward-looking tables that break the overall stock into more than 100 subgroups. For each subgroup, these tables detail how many of the 2011 units in that subgroup were in the same subgroup in 2011, have moved from another subgroup, or are new additions to the stock. Section 4 looks across the Appendix B backward-looking tables and focuses on those subgroups that gained an unusually high or an unusually low number of units over the 2002–2011 period.

4. Components With Atypical Losses or Additions

The Phoenix metropolitan area lost 1.1 percent of all 2002 housing units by 2011, but the loss rate varied across sectors of the stock. For example, the occupied housing stock lost 1.0 percent of its units between 2002 and 2011.

⁷ With the caveats noted in Appendix A, this analysis applies to the area common to both the 2002 and 2011 definitions of the metropolitan area. Inconsistencies between Tables 1 and 2 result from a combination of (1) changes in metropolitan boundaries, (2) changes in control housing counts between censuses, and (3) different weights.

⁸ Numbers may not add consistently due to rounding. Counts were rounded to the nearest hundred.

We examined all of the components of the 2002 Phoenix housing stock contained in the four forward-looking tables in Appendix B to identify subgroups with unusual loss rates. Forward-Looking Table A reports information on all units in the stock; Table 3 lists subgroups from Table A with loss rates statistically different than the loss rate of the overall stock. Forward-Looking Tables B, C, and D describe important characteristics of occupied units and their residents; Table 3 lists subgroups from those tables with loss rates statistically different than the loss rate of occupied units. We also employed judgment in selecting among components with statistically different loss rates. In general, we looked for subgroups with loss rates less than half or more than double the benchmark rate, but we listed other subgroups if their inclusion illustrated interesting patterns within loss rates. Finally, Table 3 includes the loss rates for four key segments of the housing market—occupied units, vacant units, owner-occupied units, and renter-occupied units—even if their loss rates are not statistically different.

Table 3: Sectors Experiencing Atypical Loss Rates in Phoenix, 2002–2011⁹

Characteristics	Present in 2002	Total lost	Percent lost
<i>Housing stock</i>	1,340,300	14,300	1.1%
<i>Occupancy status</i>			
Occupied	1,165,700	12,000	1.0%
Vacant	150,600	2,300	1.5%
<i>Units in structure</i>			
2 to 4	60,500	3,500	5.7%**
<i>Year built</i>			
2000–2004	116,500	300	0.2%**
1995–1999	175,500	300	0.2%***
1990–1994	106,200	100	0.1%***
1985–1989	157,800	600	0.4%*
<i>Rooms</i>			
1	2,000	1,100	53.9%***
3	132,800	4,700	3.6%**
<i>Bedrooms</i>			
1	170,000	4,800	2.8%*
4 or more	282,600	1,000	0.4%*
<i>Multiunit structures</i>	294,700	6,300	2.1%*
<i>Stories in structure</i>			
1	58,100	3,700	6.4%**
7 or more	1,800	900	46.9%**
<i>Lacking complete kitchen facilities</i>	37,400	2,200	5.8%*
<i>Lacking some plumbing</i>	8,400	1,300	15.8%*
No exclusive use of bathroom facilities	7,500	1,300	17.8%*
<i>Severe problems</i>	12,200	2,100	17.3%**
Plumbing	8,400	1,300	15.8%*
<i>Moderate problems</i>			
Kitchen	37,400	2,200	5.8%*

⁹ Two conditions were necessary for a housing sector to appear in Table 3, one mathematical and one judgmental: (1) the difference between the sector’s loss rate and the benchmark rate had to have been statistically significant at the 10-percent level, and (2) the difference had to be interesting. Counts are rounded to the nearest hundred.

Characteristics	Present in 2002	Total lost	Percent lost
<i>Race and ethnicity</i>			
Other	128,300	4,200	3.3%*
Hispanic or Latino (any race)	244,900	5,900	2.4%*
<i>Tenure</i>			
Owner-occupied	810,300	3,500	0.4%**
Renter-occupied	355,400	8,700	2.4%**
<i>Renter monthly housing costs</i>			
Less than \$350	21,800	3,300	15.1%***
\$350 to \$599	110,900	4,500	4.1%**
<i>Renter household income</i>			
Less than \$15,000	79,300	4,800	6.1%***
<i>Owner monthly housing costs</i>			
\$1,250 or more	227,800	600	0.3%**
<i>Owner household income</i>			
\$50,000 to \$99,999	280,800	1,100	0.4%*
\$100,000 or more	151,800	800	0.5%**

*Statistically different from either all units or all occupied units, as appropriate, at the 10-percent level.

**Statistically different from either all units or all occupied units, as appropriate, at the 5-percent level.

*** Statistically different from either all units or all occupied units, as appropriate, at the 1-percent level.

Table 3 shows the following variation in loss rates across subgroups.

- Units in multifamily structures had a higher-than-average loss rate, and the rate was particularly high among units in multifamily buildings with 2–4 units or with 1 floor or 7 or more floors.
- The loss rate was lower among units built in 1985 or later.
- Smaller units (1 or 3 rooms or 1 bedroom) experienced high loss rates, whereas larger units (4 or more bedrooms) had lower rates.
- Loss rates were high among units with severe physical problems, particularly among units lacking complete plumbing or exclusive use of bathroom facilities. Units lacking complete kitchen facilities also experienced high loss rates.
- Units occupied in 2002 by households with Hispanic householders or householders who identified their race as “Other” had high loss rates.
- Units that were owner-occupied in 2002 experienced a low loss rate, but units that were renter-occupied had a high loss rate. Among 2002 rental units, those with low monthly housing costs (less than \$600) and those occupied by low-income households (less than \$15,000) had high loss rates. Among 2002 owner-occupied units, those with high monthly housing costs (\$1,250 or more) and those occupied by high-income households (\$50,000 or more) had low loss rates.

The 359,300 additions reported in Table 2 represented 19.7 percent of the 2011 housing stock. The rate of addition varied by the characteristics of the housing. Additions represented 19.1 percent of occupied units.

We examined all of the components of the 2002 Phoenix housing stock contained in the four backward-looking tables in Appendix B to identify subgroups with unusual addition rates. Backward-Looking Table A reports information on all units in the stock; Table 4 lists subgroups from Table A with addition rates statistically different than the addition rate of the overall stock. Backward-Looking Tables B, C, and D describe important characteristics of occupied units and their residents; Table 4 lists subgroups from those tables with addition rates statistically different than the addition rate of occupied units. We also employed judgment in selecting among components with statistically different addition rates. In general, we looked for subgroups with addition rates less than half or more than double the benchmark rate, but we listed other subgroups if their inclusion illustrated interesting patterns within addition rates. Finally, Table 4 includes the addition rates for four key segments of the housing market—occupied units, vacant units, owner-occupied units, and renter-occupied units—even if their addition rates are not statistically different.

Table 4: Sectors Experiencing Atypical Rates of Addition in Phoenix, 2002–2011¹⁰

Characteristics	Present in 2011	Total additions	Percent additions
<i>Housing stock</i>	1,821,500	359,300	19.7%
<i>Occupancy status</i>			
Occupied	1,510,000	287,800	19.1%
Vacant	254,400	56,000	22.0%
<i>Units in structure</i>			
1, detached	1,152,400	292,500	25.4%***
1, attached	113,400	13,600	12.0%***
2 to 4	101,900	15,000	14.7%*
5 to 9	106,300	9,800	9.3%***
10 to 19	118,900	8,400	7.0%***
20 to 49	74,900	10,100	13.5%**
50 or more	40,500	4,800	11.8%**
Manufactured/mobile home	113,200	5,000	4.5%***
<i>Rooms</i>			
3	158,300	15,500	9.8%***
4	344,400	32,000	9.3%***
5	374,100	61,100	16.3%*
7	257,800	61,500	23.9%*
8	177,700	46,000	25.9%**
9	63,200	31,800	50.3%***
10 or more	43,700	22,300	51.1%***
<i>Bedrooms</i>			
None	9,900	500	5.0%***
1	203,700	21,200	10.4%***
2	524,800	58,300	11.1%***
4 or more	449,800	144,900	32.2%***
<i>Multunit structures</i>	442,500	48,100	10.9%***
<i>Stories in structure</i>			
1	85,200	8,900	10.5%***
2	269,300	20,800	7.7%***
<i>Lacking complete kitchen facilities</i>	22,500	1,900	8.5%**
<i>Water</i>			
Well serving 1 to 5 units	11,600	6,200	53.7%***
<i>Moderate problems</i>	37,100	3,000	8.1%***
Kitchen	22,500	1,900	8.5%**
<i>Age of householder</i>			
65 to 74	187,600	25,600	13.6%**
75 or older	149,800	14,500	9.7%***
<i>Children in household</i>			
Some	526,500	133,200	25.3%***
None	983,500	154,600	15.7%**

¹⁰ Two conditions were necessary for a housing sector to appear in Table 4, one mathematical and one judgmental: (1) the difference between the sector's addition rate and the benchmark rate had to have been statistically significant at the 10-percent level, and (2) the difference had to be interesting. Counts are rounded to the nearest hundred.

