Appendix B. Source and Accuracy of the Estimates

ACCURACY OF THE ESTIMATES

The accuracy of the estimates contained in this report depends on (a) the sampling and nonsampling error, as measured by the error formulas that follow; (b) biases; and (c) other nonsampling errors not measured by the error formulas.

Below is an explanation of sampling and nonsampling errors associated with the American Housing Survey (AHS).

Sampling Errors for the AHS Combined Sample Estimates. Sampling error reflects how estimates from a sample vary from the actual value. (NOTE: By the term "actual value," we mean the value we would have gotten had all housing units been interviewed, under the same conditions, rather than only a sample.

The numbers presented in table I (page B-14) are approximations to the errors of various estimates shown in this report for this metropolitan area. To derive errors that would be applicable to a wide variety of items and also could be prepared at a moderate cost, a number of approximations were required. As a result, the tables of errors provide an indication of the order of magnitude of the errors rather than precise errors for any specific item. To compute a 90-percent confidence interval for an estimate from table I —

a. Multiply the error value by 1.6.

b. Add and subtract this value to the publication estimate.

Use the following guidelines to obtain errors for estimates in this publication that are not included in table I:

For estimate that includes—	If estimate is less than—	Standard error is—
Owner-occupied housing units	375	375
Renter-occupied housing units	328	328
Combined owner-occupied and renter-occupied housing units	343	343

To obtain errors for other estimates in this publication, the following formulas allow you to compute a range of error such that there is a known probability of being correct if you say the actual value is within the range. The error formulas are approximations to the errors. They indicate the order of magnitude of the errors rather than the actual errors for any specific characteristic. To construct the range, add and subtract the error computed from the formulas to the publication estimate.

For owner-occupied housing units, use—

$$Z \times \sqrt{(375.320 \times A) - (.000310 \times A^2)} \qquad (2a)$$

For renter-occupied housing units, use—

$$Z \times \sqrt{(327.807 \times A) - (.000271 \times A^2)} \qquad (2b)$$

For combinations of owner-occupied and renter-occupied housing units, use—

$$Z \times \sqrt{(342.851 \times A) - (.000283 \times A^2)} \qquad (2c)$$

The letter "A" in the formulas represents the publication estimate.

The letter "Z" determines the probability that the actual value is within the range you compute. The larger the value of Z, the larger the range, and the higher the odds the actual value will be in the range. The following values of Z are most commonly used:

Value of Z	Meaning
1.00	There is a 67-percent chance you'll be correct if you say the actual value is in the range you compute.
1.60	There is a 90-percent chance you'll be correct if you say the actual value is in the range you compute.
1.96	There is a 95-percent chance you'll be correct if you say the actual value is in the range you compute.
2.58	There is a 99-percent chance you'll be correct if you say the actual value is in the range you compute.

Ranges of 90 and 95 percent are commonly used. The range of error is also referred to as the confidence interval since there is a certain level of confidence that the actual value is within the interval. To compute a confidence interval for an estimate from table I, multiply the error value by an appropriate Z.

Refer to the footnote in table I for factors to apply to estimates involving new construction. Multiply the error computed from the formulas by the appropriate new construction factor.

The reliability of an estimated percentage, computed by using the sample data for both numerator and denominator, depends upon both the size of the percentage and the size of the total upon which the percentage is based. Estimated percentages are relatively more reliable than the corresponding estimates of the numerators of the percentages, particularly if the percentages are 50 percent or more.

Table II presents the errors of estimated percentages for the 1991 housing inventory. To obtain an estimate of errors associated with percentages that are not shown in table II, apply one of the following formulas:

Owner-occupied housing units:

$$Z \times \sqrt{\frac{375.320 \times P \times (100-P)}{Y}} \qquad (3a)$$

Renter-occupied housing units:

$$Z \times \sqrt{\frac{327.807 \times P \times (100-P)}{Y}} \qquad (3b)$$

Combinations of owner-occupied and renter-occupied housing units:

$$Z \times \sqrt{\frac{342.851 \times P \times (100-P)}{Y}} \qquad (3c)$$

The "P" is the estimated percentage, and the "Y" is the base (denominator) of the percentage. The "Z," as described earlier in this section, determines the probability that the actual value is within the range you compute. You can also multiply an error from table II by a Z value to obtain a confidence interval. Also, refer to the footnote in table I for factors to apply to percentages involving new construction.

Illustration of the Use of the Formulas. Table 2-1 of this report shows that there were 691,100 owner-occupied housing units in the Atlanta, GA, metropolitan area. Apply formula 2a to obtain a 90-percent confidence interval:

$$16{,}880 = 1.6 \times \sqrt{(375.320 \times 691{,}100) - (.000310 \times 691{,}100^2)}$$

Consequently, there is a 90-percent chance we would be correct if we conclude that the actual value is within the range of 691,100 ± 16,880, or 674,220 to 707,980 housing units.

Table 2-3 shows that of 691,100 owner-occupied housing units, 123,200 or 17.8 percent had two bedrooms. Apply formula (3a) to obtain a 90-percent confidence interval for the percentage:

$$1.4 = 1.6 \times \sqrt{\frac{375.320 \times 17.8 \times (100-17.8)}{(691{,}100)}}$$

Consequently, there is a 90 percent chance we would be correct if we concluded that the actual proportion is within the range 17.8 ± 1.4, or 16.4 to 19.2 percent.

Differences. People often ask whether two numbers are actually different. If the range of error does not include zero, the numbers are different. As a general rule, if the confidence intervals do not overlap, they are different. To compute the range of error on the difference, use the following formula:

$$\sqrt{(\text{error on first number})^2 + (\text{error on second number})^2} \qquad (4)$$

This formula is quite accurate for (a) the difference between estimates of the same item in two different areas or (b) the difference between separate and uncorrelated items in the same area. If there is a high positive correlation between the two items, the formula will overestimate the error. If there is a high negative correlation, the formula will underestimate the error. The following illustration shows how to compute the error of a difference.

Illustration of the Computation of the Error of a Difference. Table 2-3 of this report shows that there were 383,700 owner-occupied housing units with three bedrooms in the Atlanta, GA, metropolitan area. Thus, the apparent difference, as shown by these data, between owner-occupied units with two bedrooms and owner-occupied units with three bedrooms is 260,500. The errors for a 90-percent confidence interval for the number of owner-occupied housing units with two bedrooms and three bedrooms are 10,310 and 15,870, respectively.

Apply formula (4) to calculate the error of the difference between the estimates of the number of owner-occupied housing units with three bedrooms and the number with two bedrooms:

$$18{,}920 = \sqrt{(10{,}310)^2 + (15{,}870)^2}$$

Consequently, there is a 90 percent chance we would be correct if we concluded that the interval for the difference is 260,500 ± 18,920, or 241,580 to 279,420 housing units.

Thus, we can conclude that there is a 90 percent chance that the number of 1991 owner-occupied housing units with three bedrooms is greater than the number of owner-occupied housing units with two bedrooms, since the 90-percent confidence interval does not include zero or negative values.

