

# **American Housing Survey**

## **Weighting Strategy for 2011 Metropolitan CINCH Analysis**

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# Weighting Strategy for 2011 Metropolitan CINCH Analysis

This paper adapts the weighting strategy used by Econometrica, Inc., in its components of inventory change (CINCH) analysis of changes in the national housing stock between the previous survey year and 2011.<sup>1</sup> The algorithm used for the 2011 metropolitan analysis differs from the one used for the previous survey year-2011 national analysis in several ways; the most important difference is the inability to adjust for mobile homes separately in some of the metropolitan areas because of an insufficient number of mobile home cases in those areas. This difference and other differences are explained in the sections that describe the steps in the weighting algorithms.

The 29 metropolitan areas examined and the year in which they were last surveyed are:

<u>1998</u>	<u>2002</u>	<u>2004</u>	<u>2009</u>
Birmingham	Anaheim	Atlanta	Los Angeles
Cincinnati	Buffalo	Cleveland	New Orleans
Oakland	Charlotte	Denver	
Providence	Columbus	Indianapolis	
San Francisco	Dallas	Memphis	
San Jose	Fort Worth	Pittsburgh	
Virginia Beach	Kansas City	Sacramento	
	Milwaukee	St. Louis	
	Phoenix		
	Portland		
	Riverside		
	San Diego		

## ***The CINCH Objective***

Figure 1 on the next page illustrates the question that CINCH analysis seeks to answer.

CINCH tries to explain how the housing stock evolves from one period to the next. Figure 1 contains four ovals and two rectangles. The Census Bureau provides estimates for both rectangles and one oval (units added through new construction between previous survey year and 2011). No one estimates the other three ovals: the number of units that belong to both the previous survey year and the 2011 housing stock, units lost to the housing stock between the previous survey year and 2011, and other additions to the housing stock between the previous survey year and 2011.

Losses can be either permanent or temporary. Units destroyed by natural disasters or intentionally demolished are permanent losses. Temporary losses include units that are merged into other units or units that are used for nonresidential purposes.<sup>2</sup> Besides new construction,

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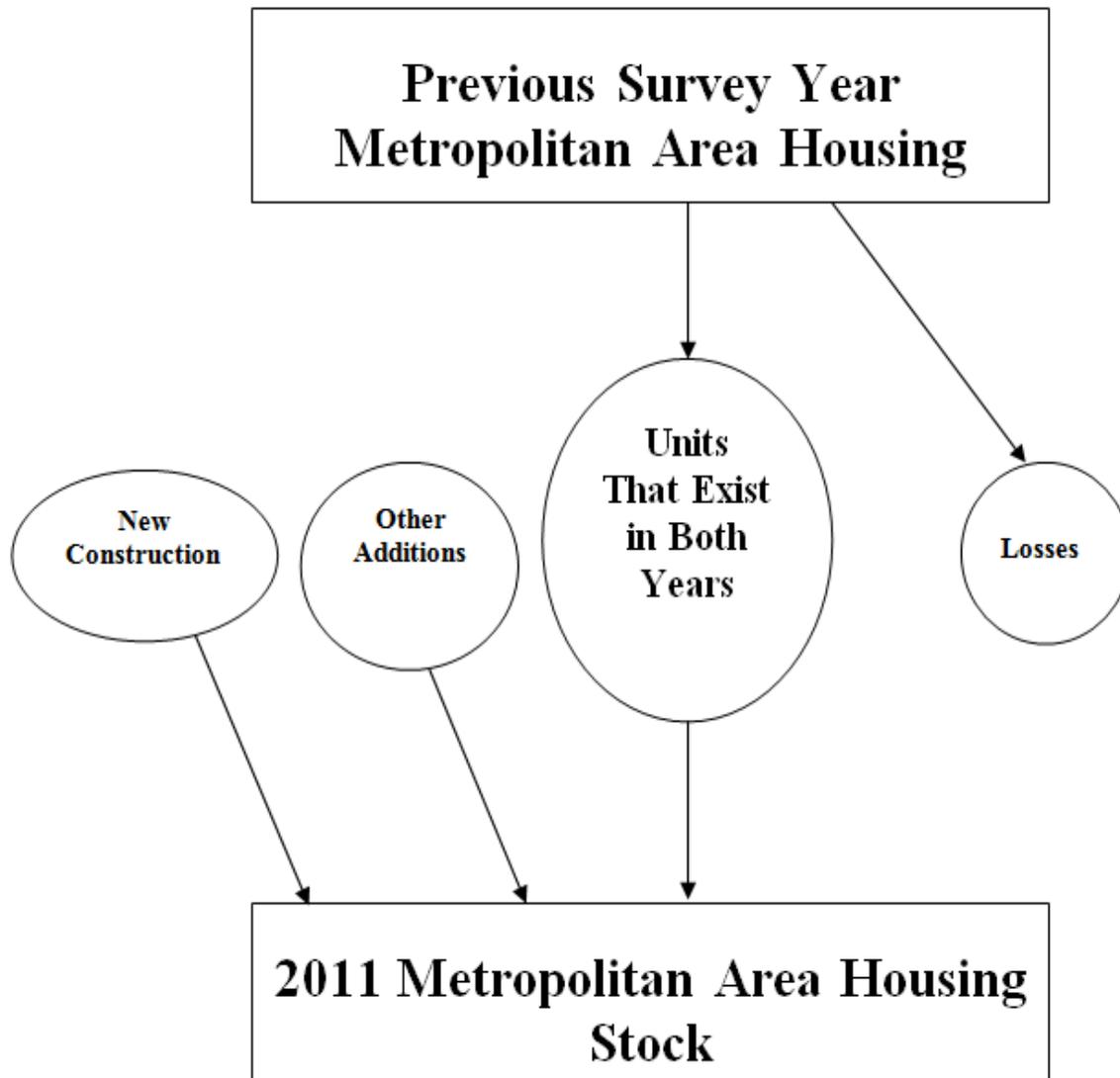
<sup>1</sup> See <http://www.huduser.org/datasets/cinch.html>.

<sup>2</sup> “Potentially reversible” might be a better term than “temporary” for these types of losses.

additions can include units resulting from splitting up larger units, mobile home move-ins, and units that had been used formerly for nonresidential purposes.

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.

**Figure 1: The CINCH Objective**



CINCH analysis has three goals:

- To provide estimates for all six components of Figure 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.

## ***Weighting***

Ideally, analysts would like to solve two simultaneous equations using CINCH analysis:<sup>3</sup>

- (1) Previous survey year housing stock = units that exist in both years + losses.
- (2) New construction + other additions + units that exist in both years = 2011 housing stock.

Unfortunately, previous experience with CINCH analysis has shown it is difficult to find satisfactory simultaneous solutions to the equations using weighted data. For this reason, Econometrica chose to solve the two equations separately in previous CINCH studies.

Solving equation (1) is termed forward-looking analysis because it tracks what happens to the units in the previous survey year housing stock. In terms of Figure 1, forward-looking analysis deals with the top rectangle and the two ovals on the right. Solving equation (2) is termed backward-looking analysis because it tracks where units in the 2011 housing stock came from. In terms of Figure 1, backward-looking analysis deals with the bottom rectangle and the three ovals on the left. In analytical terms, backward-looking analysis reverses the arrows at the bottom of Figure 1 by taking the 2011 housing stock as its starting point.

Separating the analysis into forward-looking and backward-looking components results in each observation having two weights: a weight for the forward-looking analysis (FLCINCHWT) and a weight for the backward-looking analysis (BLCINCHWT).

## ***Issues Affecting CINCH Analyses Involving Metropolitan Areas Surveyed in 2011***

### **Manufactured (Mobile) Homes**

One concern in preparing new algorithms based on the old algorithms is the reconstitution of the manufactured (mobile) home sample in 2005. The Census Bureau added new mobile home units in metropolitan surveys after 2005 and dropped some mobile home units that had been in previous AHS samples. Approximately half the mobile homes in the pre-2005 samples were

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<sup>3</sup> The equations are “simultaneous” because the term “units that exist in both years” appears in each equation.

dropped in the 2011 metropolitan sample and replaced by different mobile homes. This change affects the CINCH analysis for 27 metropolitan areas; only Los Angeles and New Orleans are not affected.

Step 4 in the forward-looking algorithm and step 3 in the backward-looking algorithm were added to correct this problem. The logic of the mobile-home adjustment is as follows. The general algorithms attempt to adjust the pure weight of each sample unit sequentially for (a) deviations between the aggregate of the pure weights and the published total stock, (b) the loss of sample due to type A non-interviews, and (c) deviations between the sum of the adjusted pure weights and key published subtotals. The step 4 adjustment in the forward-looking algorithm and the step 3 adjustment in the backward-looking algorithm occur as part of stage (a) and change the pure weights of the mobile home units from previous samples that were retained in the 2011 sample so that they sum to the pure weights of all the mobile home units (except newly manufactured mobile homes). This means that mobile home units enter stages (b) and (c) with the correct aggregate count.

We adjusted the weights only for mobile homes built prior to 2000 because the Census Bureau did not drop any units built in 2000 or later. The Census Bureau used the address list for the 2000 census to update the mobile home sample and therefore could not replace units built in 2000 or later with other units built in 2000 or later.

Step 4 in the forward-looking and step 3 in the backward-looking algorithm should allow us to obtain reasonable counts of mobile homes in both years. The estimates of losses and additions and the estimates of type of loss and type of addition depend upon the extent to which the retained mobile homes are a representative sample of all mobile homes in both previous survey years and 2011. We can correct for the decline in the sample, but not for any biases introduced by dropping and adding mobile homes.

## **Sample Sizes**

Changes in the geographical definition of a metropolitan area affect sample sizes. If a county or counties are dropped from the official definition of a metropolitan area between surveys, the sample units in the dropped counties will not appear in the 2011 survey. Three metropolitan areas dropped counties: Charlotte, Cleveland, and Indianapolis. If a county or counties were added to a metropolitan area between surveys, new sample units had to be drawn in these counties for the 2011 AHS survey. These units will not appear in the previous survey. Nineteen metropolitan areas had counties added to their geographical definitions between surveys. Some of the additions were large. For example, 22 percent of the population of the Cincinnati metropolitan area in 2011 lived in counties not in the metropolitan area in 1998.

The Census Bureau enlarged the AHS sample in 2011 by adding new sample units. These units do not appear in earlier surveys and therefore cannot be used in the CINCH analysis. The Census Bureau also dropped sample units from the previous surveys in an idiosyncratic fashion across the metropolitan areas. Many of these deletions were carried out to maintain the confidentiality of sample units. In most cases, deletions of units in previous surveys were accompanied by the addition of replacement units in the 2011 survey. Some of the deletions were large; in Los

Angeles, the Census Bureau eliminated all the supplemental sample units from 2003 and introduced a new supplemental sample.

The changes discussed in this section are important for three reasons:

- Before the 2005 CINCH, the CINCH weights underestimated mobile homes and overestimated single-family attached homes. Beginning with the 2005 CINCH, a special adjustment was added to the weighting process to ensure that the CINCH mobile home count equaled the published count. This adjustment is straightforward for the national CINCH but can be problematic for the metropolitan CINCH if there is not an adequate sample of mobile homes. The 2005 reconstitution of the mobile home sample reduced the sample available for CINCH analysis. In 27 of the 29 metropolitan areas, this adjustment could not be made for the forward-looking CINCH weights because of an inadequate sample of mobile homes. In 25 of the 29 metropolitan areas, this adjustment could not be made for the backward-looking CINCH weights because of an inadequate sample of mobile homes. A new adjustment was developed for these areas.
- Changes in geography can reduce sample sizes available for the metropolitan CINCH; these reductions can result in imprecise estimates. Geography changes also affect the interpretation of the CINCH results.
- Idiosyncratic elimination of sample units affects sample size and can produce imprecise estimates.

For these reasons, the CINCH reports for each metropolitan area contain a discussion of these three factors.

### ***Forward Looking: From Previous Survey to 2011***

The following are the steps necessary to prepare the data to analyze what happened between the previous survey and 2011 to units that existed in the previous survey. AHS variables are given their codebook names and presented in capital letters. We refer to the previous survey variables by the prefix INxx\_; 2011 variables have the prefix IN11\_.

- 1) This is preliminary work for the mobile home adjustment in step 4. For each metro area except New Orleans, using previous file before merger, compute a pure weight count of mobile homes built before 2000 (OLDMHPWT) by summing PWT for cases where  $INxx\_NUNIT2 = \{4,5\}$  AND  $INxx\_BUILT \leq 1999$ . This change will affect only the 1998 metro areas. This can be a permanent change to the code as it affects only those years in which the NUNIT2 code included a “5” value.
- 2) Create a working file as follows.
  - a) Merge the previous survey files and 2011 files, using the flat files, and keep only those cases in both files or in the previous file only.

- b) Merge the file from step 2a with PYTC, keeping only those cases in both files or the 2a file only.
- c) Eliminate cases where IN11\_NOINT GE 38. This eliminates losses due to sample changes. CINCH should ignore these losses because they are not market-related losses and because we cannot say anything useful about what happens to these units.
- d) Eliminate cases where IN11\_SAMEDU = 2. This eliminates cases where it is possible that the Census Bureau went to the wrong unit in the previous survey.
- e) Eliminate all observations that were type B or type C losses (10 LE INxx\_NOINT LT 38) in the previous survey. These units were not part of the housing stock in the previous survey year and therefore are not tracked in the forward-looking analysis.

