American Housing Survey

Components of Inventory Change and Rental Dynamics: Houston 1998-2007

American Housing Survey

Components of Inventory Change and Rental Dynamics: Houston 1998–2007

Table of Contents

List of Tables

Components of Inventory Change and Rental Market Dynamics: Houston 1998–2007

Overview

Components of Inventory Change (CINCH) and rental market dynamics are two techniques for explaining how changes that take place in a housing market over time came about in physical (bricks and mortar) terms. CINCH focuses first on the overall number and then the characteristics of units at different times. Using CINCH methods, analysts answer such question as: "What happened to the x units that disappeared from the housing stock between the beginning and the end of the period?" or "Where did the increase in owner-occupied units come from?" Rental market dynamics, which is really a type of CINCH analysis, focuses on the rental market with particular emphasis on the affordability of rental housing. Using rental market dynamics techniques, analysts answer such questions as: "Have the number of rental units affordable to households with very low incomes increased or decreased over the period?" or "What happened to the rental units that were affordable to low-income households at the beginning of the period?"[1]

This report focuses on the Houston metropolitan housing market over the period between 1998 and 2007. It is one of seven reports based on local American Housing Surveys (AHS) conducted in 2007; these seven metropolitan areas were previously surveyed in either 1998 or 2002.

CINCH and rental market dynamics have both forward-looking and backward-looking components. The forward-looking component starts with the housing stock available at the beginning of the period and then, looking at the end of the period, attempts to explain what happened to those units. Possible answers include: Some units still exist and serve the same market; some units still exist but serve a different market; some units have been demolished or destroyed in natural disasters; or some units are being used for nonresidential purposes. The backward-looking component starts with the housing stock available at the end of the period and, looking at the beginning of the period, attempts to explain where those units came from. Possible answers include: Some units existed at the beginning of the period and served the same market; some units existed at the beginning of the period but served a different market; some units were newly constructed over the period; or some units were being using for nonresidential purposes at the beginning of the period. Neither CINCH nor rental market dynamics try to track the experience of a unit over the entire period; both are interested only in the beginning and the end of the period. For example, a housing unit in 1998 may have become a medical office in 2003 but returned to being a housing unit in 2006. CINCH would record this unit as having undergone no change over the period from 1998 to 2007. In research jargon, CINCH and rental market dynamics are *comparative static* analyses.

Ideally, one would want to combine the forward-looking and backward-looking analyses to produce a complete accounting that can explain the beginning and the end consistently in terms

---

[1] See http://www.huduser.org/datasets/cinch.html for examples of previous CINCH and rental dynamics studies.

of units that existed in both periods, losses from the stock over the period, and additions to the stock over the period. The research in this report uses the AHS, which is a sample of units at both points in time; and previous efforts have learned that creating sample weights that take both periods into account can generate some inconsistent or inaccurate results. For this reason, recent CINCH and rental market dynamics studies have separated the forward-looking and backward-looking components. This paper will do the same. (Weighting is explained briefly in Appendix C and more fully in a separate paper referenced in that appendix.)

The remainder of this report consists of five sections:

- A discussion of some data issues that complicate the 1998–2007 comparisons for the Houston metropolitan area.
- An explanation of how to read the CINCH tables.
- Two sets of four tables each: a set of forward-looking tables tracing the movement of units from 1998 to 2007 and identifying how units were lost to the housing stock, and a set of backward-looking tables tracing where 2007 units came from and distinguishing between units that were part of the stock in 1998 and units that were additions to the stock since 1998.
- Two tables, and accompanying discussion, that highlight interesting changes in the Houston housing stock between 1998 and 2007.
- A brief discussion of the rental market dynamics results, using CINCH-like tables.

There are three appendices:

- Appendix A compares the 1998 AHS geography for the Houston metropolitan area to the AHS geography in 2007.
- Appendix B explains how the results were tested.
- Appendix C explains how the weights were created.

Data Issues Affecting the Analyses

The AHS underwent three changes between 1998 and 2007 that complicate the CINCH and rental dynamics analyses in this paper:

- In 2007, the U.S. Department of Housing and Urban Development (HUD) reduced the sample sizes of both the national and metropolitan AHS surveys because of its reduced research budget. In 1998, the AHS sample for Houston contained 4,819 housing units; the 2007 sample contained only 2,868 housing units.
- In 2005, the Census Bureau replaced approximately half of the manufactured housing units (mobile homes) in the AHS samples—both national and metropolitan—with newly sampled units to improve the coverage of mobile homes constructed before 2000.
- In 2007, the Census Bureau revised the geography used for the Houston metropolitan area. Appendix A compares the old geography used for the Houston metropolitan area (5,921.1 square miles and 3.3 million people) to the new geography (8,928.3 square miles

and 4.7 million people). Four new counties were added to the Houston metropolitan area for the 2007 surveys; the population of these counties was 540,000.

For housing units that existed in 1998 and 2007, CINCH and rental dynamic analyses can use only those sample units whose householders were interviewed in both years. Decreases in sample sizes, the dropping and adding of mobile home units to the sample, and changes in geography combine with difficulties in obtaining interviews to reduce substantially the useable sample. The forward-looking CINCH analysis for Houston uses a sample of 1,291 units, of which only 16 are mobile homes; the backward-looking CINCH analysis uses a sample of 1,969, of which only 16 are mobile homes. The forward-looking analysis can track what happens only to 1998 housing units that are in the places common to both the old and new geographical boundaries. The backward-looking analysis explains where all additions to the 2007 housing stock in the new geography came from, but for 2007 units that existed in 1998, it can explain the characteristic only of those units common to both geographies.

The small sample sizes, particularly the paucity of mobile homes, limited the extent to which the weighting algorithms could be controlled to published counts of important segments of the Houston housing stock. Comparisons between forward-looking estimates and counts published in the 1998 AHS report are less accurate than similar comparisons between estimates based on the backward-looking weights and counts published in the 2007 AHS report. Additionally, these limitations resulted in particularly poor estimates involving the mobile home component of the housing stock.

How to Read CINCH Tables

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

> The forward-looking tables are concerned with what happened to the 1998 housing stock by 2007. There are three basic dispositions of 1998 units: (1) units that continue to exist in 2007 with the same characteristics (or serving the same market); (2) units that continue to exist in 2007, but with different characteristics (or serving a different market); or (3) units that were lost to the stock.

> The backward-looking tables are concerned with where the 2007 housing stock came from in reference to 1998. There are three basic sources of 2007 units: (1) units that existed in 1998 with the same characteristics (or serving the same market); (2) units that existed in 1998 but with different characteristics (or serving a different market); or (3) units that are additions to the housing stock.

The essence of the CINCH analysis lies in the columns because they specify the state of a unit in the other time period.

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

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

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

- Column A specifies the characteristic that defines the subset of the stock that is being tracked forward or backward in a particular row. For example, row 2 of Forward-Looking Table 1 focuses on occupied units; row 15 focuses on units built in 1995 through 2000.
- Column B gives the estimate published in the AHS report for the number of units that satisfy the conditions specified in Column A. For example, the 1998 AHS report for Houston counted 1,386,500 occupied units (row 2, column B, Forward-Looking Table 1); the 2007 AHS report counted 1,872,000 occupied units (row 2, column B, Backward-Looking Table 1).[2]
- Column C gives the CINCH estimate of the number of units that satisfy two conditions: (a) being part of the housing stock in the relevant year (1998 for the forward-looking tables and 2007 for the backward-looking tables), and (b) satisfying the condition in column A. CINCH uses different weights than those used in preparing the published AHS reports. Therefore, CINCH estimates can differ from AHS estimates for particular subsets of the housing stock. As explained in the appendix, the weights were created to match AHS published totals for rows 2 through 4 of Table 1 and rows 2 and 4 of Table 4. This perfect match will not be true of other rows.[3]
- Column D is the CINCH estimate of the number of units from column C that (a) are also part of the housing stock in the *other* year, and (b) continue to belong to the subset defined by column A. For example, column D of row 2 of Forward-Looking Table 1 estimates that 1,174,700 of the occupied units from 1998 were also occupied in 2007.
- Column E is the CINCH estimate of the number of units from column C that (a) are also part of the housing stock in the *other* year, but (b) no longer belong to the subset defined by column A. Column E of row 2 indicates that 175,200 units that were occupied in 1998 are still part of the housing stock in 2007 but are no longer occupied. In some cases, the analysis will not allow a unit to change characteristics between the base year and the other year. Examples include type of structure, year built, and number of stories; these are characteristics that are considered impossible or unlikely to change.

