

BUREAU OF THE CENSUS
STATISTICAL RESEARCH DIVISION REPORT SERIES

SRD Research Report Number: CENSUS/SRD/RR-87/13

DOCUMENTATION OF THE SAMPLING AND ESTIMATION
FOR THE 1987 TAXABLE PROPERTY VALUES SURVEY

by

Carma R. Hogue
Statistical Research Division
Bureau of the Census
Room 3130, F.O.B. #4
Washington, D.C. 20233 U.S.A.

This series contains research reports, written by or in cooperation with staff members of the Statistical Research Division, whose content may be of interest to the general statistical research community. The views reflected in these reports are not necessarily those of the Census Bureau nor do they necessarily represent Census Bureau statistical policy or practice. Inquiries may be addressed to the author(s) or the SRD Report Series Coordinator, Statistical Research Division, Bureau of the Census, Washington, D.C. 20233.

Recommended: Nash M. Monsour

Report completed: May 12, 1987

Report issued: May 14, 1987

Documentation of the Sampling and Estimation
for the 1987 Taxable Property Values Survey

Prepared by: Carma R. Hogue
Issued: May 12, 1987

SAMPLING PROCEDURES FOR THE
1987 TAXABLE PROPERTY VALUES SURVEY

CONTENTS

	Page
1. Introduction.....	1
2. First Stage of Sampling.....	2
2.1 Sampling Procedure.....	2
2.2 Treatment of Reappraisals.....	7
3. Second Stage of Sampling.....	7
3.1 Introduction.....	7
3.2 Calculation of the Certainty Cutoffs.....	9
3.3 Estimates of 1986 Average Assessed Values.....	10
3.4 Construction of the Forms.....	11
3.5 Assignment of Forms.....	12
3.6 Calculation of the Sampling Interval.....	13
3.7 Deletion Procedure.....	14
4. Remarks.....	15

Appendices

A. State Stratifications.....	16
B. Summary of Factors Affecting State Assessed Values.....	32
C. 1987 TPV Listing and Sampling Sheets.....	37
D. Estimates of Totals and Variances from the 1987 Taxable Property Values Survey.....	45
1. Assessed Value Estimates.....	45
1.1 Assessed Values for Subsets - States.....	45
1.2 Assessed Values for Subsets - Jurisdictions.....	47
1.3 Summary of Assessed Value Estimates.....	48
2. Variance of the Assessed Value Estimates.....	48
3. Estimation of the Variance of Assessed Value Estimates.....	52
3.1 Estimated Variance for a Single Jurisdiction.....	52
3.2 Estimated Variances for State Totals.....	53
3.2.1 States with Only Certainty Jurisdictions.....	53
3.2.2 States with Certainty and Noncertainty Jurisdictions.....	54
4. Estimates of Number of Parcels.....	55
4.1 Jurisdiction Estimates.....	55
4.2 Estimates for States with Certainties Only.....	56
4.3 Estimates for States with Certainties and Noncertainties....	56
5. Estimated Variances for Estimated Parcel Counts.....	57
5.1 Single Jurisdiction Estimates.....	57
5.2 Estimates for States with Certainties Only.....	58
5.3 Estimates for States with Noncertainties.....	59

SAMPLING PROCEDURES FOR THE 1987
TAXABLE PROPERTY VALUES SURVEY

1. INTRODUCTION

The Taxable Property Values Survey is conducted every five years in conjunction with the census of governments. Officials of each State, the District of Columbia, Puerto Rico, Guam, and the Virgin Islands are surveyed in order to obtain real property tax assessments information as well as data on tangible and intangible personal property for States, counties, and cities having a population of 50,000 or more. In order to get assessed values and parcel counts by property use, a sample of parcels is selected from assessment rolls or equivalent public record. The 1987 survey is a two-stage stratified sample of locally assessed real property parcels designed to give State estimates of property tax assessments and number of parcels by use of property (residential, commercial, industrial, etc.). As a second part of this survey in years prior to the 1987 survey, real estate sales prices were also collected. For 1987 this phase of the survey and calculations of SMSA estimates were excluded due to budget constraints. The real estate sales phase of the previous surveys is documented in the Taxable Property Values and Assessment-Sales Price Ratios volumes for census years prior to 1987.

The first stage of sampling is a sample of local jurisdictions with powers to assess taxes for local properties. These jurisdictions were counties in 40 States, and townships or municipalities in 10 States (the New England States, Michigan, Wisconsin, New Jersey, and New York). For each State, the sample was designed to yield estimates of statewide assessments with relative standard errors of 2 percent or less in most States. The exceptions were New Hampshire, Rhode Island, and Vermont which were sampled to yield relative standard errors of about 3 percent.

The sampling was done within each State, but in total, 976 jurisdictions were selected for the 1987 sample from the 2834 jurisdictions in the 40 States where the county was the assessing jurisdiction. For the 10 "township States," 900 of 6475 jurisdictions were selected. A total of 316 townships and 526 counties was selected with certainty at the first stage. All of the jurisdictions in Delaware and Hawaii were included with certainty.

The second stage of sampling consists of the selection of individual parcels from each jurisdiction selected in the first stage. These individual parcel assessed values are selected from the assessment rolls of the jurisdiction. In the years when the real estate sales portion of the survey is conducted, sampling for this portion of the survey is done from grantor-grantee indexes or other such listings found in the jurisdiction's office.

The entire first-stage sample selection process is done by Statistical Research Division (SRD) staff. The second-stage sample is designed by SRD but Governments Division (GOVS) monitors the selection of the sample. Every five years with each sample selection, a greater portion of the second-stage sampling is done by computer, thus reducing the chances for clerical error. Computer-assisted enumeration has been successful even though problems with local property classification codes exist.

The details of the first stage of sampling are given in section 2. The second stage is covered in section 3. Details of the estimation are covered in Appendix D.

2. FIRST STAGE OF SAMPLING

2.1 Sampling Procedure

The first stage of sampling in the TPV survey is a stratified sample of assessing jurisdictions within each State with stratification based on the

most recent available assessed values. GOVS supplied a listing of all jurisdictions (either county or township) arrayed within State by 1984 assessed values. The 1984 population and 1981 assessed values for each jurisdiction were also on the printout. State total assessed values and parcel counts for 1981 and 1984 as well as occasional notes explaining large decreases in the assessed values of some jurisdictions were also included.

Every assessing jurisdiction (county or township) with a 1984 population of 100,000 or more was designated by GOVS to be a certainty jurisdiction. In Michigan and Wisconsin, "part" jurisdictions existed. These were usually parts of a large metropolitan area that covered several counties. If the metropolitan area satisfied the certainty criterion, all of its "parts" were added to certainty also. Other jurisdictions were added to certainty in order to satisfy the error goals. The error goals were to select a sample of jurisdictions large enough to achieve a relative standard error of 2% or better for the estimated State total of a simple unbiased estimate of assessed value from the first-stage sample. (Exceptions to these error goals were noted in Section 1). Generally, a jurisdiction was added to certainty if it exceeded Y_{NC}/n where Y_{NC} is the total of all noncertainty 1984 assessed values in a state and n is an estimate of the sample size for the state, initially estimated from the previous TPV survey.

The stratification of the noncertainty jurisdictions was done using 1984 assessed value data with the allocation of the sample to the strata based on 1981 data. Preliminary stratifications were constructed using the previous survey (1982) as a guide. Usually, the preliminary stratum breaks were made using the number of strata from the previous survey, L_1 , in the current stratification. Usually stratum breaks were also constructed for (L_1+1) strata and occasionally for (L_1+2) strata.

After setting the preliminary certainty cutoff and determining the desired number of strata, boundaries were constructed in at least one of the following four ways: (1) using the cum \sqrt{f} method (Cochran, 1977, p. 130); (2) using the cum $\sqrt[3]{f}$ method; (3) constructing strata with approximately equal total assessed value for each stratum; and (4) dividing the certainty cutoff value by 2 to get the first stratum boundary, multiplying the lowest "realistic" assessed value by two to get the last stratum boundary, and constructing the remainder of the strata to give approximately equal total assessed values.¹ The lowest "realistic" assessed value refers to the few very small jurisdictions (that exist in virtually every State) which, for some reason, had much lower assessed values than the other jurisdictions. In the majority of the States, the assessed values for the last few jurisdictions were substantially lower than the average. These extreme values were included in the sample but they were excluded from the calculation of the stratum boundary under method (4). A special case is Alaska where there are several jurisdictions with the power to assess but they do not exercise that power. These jurisdictions, which had an assessed value of zero, were not included in the sample. Nonresponse in three Michigan jurisdictions produced zeros and values were imputed for these jurisdictions based upon their populations.

After the stratum boundaries were specified, a Neyman allocation to the strata was done. In the large township States, GOVS calculated the S_h for each of SRD's designated strata. The formulas that were used for the sample size and allocation to strata were 2.1 and 2.2, respectively:

$$n = \left(\sum_{h=1}^L N_h S_h \right)^2 / \left[(CV_o)^2 (X_C + X_{NC})^2 + \sum_{h=1}^L N_h S_h^2 \right] \quad (2.1)$$

¹ The first two methods did not work well in states with a small number of jurisdictions.

where

$$S_h^2 = \left(\sum_{i=1}^{N_h} X_{hi}^2 - (X_h)^2 / N_h \right) / (N_h - 1) = \text{stratum variance}$$

$$S_h = (S_h^2)^{1/2}$$

$$X_h = \sum_{i=1}^{N_h} X_{hi}$$

N_h = Number of jurisdictions in the h-th noncertainty stratum

• L = Number of noncertainty strata

X_{hi} = 1981 assessed value for jurisdiction i and stratum h.

CV_0 = Specified coefficient of variation

X_C = Total of the 1981 assessed values for the certainty stratum

X_{NC} = Total of the 1981 assessed values for the noncertainty strata.

$$n_h = n N_h S_h / \sum_{h=1}^L N_h S_h \quad (2.2)$$

The contribution of each stratum to the variance was calculated along with the coefficient of variation using the following formulas:

$$\sigma_h^2 = (N_h - n_h) N_h S_h^2 / n_h \quad (2.3)$$

$$\sigma^2 = \sum_{h=1}^L \sigma_h^2 \quad (2.4)$$

$$CV = \sigma / \left(\sum_{h=1}^L X_C + X \right) \quad (2.5)$$

where $\sigma = (\sigma^2)^{1/2}$

X_C = Total of the 1981 assessed values for the certainty stratum.