<b>Survey year</b>	<b>Metro area</b>	<b>Sample units after step 2e</b>
1998	Birmingham	4,657
1998	Cincinnati	4,819
1998	Oakland	4,606
1998	Providence	4,546
1998	San Francisco	4,623
1998	San Jose	4,610
1998	Virginia Beach	4,556
2002	Anaheim	4,542
2002	Buffalo	3,808
2002	Charlotte	4,709
2002	Columbus	4,680
2002	Dallas	4,813
2002	Fort Worth	4,177
2002	Kansas City	4,484
2002	Milwaukee	4,203
2002	Phoenix	4,515
2002	Portland	4,711
2002	Riverside	5,228
2002	San Diego	4,347
2004	Atlanta	4,726
2004	Cleveland	4,468
2004	Denver	4,666
2004	Indianapolis	4,512
2004	Memphis	4,267
2004	Pittsburgh	4,401
2004	Sacramento	4,449
2004	St. Louis	4,315
2009	New Orleans	3,820

- 3) Create a metro pure weight as follows:  $MPWT = IN_{xx\_PWT}$  for each case.
- 4) For each metro area except New Orleans, adjust the metro pure weights of manufactured (mobile) homes.
  - a) From merged file, compute a pure weight count of mobile homes built before 2000 that are in both years (OLDMHKEPT) by summing MPWT for cases where  $IN_{xx\_NUNIT2} = \{4,5\}$  AND  $IN_{xx\_BUILT} \leq 1999$ . The inclusion of  $NUNIT2 = 5$  cases affects only the 1998 metro areas.

*Please print out the number of pre-2000 mobile homes in each metropolitan area and the OLDMHKEPT for each area.*

- b) Adjust the pure weights of all manufactured (mobile) homes as follows:

IF  $IN_{xx\_NUNIT2} = \{4,5\}$  AND  $IN_{xx\_BUILT} \geq 2000$  THEN  $MPWT = MPWT$ .  
 IF  $IN_{xx\_NUNIT2} = \{4,5\}$  AND  $IN_{xx\_BUILT} \leq 1999$  THEN  $MPWT = MPWT * (OLDMHPWT / OLDMHKEPT)$ .

NOTE:  $OLDMHPWT / OLDMHKEPT$  will vary by metropolitan area.

Survey year	Metro area	Pre-2000 mobile homes in previous year	Sum of PWT in previous year	Pre-2000 mobile homes in 2011	Sum of PWT in previous survey	PWT ratio for mobile homes
1998	Birmingham	317	25,340	281	22,458	1.128
1998	Cincinnati	108	14,130	100	13,083	1.080
1998	Oakland	53	10,013	51	9,635	1.039
1998	Providence	40	3,621	40	3,621	1.000
1998	San Francisco	19	2,862	16	2,410	1.188
1998	San Jose	138	16,991	132	16,252	1.045
1998	Virginia Beach	119	15,704	111	14,648	1.072
2002	Anaheim	157	33,308	152	32,286	1.032
2002	Buffalo	39	5,422	35	4,928	1.100
2002	Charlotte	231	30,433	219	28,850	1.055
2002	Columbus	75	10,948	73	10,656	1.027
2002	Dallas	79	29,799	75	28,886	1.032
2002	Fort Worth	105	13,924	98	12,989	1.072
2002	Kansas City	58	9,908	53	9,054	1.094
2002	Milwaukee	16	1,933	16	1,933	1.000
2002	Phoenix	207	45,166	197	44,073	1.025
2002	Portland	144	24,238	139	23,396	1.036

Survey year	Metro area	Pre-2000 mobile homes in previous year	Sum of PWT in previous year	Pre-2000 mobile homes in 2011	Sum of PWT in previous survey	PWT ratio for mobile homes
2002	Riverside	307	41,905	298	40,104	1.045
2002	San Diego	128	26,513	126	26,179	1.013
2004	Atlanta	99	36,133	97	35,403	1.021
2004	Cleveland	55	10,318	54	10,131	1.019
2004	Denver	63	12,526	59	11,724	1.068
2004	Indianapolis	102	16,256	98	15,611	1.041
2004	Memphis	65	7,196	59	6,527	1.103
2004	Pittsburgh	132	31,041	121	28,593	1.086
2004	Sacramento	123	19,909	117	18,938	1.051
2004	St. Louis	110	28,285	101	25,966	1.089

- 5) Obtain from the published report an estimate of the housing stock (BASECOUNT) in the previous survey—see below.
  - a) Compute SMPWT = sum of MPWT after step 4; this sum is a first estimate of the size of the housing stock based on the units retained for analysis.
  - b) Compute a FLCINCHWT = MPWT\*(BASECOUNT/SMPWT). This computation ratios the weights up so that they sum to the housing stock in the previous survey.

Survey year	Metro area	BASECOUNT	SMPWT	Ratio	Sum_FLCINCHWT
1998	Birmingham	394,000	371,423	1.0608	394,000
1998	Cincinnati	647,500	628,495	1.0302	647,500
1998	Oakland	895,000	868,451	1.0306	895,000
1998	Providence	415,400	407,489	1.0194	415,400
1998	San Francisco	700,200	696,691	1.0050	700,200
1998	San Jose	591,000	569,115	1.0385	591,000
1998	Virginia Beach	632,100	598,988	1.0553	632,100
2002	Anaheim	995,600	996,046	0.9996	995,600
2002	Buffalo	515,500	501,999	1.0269	515,500
2002	Charlotte	667,800	612,225	1.0908	667,800
2002	Columbus	682,600	664,621	1.0271	682,600
2002	Dallas	1,365,400	1,416,982	0.9636	1,365,400
2002	Fort Worth	639,400	621,778	1.0283	639,400
2002	Kansas City	766,500	760,141	1.0084	766,500
2002	Milwaukee	626,500	619,441	1.0114	626,500
2002	Phoenix	1,340,400	1,281,901	1.0456	1,340,400
2002	Portland	811,700	783,867	1.0355	811,700

Survey year	Metro area	BASECOUNT	SMPWT	Ratio	Sum_FLCINCHWT
2002	Riverside	1,229,500	1,103,349	1.1143	1,229,500
2002	San Diego	1,072,000	1,019,631	1.0514	1,072,000
2004	Atlanta	1,802,800	1,710,201	1.0542	1,802,800
2004	Cleveland	856,100	829,553	1.0320	856,100
2004	Denver	949,100	929,586	1.0210	949,100
2004	Indianapolis	744,900	720,232	1.0343	744,900
2004	Memphis	489,200	471,601	1.0373	489,200
2004	Pittsburgh	1,069,200	1,035,299	1.0327	1,069,200
2004	Sacramento	727,500	716,796	1.0149	727,500
2004	St. Louis	1,139,600	1,103,452	1.0328	1,139,600
2009	New Orleans	512,500	475,812	1.0771	512,500

6) Identify same, losses, and interviewed losses:

- a) SAME = 1 if INxx\_ISTATUS = 1, 2, or 3 AND IN11\_ISTATUS = 1, 2, or 3.
- b) LOSS = 1 if INxx\_ISTATUS = 1, 2, 3, or 4 AND (10 LE IN11\_NOINT LT 38).
- c) INTLOSS = 1 if INxx\_ISTATUS = 1, 2, or 3 AND LOSS = 1.

Survey year	Metro area	SAME	LOSS	INTLOSS
1998	Birmingham	1,989	95	91
1998	Cincinnati	1,336	29	27
1998	Oakland	2,589	35	30
1998	Providence	1,887	42	36
1998	San Francisco	2,745	46	41
1998	San Jose	2,666	37	28
1998	Virginia Beach	2,713	103	100
2002	Anaheim	2,961	24	22
2002	Buffalo	1,594	87	78
2002	Charlotte	2,337	72	69
2002	Columbus	2,262	27	26
2002	Dallas	2,105	92	89
2002	Fort Worth	2,373	56	53
2002	Kansas City	2,306	54	48
2002	Milwaukee	1,884	32	31
2002	Phoenix	2,062	59	59
2002	Portland	2,649	30	27
2002	Riverside	2,421	39	36
2002	San Diego	2,772	30	28
2004	Atlanta	2,026	100	88

Survey year	Metro area	SAME	LOSS	INTLOSS
2004	Cleveland	1,665	39	34
2004	Denver	2,585	24	23
2004	Indianapolis	2,877	66	61
2004	Memphis	2,325	89	74
2004	Pittsburgh	2,151	59	58
2004	Sacramento	2,492	24	19
2004	St. Louis	1,979	38	34
2009	New Orleans	2,888	95	86

7) Calculate:

- a) SSAME = sum of FLCINCHWT for all SAME = 1.
- b) SLOSS = sum of FLCINCHWT for all LOSS = 1.
- c) SINTLOSS = sum of FLCINCHWT for INTLOSS = 1.

Survey year	Metro area	SSAME	SLOSS	SINTLOSS
1998	Birmingham	167,366	8,101	7,761
1998	Cincinnati	177,981	3,909	3,639
1998	Oakland	503,192	6,814	5,841
1998	Providence	172,384	3,875	3,322
1998	San Francisco	415,809	6,878	6,121
1998	San Jose	340,444	4,749	3,598
1998	Virginia Beach	376,477	14,344	13,926
2002	Anaheim	651,600	4,983	4,624
2002	Buffalo	218,926	10,718	9,567
2002	Charlotte	330,616	10,478	10,118
2002	Columbus	329,066	4,048	3,898
2002	Dallas	579,996	23,183	22,432
2002	Fort Worth	365,481	7,012	6,683
2002	Kansas City	394,306	9,259	8,225
2002	Milwaukee	286,512	4,587	4,443
2002	Phoenix	619,241	15,274	15,274
2002	Portland	456,125	5,151	4,648
2002	Riverside	571,861	7,955	7,176
2002	San Diego	686,388	7,427	6,909
2004	Atlanta	772,477	38,474	33,857
2004	Cleveland	318,567	7,551	6,583
2004	Denver	525,795	4,860	4,655
2004	Indianapolis	474,906	11,014	10,180

<b>Survey year</b>	<b>Metro area</b>	<b>SSAME</b>	<b>SLOSS</b>	<b>SINTLOSS</b>
2004	Memphis	266,151	10,300	8,564
2004	Pittsburgh	520,108	14,426	14,179
2004	Sacramento	407,449	3,943	3,121
2004	St. Louis	520,958	10,005	8,940
2009	New Orleans	393,614	13,403	12,146

8) For CINCH analysis, we need information on the characteristics of units and their occupants in both the previous survey and 2011 for all units that were part of the stock in both the previous survey and 2011. For units that are part of the stock in only the previous survey, we need information on the characteristics of the units and their occupants only in the previous survey. Up to this point, we retained units that failed to meet these conditions so that we can get good estimates of the number of losses (SLOSS).

a) Keep for future analysis only those units where SAME =1 OR INTLOSS = 1.

9) Calculate:

a) Ratio1 = (BASECOUNT – SLOSS)/SSAME.

b) Ratio2 = SLOSS/SINTLOSS.

<b>Survey year</b>	<b>Metro area</b>	<b>Units SAME = 1 OR INTLOSS = 1</b>	<b>Ratio 1</b>	<b>Ratio 2</b>
1998	Birmingham	2,080	2.30572	1.04377
1998	Cincinnati	1,363	3.61606	1.07407
1998	Oakland	2,619	1.76510	1.16667
1998	Providence	1,923	2.38726	1.16667
1998	San Francisco	2,786	1.66741	1.12367
1998	San Jose	2,694	1.72202	1.31980
1998	Virginia Beach	2,813	1.64089	1.03000
2002	Anaheim	2,983	1.52028	1.07773
2002	Buffalo	1,672	2.30572	1.12033
2002	Charlotte	2,406	1.98818	1.03555
2002	Columbus	2,288	2.06205	1.03846
2002	Dallas	2,194	2.31418	1.03349
2002	Fort Worth	2,426	1.73029	1.04922
2002	Kansas City	2,354	1.92044	1.12565
2002	Milwaukee	1,915	2.17063	1.03248
2002	Phoenix	2,121	2.13992	1.00000
2002	Portland	2,676	1.76826	1.10833
2002	Riverside	2,457	2.13609	1.10856

<b>Survey year</b>	<b>Metro area</b>	<b>Units SAME = 1 OR INTLOSS = 1</b>	<b>Ratio 1</b>	<b>Ratio 2</b>
2002	San Diego	2,800	1.55098	1.07496
2004	Atlanta	2,114	2.28398	1.13636
2004	Cleveland	1,699	2.66364	1.14706
2004	Denver	2,608	1.79583	1.04396
2004	Indianapolis	2,938	1.54533	1.08197
2004	Memphis	2,399	1.79936	1.20270
2004	Pittsburgh	2,209	2.02799	1.01739
2004	Sacramento	2,511	1.77582	1.26316
2004	St. Louis	2,013	2.16830	1.11909
2009	New Orleans	2,974	1.26799	1.10343

10) Recalculate FLCINCHWT as follows:

- a) For SAME = 1,  $FLCINCHWT = Ratio1 * FLCINCHWT$ .
- b) For INTLOSS = 1,  $FLCINCHWT = Ratio2 * FLCINCHWT$ .
- c) For each metro area, compute sum of FLCINCHWT.

<b>Survey year</b>	<b>Metro area</b>	<b>BASECOUNT</b>	<b>Sum_FLCINCHWT</b>
1998	Birmingham	394,000	394,000
1998	Cincinnati	647,500	647,500
1998	Oakland	895,000	895,000
1998	Providence	415,400	415,400
1998	San Francisco	700,200	700,200
1998	San Jose	591,000	591,000
1998	Virginia Beach	632,100	632,100
2002	Anaheim	995,600	995,600
2002	Buffalo	515,500	515,500
2002	Charlotte	667,800	667,800
2002	Columbus	682,600	682,600
2002	Dallas	1,365,400	1,365,400
2002	Fort Worth	639,400	639,400
2002	Kansas City	766,500	766,500
2002	Milwaukee	626,500	626,500
2002	Phoenix	1,340,400	1,340,400
2002	Portland	811,700	811,700
2002	Riverside	1,229,500	1,229,500
2002	San Diego	1,072,000	1,072,000

Survey year	Metro area	BASECOUNT	Sum_FLCINCHWT
2004	Atlanta	1,802,800	1,802,800
2004	Cleveland	856,100	856,100
2004	Denver	949,100	949,100
2004	Indianapolis	744,900	744,900
2004	Memphis	489,200	489,200
2004	Pittsburgh	1,069,200	1,069,200
2004	Sacramento	727,500	727,500
2004	St. Louis	1,139,600	1,139,600
2009	New Orleans	512,500	512,500

11) At this point, we need to get unweighted counts of certain mobile home groups before deciding how to proceed in each metropolitan area.