---

[2] Part of the increase in the number of occupied units results from the change in the geography covered in the published reports.
[3] Columns B and C will also match, except for rounding, in row 1 of Table 1, because row 1 is defined as the sum of rows 2 through 4. Categories for which the CINCH weights seem to have trouble matching the published numbers for most of the seven metropolitan areas were: the number of mobile homes, units built after 2007, rental units that do not have a cash rent, and monthly housing costs less than $350 for owners.

Columns Unique to Forward-Looking Tables

In forward-looking tables, columns F through K track what happened to units that were lost from 1998 to 2007.

- Column F is the CINCH estimate of the number of units from column C that are not in the 2007 housing stock because they were merged with other units or converted into multiple units. In the Houston metropolitan area, no units were lost to mergers or conversions between 1998 and 2007.
- Column G is the CINCH estimate of the number of mobile homes or houses from column C that were moved out during the period. In the Houston metropolitan area, no houses or mobile homes were moved out between 1998 and 2007.[4]
- Column H is the CINCH estimate of the number of units from column C that became nonresidential at the end of the period. For example, a real estate firm, a tax preparation office, a palm reader, or some other business might buy or rent a house to use for business rather than residential purposes.[5] Among occupied units, 4,000 became nonresidential.
- Column I is the CINCH estimate of the number of units from column C that were demolished or were destroyed by fires or natural disasters by 2007. In this case, 21,300 units were demolished or destroyed from the total housing stock.
- Column J is the CINCH estimate of the number of units from column C that by 2007 were condemned or that were no longer usable for housing because of extensive damage. In the Houston metropolitan area, 7,300 units are recorded as having been temporarily lost because of damage or similar cause.
- Column K is the CINCH estimate of the number of units from column C that were lost by 2007 for other reasons. Among occupied units, there were 11,300 units lost for these miscellaneous reasons.

The columns form a closed system. Column C counts the number of units tracked; columns D through K account for all the possible outcomes. Therefore, column C minus the sum of columns D through K always equals zero, except for rounding.[6]

Columns Unique to Backward-Looking Tables

In backward-looking tables, Columns F through K track where units came from that are part of the housing stock in 2007 but were not part of the 1998 housing stock.

---

[4] The small sample sizes probably account for the absence of losses due to mergers or conversions or to mobile homes or houses being moved out.

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

[6] The weighted numbers are rounded to the nearest 100 to match practices used by the Census Bureau in the AHS publications.

- Column F is the CINCH estimate of the number of units created through mergers and conversions (splitting one unit into multiple units). Of the entire housing stock in the Houston metropolitan area, 15,200 units were created through mergers or splits.
- Column G is the CINCH estimate of the number of mobile homes included in the count in column C that were moved in during the period. In the 2007 housing stock 2,000 were mobile homes moved in after 1998.[7]
- Column H is the CINCH estimate of the number of units from column C that had been nonresidential in 1998. Among occupied units, 2,600 had been nonresidential.
- Column I is the CINCH estimate of the number of units from column C that were newly constructed between 1998 and 2007. Among occupied units, 425,500 units were newly constructed.
- Column J is the CINCH estimate of the number of units from column C that were added by 2007 due to the recovery of units that had been temporarily lost to the housing stock because occupancy was prohibited in 1998, or the interior of the unit was exposed to the elements, or for reasons "not classified." The 2007 occupied housing stock includes 900 recovered units.
- Column K includes units added by the Census Bureau for other reasons. Of the entire housing stock in the Houston metropolitan area, 101,200 were added for other reasons.

Table 1

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

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

Rows 5–12 divide the housing stock by type of structure to see what type of units account for losses. Column E is forced to be zero on the grounds that changes in structure types are extremely rare and that any observed changes are most likely data errors.

Rows 13–26 divide the housing stock by year built.[8] Column E is forced to be zero because units cannot change year built. The reader will note that in Backward-Looking Table 1 there is an apparent anomaly, namely units reported as newly constructed (Column I) that have year-built dates that are inconsistent with being newly constructed. Backward-Looking Table 1 calls a unit newly constructed if the unit was added to the sample in 2007 from a listing of new construction

---

[7] There is a problem in the 2007 AHS public use file with the variable for "reason unit added" (REUAD), and therefore it is not possible to determine whether any houses were moved in during this period.
[8] Rows 13 and 14 are not included in Forward-Looking Table 1 because the 1998 housing stock cannot contain units built after 1998.

permits. The table bases year built on information provided by the surveyed household.[9] In some cases, the apparent anomaly is the result of an error—either the respondent answered the question incorrectly or the Census Bureau recorded the answer incorrectly. However, in many cases, the apparent anomaly is not really an anomaly. If an existing housing unit is remodeled to the extent that the local jurisdiction requires the contractor to draw a "new construction" permit, then the unit becomes eligible for inclusion in the AHS as a "newly constructed" unit. In these cases, when the Census Bureau questions the household about the age of the unit, the respondent may very well give the date of construction of the original unit and not the date of the remodeling. In recent years, there has been a substantial number of existing units that have been gutted and totally remodeled, often with a substantial increase in the area of the ground floor, the so-called unit "footprint." Sometimes local jurisdictions base the decision on whether a "new construction" permit is required on changes in the footprint.

Rows 27–33 and 34–38 divide the housing stock by two different measures of interior space, the number of rooms and the number of bedrooms.[10]

Rows 39–44 focus on multi-unit structures only and divide them by number of stories. Column E is forced to be zero. The Census Bureau sometimes suppresses data to protect the confidentiality of respondents. For some metropolitan areas, suppression results in zero estimates for certain multiunit structures in the public use data file, whereas the published tables contain estimates for these multiunit classes. In Houston, units in structures with 3 or more stories are listed in row 42 instead of rows 42–44 in Forward-Looking Table 1 because of suppression.

Rows 45–46 divide the housing stock between central cities units and suburban residences to see how the observed changes vary by location. Rows 47–48 divide the housing stock by whether or not the occupants have moved in within the last 2 calendar years, to see if certain units consistently have high turnover and to see if high turnover units are more susceptible to loss.

Table 2

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

Rows 2–3 look at whether the units have complete kitchens, that is, an installed sink with piped water, a mechanical refrigerator, and built-in burners for the exclusive use of the occupants. Rows 4–5 look at whether the units have complete plumbing facilities, that is, hot-and-cold piped water, a flush toilet, and a bathtub or shower inside the structure for the exclusive use of the occupants. Rows 6–9 look at each of these requirements separately. Rows 2–3, 4–5, and 6–9 separate out good units from the least desirable units based on kitchen and bath equipment.

Rows 10–15 look at how units obtain water and dispose of sewage.[11]

---

[9] New construction is based on a value of "3" for the variable REUAD (reason unit added), whereas year built is based on answers to the variable BUILT.