After the initial allocation, more jurisdictions were added to certainty, if needed, and the procedure was repeated. Due to budget constraints, the total number of jurisdictions selected at the first stage in 1987 was to be about the same as the number of jurisdictions selected in 1982. If the allocation gave a sample size substantially larger than the 1982 sample size for the State, the coefficient of variation was increased from .02. This only happened 3 times since the 1982 sample was designed to give estimates of State and SMSA totals. Due to budget constraints, SMSA estimates will not be calculated in 1987.

A stratification was selected from among the four methods for constructing strata if it gave a low coefficient of variation in which the stratum contributions to σ^2 were not highly variable and if the values of $N_h S_h$ were not vastly different. The sampling rate was also considered. Generally, smaller rates were desired in the strata containing jurisdictions with the smallest assessed values. Occasionally, more jurisdictions were taken from these "lower-valued strata" to avoid a very large first-stage weight. The final stratification for each state is given in Appendix A.

After the final allocation was made, a systematic random sample was drawn within each stratum and marked on the original printout. These printouts were returned to GOVS on a flow basis.

2.2 Treatment of Reappraisals

In several states, parcels were reappraised between 1981 and 1984. GOVS provided extra information about whether or not these reappraisals were expected to continue and to what extent. If GOVS had complete information about durations of reappraisals for each jurisdiction, this information was used to adjust each jurisdiction to reflect whether the 1984-87 changes would be due to growth or reappraisals. In most cases only general information about the amount of reappraisals was available. If the reappraisals were expected to continue at the same pace, the 1981-84 trends were expected to reflect the 1984-87 trends and no adjustments to the data were made. If the reappraisals ended in 1984, the 1981 data were adjusted to reflect growth only. If a jurisdiction was known to have been reappraised after 1984, the 1984 assessed value was adjusted and the jurisdiction was placed in the correct stratum. All adjustments were made based on the average growth or reappraisal trends evident in the State.

Some States, particularly in the West, required special adjustments to the data or an increase in sample size to account for the effects of highly variable metals and oil prices on property values. The States that required special treatment because of reappraisals or other factors are given in Appendix B.

3. SECOND STAGE OF SAMPLING

3.1 Introduction

The second stage of sampling involves an enumeration of a sample of individual parcels taken from the assessment rolls from each jurisdiction selected in the first stage. Stratification is applied on the basis of the assessed value of individual parcels. Within each jurisdiction selected at

the first stage of sampling, all taxable real properties with an assessed value exceeding the certainty cutoff level are included in the sample. For properties with assessments below the cutoff, a sample is selected using forms designed for use in listing properties.

The assessment values for two different years (1981 and 1984 for the design of the 1986 TPV) are available for every jurisdiction in the universe. Total parcel counts for each State are also available for 1981 and 1984. Unfortunately, the parcel counts from the previous census year are available only for most of the large certainty jurisdictions. For some certainty jurisdictions, the parcel counts for later years are available upon request from Governments Division. Parcel counts for non-certainty jurisdictions are not available.

The primary purpose of the TPV is to provide breakdowns of assessment values for "land-use" categories (commercial, residential, vacant platted lots, etc.) for each State. Estimates of these breakdowns are available by State only from the previous TPV survey. No current breakdowns are available. No "land-use" breakdowns are available for all jurisdictions, just those that were in the previous sample.

The sampling procedure detailed in this section was designed to yield a sample of about 1.25 million parcels or approximately 1.2 percent of the total number of parcels in the United States. In general, a certainty level is calculated for each jurisdiction. Enumerators search the assessed value rolls for values above the certainty cutoff level. Data for all certainties in the jurisdiction are copied before the second part of the sampling is done. In order to sample non-certainty properties, the enumerator counts down the list of all properties using a specified sampling interval. The assessed value for the selected parcel is compared to the test value given on the sampling

form. If the selected parcel's value is greater than or equal to the test value, the parcel is selected for inclusion in the sample. Much of the sampling from the large metropolitan areas is done on the computer. For the remaining jurisdictions, field staff do the operations.

3.2 Calculations of the Certainty Cutoffs

Governments Division set a maximum assessed value certainty cutoff level of \$1.6 million for Los Angeles, California, \$1.0 million for Washington, D.C. and Honolulu, Hawaii, and \$800,000 for all other jurisdictions. Theoretical cutoff values were calculated for each State using the procedures given in this section. Cutoffs for each stratum in a State were calculated from the State's certainty cutoff by dividing the theoretical cutoff value by the first stage sampling weight, w_{hi} , for State h and stratum i.

Theoretically, the cutoff for State h is X_h/n_h where X_h is the total assessed value for the State and n_h is the number of parcels to be sampled in the State. The total sample size needed, n, is 1,250,000 parcels which is about 1.2% of the total number of parcels in the United States. Since detailed data are not available for each State, a safety factor of 2 was applied to give $2(.012)N_h$ as an estimate of n_h for each State. The certainty cutoff, X_h/n_h , was then estimated to be

$$\text{cutoff} = X_h / 2(.012)N_h \doteq 40 \bar{X}_h \quad (3.1)$$

where \bar{X}_h is an estimate of the 1986 \overline{AV} for State h as estimated in section 3.3.

The theoretical certainty cutoff was calculated for each State using equation 3.1. This process was repeated with the remaining assessed value total and number of parcels. For all but 25 States, the certainty cutoff of

\$800,000 set by Governments Division was lower than the theoretical cutoff. For first-stage certainty jurisdictions and any other jurisdictions where $40\bar{X}_h/w_{hi}$ was greater than Governments Division's designated cutoff, the designated cutoff was used.

3.3 Estimates of 1986 Average Assessed Values

To determine the State certainty cutoffs for parcels, estimates of 1986 average assessed values for each State are needed. Using the available 1981 and 1984 assessed values and parcel counts for the States, a projection of the 1986 average assessed value based on two-thirds of the 1981-84 trend was made. These projections were altered to account for variations (like reassessments) in the 1981-84 data that were not due to growth, if these variations were not expected to continue. Also, an attempt was made to project 1986 estimates for States that underwent reassessment between 1984 and 1986. Appendix B provides a list of States in which factors other than growth factors had to be considered.

The 1986 average assessed values were estimated two ways. In method 1, the total assessed value and the parcel count for the State were estimated using equations 3.2 and 3.3:

$$\left(\left(\frac{\hat{AV}_{84} - \hat{AV}_{81}}{\hat{AV}_{81}} \right) \frac{2}{3} + 1 \right) \hat{AV}_{84} = \hat{AV}_{86} \quad (3.2)$$

and similarly,

$$\left(\left(\frac{\hat{PC}_{84} - \hat{PC}_{81}}{\hat{PC}_{81}} \right) \frac{2}{3} + 1 \right) \hat{PC}_{84} = \hat{PC}_{86} \quad (3.3)$$

where \hat{AV}_i is the estimated assessed value in year i
and \hat{PC}_i is the estimated parcel count in year i .

The average assessed value was calculated as

$$\widehat{AV}_{86}/\widehat{PC}_{86} = \widehat{AV}_{86}. \quad (3.4)$$

This method of calculation was used particularly in the estimation of States that had undergone reassessments. The parcel counts were allowed to grow at the 1981-84 rate but the assessed values were adjusted to reflect the reappraisals.

In the other method, \widehat{AV}_{86} was based on the growth of the average assessed value:

$$\widehat{AV}_{86} = [(\widehat{AV}_{84} - \widehat{AV}_{81})/\widehat{AV}_{81}] \frac{2}{3} + 1] \widehat{AV}_{84} \quad (3.5)$$

where $\widehat{AV}_i = \widehat{AV}_i/\widehat{PC}_i$ for year i .

Both methods were used to calculate \widehat{AV}_{86} and they usually yielded estimates that were very close to each other. Slightly higher averages were realized with the first method.

Separate \widehat{AV}_{86} calculations were made for jurisdictions (e.g., Honolulu, Hawaii and Boston, Massachusetts, etc.) that had large total assessed values and had average assessed values that were vastly different from the balance of the State. Estimates of \widehat{AV}_{86} were made for the balance of the State also.

3.4 Construction of the Forms

In order to facilitate the computer processing, separate sampling forms were not designed for each State. A maximum of nine forms could have been designed to cover sampling in the States and special jurisdictions. The estimated average assessed values for the States and special jurisdictions

were arrayed from the largest to the smallest. They were grouped into eight classes with approximately the same \overline{AV}_{86} . A form that followed approximately the following criterion was designed for each of the eight groups:

<u>For line number</u> <u>on the sampling form</u>	<u>the entry is approximately</u>
1	0
17	$\overline{x}/4$
9	$\overline{x}/2$
5, 13, 21	\overline{x}
3, 7, 11, 15, 19, 23	$2\overline{x}$
All even	$4\overline{x}$

For each form, a maximum certainty cutoff level of about $12\overline{x}$ was designated. Individual State and special jurisdiction certainty cutoffs were determined using the criterion described in section 3.2. All assessed values above the cutoff were taken with certainty. The individual, assigned cutoff for the State could not be greater than the designated maximum certainty level for each form. The final forms specifications are given in Appendix C.

3.5 Assignment of Forms

Parcel counts and assessed values for 1981 are available for most of the large certainty jurisdictions in the 1982 Census of Governments, volume 2, Taxable Property Values and Assessment-Sales Price Ratios. Using this information, along with information on 1984 assessed values, special 1984 estimates of parcel counts when available from Governments Division, and information on reassessments, estimates of 1986 average assessed values for the large certainty jurisdictions were made. Jurisdictions that had average assessed values that were greatly different from the assessed values of other jurisdictions in the certainty stratum were separated and given a different certainty cutoff from the balance of the certainty stratum.

After estimates for the special certainty jurisdictions were determined and after certainty cutoffs were calculated for all of the strata, the eight

forms that were discussed in section 3.4 were assigned to each first-stage stratum. The AV certainty cutoff for each stratum was compared to the maximum certainty level designated for each form. The form that most closely matched the stratum certainty level was assigned to the stratum. Since forms 1 and 2 were both capped by maximum certainty levels of 800,000, the stratum mean, where available, was compared to the mean (value on line 5) of each form to determine which of the two forms was more appropriate. Form number 8 was designed specifically to fit Honolulu, Hawaii and Washington, D.C.