Characteristics	Present in 2011	Total additions	Percent additions
<i>Race and ethnicity</i>			
Black	88,300	25,700	29.0% ***
Black Hispanic	10,000	5,500	54.6% ***
Black Non-Hispanic	78,300	20,200	25.8% *
American Indian or Alaska Native alone	25,100	2,500	10.2% *
Asian	39,700	12,100	30.4% *
<i>Tenure</i>			
Owner-occupied	980,800	201,500	20.5%
Renter-occupied	529,200	86,200	16.3% *
<i>Renter monthly housing costs</i>			
\$350 to \$599	61,300	4,300	6.9% ***
\$600 to \$799	128,300	12,000	9.4% ***
\$1,250 or more	99,500	30,000	30.2% ***
<i>Renter household income</i>			
Less than \$15,000	125,500	14,800	11.8% ***
\$15,000 to \$29,999	127,000	14,500	11.4% ***
\$50,000 to \$99,999	133,400	33,000	24.8% *
<i>Owner monthly housing costs</i>			
Less than \$350	51,100	4,300	8.4% ***
\$350 to \$599	156,100	14,200	9.1% ***
\$1,250 or more	463,300	134,600	29.0% ***
<i>Owner household income</i>			
Less than \$15,000	104,400	14,100	13.5% *
\$15,000 to \$29,999	151,000	20,400	13.5% **
\$50,000 to \$99,999	293,200	71,300	24.3% **
\$100,000 or more	254,300	67,100	26.4% ***

*Statistically different from either all units or all occupied units, as appropriate, at the 10-percent level.

**Statistically different from either all units or all occupied units, as appropriate, at the 5-percent level.

*** Statistically different from either all units or all occupied units, as appropriate, at the 1-percent level.

The results reported in Table 4 tell a clear story about changes in the Phoenix metropolitan area. The high rate of addition for the overall stock, combined with a large sample size, makes it easy to discern not only general patterns but also the dividing lines between below-average and above-average growth.

- Single-family detached units had a high rate of addition, while single-family attached units and manufactured houses had low rates of addition.
- Overall, units in multifamily structures experienced a low rate of addition, and low rates were characteristic of units in all multifamily buildings (regardless of the number of units in the building) and units in 1- and 2-story multifamily structures.
- The rate of addition also varied sharply by unit size. As measured by the number of rooms, 6 rooms was the dividing line. Units with fewer than 6 rooms had below-average rates of addition; units with 7 or more rooms had above-average rates. Units with fewer than 3 bedrooms had below-average rates of addition, and units with 4 or more bedrooms had an above-average rate.

- The rate of addition was higher than average among units with wells.
- New additions to the stock were underrepresented among units in 2011 with moderate physical problems. Specifically, units lacking complete kitchen facilities had a low rate of addition.
- Units occupied by households with elderly householders (65 years or older) had low rates of addition. Units occupied by households with children had an above-average rate of addition, while those without children had a below-average rate.
- As separate groups, households in 2011 with American Indian householders had low rates of addition, whereas those with Black or Asian householders had higher-than-average rates.
- The rate of addition was low among units that were renter-occupied in 2011 and, among rental units, particularly low for those occupied by households earning less than \$30,000 and those with low rents (\$350–\$799). Additions were higher than normal among high-cost rentals (\$1,250 per month or more) and those occupied by households earning between \$50,000 and \$99,999.
- The rate of addition among units that were owner-occupied in 2011 was higher than that of all occupied units but not statistically different. Among owner-occupied units, those occupied by lower income owners (less than \$30,000) and those with lower monthly housing costs (less than \$600) had lower rates of addition, while those occupied by high-income owners (\$50,000 or more) and those with high monthly housing costs (\$1,250 or more) had higher-than-average rates of addition.

5. Rental Market Dynamics: 2002–2011

Rental market dynamics focuses on the supply of rental housing and how that supply changes over time. Rental dynamics analysis has many of the features of CINCH analysis. A key step in rental dynamics analysis is to separate the rental stock into classes or strata based on how affordable the units are. This paper uses eight categories:

- Non-market: Either no cash rent or a subsidized rent.
- Extremely low rent: Affordable to renters with incomes less than or equal to 30 percent of local area median income.
- Very low rent: Affordable to renters with incomes greater than 30 percent but less than or equal to 50 percent of local area median income.
- Low rent: Affordable to renters with incomes greater than 50 percent but less than or equal to 60 percent of local area median income.

- Moderate rent: Affordable to renters with incomes greater than 60 percent but less than or equal to 80 percent of local area median income.
- High rent: Affordable to renters with incomes greater than 80 percent but less than or equal to 100 percent of local area median income.
- Very high rent: Affordable to renters with incomes greater than 100 percent but less than or equal to 120 percent of local area median income.
- Extremely high rent: Affordable to renters with incomes greater than 120 percent of local area median income.

For each category, “affordable” is defined as a gross-rent-to-income ratio of 30 percent or less for the higher of the incomes that define the boundaries for that category.¹¹ The categories are defined relative to area median income; therefore, the boundaries of the categories will change as area median income changes.

Table 5 summarizes what happened to the 2002 rental units by how affordable they were in 2002. It is based on Forward-Looking Rental Dynamics Table 1 in Appendix B, which traces in more detail where these units wound up in 2011.

Table 5: Summary of Forward-Looking Rental Dynamics for Phoenix

Affordability categories	2002 rental units	To more affordable categories in 2011	In same affordability category in both years	To less affordable categories in 2011	2002 rental units non-rental in 2011
Non-market	58,100	NA	13.7%	66.1%	20.2%
Extremely low rent	24,700	1.9%	4.0%	21.6%	72.4%
Very low rent	165,000	6.5%	41.5%	35.4%	16.5%
Low rent	91,100	19.0%	27.3%	39.8%	13.9%
Moderate rent	78,900	12.2%	42.8%	16.5%	28.5%
High rent	12,700	9.1%	33.5%	3.2%	54.2%
Very high rent	1,600	63.1%	0.0%	36.9%	0.0%
Extremely high rent	8,100	67.0%	19.5%	NA	13.6%
Total	440,200	10.4%	32.2%	34.6%	22.7%

The 2002 rental stock in Phoenix was on the borderline between affordable and not affordable. Of the 440,200 rental units in 2002, 189,700 were extremely low rent or very low rent units. In addition, 58,100 units were non-market; that is, they were either assisted or offered for no cash rent. These three categories accounted for 56.3 percent of the 2002 rental stock. The three highest rent categories comprised 5.1 percent of the rental stock. Moves to a less affordable category (sometimes called gentrification) exceeded moves to a more affordable category (sometimes called filtration)—34.6 percent of all 2002 units compared to 10.4 percent.

¹¹ Gross rent is equal to rent plus utilities.

By 2011, 22.7 percent of the 440,200 rental units in 2002 were no longer in the rental stock (99,900 units). The largest proportion of these losses was due to changes in tenure, with 62,800 rental units becoming owner-occupied or vacant for sale in 2011. Another 27,400 units became seasonal units, units occupied by persons with usual residence elsewhere, or units used for migratory workers. Finally, 9,800 rental units were no longer in the housing stock in 2011. Some of these losses were permanent; that is, the units were demolished or destroyed. Some losses were potentially reversible, such as units being used for nonresidential purposes. Forward-Looking Rental Dynamics Table 2 shows how the movement out of the rental stock varied across the affordability categories.

Table 6 summarizes where the 2011 rental units came from, with respect to 2002, by how affordable they were in 2011. It is based on Backward-Looking Rental Dynamics Table 1 in Appendix B, which traces in more detail the origin of these units.

The rental stock in Phoenix was less affordable in 2011 than in 2002. Of the 647,800 rental units in 2011, 156,600 were extremely low rent or very low rent units. In addition, 47,000 units were non-market; that is, they were either assisted or offered for no cash rent. These three categories accounted for 31.4 percent of the 2011 rental stock. The three highest rent categories comprised 15.7 percent of the rental stock. Moves from a more affordable category (sometimes called gentrification) exceeded moves from a less affordable category (sometimes called filtration)—26.2 percent of all 2011 units compared to 7.9 percent.

Table 6: Summary of Backward-Looking Rental Dynamics for Phoenix

Affordability categories	2011 rental units	From more affordable categories in 2002	In same affordability category in both years	From less affordable categories 2011	2011 rental units non-rental in 2002
Non-market	47,000	NA	19.4%	26.7%	53.9%
Extremely low rent	14,600	3.2%	6.8%	53.2%	36.8%
Very low rent	142,000	15.7%	54.0%	11.4%	18.9%
Low rent	138,000	44.3%	20.3%	6.0%	29.4%
Moderate rent	204,600	31.3%	19.1%	1.4%	48.2%
High rent	68,100	25.6%	7.1%	2.9%	64.4%
Very high rent	16,500	11.0%	0.0%	10.0%	79.0%
Extremely high rent	16,900	13.5%	10.4%	NA	76.0%
Total	647,800	26.2%	24.8%	7.9%	41.1%

Of the 647,800 rental units in 2011, 41.1 percent were not rental in 2002 (266,500 units). The largest proportion of these gains was due to changes in tenure, with 146,700 rental units having been owner-occupied or vacant for sale in 2002. Another 15,000 units had been seasonal units, units occupied by persons with usual residence elsewhere, or units used for migratory workers. Finally, 104,800 rental units had not been in the housing stock in 2002. Of these, 100,000 were added by new construction and 4,800 by other means. Backward-Looking Rental Dynamics Table 2 shows how the movement into the rental varied stock across the affordability categories.