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

Rows 16–20 look at units with severe physical problems. Rows 17–20 identify specific types of serious deficiencies. Row 16 counts the units having one or more of these deficiencies.[12] Rows 21–25 look at units with moderate problems. Rows 22–25 identify specific types of deficiencies. Row 21 counts the units having one or more of these deficiencies.[13] These rows are in the analysis to answer two questions: (1) whether poor quality units in one year are also poor quality units in the other year; and (2) whether poorer quality units are more likely to be lost.

Table 3

This table studies the characteristics of occupants. Row 1 repeats the analysis from row 2 in Table 1. All the subsequent rows are based on row 1. In all cases, the analysis seeks to find out how stable occupancy characteristics are over time and what part of the market was served by units that were lost or added between 1998 and 2007.

Rows 2–3 look at the age of the householder. Rows 4–5 look at whether or not the household includes children. Rows 6–11 look at the race or ethnicity of the householder.[14] Rows 12–14 look at three possible sources of household income.

Table 4

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

Rows 2–4 focus on tenure to see the extent to which units change tenure characteristics and whether rental or owner-occupied units are more likely to be lost or added.

Rows 5–10 analyze the rental stock using 6 categories based on monthly housing costs. Row 5 identifies units provided to tenants for no cash rents, e.g., units provided to maintenance or management personnel or units provided to relatives. Rows 16–20 identify owner-occupied units by total monthly housing costs.

Rows 11–15 track rental units by household income; rows 21–25 track owner-occupied units by household income.[15]

---

[11] Row 15 (sewage disposal = other or none) is omitted in the backward-looking tables because the 2007 AHS publications report no housing units with this characteristic in any of the metropolitan areas.
[12] Row 19 (severe electrical problems) is omitted from the backward-looking tables because the 2007 AHS publications report no housing units with this characteristic in any of the metropolitan areas.
[13] For definitions of severe and moderate problems see pages 1042 and 1043 of the AHS Codebook, version 1.78, at http://www.huduser.org/intercept.asp?loc=/Datasets/ahs/AHS_Codebook.pdf.
[14] In compliance with new Federal guidelines, the 2007 AHS used different categories for recording race. For 2007, "white" was defined as "white only"; Black as "Black only"; and "other" as all other answers, including householders of more than one race.
[15] The published reports list more categories for both monthly housing costs and household income. This report combined categories for two reasons. First, the sample size in each metropolitan area is small and therefore larger categories provide more stable measurement of the various types of losses and additions. Second, columns D and E track whether the units in each category remain occupied and stay in the same cost or income category. The combined categories create more interesting analysis because bigger changes in monthly housing costs or income are needed to move between broader categories.

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

	A Characteristics	B Published Numbers	C Present in 98	D 98 units present in 2007	E Changed in characteristics	F 98 units affected by conversion /merger	G 98 units moved out	H 98 units changed to nonresidential use	I 98 units lost through demolition or disaster	J 98 units badly damaged or condemned	K 98 units lost in other ways	
1	**Total**	1,547,300	1,547,300	1,495,600	0	0	0	7,400	21,300	7,300	15,700	1
	Occupancy Status											
2	Occupied	1,386,400	1,386,500	1,174,700	175,200	0	0	4,000	16,200	5,100	11,300	2
3	Vacant	155,300	155,300	41,500	99,300	0	0	3,300	4,500	2,200	4,400	3
4	Seasonal	5,500	5,500	1,600	3,200	0	0	0	700	0	0	4
		10.0%										
	Units in Structure											
5	1, detached	951,400	964,800	933,200	0	0	0	4,100	13,100	5,100	9,300	5
6	1, attached	112,300	111,800	109,600	0	0	0	0	1,000	1,100	0	6
7	2 to 4	74,300	63,500	60,300	0	0	0	1,100	0	1,000	1,000	7
8	5 to 9	83,000	87,200	82,900	0	0	0	1,000	0	0	3,200	8
9	10 to 19	125,400	126,600	123,400	0	0	0	0	2,200	0	1,000	9
10	20 to 49	56,600	50,200	48,100	0	0	0	1,100	1,000	0	0	10
11	50 or more	76,400	87,500	86,300	0	0	0	0	0	0	1,100	11
12	Mobile Home/Trailer	67,800	55,800	51,800	0	0	0	0	4,000	0	0	12
	Year Built											
15	1995-2000	91,200	94,600	92,700	0	0	0	0	2,000	0	0	15
16	1990-1994	134,900	121,600	119,400	0	0	0	0	0	0	2,200	16
17	1985-1989	130,600	154,500	151,400	0	0	0	1,000	1,100	0	1,000	17
18	1980-1985	214,400	200,500	197,400	0	0	0	0	0	0	3,100	18
19	1975-1979	226,300	222,500	221,500	0	0	0	0	0	0	1,000	19
20	1970-1974	203,100	198,800	194,500	0	0	0	0	0	3,200	1,100	20
21	1960-1969	251,100	294,400	276,800	0	0	0	3,100	10,300	0	4,100	21
22	1950-1959	147,900	148,400	142,200	0	0	0	1,100	2,100	2,100	1,000	22
23	1940-1949	88,100	66,300	59,400	0	0	0	1,100	3,800	1,000	1,000	23
24	1930-1939	27,800	26,000	20,900	0	0	0	1,000	2,000	1,000	1,100	24
25	1920-1929	16,500	6,900	6,900	0	0	0	0	0	0	0	25
26	1919 or earlier	15,300	12,600	12,600	0	0	0	0	0	0	0	26

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

	A Characteristics	B Published Numbers	C Present in 98	D 98 units present in 2007	E Changed in characteristics	F 98 units affected by conversion /merger	G 98 units moved out	H 98 units changed to nonresidential use	I 98 units lost through demolition or disaster	J 98 units badly damaged or condemned	K 98 units lost in other ways	
	Rooms											
27	1 - 4 rooms	529,400	503,600	382,000	98,600	0	0	4,400	11,100	1,000	6,400	27
28	5 rooms	306,300	318,500	164,700	142,500	0	0	1,000	2,000	4,200	4,100	28
29	6 rooms	271,300	248,700	117,500	122,000	0	0	0	5,000	1,000	3,200	29
30	7 rooms	184,000	192,400	89,000	97,300	0	0	1,000	2,200	1,000	2,000	30
31	8 rooms	147,700	155,100	63,800	90,300	0	0	0	1,000	0	0	31
32	9 rooms	73,500	81,700	29,800	50,900	0	0	1,000	0	0	0	32
33	10 rooms or more	35,200	47,200	20,300	27,000	0	0	0	0	0	0	33
	Bedrooms											
34	None	2,700	0	0	0	0	0	0	0	0	0	34
35	1	273,400	259,500	214,600	36,200	0	0	1,100	3,200	0	4,300	35
36	2	414,700	389,500	303,500	65,400	0	0	3,300	8,900	4,300	4,100	36
37	3	549,900	555,200	449,400	88,400	0	0	2,000	7,200	3,000	5,200	37
38	4 or more	306,600	343,100	275,100	63,000	0	0	1,000	2,000	0	2,100	38
		0	0	0	0	0	0	0	0	0	0	
39	**Multiunit Structures**	415,700	415,000	401,000	0	0	0	3,300	3,200	1,000	6,400	39
	Stories in Structures											
40	1	NA	65,500	64,500	0	0	0	1,000	0	0	0	40
41	2	NA	296,300	284,500	0	0	0	2,200	3,200	1,000	5,300	41
42	3	NA	53,100	52,000	0	0	0	0	0	0	1,100	42
43	4 to 6	NA										43
44	7 or more	NA										44
	Metropolitan status											
45	In central cities	NA	685,700	656,400	0	0	0	4,300	12,400	6,300	6,300	45
46	In suburbs	NA	861,600	839,200	0	0	0	3,100	8,900	1,000	9,400	46
	Mover status											
47	Moved in last 2 years	NA	390,900	116,200	266,600	0	0	1,000	4,100	1,000	2,100	47
48	Not a Recent Mover	NA	995,600	677,200	289,900	0	0	3,100	12,100	4,000	9,300	48