3.6 Calculation of the Sampling Interval

The sampling interval or "take every" for each stratum is determined by dividing the national "sampling" interval, which equals 16, by the first-stage sampling weight, w_{hi} . This number is rounded to the next integer. The national "sampling" interval was estimated by getting an expected yield from an assumed 1986 United States distribution of assessed-value size classes and the take rates of the proposed size classes. The sampling interval, K , is calculated as follows:

$$K = \frac{\text{Expected yield}}{\text{Total sample size needed}}$$

As illustrated in Table 1, a sampling interval of 16 was expected to give the approximately 1.25 million sample size. From the table, the expected take per 10,000 is $17+1609/K$. The estimated total number of parcels in 1986 is 106×10^6 . The total sample size needed is 1.25 million. The following equation gives the value of K :

$$((17+1609/K)10,000) 106 \times 10^6 = 1,250,000$$

$$K = 16$$

Table 1. 1982 Census of Governments - U.S. Properties

A.V. Class	N_i	$X_i (10^6)$	Approx. Strata	% of Parcels	Sampling Fraction for Form Designed	Take per 10,000
500,000+	165,686	139,740	certainty	.17	1/1	17
200,000-499,999	558,539	163,204	} $5\bar{x}$	2.60	1/K	260/K
100,000-199,999	1,949,844	259,581				
50,000-99,999	7,403,863	502,002	$2.5\bar{x} - 5\bar{x}$	7.68	1/2K	384/K
20,000-49,999	18,720,204	602,244	$\bar{x} - 2.5\bar{x}$	19.41	1/4K	485/K
10,000-19,999	14,543,698	208,615	$.5\bar{x} - \bar{x}$	15.08	1/8K	188/K
5,000-9,999	14,441,867	103,717	$.25\bar{x} - .5\bar{x}$	14.97	1/12K	125/K
1,000-4,999	23,147,996	62,559	} $< .25\bar{x}$	40.09	1/24K	167/K
< 1,000	<u>15,513,368</u>	<u>6,108</u>				
	<u>96,445,065</u>	<u>2,047,770</u>	$\bar{x} = 21,232$			<u>17+1609/K</u>

After the enumerator has completed identification of the certainty parcels, he/she uses the "take every" number to select a random sample of all parcels. The value of the selected line number is compared against the form line test value. As explained in section 3.1, the selected number is retained in the sample if the assessed value of the parcel is greater than the appropriate value on the forms.

3.7 Deletion Procedure

In order to avoid any possible biases by always starting with line 1 of the assessment rolls and proceeding with the first line of the sampling form, a deletion procedure was established. The first few lines, say 'd', on the first page of the sampling form for each sample jurisdiction are deleted by Governments Division.

The procedure for calculating the deletion number, d, is as follows:

1. Select a random number (RN) between 1 and αK , where α = the number of lines on a form (i.e., 24 for all forms in 1987) and K is the "take every" calculated according to the formulas given in section 3.6.
2. Calculate RN/K. The quotient is the deletion number, d, and the remainder is the random start, r, as follows:

$$\begin{aligned} \text{RN/K} &= \text{Q} + \text{Remainder} \\ &= \text{d} + \text{r/K} \end{aligned}$$

Governments Division used r, the random start, and d, the number of lines to delete, to prepare the forms for the enumerators.

4. REMARKS

For 1992, GOVS wants to have fewer second-stage sampling units. This sampling is done in the assessing jurisdiction offices by Field Division's clerical staff. For many of the larger jurisdictions, this sample selection is done by computer. GOVS objective can be achieved either by taking more first-stage units or raising the coefficient of variation requirements.

Appendix A

State Stratifications

Alabama (01)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
130,000 +	13	13	1.0000	
95,000-129,999	6	2	3.0000	
60,000-94,999	13	3	4.3333	
35,000-59,999	16	2	8.0000	
Under 35,000	19	3	6.3333	
	<u>67</u>	<u>23</u>		CV = .02

Alaska (02)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
300,000 +	9	9	1.0000	
Under 300,000	16	3	5.3333	
	<u>25</u>	<u>12</u>		CV = .02

Arizona (03)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
275,000 +	3	3	1.0000	
155,000-274,999	6	3	2.0000	
Under 155,000	6	2	3.0000	
	<u>15</u>	<u>8</u>		CV = .02

Arkansas (04)

<u>Adjusted '84 AV*</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
150,000 + & St. Francis, Ashley, Clay, & Prairie	17	17	1.0000	
Sevier, Little River, Pike, Calhoun, Madison, Cleveland	6	3	2.0000	
Rest:				
85,000-149,999	16	6	2.6667	
48,000-84,999	21	5	4.2000	
Under 48,000	<u>15</u>	<u>3</u>	5.0000	
	75	34		CV = .02

*1985 reappraisals for 15 jurisdictions were taken into consideration. Their '84 AV's were adjusted accordingly and they were put in the appropriate strata.

California (05)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
2,500,000 +*	33	33	1.0000	
Under 2,500,000	<u>25</u>	<u>3</u>	8.3333	
	58	36		CV = .02

*There was 1 jurisdiction with AV < 2,500,000 but population > 100,000.

Colorado (06)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
240,000 +	13	13	1.0000	
100,000-239,999	9	3	3.0000	
50,000-99,999	17	4	4.2500	
Under 50,000	<u>24</u>	<u>3</u>	8.0000	
	63	23		CV = .02

Connecticut (07)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
650,000 +	26	26	1.0000	
525,000-649,999	9	5	1.8000	
330,000-524,999	15	7	2.1429	
225,000-329,999	24	7	3.4286	
120,000-224,999	30	7	4.2857	
60,000-119,999	37	5	7.4000	
Under 60,000	<u>28</u>	<u>3</u>	9.3333	
	169	60		CV = .02

Delaware (08)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>
397,000 +	3	3	1.0000

D.C. (09)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>
24,000,000* +	1	1	1.0000

Florida (10)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
3,4000,000 +*	24	24	1.0000	
1,000,000-3,399,999	11	3	3.6667	
Under 1,000,000	<u>32</u>	<u>3</u>	10.6667	
	67	30		CV = .02

*There were 6 certainty jurisdictions with AV's less than 3,400,000 but populations greater than 100,000.

Georgia (11)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
500,000 +	12	12	1.0000	
325,000-499,999	8	3	2.6667	
210,000-324,999	18	3	6.0000	
120,000-209,999	27	3	9.0000	
70,000-119,000	47	4	11.7500	
Under 70,000	<u>47</u>	<u>3</u>	15.6667	
	159	28		CV = .02

Hawaii (12)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>
2,000,000 +	4	4	1.0000

Idaho (13)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
500,000 +	12	12	1.0000	
280,000-499,999	9	4	2.2500	
170,000-279,999	12	4	3.0000	
Under 170,000	<u>11</u>	<u>3</u>	3.6667	
	44	23		CV = .02

Illinois (14)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
900,000 +*	18	18	1.0000	
338,000-899,999	15	3	5.0000	
157,700-337,999	30	3	10.0000	
Under 157,700	<u>39</u>	<u>3</u>	13.0000	
	102	27		CV = .02

*One certainty had AV < 900,000 but population > 100,000.

Indiana (15)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
300,000 +*	14	14	1.0000	
175,000-299,999	9	3	3.0000	
100,000-174,999	28	5	5.6000	
65,000-99,999	24	3	8.0000	
Under 65,000	<u>17</u>	<u>3</u>	5.6667	
	92	28		CV = .02

*Two certainties had AV's less than 300,000 but population > 100 000.

Iowa (16)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
1,200.000 +	9	9	1.0000	
800,000-1,199,999	8	3	2.6667	
550,000-799,999	16	3	5.3333	
445,000-549,999	19	3	6.3333	
325,000-444,999	26	3	8.6667	
Under 325,000	<u>21</u>	<u>3</u>	7.0000	
	99	24		CV = .02

Kansas (17)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
125,000 +	6	6	1.0000	
65,000-124,999	10	4	2.5000	
35,000-64,999	14	4	3.5000	
23,000-34,999	30	4	7.5000	
Under 23,000	<u>45</u>	<u>5</u>	9.0000	
	105	23		CV = .02

Kentucky (18)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>
750,000 +	10	10	1.0000
500,000-749,999	9	3	3.0000
310,000-499,999	16	3	5.3333
185,000-309,999	23	3	7.6667
106,000-184,999	29	3	9.6667
Under 106,000	<u>33</u>	<u>3</u>	11.0000
	120	25	

CV = .02

Louisiana (19)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>
155,000 +	10	10	1.0000
80,000-154,999	8	3	2.6667
50,000-79,999	10	2	5.0000
30,000-49,999	16	3	5.3333
Under 30,000	<u>20</u>	<u>2</u>	10.0000
	64	20	

CV = .02

Maine (20)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>
195,000 + cert.	23	23	1.0000
120,000-194,999	16	11	1.4545
80,000-119,999	26	9	2.8889
49,000-79,999	39	8	4.8750
30,000-48,999	65	9	7.2222
13,000-29,999	110	10	11.0000
Under 13,000	<u>214</u>	<u>11</u>	19.4545
	493	58	

CV = .02

Maryland (21)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>
850,000 +	10	10	1.0000
500,000-849,999	5	3	1.6667
Under 500,000	<u>9</u>	<u>2</u>	4.5000
	24	15	

CV = .02

Massachusetts (22)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>
1,000,000 +	26	26	1.0000
840,000-999,999	16	8	2.0000
625,000-839,999	27	9	3.0000
400,000-624,999	37	8	4.6250
220,000-399,999	59	9	6.5556
100,000-219,999	79	7	11.2857
Under 100,000	107	7	15.2857
	<u>351</u>	<u>74</u>	

CV = .02

Michigan (23)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>
400,000 +*	42	42	1.0000
240,000-399,999	31	6	5.1667
125,000-239,999	58	7	8.2857
70,000-124,999	83	6	13.8333
39,000-69,999	194	7	27.7143
21,500-38,999	348	8	43.5000
11,500-21,499	396	7	56.5714
Under 11,500	368	6	61.3333
	<u>1520</u>	<u>89</u>	

CV = .02

*There were 3 "parts" that were added to certainty. Also, GOVS indicated that Rochester Hills (a new incorporation) would be large enough to be a certainty.

Minnesota (24)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>
500,000 +	8	8	1.0000
245,000-499,999	11	3	3.6667
150,000-244,999	17	3	5.6667
90,000-149,999	26	3	8.6667
Under 90,000	25	4	6.2500
	<u>87</u>	<u>21</u>	

CV = .02

Mississippi (25)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
80,000 +*	19	19	1.0000	
50,000-79,999	8	5	1.6000	
38,000-49,999	11	4	2.7500	
23,000-37,999	22	5	4.4000	
Under 23,000	<u>22</u>	<u>6</u>	3.6667	
	82	39		CV = .02

*Three jurisdictions were added to certainty because they had not yet been reassessed.