6. Summary of Housing Market Changes: Phoenix Metropolitan Area, 2002–2011

In 2002 the Phoenix metropolitan area contained 1,340,300 housing units, including vacant units. By 2011 the number of housing units had increased to 1,821,700. Part of this increase was due to a redefinition of the metropolitan area that added Pinal County. We estimate that the 2011 count of housing units for the metropolitan area as defined in 2002 would be 1,675,900. This represents an overall increase of 25.0 percent, which translates to an average annual increase of 2.5 percent over the 9-year period.

The change in the geographical definition of Phoenix affects the interpretation of the information presented in this report. Our analysis applies only to that portion of the metropolitan area that was common to the Phoenix metropolitan area as defined in both 2002 and 2011.

Between 2002 and 2011, only 14,300 units left the housing stock. Of these, 5,600 are clearly permanent losses—the original unit is gone, and major construction would be required to replace it with a new unit. Another 3,800 are temporary losses—the original unit needs repairs or is being used for other purposes. These units may or may not return to the housing stock. Finally, there were 4,900 units that left the housing stock either permanently or temporarily for “other” reasons, a category that encompasses a wide variety of situations. Demolitions and natural disasters accounted for 5,000 of the permanent losses, while mergers and conversions contributed another 400 permanent losses. The 2011 AHS survey in Phoenix did track mobile home move-outs, a factor accounting for another 200 losses.

In the period between the 2002 and the 2011 AHS surveys, 359,300 units were added to the housing stock. Ninety-six percent of these additions were newly constructed units. The 2011 AHS did track move-ins of mobile homes in Phoenix, a factor that contributed 4,200 units. No units were formed from the conversion or merger of 2002 units. We classified 8,500 units as recovered because these units had been in the housing stock at some point but were classified in 2002 as nonresidential (7,900) or uninhabitable (600). Finally, no units were added in other unclassified ways.

The Phoenix metropolitan area lost 1.1 percent of all 2002 housing units by 2011; additions between 2002 and 2011 represented 19.7 percent of the 2011 housing stock. Losses and additions varied across portions of the Phoenix housing market defined by the characteristics of the unit or its occupants. We observed the following patterns, which were both atypical of the overall housing stock and statistically significant:

- Units in multifamily structures had a higher-than-average loss rate, and the rate was particularly high among units in multifamily buildings with 2–4 units or with 1 floor or 7 or more floors.
- The loss rate was lower among units built in 1985 or later.
- Smaller units (1 or 3 rooms or 1 bedroom) experienced high loss rates, whereas larger units (4 or more bedrooms) had lower rates.

- Loss rates were high among units with severe physical problems, particularly among units lacking complete plumbing or exclusive use of bathroom facilities. Units lacking complete kitchen facilities also experienced high loss rates.
- Units occupied in 2002 by households with Hispanic householders or householders who identified their race as “Other” had high loss rates.
- Units that were owner-occupied in 2002 experienced a low loss rate, but units that were renter-occupied had a high loss rate. Among 2002 rental units, those with low monthly housing costs (less than \$600) and those occupied by low-income households (less than \$15,000) had high loss rates. Among 2002 owner-occupied units, those with high monthly housing costs (\$1,250 or more) and those occupied by high-income households (\$50,000 or more) had low loss rates.
- Single-family detached units had a high rate of addition, while single-family attached units and manufactured houses had low rates of addition.
- Overall, units in multifamily structures experienced a low rate of addition, and low rates were characteristic of units in all multifamily buildings (regardless of the number of units in the building) and units in 1- and 2-story multifamily structures.
- The rate of addition also varied sharply by unit size. As measured by the number of rooms, 6 rooms was the dividing line. Units with fewer than 6 rooms had below-average rates of addition; units with 7 or more rooms had above-average rates. Units with fewer than 3 bedrooms had below-average rates of addition, and units with 4 or more bedrooms had an above-average rate.
- The rate of addition was higher than average among units with wells.
- New additions to the stock were underrepresented among units in 2011 with moderate physical problems. Specifically, units lacking complete kitchen facilities had a low rate of addition.
- Units occupied by households with elderly householders (65 years or older) had low rates of addition. Units occupied by households with children had an above-average rate of addition, while those without children had a below-average rate.
- As separate groups, households in 2011 with American Indian householders had low rates of addition, whereas those with Black or Asian householders had higher-than-average rates.
- The rate of addition was low among units that were renter-occupied in 2011 and, among rental units, particularly low for those occupied by households earning less than \$30,000 and those with low rents (\$350–\$799). Additions were higher than normal among high-cost rentals (\$1,250 per month or more) and those occupied by households earning between \$50,000 and \$99,999.

- The rate of addition among units that were owner-occupied in 2011 was higher than that of all occupied units but not statistically different. Among owner-occupied units, those occupied by lower income owners (less than \$30,000) and those with lower monthly housing costs (less than \$600) had lower rates of addition, while those occupied by high-income owners (\$50,000 or more) and those with high monthly housing costs (\$1,250 or more) had higher-than-average rates of addition.

The 2002 rental stock in Phoenix was on the borderline between affordable and not affordable. Of the 440,200 rental units in 2002, 189,700 were extremely low rent or very low rent units. In addition, 58,100 units were non-market; that is, they were either assisted or offered for no cash rent. These three categories accounted for 56.3 percent of the 2002 rental stock. The three highest rent categories comprised 5.1 percent of the rental stock. Moves to a less affordable category (sometimes called gentrification) exceeded moves to a more affordable category (sometimes called filtration)—34.6 percent of all 2002 units compared to 10.4 percent. By 2011, 22.7 percent of the 440,200 rental units in 2002 were no longer in the rental stock (99,900 units). The largest proportion of these losses was due to changes in tenure, with 62,800 rental units becoming owner-occupied or vacant for sale in 2011.

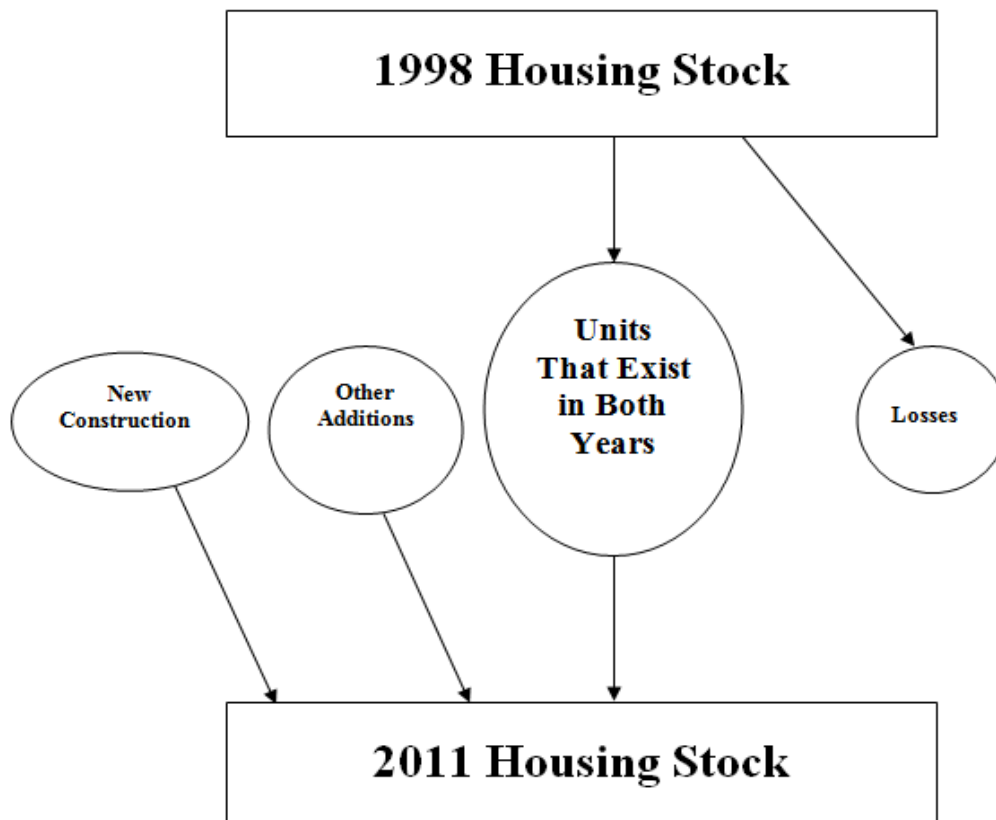
The rental stock in Phoenix was less affordable in 2011 than in 2002. Of the 647,800 rental units in 2011, 156,600 were extremely low rent or very low rent units. In addition, 47,000 units were non-market; that is, they were either assisted or offered for no cash rent. These three categories accounted for 31.4 percent of the 2011 rental stock. The three highest rent categories comprised 15.7 percent of the rental stock. Moves from a more affordable category (sometimes called gentrification) exceeded moves from a less affordable category (sometimes called filtration)—26.2 percent of all 2011 units compared to 7.9 percent. Of the 647,800 rental units in 2011, 41.1 percent were not rental in 2002 (266,500 units). The largest proportion of these gains was due to changes in tenure, with 146,700 rental units having been owner-occupied or vacant for sale in 2002.

Appendix A: CINCH and Rental Dynamics Methodology

Overview

Components of Inventory Change (CINCH) is a tool used by housing analysts to study how the housing inventory changes over time. Figure 1 illustrates how the inventory evolves.

Figure A-1: How the Housing Inventory Changes



In the context of Figure A-1, the U.S. Census Bureau provides estimates for both rectangles (the 2002 and 2011 housing stocks) and one oval (units added through new construction between 2002 and 2011). No one estimates the other three ovals: the number of units that belong to both the 2002 and 2011 housing stock, units lost to the housing stock between 2002 and 2011, and other additions to the housing stock between 2002 and 2011.