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

	A Characteristics	B Published Numbers	C Present in 98	D 98 units present in 2007	E Changed in characteristics	F 98 units affected by conversion /merger	G 98 units moved out	H 98 units changed to nonresidential use	I 98 units lost through demolition or disaster	J 98 units badly damaged or condemned	K 98 units lost in other ways	
1	**Occupied Units**	1,386,400	1,386,500	1,174,700	175,200	0	0	4,000	16,200	5,100	11,300	1
	Kitchen											
2	Complete kitchen	1,352,700	1,353,500	1,118,600	198,300	0	0	4,000	16,200	5,100	11,300	2
3	Not complete kitchen	33,700	33,000	1,200	31,800	0	0	0	0	0	0	3
	Plumbing											
4	With all plumbing	1,375,300	1,364,500	1,149,300	178,700	0	0	4,000	16,200	5,100	11,300	4
5	Lack some plumbing	11,200	22,000	1,100	20,900	0	0	0	0	0	0	5
6	No hot piped water	3,400	1,100	0	1,100	0	0	0	0	0	0	6
7	No bathtub/shower	1,000	0	0	0	0	0	0	0	0	0	7
8	No flush toilet	1,400	0	0	0	0	0	0	0	0	0	8
9	No exclusive use	7,800	20,900	0	20,900	0	0	0	0	0	0	9
	Water											
10	Public/private water	1,342,300	1,346,800	1,140,500	170,800	0	0	3,000	16,200	5,100	11,300	10
11	Well	44,200	38,600	33,100	4,500	0	0	1,000	0	0	0	11
12	Other water source	0	1,100	0	1,100	0	0	0	0	0	0	12
	Sewer											
13	Public sewer	1,300,100	1,302,800	1,105,800	164,400	0	0	2,100	15,200	5,100	10,300	13
14	Septic tank/cesspool	86,400	83,700	43,500	36,200	0	0	2,000	1,000	0	1,000	14
15	Other or none	0	0	0	0	0	0	0	0	0	0	15
		0	0	0	0	0	0	0	0	0	0	
16	**Severe Problems**	22,300	37,000	1,100	35,900	0	0	0	0	0	0	16
17	Plumbing	11,500	22,000	1,100	20,900	0	0	0	0	0	0	17
18	Heating	8,400	13,800	0	13,800	0	0	0	0	0	0	18
19	Electric	0	0	0	0	0	0	0	0	0	0	19
20	Upkeep	3,700	1,200	0	1,200	0	0	0	0	0	0	20
21	**Moderate problems**	129,100	113,400	28,800	76,600	0	0	1,000	3,000	4,100	0	21
22	Plumbing	8,600	10,700	0	10,700	0	0	0	0	0	0	22
23	Heating	61,600	37,000	22,900	9,100	0	0	1,000	1,000	3,100	0	23
24	Kitchen	33,000	33,000	1,200	31,800	0	0	0	0	0	0	24
25	Upkeep	35,000	46,800	2,300	40,500	0	0	0	2,000	2,000	0	25

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

	A Characteristics	B Published Numbers	C Present in 98	D 98 units present in 2007	E Changed in characteristics	F 98 units affected by conversion /merger	G 98 units moved out	H 98 units changed to nonresidential use	I 98 units lost through demolition or disaster	J 98 units badly damaged or condemned	K 98 units lost in other ways	
1	**Occupied units**	1,386,400	1,386,500	1,174,700	175,200	0	0	4,000	16,200	5,100	11,300	1
	Age of Householder											
2	Under 65	1,198,200	1,222,300	937,800	259,100	0	0	2,000	11,200	3,100	9,300	2
3	65 or older	188,200	164,200	64,000	89,000	0	0	2,000	5,000	2,000	2,100	3
	Children											
4	Some	598,900	633,700	297,200	325,300	0	0	2,000	3,100	3,100	3,100	4
5	None	787,400	752,800	441,300	286,100	0	0	2,000	13,100	2,000	8,200	5
	Race/Origin of Householder											
6	White	888,600	891,400	668,000	202,200	0	0	3,000	11,100	1,000	6,200	6
7	Hispanic	104,600	108,100	68,200	39,800	0	0	0	0	0	0	7
8	NonHispanic	784,100	783,300	490,300	271,800	0	0	3,000	11,100	1,000	6,200	8
9	Black	229,800	226,300	124,800	93,400	0	0	0	2,000	3,000	3,100	9
10	Other	268,000	268,800	86,900	174,600	0	0	1,000	3,100	1,000	2,100	10
11	Total Hispanics	284,800	283,000	189,800	85,900	0	0	1,000	3,100	1,000	2,100	11
	Income Source											
12	Wages and salaries	1,181,400	1,062,400	790,400	251,500	0	0	2,100	8,200	3,100	7,200	12
13	Social security or pension	243,400	223,300	84,500	124,700	0	0	1,000	9,000	1,000	3,100	13
14	Welfare or SSI	50,500	57,000	0	50,900	0	0	0	5,000	0	1,000	14

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

	A Characteristics	B Published Numbers	C Present in 98	D 98 units present in 2007	E Changed in characteristics	F 98 units affected by conversion /merger	G 98 units moved out	H 98 units changed to nonresidential use	I 98 units lost through demolition or disaster	J 98 units badly damaged or condemned	K 98 units lost in other ways	
1	**Occupied units**	1,386,400	1,386,500	1,174,700	175,200	0	0	4,000	16,200	5,100	11,300	1
	Tenure											
2	Owner occupied	819,500	819,500	682,500	112,900	0	0	3,000	12,000	4,000	5,000	2
3	Pct owner-occupied	59.1%	59.1%									3
4	Renter occupied	567,000	567,000	364,700	189,700	0	0	1,000	4,200	1,000	6,300	4
	Renter Monthly Housing Costs											
5	No cash rent	20,300	20,800	3,600	16,200	0	0	0	1,000	0	0	5
6	Less than $350	66,900	50,400	8,300	37,900	0	0	0	2,100	0	2,100	6
7	$350 to $599	249,400	267,500	74,400	189,900	0	0	1,000	1,000	1,000	0	7
8	$600 to $799	124,600	130,300	29,900	99,300	0	0	0	0	0	1,000	8
9	$800 to $1249	86,400	86,200	34,500	48,600	0	0	0	0	0	3,100	9
10	$1,250 or more	19,400	11,900	3,600	8,300	0	0	0	0	0	0	10
	Renter Hsd Income											
11	Less than $15,000	156,500	147,000	31,900	110,900	0	0	0	1,000	1,000	2,100	11
12	$15,000 to $29,999	162,600	164,300	44,000	116,100	0	0	1,000	2,100	0	1,000	12
13	$30,000 to $49,999	125,000	134,400	19,000	113,300	0	0	0	1,000	0	1,000	13
14	$50,000 to $99,999	103,300	108,300	21,000	85,300	0	0	0	0	0	2,100	14
15	$100,000 or more	19,700	13,100	1,200	11,900	0	0	0	0	0	0	15
	Owner Monthly Housing Costs											
16	Less than $350	208,000	144,200	24,800	108,400	0	0	1,000	5,000	4,000	1,000	16
17	$350 to $599	157,900	183,400	36,400	136,000	0	0	2,000	6,000	0	3,000	17
18	$600 to $799	108,600	98,200	10,200	88,000	0	0	0	0	0	0	18
19	$800 to $1249	180,800	229,600	54,700	173,800	0	0	0	0	0	1,000	19
20	$1,250 or more	164,100	164,100	105,000	58,200	0	0	0	1,000	0	0	20
	Owner Hsd Income											
21	Less than $15,000	132,200	133,200	16,000	104,100	0	0	0	8,000	3,000	2,000	21
22	$15,000 to $29,999	103,500	92,100	19,100	70,000	0	0	1,000	1,000	1,000	0	22
23	$30,000 to $49,999	154,300	159,200	24,000	133,300	0	0	0	1,000	0	1,000	23
24	$50,000 to $99,999	266,900	264,500	99,200	162,400	0	0	2,000	1,000	0	0	24
25	$100,000 or more	162,500	170,500	83,300	84,200	0	0	0	1,000	0	2,000	25