Missouri (26)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
175,000 +	10	10	1.0000	
90,000-174,999	8	4	2.0000	
45,000-89,999	20	2	10.0000	
25,000-49,999	33	3	11.0000	
Under 25,000	<u>44</u>	<u>3</u>	14.6667	
	115	22		CV = .02

Montana (27)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
19,000 +	9	9	1.0000	
10,000-18,999	10	5	2.0000	
5,000-9,999	18	5	3.6000	
Under 5,000	<u>19</u>	<u>4</u>	4.75000	
	56	23		CV = .02

Nebraska (28)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
600,000 +	10	10	1.0000	
400,000-599,999	9	3	3.0000	
270,000-399,999	16	3	5.3333	
195,000-269,999	19	3	6.3333	
100,000-194,999	24	3	8.0000	
Under 100,000	15	2	7.5000	
	<u>93</u>	<u>24</u>		CV = .02

Nevada (29)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
150,000 +	5	5	1.0000	
50,000-149,999	4	2	2.0000	
Under 50,000	8	2	4.0000	
	<u>17</u>	<u>9</u>		CV = .02

New Hampshire (30)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
150,000 +	28	28	1.0000	
120,000-149,999	8	6	1.3333	
85,000-119,999	16	8	2.0000	
57,000-84,999	32	9	3.5556	
33,000-56,999	47	9	5.2222	
15,000-32,999	56	7	8.0000	
Under 15,000	47	4	11.75000	
	<u>234</u>	<u>71</u>		CV = .03

New Jersey (31)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
650,000 +*	47	47	1.0000	
490,000-649,999	35	22	1.5909	
365,000-489,999	48	21	2.2857	
250,000-364,999	67	20	3.3500	
162,500-249,999	84	18	4.6667	
75,000-162,499	128	18	7.1111	
Under 75,000	<u>158</u>	<u>12</u>	13.1667	
	567	158		CV = .02

*All jurisdictions with population > 99,000 were included. There was 1 of these with AV < 650,000.

New Mexico (32)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
125,000 +	9	9	1.0000	
100,000-124,999	5	3	1.6667	
35,000-99,999	10	4	2.5000	
Under 35,000	<u>9</u>	<u>3</u>	3.0000	
	33	19		CV = .02

New York (33)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
300,000 +*	44	44	1.0000	
175,000-299,999	36	9	4.0000	
100,000-174,999	85	10	8.5000	
50,000-99,999	130	10	13.0000	
25,000-49,999	162	8	20.2500	
10,000-24,999	180	5	36.0000	
Under 10,000	<u>344</u>	<u>5</u>	68.8000	
	981	91		CV = .02

*All jurisdictions with population > 99,000 were included. Three of these had AV < 300,000.

North Carolina (34)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
1,500,000 +*	19	19	1.0000	
1,000,000-1,499,999	7	3	2.3333	
725,000-999,999	10	3	3.3333	
500,000-724,999	13	3	4.3333	
325,000-499,999	22	4	5.5000	
Under 325,000	<u>29</u>	<u>4</u>	7.2500	
	100	36		CV = .02

*There were 3 jurisdictions with AV < 1,500,000 and population > 99,000. These were included in the certainties.

North Dakota (35)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
35,000 +	5	5	1.0000	
25,000-34,999	5	3	1.6667	
15,000-24,999	7	3	2.3333	
10,000-14,999	11	3	3.6667	
7,000-9,999	12	3	4.0000	
Under 7,000	<u>13</u>	<u>3</u>	4.3333	
	53	20		CV = .02

Ohio (36)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
700,000 +*	25	25	1.0000	
400,000-699,999	10	3	3.3333	
200,000-399,999	32	4	8.0000	
Under 200,000	<u>21</u>	<u>2</u>	10.5000	
	88	34		CV = .02

*Four certainties had AV < 700,000 but population > 100,000.

Oklahoma (37)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
120,000 +	8	8	1.0000	
74,000-119,999	7	3	2.3333	
45,000-73,999	14	3	4.6667	
25,000-44,999	23	4	5.7500	
Under 25,000	<u>25</u>	<u>3</u>	8.3333	
	<u>77</u>	<u>21</u>		CV = .02

Oregon (38)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
2,000,000 +	9	9	1.0000	
1,000,000-1,999,999	9	4	2.2500	
350,000-999,999	7	2	3.5000	
Under 350,000	<u>11</u>	<u>2</u>	5.5000	
	<u>36</u>	<u>17</u>		CV = .02

Pennsylvania (39)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
340,000 +*	31	31	1.0000	
130,000-339,999	14	3	4.6667	
Under 130,000	<u>22</u>	<u>3</u>	7.3333	
	<u>67</u>	<u>37</u>		CV = .02

*Seven certainties had AV's less than 340,000 but population greater than 100,000.

Rhode Island (40)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
800,000 +*	12	12	1.0000	
400,000	8	5	1.6000	
150,000	11	6	1.8333	
Under 150,000	<u>8</u>	<u>3</u>	2.6667	
	<u>39</u>	<u>26</u>		CV = .03

*There were 6 jurisdictions that are expected to be reassessed before the survey. These were added into certainty.

South Carolina (41)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
45,000 +*	19	19	1.0000	
27,000-44,999	6	4	1.5000	
14,000-26,999	9	3	3.0000	
Under 14,000	<u>12</u>	<u>3</u>	4.0000	
	<u>46</u>	<u>29</u>		CV = .02

*Darlington was added to the certainty stratum because its AV dropped sharply from 1981 to 1984.

South Dakota (42)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
140,000 +	10	10	1.0000	
83,000-139,999	11	3	3.6667	
60,000-82,999	14	3	4.6667	
35,000-59,999	16	3	5.3333	
Under 35,000	<u>15</u>	<u>3</u>	5.0000	
	<u>66</u>	<u>22</u>		CV = .02

Tennessee (43)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
170,000 +	20	20	1.0000	
120,000-169,999	11	5	2.2000	
85,000-119,999	17	5	3.4000	
50,000-84,999	18	5	3.6000	
Under 50,000	<u>29</u>	<u>5</u>	5.8000	
	95	40		CV = .02

Texas (44)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
2,350,000 +*	34	34	1.0000	
1,700,000-2,349,999	9	6	1.5000	
1,270,000-1,699,999	14	5	2.8000	
860,000-1,269,999	25	7	3.5714	
540,000-859,999	47	8	5.8750	
250,000-539,999	62	8	7.7500	
Under 250,000	<u>63</u>	<u>5</u>	12.6000	
	254	73		CV = .02

*Includes 1 certainty with AV < 2,350,000 but population > 100,000.

Utah (45)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>	
100,000 +	8	8	1.0000	
35,000-99,999	9	2	4.5000	
Under 35,000	<u>12</u>	<u>2</u>	6.0000	
	29	12		CV = .02

Vermont (46)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>
870 +	30	30	1.0000
648-869	10	7	1.4286
500-647	18	9	2.0000
390-499	21	9	2.3333
290-389	36	12	3.0000
220-289	33	9	3.6667
125-219	46	8	5.7500
Under 125	52	5	10.4000
	<u>246</u>	<u>89</u>	

CV = .03

Virginia (47)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>
1,200 +	20	20	1.0000
850,000-1,199,999	10	3	3.3333
600,000-849,999	15	3	5.0000
365,000-599,999	24	3	8.0000
210,000-364,999	38	3	12.6667
Under 210,000	29	3	9.6667
	<u>136</u>	<u>35</u>	

CV = .02

Washington (48)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>
2,000,000 +	12	12	1.0000
975,000-1,999,999	10	3	3.3333
Under 975,000	17	4	4.2500
	<u>39</u>	<u>19</u>	

CV = .02

West Virginia (49)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>
250,000 +	9	9	1.0000
150,000-249,999	6	3	2.0000
90,000-149,999	10	3	3.3333
60,000-89,999	14	4	3.5000
Under 60,000	16	4	4.0000
	<u>55</u>	<u>23</u>	

CV = .02

Wisconsin (50)

<u>'84 AV</u>	<u>N_hn</u>	<u>n_h</u>	<u>Wt.</u>
300,000 +*	38	38	1.0000
200,000-299,999	27	18	1.5000
105,000-199,999	56	21	2.6667
62,000-104,999	105	22	4.7727
35,000-61,999	257	30	8.5667
20,000-34,999	382	27	14.1481
10,000-19,999	455	17	26.7647
Under 10,000	555	11	50.4545
	<u>1875</u>	<u>184</u>	

CV = .02

*There were 4 "part" jurisdictions with AV < 300,000 that were added into certainty.

Wyoming (51)

<u>'84 AV</u>	<u>N_h</u>	<u>n_h</u>	<u>Wt.</u>
63,000 +	6	6	1.0000
44,000-62,999	4	3	1.3333
25,000-43,999	5	2	2.5000
Under 25,000	8	3	2.6667
	<u>23</u>	<u>14</u>	

CV = .02

Appendix B

Summary of Factors Affecting
State Assessed ValuesAlaska:

There are 11 jurisdictions that can levy property taxes but they do not. Consequently, they do not assess property. They have the legal authority to levy taxes and they may do so at any time.

Arkansas:

In Arkansas, 60 counties were reappraised between 1981 and 1983 under a court order by the Arkansas Supreme Court. The rest of the counties in the state were reappraised in 1984. No more reappraisals are expected between 1984 and 1986. The 1984 AV estimate does not reflect the effect of the 1984 reappraisals. (Fifteen states were reappraised in 1984).

Colorado:

Beginning in 1983, the State Board began a review of assessments to determine which counties did not comply with a 1982 amendment which changed the way assessments are to be done. Supposedly, reappraisals will be made every 2 years starting January 1987. (The reassessments were originally set to begin in 1986.) Between 1981-84, falling metal prices brought decreases in the assessed values of metalliferous mines in two Colorado counties.

Connecticut:

In 1984, eleven towns & cities started phasing-in their last revaluation over a 5-yr. period. Legislation authorizing phase-in has expired. All towns & cities now have a uniform "70% of fair market value" assessment ratio.

Idaho:

Fluctuations in mining caused a few decreases in assessed values between 1981-84. Such fluctuations are expected to continue.