While losses and other additions are small relative to the overall stock, they encompass important features of how housing markets evolve. Housing units are “clumps” of physical capital associated with specific plots of land, and the housing inventory is the aggregation of these capital-land combinations. New construction creates new clumps, and—like all capital—some “clumps” depreciate and disappear. However, housing units undergo other interesting changes. Losses can be either permanent or temporary. Units destroyed by natural disasters or intentionally demolished are permanent losses. Temporary losses include units that are used for

nonresidential purposes and units that are uninhabitable because of structural defects that can be repaired. Additions can result from restoring units that were uninhabitable or converting nonresidential structures into residential structures.

In addition to determining the size of each oval, housing analysts find information about the characteristics of the units in the different ovals useful. Interesting characteristics include structure type, age of the unit, size of the unit, location by region, location by metropolitan status, tenure, household size and composition, resident income, and resident race and ethnicity.

CINCH analysis has three goals:¹²

- To provide an estimate for all six components of Figure A-1.
- To disaggregate losses and other additions into relevant component parts.
- To characterize the units that survive from one period to the next and the units that are added or lost between periods.

The AHS has four features that make CINCH analysis possible:

- Each unit has weights that can be used to estimate its share of the overall stock.
- The AHS tracks new construction and the various types of losses and other additions.
- The AHS has detailed information about the characteristics of each unit and its occupants.
- The AHS tracks the same unit from one period to the next so that changes in status and characteristics can be observed directly.

Housing analysts and policymakers are particularly interested in what happens to affordable rental housing units. Rental dynamics is a form of CINCH analysis that classifies the rental housing stock by affordability level and tracks the evolution of the rental housing stock by affordability class.

¹² Previous CINCH analyses have distinguished between the “status” of a unit with respect to the housing stock (e.g., existing as a nonresidential structure) and the “characteristics” of the unit or its occupants (e.g., rental vs. owner-occupied, or race of householder). This report uses this same distinction. Also adopting previous CINCH terminology, Appendix A will refer to the more recent AHS survey year, 2011, as the current year and the previous AHS survey year, 2002, as the base year.

Why the analysis needs to be separated into two components

It would be possible to list for every AHS sample unit its status and characteristics in both 2002 and 2011. In some cases, there may be no status, (e.g., not yet constructed in 2002) or no characteristics (e.g., no race of householder for vacant units), but with this understanding such a listing would still be possible. From the listing, one could construct an exact accounting of the movement of units among the various statuses and characteristics between 2002 and 2011.

The exact accounting would apply only to AHS sample observations, roughly a 1-in-500 picture of the housing stock at the metropolitan level. To obtain estimates of the magnitude of actual changes in the housing stock, one needs to apply weights to the sampled units. When weights are applied, the accounting will no longer be exact because units have different weights in different years.¹³ For example, the exact accounting might show that 2,500 sample units that were rental in 2002 became owner-occupied or vacant for sale in 2011. To estimate the number of units in the national housing stock that were rental in 2002 and became owner-occupied in 2011, one would need to apply weights. However, using 2002 weights would produce a different estimate than using 2011 weights. There is no conceptual reason to favor the answer using 2002 weights over the answer using 2011 weights. The choice of weights depends upon how the intended analysis will be used.

For this reason, previous CINCH analyses have distinguished between:

1. *Forward-looking analysis*; that is, starting with the base-year stock (2002) and determining the status and characteristics of *those* units in the current year (2011). The goal is to explain what happened to the units comprising the housing stock in the base year. Forward-looking analysis takes the housing stock as given in the base year and looks at the destination of these units in the current year.
2. *Backward-looking analysis*; that is, starting from the current year (2011) stock and determining the status and characteristics of *those* units in the base year (2002). The goal here is to explain where the units comprising the current year housing stock came from. Backward-looking analysis takes the current-year housing stock as given and looks at the source of these units, either in the base year or in new construction or other additions.

¹³ The Census Bureau assigns both a pure weight (the inverse of the probability of selection) and a final weight to each AHS observation. The final weights are designed to sum up to independent estimates of the total housing stock. The pure weights will vary over observations within a given AHS survey because of stratification in drawing the sample. Generally, pure weights do not vary across survey years. The final weights will differ over observations within a given AHS because the Census Bureau makes adjustments for various factors affecting the sample. The final weights of a given observation will also vary between AHS surveys because of changes in the housing stock.

Why changes in geography boundaries affect CINCH analysis

The analysis in this report applies only to that portion of the metropolitan area that was common to the metropolitan area as defined in both 2002 and 2011, and the application to the common area is not precise for the following reasons:

- For forward-looking analysis (2002 to 2011), we observe only those sample units in the geography common to both 2002 and 2011. Thus the observed changes correctly apply only to the common area. However, the forward-looking weights are based by necessity on the entire 2002 geography. Since the common area is smaller than the 2002 geography, the counts are overestimates for the common area.
- For the backward-looking analysis (2011 from 2002), we observe (a) sample units that were in the common area in 2002 and are still in the stock in 2011, (b) sample units representing additions to the stock throughout the metropolitan area as newly defined, and (c) sample units that represent housing existing in 2002 in the added portion of the metropolitan area. We can eliminate (c) and try to focus the analysis on the common area, but there are two problems. The backward-looking weights are based by necessity on the entire 2011 geography. Since the common area is smaller than the 2011 geography, the counts are overestimates for the common area. Moreover, we cannot determine which newly added sample units in (b) represent the common area and which represent the added portion of the metropolitan area. Therefore, additions are overestimated with respect to the common area.

Appendix B: CINCH and Rental Dynamics Tables

Contents

This appendix contains 12 detailed CINCH and rental dynamics tables that have been featured in previous reports. There are:

- Four forward-looking CINCH tables that track changes to the 2002 housing stock in 2011 by various characteristics of the units or their occupants.
- Four backward-looking CINCH tables that track where the 2011 housing stock originated by various characteristics of the units or their occupants.
- Two forward-looking rental dynamics tables (one with counts and one with percentages) that track by affordability category what happened to the 2002 rental stock by 2011.
- Two backward-looking rental dynamics tables (one with counts and one with percentages) that track by affordability category where the 2011 rental stock came from with respect to 2002.

Appendix B begins with an explanation of how to read the tables.

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. All counts are rounded to the nearest hundred.

The forward-looking tables report what happened to the 2002 housing stock by 2011. There are three possible dispositions of 2002 units:

- Units that continue to exist in 2011 with the same characteristics (or serving the same market).
- Units that continue to exist in 2011 but with different characteristics (or serving a different market).
- Units that were lost to the stock in 2011.

The backward-looking tables report where the 2011 housing stock came from in reference to 2002. There are three possible sources of 2011 units:

- Units that existed in 2002 with the same characteristics (or serving the same market).

- Units that existed in 2002 but with different characteristics (or serving a different market).
- Units that are additions to the housing stock between 2002 and 2011.

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, which are identical for the same tables in the forward-looking and backward-looking sets. Columns A through D 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, occupied units or units built from 1990 through 1994.
- Column B gives the CINCH estimate of the number of units that satisfy two conditions: (a) being part of the housing stock in the relevant year (2002 for the forward-looking tables and 2011 for the backward-looking tables) and (b) satisfying the condition in column A.
- Column C is the CINCH estimate of the number of units from column B 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.
- Column D is the CINCH estimate of the number of units from column B 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. 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; these characteristics are considered impossible or unlikely to change.

Columns Unique to Forward-Looking Tables

In the forward-looking tables, columns E through J track what happened to units that were lost from 2002 to 2011.

- Column E is the CINCH estimate of the number of units from column B that are not in the 2011 housing stock because they were merged with other units or converted into multiple units.
- Column F is the CINCH estimate of the number of houses or manufactured homes from column B that were moved out during the period. In most cases, these units were relocated rather than destroyed. The AHS considers them “losses” because a housing unit is a combination of land and capital, and a move breaks that specific combination to

create a new combination at a different location. For this reason, manufactured houses that move from one lot to another are treated as both losses and additions.¹⁴

- Column G is the CINCH estimate of the number of units from column B 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.¹⁵
- Column H is the CINCH estimate of the number of units from column B that were demolished or were destroyed by fires or natural disasters by 2011.
- Column I is the CINCH estimate of the number of units from column B that in 2011 were condemned or were no longer usable for housing because of extensive damage.
- Column J is the CINCH estimate of the number of units from column B that were lost by 2011 for other reasons.

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

Columns Unique to Backward-Looking Tables

In backward-looking tables, columns E through J track where units came from that are part of the housing stock in 2011 but were not part of the 2002 housing stock.

- Column E is the CINCH estimate of the number of units from column B that were created by the merger or conversion of other units.
- Column F estimates the number of houses or mobile homes from column B that were moved in during the period. For many of the metropolitan areas in the 2011 AHS survey, information on movements was not collected.
- Column G is the CINCH estimate of the number of units from column B that had been nonresidential in 2002.
- Column H is the CINCH estimate of the number of units from column B that were newly constructed between 2002 and 2011. Note: Generally, in Backward-Looking Table A, there will be units in column H with year-built data substantially earlier than the survey year. There are three explanations for this apparent inconsistency. (1) With the exception of manufactured houses, presence in column H is determined by information from the

¹⁴ The AHS does not track what happens to a house or mobile home that is moved off of a lot that is part of the AHS sample, and does not inquire about the previous history of a unit that is moved on to a lot that is part of the AHS sample.