13

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

	A Characteristics	B Published Numbers	C Present in 2007	D 2007 units present in 1998	E Changed in characteristics	F Units from mergers & splits	G Units moved in	H Units derived from nonresidential use	I Units added through new construction	J Units added from temporary losses	K Units added by other means	
1	**Total**	2,160,100	2,160,000	1,542,000	0	15,200	2,000	2,600	494,600	2,300	101,200	1
	Occupancy Status											
2	Occupied	1,872,000	1,872,000	1,251,100	94,800	12,200	2,000	2,600	425,500	900	82,900	2
3	Vacant	265,400	265,400	33,500	151,200	3,000	0	0	60,300	1,500	15,900	3
4	Seasonal	22,600	22,600	2,200	9,200	0	0	0	8,700	0	2,500	4
	Units in Structure											
5	1, detached	1,343,800	1,375,400	957,900	0	5,300	0	900	339,700	1,500	70,200	5
6	1, attached	105,500	94,000	51,500	0	900	0	900	37,800	0	2,900	6
7	2 to 4	64,300	64,200	45,600	0	1,700	0	0	12,600	0	4,200	7
8	5 to 9	133,100	142,400	108,000	0	3,100	0	900	23,700	900	5,900	8
9	10 to 19	214,500	222,100	178,600	0	2,500	0	0	32,900	0	8,100	9
10	20 to 49	90,200	85,800	53,600	0	0	0	0	28,000	0	4,200	10
11	50 or more	69,900	82,900	61,700	0	1,800	0	0	16,300	0	3,100	11
12	Mobile Home/Trailer	138,700	93,200	85,000	0	0	2,000	0	3,500	0	2,600	12
	Year Built											
13	2005-2007	115,100	105,000	0	0	0	0	0	105,000	0	0	13
14	2000-2005	230,400	203,200	0	0	900	2,000	0	196,100	0	4,200	14
15	1995-2000	188,600	164,200	98,200	0	0	0	900	56,900	900	7,300	15
16	1990-1994	147,800	148,200	128,700	0	0	0	0	16,300	0	3,100	16
17	1985-1989	172,300	179,500	159,000	0	0	0	0	11,900	0	8,600	17
18	1980-1985	245,900	237,800	202,600	0	900	0	0	17,400	0	16,900	18
19	1970-1979	451,800	464,800	418,000	0	4,100	0	1,700	26,700	0	14,200	19
21	1960-1969	284,000	318,500	279,400	0	0	0	0	18,000	0	21,100	21
22	1950-1959	171,000	181,900	149,200	0	2,500	0	0	15,700	0	14,500	22
23	1940-1949	75,300	85,600	65,800	0	900	0	0	10,400	700	7,800	23
24	1930-1939	35,200	34,300	21,400	0	2,600	0	0	10,300	0	0	24
25	1920-1929	15,500	12,700	6,900	0	900	0	0	4,200	0	900	25
26	1919 or earlier	27,000	24,400	12,900	0	2,500	0	0	5,800	700	2,500	26

14

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

	A Characteristics	B Published Numbers	C Present in 2007	D 2007 units present in 1998	E Changed in characteristics	F Units from mergers & splits	G Units moved in	H Units derived from nonresidential use	I Units added through new construction	J Units added from temporary losses	K Units added by other means	
	Rooms											
27	1 - 4 rooms	595,400	595,200	374,700	56,800	10,000	0	1,700	116,000	900	35,100	27
28	5 rooms	476,700	466,600	178,500	162,100	2,500	900	0	87,500	1,500	33,600	28
29	6 rooms	397,100	403,600	123,100	169,600	900	1,100	0	91,300	0	17,500	29
30	7 rooms	323,300	319,300	94,400	134,100	900	0	0	81,200	0	8,800	30
31	8 rooms	191,100	192,000	67,600	65,900	900	0	0	54,900	0	2,700	31
32	9 rooms	110,300	115,500	31,400	43,200	0	0	0	37,200	0	3,600	32
33	10 rooms or more	66,400	67,800	21,300	19,200	0	0	900	26,400	0	0	33
	Bedrooms											
34	None	9,700	7,700	0	4,500	0	0	0	1,600	0	1,600	34
35	1	308,600	312,000	203,100	25,200	5,000	0	1,700	62,100	0	14,700	35
36	2	512,000	507,500	307,300	68,000	8,400	0	0	90,000	1,600	32,200	36
37	3	807,400	805,200	475,800	108,900	0	2,000	0	178,300	700	39,400	37
38	4 or more	522,500	527,600	289,600	59,500	1,800	0	900	162,500	0	13,400	38
39	**Multiunit Structures**	572,000	597,400	447,500	0	9,000	0	900	113,500	900	25,600	39
	Stories in Structures											
40	1	NA	58,200	42,600	0	900	0	900	9,600	0	4,300	40
41	2	NA	413,900	351,700	0	4,900	0	0	41,600	0	15,700	41
42	3	NA	95,900	37,600	0	3,300	0	0	50,900	900	3,300	42
43	4 to 6	NA	13,300	10,300	0	0	0	0	1,700	0	1,300	43
44	7 or more	NA	15,900	5,400	0	0	0	0	9,700	0	900	44
	Metropolitan status											
45	In central cities	NA	841,800	653,200	0	13,600	1,100	900	144,500	0	28,500	45
46	In suburbs	NA	1,318,200	888,800	0	1,600	900	1,800	350,100	2,300	72,700	46
	Mover status											
47	Moved in last 2 years	NA	509,200	115,800	222,700	1,700	900	900	140,100	0	27,200	47
48	Not a Recent Mover	NA	1,362,800	741,000	266,400	10,500	1,100	1,800	285,400	900	55,700	48

15

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

	A Characteristics	B Published Numbers	C Present in 2007	D 2007 units present in 1998	E Changed in characteristics	F Units from mergers & splits	G Units moved in	H Units derived from nonresidential use	I Units added through new construction	J Units added from temporary losses	K Units added by other means	
1	**Occupied Units**	1,872,000	1,872,000	1,251,100	94,800	12,200	2,000	2,600	425,500	900	82,900	1
	Kitchen											
2	Complete kitchen	1,825,400	1,826,900	1,194,400	116,400	11,400	2,000	2,600	418,600	900	80,700	2
3	No complete kitchen	46,600	45,100	1,200	34,000	900	0	0	7,000	0	2,200	3
	Plumbing											
4	With all plumbing	1,853,000	1,853,100	1,222,200	108,200	12,200	2,000	2,600	423,000	900	82,000	4
5	Lack some plumbing	19,000	18,900	1,200	14,300	0	0	0	2,600	0	900	5
6	No hot piped water	4,200	900	0	0	0	0	0	900	0	0	6
7	No bathtub/shower	2,600	0	0	0	0	0	0	0	0	0	7
8	No flush toilet	0	0	0	0	0	0	0	0	0	0	8
9	No exclusive use	12,100	18,000	0	15,500	0	0	0	1,700	0	900	9
	Water											
10	Public/private water	1,782,900	1,798,200	1,213,300	88,000	12,200	2,000	1,700	405,100	900	75,100	10
11	Well	89,200	73,800	36,600	8,100	0	0	900	20,400	0	7,800	11
12	Other water source	0	0	0	0	0	0	0	0	0	0	12
	Sewer											
13	Public sewer	1,731,600	1,770,200	1,170,100	114,700	11,400	2,000	1,700	396,100	900	73,300	13
14	Septic tank/cesspool	140,500	101,800	49,300	11,800	900	0	900	29,400	0	9,500	14
16	**Severe Problems**	27,400	26,900	1,200	17,900	0	0	0	5,300	0	2,600	16
17	Plumbing	19,000	18,900	1,200	14,300	0	0	0	2,600	0	900	17
18	Heating	7,400	6,000	0	2,400	0	0	0	2,700	0	900	18
20	Upkeep	2,800	2,100	0	1,200	0	0	0	0	0	900	20
21	**Moderate problems**	136,900	132,500	31,400	64,000	5,100	0	1,800	19,300	0	10,900	21
22	Plumbing	7,400	6,900	0	6,000	0	0	900	0	0	0	22
23	Heating	60,800	58,600	25,500	6,100	5,100	0	900	14,000	0	7,000	23
24	Kitchen	45,700	45,100	1,200	34,000	900	0	0	7,000	0	2,200	24
25	Upkeep	27,700	31,500	2,400	23,900	900	0	0	900	0	3,500	25