- a) Compute in each metro area the number of mobile home sample units:  
unweighted sum of INxx\_NUNIT2 = 4.
- b) Compute in each metro area the number of owner-occupied mobile home sample units:  
unweighted sum of INxx\_ISTATUS = "1" AND INxx\_TENURE = 1 AND  
INxx\_NUNIT2 = 4.
- c) Compute in each metro area the number of renter-occupied mobile home sample units:  
unweighted sum of INxx\_ISTATUS = "1" AND (2 LE INxx\_TENURE LE 3) AND  
INxx\_NUNIT2 = 4.
- d) Compute in each metro area the number of vacant mobile home sample units:  
unweighted sum of (INxx\_ISTATUS='2' OR INxx\_ISTATUS='3') AND NOT(8 LE  
INxx\_VACANCY LE 11) AND INxx\_NUNIT2 = 4.
- e) Compute in each metro area the number of seasonal mobile home sample units:  
unweighted sum of (INxx\_ISTATUS='2' OR INxx\_ISTATUS='3') AND (8 LE  
INxx\_VACANCY LE 11) AND INxx\_NUNIT2 = 4.

Survey year	Metro area	All MH	Owner MH	Renter MH	Vacant MH	Seasonal MH
1998	Birmingham	76	59	8	6	3
1998	Cincinnati	21	19	0	1	1
1998	Oakland	14	12	2	0	0
1998	Providence	6	6	0	0	0
1998	San Francisco	7	6	1	0	0
1998	San Jose	46	42	4	0	0
1998	Virginia Beach	30	18	7	2	3
2002	Anaheim	56	49	3	3	1
2002	Buffalo	13	12	1	0	0

Survey year	Metro area	All MH	Owner MH	Renter MH	Vacant MH	Seasonal MH
2002	Charlotte	54	37	9	8	0
2002	Columbus	15	12	2	1	0
2002	Dallas	24	16	5	2	1
2002	Fort Worth	33	25	4	4	0
2002	Kansas City	17	15	2	0	0
2002	Milwaukee	7	7	0	0	0
2002	Phoenix	73	45	9	6	13
2002	Portland	44	40	3	1	0
2002	Riverside	111	90	8	4	9
2002	San Diego	44	39	3	2	0
2004	Atlanta	28	19	4	5	0
2004	Cleveland	12	10	0	2	0
2004	Denver	20	15	2	3	0
2004	Indianapolis	37	29	6	2	0
2004	Memphis	26	13	8	5	0
2004	Pittsburgh	58	44	3	11	0
2004	Sacramento	51	40	7	3	1
2004	St. Louis	42	34	5	2	1
2009	Los Angeles	7	6	1	0	0
2009	New Orleans	96	60	16	19	1

Ideally we would like to have 8 control counts: owners, renters, vacant, and seasonal for mobile homes and for all other units. The sample counts in the above table indicate that would be a reasonable approach only for Phoenix and Riverside-San Bernardino. For the remaining 27 areas, we will have to be satisfied with only 4 control counts: owners, renters, vacant, and seasonal for all units.

**The following steps (12 and 13) are for Phoenix and Riverside-San Bernardino only.**

- 12) From published reports, obtain estimates from the previous survey counts for all owner-occupied units, all renter-occupied units, all vacant, and all seasonal units, distinguishing between mobile homes and all other structure types (non-mobile homes). Calculate new adjustment ratios using the formulas in columns C & D of the table.

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
		<b>Pub- lished numbers</b>	<b>Sum of FLCINCHWT where</b>	<b>Ratio</b>
1	Housing Stock			
2	Occupied			
3	Owner-Occupied (mobile homes)		IN <sub>xx</sub> _ISTATUS = "1" AND IN <sub>xx</sub> _TENURE = 1 AND IN <sub>xx</sub> _NUNIT2 = 4	D3 = B3/C3
4	Owner-Occupied (other)		IN <sub>xx</sub> _ISTATUS = "1" AND IN <sub>xx</sub> _TENURE = 1 AND IN <sub>xx</sub> _NUNIT2 NE 4	D4 = B4/C4
5	Renter (mobile homes)		IN <sub>xx</sub> _ISTATUS = "1" AND (2 LE IN <sub>xx</sub> _TENURE LE 3) AND IN <sub>xx</sub> _NUNIT2 = 4	D5 = B5/C5
6	Renter (other)		IN <sub>xx</sub> _ISTATUS = "1" AND (2 LE IN <sub>xx</sub> _TENURE LE 3) AND IN <sub>xx</sub> _NUNIT2 NE4	D6 = B6/C6
7	Vacant (mobile homes)		(IN <sub>xx</sub> _ISTATUS='2' OR IN <sub>xx</sub> _ISTATUS='3') AND NOT(8 LE IN <sub>xx</sub> _VACANCY LE 11) AND IN <sub>xx</sub> _NUNIT2 = 4	D7 = B7/C7
8	Vacant (other)		(IN <sub>xx</sub> _ISTATUS='2' OR IN <sub>xx</sub> _ISTATUS='3') AND NOT(8 LE IN <sub>xx</sub> _VACANCY LE 11) AND IN <sub>xx</sub> _NUNIT2 NE 4	D8 = B8/C8
9	Seasonal (mobile homes)		(IN <sub>xx</sub> _ISTATUS='2' OR IN <sub>xx</sub> _ISTATUS='3') AND (8 LE IN <sub>xx</sub> _VACANCY LE 11) AND IN <sub>xx</sub> _NUNIT2 = 4	D9 = B9/C9
10	Seasonal (other)		(IN <sub>xx</sub> _ISTATUS='2' OR IN <sub>xx</sub> _ISTATUS='3') AND (8 LE IN <sub>xx</sub> _VACANCY LE 11) AND IN <sub>xx</sub> _NUNIT2 NE 4	D10 = B10/C10

In this table, IN<sub>xx</sub>\_ refers to the previous survey year.

The following table contains the 8 control totals for Phoenix and Riverside-San Bernardino. The first two rows are added as checks.

	<b>Phoenix (2002)</b>	<b>Riverside (2002)</b>
Housing Stock	1,340,400	1,229,500
Occupied	1,165,700	1,083,900
Owner-Occupied (mobile homes)	60,700	93,200
Owner-Occupied (other)	749,600	673,500
Renter-Occupied (mobile homes)	13,200	16,000
Renter-Occupied (other)	342,200	301,200
Vacant (mobile homes)	16,700	7,700
Vacant (other)	133,900	95,900
Seasonal (mobile homes)	11,500	5,800
Seasonal (other)	12,500	36,100

13) Use the new adjustment ratios to make final adjustment in the FLCINCHWT.

- a) If  $IN_{xx\_ISTATUS} = "1"$  (occupied units) AND  $IN_{xx\_TENURE} = 1$  (owner-occupied units) AND  $IN_{xx\_NUNIT2} = 4$  (mobile homes),  $FLCINCHWT = D3 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for owner-occupied mobile homes.
- b) If  $IN_{xx\_ISTATUS} = "1"$  (occupied units) AND  $IN_{xx\_TENURE} = 1$  (owner-occupied units) AND  $IN_{xx\_NUNIT2} \neq 4$  (non-mobile home),  $FLCINCHWT = D4 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for owner-occupied non-mobile homes.
- c) If  $IN_{xx\_ISTATUS} = "1"$  (occupied units) AND  $(2 \leq IN_{xx\_TENURE} \leq 3)$  (renter-occupied units) AND  $IN_{xx\_NUNIT2} = 4$  (mobile homes),  $FLCINCHWT = D5 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for renter-occupied mobile homes.
- d) If FLCINCHWT in which  $IN_{xx\_ISTATUS} = "1"$  (occupied units) AND  $(2 \leq IN_{xx\_TENURE} \leq 3)$  (renter-occupied units) AND  $IN_{xx\_NUNIT2} \neq 4$  (non-mobile homes),  $FLCINCHWT = D6 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for renter-occupied non-mobile homes.
- e) If FLCINCHWT in which  $(IN_{xx\_ISTATUS} = '2' \text{ OR } IN_{xx\_ISTATUS} = '3')$  AND NOT  $(8 \leq IN_{xx\_VACANCY} \leq 11)$  (URE and vacant units) AND  $IN_{xx\_NUNIT2} = 4$  (mobile homes),  $FLCINCHWT = D7 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for vacant mobile homes.
- f) If FLCINCHWT in which  $(IN_{xx\_ISTATUS} = '2' \text{ OR } IN_{xx\_ISTATUS} = '3')$  AND NOT  $(8 \leq IN_{xx\_VACANCY} \leq 11)$  (URE and vacant units) AND  $IN_{xx\_NUNIT2} \neq 4$  (non-mobile homes),  $FLCINCHWT = D8 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for vacant non-mobile homes.
- g) If FLCINCHWT in which  $(IN_{xx\_ISTATUS} = '2' \text{ OR } IN_{xx\_ISTATUS} = '3')$  AND  $(8 \leq IN_{xx\_VACANCY} \leq 11)$  (seasonal units) AND  $IN_{xx\_NUNIT2} = 4$  (mobile homes),  $FLCINCHWT = D9 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for seasonal mobile homes.
- h) If FLCINCHWT in which  $(IN_{xx\_ISTATUS} = '2' \text{ OR } IN_{xx\_ISTATUS} = '3')$  AND  $(8 \leq IN_{xx\_VACANCY} \leq 11)$  (seasonal units) AND  $IN_{xx\_NUNIT2} \neq 4$  (non-mobile homes),  $FLCINCHWT = D10 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for seasonal non-mobile homes.

METRO_AREA	GROUP	PUBLISHED	SUM_FLCINCHWT	RATIO	SUM_FLCINCHWT after adjustment
Phoenix	3	60,700	22524.31	2.69487	60,700
Phoenix	4	749,600	768055.8	0.97597	749,600
Phoenix	5	13,200	4200.52	3.14247	13,200
Phoenix	6	342,200	360275.63	0.94983	342,200
Phoenix	7	16,700	1879.38	8.88589	16,700
Phoenix	8	133,900	159358.36	0.84024	133,900
Phoenix	9	11,500	5017.29	2.29208	11,500
Phoenix	10	12,500	19088.72	0.65484	12,500
Riverside	3	93,200	26981.03	3.45428	93,200
Riverside	4	673,500	705061.05	0.95524	673,500
Riverside	5	16,000	3602.49	4.44137	16,000
Riverside	6	301,200	338312.26	0.8903	301,200
Riverside	7	7,700	948.66	8.11675	7,700
Riverside	8	95,900	107343.93	0.89339	95,900
Riverside	9	5,800	2877.88	2.01537	5,800
Riverside	10	36,100	44372.7	0.81356	36,100

**The following steps (11a, 11b, 12, and 13) are for all the metropolitan areas except Phoenix and Riverside-San Bernardino.**

11a) From published reports, obtain previous year counts of units by unit type. Calculate new adjustment ratios using the formulas in columns C & D of the table. To prevent confusion with the ratios developed in step 12, we label these ratios N for NUNIT2.

	A	B	C	D
		<b>Pub- lished numbers</b>	<b>Sum of FLCINCHWT where</b>	<b>Ratio</b>
1	Single-family detached		IN <sub>xx</sub> _NUNIT2 = '1'	N1 = B1/C1
2	Single-family attached		IN <sub>SS</sub> _NUNIT2 = '2'	N2 = B2/C2
3	2-4 unit structures		IN <sub>xx</sub> _NUNIT2 = '3' AND IN <sub>xx</sub> _NUNITS = {2,3,4}	N3 = B3/C3
4	5+ unit structures		IN <sub>xx</sub> _NUNIT2 = '3' AND IN <sub>xx</sub> _NUNITS GE 5	N4 = B4/C4
5	Manufactured houses		IN <sub>xx</sub> _NUNIT2 = {'4','5'}	N5 = B5/C5

The following table contains the 5 control totals for all the metropolitan areas except Phoenix and Riverside-San Bernardino. The BASECOUNT column acts as a check.