Illinois:

For tax years 1981 and beyond, farm land assessments will be based on agricultural economic value per acre. In illinois, all real property is reassessed every 4 years. Cook, Lake, and St. Clair counties are divided into 4 parts, one of which is reassessed each year. All other township counties were reassessed in 1983. Commission counties were reassessed in 1982. Several decreases in assessed values occurred because of decreasing farmland values.

Mississippi:

Effective July 1, 1984, all Class I and II property is to be assessed at 15% of true value. All Class III and IV property is to be assessed at 30%. Formerly, no such ratios existed. Nineteen of Mississippi's 82 counties were scheduled for reappraisal in 1985-86.

Nevada:

A statute passed in 1981 called for the replacement of the "comparable sales" criterion for evaluating residential improvements with a "cost less depreciation" criterion. Factors were provided for adjusting residential and other properties. A lower court ruled the plan unconstitutional but the Nevada Supreme Court upheld the revision in 1983.

North Carolina:

Twenty-three counties were revaluated between 1982-84 inclusive. No other reappraisals are scheduled until 1990.

New Mexico:

In 1986, the basic value of residential property used for property tax purposes will be changed from a 1975 market value to a 1980 market value.

Rhode Island:

Twenty-five jurisdictions were reassessed in the 1981-84 time span. Of the 44 that were not reassessed, 7 are scheduled for reassessment in 1985-86. These are Providence City, North Providence Township, Barrington, East Greenwich, Woonsocket, Cumberland, and Charlestown.

Tennessee:

The goal in Tennessee is to complete a statewide reappraisal within 9 years, beginning January 1, 1981. A list is available that gives the status of the reappraisal work as of July 1984. At that time, 44 of the 95 counties had been reappraised under the 1981 program. In 1985, Fentress, Henry, McNary, and Maury were reappraised. Reappraisal in Bradley, Hamblin, Hardin, Hickman, Lauderdale, Macon, Roan, Rutherford, and Wilson is scheduled for completion in 1986. Other county reassessments should begin in 1986.

Texas:

In Texas, oil prices greatly affected assessment values. Several counties' assessed values dropped between 1981 and 1984. The recent decline in oil prices should bring even greater decreases in assessments.

Utah:

The Utah Supreme Court found the Property Tax Rollback Statute unconstitutional. Beginning in 1986, county assessors must use new regulations set by the State Tax Commission. Adjustments began in 1984.

Vermont:

Almost all of the towns and cities in Vermont have brought their appraisals closer to fair market value. There were 17 reappraisals in 1982, 25 in 1983, 50 in 1984, and 48 in 1985. Reappraisals are scheduled to continue at the 1984 and 1985 levels.

Virginia:

The large cities and counties in Virginia are reassessed either annually or biennially. Thirty-four jurisdictions have this type of reassessment procedure. Of the other jurisdictions, forty-four were reassessed in 1982-83.

Washington:

Washington has an ongoing reappraisal system. All properties must be reassessed at least every 6 years.

Wisconsin:

Of the 32 communities in the Milwaukee metropolitan area, 19 were scheduled for reassessment in the 1985-86 time period. The other 13 communities were reassessed between 1981-84. Other parts of the state also experienced reassessments. At this time, the 1985-86 reassessment programs have been dropped. Due to depressed economic activity, most of the property values are dropping, thus bringing undervalued property assessments into line. Reappraisals are no longer needed.

Wyoming:

In 1984, county assessors reappraised town lot values. In 1985, a reappraisal of selected taxable property is scheduled to begin.

Appendix C - 1987 TPV Listing and Sampling Sheets

GP-22

FORM GP-22 <small>(9-11-80)</small>		U.S. DEPARTMENT OF COMMERCE BUREAU OF THE CENSUS		1. Name of assessing area	2. Jurisdiction No.	3. Sheet No.
1987 CENSUS OF GOVERNMENTS LISTING SHEET (Certainty Properties) PROPERTY VALUES SURVEY				4. State	5. Certainty level \$ _____	
Assessment roll identification (a)	Line No. (b)	Assessed value of property <i>Report in whole dollars — omit cents</i>			Use of property Codes for column (f) below	
		Land (c)	Improvements (d)	TOTAL <i>Use ONLY when separate "land" and "improvements" amounts are not readily available</i> (e)	Code (f)	Description of properties coded 500, 600, 800, or 900 in column (f) (g)
	501					
	502					
	503					
	504					
	505					
	506					
	507					
	508					
	509					
	510					
	511					
	512					
	513					
	514					
	515					
	516					
	517					
	518					
	519					
	520					
	521					
	522					
	523					
	524					
	525					
Volume number or file reference <i>(See instructions)</i> (h)		Beginning at line number (i)	Volume number or file reference <i>(See instructions)</i> (h)		Beginning at line number (i)	

GP-23-1

FORM GP-23-1 (8-8-88)		U.S. DEPARTMENT OF COMMERCE BUREAU OF THE CENSUS			1. Name of assessing area	2. Jurisdiction No.	3. Sheet No.
1987 CENSUS OF GOVERNMENTS LISTING SHEET (Sample Properties) PROPERTY VALUES SURVEY					4. State	5. Start with _____ Property	6. Take every _____ Property
Assessment roll identification (a)	Line No. (b)	Assessed value of property Report in whole dollars -- omit cents			Use of property Codes for column (f) below		
		Land (c)	Improvements (d)	TOTAL Use ONLY when separate "land" and "improve- ments" amounts are not readily available (e)	Code (f)	Description of properties coded 500, 600, 800, or 900 in column (f) (g)	
\$ 0	01						
\$500,000	02						
\$240,000	03						
\$500,000	04						
\$100,000	05						
\$500,000	06						
\$240,000	07						
\$500,000	08						
\$ 50,000	09						
\$500,000	10						
\$240,000	11						
\$500,000	12						
\$100,000	13						
\$500,000	14						
\$240,000	15						
\$500,000	16						
\$ 25,000	17						
\$500,000	18						
\$240,000	19						
\$500,000	20						
\$100,000	21						
\$500,000	22						
\$240,000	23						
\$500,000	24						
Volume number or file reference (See instructions) (h)		Beginning at line number (i)	Volume number or file reference (See instructions) (h)		Beginning at line number (i)		

GP-23-2

FORM GP-23-2 (9-8-88)		U.S. DEPARTMENT OF COMMERCE BUREAU OF THE CENSUS			1. Name of assessing area	2. Jurisdiction No.	3. Sheet No.
1987 CENSUS OF GOVERNMENTS LISTING SHEET (Sample Properties) PROPERTY VALUES SURVEY					4. State	5. Start with _____ Property	6. Take every _____ Property
Assessment roll identification (a)	Line No. (b)	Assessed value of property Report in whole dollars — omit cents			Use of property Codes for column (f) below		
		Land (c)	Improvements (d)	TOTAL Use ONLY when separate "land" and "improvements" amounts are not readily available (e)	Code (f)	Description of properties coded 500, 600, 800, or 900 in column (f) (g)	
\$ 0	01						
\$350,000	02						
\$140,000	03						
\$350,000	04						
\$ 60,000	05						
\$350,000	06						
\$140,000	07						
\$350,000	08						
\$ 30,000	09						
\$350,000	10						
\$140,000	11						
\$350,000	12						
\$ 60,000	13						
\$350,000	14						
\$140,000	15						
\$350,000	16						
\$ 15,000	17						
\$350,000	18						
\$140,000	19						
\$350,000	20						
\$ 60,000	21						
\$350,000	22						
\$140,000	23						
\$350,000	24						
Volume number or file reference (See instructions) (h)		Beginning at line number (i)	Volume number or file reference (See instructions) (h)			Beginning at line number (i)	

GP-23-3

FORM GP-23-3 (7-8-80)		U.S. DEPARTMENT OF COMMERCE BUREAU OF THE CENSUS			1. Name of assessing area	2. Jurisdiction No.	3. Sheet No.
1987 CENSUS OF GOVERNMENTS LISTING SHEET (Sample Properties) PROPERTY VALUES SURVEY					4. State	5. Start with _____ Property	6. Take every _____ Property
					Assessed value of property Report in whole dollars - omit cents		
Assessment roll identification	Line No.	Land	Improvements	TOTAL Use ONLY when separate "land" and "improvements" amounts are not readily available	Code	Description of properties coded 500, 600, 800, or 900 in column (f)	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	
\$ 0	01						
\$200,000	02						
\$ 80,000	03						
\$200,000	04						
\$ 35,000	05						
\$200,000	06						
\$ 80,000	07						
\$200,000	08						
\$ 16,000	09						
\$200,000	10						
\$ 80,000	11						
\$200,000	12						
\$ 35,000	13						
\$200,000	14						
\$ 80,000	15						
\$200,000	16						
\$ 8,000	17						
\$200,000	18						
\$ 80,000	19						
\$200,000	20						
\$ 35,000	21						
\$200,000	22						
\$ 80,000	23						
\$200,000	24						
Volume number or file reference (See instructions) (h)		Beginning at line number (i)	Volume number or file reference (See instructions) (h)			Beginning at line number (i)	

GP-23-4

FORM GP-23-4 <small>(9-8-80)</small> 1987 CENSUS OF GOVERNMENTS LISTING SHEET (Sample Properties) PROPERTY VALUES SURVEY	<small>U.S. DEPARTMENT OF COMMERCE</small> <small>BUREAU OF THE CENSUS</small>	1. Name of assessing area 	2. Jurisdiction No. 	3. Sheet No.
		4. State 	5. Start with _____ Property	6. Take every _____ Property

Assessment roll identification (a)	Line No. (b)	Assessed value of property <i>Report in whole dollars - omit cents</i>			Use of property Codes for column (f) below	
		Land (c)	Improvements (d)	TOTAL <i>Use ONLY when separate "land" and "improvements" amounts are not readily available</i> (e)	Code (f)	Description of properties coded 500, 600, 800, or 900 in column (f) (g)
\$ 0	01					
\$100,000	02					
\$ 40,000	03					
\$100,000	04					
\$ 16,000	05					
\$100,000	06					
\$ 40,000	07					
\$100,000	08					
\$ 8,000	09					
\$100,000	10					
\$ 40,000	11					
\$100,000	12					
\$ 16,000	13					
\$100,000	14					
\$ 40,000	15					
\$100,000	16					
\$ 4,000	17					
\$100,000	18					
\$ 40,000	19					
\$100,000	20					
\$ 16,000	21					
\$100,000	22					
\$ 40,000	23					
\$100,000	24					

Volume number or file reference <i>(See instructions)</i> (h)	Beginning at line number (i)	Volume number or file reference <i>(See instructions)</i> (h)	Beginning at line number (i)