16

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

	A Characteristics	B Published Numbers	C Present in 2007	D 2007 units present in 1998	E Changed in characteristics	F Units from mergers & splits	G Units moved in	H Units derived from nonresidential use	I Units added through new construction	J Units added from temporary losses	K Units added by other means	
1	**Occupied units**	1,872,000	1,872,000	1,251,100	94,800	12,200	2,000	2,600	425,500	900	82,900	1
	Age											
2	Under 65	1,623,300	1,618,800	994,200	159,300	7,800	2,000	2,600	386,400	900	65,500	2
3	65 or older	248,700	253,200	68,200	124,100	4,400	0	0	39,200	0	17,300	3
	Children											
4	Some	790,400	787,900	320,200	227,800	900	1,100	0	214,200	0	23,700	4
5	None	1,081,800	1,084,100	470,900	326,900	11,400	900	2,600	211,400	900	59,200	5
	Race/Origin											
6	White	1,356,300	1,348,300	724,400	243,200	7,000	2,000	1,800	302,800	900	66,300	6
7	Hispanic	420,100	434,000	72,900	256,300	900	0	900	82,800	0	20,300	7
8	NonHispanic	936,300	914,300	534,700	103,600	6,100	2,000	900	220,000	900	46,100	8
9	Black	335,000	335,700	130,200	109,100	4,400	0	900	77,300	0	13,900	9
10	Other	180,600	188,000	94,900	44,100	900	0	0	45,500	0	2,700	10
11	Total Hispanics	489,100	514,600	203,200	201,500	2,600	0	900	85,300	0	21,100	11
	Income Source											
12	Wages and salaries	1,521,500	1,532,100	923,900	184,600	6,100	2,000	2,600	360,400	900	51,700	12
13	Social security or pension	304,600	298,500	90,500	134,400	4,400	0	0	48,500	0	20,700	13
14	Welfare or SSI	20,400	22,500	0	16,500	0	0	0	2,600	0	3,400	14

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

	A Characteristics	B Published Numbers	C Present in 2007	D 2007 units present in 1998	E Changed in characteristics	F Units from mergers & splits	G Units moved in	H Units derived from nonresidential use	I Units added through new construction	J Units added from temporary losses	K Units added by other means	
1	**Occupied units**	1,872,000	1,872,000	1,251,100	94,800	12,200	2,000	2,600	425,500	900	82,900	1
	Tenure											
2	Owner occupied	1,242,100	1,242,100	750,500	133,100	5,400	900	900	302,400	0	49,000	2
3	Percent owner-occupied	66.4%	66.4%									3
4	Renter occupied	629,900	629,900	363,200	99,200	6,900	1,100	1,700	123,200	900	33,800	4
	Renter Monthly Housing Costs											
5	No cash rent	27,000	14,000	3,500	4,600	0	0	900	4,200	0	800	5
6	Less than $350	28,200	27,000	8,100	8,100	0	0	0	5,600	0	5,200	6
7	$350 to $599	126,500	132,900	74,700	30,200	2,600	0	900	19,500	0	5,100	7
8	$600 to $799	209,900	211,400	30,900	136,500	4,300	0	0	29,400	900	9,400	8
9	$800 to $1,249	188,300	198,700	33,900	103,700	0	1,100	0	48,800	0	11,100	9
10	$1,250 or more	50,000	45,900	3,500	24,600	0	0	0	15,600	0	2,200	10
	Renter Hsd Income											
11	Less than $15,000	145,300	140,500	31,400	68,100	3,400	0	900	23,800	0	12,900	11
12	$15,000 to $29,999	177,600	183,700	43,300	104,000	900	1,100	900	25,500	900	7,200	12
13	$30,000 to $49,999	154,000	163,400	18,700	99,000	900	0	0	36,300	0	8,600	13
14	$50,000 to $99,999	127,800	121,200	22,000	60,800	900	0	0	32,400	0	5,100	14
15	$100,000 or more	25,300	21,200	1,200	14,000	900	0	0	5,200	0	0	15
	Owner Monthly Housing Costs											
16	Less than $350	132,700	95,100	28,200	46,300	1,800	0	0	13,400	0	5,400	16
17	$350 to $599	222,100	201,100	39,200	115,700	1,800	0	0	30,400	0	14,100	17
18	$600 to $799	130,600	137,000	11,000	87,600	0	900	0	33,900	0	3,600	18
19	$800 to $1,249	280,600	280,100	61,100	152,000	900	0	0	55,300	0	10,800	19
20	$1,250 or more	476,200	528,700	112,800	229,500	900	0	900	169,300	0	15,300	20
	Owner Hsd Income											
21	Less than $15,000	79,300	73,000	17,200	34,400	1,800	900	0	13,500	0	5,400	21
22	$15,000 to $29,999	167,400	162,100	22,100	114,800	0	0	0	18,000	0	7,200	22
23	$30,000 to $49,999	225,100	220,800	25,800	139,600	1,800	0	0	42,900	0	10,700	23
24	$50,000 to $99,999	403,900	409,500	106,600	183,600	900	0	0	104,100	0	14,200	24
25	$100,000 or more	366,400	376,700	89,500	150,000	900	0	900	123,800	0	11,600	25

Changes in the Houston Housing Stock: 1998–2007

Forward-Looking Table 5 looks at how losses affected certain portions of the Houston housing stock. The rows were selected because of their inherent interest or because an examination of losses in all seven metropolitan areas showed that these categories typically had high loss rates or rates that varied substantially across the metropolitan areas. In most cases, if a category had a high loss rate, then a category with the opposite characteristic would have a low loss rate, e.g., units in central cities compared to units in the remainder of the metropolitan area.