Medians. The median is the value 50 percent of the way through the distribution. Thus, 50 percent of the total falls below and 50 percent falls above the median. You can construct a confidence interval around the median by computing the error on a 50-percent characteristic and translating that into an interval for the characteristic.

Use the following procedure to estimate the upper and lower limits of a confidence interval for a median:

1. Using the error formula for percents, above (3a, 3b, or 3c), compute the error of 50 percent. The total number of housing units from the distribution is the denominator in the formula. Subtract "not reported" or "don't know" categories from the total.
2. Calculate the confidence interval for 50 percent by adding and subtracting the error, from step 1, to 50 percent.
3. Translate the confidence interval for 50 percent to an interval for the characteristic. The lower and upper endpoints for the 50-percent confidence interval represent the percent of cases that fall below the respective endpoints of the interval for the characteristic. These values are found by linearly interpolating within the appropriate intervals of the distribution.

The probability you will be correct if you conclude that the actual median is within the interval depends on the value of Z in the error-of-percent formula. The following example shows how to compute a 90-percent confidence interval.

Illustration of the Computation of the 90-Percent Confidence Interval of a Median. Table 3-13 of this report shows the median monthly housing cost for owner-occupied housing units is $672. The base of this distribution is obtained by subtracting "mortgage payment not reported" from the number of occupied units. Using this definition, the base is equal to 617,400.

1. Applying formula (3a) with P=50 and the corrected base of 617,400, we obtain an error of 2.0.

$$2.0 = 1.6 \times \sqrt{\frac{375.320 \times (50) \times (100-50)}{617{,}400}}$$

2. To obtain a 90-percent confidence interval on the estimated median, initially add to and subtract from 50 percent the error obtained above. This yields percentage limits of 48.0 and 52.0.

3. From the distribution for monthly housing cost in Table 3-13, the $600 to $700 interval for owner-occupied housing units contains the 48.0 percent derived in step 2. About 276,500 housing units, or 44.8 percent, fall below this interval, and 44,500 housing units, or 7.2 percent, fall within this interval. By linear interpolation, the lower limit of the 90 percent confidence interval is found to be about $644.

$$600 + (700 - 600)\frac{48.0 - 44.8}{7.2} = 644$$

4. Similarly, the $600 to $700 interval for owner-occupied housing units contains the 52.0 percent derived in step 2. About 276,500 housing units (44.8 percent) fall below this interval, and 44,500 housing units or 7.2 percent, fall within this interval. The upper limit of the 90-percent confidence interval is found to be about $700.

$$600 + (700 - 600)\frac{52.0 - 44.8}{7.2} = 700$$

Thus, the 90-percent confidence interval ranges from $644 to $700; there is a 90 percent chance we would be correct if we concluded that the actual value lies within this range.

5. Finally, note that the medians shown in this report are calculated from unbounded data and then rounded. Thus, they may differ from the medians calculated from the grouped data in the tables of this report.

Nonsampling Errors. In general, nonsampling errors can be attributed to many sources:

a. Inability to obtain information about all cases.
b. Definitional difficulties.
c. Differences in the interpretation of questions.
d. Inability or unwillingness of respondents to provide correct information.
e. Mistakes in recording or coding the data.
f. Other errors of collection, response, processing, and coverage.
g. Estimation for missing data.

Nonsampling errors are not unique to sample surveys since they can, and do, occur in complete censuses as well.

The most noteworthy of these error sources are as follows:

a. Response error, which we measure by reinterviews.
b. Coverage error.
c. Errors resulting from incomplete data, which includes nonresponse as well as coverage errors.

Obtaining a measurement of the total nonsampling error associated with the estimates from a survey is very difficult, considering the number of possible sources of error. However, an attempt was made to measure some of the

nonsampling errors associated with the estimates for the 1991 AHS-Metropolitan Area sample. In the following sections, the major sources of nonsampling errors will be discussed.

AHS-MS Content Errors. A content reinterview program was done for the 1991 AHS-Metropolitan Area sample units. A sample of these units was revisited, and answers to some of the questions on the questionnaire were obtained again. The original interview and reinterview were assumed to be two independent readings and thus were the basis for the measurement of the accuracy of the data collected from interviewed units.

Since the 1991 AHS-MS reinterview program was intended as an interviewer quality check, a content reinterview report is not available. However, past reinterview programs have shown that certain items are likely to produce moderate or high response variability. Response variability is defined as the measure of consistency between the original survey response to an item and the reinterview response to that item. Moderate levels of variability indicate that the response error is not insignificant in comparison to the sampling error. High variability indicates that the response errors are very significant in relation to the sampling errors with which they are associated; therefore, caution should be used when considering estimates of these characteristics. The 1985 Content Reinterview Program had five items that exhibited high variability: (1) major repairs over $500 each; (2) payments the same throughout mortgage; (3) area lived at age 16; (4) preferred place to live in 5 years; and (5) size of lot. Prior-year results for the 1991 metropolitan areas can be found in the Census Bureau publication series H-170 for the years 1981 through 1983.

AHS-National Content Errors. A content reinterview program was conducted for the AHS-National households as well. A subsample of the original households was revisited, and certain questions from the original questionnaire were asked again. This was intended to evaluate the coverage of correct addresses and the correct classification of noninterviews. The 1991 reinterview program also evaluated population coverage by questions about household members missed during the original interview. It was determined that interviews had missed people in fewer than 1 percent of the survey households.

Reinterview studies were also conducted in conjunction with previous AHS-National and AHS-MS enumerations. These studies included items dealing primarily with poor housing quality, attitudes about the neighborhood, and certain housing costs. The following table shows the items that had moderate or high levels of inconsistency. Although not all of these questions were included in the 1991 reinterview studies, questions from previous enumerations were not altered enough to lead one to believe that the level of inconsistent responses would change.

Survey items	Level of inconsistency
Mice and rats	Moderate
Real estate taxes	Moderate
Cost of real estate taxes	Moderate
Prefer to live in same area or somewhere else	Moderate
Open cracks or holes on inside of building	Moderate to High
Holes in floors	Moderate to High
Blown fuses/tripped circuit breakers	Moderate to High
Neighborhood conditions: Street noise; roads in need of repair; crime; trash, litter,junk in streets or on properties; boarded up/abandoned structures; nonresidentialactivities; odors, smoke, gas	Moderate to High
Satisfactory neighborhood services: Police protection; hospitals/health clinic;public transportation; shopping; elementary schools	Moderate to High
Electricity cost	Moderate to High
Oil, coal, kerosene, wood or other fuel cost	Moderate to High
Fire/hazard insurance	Moderate to High
Cost of garbage collection	Moderate to High
Broken plaster or peeling paint on ceiling and walls	High
Working electric outlet in all rooms	High
Concealed wiring	High
Gas cost	High
Cost of water supply and sewage disposal	High
Gross income	High

A possible explanation for the results of the reinterview studies, as well as the surveys themselves, is that respondents may lack precise information. Also, since the results of the reinterview studies are derived from sample surveys, there is sampling error associated with these estimates of nonsampling error. The possibility of such errors should be taken into account when considering the results of these studies.