GP-23-5

FORM GP-23-5 (2-8-80)	U.S. DEPARTMENT OF COMMERCE BUREAU OF THE CENSUS	1. Name of assessing area	2. Jurisdiction No.	3. Sheet No.
1987 CENSUS OF GOVERNMENTS LISTING SHEET (Sample Properties) PROPERTY VALUES SURVEY		4. State	5. Start with _____ Property	6. Take every _____ Property

Assessment roll identification (e)	Line No. (b)	Assessed value of property <i>Report in whole dollars -- omit cents</i>			Use of property <i>Codes for column (f) below</i>	
		Land (c)	Improvements (d)	TOTAL <i>Use ONLY when separate "land" and "improve- ments" amounts are not readily available</i> (e)	Code (f)	Description of properties coded 500, 600, 800, or 900 in column (f) (g)
\$ 0	01					
\$50,000	02					
\$20,000	03					
\$50,000	04					
\$ 8,000	05					
\$50,000	06					
\$20,000	07					
\$50,000	08					
\$ 4,000	09					
\$50,000	10					
\$20,000	11					
\$50,000	12					
\$ 8,000	13					
\$50,000	14					
\$20,000	15					
\$50,000	16					
\$ 2,000	17					
\$50,000	18					
\$20,000	19					
\$50,000	20					
\$ 8,000	21					
\$50,000	22					
\$20,000	23					
\$50,000	24					

Volume number or file reference <i>(See instructions)</i> (h)	Beginning at line number (i)	Volume number or file reference <i>(See instructions)</i> (h)	Beginning at line number (i)

GP-23-6

FORM GP-23-6 (2-3-86)		U.S. DEPARTMENT OF COMMERCE BUREAU OF THE CENSUS			1. Name of assessing area	2. Jurisdiction No.	3. Sheet No.
1987 CENSUS OF GOVERNMENTS LISTING SHEET (Sample Properties) PROPERTY VALUES SURVEY					4. State	5. Start with _____ Property	6. Take every _____ Property
					Assessed value of property Report in whole dollars — omit cents		
Assessment roll identification	Line No.	Land	Improvements	TOTAL Use ONLY when separate "land" and "improvements" amounts are not readily available	Code	Description of properties coded 500, 600, 800, or 900 in column (f) (g)	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	
\$ 0	01						
\$25,000	02						
\$10,000	03						
\$25,000	04						
\$ 4,000	05						
\$25,000	06						
\$10,000	07						
\$25,000	08						
\$ 2,000	09						
\$25,000	10						
\$10,000	11						
\$25,000	12						
\$ 4,000	13						
\$25,000	14						
\$10,000	15						
\$25,000	16						
\$ 1,000	17						
\$25,000	18						
\$10,000	19						
\$25,000	20						
\$ 4,000	21						
\$25,000	22						
\$10,000	23						
\$25,000	24						
Volume number or file reference (See instructions) (h)		Beginning at line number (i)		Volume number or file reference (See instructions) (h)		Beginning at line number (i)	

GP-23-7

<p><small>Form GP-23-7 (2-3-82)</small></p> <p style="text-align: center;"><small>U.S. DEPARTMENT OF COMMERCE BUREAU OF THE CENSUS</small></p> <p style="text-align: center;">1987 CENSUS OF GOVERNMENTS LISTING SHEET (Sample Properties) PROPERTY VALUES SURVEY</p>		<p>1. Name of assessing area</p> <hr/> <p>4. State</p>	<p>2. Jurisdiction No.</p> <hr/> <p>5. Start with</p> <p>_____ Property</p>	<p>3. Sheet No.</p> <hr/> <p>6. Take every</p> <p>_____ Property</p>		
Assessment roll identification (a)	Line No. (b)	Assessed value of property <i>Report in whole dollars — omit cents</i>			Use of property Codes for column (f) below	
		Land (c)	Improvements (d)	TOTAL <i>Use ONLY when separate "land" and "improvements" amounts are not readily available</i> (e)	Code (f)	Description of properties coded 500, 600, 800, or 900 in column (f) (g)
\$ 0	01					
\$10,000	02					
\$ 3,500	03					
\$10,000	04					
\$ 1,700	05					
\$10,000	06					
\$ 3,500	07					
\$10,000	08					
\$ 800	09					
\$10,000	10					
\$ 3,500	11					
\$10,000	12					
\$ 1,700	13					
\$10,000	14					
\$ 3,500	15					
\$10,000	16					
\$ 400	17					
\$10,000	18					
\$ 3,500	19					
\$10,000	20					
\$ 1,700	21					
\$10,000	22					
\$ 3,500	23					
\$10,000	24					
Volume number or file reference <i>(See instructions)</i> (h)		Beginning at line number (i)	Volume number or file reference <i>(See instructions)</i> (h)		Beginning at line number (i)	

Appendix D

Estimates of Totals and Variances from the
1987 Taxable Property Values Survey

The estimates of assessed values for the 1987 TPV Survey and the standard errors of those estimates are given in this paper. Minor changes to the 1982 formulas are necessary because of the elimination of the SMSA stratum breaks. Otherwise, the estimators are the same as those used in 1982. The computer specifications for the estimation are given in a memorandum from Hogue to Jennings dated March 12, 1987.

1. ASSESSED VALUE ESTIMATES

1.1 Assessed Values for Subsets - States

In order to estimate the assessed value for a subset of the total (either kind of property or size class), the following equation should be used:

$$x'' = (x'_C + x'_{NC}) Y / (y'_C + y'_{NC}) \quad (1)$$

where x'_C and x'_{NC} are simple unbiased estimates of total assessed value for either a kind of property and/or size group from the certainty and noncertainty jurisdictions, respectively. Similarly, y'_C and y'_{NC} are simple unbiased weighted totals over all subsets (kinds of property and/or size groups) for certainty and noncertainty jurisdictions, respectively. Y is the known total assessed value for the state.

For state estimates, x'_{NC} is the sum of the weighted parcel assessed values in the noncertainty strata and is estimated as follows:

$$x'_{NC} = \sum_{h=1}^{L_{NC}} k_h \sum_{i=1}^m \sum_{\alpha=1}^R g_{hia} \sum_{j=1}^n x_{hiaj} \quad (2)$$

where

L_{NC} = number of noncertainty strata in the State,

k_h = reciprocal of the sampling fraction for jurisdictions in stratum $h = M_h/m_h$,

M_h = total number of jurisdictions in stratum h ,

m_h = the number of jurisdictions selected in the sample from stratum h ,

g_{hia} = sampling interval for parcels of size class α , jurisdiction i , stratum $h = N_{hi} / n_{hia}$,

N_{hi} = total number of parcels in jurisdiction i , stratum h ,

n_{hia} = number of sample parcels of size class α in jurisdiction i , stratum h ,

R_{hi} = number of assessed value size classes for jurisdiction i , stratum h , and

x_{hiaj} = assessed value for parcel j in size class α for jurisdiction i in stratum h and the subset of interest.

In order to estimate x'_C , the sum of the weighted assessed values in the certainty stratum of a State, use the following equation:

$$x'_C = \sum_{i=1}^{M_C} \sum_{\alpha=1}^{R_{Ci}} g_{Ci\alpha} \sum_{j=1}^{N_{hi\alpha}} x_{Ci\alpha j} \quad (3)$$

where

M_C = number of jurisdictions in the certainty stratum,

R_{Ci} = number of assessed value size classes in jurisdiction i as determined from the sampling form,

$g_{Ci\alpha}$ = sampling interval for parcels in jurisdiction i and size class α ,

$n_{Ci\alpha}$ = sample number of parcels in jurisdiction i , size class α , and

$x_{Ci\alpha j}$ = assessed value for parcel j in jurisdiction i , size class α and the subset of interest.

Estimates of y'_C and y'_{NC} may be obtained using equations (2) and (3) with $y_{Ci\alpha j}$ or $y_{hi\alpha j}$, the individual assessed values for all kinds of property and size classes, substituted for $x_{Ci\alpha j}$ and $x_{hi\alpha j}$, respectively.

1.2 Assessed Values for Subsets - Jurisdictions

Estimates of kind of property totals for some jurisdictions are also desired. These totals may be estimated by

$$x''_{hi} = \frac{x'_{hi}}{y'_{hi}} Y_{hi} \quad (4)$$

where x'_{hi} is the simple unbiased weighted total of assessed values for a subset (kind of property and/or size group) for jurisdiction i in stratum h .

y'_{hi} is similarly defined for the total of all classes and kinds of property, and

Y_{hi} is the known total assessed value for the jurisdiction.

x'_{hi} and y'_{hi} are estimated by

$$x'_{hi} = \sum_{\alpha=1}^{R_{hi}} g_{hi\alpha} \sum_{j=1}^{n_{hi\alpha}} x_{hi\alpha j} \quad (5)$$

where R_{hi} = number of assessed values of size classes on the form for the jurisdiction,

- g_{hia} = sampling interval for parcels in size class α of the jurisdiction
- n_{hia} = sample number of parcels in size class α , jurisdiction i , stratum h , and
- x_{hiaj} = assessed value for parcel j in size class α for the subset of interest in the jurisdiction.

y' is similarly defined as a total for all size classes and kinds of property.

1.3 Summary of Assessed Value Estimates

For a jurisdiction, an estimate of the total assessed value for a kind of property and/or size group is the weighted sum of the assessed values of the parcels in the subset of interest divided by the weighted sum of the assessed values of all parcels in the jurisdiction, multiplied by the known total assessed value for the jurisdiction. Equation (4) gives the estimate.

For State estimates of assessed value for a subset, the sum of the certainty and noncertainty weighted total assessed values for the subset is divided by the sum of the certainty and noncertainty weighted total assessed values for all parcels, multiplied by the known State total assessed value. Equation (1) gives the estimator.

