

**MAINTAINING THE SAMPLING FRAMES FOR DEMOGRAPHIC SURVEYS**

**Kathleen M. Walsh, Jon Clark, Bureau of Census  
Kathleen M. Walsh, Census, 1201 E. Tenth St., Jeffersonville, IN, 47132**

**KEY WORDS: UNIT, GROUP-QUARTERS, PERMIT, AREA**

Program Participation (SIPP), the Current Population Survey (CPS), the Consumer Expenditure-Diary Survey (CE-D), the Consumer Expenditure-Quarterly Survey (CE-Q) and the RENT Survey.

**I. INTRODUCTION**

**A. SAMPLING FRAMES FOR DEMOGRAPHIC SURVEYS**

The Census Bureau creates designs for selecting samples from the census. The problem is how do we implement this very sophisticated design to get precision in our estimates. Maintaining the sampling frames has evolved as the solution to this problem.

In the present design, these addresses are divided into three frames: the unit, group quarters, and area frames. Urban addresses are in the unit frame. The group quarters frame consists of living quarters where residents share common facilities or receive authorized custody or care. Land areas, usually rural, are in the area frame. A fourth frame is composed of new construction addresses from registers in building permit offices throughout the United States.

Demographic Surveys Sampling Frames

Frame	Composition	Percent of Total
Unit	Census Addresses	81.8%
Group Quarters	Share Common Facilities	0.3%
Permit	New Construction	7.5%
Area	Rural	10.4%

The major demographic surveys for which the Census Bureau maintains sampling frames are the American Housing Survey-National (AHS-N), the American Housing Survey-Metropolitan Sample (AHS-MS), the National Crime and Victimization Survey (NCVS), the National Health Interview Survey (NHIS), the Survey of Income and

**B. MAINTAINING THE SAMPLING FRAMES**

Maintaining the sampling frames takes place between the time of the initial sample design for the current demographic surveys and the time the persons in sample units are interviewed. The intent of this Frame Maintenance phase is to ensure that the sample meets the design specifications to the extent possible. This is a coordinated effort across the ten surveys. The following are some of the steps necessary to accomplish the objectives of quality, customer service, and accuracy. Sample adjustments are made so each unit has only one chance of selection and the field representative is assisted in locating the correct unit. Geographic adjustments ensure that the land area traversed by the field representative is of a manageable size. Sampling intervals and sample database are updated. Finally, weighting factors are applied to adjust for subsampling.

Since each sampling unit is representative of so many other units, great care is taken to maintain the integrity of the design and the sampling frames. The maintenance of the sampling frames involves exacting review and preparation of the sampling frame products and interpreting the frames to the regional office field representatives, the users of the frame products.

**C. COMPLEXITIES**

Several factors make interpretation of the frames complex. Each survey has unique features, so problem solving for all surveys is a very different matter from having expertise in just one survey. Last minute changes before sample introduction require constant flexibility in operating

procedures. Especially during re-design of the samples, there are many conceptual changes to be implemented.

The Frame Maintenance Staff communicates with the design and automation teams to determine what will work in actual field operations. Adaptions must be made to accommodate improved automation procedures for the design processing and field operations. Frame definition and other design changes require several years of working with parallel designs and with surveys in varying stages of integration with the new design.

## II. THE UNIT FRAME

The unit frame makes up about 82 percent of the sample. There are six demographic surveys for which unit Frame Maintenance is performed. Those surveys are: AHS-MS, NCVS, SIPP, CPS, CE-Q, and CE-D.

The unit frame samples are selected directly from the census universe of residential housing units. A subset of this information was stored with some sampling information to be used as a major research resource for Frame Maintenance.

Unit Frame Maintenance includes the following processes. (A) Incomplete addresses are provided a unique designation. (B) Directions for locating the unit are prepared. (C) Sample interview materials are reviewed. (D) Problem solving is done during the interview period. (E) Discrepancies are reconciled. (F) Weighting control factors are prepared. (G) Updates are made to future samples.