Forward-Looking Table 5: Selected Loss Rates

Category	Based on columns in Tables 1-4		
	All losses 1998-2007 (F+G+H+I+J+K)/C	**Permanent losses** (I/C)	**Potentially reversible losses** (F+G+H+J+K)/C
All units[16]	3.3%	1.4%	2.0%
Vacant units	9.3%	2.9%	6.4%
Units in structures with 2-4 units	5.0%	0.0%	5.0%
Units in structures with 5-9 units	4.9%	0.0%	4.9%
Units built 1930-1939	19.7%	7.7%	12.0%
Units built 1920-1929	0.0%	0.0%	0.0%
Units built in 1919 or earlier	0.0%	0.0%	0.0%
Units with 1-4 rooms	4.6%	2.2%	2.4%
Units with no bedrooms	NA	NA	NA
Units in central cities	4.3%	1.8%	2.5%
Units outside of central city	2.6%	1.0%	1.6%
Occupied units[17]	2.6%	1.2%	1.5%
Units with severe problems	0.0%	0.0%	0.0%
Units with moderate problems	7.1%	2.7%	4.4%
Units with a white householder	2.4%	1.2%	1.1%
Units with a Black householder	3.6%	0.9%	2.7%
Units with Hispanic householder	2.6%	1.1%	1.5%
Household receives welfare/SSI	1.9%	0.8%	1.2%
Owner-occupied units	2.9%	1.5%	1.5%
Renter-occupied units	2.2%	0.7%	1.5%
Renter-occupied – monthly housing costs less than $350	8.3%	4.2%	4.2%
Renter-occupied – household income less than $15,000	2.8%	0.7%	2.1%

---

[16] All the rows above "Occupied units" refer to portions of the entire housing stock.
[17] All the rows below "Occupied units" refer to portions of the occupied housing stock.

By 2007, 3.3 percent of the units in the 1998 housing stock were no longer part of the housing stock; 1.4 percent were permanent losses—for example, the units had either been demolished or destroyed by fire or natural disasters—while 2.0 percent were lost in ways that could be reversed, such as nonresidential use.

Units that were vacant in 1998 had a higher loss rate, as did units in structures containing 2 to 4 units and buildings containing 5 to 9 units. Units built prior to 1940 had a mix of loss rates. Those built between 1930 and 1939 had a loss rate of 19.7 percent, while the relatively small number of those built between 1920 and 1929 or in 1919 or earlier experienced no losses. The central city loss rate was greater than the loss rate in the rest of the metropolitan area.

Among units occupied in 1998, 2.6 percent were lost by 2007. The loss rate was higher for units with moderate physical problems; but, surprisingly, none of the units with severe physical problems were lost. Units with white householders had an average loss rate, while units with Hispanic householders had double the average loss rates. Units occupied by Black householders had a slightly higher than average loss rate of 3.6 percent. Units with households on welfare or Supplemental Security Income (SSI) had lower than average loss rates.

Unlike most of the seven metropolitan areas studied, the loss rate among rental units in Houston was lower than the loss rate among owner-occupied units. Low rent units had high loss rates.

Permanent losses were particularly high among units built between 1930 and 1939, units with moderate physical problems, and low rent units. Potentially reversible losses were high among units built between 1930 and 1939, units in small structures, units with moderate physical problems, and low rent units.

Backward-Looking Table 5 presents addition rates for selected segments of the Houston housing stock. The rows were selected because of their inherent interest or because an examination of additions in all seven metropolitan areas showed that these categories typically had high addition rates or rates that varied substantially across the metropolitan areas. In most cases, if a category had a high addition rate, then a category with the opposite characteristic would have a low addition rate, e.g., units in central cities compared to units in the remainder of the metropolitan area.

Of all the units in the Houston housing stock in 2007, 28.6 percent were not in the 1998 housing stock. The majority of the new units came from new construction, but the return to the housing stock of units that were not available in 1998 accounted for over 5 percent of the total units in 2007.

Vacant units had higher than average rates of additions other than by new construction. Perhaps owners of units returning to the housing stock have had a difficult time finding tenants for these units in the slower housing market in 2007 and immediately preceding 2007. Single-units in attached structures had a higher than average addition rate. As in some other metropolitan areas studied, both units with 10 or more rooms and units with no bedrooms had a higher than average rate. The addition rate in central cities was substantially lower than the addition rate in the rest of the metropolitan area. New construction was stronger outside of the central cities than in the

central cities, while the rate of other additions was approximately the same in central cities and suburbs.

Backward-Looking Table 5: Selected Addition Rates

Category	Based on columns in Tables 1-4		
	All additions (F+G+H+I+J+K)/C	**New construction** I/C	**Other additions** (F+G+H+J+K)/C
All units[18]	28.6%	22.9%	5.7%
Vacant units	30.4%	22.7%	7.7%
Single-unit, attached structure	45.2%	40.2%	4.9%
Units in structures with 50 or more units	25.6%	19.7%	5.9%
Units with 10 or more rooms	40.2%	38.9%	1.3%
Units with no bedrooms	41.3%	20.9%	20.4%
Units in central cities	22.4%	17.2%	5.2%
Units outside of central city	32.6%	26.6%	6.0%
Occupied units[19]	28.1%	22.7%	5.4%
Owner-occupied units	28.9%	24.3%	4.5%
Renter-occupied units	26.6%	19.6%	7.0%
Renter-occupied - no cash rent	42.0%	30.1%	11.9%
Renter-occupied - monthly housing costs less than $350	40.0%	20.8%	19.2%
Renter-occupied - monthly housing costs $1,250 or more	38.9%	34.1%	4.8%
Owner-occupied - monthly housing costs $1,250 or more	35.2%	32.0%	3.2%
Owner-occupied - household income $100,000 or more	36.4%	32.9%	3.6%

The rate of all additions was only slightly higher for owner-occupied units than for renter-occupied units; this was true for both the rate of new construction and the rate of other additions. Addition rates were high at both ends of the rental stock. Total additions and new construction were also high for owner-occupied units with monthly housing costs greater than $1,250 and owner-occupied units with households that had income of $100,000 or more.

Rental Market Dynamics

Tables A and B present the rental market dynamics analysis. Rental market dynamics differs in two ways from the analysis in rows 5–10 in Table 4 of both the forward-looking and backward-looking tables. First, rental market dynamics uses categories (rows) based on affordability instead of absolute dollar amount. Affordability is defined relative to local area median income, measured at the same time that monthly housing costs are measured. Tables A and B use the following eight categories:

---

[18] All the rows above "Occupied units" refer to portions of the entire housing stock.
[19] All the rows below "Occupied units" refer to portions of the occupied housing stock.

- non-market (either no cash rent or a subsidized rent)
- extremely low rent (monthly housing costs affordable to renters with incomes less than or equal to 30 percent of local area median income)
- very low rent (monthly housing costs affordable to renters with incomes greater than 30 percent but less than or equal to 50 percent of local area median income)
- low rent (monthly housing costs affordable to renters with incomes greater than 50 percent but less than or equal to 60 percent of local area median income)
- moderate rent (monthly housing costs affordable to renters with incomes greater than 60 percent but less than or equal to 80 percent of local area median income)
- high rent (monthly housing costs 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 (monthly housing costs 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 (monthly housing costs affordable to renters with incomes greater than 120 percent of local area median income)

The second difference is that rental market dynamics uses different columns in order to highlight changes in availability and affordability. Columns *A* through *I* duplicate the rows so that one can trace how rental units change their affordability status. Columns *J* and *K* track movement into or out of the owner-occupied stock or the seasonal or vacant stock, respectively. In Table A, the various types of losses are combined in column *L*, while, in Table B, new construction is recorded in column *L* and all other additions in column *M*.

Table A shows that there were 658,100 rental units in the Houston metropolitan area in 1998. In 2007, 173,600 of these units were no longer rental; 133,800 were owner-occupied; 21,700 were either vacant or being used seasonally; and 18,100 had been lost to the stock. Taken as a proportion of the units in 1998, movement into owner-occupancy was spread rather evenly among units across all the affordability categories, and losses to the stock were concentrated among extremely low rent units and units with high rents.