Survey year	Metro area	BASECOU NT	Single-family detached	Single-family attached	2-4 units	5+ units	Manufactured houses
1998	Birmingham	394,000	288,500	10,600	16,100	45,300	33,500
1998	Cincinnati	647,500	422,300	18,800	63,300	121,600	21,600
1998	Oakland	895,000	550,500	91,700	86,100	150,200	16,600
1998	Providence	415,400	245,100	12,300	99,100	53,100	5,700
1998	San Francisco	700,200	332,400	71,900	103,500	186,500	6,000
1998	San Jose	591,000	351,300	78,200	41,400	95,800	24,300
1998	Virginia Beach	632,100	384,900	81,700	48,100	92,200	25,200
2002	Anaheim	995,600	503,300	240,900	81,700	133,700	35,900
2002	Buffalo	515,500	312,800	16,700	130,600	46,500	8,900
2002	Charlotte	667,800	451,600	65,200	22,000	70,500	58,500
2002	Columbus	682,600	426,300	114,200	46,800	76,300	18,900
2002	Dallas	1,365,400	827,100	164,800	59,000	258,200	56,400
2002	Fort Worth	639,400	433,300	62,800	24,300	90,100	28,900
2002	Kansas City	766,500	541,700	98,500	26,100	80,000	20,300
2002	Milwaukee	626,500	352,600	41,200	112,700	116,500	3,500
2002	Portland	811,700	529,500	50,300	54,800	138,100	39,000
2002	San Diego	1,072,000	565,200	152,300	75,500	228,600	50,400
2004	Atlanta	1,802,800	1,225,800	108,900	68,500	331,900	67,600
2004	Cleveland	856,100	576,600	42,700	79,300	143,700	13,700
2004	Denver	949,100	565,600	93,400	35,300	234,700	20,100
2004	Indianapolis	744,900	520,200	38,800	43,300	115,300	27,200
2004	Memphis	489,200	337,700	17,400	33,900	83,900	16,400
2004	Pittsburgh	1,069,200	709,200	86,800	96,000	120,700	56,500
2004	Sacramento	727,500	495,300	32,000	49,000	115,000	36,300
2004	St. Louis	1,139,600	782,100	50,500	115,000	139,900	52,100
2009	Los Angeles	3,221,075	1,526,394	157,555	330,213	1,185,560	21,352
2009	New Orleans	512,500	334,600	30,100	71,100	59,100	17,700

11b) Use the N ratios to make the penultimate adjustment in the FLCINCHWT as follows:

- i. If IN<sub>xx</sub>\_NUNIT2 = '1' THEN FLCINCHWT = N1\*FLCINCHWT.
- ii. If IN<sub>xx</sub>\_NUNIT2 = '2' THEN FLCINCHWT = N2\*FLCINCHWT.
- iii. If IN<sub>xx</sub>\_NUNIT2 = '3' AND IN<sub>xx</sub>\_NUNITS = {2,3,4} THEN FLCINCHWT = N3\*FLCINCHWT.
- iv. If IN<sub>xx</sub>\_NUNIT2 = '3' AND IN<sub>xx</sub>\_NUNITS GE 5 THEN FLCINCHWT = N4\*FLCINCHWT.
- v. If IN<sub>xx</sub>\_NUNIT2 = {'4','5'} THEN FLCINCHWT = N5\*FLCINCHWT.

Steps 11a and 11b result in weights that produce unit in structure counts equal to the published counts (except that the four subdivisions of 5+ structures have been collapsed) **prior to** adjusting the weights to equal the counts of owner-occupied, renter-occupied, vacant, and seasonal counts. Steps 11a and 11b are designed to eliminate the substantial undercount of mobile homes that results from the application of the algorithm as used in prior metro CINCH analyses and to produce better estimates of the 2–4 unit structure group that is important in several metro areas.

- 12) From published reports, obtain estimated previous year counts for all owner-occupied units, all renter-occupied units, all vacant units, and all seasonal units, distinguishing between mobile homes and all other units. Calculate new adjustment ratios using the formulas in columns C & D of the table:

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
		<b>Pub- lished numbers</b>	<b>Sum of FLCINCHWT where</b>	<b>Ratio</b>
1	Housing Stock			
2	Occupied			
3	Owner-Occupied (all units)		IN <sub>xx</sub> _ISTATUS = "1" AND IN <sub>xx</sub> _TENURE = 1	D3 = B3/C3
5	Renter (all units)		IN <sub>xx</sub> _ISTATUS = "1" AND (2 LE IN <sub>xx</sub> _TENURE LE 3)	D5 = B5/C5
7	Vacant (all units)		(IN <sub>xx</sub> _ISTATUS = '2' OR IN <sub>xx</sub> _ISTATUS='3') AND NOT(8 LE IN <sub>xx</sub> _VACANCY LE 11)	D7 = B7/C7
9	Seasonal (all units)		(IN <sub>xx</sub> _ISTATUS='2' OR IN <sub>xx</sub> _ISTATUS='3') AND (8 LE IN <sub>xx</sub> _VACANCY LE 11)	D9 = B9/C9

The following table contains the 4 control totals for all the metropolitan areas except Phoenix and Riverside-San Bernardino. The first two columns are added as checks.

<b>Previous survey published data for</b>	<b>Housing stock</b>	<b>Occupied</b>	<b>Owner- occupied</b>	<b>Renter</b>	<b>Vacant</b>	<b>Seasonal</b>
Birmingham	394,000	358,800	252,700	106,100	32,200	3,100
Cincinnati	647,500	592,400	396,300	196,100	52,800	2,300
Oakland	895,000	855,700	508,600	347,100	37,600	1,800
Providence	415,400	379,500	239,900	139,600	28,600	7,300
San Francisco	700,200	663,200	323,500	339,800	35,000	2,000
San Jose	591,000	565,900	343,800	222,100	24,500	500
Virginia Beach	632,100	564,000	353,600	210,400	61,600	6,500
Anaheim	995,600	937,500	597,400	340,200	51,900	6,200
Buffalo	515,500	461,300	314,100	147,200	50,800	3,400
Charlotte	667,800	593,700	424,200	169,500	72,000	2,100
Columbus	682,600	613,200	401,400	211,800	67,600	1,800

Previous survey published data for	Housing stock	Occupied	Owner-occupied	Renter	Vacant	Seasonal
Dallas	1,365,400	1,235,300	784,100	451,200	127,900	2,300
Fort Worth	639,400	585,900	392,800	193,100	51,700	1,800
Kansas City	766,500	697,400	487,100	210,300	67,300	1,700
Milwaukee	626,500	584,600	371,500	213,100	40,500	1,400
Portland	811,700	747,800	497,600	250,200	61,500	2,500
San Diego	1,072,000	999,100	586,000	413,100	67,100	5,800
Atlanta	1,802,800	1,595,800	1,133,500	462,300	203,200	3,800
Cleveland	856,100	769,300	545,500	223,800	86,400	400
Denver	949,100	855,700	600,600	255,100	91,000	2,400
Indianapolis	744,900	657,600	469,800	187,900	86,100	1,200
Memphis	489,200	430,800	287,500	143,200	57,300	1,200
Pittsburgh	1,069,200	953,800	705,800	248,100	111,800	3,500
Sacramento	727,500	669,400	450,600	218,900	53,300	4,700
St. Louis	1,139,600	1,029,400	750,400	279,000	105,200	5,100
Los Angeles	3,221,075	3,004,631	1,443,277	1,561,354	198,308	18,136
New Orleans	512,500	436,000	290,400	145,700	71,700	4,700

13) Use the new adjustment ratios to make final adjustment in the FLCINCHWT.

- a) If  $IN_{xx\_ISTATUS} = "1"$  (occupied units) AND  $IN_{xx\_TENURE} = 1$  (owner-occupied units),  $FLCINCHWT = D3 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for owner-occupied homes.
- b) If  $IN_{xx\_ISTATUS} = "1"$  (occupied units) AND (2 LE  $IN_{xx\_TENURE}$  LE 3) (renter-occupied units),  $FLCINCHWT = D5 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for renter-occupied homes.
- c) If FLCINCHWT in which ( $IN_{xx\_ISTATUS} = "2"$  OR  $IN_{xx\_ISTATUS} = "3"$ ) AND NOT (8 LE  $IN_{xx\_VACANCY}$  LE 11) (URE and vacant units),  $FLCINCHWT = D7 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for vacant units.
- d) If FLCINCHWT in which ( $IN_{xx\_ISTATUS} = "2"$  OR  $IN_{xx\_ISTATUS} = "3"$ ) AND (8 LE  $IN_{xx\_VACANCY}$  LE 11) (seasonal units),  $FLCINCHWT = D9 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for seasonal homes.

<b>METRO_AREA</b>	<b>GROUP</b>	<b>PUBLISHED</b>	<b>SUM_FLCINCHWT</b>	<b>RATIO</b>	<b>SUM_FLCINCHWT after adjustment</b>
Birmingham	3	252,700	265424.97	0.95206	252,700
Birmingham	4	106,100	97316.24	1.09026	106,100
Birmingham	5	32,200	27569.87	1.16794	32,200
Birmingham	6	3,100	3688.92	0.84035	3,100
Cincinnati	3	396,300	465136.63	0.85201	396,300
Cincinnati	4	196,100	144327.71	1.35871	196,100
Cincinnati	5	52,800	36389.66	1.45096	52,800
Cincinnati	6	2,300	1646	1.39733	2,300
Oakland	3	508,600	508902.22	0.99941	508,600
Oakland	4	347,100	346847.29	1.00073	347,100
Oakland	5	37,600	38336.05	0.9808	37,600
Oakland	6	1,800	914.45	1.96841	1,800
Providence	3	239,900	242873.49	0.98776	239,900
Providence	4	139,600	132674.55	1.0522	139,600
Providence	5	28,600	31701.87	0.90216	28,600
Providence	6	7,300	8150.09	0.8957	7,300
San Francisco	3	323,500	314445.56	1.02879	323,500
San Francisco	4	339,800	345116.34	0.9846	339,800
San Francisco	5	35,000	37790.96	0.92615	35,000
San Francisco	6	2,000	2847.14	0.70246	2,000
San Jose	3	343,800	335274.9	1.02543	343,800
San Jose	4	222,100	229201.94	0.96901	222,100
San Jose	5	24,500	25914.07	0.94543	24,500
San Jose	6	500	609.09	0.82089	500
Virginia Beach	3	353,600	354926.89	0.99626	353,600
Virginia Beach	4	210,400	210321.86	1.00037	210,400
Virginia Beach	5	61,600	59973.26	1.02712	61,600
Virginia Beach	6	6,500	6878	0.94504	6,500
Anaheim	3	597,400	582522.25	1.02554	597,400
Anaheim	4	340,200	346640.78	0.98142	340,200
Anaheim	5	51,900	59641.41	0.8702	51,900
Anaheim	6	6,200	6795.56	0.91236	6,200
Buffalo	3	314,100	342520.69	0.91702	314,100
Buffalo	4	147,200	125060.2	1.17703	147,200
Buffalo	5	50,800	43029.22	1.18059	50,800
Buffalo	6	3,400	4889.89	0.69531	3,400
Charlotte	3	424,200	420384.54	1.00908	424,200
Charlotte	4	169,500	164605.78	1.02973	169,500
Charlotte	5	72,000	80074.65	0.89916	72,000

<b>METRO_AREA</b>	<b>GROUP</b>	<b>PUBLISHED</b>	<b>SUM_FLCINCHWT</b>	<b>RATIO</b>	<b>SUM_FLCINCHWT after adjustment</b>
Charlotte	6	2,100	2735.03	0.76782	2,100
Columbus	3	401,400	424404.05	0.9458	401,400
Columbus	4	211,800	190936.11	1.10927	211,800
Columbus	5	67,600	65249.21	1.03603	67,600
Columbus	6	1,800	2010.63	0.89524	1,800
Dallas	3	784,100	769638.39	1.01879	784,100
Dallas	4	451,200	466045.51	0.96815	451,200
Dallas	5	127,900	127592.27	1.00241	127,900
Dallas	6	2,300	2123.83	1.08295	2,300
Fort Worth	3	392,800	393078.31	0.99929	392,800
Fort Worth	4	193,100	188406.89	1.02491	193,100
Fort Worth	5	51,700	56857.88	0.90928	51,700
Fort Worth	6	1,800	1056.92	1.70306	1,800
Kansas City	3	487,100	488274.86	0.99759	487,100
Kansas City	4	210,300	210141.87	1.00075	210,300
Kansas City	5	67,300	65904.52	1.02117	67,300
Kansas City	6	1,700	2178.74	0.78027	1,700
Milwaukee	3	371,500	422872.83	0.87851	371,500
Milwaukee	4	213,100	165286.06	1.28928	213,100
Milwaukee	5	40,500	36492.93	1.1098	40,500
Milwaukee	6	1,400	1848.18	0.7575	1,400
Portland	3	497,600	481677.09	1.03306	497,600
Portland	4	250,200	257427.68	0.97192	250,200
Portland	5	61,500	69320.06	0.88719	61,500
Portland	6	2,500	3275.17	0.76332	2,500
San Diego	3	586,000	574860.13	1.01938	586,000
San Diego	4	413,100	415385.98	0.9945	413,100
San Diego	5	67,100	76343.14	0.87893	67,100
San Diego	6	5,800	5410.76	1.07194	5,800
Atlanta	3	1,133,500	1165910.01	0.9722	1,133,500
Atlanta	4	462,300	418264.2	1.10528	462,300
Atlanta	5	203,200	212478.93	0.95633	203,200
Atlanta	6	3,800	6146.87	0.6182	3,800
Cleveland	3	545,500	592651.93	0.92044	545,500
Cleveland	4	223,800	185857.01	1.20415	223,800
Cleveland	5	86,400	77591.06	1.11353	86,400
Denver	3	600,600	577191.35	1.04056	600,600
Denver	4	255,100	263001.6	0.96996	255,100
Denver	5	91,000	106274.98	0.85627	91,000

METRO_AREA	GROUP	PUBLISHED	SUM_FLCINCHWT	RATIO	SUM_FLCINCHWT after adjustment
Denver	6	2,400	2632.07	0.91183	2,400
Indianapolis	3	469,800	455092.2	1.03232	469,800
Indianapolis	4	187,900	196714.2	0.95519	187,900
Indianapolis	5	86,100	92319.96	0.93263	86,100
Indianapolis	6	1,200	773.64	1.5511	1,200
Memphis	3	287,500	306274.74	0.9387	287,500
Memphis	4	143,200	130764.45	1.0951	143,200
Memphis	5	57,300	50980.4	1.12396	57,300
Memphis	6	1,200	1180.41	1.0166	1,200
Pittsburgh	3	705,800	756709.56	0.93272	705,800
Pittsburgh	4	248,100	214853.16	1.15474	248,100
Pittsburgh	5	111,800	92834.62	1.20429	111,800
Pittsburgh	6	3,500	4802.66	0.72876	3,500
Sacramento	3	450,600	437240.22	1.03055	450,600
Sacramento	4	218,900	220348.73	0.99343	218,900
Sacramento	5	53,300	63562.32	0.83855	53,300
Sacramento	6	4,700	6348.73	0.74031	4,700
St. Louis	3	750,400	799518.56	0.93856	750,400
St. Louis	4	279,000	251090.24	1.11115	279,000
St. Louis	5	105,200	81823.27	1.2857	105,200
St. Louis	6	5,100	7167.93	0.7115	5,100
New Orleans	3	290,400	273439.34	1.06203	290,400
New Orleans	4	145,700	145852.39	0.99896	145,700
New Orleans	5	71,700	87708.69	0.81748	71,700
New Orleans	6	4,700	5499.59	0.85461	4,700

**The remaining steps apply to all areas:**

14) Calculate the sum of FLCINCHWT after final weighting for cases with SAME=1, for cases with INTLOSS =1, and for all cases. The first two sums should equal the third for each area and the third sum should equal the BASECOUNT for each area.