### A. COMPLETING AND COMBINING UNIT ADDRESSES

The first factor in the maintenance of the unit frame sample is preparing the product for the customers. Some addresses, as captured by the census, are incomplete and therefore difficult to locate. Frame Maintenance reviews these addresses to make them complete or at least easier to find.

Combining incomplete addresses with

other addresses is done when it is discovered that a sample unit actually is part of another address. For example, if a unit with an incomplete address is found to be part of a building complex, that unit is combined with other units in the complex at the same address.

There are several source materials used for Frame Maintenance. These are the census questionnaire data, telephone directories, zip code directories, and census address listings and files. Frame Maintenance does research to discover as much information as possible about the address.

### B. LOCATING THE SAMPLE UNIT

When an address remains incomplete or appears difficult to locate, and other methods for completing the address are not available, then materials are prepared in order to help the interviewer find the address. The major aids that are sent to the regional offices are: information from the 1990 Decennial Census documents; a copy of the census address listings surrounding the sample unit; a copy of the census spotted map or county locator map; any changes in the address; and the actions to be taken.

### C. REVIEW OF UNIT INTERVIEW MATERIALS

For demographic data to be accurate, the exact units designated must be sent for interview according to an exacting survey time schedule that matches the ascribed alpha numeric sample designation. This shepherding role is one aspect of Frame Maintenance.

There are several basic steps for the review of interview materials. They are: order of materials; sample adjustments, reductions, reinstatements and reassignments; verification; resolving discrepancies; incomplete address check; and future samples check. If there are discrepancies or inconsistencies, the sample unit is referred to the Frame Maintenance area of expertise for further review. All materials are prepared to make the field representative's work as user friendly as possible.

#### **D. UNIT PROBLEM SOLVING**

During the time period that the survey field representatives are attempting to interview sample units, there is a telephone problem referral system to assist these Frame Maintenance customers. There are two main types of referrals from the regional offices. One is unable to locate address. The other is additional units found.

These situations may be an indication that the entire address is not consistent with what is in census because of inconsistent spelling. An action decision is made by the Frame Maintenance Staff based on research of census resource materials and existing conditions found by the field representatives. The interviewer is advised which unit to contact for the given survey sample.

#### **E. UNIT RECONCILIATION OF DISCREPANCIES**

Sometimes a sample adjustment is made because some units that actually exist at an address were not recognized by the computer as belonging at that address. These units also had complete addresses, so were not identified during the incomplete address operation. Frame Maintenance Staff performs a review to see if there is any conflict with other adjustments that have been made before or during interview.

#### **F. UNIT WEIGHTS**

There is a file of subsampling factors prepared to assist in adjusting baseweights as a result of subsampling. The purpose is to adjust the weight of the cases we are interviewing to make up for the dropped cases. The staff provides the regional office with subsampling instructions when needed and verifies that the subsampling was performed correctly.

The file information that is collected and keyed represents the weighting factor for the given survey, segment, sample designation, and serial number. This operation assures that the correct statistical inference is drawn from the data collected.

#### **G. FUTURE UNIT SAMPLE UPDATES**

The design selects samples across census addresses for several demographic surveys. Each unit is included in sample only once and sample adjustments are documented and referenced for all future samples. When changes are made to the sample address or unit, updates are made to a cross reference tool called the future file. Changes are entered in this file: when an incomplete address is converted into a complete address; when there has been a clerical combining of multiple units at an address that the computer did not combine; or when any other necessary changes are made to the address.

#### **III. THE GROUP QUARTERS (GQ) FRAME**

The group quarters frame makes up about one-fourth of one percent of the sample. There are six surveys for which the GQ Frame Maintenance is performed. These surveys are: AHS-MS, CE-D, CE-Q, CPS, NCVS, and SIPP.