2. VARIANCE OF THE ASSESSED VALUE ESTIMATES

As given in Hurwitz (1983), the variance of the ratio estimate of total assessed value for a subset, x'' is

$$\sigma_{x''}^2 = X^2 \left\{ \frac{\sigma_{x'}^2}{X^2} + \frac{\sigma_{y'}^2}{Y^2} + \frac{\sigma_{x'y'}}{X Y} \right\} \quad (6)$$

where

X is the total assessed value for a specified subset

Y is the total assessed values for all subsets

$$\begin{aligned} \sigma_{X'}^2 = & \sum_h^L M_h^2 \frac{M_h - m_h}{(M_h - 1)m_h} \sigma_{hX}^2 + \sum_h^L \frac{M_h}{m_h} \sum_{i=1}^{M_h} \sum_{\alpha=1}^{R_h - 1} N_{hi}^{-1} \frac{N_{hi} - n_{hi\alpha}}{(N_{hi} - 1)n_{hi\alpha}} \sigma_{hiaX}^2 \\ & + 2 \sum_h^L \frac{M_h}{m_h} \sum_{i=1}^{M_h} \sum_{\alpha < \beta}^{R_{hi} - 1} N_{hi}^{-2} \frac{N_{hi} - n_{hi\beta}}{(N_{hi} - 1)n_{hi\beta}} \sigma_{hiaX, hi\beta X} \end{aligned} \quad (7)$$

and the variance between jurisdictions in stratum h is

$$\sigma_{hx}^2 = \frac{M_h}{\sum_{i=1}^{M_h}} (X_{hi} - \bar{X}_h)^2 / M_h \quad (8)$$

where $\bar{X}_h = \frac{M_h}{\sum_{i=1}^{M_h}} X_{hi} / M_h$

and X_{hi} is the total assessed value for jurisdiction i of stratum h.

The variance between parcels in the same size class, α , for a particular subset is

$$\sigma_{hiaX}^2 = \frac{N_{hi}}{\sum_{j=1}^{N_{hi}}} (X_{hiaj} - \bar{X}_{hia})^2 / N_{hi} \quad (9)$$

where $\bar{X}_{hia} = \frac{N_{hi}}{\sum_j} X_{hiaj} / N_{hi}$

The covariance between parcels in two different size groups, α and β , for a particular subset is

$$\sigma_{hiaX, hi\beta X} = \frac{N_{hi}}{\sum_j} (X_{hiaj} - \bar{X}_{hia})(X_{hi\beta j} - \bar{X}_{hi\beta}) / N_{hi} \quad (10)$$

All other variables were defined in section 1. $\sigma_{y'}^2$ is defined in a manner similar to $\sigma_{x'}^2$.

The covariance between x' and y' is defined as

$$\begin{aligned} \sigma_{x'y'} = & \sum_h^L M_h^2 \frac{M_h^{-m_h}}{(M_h^{-1})^{m_h}} \sigma_{hXY} \\ & + \sum_h^L \frac{M_h}{M_h} \frac{M_h}{\Sigma_h} \frac{R_{hi}^{-1}}{\alpha} N_{hi}^2 \frac{N_{hi}^{-n_{hi\alpha}}}{(N_{hi}^{-1})^{n_{hi\alpha}}} \sigma_{hiaXY} \\ & + \sum_h^L \frac{M_h}{m_h} \frac{M_h}{\Sigma_h} \frac{R_{hi}^{-1}}{\alpha < \beta} N_{hi}^2 \frac{N_{hi}^{-n_{hi\beta}}}{(N_{hi}^{-1})^{n_{hi\beta}}} (\sigma_{hiaX,hi\beta Y} \\ & + \sigma_{hiaY,hi\beta X}) \end{aligned} \quad (11)$$

where $\sigma_{hXY} = \frac{1}{M_h} \sum_i^{M_h} (X_{hi} - \bar{X}_h)(Y_{hi} - \bar{Y}_h)/M_h$. Note that \bar{X}_h was defined earlier. \bar{Y}_h is defined similarly. In equation (11),

$$\sigma_{hiaXY} = \frac{1}{N_{hi}} \sum_j^{N_{hi}} (X_{hiaj} - \bar{X}_{hia})(Y_{hiaj} - \bar{Y}_{hia})/N_{hi}$$

$$\text{and } \sigma_{hiaX,hi\beta Y} = \frac{1}{N_{hi}} \sum_j^{N_{hi}} (X_{hiaj} - \bar{X}_{hia})(Y_{hi\beta j} - \bar{Y}_{hi\beta})$$

with \bar{X}_{hia} defined earlier. \bar{Y}_{hia} and $\bar{Y}_{hi\beta}$ are similarly defined. $\sigma_{hiaY,hi\beta X}$ is defined in a manner similar to $\sigma_{hiaX,hi\beta Y}$.

In her memorandum, Hurwitz (1983) simplifies the equations for $\sigma_{x'}^2$, $\sigma_{y'}^2$, and $\sigma_{x'y'}$ by assuming $N_{hi}/(N_{hi}-1) = 1$ and by using the rel-variance, V_{hiaX}^{*2} , of parcels in jurisdiction i , stratum h , size class α and kind of property X .

Note also that the covariance between two size classes α and β for the same jurisdiction simplifies to

$$\sigma_{hi\alpha X, hi\beta X} = -\bar{X}_{hi\alpha} \bar{X}_{hi\beta}$$

since $X_{hi\alpha j} = 0$ if $X_{hi\beta j} > 0$ and vice versa, thus making the first term zero. With these changes, $\sigma_{X'}^2$ becomes

$$\begin{aligned} \sigma_{X'}^2 &= \sum_h^L \frac{M_h^2}{M_h - 1} (k_h - 1) \sigma_{hX}^2 \\ &+ \sum_h^L k_h \sum_i^{M_h} \frac{R_{hi}^{-1}}{\sum_{\alpha} R_{hi}^{-1}} \frac{g_{hi\alpha}^{-1}}{g_{hi\alpha} n_{hi\alpha}} X_{hi\alpha}^2 \left(\frac{1 + V_{hi\alpha X}^*}{P_{hi\alpha X}} - 1 \right) \\ &- 2 \sum_h^L k_h \sum_i^{M_h} \frac{R_{hi}^{-1}}{\sum_{\alpha < \beta} R_{hi}^{-1}} \frac{g_{hi\beta}^{-1}}{g_{hi\beta} n_{hi\beta}} X_{hi\alpha} X_{hi\beta} \end{aligned} \quad (12)$$

where $P_{hi\alpha X} = N_{hi\alpha X}^* / N_{hi}$

$N_{hi\alpha X}^*$ is the number of parcels in the h-th stratum, i-th jurisdiction of size α with use class X.

$V_{hi\alpha X}^2$ is the rel-variance of parcels in stratum h, jurisdiction i, size class α , and property use class X

$$= \left[\frac{N_{hi\alpha X}^* \sum_j N_{hi\alpha X}^* X_{hi\alpha j}^2}{\sum_j N_{hi\alpha X}^* X_{hi\alpha j}^2} \right] - 1.$$

All other variables were defined in section 1. Using similar changes, $\sigma_{Y'}^2$ can be approximated equivalently. Also,

$$\begin{aligned}
\sigma_{x'y'} &= \sum_h^L \frac{M_h^2}{M_h^{-1}} (k_h^{-1}) \sigma_{hXY} \\
&+ \sum_h^L k_h \sum_i^M \frac{R_{hi}^{-1} g_{hi\alpha}^{-1}}{g_{hi\alpha}^{n_{hi\alpha}}} X_{hi\alpha} Y_{hi\alpha} \left(\frac{1+V_{hi\alpha XY}^*}{P_{hi\alpha X}} - 1 \right) \\
&- \sum_h^L k_h \sum_i^M \frac{R_{hi}^{-1} g_{hi\beta}^{-1}}{g_{hi\beta}^{n_{hi\beta}}} (X_{hi\alpha} Y_{hi\beta} + Y_{hi\alpha} X_{hi\beta}) \quad (13)
\end{aligned}$$

where

$$V_{hi\alpha XY}^* = \left[N_{hi\alpha X}^* \sum_j^{N_{hi\alpha X}^*} X_{hi\alpha j}^2 / \left(\sum_j^{N_{hi\alpha X}^*} X_{hi\alpha j} \right) \left(\sum_j^{N_{hi\alpha Y}^*} Y_{hi\alpha j} \right) \right]^{-1}$$

All other variables were previously defined.

3. ESTIMATION OF THE VARIANCE OF ASSESSED VALUE ESTIMATES

3.1 Estimated Variance for a Single Jurisdiction

For a single jurisdiction the estimated variance of the total assessed value estimate is

$$s_{hi}^2 = s_{whiX}^2 + r_{hi}^2 s_{whiY}^2 - 2 r_{hi} s_{whiXY} \quad (14)$$

where

$r_{hi} = x'_{hi} / y'_{hi}$, i.e., the ratio of the estimated assessed value for stratum h, jurisdiction i for property use X to the total estimated assessed value for the jurisdiction over all use classes.

$$s_{whiX}^2 = \frac{R_{hi}^{-1}}{\sum_{\alpha} g_{hia} (g_{hia}^{-1})} \sum_j^{n_{hia}^*} x_{hiaj}^2 - \frac{R_{hi}^{-1}}{\sum_{\alpha} g_{hia} (g_{hia}^{-1})} \frac{(\sum_j^{n_{hia}^*} x_{hiaj})^2}{\sum_{\alpha} g_{hia} n_{hia}} \quad (15)$$

$$s_{whiXY}^2 = \frac{R_{hi}^{-1}}{\sum_{\alpha} g_{hia} (g_{hia}^{-1})} \sum_j^{n_{hia}^*} x_{hiaj}^2 - \frac{R_{hi}^{-1}}{\sum_{\alpha} g_{hia} (g_{hia}^{-1})} \frac{(\sum_j^{n_{hia}^*} x_{hiaj})(\sum_j^{n_{hia}^*} y_{hiaj})}{\sum_{\alpha} g_{hia} n_{hia}} \quad (16)$$

s_{whiY}^2 is similarly defined with n_{hia} used instead of n_{hia}^* and y_{hiaj} instead of x_{hiaj} in equation (15). In other words, s_{whiX}^2 is applied to all use categories to yield s_{whiY}^2 .

3.2 Estimated Variances for State Totals

Two States had all of their jurisdictions in sample with certainty. Instructions for calculating estimated variances for these States (Hawaii and Delaware) are given in section 3.2.1. Instructions for variance estimates for states containing certainty and noncertainty jurisdictions are given in section 3.2.2.

3.2.1 States with Only Certainty Jurisdictions

For Hawaii and Delaware, the variance of the State assessed value for a subset is estimated as follows:

$$s_{w,C}^2 = \sum_i^{M_C} s_{wCiX}^2 + r_C^2 \sum_i^{M_C} s_{wCiY}^2 - 2r_C \sum_i^{M_C} s_{wCiXY} \quad (17)$$

where $r_C = \frac{\sum_i^{M_C} x'_{Ci}}{\sum_i^{M_C} y'_{Ci}}$ and

M_C is the number of jurisdictions (in this case, all certainty) in the State.

x'_{Ci} and y'_{Ci} are weighted totals for each of the certainty jurisdictions.