Coverage Errors. In errors of coverage and estimation for missing data, the AHS new construction sample had deficiencies in the representation of conventional (nonmobile home or trailer) new construction. Because of time constraints, only those building permits issued more than 7 months before the survey ended were eligible to be sampled to represent conventional new construction in permit-issuing areas for each metropolitan area. However, those permits issued during the last 7 months of the survey do not necessarily represent missed housing units. Because of the relatively short time span involved, it is possible that construction of these housing units was not completed at the time the survey was conducted, in which case, they would not have been eligible for interview. In addition to these deficiencies, new construction in special places that do not require building permits, such as military bases, is not adequately presented.

AHS misses a significant portion of new mobile homes. It is believed that most of the difference is because of poor coverage of mobile home parks in address enumeration districts (ED's). Undercoverage exists for those mobile homes built between the time of the last coverage improvement procedure and the 1980 census. It has been estimated that on a national level, up to 25 percent of those

mobile homes built after January 1, 1980, may be missed. Deficiencies also exist in ED's where area sampling methods are used. It had been assumed that all housing units located inside these ED's would be represented in the sample. However, it has been established that the AHS sample missed up to 2 percent of all housing units in these ED's because they were not listed during the canvassing. It should be noted that since these ED's were recanvassed each time this metropolitan area was surveyed, the number of missed housing units may be considerably less for the 1991 survey.

The mobile home and total housing unit ratio estimation procedures correct for these deficiencies as far as the count of mobile homes and total housing units is concerned (i.e., it adjusts to the best available estimate). However, biases of subtotals would still remain.

Rounding Errors. For errors associated with processing, rounding of estimates introduces another source of error in the data, the severity of which depends upon the statistics being measured. The effect of rounding is significant relative to the sampling error only for small percentages or small medians, when these figures are derived from relatively large bases (e.g., median number of persons per household). This means that confidence intervals formed from the standard errors given may be distorted, and this should be taken into account when considering the results of the survey.

Errors Resulting From Incomplete Data. There are three main errors associated with incomplete data: (a) noninterview error, (b) missing housing units, and (c) item nonresponse error.

Noninterview error occurs because noninterviews are not adequately represented by interviewed units in the noninterview weighting adjustment. The extent to which interviews do not represent noninterviews determines the magnitude of the nonsampling error from these units.

Missing housing units error occurs because the weighting adjustment does not adequately account for these units. We miss these units because the frames from which we selected the AHS-MS sample had deficiencies (see Coverage Errors).

Item nonresponse error occurs because certain items on the questionnaire are blank because the respondent is unwilling or unable to provide a response. The computer assigns, or "imputes," values for these items. We do not know how close the imputed values are to the actual values.

For some items, there is no imputation for item nonresponse. Totals and subcategories of these items will be underestimated. Also, if the nonresponses are distributed differently than responses, percent distributions will be distorted.

The errors in table III are an innovative way of presenting incompleteness errors as standard errors. They should be regarded as examples of errors caused by incompleteness rather than exact errors for any specific estimate.

These results are based on total estimates of various geographic levels. These geographic levels were chosen to be homogeneous sociologically and, thus, represent other characteristics. Therefore, they act as a proxy for items of various sizes. Although no specific data items (e.g., tenure) were used, the results were generalized to apply to all items. Thus, these errors may overestimate or underestimate the error for other data items.

For more detail on the methodology and the results, see a paper titled, "How Response Error, Missing Data and Undercoverage Bias Survey Data," by P. Burke (HUD), G. Shapiro (Census), D. Kostanich (Census), K. Mansur (Census), and L. Cahoon (Census). You can get a copy of this paper from Gary Shapiro in the Statistical Research Division, Bureau of the Census at 301-763-7880.

As the paper referenced above explains, the standard errors in table III represent the variability (standard deviation) of the bias resulting from incomplete data modeled from the AHS-Metropolitan data. These errors do not reflect reductions in error resulting from the AHS-MS weighting process, which attempts to adjust for this incomplete data. Thus, we believe the errors in table III are overestimates of the error for incomplete data.

Although these errors seem large compared to the sampling errors shown in table I, consider the following scenario. Assume there are 100,000 units of a particular type, and the completeness rate for the item is 90 percent. That is, 90 percent of the sample cases contained good data for the item.

The number of housing units in each of the 1991 MSA's range from approximately 438,000 (in Hartford) to 4,480,000 (in New York). Thus, a 90-percent completeness rate would mean that from 43,800 housing units (in Hartford) to 448,000 housing units (in New York) would have to be accounted for through imputation or weighting adjustments (i.e., 10 percent of the cases did not have good data for the item). Table III shows that the errors resulting from incomplete data range from 562 to 4,156 (for Hartford) and from 5,417 to 77,981 (for New York). The numbers are small, considering the number that we could have accounted for incorrectly.

SAMPLE DESIGN

Introduction. The estimates for each of the 11 metropolitan areas in this report series (H170/91) are based on data collected from the 1991 American Housing Survey Metropolitan Sample (AHS-MS) and the 1991 American Housing Survey National Sample, which were conducted by the Bureau of the Census acting as collection agent for the Department of Housing and Urban Development.

The sample areas covered for metropolitan areas that remained in the AHS sample after survey year 1983 are consistent with the 1983 Office of Management and Budget (OMB) definitions of a metropolitan statistical area (MSA), consolidated metropolitan statistical area (CMSA), or primary metropolitan statistical area (PMSA). In some instances, a given metropolitan area is a combination of primary metropolitan statistical areas and will be referred to as PMSA's. In addition to adding new areas to some metropolitan samples in order to comply with the 1983 definitional changes, some new metropolitan areas have been added. Thus, each of the 1991 metropolitan areas will fall into one of three categories:

a. Areas of the same geographic area as defined for surveys before 1984 (i.e., areas in which the 1970 OMB definition of a standard metropolitan statistical area is the same as the 1983 MSA, PMSA, or CMSA definition, 1970-based area)—San Diego, CA MSA; and Seattle-Tacoma, WA CMSA;

b. Areas consisting of new area in addition to the 1970-based area—Atlanta, GA MSA; Baltimore, MD MSA; Chicago, IL area PMSA's; Columbus, OH MSA; Hartford, CT CMSA; New York Nassau-Suffolk, NY PMSA's; Northern NJ area PMSA's; and St. Louis, MO-IL CMSA;

c. Areas that are strictly 1980-based—Houston, TX area PMSA s.

The metropolitan areas selected for the 1991 AHS-MS are interviewed on a rotating basis once every 4 years. Initially, each metropolitan area had an expected sample size of 4,250 or 8,500 housing units, uniformly distributed throughout nine panels (panels 4 through 12). Because of budget constraints, the expected sample sizes were reduced to 4,250 in the metropolitan areas with sample sizes of 8,500, and panel 12 was dropped from sample in all metropolitan areas except New York and Northern NJ. For all of the 1991 MSA's except New York and Northern NJ, interviewing took place from April 1991 through December 1991. In New York and Northern New Jersey, the interviewing took place from June 1991 through January 1992.