Group quarters samples are selected from GQ's in census. Group quarters are places where people live together but without separate and direct access. Group quarters include: (1) institutions such as jails, (2) non-institutions such as dormitories, and (3) military quarters. However, field representatives list only non-institutions and non-military group quarters.

The Frame Maintenance Staff operation for group quarters includes: (A) completeness checks of the computer produced materials; (B) consistency checks of the addresses; and (C) review, weighting, and address updates.

#### **A. GQ COMPLETENESS CHECKS**

The staff performs completeness checks before sending the sampling materials to the field for interview. These checks determine if there is a necessity to provide more information for finding the address.

If the GQ does not have a complete address or unique name, the street name field on the census file is checked to see if the group quarters name can be found, but was not

recognized by the computer. There is also a search of the census research resources to aid in obtaining group quarters addresses that can be located by the field representatives.

#### **B. GQ CONSISTENCY CHECKS**

The consistency checks determine if the sample interview materials prepared are in agreement with what should be going to the regional offices for interview for the scheduled sample and survey. There are duplication checks to determine if there is a duplicate address or if there should be an address change. Material corrections and creations are performed as a result of the completeness and consistency checks.

#### **C. GQ REVIEW, WEIGHTING, AND ADDRESS UPDATES**

The basic review steps include: order of materials, check-in, verification, discrepancy resolution, and interview material corrections. Weighting control factors and address updates are similar to the unit frame.

#### **IV. PERMIT FRAME**

The permit frame comprises about eight percent of the sample. There are nine surveys for which permit Frame Maintenance is performed. These are AHS-MS, AHS-N, CE-D, CE-Q, CPS, NHIS, NCVS, RENT, and SIPP.

The permit frame represents residential units, in building permit issuing places, that are not in the census universe because they have been built since the census. The inclusion of these units allows coverage of addresses that were not in existence during the time of the last decennial census.

Permit Frame Maintenance includes: (A) edits to reduce sampling problems; (B) edit of the permit address listings; (C) quality assurance and sample adjustments; (D) review and weighting; (E) post listing and address updates.

#### **A. PRE-SAMPLING PERMIT EDIT**

Permit Frame Maintenance begins even before the sample units are selected. Since the permit frame does not have one existing composite source, Frame

Maintenance participates in improving the product by making the new construction universe easier to sample. The staff accomplishes this by editing the forms that list information for which building permits were issued in 800 permit offices in the United States. The new construction units are collected from this source at the end of each permit issuing month.

The edited form includes: the issued permit number; the date it was issued; and the number of units to be built. The clerical edit focuses on such things as resolving problems and collapsing units whenever there is more than one permit number for the same basic address.

#### **B. POST-SAMPLING PERMIT ADDRESS EDITS**

The next permit Frame Maintenance activity is editing the forms that list the new construction addresses associated with the permit office numbers. The computer generated forms are checked for printing clarity, alignment and completeness.

#### **C. PERMIT QUALITY ASSURANCE**

Frame Maintenance performs a quality assurance check of the permit addresses. All units at one address are combined and clustered. Then, the Frame Maintenance Staff replicates the computer combining and sampling pattern to show the field representative exactly what to interview. In addition, segments are subsampled when the cases are too large to be handled by the interviewer economically and efficiently.

#### **D. PERMIT REVIEW AND WEIGHTING**

The basic review steps are the same as those for the unit frame: order of materials, sample adjustments, check-in, verification, and resolution of discrepancies.

The weighting control factors for the permit frame are prepared by querying the automated cluster sampling on the database, this is supplemented with any subsampling that occurs in the field.

## **E. PERMIT POST LISTING AND ADDRESS UPDATES**

After interview, there is a final completeness and accuracy edit of the permit address listing data collection instruments.

If there are any changes to the house number, street name, post office name, or zip code, then the sample database is updated.

## **V. THE AREA FRAME**

The area frame comprises about 10 percent of the sample. The seven surveys for which area Frame Maintenance is performed are CPS, NCVS, SIPP, NHIS, AHS-MS, CE-D, and CE-Q.