¹⁵ 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. Nonresidential, therefore, means strictly no residential use.

Census Bureau indicating that the unit entered the sample from a listing of new construction; the Census Bureau may be mistaken. (2) Year built is based on information from the respondent; the respondent may be mistaken. (3) An older unit may have undergone substitution renovation that required a new construction permit, but the respondent may have given the original construction date rather than the renovation date. The extent of major renovation occurring in many established neighborhoods throughout the country makes (3) a likely possibility.

- Column I is the CINCH estimate of the number of units from column B that were added by 2011 from units that were structurally unsound in 2002.¹⁶
- Column J is the CINCH estimate of the number of units from column B that were added by 2011 from units that had been temporarily lost to the stock in 2002 for reasons “not classified” or were newly added by “other” means.

In some metropolitan areas, the AHS surveys do not report data for all the rows in the tables in this appendix. The columns for those rows are left blank.

How to read rental dynamics tables

Forward-Looking Rental Dynamics Table 1 details by affordability category how the rental units in the 2002 housing stock relate to the 2011 housing stock. Column A estimates the number of units in each affordability category in 2002. Columns B through L explain where the 2002 rental units fit into the 2011 housing stock.

- If the units are still rental in 2011, they will be counted in columns B through I, depending upon how affordable they are in 2011.
- If the units have become owner-occupied or for vacant for sale, they will be counted in column J.
- Seasonal units, units that are not the primary residence of their occupants, units used for migratory workers, and units that are vacant but not for rent or sale are counted in column K.
- Column L counts 2002 units that are not in the 2011 housing stock; these can be either temporary or permanent losses to the stock.

The sum of columns B through L equals column A, except for rounding.

Forward-Looking Rental Dynamics Table 2 presents the same information as Table 1, but columns B through L are now percentages of column A. Columns B through L sum to 100 percent in each row.

¹⁶ These units had codes that identified them as “occupancy prohibited” or “interior exposed to the elements.”

Backward-Looking Rental Dynamics Table 1 details by affordability category where the rental units in the 2011 housing stock came from with respect to the 2002 housing stock. Column A estimates the number of units in each affordability category in 2011. Columns B through L explain where the 2011 rental units originated.

- If the units were rental in 2002, they will be counted in columns B through I, depending upon how affordable they are in 2002.
- If the units were owner-occupied or for vacant for sale, they will be counted in column J.
- Seasonal units, units that are not the primary residence of their occupants, units used for migratory workers, and units that are vacant but not for rent or sale in 2002 are counted in column K.
- Column L counts rental units that were newly constructed between 2002 and 2011.
- Column M counts rental units that were added to the housing stock after 2002 by other means.

The sum of columns B through M equals column A, except for rounding.

Backward-Looking Rental Dynamics Table 2 presents the same information as Table 1, but columns B through M are now percentages of column A. Columns B through M sum to 100 percent in each row.

These four Rental Dynamics Tables look only at the endpoints of the 9-year period; for example, a unit that is low rent in 2002 and moderate rent in 2011 might have been high rent, owned, or out of the stock at points in between the two surveys. These tables do not track the path of rental units between 2002 and 2011.

Forward-Looking Table A: Housing Characteristics, Phoenix

	A	B	C	D	E	F	G	H	I	J	
Row	Characteristics	Present in 2002	2002 units present in 2011	Change in characteristics	2002 units lost due to conversion/merger	2002 house or mobile home moved out	2002 units changed to nonresidential use	2002 units lost through demolition or disaster	2002 units badly damaged or condemned	2002 units lost in other ways	Row
1	Housing stock	1,340,300	1,326,000	0	400	200	2,000	5,000	1,800	4,900	1
	Occupancy status										
2	Occupied	1,165,700	980,900	172,800	200	200	1,400	4,800	1,400	4,100	2
3	Vacant	150,600	35,600	112,800	200	0	600	200	400	900	3
4	Seasonal	24,000	5,100	18,900	0	0	0	0	0	0	4
	Units in structure										
5	1, detached	791,300	785,600	0	0	200	1,300	700	1,400	2,000	5
6	1, attached	152,200	149,800	0	200	0	0	800	0	1,400	6
7	2 to 4	60,500	57,100	0	200	0	0	1,700	400	1,100	7
8	5 to 9	72,300	71,500	0	0	0	0	900	0	0	8
9	10 to 19	72,900	72,900	0	0	0	0	0	0	0	9
10	20 to 49	54,100	53,000	0	0	0	600	400	0	0	10
11	50 or more	34,900	34,000	0	0	0	0	400	0	400	11
12	Manufactured/mobile home	102,100	102,100	0	0	0	0	0	0	0	12

	A	B	C	D	E	F	G	H	I	J	
Row	Characteristics	Present in 2002	2002 units present in 2011	Change in characteristics	2002 units lost due to conversion/ merger	2002 house or mobile home moved out	2002 units changed to nonresidential use	2002 units lost through demolition or disaster	2002 units badly damaged or condemned	2002 units lost in other ways	Row
	Year built										
15	2000–2004	116,500	116,300	0	0	0	300	0	0	0	15
16	1995–1999	175,500	175,200	0	0	100	0	0	0	200	16
17	1990–1994	106,200	106,100	0	0	0	0	0	0	100	17
18	1985–1989	157,800	157,200	0	0	0	0	0	0	600	18
19	1980–1984	174,400	173,000	0	0	0	600	0	0	700	19
20	1975–1979	121,100	120,600	0	0	100	0	0	200	200	20
21	1970–1974	180,800	180,000	0	0	0	400	0	0	500	21
22	1960–1969	165,800	162,400	0	200	0	0	1,900	0	1,300	22
23	1950–1959	102,700	99,200	0	200	0	0	1,900	200	1,100	23
24	1940–1949	19,000	17,500	0	0	0	200	700	500	200	24
25	1930–1939	16,300	14,800	0	0	0	200	500	900	0	25
26	1920–1929	3,200	3,000	0	0	0	200	0	0	0	26
27	1919 or earlier	900	900	0	0	0	0	0	0	0	27
	Rooms										
28	1	2,000	500	500	0	0	0	600	0	400	28
29	2	10,000	7,000	2,800	0	0	0	200	0	0	29
30	3	132,800	101,100	26,900	400	100	400	1,900	0	1,900	30
31	4	284,300	186,800	93,400	0	100	600	1,600	900	900	31
32	5	290,500	127,800	160,500	0	0	400	700	700	400	32
33	6	245,300	118,400	125,900	0	0	0	0	200	800	33
34	7	186,300	79,400	106,200	0	0	200	0	0	500	34
35	8	116,300	52,900	63,300	0	0	0	0	0	0	35
36	9	40,100	8,100	31,700	0	0	300	0	0	0	36
37	10 or more	32,700	6,800	25,900	0	0	0	0	0	0	37

	A	B	C	D	E	F	G	H	I	J	
Row	Characteristics	Present in 2002	2002 units present in 2011	Change in characteristics	2002 units lost due to conversion/merger	2002 house or mobile home moved out	2002 units changed to nonresidential use	2002 units lost through demolition or disaster	2002 units badly damaged or condemned	2002 units lost in other ways	Row
	Bedrooms										
38	None	10,300	5,900	3,300	0	0	0	600	0	400	38
39	1	170,000	150,500	14,600	400	200	400	2,100	0	1,700	39
40	2	442,500	391,200	46,100	0	0	600	2,000	1,100	1,400	40
41	3	434,900	378,100	54,600	0	0	400	200	700	1,000	41
42	4 or more	282,600	242,400	39,200	0	0	500	0	0	500	42
43	Multiunit structures	294,700	288,500	0	200	0	600	3,500	400	1,500	43
	Stories in structure										
44	1	58,100	54,400	0	200	0	0	2,400	400	700	44
45	2	188,600	186,900	0	0	0	600	600	0	400	45
46	3	40,600	40,600	0	0	0	0	0	0	0	46
47	4 to 6	5,600	5,600	0	0	0	0	0	0	0	47
48	7 or more	1,800	1,000	0	0	0	0	400	0	400	48

Forward-Looking Table B: Unit Quality, Phoenix

	A	B	C	D	E	F	G	H	I	J	
Row	Characteristics	Present in 2002	2002 units present in 2011	Change in characteristics	2002 units lost due to conversion/merger	2002 house or mobile home moved out	2002 units changed to nonresidential use	2002 units lost through demolition or disaster	2002 units badly damaged or condemned	2002 units lost in other ways	Row
1	Occupied units	1,165,700	980,900	172,800	200	200	1,400	4,800	1,400	4,100	1
2	With complete kitchen	1,128,300	941,200	177,300	200	200	1,100	3,300	1,400	3,600	2
3	Lacking complete kitchen facilities	37,400	1,000	34,200	0	0	200	1,500	0	400	3
4	With complete plumbing	1,157,300	970,600	176,000	200	200	1,400	4,200	1,400	3,400	4
5	Lack some plumbing	8,400	0	7,100	0	0	0	600	0	700	5
6	No hot piped water										6
7	No bathtub/shower										7
8	No flush toilet	900	0	900	0	0	0	0	0	0	8
9	No exclusive use	7,500	0	6,200	0	0	0	600	0	700	9
	Water										
10	Public/private water	1,157,600	975,400	170,100	200	200	1,400	4,800	1,400	4,100	10
11	Well serving 1 to 5 units	7,500	4,900	2,600	0	0	0	0	0	0	11
12	Other water source	600	0	600	0	0	0	0	0	0	12
	Sewer										
13	Public sewer	1,102,200	917,400	173,500	200	200	1,400	4,800	1,400	3,300	13
14	Septic tank/cesspool	63,500	43,800	19,000	0	0	0	0	0	800	14
15	Other										15