Table IV summarizes the interview activity for the 1991 AHS in each of the metropolitan areas. The table provides the number of eligible units (composed of completed interviews and noninterviews) and the number of units visited but ineligible for interview.

The AHS-National sample is interviewed biennially in odd-numbered years. The interviews were a combination of field interviewing and CATI (computer assisted telephone interviews). The sample covers 878 counties and independent cities with coverage in each of the 50 States and the District of Columbia. To increase the reliability of the AHS-MS sample estimates, AHS-National sample units in the metropolitan area were used in the estimation process. Table IV also summarizes data on AHS-National units used in the sample.

Designation of AHS-MS Sample Housing Units for the 1991 Survey. The sample housing units designated to be interviewed in the 1991 survey consisted of the following categories, which are described in the following sections:

Housing units that were in the 1970-based area include the following:

a. All sample housing units that were interviewed in the previous survey. This sample includes housing units that were selected as part of the 1976-1981 Coverage Improvement Program. These coverage improvement cases represented most of the housing units that, until these procedures were implemented, did not have a chance of selection.

b. All sample housing units that were type A noninterviews (i.e., units eligible to be interviewed) or type B noninterviews (i.e., units not eligible for interview at the time of the survey but which could become eligible in the future) in the previous survey.

c. All sample housing units selected from a listing of new residential construction building permits issued since the previous survey. This sample represented the housing units built in permit-issuing areas since the previous survey.

d. All sample housing units that were added since the previous survey in sample segments from the nonpermit universe. This sample represented additions to the housing inventory since the previous survey in nonpermit-issuing areas.

e. In the 1970-based areas of the Baltimore, MD MSA; Chicago, IL area PMSA's; Hartford, CT CMSA; and St. Louis, MO-IL CMSA, all sample housing units selected from the 1980 Census of Population and Housing.

f. All sample housing units reinstated in sample in 1991. This sample represents units that had been dropped from sample because of sample reductions before 1991.

Housing units within new areas added to the metropolitan area in 1980 (1980-based area) include the following:

a. All housing units selected from the 1980 Census of Population and Housing.

b. All housing units that were selected from a list of new residential construction building permits. This sample represented the housing units built in permit-issuing areas since the 1980 census.

c. All sample housing units that were selected in sample segments added from the nonpermit universe. This sample represents units enumerated in the 1980 census as well as additions to the housing inventory in nonpermit-issuing areas since the 1980 census.

The following table shows the percent of the AHS-MS old construction sample that is 1970-based and 1980-based for each metropolitan area:

Metropolitan area	Percent 1970-based area	Percent 1980-based area
Atlanta, GA MSA	83.4	16.6
Baltimore, MD MSA	97.7	2.3
Chicago, IL area PMSA's	98.6	1.4
Columbus, OH MSA	80.4	19.6
Hartford, CT CMSA	61.8	38.2
Houston, TX area PMSA's	0.0	100.0
New York-Nassau-Suffolk, NY PMSA's	97.0	3.0
Northern NJ area PMSA's	55.9	44.1
St. Louis, MO-IL CMSA	95.8	4.2
San Diego, CA MSA	100.0	0.0
Seattle-Tacoma, WA CMSA	100.0	0.0

1991 AHS-MS Original Sample Selection for the 1970-Based Area Sample of the Metropolitan Areas. The 1991 AHS-MS original sample for the 1970-based area of the metropolitan areas which, in 1970, were 100-percent permit-issuing was selected from two frames:

a. Housing units enumerated in the 1970 Census of Population and Housing in areas under the jurisdiction of permit-issuing areas (the 1970-based permit-issuing universe).

b. Housing units constructed in permit-issuing areas since the 1970 census (the 1970-based new construction universe).

In addition, the sample for those metropolitan areas that were not 100-percent permit-issuing in 1970 included a sample selected from a third frame: housing units located in areas not under the jurisdiction of permit-issuing offices (the 1970-based nonpermit universe).

In 1970, the Hartford, CT CMSA; New York-Nassau-Suffolk, NY PMSA's; Northern NJ area PMSA's; and San Diego, CA MSA were the only metropolitan areas that were 100-percent permit-issuing.

Sampling operations, described in the following paragraphs, were performed separately within the central city and balance, using the 1970 OMB definitions of the central city of each metropolitan area for each of the sample frames. The overall sampling rate used to select the sample for each metropolitan area was determined by the size of the sample. Each metropolitan area had a sampling rate about the same for the central city and the balance, since the sample was distributed proportionately between the two, according to the corresponding distribution of total housing units.

Sample from the 1970-Based Permit-Issuing Universe. The major portion of the sample in each of the metropolitan areas was selected from a file that represented the 20-percent sample of housing units enumerated in permit-issuing areas of the metropolitan areas during the 1970 Census of Population and Housing. This file contained records for occupied housing units, vacant housing units, and housing units in certain special places or group quarters. Sampling operations were done separately for the special place and group quarters records, and for the occupied and vacant housing unit records. Before the sample was selected from the occupied and vacant housing unit records, the records were stratified by race of the head of household (non-Black/Black), and the vacant records were stratified into four categories pertaining to the value or rent associated with the vacant housing units. The occupied housing unit records were further stratified so that each unit was assigned to one of 50 strata according to its tenure (owner/renter), family size, and family income category as illustrated by the following table:

Family income	Tenure									
	Owner family size					Renter family size				
	1	2	3	4	5+	1	2	3	4	5+
Under $3,000										
$3,000 to $5,999										
$6,000 to $9,999										
$10,000 to $14,999										
$15,000 and over										

Thus, the occupied housing unit records from the permit-issuing universe were assigned to one of 100 strata for either the central city or for the balance, and the vacant housing unit records were assigned to one of the four vacant strata for either the central city or for the balance of the metropolitan areas. A sample selection procedure was then instituted that would produce one-half of the desired sample. However, whenever a record was selected to be in sample, the housing unit record adjacent to it on the file was also selected to be in sample, thereby insuring the necessary designated sample size.

Before the sample was selected from the group quarters and special place records, the records were stratified by census tract and census enumeration district (ED) within the central city and within the balance of the metropolitan areas. A sample of special place records was then selected by a procedure that produced one-quarter of the desired sample size. However, at the time of the survey, the housing units at each of the special places were listed and subsampled at a rate that produced an expected four sample units, thereby insuring the necessary designated sample size.

Sample from the 1970-Based New Construction Universe. The second frame from which the metropolitan area sample was selected was a list of new construction building permits issued since 1970 (i.e., the new construction universe). The sample selection from the list of new construction building permits was an independent operation within the metropolitan area. Under clerically selected

procedures, the list of permits was stratified by the date the permits were issued, and clusters of an expected four (usually adjacent) housing units were formed. These clusters were then sampled for inclusion at the overall sampling rate. In February 1984, the new construction sampling operation for the 1970-based and 1980-based areas were combined into one computerized system. The universe sampled in the computerized system will be referred to in the estimation section as the 1980-based permit universe. Under these procedures, prior to sample selection, the list of permits was stratified by the date of issue, State, 1980 central city and balance, county or minor civil division, and permit office. Clusters of an expected four (usually adjacent) housing units were formed. These clusters were then sampled for inclusion at twice the overall sampling rate. The housing units within each of the clusters were then subsampled so that two of the four housing units originally selected were kept in sample.