Survey year	Metro area	BASECOUNT	SUM_FLCINCHWT for SAME = 1	SUM_FLCINCHWT for INTLOSS = 1	SUM_FLCINCHWT for all units
1998	Birmingham	394,000	385,784	8,316	394,100
1998	Cincinnati	647,500	642,530	4,970	647,500
1998	Oakland	895,000	888,085	7,015	895,100
1998	Providence	415,400	411,526	3,874	415,400
1998	San Francisco	700,200	693,655	6,646	700,300
1998	San Jose	591,000	586,284	4,616	590,900

Survey year	Metro area	BASECOUNT	SUM_FLCINCHWT for SAME = 1	SUM_FLCINCHWT for INTLOSS = 1	SUM_FLCINCHWT for all units
1998	Virginia Beach	632,100	617,702	14,399	632,100
2002	Anaheim	995,600	991,067	4,633	995,700
2002	Buffalo	515,500	503,714	11,786	515,500
2002	Charlotte	667,800	657,505	10,295	667,800
2002	Columbus	682,600	678,311	4,289	682,600
2002	Dallas	1,365,400	1,342,664	22,836	1,365,500
2002	Fort Worth	639,400	632,395	7,005	639,400
2002	Kansas City	766,500	757,134	9,266	766,400
2002	Milwaukee	626,500	621,333	5,168	626,500
2002	Phoenix	1,340,400	1,325,995	14,305	1,340,300
2002	Portland	811,700	806,845	4,955	811,800
2002	Riverside	1,229,500	1,222,209	7,191	1,229,400
2002	San Diego	1,072,000	1,064,861	7,139	1,072,000
2004	Atlanta	1,802,800	1,763,472	39,328	1,802,800
2004	Cleveland	856,100	847,227	8,473	855,700
2004	Denver	949,100	944,479	4,621	949,100
2004	Indianapolis	744,900	734,328	10,672	745,000
2004	Memphis	489,200	478,102	11,098	489,200
2004	Pittsburgh	1,069,200	1,053,043	16,157	1,069,200
2004	Sacramento	727,500	723,822	3,678	727,500
2004	St. Louis	1,139,600	1,129,509	10,191	1,139,700
2009	New Orleans	512,500	500,911	11,589	512,500

15) Check on the estimate of mobile homes (INxx\_NUNIT2 = 4) and single-unit, detached (INxx\_NUNIT2 = 1). In past CINCH analyses, these two counts have been the most difficult to estimate. For the national CINCH and for Phoenix and Riverside-San Bernardino, we forced these sums to equal their controls. The sample counts of mobile homes were insufficient for us to do this in the remaining sites.

**Step 15 Table**

Survey year	Metro area	Published		Estimated		(Est - Pub)/Published	
		Single-family detached	Manufactured houses	Single-family detached	Manufactured houses	Single-family detached	Manufactured houses
1998	Birmingham	288,500	33,500	303,489	16,073	5.2%	-52.0%
1998	Cincinnati	422,300	21,600	444,652	10,021	5.3%	-53.6%
1998	Oakland	550,500	16,600	561,496	4,998	2.0%	-69.9%
1998	Providence	245,100	5,700	253,381	1,305	3.4%	-77.1%
1998	San Francisco	332,400	6,000	330,144	2,145	-0.7%	-64.2%
1998	San Jose	351,300	24,300	361,176	10,806	2.8%	-55.5%
1998	Virginia Beach	384,900	25,200	396,890	7,306	3.1%	-71.0%
2002	Anaheim	451,500	33,700	517,382	18,527	14.6%	-45.0%
2002	Buffalo	312,800	8,900	325,920	4,227	4.2%	-52.5%
2002	Charlotte	451,600	58,500	471,553	16,231	4.4%	-72.3%
2002	Columbus	426,300	18,900	441,911	4,623	3.7%	-75.5%
2002	Dallas	827,100	56,400	859,967	12,962	4.0%	-77.0%
2002	Fort Worth	433,300	28,900	448,154	8,360	3.4%	-71.1%
2002	Kansas City	541,700	20,300	553,107	6,048	2.1%	-70.2%
2002	Milwaukee	352,600	3,500	350,236	1,470	-0.7%	-58.0%
2002	Phoenix	816,900	102,000	791,253	102,100	-3.1%	0.1%
2002	Portland	529,500	39,000	552,512	14,374	4.3%	-63.1%
2002	Riverside	830,000	122,800	842,841	122,700	1.5%	-0.1%
2002	San Diego	565,200	50,400	594,685	14,583	5.2%	-71.1%
2004	Atlanta	1,225,800	67,600	1,265,775	24,785	3.3%	-63.3%
2004	Cleveland	576,600	42,700	595,317	5,969	3.2%	-86.0%
2004	Denver	565,600	20,100	574,978	7,594	1.7%	-62.2%
2004	Indianapolis	520,200	27,200	528,860	9,829	1.7%	-63.9%
2004	Memphis	337,700	16,400	350,905	6,060	3.9%	-63.0%
2004	Pittsburgh	709,200	56,500	756,433	30,084	6.7%	-46.8%
2004	Sacramento	495,300	36,300	512,401	15,591	3.5%	-57.0%

Survey year	Metro area	Published		Estimated		(Est - Pub)/Published	
		Single-family detached	Manufactured houses	Single-family detached	Manufactured houses	Single-family detached	Manufactured houses
2004	St. Louis	782,100	52,100	813,694	24,652	4.0%	-52.7%
2009	New Orleans	334,629	17,716	333,596	12,750	-0.3%	-28.0%

## ***Backward Looking: From 2011 to the Previous Survey***

The following are the steps necessary to prepare the data to analyze where 2011 units came from. AHS variables are given their codebook names and presented in capital letters. The 2011 variables are labeled IN11\_; we refer to variables in the previous survey by the prefix INxx\_ where xx is the year of the previous survey. Variables without a IN prefix have values independent of the survey year. The algorithm should be applied to each metropolitan area separately.

### 1) Preliminary step:

- a) From the previous survey PUF, compute for each metropolitan area a pure weight count of mobile homes built before 2000 (OLDMHALL) by summing INxx\_PWT for cases where INxx\_NUNIT2 = {4,5} AND INxx\_BUILT LE 1999. Omit this step for Los Angeles and New Orleans.
- b) Eliminate all cases from the 2011 PUF where NATLFLAG = '01' OR HUDSAMP = '01'. In 2011, the metropolitan and national samples were combined on the same PUF and a supplement sample of HUD-assisted units was added to the PUF. This step eliminates all cases in the national sample and in the supplemental sample.
- c) Merge files from the previous surveys and 2011 file after step 1b, using the flat files. Keep units that appear in both years and in the 2011 file only.

Los Angeles is special situation. The last metropolitan survey for Los Angeles was 2004, based on a combination of cases from the national sample and a special supplemental sample. In 2011, a new supplemental sample was drawn for Los Angeles. Therefore, the CINCH analysis for Los Angeles can only be based on cases from the national sample. For this reason, HUD opted to use 2009 as the base year for the Los Angeles CINCH. Thus, for Los Angeles, merge the 2009 national file with the 2011 PUF using only cases with IN11\_NATLFLAG = '01'.

- d) The pure weight (PWT) is the inverse of the probability of a unit being in the sample and is the base used to construct weights for CINCH analysis. In the prior metropolitan samples, PWT was calculated with respect to the geography of the metropolitan area at the time of the survey. Two things were different in 2011 PUF. The PWT was computed with respect to national housing stock, and the PWT took into account the presence of units from the national sample in the combined PUF. Because of these distortions in the 2011 PUF, the PWT from the previous survey should be used in calculating backward-looking CINCH weights. This is feasible for cases that are in both the previous survey and the 2011 survey, but it is not feasible for sample units that were added to the sample after the previous survey to account for additions to the stock. The 2011 PWT has to be used for these cases; however, using information on cases in both surveys, one can adjust the 2011 PWT to more accurately reflect the correct pure weight for CINCH purposes for these added units.

The following steps compare the prior survey PWT to the 2011 PWT for cases in both surveys. The table reports these comparisons by year of previous survey.

i) Merge the 1998 metropolitan sample with the extract after step 1c; keep cases in both files.

(1) Calculate PWTRATIO as follows:

```
IF (IN98_PWT = B OR IN11_PWT = B) THEN PWTRATIO = B
IF NOT(IN98_PWT = B OR IN11_PWT = B) THEN PWTRATIO =
IN98_PWT/IN11_PWT
```

(2) For each SMSA, do a full PROC FREQ (minimum, mean, median, maximum) for PWTRATIO (where PWTRATIO NE B).

ii) Merge the 2002 metropolitan sample with the extract after step 1c; keep cases in both files.

(1) Calculate PWTRATIO as follows:

```
IF (IN02_PWT = B OR IN11_PWT = B) THEN PWTRATIO = B
IF NOT(IN02_PWT = B OR IN11_PWT = B) THEN PWTRATIO =
IN02_PWT/IN11_PWT
```

(2) For each SMSA, do a full PROC FREQ (minimum, mean, median, maximum) for PWTRATIO (where PWTRATIO NE B).

iii) Merge the 2004 metropolitan sample with the extract after step 1c; keep cases in both files.

(1) Calculate PWTRATIO as follows:

```
IF (IN04_PWT = B OR IN11_PWT = B) THEN PWTRATIO = B
IF NOT(IN04_PWT = B OR IN11_PWT = B) THEN PWTRATIO =
IN04_PWT/IN11_PWT
```

(2) For each SMSA, do a full PROC FREQ (minimum, mean, median, maximum) for PWTRATIO (where PWTRATIO NE B).

iv) For New Orleans (SMSA = 5560, merge the 2009 metropolitan sample with the extract after step 1c), keep cases in both files.

(1) Calculate PWTRATIO as follows:

```
IF (IN09_PWT = B OR IN11_PWT = B) THEN PWTRATIO = B
IF NOT(IN09_PWT = B OR IN11_PWT = B) THEN PWTRATIO =
IN09_PWT/IN11_PWT
```

(2) Do a full PROC FREQ (minimum, mean, median, maximum) for PWTRATIO (where PWTRATIO NE B).

**Table for Step 1 d**

Area	Survey year	Sample size	Ratio of (PWT in prior survey)/(PWT in 2011)			
			Minimum	Mean	Median	Maximum
Birmingham	1998	2553	0.38242	1.74735	1.52969	25.9907
Cincinnati	1998	1676	0.3507	1.46323	1.40281	23.8348
Oakland	1998	3522	0.41804	1.82069	1.67218	28.4116
Providence	1998	2437	0.33394	1.67704	1.33577	22.6957
San Francisco	1998	3780	0.43841	2.14041	1.75365	29.7959
San Jose	1998	3495	0.42347	1.80545	1.6939	28.7807
Virginia Beach	1998	3480	0.43784	2.06535	1.75137	29.7572
Anaheim	2002	3717	0.44453	1.81465	1.77813	30.2119
Buffalo	2002	2214	0.5326	2.40693	2.13038	36.1969
Charlotte	2002	3016	0.35404	1.42088	1.41617	24.0618
Columbus	2002	2905	0.42166	1.76983	1.68666	28.6576
Dallas	2002	2907	0.35239	1.43859	1.40956	23.9496
Fort Worth	2002	3113	0.40978	1.80422	1.6391	28.2696
Kansas City	2002	2861	0.38956	1.64644	1.55824	26.4757
Milwaukee	2002	2277	0.48075	2.2215	1.923	32.6733
Phoenix	2002	2772	0.35459	1.44958	1.41835	24.099
Portland	2002	3393	0.36371	1.5851	1.45482	24.7185
Riverside	2002	3083	0.31163	1.3649	1.24652	21.1794
San Diego	2002	3571	0.41897	1.76115	1.6759	28.754
Atlanta	2004	2677	0.3546	1.45503	1.4184	24.0998
Cleveland	2004	2266	0.4342	1.85818	1.73678	29.5093
Denver	2004	3272	0.36217	1.60112	1.44868	24.6143
Indianapolis	2004	3549	0.45586	1.99082	1.82346	30.982
Memphis	2004	3007	0.39369	2.05249	1.88971	32.1076
Pittsburgh	2004	2729	0.45117	2.02035	1.80469	30.6631
Sacramento	2004	3367	0.40158	1.66462	1.60631	27.2925
St. Louis	2004	2452	0.45384	1.95537	1.81536	30.8443
Los Angeles	2009	1335	3.37658	3.04836	3.04836	3.04836
New Orleans	2009	4427	0.50946	2.20604	2.03783	36.7779

The Los Angeles numbers are from an analysis of national only cases in 2009 and 2011.

vi) Adjust PWT in each of the 29 metropolitan as follows:

If the case has a positive value for PWT in the previous survey, then set ADJWPT = INxx\_PWT where xx is the year of the previous survey.

If the case has a positive value for PWT only in 2011, then set ADJPWT = (mean from above table)\*IN11\_PWT.

For the national CINCH, the median PWTRATIO was used to adjust the 2011 PWT. The distribution of PWTRATIO for the cases in the national sample was much tighter with the majority of cases have a PWTRATIO equal to the median. The table above shows that PWTRATIO has a wide distribution in each of the metropolitan areas with the exception of Los Angeles. Given the wider distribution, it was decided that the mean of PWTRATIO would be a better factor in the adjustment.