	A	B	C	D	E	F	G	H	I	J	
Row	Characteristics	Present in 2002	2002 units present in 2011	Change in characteristics	2002 units lost due to conversion/merger	2002 house or mobile home moved out	2002 units changed to nonresidential use	2002 units lost through demolition or disaster	2002 units badly damaged or condemned	2002 units lost in other ways	Row
16	Severe problems	12,200	500	9,600	0	100	0	900	500	700	16
17	Plumbing	8,400	0	7,100	0	0	0	600	0	700	17
18	Heating	4,200	0	3,500	0	100	0	200	500	0	18
19	Electric	500	0	500	0	0	0	0	0	0	19
20	Upkeep										20
21	Moderate problems	51,700	2,600	47,000	0	0	400	1,100	0	600	21
22	Plumbing	4,600	0	4,600	0	0	0	0	0	0	22
23	Heating	5,200	2,500	2,500	0	0	200	0	0	0	23
24	Kitchen	37,400	1,000	34,200	0	0	200	1,500	0	400	24
25	Upkeep	8,500	0	8,300	0	0	0	0	0	200	25

Forward-Looking Table C: Occupant Characteristics, Phoenix

Row	A	B	C	D	E	F	G	H	I	J	Row
	Characteristics	Present in 2002	2002 units present in 2011	Change in characteristics	2002 units lost due to conversion/merger	2002 house or mobile home moved out	2002 units changed to nonresidential use	2002 units lost through demolition or disaster	2002 units badly damaged or condemned	2002 units lost in other ways	
1	Occupied units	1,165,700	980,900	172,800	200	200	1,400	4,800	1,400	4,100	1
	Age of householder										
2	Under 65	937,600	677,400	250,700	200	200	900	4,000	1,200	3,100	2
3	65 to 74	129,300	19,200	108,900	0	0	300	400	0	500	3
4	75 or older	98,900	37,700	59,800	0	0	200	400	200	500	4
	Children in household										
5	Some	426,000	205,100	215,900	200	0	700	2,500	500	1,100	5
6	None	739,700	487,400	245,200	0	200	700	2,400	900	2,900	6
	Race and ethnicity										
7	White	961,200	748,400	206,800	0	200	500	1,800	400	3,200	7
8	Hispanic	125,100	75,100	48,300	0	100	0	900	200	400	8
9	Non-Hispanic	836,200	595,200	236,600	0	100	500	900	200	2,700	9
10	Black	41,200	11,900	28,200	0	0	0	600	500	0	10
11	Hispanic	1,200	0	1,200	0	0	0	0	0	0	11
12	Non-Hispanic	40,000	11,900	27,100	0	0	0	600	500	0	12
13	American Indian or Alaska Native alone	13,800	1,000	12,600	0	0	200	0	0	0	13
14	Asian or Pacific Islander	21,200	3,000	17,800	0	0	200	200	0	0	14
16	Other	128,300	0	124,000	200	0	400	2,200	500	900	16
17	Hispanic or Latino (any race)	244,900	153,800	85,300	200	100	400	3,100	700	1,400	17

	A	B	C	D	E	F	G	H	I	J	
Row	Characteristics	Present in 2002	2002 units present in 2011	Change in characteristics	2002 units lost due to conversion/merger	2002 house or mobile home moved out	2002 units changed to nonresidential use	2002 units lost through demolition or disaster	2002 units badly damaged or condemned	2002 units lost in other ways	Row
	Income sources of families and primary individuals										
18	Wages and salaries	925,300	611,100	304,700	200	200	1,400	3,800	1,200	2,900	18
20	Dividends, interest, or rent	371,600	117,000	252,900	0	0	300	200	200	1,000	20
21	Public assistance or public welfare	38,100	1,100	36,400	0	0	200	400	0	0	21

Forward-Looking Table D: Income and Housing Cost, Phoenix

	A	B	C	D	E	F	G	H	I	J	
Row	Characteristics	Present in 2002	2002 units present in 2011	Change in characteristics	2002 units lost due to conversion/merger	2002 house or mobile home moved out	2002 units changed to nonresidential use	2002 units lost through demolition or disaster	2002 units badly damaged or condemned	2002 units lost in other ways	Row
1	Occupied units	1,165,700	980,900	172,800	200	200	1,400	4,800	1,400	4,100	1
	Tenure										
2	Owner-occupied	810,300	608,000	198,800	0	200	500	500	700	1,600	2
3	Homeownership rate	69.5%									3
4	Renter-occupied	355,400	213,200	133,600	200	0	900	4,400	700	2,500	4
	Renter monthly housing costs										
5	No cash rent	7,900	1,500	6,400	0	0	0	0	0	0	5
6	Less than \$350	21,800	1,800	16,700	0	0	0	2,400	0	900	6
7	\$350 to \$599	110,900	27,300	79,200	200	0	600	1,600	500	1,600	7
8	\$600 to \$799	109,700	36,600	72,300	0	0	200	400	200	0	8
9	\$800 to \$1,249	84,100	36,200	47,900	0	0	0	0	0	0	9
10	\$1,250 or more	20,900	8,200	12,700	0	0	0	0	0	0	10
	Renter household income										
11	Less than \$15,000	79,300	20,300	54,200	0	0	600	2,800	0	1,400	11
12	\$15,000 to \$29,999	97,600	16,600	78,600	0	0	0	900	500	1,100	12
13	\$30,000 to \$49,999	104,500	17,600	85,600	200	0	200	600	200	0	13
14	\$50,000 to \$99,999	61,000	11,300	49,700	0	0	0	0	0	0	14
15	\$100,000 or more	13,000	0	13,000	0	0	0	0	0	0	15

	A	B	C	D	E	F	G	H	I	J	
Row	Characteristics	Present in 2002	2002 units present in 2011	Change in characteristics	2002 units lost due to conversion/merger	2002 house or mobile home moved out	2002 units changed to nonresidential use	2002 units lost through demolition or disaster	2002 units badly damaged or condemned	2002 units lost in other ways	Row
	Owner monthly housing costs										
16	Less than \$350	144,500	19,700	123,200	0	100	200	500	200	500	16
17	\$350 to \$599	112,000	29,200	82,700	0	100	0	0	0	0	17
18	\$600 to \$799	82,900	8,900	74,100	0	0	0	0	0	0	18
19	\$800 to \$1,249	243,100	53,200	188,600	0	0	0	0	500	800	19
20	\$1,250 or more	227,800	142,800	84,400	0	0	300	0	0	300	20
	Owner household income										
21	Less than \$15,000	84,900	16,100	68,800	0	100	0	0	0	0	21
22	\$15,000 to \$29,999	116,700	23,600	92,500	0	100	0	0	0	500	22
23	\$30,000 to \$49,999	176,100	41,700	133,400	0	0	0	0	700	300	23
24	\$50,000 to \$99,999	280,800	76,600	203,100	0	0	200	500	0	400	24
25	\$100,000 or more	151,800	61,800	89,300	0	0	300	0	0	500	25

Backward-Looking Table A: Housing Characteristics, Phoenix

	A	B	C	D	E	F	G	H	I	J	
Row	2011 characteristics	Present in 2011	2011 units present in 2002	Change in characteristics	2011 units added by conversion/ merger	2011 house or mobile home moved in	2011 units added from nonresidential use	2011 units added by new construction	2011 units added from temporary losses in 2002 stock	2011 units added in other ways	Row
1	Housing stock	1,821,500	1,462,200	0	0	4,200	7,900	346,700	600	0	1
	Occupancy status										
2	Occupied	1,510,000	1,091,200	131,000	0	3,400	6,500	277,300	600	0	2
3	Vacant	254,400	37,000	161,400	0	800	1,400	53,800	0	0	3
4	Seasonal	57,100	10,100	31,500	0	0	0	15,600	0	0	4
	Units in structure										
5	1, detached	1,152,400	859,900	0	0	0	4,000	288,000	600	0	5
6	1, attached	113,400	99,800	0	0	0	600	13,000	0	0	6
7	2 to 4	101,900	86,900	0	0	0	1,500	13,500	0	0	7
8	5 to 9	106,300	96,400	0	0	0	0	9,800	0	0	8
9	10 to 19	118,900	110,600	0	0	0	0	8,400	0	0	9
10	20 to 49	74,900	64,800	0	0	0	1,000	9,200	0	0	10
11	50 or more	40,500	35,700	0	0	0	0	4,800	0	0	11
12	Manufactured/mobile home	113,200	108,200	0	0	4,200	900	0	0	0	12