Sample from the 1970-Based Nonpermit Universe. For those metropolitan areas that were not 100-percent permit-issuing, the remainder of the AHS-MS sample was selected from a frame consisting of areas not under the jurisdiction of permit-issuing offices (i.e., the nonpermit universe). The first step in the sampling operation for the nonpermit universe was the selection of a sample of census enumeration districts. Prior to this sample selection, the ED's were stratified by census tract within the central city and within the balance of the metropolitan area.

The probability of selection of an ED was proportionate to the following:

$$\frac{\text{Number of housing units in 1970 census ED} + \dfrac{\text{Group quarters population in 1970 census ED}}{3}}{4}$$

The sample ED's were then divided into segments (i.e., small land areas with well-defined boundaries having an expected size of four, or a multiple of four, housing units). At the time of the survey, those segments that did not have an expected size of four were further subdivided to produce an expected four sample housing units. The next step was the selection of one of these segments within each sample ED. All housing units in existence at the time of interview in these selected segments were eligible for sample. Thus, housing units enumerated in the 1970 census as well as housing units built since the 1970 census were included.

Sample Selection for the AHS-MS Coverage Improvement Program. The AHS-MS Coverage Improvement Program was undertaken to correct certain deficiencies in the AHS-Metropolitan Area sample from the 1970-based permit-issuing universe and the 1970-based new construction universe within the 1970-based area. The coverage deficiencies included the following units:

a. New construction from building permits issued before January 1970, but completed after April 1, 1970.

b. Mobile homes placed in parks either missed during the 1970 census or established since the 1970 census.

c. Housing units missed in the 1970 census.

d. Housing units converted to residential use that were nonresidential at the time of the 1970 census.

e. Houses that have been moved onto their present site since the 1970 census.

f. Mobile homes placed outside parks since the 1970 census or vacant at the time of the 1970 census.

For a detailed description of the coverage improvement sample selection process, see earlier reports in the H-170 series for the years 1976 through 1981.

1987 AHS-MS Sample Reduction and Sample Reinstatement. The 1987 AHS-MS sample reduction dropped units from sample, whereas the 1987 AHS-MS sample reinstatement added enumerated units that were previously dropped from sample. The universes involved were (a) the 1970-based permit-issuing universe, (b) the 1970-based new construction universe, and (c) the 1970-based nonpermit universe.

Sample reduction and reinstatement involved dropping or adding (a) individual housing units from the permit-issuing universe, (b) whole clusters from the new construction universe, and (c) whole segments from the nonpermit universe.

The reduction/reinstatement was implemented to achieve two criteria:

a. A sample size of 4,250 or 8,500 in each metropolitan area.

b. A sample having an equal number of owners and renters.

To achieve these results, each unit was classified according to the original panel number (the original sample was divided into 12 panels, with one-twelfth of the sample being in each panel) and 1987 tenure (each housing unit was given a 1987 tenure based on the previous year's tenure status). To simplify field procedures, panels 1 through 3 (i.e., a random one-fourth of the original sample) were dropped from sample whenever possible. Because of budget constraints, panels 4 and 5 were also subsequently dropped, and the final sample sizes were smaller than

4,250. More sample reductions were implemented separately for each 1987 tenure group (using different selection rates) across the remaining panels.

AHS-MS Sample Selection for the 1980-Based Area Sample of the Metropolitan Areas. The sample for new areas added to the 1970-based metropolitan areas, and metropolitan areas in sample for the first time that, in 1980, were 100-percent permit-issuing, was selected from two frames:

a. Housing units enumerated in the 1980 Census of Population and Housing in areas under the jurisdiction of permit-issuing areas (the 1980-based permit-issuing universe).

b. Housing units constructed in permit-issuing areas since the 1980 census (1980-based new construction universe).

In addition, the sample for those metropolitan areas that were not 100-percent permit-issuing in 1980 included a sample from a third frame: housing units not under the jurisdiction of permit-issuing offices (1980-based non-permit universe).

In 1980, the Hartford, CT CMSA was the only metropolitan area that added new areas that were not 100-percent permit-issuing. To satisfy confidentiality requirements in the Baltimore, MD MSA; Chicago, IL area PMSA's; Hartford, CT CMSA; and St. Louis, MO-IL CMSA, it was necessary to supplement the existing sample within the 1970-based area. The additional housing units were selected separately for each metropolitan area from the 1980-based permit-issuing universe.

Sample From the 1980-Based Permit-Issuing Universe. The major portion of the sample in each metropolitan area was selected from a file that represented all the housing units enumerated in permit-issuing areas during the 1980 Census of Population and Housing. This file contained records for occupied housing units, vacant housing units, and housing units in group quarters. Sampling operations were done separately for noninstitutionalized group quarters and for all other housing units in permit-issuing areas. In addition, in order that an equal number of owner and renter housing units were selected in each metropolitan area, a selection rate that differed by tenure group was used. Before the sample was selected, the housing units that were not classified as group quarters were stratified into 60 categories by tenure, contract rent, value, and number of rooms as illustrated by the following table:

Contract rent and value	Number of rooms		
	1-3	4-5	6+
RENTER			
Contract rent			
Less than $100			
$100 to $149			
$150 to $199			
$200 to $249			
$250 to $299			
$300 to $349			
$350 to $399			
$400 or more			
Not available			
OWNER			
Value			
Less than $20,000			
$20,000 to $29,999			
$30,000 to $34,999			
$35,000 to $39,999			
$40,000 to $49,999			
$50,000 to $64,999			
$65,000 to $79,999			
$80,000 to $99,999			
$100,000 to $149,999			
$150,000 or more			
Not available			

The group quarters housing units were grouped into two strata: (1) institutionalized group quarters, and (2) noninstitutionalized group quarters.

The following sample selection procedures were then implemented separately within the central city and balance of the metropolitan area. For the Baltimore, MD MSA; Chicago, IL area PMSA's; Hartford, CT CMSA; and St. Louis, MO-IL CMSA, the sample selections were implemented separately by the 1970-based and 1980-based areas. All units were sorted by the 1980 central city and balance, stratum, State, district office, ED, and census serial number. The sample selection procedure was then implemented separately for (a) institutionalized group quarters and nongroup quarters housing units, and (b) noninstitutionalized group quarters.

Individual housing units were selected for the nongroup quarters while each institutionalized group quarters had one chance of selection. Before the sample selection for the noninstitutionalized group quarters was implemented, the following measure of size was calculated for each record:

$$\frac{(1/4) \times (\text{Total group quarters population})}{2.75}$$

The noninstitutionalized group quarters were then selected proportionate to the measure of size.

Sample Selection From the 1980-Based New Construction Universe. The second frame from which the metropolitan area sample was selected was a list of new construction building permits issued since 1980 (i.e., the new construction universe). The sample selection from the list of new

construction building permits was an independent operation within each metropolitan area. This operation was described in the discussion of the 1970-based new construction universe.