2) Delete cases where:

- a) (IN11\_NOINT GE 38) These units were dropped from the sample for statistical reasons. They do not represent the housing stock in the 2011 AHS.
- b) (10 LE IN11\_NOINT LT 38). These are type B or type C losses in 2011. These units are not part of the 2011 stock, and therefore we do not track them backward.
- c) (IN11\_SAMEDU = 2). These are cases where it is possible that the Census Bureau interviewed the wrong unit in the previous survey.
- d) IN11\_REUAD = 11. These are units added to improve the sample. They are part of the 2011 housing stock, but we cannot tell whether they were in the previous survey year stock or added by new construction or other means between previous survey year and 2011. In most cases, they do not represent market-driven additions to the housing stock.
- e) (IN11\_NUNIT2 = '4' AND IN11\_BUILT LE 1999 AND NOT(INxx\_ISTATUS = '1' OR INxx\_ISTATUS = '2' OR INxx\_ISTATUS = '3' OR INxx\_ISTATUS = '4')) These cases are the mobile homes added to the sample in 2005. We cannot use them for CINCH analysis because we have no information on their status in previous survey year or 2002. Omit this step for Los Angeles and New Orleans because the previous samples for these two metro were post-2005 and therefore these units had already been dropped.

**Table for Step 2**

YEAR	METRO_AREA	Number of sample cases after preceding steps					
		After 1	After 2a	After 2b	After 2c	After 2d	After 2e
1998	Birmingham	4387	4377	3891	3887	2902	2902
1998	Cincinnati	4132	4132	3923	3921	2107	2106
1998	Oakland	3994	3993	3889	3888	3861	3861
1998	Providence	4368	4364	4206	4206	2661	2661
1998	San Francisco	4085	4083	3933	3933	3917	3917
1998	San Jose	4153	4149	4037	4036	3841	3840
1998	Virginia Beach	4249	4248	3961	3960	3816	3815

YEAR	METRO_AREA	Number of sample cases after preceding steps					
		After 1	After 2a	After 2b	After 2c	After 2d	After 2e
2002	Anaheim	4011	4010	3948	3944	3890	3890
2002	Buffalo	4149	4147	3772	3763	2393	2393
2002	Charlotte	4101	4099	3888	3888	3670	3669
2002	Columbus	4157	4157	4018	4017	3176	3175
2002	Dallas	3827	3826	3584	3583	3319	3319
2002	Fort Worth	4184	4179	3932	3928	3618	3618
2002	Kansas City	3978	3976	3812	3811	3160	3160
2002	Milwaukee	4202	4200	4030	4029	2714	2714
2002	Phoenix	3731	3727	3524	3522	3307	3306
2002	Portland	4019	4012	3910	3910	3760	3757
2002	Riverside	3902	3902	3762	3754	3615	3615
2002	San Diego	3962	3961	3852	3847	3774	3773
2004	Atlanta	3578	3577	3267	3266	2947	2946
2004	Cleveland	4129	4128	3955	3953	2342	2342
2004	Denver	3777	3765	3674	3674	3538	3538
2004	Indianapolis	4144	4143	3967	3967	3792	3788
2004	Memphis	4233	4231	3897	3897	3233	3224
2004	Pittsburgh	3955	3951	3698	3698	2711	2711
2004	Sacramento	4118	4117	4027	4027	3683	3682
2004	St. Louis	3917	3916	3694	3693	2591	2591
2009	Los Angeles	4463	4463	4354	4354	1602	1602
2009	New Orleans	4545	4544	3916	3912	3842	3842

3) Adjust the pure weights of manufactured (mobile) homes. Omit this step for Los Angeles and New Orleans.

a) From merged file after step 2, compute a pure weight count of mobile homes built before 2000 that are in both years (OLDMHKEPT) by summing ADJPWT for cases where IN11\_NUNIT2 = 4 AND IN11\_BUILT LE 1999.

b) Adjust the pure weights of all manufactured (mobile) homes.  
IF IN11\_NUNIT2 = 4 AND IN11\_BUILT GE 2000  
ADJPWT = ADJPWT.  
IF IN11\_NUNIT2 = 4 AND IN11\_BUILT LE 1999  
ADJPWT = ADJPWT\*(OLDMHALL/OLDMHKEPT).

**Table for Step 3**

<b>YEAR</b>	<b>METRO_AREA</b>	<b>OLDMHALL</b>	<b>OLDMHKEPT</b>	<b>OLDMHALL/ OLDMHKEPT</b>
1998	Birmingham	25,340	6,505	3.895
1998	Cincinnati	14,130	3,402	4.154
1998	Oakland	10,013	3,023	3.313
1998	Providence	3,621	634	5.714
1998	San Francisco	2,862	1,657	1.727
1998	San Jose	16,991	6,402	2.654
1998	Virginia Beach	15,704	4,883	3.216
2002	Anaheim	33,308	12,196	2.731
2002	Buffalo	5,422	1,772	3.059
2002	Charlotte	30,433	8,968	3.393
2002	Columbus	10,948	2,993	3.659
2002	Dallas	29,799	8,481	3.513
2002	Fort Worth	13,924	5,426	2.566
2002	Kansas City	9,908	3,587	2.762
2002	Milwaukee	1,933	945	2.046
2002	Phoenix	45,166	17,181	2.629
2002	Portland	24,238	8,079	3.000
2002	Riverside	41,905	15,224	2.753
2002	San Diego	26,513	10,609	2.499
2004	Atlanta	36,133	10,584	3.414
2004	Cleveland	10,318	2,064	5.000
2004	Denver	12,526	3,708	3.378
2004	Indianapolis	16,256	6,010	2.705
2004	Memphis	7,196	2,901	2.481
2004	Pittsburgh	31,041	12,297	2.524
2004	Sacramento	19,909	7,931	2.510
2004	St. Louis	28,285	9,020	3.136

- 4) Obtain an estimate of the 2011 stock (CURRENTCOUNT) from the AHS publication for 2011.
- 5) Compute SADJPWT = sum of ADJPWT after step 5; this sum is a first estimate of the size of the 2011 housing stock based on units retained for analysis.
- 6) Compute a BLCINCHWT = ADJPWT\*(CURRENTCOUNT/SADJPWT). This computation ratios the weights up so that they sum to the 2011 stock.

**Table for Steps 4, 5, & 6**

YEAR	METRO_AREA	CURRENTCOUNT	SADJPWT	CURRENTCOUNT/ SADJPWT
1998	Birmingham	502,000	255,231	1.967
1998	Cincinnati	921,700	291,655	3.160
1998	Oakland	994,600	741,770	1.341
1998	Providence	583,000	248,563	2.345
1998	San Francisco	766,600	598,916	1.280
1998	San Jose	655,900	493,975	1.328
1998	Virginia Beach	694,200	525,257	1.322
2002	Anaheim	1,054,100	875,181	1.204
2002	Buffalo	520,200	325,679	1.597
2002	Charlotte	747,600	497,855	1.502
2002	Columbus	798,400	459,854	1.736
2002	Dallas	1,691,000	958,043	1.765
2002	Fort Worth	856,200	555,852	1.540
2002	Kansas City	893,600	546,332	1.636
2002	Milwaukee	674,100	417,265	1.616
2002	Phoenix	1,821,700	967,980	1.882
2002	Portland	934,000	647,055	1.443
2002	Riverside	1,511,800	802,165	1.885
2002	San Diego	1,186,100	906,119	1.309
2004	Atlanta	2,175,600	1,096,232	1.985
2004	Cleveland	958,700	444,145	2.159
2004	Denver	1,067,000	720,348	1.481
2004	Indianapolis	765,300	621,934	1.231
2004	Memphis	552,500	363,417	1.520
2004	Pittsburgh	1,104,900	656,153	1.684
2004	Sacramento	883,700	607,050	1.456
2004	St. Louis	1,248,100	683,765	1.825
2009	Los Angeles	3,457,800	3,749,490	0.922
2009	New Orleans	545,700	486,863	1.121

7) Identify *sames*, *new construction*, *interviewed new construction*, *other adds*, and *interviewed other adds*: 4

a) SAME = 1 if IN<sub>xx</sub>\_ISTATUS = 1, 2, or 3 AND IN11\_ISTATUS = 1, 2, OR 3 AND NOT(IN11\_NUNIT2 = '4' AND IN11\_BUILT GE xx AND IN<sub>xx</sub>\_BUILT NE xx))

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<sup>4</sup> Other adds are units that were type B losses in the previous survey but are in the 2011 housing stock, plus new housing units that are not new construction, such as the conversion to residential use of a warehouse or mobile home move-ins.

- b) NC = 1 if IN11\_ISTATUS=1, 2, 3, or 4 AND ((IN11\_REUAD = 3) OR (10 LE INxx\_NOINT LE 11) OR (IN11\_NUNIT2 = '4' AND IN11\_BUILT GE xx AND INxx\_BUILT NE xx)) .
- c) INTNC = 1 IF NC=1 AND IN11\_ISTATUS=1, 2, or 3
- d) ADD = 1 if IN11\_ISTATUS=1, 2, 3, or 4 AND ((4 LE IN11\_REUAD LE 10) OR (12 LE INxx\_NOINT LE 17)) AND NOT NC=1
- e) INTADD = 1 if ADD =1 AND IN11\_ISTATUS=1, 2, OR 3

**Table for Step 7 – Sample counts**

YEAR	METRO_AREA	After 2e	SAME	NC	INTNC	ADD	INTADD	Other
1998	Birmingham	2902	1988	592	517	17	16	305
1998	Cincinnati	2106	1336	487	436	17	15	266
1998	Oakland	3861	2589	406	335	43	37	823
1998	Providence	2661	1887	288	238	27	25	459
1998	San Francisco	3917	2745	222	172	75	62	875
1998	San Jose	3840	2666	437	380	63	54	674
1998	Virginia Beach	3815	2713	548	458	21	18	533
2002	Anaheim	3890	2961	236	190	8	8	685
2002	Buffalo	2393	1594	144	108	22	20	633
2002	Charlotte	3669	2337	804	680	14	13	514
2002	Columbus	3175	2262	343	289	15	14	555
2002	Dallas	3319	2105	598	505	14	13	602
2002	Fort Worth	3618	2373	673	563	13	13	559
2002	Kansas City	3160	2306	406	360	15	15	433
2002	Milwaukee	2714	1884	290	247	7	7	533
2002	Phoenix	3306	2062	669	562	22	19	553
2002	Portland	3757	2649	439	359	20	19	649
2002	Riverside	3615	2421	659	547	25	25	510
2002	San Diego	3773	2772	317	257	20	19	664
2004	Atlanta	2946	2026	445	366	9	9	466
2004	Cleveland	2342	1665	151	128	9	8	517
2004	Denver	3538	2585	322	278	12	9	619
2004	Indianapolis	3788	2877	370	317	35	28	506
2004	Memphis	3224	2325	364	308	16	15	519
2004	Pittsburgh	2711	2151	113	94	17	16	430
2004	Sacramento	3682	2492	382	307	17	16	791
2004	St. Louis	2591	1979	225	189	21	17	366
2009	Los Angeles	1602	1049	144	120	7	7	402
2009	New Orleans	3842	2885	50	46	152	146	755

“Other” are cases that were in both 2009 and 2011 but were not interviewed in both years and, therefore, were not SAME.

8) Calculate:

- a) SSAME = sum of ADJPWT for SAME = 1
- b) SNC = sum of ADJPWT for NC = 1.
- c) SINTNC = sum of ADJPWT for INTNC = 1
- d) SADD = sum of ADJPWT for ADD = 1.
- e) SINTADD = sum of ADJPWT for INTADD = 1.

9) Calculate:

- a) Ratio1 = (CURRENTCOUNT – (SADD + SNC))/SSAME.
- b) Ratio2 = SNC/SINTNC.
- c) Ratio3 = SADD/SINTADD.

**Table for Step 9**

YEAR	METRO_AREA	RATIO1	RATIO2	RATIO3
1998	Birmingham	1.1413	1.1455	1.0352
1998	Cincinnati	1.1911	1.1071	1.1169
1998	Oakland	1.3148	1.2134	1.1555
1998	Providence	1.2412	1.2104	1.0879
1998	San Francisco	1.3185	1.2917	1.2115
1998	San Jose	1.2497	1.1449	1.2868
1998	Virginia Beach	1.1913	1.1967	1.1711
2002	Anaheim	1.2244	1.2427	1.0000
2002	Buffalo	1.3937	1.3340	1.1054
2002	Charlotte	1.2095	1.1816	1.0443
2002	Columbus	1.2407	1.1875	1.0109
2002	Dallas	1.2947	1.1821	1.0489
2002	Fort Worth	1.2289	1.1960	1.0000
2002	Kansas City	1.1844	1.1273	1.0000
2002	Milwaukee	1.2982	1.1753	1.0000
2002	Phoenix	1.2554	1.1899	1.0737
2002	Portland	1.2372	1.2237	1.0462
2002	Riverside	1.2022	1.2042	1.0000
2002	San Diego	1.2342	1.2316	1.0598
2004	Atlanta	1.2227	1.2157	1.0000
2004	Cleveland	1.3068	1.1795	1.1229
2004	Denver	1.2363	1.1584	1.2770
2004	Indianapolis	1.1736	1.1683	1.1868

YEAR	METRO_AREA	RATIO1	RATIO2	RATIO3
2004	Memphis	1.2193	1.1796	1.0331
2004	Pittsburgh	1.1934	1.1972	1.0548
2004	Sacramento	1.3106	1.2451	1.0561
2004	St. Louis	1.1811	1.1908	1.1930
2009	Los Angeles	1.3856	1.1990	1.0000
2009	New Orleans	1.2613	1.0872	1.0399

10) Recalculate BLCINCHWT as follows:

- a) For SAME = 1,  $BLCINCHWT = Ratio1 * BLCINCHWT$ .
- b) For INTNC = 1,  $BLCINCHWT = Ratio2 * BLCINCHWT$ .
- c) For INTADD = 1,  $BLCINCHWT = Ratio4 * BLCINCHWT$ .