The area frame is composed of relatively small areas of land with well defined boundaries. They are usually found in rural parts of the country where a large percentage of the living quarters are not identified with complete addresses or where building permits for new residential construction are not available.

Area Frame Maintenance assures that field representatives are sent maps with identifiable boundaries that are of a reasonable size so the field representative can accurately list and identify the location of area segment housing units. The process consists of five major steps: (A) basic segmenting, (B) sub-blocking, (C) combining blocks, and (D) review and weights.

### **A. BASIC AREA SEGMENTING**

During segmenting there is a precise geographic review of the computer generated maps. If the census block boundaries are not physical features that can be seen by the field representative, then the block is combined with other blocks with visual boundaries when possible.

For blocks which have to be combined, there is also a check to see if the block has been computer combined. If a block contains less than four housing units at census time, the block was computer combined with other blocks in the same frame. If the block is in the unit, GQ or permit

frame, then the combination is not made to avoid overlap and duplication of sample units.

### **B. AREA SUB-BLOCKING**

When the Frame Maintenance Staff can identify an area segment which has too many housing units to be manageably listed, the block is broken down to a smaller size. There are two kinds of sub-blocking: in-house sub-blocking and field sub-blocking. In-house can be done using census housing unit and block information and maps. Field sub-blocking is performed by field representatives who map out block boundaries and housing unit locations. Field requested sub-blocking occurs when the block is too big for the interviewer to reasonably list. This avoids the problem of the interviewer having to traverse miles and miles of land area.

### **C. COMBINING AREA BLOCKS**

Blocks are geographically combined when it is necessary to link two or more blocks to form a segment with physical boundaries that can be located by a field representative. This requires accessing the census maps. Blocks cannot be combined if the block has been used for a previous sample or is in the unit, permit or GQ frame. Blocks are combined if they have similar characteristics such as frame, permit status, urban/rural type, and military or non-military.

When blocks are combined, appropriate adjustments are made to the sampling intervals. The block measures are recalculated and the sampling instructions within the block are then adjusted to reflect a new start and sampling interval for the regional office to use in yielding the correct number of sample units.

### **D. AREA REVIEW AND WEIGHTS**

The review includes some of the same basic steps used for the other frames: order of material, check-in, verification, and resolving discrepancies. Maps are more complete, detailed and extensive than in any of the other frames. If there are too many units in sample to reasonably interview, the segment can be referred to the Frame Maintenance Staff. After reviewing for boundary

or frame duplication problem, the staff determines the sampling intervals and relays the information to the regional offices. The subsampling factors from this step are included and sent as part of the weighting control factors.

## **VI. CONCLUSION**

Maintaining the sampling frames results in quality, customer service and accuracy. Quality in implementing the sample design results from precise unit location and sample adjustments carried out over all surveys and time.

Interpreting the frames to the users ensures adherence to sponsor specification. It also reduces respondent burden by assuring a unit is in only one sample in any of the surveys. Time and cost savings result from a system that helps the field representatives increase productivity.

One chance of sample selection, avoiding frame overlap and precisely locating the sample unit are key results. Accuracy in all these, results in the bottom line, reliable estimates for demographic surveys.

The challenges that loom in the future include demographic survey sample redesign using the census data for the year 2000 and automation that will further the goals of survey research and statistical methods. Redesign could possibly take on a whole new concept and approach for the demographic surveys. Automation will certainly afford the opportunity to achieve new methods of interviewing, storing data, querying databases, communicating, controlling, researching, reporting and programming. The future challenge is to excel through a strategic plan to value the work force, continuously improve quality and accuracy, meet and exceed customer satisfaction, and increase productivity. We look forward in the future to further "Challenging the Frontiers of Knowledge Using Statistical Science"\* in maintaining the sampling frames for demographic surveys.

\*Theme of the 1996 Joint Statistical Meetings