Sample From the 1980-Based Nonpermit Universe. For those metropolitan areas that were not 100-percent permit-issuing, the remainder of the AHS-MS sample was selected from a frame consisting of areas not under the jurisdiction of permit-issuing offices (i.e., the 1980-based nonpermit universe). The first step in the sampling operation for the nonpermit universe was the selection of a sample of census ED's within these areas (using the overall sampling rate). Prior to this sample selection, the ED's were sorted by State, district office and enumeration district number. The probability of selection of an ED was proportionate to the following:

$$\frac{\text{Number of housing units in 1980 census ED} + \dfrac{\text{Noninstitutionalized group quarters population in 1980 census ED}}{2.75}}{4}$$

The sample ED's were then divided into segments (i.e., small land areas with well-defined boundaries having an expected size of four, or a multiple of four, housing units). At the time of the survey, those segments that did not have an expected size of four housing units were further subdivided to produce an expected four sample housing units. Following the division, a segment from each sample ED was selected. All housing units in existence at the time of interview in these selected segments were eligible for sample. Thus, housing units enumerated in the 1980 census as well as housing units built since the 1980 census are included.

1991 AHS-MS Sample Reduction and Sample Reinstatement. For the current survey year, 3 of the 11 metropolitan areas had an expected sample size of 8,500; the remaining areas had an expected sample size of 4,250. Because of budget constraints, the sample sizes for the three large metropolitan areas were reduced from 8,500 to 4,250.

Panels 4 and 5 were reinstated in all areas in 1991; panel 12 was dropped in all areas except New York and Northern NJ. In addition, some housing units were reassigned from one panel to another to insure equitable workloads among all panels. This operation will also make it possible to interview the dropped units (and return to the 8,500 sample size for the three large metropolitan areas) when these metropolitan areas are surveyed in the future.

AHS-National Sample Selection. The United States was divided into areas made up of counties and independent cities called primary sampling units (PSU's). These PSU's were grouped into strata of one or more PSU's; one PSU was selected from each stratum to represent all PSU's in that stratum.

Selection from the 1980 census. Sample units were selected from the 1980 census units in these PSU's at an overall sampling rate of 1 in 2,148. The procedure for sampling of housing units, in a given area, depended on (a) the completeness of addresses and (b) the degree of monitoring of new construction by permits.

In areas where addresses were mostly complete and new construction was monitored by permits, a sample was selected from a list of housing units that received long-form questionnaires in the 1980 census.

In areas where at least 4 percent of the addresses were incomplete or inadequate, or where new construction was not monitored by building permits (most rural areas), a sample of 1980 "long-form questionnaire" census units was selected in several steps:

a. The areas were grouped, and a sample of areas was chosen.

b. A segment was selected within each sample area.

c. A sample of housing units that received 1980 census long forms was selected within the segment.

Selection of New Construction Housing Units in Permit-Issuing Areas. The sample of permit new construction was selected from issued building permits such that the units were expected to be completed after April 1, 1980. The sampling procedure was similar to that of AHS-MS; however, the subsampling rate used was 1 in 4.

Selection of Other Added Units and New Construction in Nonpermit-Issuing Areas. These types of housing units added to the inventory since the 1980 census were represented using two methods:

a. Within-structure additions are units in structures that contained at least one unit enumerated in the 1980 census

b. Whole-structure additions include units in structures that contained no units enumerated in the 1980 census.

Additional information concerning the 1991 AHS-National survey is available in the Current Housing Report series H150/91.

ESTIMATION

The 1991 AHS-Metropolitan Area sample produced estimates pertaining to characteristics of the housing inventory at the time of the interview (i.e., the 1991 housing inventory). The combined estimates used information from both the AHS-MS and AHS National samples (i.e., the combined sample estimates).

AHS-MS. Before performing estimation procedures using the combined sample, the AHS-MS sample housing units were weighted according to a one-stage ratio estimation procedure. Before the implementation of the ratio estimation procedure, the basic weight (i.e., the inverse of the probability of selection) for each interviewed sample housing unit was adjusted to account for Type M and Type A noninterviews.

Type M Noninterview Adjustment. The Type M noninterviews are sample units that were dropped because of selection by another survey. These noninterviews occur in (a) the 1980-based permit-issuing area universe, (b) the 1980-based nonpermit-issuing area universe, and (c) the 1980-based new construction universe.

The adjustment was done separately for the above universes for the central city and balance for each metropolitan area. The adjustment was equal to the following:

$$\frac{\text{AHS-MS sample estimate of 1980 housing units in the cell} + \text{Weighted count of Type M noninterviewed housing units}}{\text{AHS-MS sample estimate of 1980 housing units in the cell}}$$

Type A Noninterview Adjustment. Type A noninterviews are sample units for which (a) occupants were not home, (b) occupants refused to be interviewed, or (c) occupants were unavailable for some other reason.

The adjustment was done on occupied units and was computed separately for the following:

a. Units in the 1980-based permit-issuing area universe.

b. New construction.

c. All other housing units (this includes the 1970-based permit-issuing universe, the 1970-based and 1980-based nonpermit-issuing universes, and the 1970-based new construction housing units built before the last survey).

For units in the 1980-based permit-issuing universe, a Type A noninterview adjustment factor was computed separately, for each of the 62 strata used in the sample selection process, by central city and balance. For new construction units, a Type A noninterview adjustment factor was computed separately for each of the central city and balance. For all other units, a Type A noninterview adjustment factor was calculated separately by tenure and 1970 central city and balance for each of the following:

a. Twenty-four noninterview cells for sample housing units from the permit-issuing universe (each cell was derived from one or more of the 50 different strata used in the 1970-based permit-issuing universe, illustrated earlier).

b. One noninterview cell for new construction housing units.

c. One noninterview cell for mobile homes or trailers from the nonpermit-issuing universe.

d. One noninterview cell for units that were not mobile homes or trailers from the nonpermit-issuing universe.

e. Three noninterview cells for units from the coverage improvement universe.

f. One noninterview cell for units classified as vacants at the time of the 1970 census.

g. One noninterview cell for units classified as group quarters at the time of the 1970 census.