11) For CINCH analysis, we need information on the characteristics of units and their occupants in both the previous survey and 2011 for all units that were part of the stock in both the previous survey and 2011. For units that are part of the stock in only 2011, we need information on the characteristics of the units and their occupants only in 2011. Up to this point, we retained units that failed to meet these conditions so that we can get good estimates of the number of other additions (SADD).

Keep for future analysis only those units where: SAME = 1 OR INTNC = 1 OR INTADD = 1. See Table for Step 7.

For each metropolitan area, calculate the sum of BLCINCHWT after step 11. For each metropolitan area the sum equals the CURRENTCOUNT.

12) At this point, we need to get unweighted counts of certain mobile home groups before deciding how to proceed in each metropolitan area.

- a) Compute in each metro area the number of mobile home sample units:  
unweighted sum of  $IN11\_NUNIT2 = 4$ .
- b) Compute in each metro area the number of owner-occupied mobile home sample units:  
unweighted sum of  $IN11\_ISTATUS = "1" \text{ AND } IN11\_TENURE = 1 \text{ AND } IN11\_NUNIT2 = 4$ .
- c) Compute in each metro area the number of renter-occupied mobile home sample units:  
unweighted sum of  $IN11\_ISTATUS = "1" \text{ AND } (2 \text{ LE } IN11\_TENURE \text{ LE } 3) \text{ AND } IN11\_NUNIT2 = 4$ .
- d) Compute in each metro area the number of vacant mobile home sample units:  
unweighted sum of  $(IN11\_ISTATUS='2' \text{ OR } IN11\_ISTATUS='3') \text{ AND NOT}(8 \text{ LE } IN11\_VACANCY \text{ LE } 11) \text{ AND } IN11\_NUNIT2 = 4$ .

- e) Compute in each metro area the number of seasonal mobile home sample units: unweighted sum of (IN11\_ISTATUS='2' OR IN11\_ISTATUS='3') AND (8 LE IN11\_VACANCY LE 11) AND IN11\_NUNIT2 = 4.

Ideally we would like to have 8 control counts: owners, renters, vacant, and seasonal for mobile homes and for all other units. The sample counts in the above table will determine whether using separate controls for mobile homes would be a reasonable approach.

**Table A for Step 12**

<b>YEAR</b>	<b>METRO_AREA</b>	<b>1-Not Mobile Homes</b>	<b>2_owner- occupied MH</b>	<b>3_renter- occupied MH</b>	<b>4_vacant MH</b>	<b>5_seasonal MH</b>	<b>Total</b>
1998	Birmingham	2395	91	19	12	4	2521
1998	Cincinnati	1753	26	2	6	0	1787
1998	Oakland	2946	14	0	1	0	2961
1998	Providence	2143	6	0	1	0	2150
1998	San Francisco	2971	6	1	0	1	2979
1998	San Jose	3053	38	7	2	0	3100
1998	Virginia Beach	3152	23	7	4	3	3189
2002	Anaheim	3103	47	3	5	1	3159
2002	Buffalo	1708	12	2	0	0	1722
2002	Charlotte	2964	40	22	4	0	3030
2002	Columbus	2541	19	2	3	0	2565
2002	Dallas	2585	26	7	5	0	2623
2002	Fort Worth	2903	27	9	9	1	2949
2002	Kansas City	2656	16	7	2	0	2681
2002	Milwaukee	2131	5	1	1	0	2138
2002	Phoenix	2559	47	8	25	4	2643
2002	Portland	2979	35	8	5	0	3027
2002	Riverside	2875	85	13	17	3	2993
2002	San Diego	2995	48	2	2	1	3048
2004	Atlanta	2370	16	10	5	0	2401
2004	Cleveland	1788	11	0	2	0	1801
2004	Denver	2850	16	6	0	0	2872
2004	Indianapolis	3181	28	6	7	0	3222
2004	Memphis	2617	17	11	3	0	2648
2004	Pittsburgh	2197	49	9	6	0	2261
2004	Sacramento	2763	40	8	4	0	2815
2004	St. Louis	2139	28	10	7	1	2185
2009	Los Angeles	1169	5	2	0	0	1176
2009	New Orleans	2971	66	26	13	1	3077

Only Birmingham, Virginia Beach-Norfolk, Phoenix, and Riverside-San Bernardino have a sufficient number of mobile home sample units to use the desired method using 8 control counts.

For the remaining 25 metropolitan areas, we will use a different approach for steps 13 and 14. This approach uses 5 control totals based on unit counts by structure type: single-family detached, single-family attached, 2–4 unit structures, 5+ unit structures, and manufactured houses /mobile homes.

Single-family detached	IN <sub>xx</sub> _NUNIT2 = '1'
Single-family attached	IN <sub>SS</sub> _NUNIT2 = '2'
2–4 unit structures	IN <sub>xx</sub> _NUNIT2 = '3' AND IN <sub>xx</sub> _NUNITS = {2,3,4}
5+ unit structures	IN <sub>xx</sub> _NUNIT2 = '3' AND IN <sub>xx</sub> _NUNITS GE 5
Manufactured houses	IN <sub>xx</sub> _NUNIT2 = {'4'}

The following table shows that there are sufficient sample accounts for this approach.

**Table B for Step 12**

YEAR	METRO_AREA	Single-family detached	Single-family attached	2-4 unit structures	5+ unit structures	Mobile homes	Total
1998	Cincinnati	1347	55	97	254	34	1787
1998	Oakland	1794	245	314	593	15	2961
1998	Providence	1319	60	474	290	7	2150
1998	San Francisco	1230	242	479	1020	8	2979
1998	San Jose	1690	303	229	831	47	3100
2002	Anaheim	1483	490	353	777	56	3159
2002	Buffalo	1085	59	352	212	14	1722
2002	Charlotte	2105	236	136	487	66	3030
2002	Columbus	1728	296	181	336	24	2565
2002	Dallas	1651	121	141	672	38	2623
2002	Fort Worth	2013	159	149	582	46	2949
2002	Kansas City	1912	231	160	353	25	2681
2002	Milwaukee	1237	115	302	477	7	2138
2002	Portland	2010	149	223	597	48	3027
2002	San Diego	1581	340	269	805	53	3048
2004	Atlanta	1699	126	94	451	31	2401
2004	Cleveland	1330	97	126	235	13	1801
2004	Denver	1711	252	119	768	22	2872
2004	Indianapolis	2286	151	204	540	41	3222
2004	Memphis	1998	84	140	395	31	2648
2004	Pittsburgh	1674	162	144	217	64	2261
2004	Sacramento	1985	139	196	443	52	2815

<b>YEAR</b>	<b>METRO_AREA</b>	<b>Single-family detached</b>	<b>Single-family attached</b>	<b>2-4 unit structures</b>	<b>5+ unit structures</b>	<b>Mobile homes</b>	<b>Total</b>
2004	St. Louis	1614	90	176	259	46	2185
2009	Los Angeles	536	61	121	450	7	1175
2009	New Orleans	1944	162	474	391	106	3077

Note that the Los Angeles total is one unit less than the number of SAME, NC, and ADD units in Los Angeles. One unit did not have a value for IN11\_NUNITS (number of units in structure). We arbitrarily assigned this unit an IN11\_NUNITS value of 3, which put the unit into the category with the most units by structure type.

**The following steps (13 , 14, 15, and 16) are for metropolitan areas where there are sufficient mobile home sample units to use 8 control totals.**

13) From published reports, obtain 2011 counts for all owner-occupied units, all renter-occupied units, all vacant units, and all seasonal units, distinguishing between mobile homes and all other units. Using these counts, derive eight ratios as follows:

**Table A for Backward-Looking Step 13**

	<b>Published 2011 Counts</b>			
<b>YEAR</b>	<b>1998</b>	<b>1998</b>	<b>2002</b>	<b>2002</b>
<b>METRO_AREA</b>	<b>Birmingham</b>	<b>Virginia Beach</b>	<b>Phoenix</b>	<b>Riverside</b>
Housing Stock	502,000	694,200	1,821,700	1,511,800
Owner-occupied MH	34,300	9,400	75,300	73,600
Owner-occupied Not MH	274,800	388,000	905,500	747,700
Renter-occupied MH	7,700	5,300	5,300	19,100
Renter-occupied Not MH	102,600	228,000	523,900	446,500
Vacant MH	6,800	2,600	22,100	13,300
Vacant Not MH	69,200	56,400	232,300	150,200
Seasonal MH	900	600	10,500	7,800
Seasonal Not MH	5,700	4,200	46,600	52,200
	<b>2011 Estimates</b>			
<b>YEAR</b>	<b>1998</b>	<b>1998</b>	<b>2002</b>	<b>2002</b>
<b>METRO_AREA</b>	<b>Birmingham</b>	<b>Virginia Beach</b>	<b>Phoenix</b>	<b>Riverside</b>
Owner-occupied MH	45,145	14,947	61,550	64,959
Owner-occupied Not MH	278,084	373,174	893,505	736,553
Renter-occupied MH	9,324	4,666	6,810	9,819
Renter-occupied Not MH	99,327	213,747	514,492	444,576
Vacant MH	7,413	2,673	32,140	13,022
Vacant Not MH	54,600	71,649	259,126	169,773
Seasonal MH	2,801	2,005	1,638	3,648
Seasonal Not MH	5,307	11,339	52,440	69,450

	<b>Ratios: Published Counts/Estimates</b>			
<b>METRO_AREA</b>	<b>Birmingham</b>	<b>Virginia Beach</b>	<b>Phoenix</b>	<b>Riverside</b>
Owner-occupied MH	0.7598	0.6289	1.2234	1.1330
Owner-occupied Not MH	0.9882	1.0397	1.0134	1.0151
Renter-occupied MH	0.8258	1.1358	0.7783	1.9452
Renter-occupied Not MH	1.0330	1.0667	1.0183	1.0043
Vacant MH	0.9173	0.9727	0.6876	1.0214
Vacant Not MH	1.2674	0.7872	0.8965	0.8847
Seasonal MH	0.3214	0.2993	6.4108	2.1381
Seasonal Not MH	1.0741	0.3704	0.8886	0.7516

The algorithm uses the ratios reported above to adjust the weights to match the bottom eight rows in the Table for Backward-Looking Step 13 for each metropolitan area.

14) Use the new adjustment ratios to make final adjustment in the BLCINCHWT.

- a) If  $IN11\_ISTATUS = "1"$  (occupied units) AND  $IN11\_TENURE = 1$  (owner-occupied units) AND  $IN11\_NUNIT2 = 4$  (mobile homes),  $BLCINCHWT = D3 * BLCINCHWT$ . This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for owner-occupied mobile homes.
- b) If  $IN11\_ISTATUS = "1"$  (occupied units) AND  $IN11\_TENURE = 1$  (owner-occupied units) AND  $IN11\_NUNIT2 \neq 4$  (non-mobile home),  $BLCINCHWT = D4 * BLCINCHWT$ . This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for owner-occupied non-mobile homes.
- c) If  $IN11\_ISTATUS = "1"$  (occupied units) AND  $(2 \leq IN11\_TENURE \leq 3)$  (renter-occupied units) AND  $IN11\_NUNIT2 = 4$  (mobile homes),  $BLCINCHWT = D5 * BLCINCHWT$ . This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for renter-occupied mobile homes.
- d) If BLCINCHWT in which  $IN11\_ISTATUS = "1"$  (occupied units) AND  $(2 \leq IN11\_TENURE \leq 3)$  (renter-occupied units) AND  $IN11\_NUNIT2 \neq 4$  (non-mobile homes),  $BLCINCHWT = D6 * BLCINCHWT$ . This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for renter-occupied non-mobile homes.
- e) If BLCINCHWT in which  $(IN11\_ISTATUS = "2" \text{ OR } IN11\_ISTATUS = "3")$  AND NOT  $(8 \leq IN11\_VACANCY \leq 11)$  (URE and vacant units) AND  $IN11\_NUNIT2 = 4$  (mobile homes),  $BLCINCHWT = D7 * BLCINCHWT$ . This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for vacant mobile homes.

f) If BLCINCHWT in which (IN11\_ISTATUS='2' OR IN11\_ISTATUS='3') AND NOT(8 LE IN11\_VACANCY LE 11) (URE and vacant units) AND IN11\_NUNIT2 NE 4 (non-mobile homes), BLCINCHWT = D8\*BLCINCHWT.

This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for vacant non-mobile homes.

g) If BLCINCHWT in which (IN11\_ISTATUS='2' OR IN11\_ISTATUS='3') AND (8 LE IN11\_VACANCY LE 11) (seasonal units) AND IN11\_NUNIT2 = 4 (mobile homes), BLCINCHWT = D9\*BLCINCHWT.

This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for seasonal mobile homes.

h) If BLCINCHWT in which (IN11\_ISTATUS='2' OR IN11\_ISTATUS='3') AND (8 LE IN11\_VACANCY LE 11) (seasonal units) AND IN11\_NUNIT2 NE 4 (non-mobile homes), BLCINCHWT = D10\*BLCINCHWT.

This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for seasonal non-mobile homes.

15) Calculate the sum of BLCINCHWT for the following categories:

- IN11\_ISTATUS = "1" AND IN11\_TENURE = 1 AND IN11\_NUNIT2 = 4
- IN11\_ISTATUS = "1" AND IN11\_TENURE = 1 AND IN11\_NUNIT2 NE 4
- IN11\_ISTATUS = "1" AND (2 LE IN11\_TENURE LE 3) AND IN11\_NUNIT2 = 4
- IN11\_ISTATUS = "1" AND (2 LE IN11\_TENURE LE 3) AND IN11\_NUNIT2 NE 4
- IN11\_ISTATUS={2,'3'} AND NOT(8 LE IN11\_VACANCY LE 11) AND IN11\_NUNIT2 = 4
- IN11\_ISTATUS={2,'3'} AND NOT(8 LE IN11\_VACANCY LE 11) AND IN11\_NUNIT2 NE 4
- IN11\_ISTATUS={2,'3'} AND (8 LE IN11\_VACANCY LE 11) AND IN11\_NUNIT2 = 4
- IN11\_ISTATUS={2,'3'} AND (8 LE IN11\_VACANCY LE 11) AND IN11\_NUNIT2 NE 4

This step checks to see if the ratio adjustments functioned as intended. All 4 metropolitan areas checked OK.