The subscript 'C' stands for the certainty stratum. s_{wCiX}^2 , s_{wCiY}^2 , and s_{wCiXY}^2 are calculated with formulas (15) and (16).

3.2.2 States with Certainty and Noncertainty Jurisdictions

For States that contain both certainty and noncertainty jurisdictions, there is sampling variation arising from two sources: variation due to sampling parcels within jurisdictions or the within component, s_{wX}^2 , and variation from sampling the noncertainty jurisdiction strata or the between component, s_{bX}^2 . Contributions to the within component of variance come from both certainty and noncertainty jurisdictions with the certainty within component $s_{w,C}^2$, being estimated as in equation (17) with $r = (x'_C + x'_{NC}) / (y'_C + y'_{NC})$ replacing r_C . The within component from the noncertainty jurisdiction is estimated as follows:

$$s_{w,NC}^2 = \sum_h^{L_{NC}} k_h^2 \sum_i^{m_h} s_{whiX}^2 + r^2 \sum_h^{L_{NC}} k_h^2 \sum_i^{m_h} s_{whiY}^2 - 2r \sum_h^{L_{NC}} k_h^2 \sum_i^{m_h} s_{whiXY} \quad (18)$$

where r is defined above and s_{whiX}^2 , s_{whiY}^2 , and s_{whiXY}^2 are defined in equations (15) and (16). For a State with both certainty and noncertainty jurisdictions the within component of variance is simply the sum of the within components of variance for the certainty and noncertainty strata, i.e.,

$$s_{wX}^2 = s_{w,C}^2 + s_{w,NC}^2 \quad (19)$$

Certainty strata do not contribute to the between component, s_{bx}^2 . For the noncertainty strata, the between component is

$$s_{bx}^2 = \sum_h^{L_{NC}} (k_h - 1) M_h (s_{hX}^2 + r^2 s_{hY}^2 - 2r s_{hXY}) - s_{w,NC}^2 + \sum_h^{L_{NC}} k_h \sum_i^{m_h} (s_{whiX}^2 + r^2 s_{whiY}^2 - 2r s_{whiXY}) \quad (20)$$

where

$$s_{hX}^2 = \left[\sum_i^{m_h} x'_{hi}{}^2 - \left(\sum_i^{m_h} x'_{hi} \right)^2 / m_h \right] / (m_h - 1)$$

$$x'_{hi} = \sum_{\alpha}^{R_{hi}} k_{hia} \sum_j^{n_{hia}^*} x_{hiaj}$$

$$s_{hY}^2 \text{ is similarly defined with } y'_{hi} = \sum_{\alpha}^{R_{hi}} k_{hia} \sum_j^{n_{hia}^*} y_{hiaj}$$

$$s_{hXY} = \left[\sum_i^{m_h} x'_{hi} y'_{hi} - \left(\sum_i^{m_h} x'_{hi} \right) \left(\sum_i^{m_h} y'_{hi} \right) / m_h \right] / (m_h - 1)$$

All other variables have been previously defined.

4. ESTIMATES OF NUMBER OF PARCELS

4.1 Jurisdiction Estimates

An estimate of the number of parcels in a subset (kind of property and/or assessed value size class) for a single jurisdiction is

$$n_{hi}^* = \sum_{\alpha}^{R_{hi}} g_{hia} n_{hia}^* \quad (21)$$

where $g_{hia} = N_{hi} / n_{hia} =$ sampling interval for size class α , jurisdiction i of stratum h .

n_{hia}^* = number of parcels in size class α , jurisdiction i , stratum h for the subset of interest.

For a jurisdiction, the estimate of the total number of parcels in a jurisdiction is

$$n'_{hi} = \sum_{\alpha}^{R_{hi}} g_{hia} n_{hia}^* \quad (22)$$

The estimate of the proportion of parcels in a subset for a jurisdiction is simply

$$p_{hi} = n_{hi}^* / n'_{hi} \quad (23)$$

4.2 Estimates for States with Certainties Only

All of the jurisdictions in Hawaii and Delaware were selected with certainty so the estimates of state totals are as follows:

$$n_C^* = \sum_{i=1}^M \sum_{\alpha=1}^{R_{hi}} g_{Cia} n_{Cia}^* \quad \text{for parcels in a subset}$$

$$n'_C = \sum_{i=1}^M \sum_{\alpha=1}^{R_{hi}} g_{Cia} n_{Cia} \quad \text{for total parcels}$$

$$p = n_C^* / n'_C \quad \text{for the estimated proportion of parcels in a subset}$$

4.3 Estimates for States with Certainties and Noncertainties

For the States with first-stage noncertainty units, the estimates of the number of parcels are

$$n^* = \sum_h^{L_{NC}} k_h \sum_i^m \sum_{\alpha}^{R_{hi}} g_{hia} n_{hia}^* + n_C^* \quad (24)$$

$$n' = \sum_h^{L_{NC}} k_h \sum_i^{m_h} \sum_\alpha^{R_{hi}} g_{hia} n_{hia} + n'_C \quad (25)$$

The proportion of parcels belonging to a subset is estimated by

$$p = n^*/n' \quad (26)$$

5. ESTIMATED VARIANCES FOR ESTIMATED PARCEL COUNTS

5.1 Single Jurisdiction Estimates

The variance of the estimate of parcels from a subset for a single jurisdiction involves only the within jurisdiction sampling variation. The estimated variance is

$$s_{n^*,hi}^2 = \sum_\alpha^{R_{hi}} k_{hia} (k_{hia} - 1) n_{hia}^* \left(1 - \frac{k_{hia} n_{hia}^*}{n'_{hi}}\right) - 2 \sum_{\alpha < \beta}^{R_{hi}-1} k_{hia} k_{hib} (k_{hib} - 1) n_{hia}^* n_{hib}^* \quad (27)$$

The estimated variance of the total number of parcels for the jurisdiction is $s_{n',hi}^2$ which is similarly defined with n_{hia} , n_{hib} in place of n_{hia}^* , n_{hib}^* , respectively.

The variance of the proportion of parcels in the jurisdiction that are in each subset is

$$s_{p_{hi}}^2 = (s_{n^*,hi}^2 + p_{hi}^2 s_{n',hi}^2 - 2 p_{hi} s_{n^*,hi} n'_{hi}) / n_{hi}'^2 \quad (28)$$

where $s_{n^*,hi}^2$ and $s_{n',hi}^2$ are defined in (27); p_{hi} was defined in section 4.1, and

$$s_{n_{hi}^*, n_{hi}'} = \frac{R_{hi}^{-1}}{\alpha} k_{hia} (k_{hia}^{-1}) n_{hia}^* (1 - k_{hia} n_{hia} / n_{hi}') - \sum_{\alpha < \beta}^{R_{hi}^{-1}} k_{hia} k_{hib} (k_{hib}^{-1}) (n_{hia}^* n_{hib} + n_{hib}^* n_{hia}') \quad (29)$$

5.2 Estimates for States with Certainties Only

For the States in which all of the jurisdictions are in the sample with certainty, i.e., Hawaii and Delaware, the estimate of the variance of the estimated number of parcels in a subset is

$$s_{n_C^*}^2 = \sum_i^{M_C} s_{n_{Ci}^*}^2 \quad (30)$$

where $s_{n_{Ci}^*}^2$ is calculated using equation (27) for each of the certainty jurisdictions in Hawaii and Delaware. Similar calculations are done in order to obtain $s_{n_C}^2$ or the estimated variance of the estimate of the total number of parcels.

The estimated variance of the proportion of parcels falling in each category is

$$s_{p_C}^2 = (s_{n_C^*}^2 + p_C^2 s_{n_C}^2 - 2p_C s_{n_C^*, n_C}') / n_C'^2 \quad (31)$$

where

$$s_{n_C^*, n_C}' = \sum_i^{M_C} s_{n_{Ci}^*, n_{Ci}'} .$$

All other terms were previously defined.

5.3 Estimates for States with Noncertainty Jurisdictions

The estimates of the variances for States with both certainty and noncertainty jurisdictions follow. For a subset, the estimated variance for an estimate of a parcel count is

$$s_{n^*}^2 = \sum_h^{L_{NC}} k_h \sum_i^{m_h} s_{n_{hi}^*}^2 + \sum_i^{M_C} s_{n_{Ci}^*}^2 + \sum_h^{L_{NC}} M_h (k_h - 1) s_{h,n^*}^2 \quad (32)$$

with $s_{n_{hi}^*}^2$ defined in equation (27) and

$$s_{h,n^*}^2 = \left[\sum_i^{m_h} n_{hi}^{*2} - (\sum_i^{m_h} n_{hi}^*)^2 / m_h \right] / (m_h - 1) .$$

Note that $s_{n_{Ci}^*}^2$ is the estimated variance for a certainty jurisdiction. In the second term, these jurisdictions are added together. All other terms have been previously defined. The estimated variance of the total number of parcels for a State is the same as equation (32) with n_{hi}^* substituted for n_{hi}^* .

The estimated variance of the proportion of parcels in a subset is

$$s_p^2 = (s_{n^*}^2 + p^2 s_{n'}^2 - 2p s_{n^*,n'}) / n'^2 \quad (33)$$

where $s_{n^*}^2$, p , $s_{n'}^2$ were previously defined and

$$s_{n^*,n'} = \sum_h^{L_{NC}} k_h \sum_i^{m_h} s_{n_{hi}^*, n'_{hi}} + \sum_i^{M_C} s_{n_{i}^*, n'_{i}} + \sum_h^{L_{NC}} M_h (k_h - 1) s_{h,n^*n} \quad (34)$$

with $s_{n_{hi}^*, n'_{hi}}$ defined in equation (29) and with

$$s_{h,n^*n} = \left[\sum_i^{m_h} n_{hi}^* n'_{hi} - (\sum_i^{m_h} n_{hi}^*)(\sum_i^{m_h} n'_{hi}) / m_h \right] / (m_h - 1) .$$

Note that the first term of equation (33) is the same as the second except that it is for noncertainty units and must be weighted by $k_h > 1$. Note that M_C is the number of certainty jurisdictions in the State.

References

- Hogue, Carma R. "Estimates for the 1987 Taxable Property Value Survey," memorandum to Judith Jennings dated March 12, 1987.
- Hurwitz, Blanche S. "Taxable Property Values Survey--1982 Census of Governments," memorandum to Judith Jennings dated April 20, 1983.