	A	B	C	D	E	F	G	H	I	J	
Row	2011 characteristics	Present in 2011	2011 units present in 2002	Change in characteristics	2011 units added by conversion/merger	2011 house or mobile home moved in	2011 units added from nonresidential use	2011 units added by new construction	2011 units added from temporary losses in 2002 stock	2011 units added in other ways	Row
	Year built										
13	2010–2014	11,100	0	0	0	0	0	11,100	0	0	13
14	2005–2009	215,800	0	0	0	0	0	215,800	0	0	14
15	2000–2004	233,600	125,700	0	0	0	2,700	105,200	0	0	15
16	1995–1999	207,700	193,800	0	0	0	0	13,900	0	0	16
17	1990–1994	119,100	118,500	0	0	0	0	600	0	0	17
18	1985–1989	181,700	180,000	0	0	0	1,100	0	600	0	18
19	1980–1984	193,900	193,300	0	0	0	600	0	0	0	19
20	1975–1979	139,000	134,800	0	0	2,000	2,300	0	0	0	20
21	1970–1974	196,900	196,400	0	0	0	400	0	0	0	21
22	1960–1969	181,900	180,300	0	0	800	800	0	0	0	22
23	1950–1959	100,900	99,500	0	0	1,400	0	0	0	0	23
24	1940–1949	21,500	21,500	0	0	0	0	0	0	0	24
25	1930–1939	14,100	14,100	0	0	0	0	0	0	0	25
26	1920–1929	3,300	3,300	0	0	0	0	0	0	0	26
27	1919 or earlier	1,000	1,000	0	0	0	0	0	0	0	27

	A	B	C	D	E	F	G	H	I	J	
Row	2011 characteristics	Present in 2011	2011 units present in 2002	Change in characteristics	2011 units added by conversion/merger	2011 house or mobile home moved in	2011 units added from nonresidential use	2011 units added by new construction	2011 units added from temporary losses in 2002 stock	2011 units added in other ways	Row
	Rooms										
28	1	1,600	500	700	0	0	500	0	0	0	28
29	2	9,400	7,700	1,700	0	0	0	0	0	0	29
30	3	158,300	114,900	27,800	0	1,400	1,100	13,000	0	0	30
31	4	344,400	207,000	105,400	0	2,200	400	29,400	0	0	31
32	5	374,100	141,100	171,900	0	600	2,000	58,000	600	0	32
33	6	391,400	131,100	171,600	0	0	400	88,200	0	0	33
34	7	257,800	87,700	108,600	0	0	900	60,600	0	0	34
35	8	177,700	57,900	73,800	0	0	1,100	44,800	0	0	35
36	9	63,200	8,800	22,600	0	0	1,000	30,800	0	0	36
37	10 or more	43,700	7,600	13,800	0	0	600	21,800	0	0	37
	Bedrooms										
38	None	9,900	6,500	3,000	0	0	500	0	0	0	38
39	1	203,700	166,900	15,600	0	1,400	1,100	18,700	0	0	39
40	2	524,800	437,000	29,600	0	2,800	1,500	54,000	0	0	40
41	3	633,200	415,600	83,200	0	0	1,300	132,600	600	0	41
42	4 or more	449,800	258,600	46,400	0	0	3,500	141,400	0	0	42
43	Multiunit structures	442,500	394,300	0	0	0	2,500	45,600	0	0	43
	Stories in structure										
44	1	85,200	76,300	0	0	0	1,000	8,000	0	0	44
45	2	269,300	248,400	0	0	0	1,600	19,300	0	0	45
46	3	76,400	61,600	0	0	0	0	14,800	0	0	46
47	4 to 6	3,600	3,000	0	0	0	0	600	0	0	47
48	7 or more	8,000	5,000	0	0	0	0	3,000	0	0	48

Backward-Looking Table B: Unit Quality, Phoenix

	A	B	C	D	E	F	G	H	I	J	
Row	2011 characteristics	Present in 2011	2011 units present in 2002	Change in characteristics	2011 units added by conversion/ merger	2011 house or mobile home moved in	2011 units added from nonresidential use	2011 units added by new construction	2011 units added from temporary losses in 2002 stock	2011 units added in other ways	Row
1	Occupied units	1,510,000	1,091,200	131,000	0	3,400	6,500	277,300	600		1
2	With complete kitchen	1,487,500	1,046,300	155,300	0	3,400	6,500	275,400	600		2
3	Lacking complete kitchen facilities	22,500	1,200	19,400	0	0	0	1,900	0		3
4	With complete plumbing	1,502,200	1,079,600	137,300	0	2,000	6,100	276,600	600		4
5	Lack some plumbing	7,800	0	5,300	0	1,400	400	600	0		5
6	No hot piped water	500	0	500	0	0	0	0	0		6
7	No bathtub/shower										7
8	No flush toilet										8
9	No exclusive use	7,300	0	4,800	0	1,400	400	600	0		9
	Water										
10	Public/private water	1,497,700	1,085,200	131,000	0	3,400	6,000	271,600	600		10
11	Well serving 1 to 5 units	11,600	5,400	0	0	0	600	5,700	0		11
12	Other water source	700	0	700	0	0	0	0	0		12
	Sewer										
13	Public sewer	1,442,100	1,019,700	146,000	0	3,400	6,000	266,500	600		13
14	Septic tank/cesspool	67,900	48,700	7,900	0	0	600	10,800	0		14
15	Other										15

	A	B	C	D	E	F	G	H	I	J	
Row	2011 characteristics	Present in 2011	2011 units present in 2002	Change in characteristics	2011 units added by conversion/merger	2011 house or mobile home moved in	2011 units added from nonresidential use	2011 units added by new construction	2011 units added from temporary losses in 2002 stock	2011 units added in other ways	Row
16	Severe problems	12,800	500	9,800	0	1,400	400	600	0		16
17	Plumbing	7,800	0	5,300	0	1,400	400	600	0		17
18	Heating	5,000	0	5,000	0	0	0	0	0		18
19	Electric										19
20	Upkeep										20
21	Moderate problems	37,100	2,900	31,200	0	0	400	2,500	0		21
22	Plumbing	4,600	0	4,600	0	0	0	0	0		22
23	Heating	2,800	2,800	0	0	0	0	0	0		23
24	Kitchen	22,500	1,200	19,400	0	0	0	1,900	0		24
25	Upkeep	10,500	0	9,400	0	0	400	600	0		25

Backward-Looking Table C: Occupant Characteristics, Phoenix

	A	B	C	D	E	F	G	H	I	J	
Row	2011 characteristics	Present in 2011	2011 units present in 2002	Change in characteristics	2011 units added by conversion/merger	2011 house or mobile home moved in	2011 units added from nonresidential use	2011 units added by new construction	2011 units added from temporary losses in 2002 stock	2011 units added in other ways	Row
1	Occupied units	1,510,000	1,091,200	131,000	0	3,400	6,500	277,300	600	0	1
	Age of householder										
2	Under 65	1,172,600	754,300	170,600	0	3,400	5,100	238,600	600	0	2
3	65 to 74	187,600	21,600	140,400	0	0	900	24,700	0	0	3
4	75 or older	149,800	41,700	93,600	0	0	600	14,000	0	0	4
	Children in household										
5	Some	526,500	227,800	165,500	0	1,400	2,900	128,900	0	0	5
6	None	983,500	543,200	285,700	0	2,000	3,700	148,400	600	0	6
	Race and ethnicity										
7	White	1,334,000	831,000	259,300	0	3,400	4,400	235,300	600	0	7
8	Hispanic	321,300	83,100	183,700	0	1,400	2,300	50,200	600	0	8
9	Non-Hispanic	1,012,800	660,600	162,900	0	2,000	2,100	185,100	0	0	9
10	Black	88,300	13,100	49,600	0	0	2,100	23,500	0	0	10
11	Hispanic	10,000	0	4,500	0	0	1,000	4,500	0	0	11
12	Non-Hispanic	78,300	13,100	45,100	0	0	1,100	19,100	0	0	12
13	American Indian or Alaska Native alone	25,100	1,100	21,400	0	0	0	2,500	0	0	13
14	Asian or Pacific Islander	45,700	3,300	29,100	0	0	0	13,300	0	0	14
16	Other	16,800	14,300	0	0	0	0	2,500	0	0	16
17	Hispanic or Latino (any race)	349,200	171,500	117,200	0	1,400	3,300	55,300	600	0	17

	A	B	C	D	E	F	G	H	I	J	
Row	2011 characteristics	Present in 2011	2011 units present in 2002	Change in characteristics	2011 units added by conversion/merger	2011 house or mobile home moved in	2011 units added from nonresidential use	2011 units added by new construction	2011 units added from temporary losses in 2002 stock	2011 units added in other ways	Row
	Income sources of families and primary individuals										
18	Wages and salaries	1,073,600	680,100	166,300	0	2,000	4,500	220,200	600	0	18
20	Dividends, interest, or rent	352,500	130,100	157,100	0	0	600	64,700	0	0	20
21	Public assistance or public welfare	19,200	1,200	16,100	0	0	0	1,900	0	0	21