16) Calculate the sum of BLCINCHWT for the following categories:

- IN11\_NUNIT2 = '1'
- IN11\_NUNIT2 = '4'

This step checks to see if the estimate of single family detached units and mobile homes are reasonable close to the published numbers.

**Table for Step 16**

	<b>1-Single-family detached</b>	<b>2-Mobile homes</b>
Birmingham	1.2%	0.0%
Virginia Beach	-2.9%	0.6%
Phoenix	-3.3%	0.1%
Riverside	2.0%	-0.1%

The count of mobile homes was forced to equal the published count, and it does except for rounding. The count of single-family detached units is close to the published count in all four metropolitan areas.

**The following steps (13 , 14, 15, 16, 17, 18, and 19) are for metropolitan areas where there are NOT sufficient mobile home sample units to use eight control totals. Initially, we tried to force the counts of units by structure type to match published counts. This approach caused the count of vacant and seasonal units to be far from the published counts. Then we tried to force the count of units by occupancy status to match published counts. This approach cause the count of mobile homes to be far from the published counts. Finally we decided to rake the numbers, that is, to apply these two approaches sequentially.**

13) From published reports, obtain 2011 counts of units by unit type. Calculate new adjustment ratios. To prevent confusion with the ratios developed in step 13 for metropolitan areas with sufficient mobile home sample units, we label these ratios N for NUNIT2.

YEAR	METRO_AREA	2011 Published Counts				
		Single-family detached	Single-family attached	2-4 unit structures	5+ unit structures	Mobile homes
1998	Cincinnati	611,300	44,900	93,500	141,900	30,100
1998	Oakland	585,700	77,100	106,400	212,000	13,400
1998	Providence	325,400	19,100	136,600	96,000	5,800
1998	San Francisco	312,300	57,500	125,800	266,900	4,100
1998	San Jose	369,500	55,800	52,500	158,000	20,000
2002	Anaheim	539,600	126,500	109,100	247,400	31,500
2002	Buffalo	325,600	15,400	110,100	58,700	10,300
2002	Charlotte	516,300	47,500	30,000	112,100	41,600
2002	Columbus	497,600	74,200	71,100	140,100	15,400
2002	Dallas	1,085,300	65,100	76,500	412,700	51,500
2002	Fort Worth	588,100	37,100	43,100	149,100	38,700
2002	Kansas City	624,900	54,100	70,300	126,300	18,000
2002	Milwaukee	377,000	29,000	117,300	146,400	4,400
2002	Portland	617,400	46,300	64,300	171,700	34,400
2002	San Diego	621,600	112,000	88,700	321,300	42,700
2004	Atlanta	1,503,700	127,300	79,500	395,800	69,300
2004	Cleveland	666,500	39,700	75,300	166,400	10,700
2004	Denver	653,700	89,100	44,800	261,900	17,600
2004	Indianapolis	532,800	34,200	62,600	118,100	17,700
2004	Memphis	385,300	20,400	30,300	94,100	22,400
2004	Pittsburgh	783,800	81,400	81,600	114,100	43,900
2004	Sacramento	602,000	46,400	56,800	155,000	23,600
2004	St. Louis	890,500	43,600	128,500	137,200	48,300

		2011 Published Counts				
YEAR	METRO_AREA	Single-family detached	Single-family attached	2-4 unit structures	5+ unit structures	Mobile homes
2009	Los Angeles	1,729,600	255,600	321,600	1,099,200	51,800
2009	New Orleans	353,000	34,400	76,500	64,100	17,600

14) Use the new adjustment ratios to make final adjustment in the BLCINCHWT.

- a) If  $IN11\_NUNIT2 = '1'$  THEN  $BLCINCHWT = N1 * BLCINCHWT$ .  
This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for single-family detached units.
- b) If  $IN11\_NUNIT2 = '2'$  THEN  $BLCINCHWT = N2 * BLCINCHWT$ .  
This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for single-family attached units.
- c) If  $IN11\_NUNIT2 = '3'$  AND  $IN11\_NUNITS = \{2,3,4\}$  THEN  $BLCINCHWT = N3 * BLCINCHWT$ .  
This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for units in structures with 2 to 4 units.
- d) If  $IN11\_NUNIT2 = '3'$  AND  $IN11\_NUNIT2 \geq 5$  THEN  $BLCINCHWT = N4 * BLCINCHWT$ .  
This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for units in structures with 5 or more units.
- e) If  $IN11\_NUNIT2 = '4'$  THEN  $BLCINCHWT = N5 * BLCINCHWT$ .  
This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for manufactured housing/mobile home units.

15) Sum BLCINCHWT for after final adjustment for the following categories.

- $IN_{xx}\_NUNIT2 = '1'$
- $IN_{SS}\_NUNIT2 = '2'$
- $IN_{xx}\_NUNIT2 = '3'$  AND  $IN_{xx}\_NUNITS = \{2,3,4\}$
- $IN_{xx}\_NUNIT2 = '3'$  AND  $IN_{xx}\_NUNITS \geq 5$
- $IN_{xx}\_NUNIT2 = '4'$

This step checks to see if the ratio adjustments functioned as intended. Check worked for all the areas.

16) From published reports, obtain estimated previous year counts for all owner-occupied units, all renter-occupied units, all vacant units, and all seasonal units, distinguishing between mobile homes and all other units. Calculate new adjustment ratios using the formulas in columns C & D of the table:

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
		<b>Pub- lished numbers</b>	<b>Sum of BLCINCHWT where</b>	<b>Ratio</b>
3	Owner-Occupied (all units)		IN <sub>xx</sub> _ISTATUS = "1" AND IN <sub>xx</sub> _TENURE = 1	K3 = B3/C3
5	Renter (all units)		IN <sub>xx</sub> _ISTATUS = "1" AND (2 LE IN <sub>xx</sub> _TENURE LE 3)	K5 = B5/C5
7	Vacant (all units)		(IN <sub>xx</sub> _ISTATUS = '2' OR IN <sub>xx</sub> _ISTATUS='3') AND NOT(8 LE IN <sub>xx</sub> _VACANCY LE 11)	K7 = B7/C7
9	Seasonal (all units)		(IN <sub>xx</sub> _ISTATUS='2' OR IN <sub>xx</sub> _ISTATUS='3') AND (8 LE IN <sub>xx</sub> _VACANCY LE 11)	K9 = B9/C9

The following table contains the 4 control totals for all the metropolitan areas except Birmingham, Virginia Beach-Norfolk, Phoenix, and Riverside-San Bernardino.

	<b>Owner- Occupied</b>	<b>Renter-Occupied</b>	<b>Vacant</b>	<b>Seasonal</b>
Cincinnati	559,000	256,600	103,800	2,200
Oakland	538,300	368,900	87,000	300
Providence	318,600	203,500	54,600	6,300
San Francisco	343,100	376,900	42,700	3,800
San Jose	354,900	269,200	31,000	800
Anaheim	568,300	415,000	63,000	7,800
Buffalo	311,200	158,600	49,000	1,400
Charlotte	432,800	233,000	76,700	5,000
Columbus	417,200	266,800	111,400	3,000
Dallas	950,800	594,700	143,300	2,300
Fort Worth	503,500	285,900	64,500	2,400
Kansas City	532,500	261,200	96,200	3,700
Milwaukee	405,200	222,700	45,600	700
Portland	553,700	304,800	73,200	2,300
San Diego	582,700	510,800	78,400	14,100
Atlanta	1,263,200	639,300	256,800	16,300
Cleveland	591,700	268,700	95,300	3,000
Denver	622,900	361,000	78,700	4,400
Indianapolis	455,500	221,200	85,600	3,000
Memphis	313,300	167,300	71,100	800
Pittsburgh	701,500	291,200	103,800	8,400
Sacramento	442,700	341,000	78,700	21,300
St. Louis	804,400	310,800	127,200	5,600
Los Angeles	1,518,400	1,708,600	220,600	10,300
New Orleans	303,900	159,100	77,800	4,900

17) Use the new adjustment ratios to make final adjustment in the FLCINCHWT.

- a) If  $IN_{xx\_ISTATUS} = "1"$  (occupied units) AND  $IN_{xx\_TENURE} = 1$  (owner-occupied units),  $FLCINCHWT = K3 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for owner-occupied homes.
- b) If  $IN_{xx\_ISTATUS} = "1"$  (occupied units) AND (2 LE  $IN_{xx\_TENURE}$  LE 3) (renter-occupied units),  $FLCINCHWT = K5 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for renter-occupied homes.
- c) If FLCINCHWT in which ( $IN_{xx\_ISTATUS} = '2'$  OR  $IN_{xx\_ISTATUS} = '3'$ ) AND NOT(8 LE  $IN_{xx\_VACANCY}$  LE 11) (URE and vacant units),  $FLCINCHWT = K7 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for vacant units.
- d) If FLCINCHWT in which ( $IN_{xx\_ISTATUS} = '2'$  OR  $IN_{xx\_ISTATUS} = '3'$ ) AND (8 LE  $IN_{xx\_VACANCY}$  LE 11) (seasonal units),  $FLCINCHWT = K9 * FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for seasonal homes.

18) Calculate the sum of BLCINCHWT for the following categories:

- $IN_{11\_ISTATUS} = "1"$  AND  $IN_{11\_TENURE} = 1$
- $IN_{11\_ISTATUS} = "1"$  AND (2 LE  $IN_{11\_TENURE}$  LE 3)
- $IN_{11\_ISTATUS} = \{ '2', '3' \}$  AND NOT(8 LE  $IN_{11\_VACANCY}$  LE 11)
- $IN_{11\_ISTATUS} = \{ '2', '3' \}$  AND (8 LE  $IN_{11\_VACANCY}$  LE 11)

This step checks to see if the ratio adjustments functioned as intended. Check showed that ratios were computed correctly.

19) Calculate the sum of BLCINCHWT for the following categories:

- $IN_{11\_NUNIT2} = '1'$
- $IN_{11\_NUNIT2} = '4'$

This step checks to see if the estimate of single family detached units and mobile homes are reasonable close to the published numbers.

**Table for Step 19**

		<b>Published</b>	<b>Estimated</b>	<b>Error</b>	<b>Published</b>	<b>Estimated</b>	<b>Error</b>
<b>YEAR</b>	<b>METRO_AREA</b>	<b>Single-family detached</b>	<b>Single-family detached</b>	<b>Single-family detached</b>	<b>Mobile homes</b>	<b>Mobile homes</b>	<b>Mobile homes</b>
1998	Cincinnati	611,300	597,800	-2.2%	30,100	30,000	-0.3%
1998	Oakland	585,700	590,100	0.8%	13,400	13,600	1.5%
1998	Providence	325,400	315,800	-3.0%	5,800	5,800	0.0%
1998	San Francisco	312,300	316,800	1.4%	4,100	4,100	0.0%
1998	San Jose	369,500	368,400	-0.3%	20,000	20,000	0.0%

		<b>Published</b>	<b>Estimated</b>	<b>Error</b>	<b>Published</b>	<b>Estimated</b>	<b>Error</b>
<b>YEAR</b>	<b>METRO_AREA</b>	<b>Single-family detached</b>	<b>Single-family detached</b>	<b>Single-family detached</b>	<b>Mobile homes</b>	<b>Mobile homes</b>	<b>Mobile homes</b>
2002	Anaheim	539,600	541,700	0.4%	31,500	31,400	-0.3%
2002	Buffalo	325,600	314,200	-3.5%	10,300	10,100	-1.9%
2002	Charlotte	516,300	509,400	-1.3%	41,600	41,800	0.5%
2002	Columbus	497,600	476,700	-4.2%	15,400	14,900	-3.2%
2002	Dallas	1,085,300	1,088,000	0.2%	51,500	50,200	-2.5%
2002	Fort Worth	588,100	592,000	0.7%	38,700	37,500	-3.1%
2002	Kansas City	624,900	624,000	-0.1%	18,000	18,000	0.0%
2002	Milwaukee	377,000	369,900	-1.9%	4,400	4,400	0.0%
2002	Portland	617,400	621,100	0.6%	34,400	34,700	0.9%
2002	San Diego	621,600	615,900	-0.9%	42,700	42,200	-1.2%
2004	Atlanta	1,503,700	1,502,000	-0.1%	69,300	69,100	-0.3%
2004	Cleveland	666,500	661,600	-0.7%	10,700	10,400	-2.8%
2004	Denver	653,700	648,300	-0.8%	17,600	17,600	0.0%
2004	Indianapolis	532,800	538,900	1.1%	17,700	17,700	0.0%
2004	Memphis	385,300	384,900	-0.1%	22,400	22,400	0.0%
2004	Pittsburgh	783,800	767,400	-2.1%	43,900	43,300	-1.4%
2004	Sacramento	602,000	590,200	-2.0%	23,600	22,800	-3.4%
2004	St. Louis	890,500	886,200	-0.5%	48,300	47,900	-0.8%
2009	Los Angeles	1,729,600	1,761,300	1.8%	51,800	53,500	3.3%
2009	New Orleans	353,000	358,400	1.5%	17,600	17,700	0.6%

	<b>Single-family detached</b>	<b>Mobile homes</b>
Minimum	-4.2%	-3.4%
Maximum	1.8%	3.3%
Range	6.0%	6.7%
Median	-0.4%	-0.1%
Mean	-0.6%	-0.6%