Within a given cell, the Type A noninterview adjustment factor was equal to the following ratio, using the basic weight times the Type M noninterview adjustment factor for the sample weight:

$$\frac{\text{Weighted count of interviewed housing units} + \text{Weighted count of Type A noninterviewed housing units}}{\text{Weighted count of interviewed housing units}}$$

AHS-MS Ratio Estimation Procedure for the 1970-Based Permit-Issuing Universe. The following ratio estimation procedure was employed for all sample housing units from the permit-issuing universe. This factor was computed separately for all sample housing units within each 1970-based permit-issuing universe noninterview cell mentioned previously. The ratio estimation factor for each cell was equal to the following:

$$\frac{\text{1970 census count of housing units from the 1970-based permit-issuing universe in the corresponding cell}}{\text{AHS-MS sample estimate of 1970-based housing units from the permit-issuing universe in the corresponding cell}}$$

For each metropolitan area, the numerators of the ratios were obtained from the 1970 Census of Population and Housing 20-percent file (long forms) of housing units enumerated in areas under the jurisdiction of permit-issuing offices. The denominators of the ratio estimation factors were then obtained from weighted estimates of all the AHS-MS sample housing units from the 1970-based permit-issuing universe, using the existing weights (i.e., the basic weight times the Type A noninterview adjustment). The computed ratio estimation factor was then applied to the existing weight for each sample housing unit within the corresponding ratio estimation cells. This ratio estimation procedure was introduced to correct the probabilities of selection for samples, in each of the strata used in the sample selection of the 1970-based permit-issuing universe. Before the AHS-MS sample selection within each metropolitan area, housing units already selected for other Census Bureau surveys were deleted from the permit-issuing universe. The same probability of selection was then applied to the remaining units to select the AHS-MS

sample. Since the number of housing units deleted from the AHS-MS universe frame was not necessarily proportional among all strata, some variation in the actual probability of selection between strata was introduced during the sample selection process.

AHS-MS Ratio Estimation Procedure for the 1980-Based Permit-Issuing Universe. The following ratio estimation procedure was employed for all sample units from the 1980-based permit-issuing universe. This factor was computed separately for all metropolitan areas, excluding the San Diego, CA MSA; and Seattle-Tacoma, WA CMSA, within each 1980-based permit-issuing universe noninterview cell mentioned previously. The ratio estimation factor was equal to the following:

$$\frac{\text{1980 census count of housing units from the 1980-based permit-issuing universe in the corresponding cell}}{\text{AHS-MS sample estimate of 1980-based housing units from the permit-issuing universe in the corresponding cell}}$$

For each metropolitan area, the numerator of the ratio was obtained from the 1980 Census of Population and Housing 100-percent file of housing units enumerated in areas under the jurisdiction of permit-issuing offices. The denominator of the ratio was obtained from weighted estimates of all the AHS-MS sample housing units within the corresponding ratio estimation categories using the existing weight (i.e., the basic weight times the Type M noninterview adjustment factor times the Type A noninterview adjustment factor).

The computed ratio estimation factor was then applied to the existing weight for each sample housing unit within the corresponding ratio estimation categories.

This ratio estimation procedure was introduced to adjust the sample estimate in each of the strata used in the sample selection of the 1980-based permit-issuing universe to an independent estimate (1980 census count) for the strata. This adjustment was necessary since some sample units were dropped during processing.

AHS-National. Before implementing estimation procedures using the AHS-National units for the combined sample, the AHS-National sample units were assigned a weight that reflected the probability of selection for the unit. The AHS-National weighting procedure then made adjustments for units that could not be interviewed. For each of these adjustments, a factor was computed and applied to the appropriate units.

The first of these adjustments was done for permit segments only, to account for permits that could not be sampled and units that could not be located. These units were represented by all other units in permit segments including both interviews and noninterviews (excluding "unable to locate" noninterviews).

The second of the adjustments was done for units in structures built before April 1, 1980. It was done to account for units that could not be located. These units were represented by both interviews and noninterviews (excluding "unable to locate" noninterviews).

The last of these adjustments was done to account for units that could not be interviewed because either no one was home after repeated visits or the respondent refused to be interviewed. When prior-year AHS or 1980 census data was available, this information was used to determine the noninterview adjustment cell. The cells included characteristics such as tenure, geography, units in structure, and number of rooms. When these data were not available, adjustment factors were computed separately using more general characteristics such as type of area and type of housing unit (i.e., mobile home, nonmobile home). Additional information on the AHS-National weighting procedure can be found in the current housing reports H150/91 series.

COMBINED SAMPLE WEIGHTING

Introduction. The estimates for the combined sample were obtained by summing the sample weights of interviewed AHS-MS and AHS-National units. For AHS-MS sample units, the starting weight was obtained after the AHS-MS ratio estimation procedure. For AHS-National units, the starting weight was obtained after the Type A noninterview adjustment. To account for the use of two different samples representing one metropolitan area, weighting factors were assigned to each unit prior to the combined sample ratio estimation procedures.

Weighting Factor Adjustment. The weighting factor adjustment was computed separately for each metropolitan area by sample design (AHS-MS or AHS-National) according to "new construction" or "old construction" classification. New construction was defined as units built in permit-issuing areas since the 1980 census; old construction units were then categorized by tenure classification (renter/owner).

For a given characteristic, the AHS-MS weighting factor adjustment was a function of the sample size in each survey and the variance associated with each survey's estimates.

The corresponding weighting factor was then applied to the existing weight of each AHS-MS and AHS-National sample unit and the weights were then combined according to characteristic (i.e., AHS-MS new construction + AHS-National new construction, etc.).

Combined Sample Ratio Estimation Procedures. For the three ratio estimate procedures described below, each metropolitan area was subdivided into geographic areas consisting of a combination of counties.

Mobile Home Ratio Estimation. The following ratio estimation procedure was applied in all areas except the Chicago, IL area PMSA's; Hartford, CT CMSA; New York-Nassau-Suffolk, NY PMSA's; and Northern NJ area PMSA's:

$$\frac{\text{Independent estimate of mobile homes for the corresponding geographic subdivision of the metropolitan area}}{\text{Sample estimate of mobile homes for the corresponding geographic subdivision of the metropolitan area}}$$

The numerator of this ratio was determined using data from the 1990 census. The denominator was obtained using the existing weight of AHS sample mobile home units (i.e., the starting weight times the combined sample weighting factor).

Independent Total Housing Unit Ratio Estimation. The following ratio estimation procedure was applied in all areas except the Chicago, IL area PMSA's; Hartford, CT CMSA; New York-Nassau-Suffolk, NY PMSA's; and Northern NJ area PMSA's:

$$\frac{\text{Independent estimate of the total housing inventory (excluding mobile homes) for the corresponding geographic subdivision of the metropolitan area}}{\text{Sample estimate of the total housing inventory (excluding mobile homes) for the corresponding geographic subdivision of the metropolitan area}}$$

The numerator of this ratio was determined from 1990 Census data. The denominator was obtained using the existing weight of AHS sample units (excluding mobile homes).

Independent Total Housing Unit Ratio Estimation. The following ratio estimation procedure was applied to the Chicago, IL area PMSA's; Hartford, CT CMSA; New York-Nassau-Suffolk, NY PMSA's; and Northern NJ area PMSA's:

$$\frac{\text{Independent estimate of occupied housing inventory for the corresponding geographic subdivision of the metropolitan area}}{\text{Sample estimate of occupied housing inventory for the corresponding geographic subdivision of the metropolitan area}}$$

The numerator of this ratio was determined from 1990 census data. The denominator was obtained by using the existing weight of AHS sample units (i.e., the starting weight times the combined sample weighting factor).

The computed ratio estimation factors were then applied to all appropriate housing units in the corresponding geographic area of each metropolitan area, and the resulting product was used as the final weight for tabulation purposes.