Table A: Forward-Looking Rental Dynamics Analysis, Counts: 1998-2007

Affordability groups	A Total in 1998	B Non-Market in 2007	C Extremely Low Rent in 2007	D Very Low Rent in 2007	E Low Rent in 2007	F Moderate Rent in 2007	G High Rent in 2007	H Very High Rent in 2007	I Extremely High Rent in 2007	J Owner Occupied in 2007	K Seasonal or Vacant in 2007	L Lost to Stock in 2007
Non-market	51,400	19,000	3,600	9,500	1,200	0	0	1,200	0	13,800	0	3,100
Extremely Low Rent	31,900	1,200	3,600	8,400	2,500	1,300	2,500	0	0	7,000	1,200	4,300
Very Low Rent	340,000	10,900	17,400	185,000	50,300	8,300	0	0	0	49,600	12,100	6,400
Low Rent	109,400	6,000	4,800	24,800	29,900	15,500	1,200	0	0	22,700	3,600	1,000
Moderate Rent	94,600	1,200	2,400	7,300	16,800	25,100	4,800	1,300	0	32,300	2,400	1,000
High Rent	24,900	0	0	0	1,200	8,400	1,200	1,200	2,500	7,100	1,200	2,200
Very High Rent	4,600	0	0	1,100	1,200	0	0	0	0	1,200	1,200	0
Extremely High Rent	1,200	0	0	0	0	1,200	0	0	0	0	0	0
Total	658,100	38,200	31,700	236,000	103,000	59,800	9,700	3,600	2,500	133,800	21,700	18,100

Table B: Backward-Looking Rental Dynamics Analysis, Counts: 2007-1998

Affordability groups	A Total in 2007	B Non-Market in 1998	C Extremely Low Rent in 1998	D Very Low Rent in 1998	E Low Rent in 1998	F Moderate Rent in 1998	G High Rent in 1998	H Very High Rent in 1998	I Extremely High Rent in 1998	J Owner Occupied in 1998	K Seasonal or Vacant in 1998	L New Construction	M Other Additions
Non-market	71,400	18,500	1,200	10,500	5,800	1,200	0	0	0	8,400	0	16,500	9,400
Extremely Low Rent	54,900	3,100	3,100	17,200	4,200	2,000	0	0	0	6,600	1,000	11,500	6,200
Very Low Rent	300,100	9,100	7,900	178,200	25,000	6,900	0	1,100	0	15,100	3,500	38,400	14,900
Low Rent	153,100	1,200	2,300	47,600	28,900	16,300	1,200	1,200	0	21,000	2,300	18,200	13,000
Moderate Rent	135,000	0	1,200	12,100	15,100	24,000	8,200	0	1,200	23,000	1,200	41,000	8,100
High Rent	26,400	0	2,300	0	1,000	4,400	1,200	0	0	5,700	0	10,900	900
Very High Rent	14,300	1,200	0	0	0	1,200	1,200	0	0	4,600	0	6,200	0
Extremely High Rent	14,500	0	0	0	0	0	2,000	0	0	2,500	0	9,500	500
Total	769,600	33,000	18,000	265,600	80,000	55,900	13,700	2,200	1,200	86,800	8,000	152,200	53,000

Table B shows there were 769,600 rental units in the Houston metropolitan area in 2007, of which 300,000 were not rental units in 1998. The new units came from units that had been owner-occupied (86,800), units that had been vacant or in seasonal use (8,000), newly constructed units (152,200), and other additions (53,000). Most of the formerly owner-occupied units went to the moderate rent and low rent categories; most of the newly constructed rental units went to moderate rent and very low rent categories.

Because of the change in geographical boundaries between the 1998 and 2007 AHS surveys, it is not possible to determine whether the number of rental units and the number of affordable rental units increased or decreased during this period. Table B shows where the 2007 rental stock came from. The extremely low rent units in 2007 came from a variety of sources; the four largest contributors accounted for 75 percent of the 2007 stock. In order of importance, they were very low rent units in 1998 (31 percent), new construction (21 percent), owner-occupied units (12 percent), and other additions (11 percent. The history of very low rent units is less diverse; the two largest contributors accounted for 72 percent of the 2007 stock. In order of importance, they were very low rent units in 1998 (59 percent) and new construction (13 percent).

Concluding Cautions

Readers should use caution in interpreting the results of the CINCH and rental dynamics analyses for Houston over the period between 1998 and 2007. The forward-looking components can trace only what happened to units that are within the geographical boundaries common to both the 1998 AHS and the 2007 AHS surveys. The backward-looking components represent a mixed geography. Data on new construction and other additions apply to the full 2007 geography, while data on units that existed in 1998 apply only to the geography common to the 1998 and 2007 surveys. The change in geographical boundaries was substantial; the housing stock measured in the 2007 AHS survey is 40 percent larger than the housing stock measured in 1998.

Small sample sizes reduce the reliability of estimates for a number of segments of the housing stocks, particularly for the forward-looking analyses. In particular, counts of mobile homes are substantially in error.

Appendix A: Comparison between the Geography Used for the 1998 AHS Survey of Houston and the Geography Used for the 2007 AHS Survey

1998 Geography:

Houston, TX (MSA)

> Chambers County
> Fort Bend County
> Harris County
> Liberty County
> Montgomery County
> Waller County
>
> (OMB same as AHS)

2007 Geography:

Houston, TX (MSA)

> Austin County
> Brazoria County
> Chambers County
> Fort Bend County
> Galveston County
> Harris County
> Liberty County
> Montgomery County
> San Jacinto County
> Waller County
>
> (OMB same as AHS)

Appendix B: Internal and External Checks

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

- For each row, we tested whether the sum of possible outcomes (columns D though K) equaled the number of units present in the base year (column C). In every case, exact equality was achieved prior to rounding.

- Throughout the tables, various sets of rows are related to each other. For example, the year-built rows (13-26) in Table 1 are a disaggregation of the total stock in row 1. Similarly, rows 6 (whites), 9 (Blacks), and 10 (other race) in Table 3 are a disaggregation of row 1 (occupied households). In these cases, there should be equality between the parent row and the sum of the break-out rows for all columns except D and E. The difference between column D in the parent row and the sum of column D for the break-out rows should equal the negative of the difference between column E in the parent row and the sum of column E for the break-out rows. In every case, exact equality was achieved prior to rounding.

Column B provides an external check of how well the CINCH weighting performed. As noted in the text, the backward-looking weights produced estimates closer to the published estimates.

Appendix C: Weighting

CINCH separates the AHS samples in 1998 and 2007 into three pieces: (1) units that exist and are part of the housing stock in both years (SAMES); (2) units that are part of the 1998 housing stock but are not part of the 2007 housing stock (LOSSES); and (3) units that are not part of the 1998 housing stock but are part of the 2007 housing stock (ADDITIONS). ADDITIONS are split into NEW CONSTRUCTION and RECOVERIES (structures that existed in 1998 but were not in the housing stock).

Because CINCH looks at various subsets of the housing stock, we need to know the characteristics of units and their occupants. Therefore, we can use only those SAMES observations that were interviewed in both years.   For the same reason, we can use only those LOSSES that were interviewed in 1998 and those ADDITIONS that were interviewed in 2007.

For the forward-looking analysis, we started with the AHS pure weights and used the AHS weighted count in 1998 of SAMES to create weights for the interviewed SAMES. We used the AHS weighted count in 1998 of LOSSES to create weights for interviewed LOSSES. We then adjusted the weights of SAMES and LOSSES to equal the AHS published totals for owner-occupied units, renter-occupied units, vacant units, and seasonal units in 1998.

For the backward-looking analysis, we started with the AHS pure weights and used the AHS weighted count in 2007 of SAMES to create weights for the interviewed SAMES. We used the AHS weighted counts in 2007 for NEW CONSTRUCTION and for RECOVERIES to create weights for interviewed NEW CONSTRUCTION and interviewed RECOVERIES. We then adjusted the weights for SAMES, NEW CONSTRUCTION, and RECOVERIES to equal AHS published totals for owner-occupied units, renter-occupied units, vacant units, and seasonal units in 2007.

The logic behind the weighting and the procedures used to create the weights are explained in *Weighting Strategy for 2007 Metropolitan CINCH and Rental Dynamics Analysis*.