Backward-Looking Table D: Income and Housing Cost, Phoenix

	A	B	C	D	E	F	G	H	I	J	
Row	2011 characteristics	Present in 2011	2011 units present in 2002	Change in characteristics	2011 units added by conversion/ merger	2011 house or mobile home moved in	2011 units added from nonresidential use	2011 units added by new construction	2011 units added from temporary losses in 2002 stock	2011 units added in other ways	Row
1	Occupied units	1,510,000	1,091,200	131,000	0	3,400	6,500	277,300	600	0	1
	Tenure										
2	Owner-occupied	980,800	672,200	107,000	0	3,400	2,900	194,600	600	0	2
3	Homeownership rate	65.0%									3
4	Renter-occupied	529,200	239,900	203,000	0	0	3,600	82,600	0	0	4
	Renter monthly housing costs										
5	No cash rent	18,200	1,700	10,700	0	0	0	5,700	0	0	5
6	Less than \$350	12,600	2,100	9,300	0	0	0	1,300	0	0	6
7	\$350 to \$599	61,300	30,900	26,200	0	0	400	3,800	0	0	7
8	\$600 to \$799	128,300	41,400	74,900	0	0	600	11,500	0	0	8
9	\$800 to \$1,249	209,200	39,500	136,800	0	0	600	32,400	0	0	9
10	\$1,250 or more	99,500	9,300	60,200	0	0	2,000	28,000	0	0	10
	Renter household income										
11	Less than \$15,000	125,500	23,000	87,700	0	0	1,500	13,400	0	0	11
12	\$15,000 to \$29,999	127,000	18,800	93,700	0	0	400	14,000	0	0	12
13	\$30,000 to \$49,999	109,100	19,600	71,200	0	0	1,100	17,200	0	0	13
14	\$50,000 to \$99,999	133,400	12,800	87,500	0	0	600	32,500	0	0	14
15	\$100,000 or more	34,200	0	28,600	0	0	0	5,600	0	0	15

	A	B	C	D	E	F	G	H	I	J	
Row	2011 characteristics	Present in 2011	2011 units present in 2002	Change in characteristics	2011 units added by conversion/merger	2011 house or mobile home moved in	2011 units added from nonresidential use	2011 units added by new construction	2011 units added from temporary losses in 2002 stock	2011 units added in other ways	Row
	Owner monthly housing costs										
16	Less than \$350	51,100	22,200	24,500	0	600	0	3,200	600	0	16
17	\$350 to \$599	156,100	33,500	108,500	0	0	900	13,300	0	0	17
18	\$600 to \$799	104,400	9,900	79,800	0	1,400	0	13,300	0	0	18
19	\$800 to \$1,249	205,900	58,300	113,800	0	1,400	0	32,300	0	0	19
20	\$1,250 or more	463,300	156,500	172,200	0	0	2,100	132,500	0	0	20
	Owner household income										
21	Less than \$15,000	104,400	18,700	71,600	0	1,400	0	12,700	0	0	21
22	\$15,000 to \$29,999	151,000	26,400	104,100	0	600	900	19,000	0	0	22
23	\$30,000 to \$49,999	178,000	46,300	103,100	0	1,400	0	26,600	600	0	23
24	\$50,000 to \$99,999	293,200	83,900	138,000	0	0	1,500	69,700	0	0	24
25	\$100,000 or more	254,300	67,800	119,400	0	0	600	66,600	0	0	25

Forward-Looking Rental Dynamics Table 1: Counts, 2002–2011, Phoenix

Affordability categories	A Total in 2002	B Non-market in 2011	C Extremely low rent in 2011	D Very low rent in 2011	E Low rent in 2011	F Moderate rent in 2011	G High rent in 2011	H Very high rent in 2011	I Extremely high rent in 2011	J Owner- occupied in 2011	K Seasonal or related vacant in 2011	L Lost to stock in 2011
Non-market	58,100	8,000	500	18,400	12,800	5,600	0	1,200	0	7,200	1,900	2,600
Extremely low rent	24,700	500	1,000	2,000	500	1,500	1,000	0	500	15,400	500	2,000
Very low rent	165,000	5,600	5,200	68,500	41,400	16,000	1,000	0	0	11,600	11,400	4,200
Low rent	91,100	3,600	1,600	12,100	24,800	34,600	1,600	0	0	7,300	4,800	600
Moderate rent	78,900	1,100	500	1,600	6,400	33,800	11,900	600	600	15,900	6,200	400
High rent	12,700	0	0	0	600	600	4,300	0	400	4,900	2,000	0
Very high rent	1,600	0	0	0	0	1,000	0	0	600	0	0	0
Extremely high rent	8,100	0	0	600	500	1,000	1,700	1,600	1,600	500	600	0
Total	440,200	18,800	8,800	103,200	87,000	94,100	21,500	3,400	3,700	62,800	27,400	9,800

Forward-Looking Rental Dynamics Table 2: Row Percentages, 2002–2011, Phoenix

Affordability categories	A Total in 2002	B Non-market in 2011	C Extremely low rent in 2011	D Very low rent in 2011	E Low rent in 2011	F Moderate rent in 2011	G High rent in 2011	H Very high rent in 2011	I Extremely high rent in 2011	J Owner- occupied in 2011	K Seasonal or related vacant in 2011	L Lost to stock in 2011
Non-market	58,100	13.7%	0.8%	31.7%	22.0%	9.6%	0.0%	2.0%	0.0%	12.4%	3.3%	4.5%
Extremely low rent	24,700	1.9%	4.0%	8.0%	1.9%	5.9%	4.0%	0.0%	1.9%	62.5%	1.9%	8.1%
Very low rent	165,000	3.4%	3.1%	41.5%	25.1%	9.7%	0.6%	0.0%	0.0%	7.1%	6.9%	2.6%
Low rent	91,100	3.9%	1.8%	13.3%	27.3%	38.0%	1.8%	0.0%	0.0%	8.0%	5.3%	0.7%
Moderate rent	78,900	1.4%	0.7%	2.1%	8.1%	42.8%	15.1%	0.7%	0.7%	20.1%	7.9%	0.5%
High rent	12,700	0.0%	0.0%	0.0%	4.6%	4.6%	33.5%	0.0%	3.2%	38.8%	15.4%	0.0%
Very high rent	1,600	0.0%	0.0%	0.0%	0.0%	63.1%	0.0%	0.0%	36.9%	0.0%	0.0%	0.0%
Extremely high rent	8,100	0.0%	0.0%	7.2%	5.7%	12.9%	21.6%	19.5%	19.5%	6.4%	7.2%	0.0%
Total	440,200	4.2%	2.0%	23.4%	19.8%	21.4%	4.9%	0.8%	0.8%	14.3%	6.2%	2.2%

Backward-Looking Rental Dynamics Table 1: Counts, 2002–2011, Phoenix

Affordability categories	A Total in 2011	B Non- market in 2002	C Extremely low rent in 2002	D Very low rent in 2002	E Low rent in 2002	F Moderate rent in 2002	G High rent in 2002	H Very high rent in 2002	I Extremely high rent in 2002	J Owner- occupied in 2002	K Seasonal or related vacant in 2002	L New construction	M Added in other ways
Non-market	47,000	9,100	500	6,600	4,100	1,300	0	0	0	11,600	1,100	12,700	0
Extremely low rent	14,600	500	1,000	5,300	1,800	700	0	0	0	3,300	500	1,100	400
Very low rent	142,000	20,100	2,200	76,700	13,600	1,800	0	0	700	18,300	3,800	4,400	400
Low rent	138,000	14,100	500	46,500	28,100	7,200	700	0	500	23,700	3,600	12,000	1,400
Moderate rent	204,600	6,200	1,600	18,000	38,100	39,000	700	1,100	1,200	51,300	3,000	41,800	2,600
High rent	68,100	0	1,100	1,100	1,800	13,400	4,900	0	2,000	23,900	1,600	18,400	0
Very high rent	16,500	1,200	0	0	0	700	0	0	1,600	7,200	1,500	4,300	0
Extremely high rent	16,900	0	500	0	0	600	500	700	1,800	7,500	0	5,400	0
Total	647,800	51,200	7,500	154,200	87,600	64,700	6,700	1,800	7,700	146,700	15,000	100,000	4,800

Backward-Looking Rental Dynamics Table 2: Row Percentages, 2002–2011, Phoenix

Affordability categories	A Total in 2011	B Non- market in 2002	C Extremely low rent in 2002	D Very low rent in 2002	E Low rent in 2002	F Moderate rent in 2002	G High rent in 2002	H Very high rent in 2002	I Extremely high rent in 2002	J Owner- occupied in 2002	K Seasonal or related vacant in 2002	L New construction	M Added in other ways
Non-market	47,000	19.4%	1.1%	14.0%	8.8%	2.8%	0.0%	0.0%	0.0%	24.6%	2.3%	27.0%	0.0%
Extremely low rent	14,600	3.2%	6.8%	36.1%	12.6%	4.5%	0.0%	0.0%	0.0%	22.9%	3.2%	7.7%	3.1%
Very low rent	142,000	14.2%	1.6%	54.0%	9.6%	1.3%	0.0%	0.0%	0.5%	12.9%	2.7%	3.1%	0.3%
Low rent	138,000	10.2%	0.3%	33.7%	20.3%	5.2%	0.5%	0.0%	0.3%	17.1%	2.6%	8.7%	1.0%
Moderate rent	204,600	3.0%	0.8%	8.8%	18.6%	19.1%	0.3%	0.6%	0.6%	25.0%	1.4%	20.4%	1.3%
High rent	68,100	0.0%	1.7%	1.6%	2.6%	19.7%	7.1%	0.0%	2.9%	35.0%	2.4%	27.0%	0.0%
Very high rent	16,500	7.0%	0.0%	0.0%	0.0%	4.0%	0.0%	0.0%	10.0%	43.9%	9.1%	26.1%	0.0%
Extremely high rent	16,900	0.0%	3.1%	0.0%	0.0%	3.4%	3.1%	3.9%	10.4%	44.3%	0.0%	31.7%	0.0%
Total	647,800	7.9%	1.2%	23.8%	13.5%	10.0%	1.0%	0.3%	1.2%	22.6%	2.3%	15.4%	0.7%