This is the first year we have used controls based on the 1990 census. The method for computing the controls also changed. We believe this method is better than the previous one because, using 1980 census data, it predicted the 1990 census count of housing units better than the previous method. We have included 1990-based estimates for 1987 for total housing units for each 1991 metropolitan area surveyed, in appendix C of this report.

The effect of these ratio estimation procedures was to reduce the sampling error for most statistics below what would have been obtained by simply weighting the results of the sample by the inverse of the probability of selection. Since the housing population of the sample differed somewhat, by chance, from the metropolitan area as a whole, it can be expected that the sample estimates will be improved when the sample housing population, or different portions of it, is brought into agreement with known good estimates of the metropolitan area housing population.

Table I. Standard Errors for Estimated Number of Housing Units in the 1991 Atlanta, GA MSA

Size of estimate	Standard error[1]		
	Combined owner and renter housing units[2]	Owner housing units[3]	Renter housing units[4]
0	340	380	330
400	370	390	360
700	490	510	480
1,000	590	610	570
2,500	920	970	900
5,000	1,310	1,370	1,280
10,000	1,840	1,930	1,800
25,000	2,900	3,030	2,830
50,000	4,050	4,240	3,960
75,000	4,910	5,140	4,800
100,000	5,610	5,870	5,480
150,000	6,710	7,020	6,560
200,000	7,570	7,920	7,400
250,000	8,250	8,630	8,060
300,000	8,800	9,200	8,600
400,000	9,580	10,030	9,370
500,000	10,030	10,490	9,810
600,000	10,190	10,660	-
700,000	10,060	10,530	-
800,000	9,640	10,090	-
900,000	8,900	-	-
1,000,000	7,720	-	-
1,100,000	5,870	-	-
1,210,458	-	-	-

[1]To compute standard errors for new construction estimates, the standard errors in the table should be multiplied by a factor of 1.0.

[2]Some examples that pertain to both owner and renter housing units are total housing units; all occupied housing units; all year-round housing units; mobile homes or trailers; and total vacant housing units.

[3]The owner housing units pertain to owner-occupied housing units and vacant housing units excluding vacant-for-rent housing units.

[4]The renter housing units pertain to renter-occupied housing units and vacant-for-rent housing units.

Table II. Standard Errors for Estimated Percentages of Housing Units in the 1991 Housing Inventory of the Atlanta, GA MSA

Base of percentage	Estimated percentage[1]				
	0, 1, 99, or 100	5 or 95	10 or 90	25 or 75	50
400	8.9	19.6	26.9	38.9	44.9
700	6.7	14.8	20.3	29.4	33.9
1,000	5.6	12.4	17.0	24.6	28.4
2,500	3.6	7.8	10.8	15.5	17.9
5,000	2.5	5.5	7.6	11.0	12.7
10,000	1.8	3.9	5.4	7.8	9.0
25,000	1.1	2.5	3.4	4.9	5.7
50,000	0.8	1.7	2.4	3.5	4.0
75,000	0.7	1.4	2.0	2.8	3.3
100,000	0.6	1.2	1.7	2.5	2.8
150,000	0.5	1.0	1.4	2.0	2.3
200,000	0.4	0.9	1.2	1.7	2.0
250,000	0.4	0.8	1.1	1.6	1.8
300,000	0.3	0.7	1.0	1.4	1.6
400,000	0.3	0.6	0.9	1.2	1.4
500,000	0.3	0.6	0.8	1.1	1.3
600,000	0.2	0.5	0.7	1.0	1.2
700,000	0.2	0.5	0.6	0.9	1.1
800,000	0.2	0.4	0.6	0.9	1.0
900,000	0.2	0.4	0.6	0.8	0.9
1,000,000	0.2	0.4	0.5	0.8	0.9
1,100,000	0.2	0.4	0.5	0.7	0.9
1,210,458	0.2	0.4	0.5	0.7	0.8

[1]Standard errors are presented to the nearest one-tenth of one percentage point except when the standard error is less than or equal to fifteen-hundredths of one percentage point; in those cases, the standard error is shown to the nearest one-hundredth of one percentage point. For estimates pertaining to new construction, the standard errors shown in the table should be multiplied by a factor of 1.0.

The following factors should be applied to estimates that do not pertain strictly to new construction. For estimates pertaining to both owners and renters, apply a factor of 1.0. For estimates pertaining to owner housing units, apply a factor of 1.1. For estimates pertaining to renter housing units, apply a factor of 1.0.

Table III. Estimated Error Resulting From Incomplete Data—American Housing Survey: 1991 Metropolitan Sample

Metropolitan statistical area	Size of published estimate							
	1,000	10,000	50,000	100,000	500,000	1,000,000	2,000,000	3,000,000
Atlanta, GA	1,489	1,816	3,268	5,083	19,603	9,092	(1)	(1)
Baltimore, MD	1,183	1,509	2,961	4,776	17,671	(1)	(1)	(1)
Chicago, IL	3,456	3,783	5,235	7,050	21,570	39,720	34,263	(1)
Columbus, OH	720	1,047	2,499	4,314	3,228	(1)	(1)	(1)
Hartford, CT	562	889	2,341	4,156	(1)	(1)	(1)	(1)
Houston, TX	1,775	2,101	3,553	5,368	19,888	18,025	(1)	(1)
New York-Nassau-Suffolk, NY	5,417	5,744	7,196	9,011	23,531	41,681	77,981	59,243
Northern NJ	2,727	3,054	4,506	6,321	20,841	38,991	11,488	(1)
St Louis, MO	1,254	1,580	3,032	4,847	19,367	1,743	(1)	(1)
San Diego, CA	1,194	1,521	2,973	4,788	18,043	(1)	(1)	(1)
Seattle-Tacoma, WA	1,352	1,678	3,130	4,945	19,465	4,804	(1)	(1)

(1) No error estimates are provided because estimate is larger than the estimated total number of housing units in the MSA.

Table IV. Description of the American Housing Survey—1991 Metropolitan Sample

Metropolitan statistical area	Units eligible			Units visited, not interviewed[2]	National units interviewed
	Total	Interviewed	Not interviewed[1]		
Total	42,215	40,243	1,972	2,415	7,944
Atlanta, GA	3,959	3,797	162	263	567
Baltimore, MD	3,820	3,640	180	224	434
Chicago, IL	3,846	3,740	106	154	1,326
Columbus, OH	3,846	3,677	169	202	288
Hartford, CT	3,893	3,767	126	166	212
Houston, TX	3,256	3,133	123	285	649
New York-Nassau-Suffolk, NY	4,045	3,725	320	221	2,044
Northern NJ	4,177	3,809	368	222	1,035
St Louis, MO	3,682	3,583	99	268	458
San Diego, CA	3,872	3,730	142	204	439
Seattle-Tacoma, WA	3,819	3,642	177	206	492

[1]Sample units were visited but occupants were not at home after repeated visits or were unavailable for some other reasons; or, for vacant housing units, no informed respondent could be found.

[2]Sample units were visited but did not provide information relevant to the housing inventory. This category includes sample units that were found not to be in the sampling frame.