

PART I
1960 POPULATION AND HOUSING CENSUSES



Figure 1.—“Taking the Census.” Harper’s Weekly. November 19, 1870.

Chapter 1. Introduction

The 1960 population and housing censuses of the United States instituted many new census procedures. They were the first censuses of population and housing, in this country, in which most of the public was asked to fill out the questionnaires. They were the first in which the mail was used extensively for distributing advance questionnaires and for collecting detailed questionnaires from a sample of households. They were the first in which most of the items of information were collected on a sample basis. They were the first in which sample data were collected in a separate operation from the 100-percent data. They were the first in which formal quality control procedures were used in an effort to control the quality of the work of the individual enumerators. And they were the first in which most of the data processing was done on high-speed electronic equipment, some of it especially designed and built for utilization in these censuses. These and other innovations had an effect on most of the methods and procedures of the censuses, on the costs, on the quality of the results, and on the timing of the census publications. The methods and some of the consequences are described in this report.

THE CENSUS ORGANIZATION

Organization of the Bureau

Large-scale censuses are an important part of the work of the Bureau, but only a part of the task which the Bureau performs. The regular organization must carry forward a continuing program of annual, quarterly, and monthly statistical surveys and special assignments, as well as the major censuses. This basic continuing organization, supplemented by temporary employees, conducted the Eighteenth Decennial Census. Many divisions of the Bureau devoted a substantial effort to the 1960 population and housing censuses throughout the census period.

Executive Staff

The Director, the chief executive of the Bureau, was assisted by a Deputy Director who shared his responsibilities. On their immediate staff were five Assistant Directors as well as the Chief of the International Statistical Programs Office and the Public Information Officer.

The Assistant Director for Demographic Fields was responsible for the three subject-matter divisions concerned with the decennial census--the Population, Housing, and Agriculture Divisions--as well as the Decennial Operations Division (later called the Demographic Operations Division) and the Statistical Methods Office (later called the Statistical Methods Division).

The Assistant Director for Economic Fields was responsible for the Business, Construction, Economic Operations, Foreign Trade, Governments, Industry, and Transportation Divisions, none of which were involved in the Eighteenth Decennial Census.

The Assistant Director for Statistical Standards (title later changed to Assistant Director for Research and Development) was responsible for the Electronic Systems Division (later combined with the Machine Tabulation Division to form the Data Processing Systems Division under the Assistant Director for Operations), Statistical Reports Division, and Statistical Research Division, and provided technical direction for the statistical methods, standards, and research activities in the various divisions of the Bureau.

The Assistant Director for Operations was responsible for the Field Division, Geography Division, and Machine Tabulation Division (later combined with the Electronic Systems Division to form the Data Processing Systems Division).

The Assistant Director for Administration was responsible for the Administrative Service Division, Budget and Management Division, Personnel Division, and the Jeffersonville Census Operations Office.

The Chief of the International Statistical Programs Office had the function, among his numerous other functions, of providing information about the censuses to foreign statistical agencies for their study of census methods.

The Public Information Officer directed the information and publicity program for the censuses.

The Divisions

The divisions which worked on the 1960 Censuses of Population and Housing are listed below with a brief description of their functions:

Administrative Service Division secured space, supplies, and equipment. It arranged for communication, transportation, and related facilities, and for the printing of schedules and other forms and the printing of publications containing the census results.

Budget and Management Division was primarily responsible for financial planning and control, coordinating budget estimates and their justifications, participating in the development of official time schedules and designing progress reports systems, setting production standards, accounting, payrolling, and furnishing general management staff guidance and assistance in Washington and the field.

Decennial Operations Division was established July 1958 to handle the data processing for the 1960 Censuses of Population and Housing, from the stage of receipt and check-in of the filled-in schedules sent in by the District Offices through the stage of tabulation of census results. During most of the work on the censuses, the division consisted of a headquarters staff in Washington, a processing office in Jeffersonville, Ind., another in San Juan, P.R., and staff at the various computer installations which supplemented the tabulation work done by the

electronic computers at the Bureau of the Census headquarters in Washington. In June 1962, it became a permanent division of the Bureau and the name was changed to Demographic Operations Division.

Electronic Systems Division was responsible for the maintenance and operation of the electronic data-processing equipment--FOSDIC,¹ computers, and high-speed printers--and also provided general programing materials, trained programers, and rendered substantial programing assistance during the data processing for the censuses. In September 1961, it was combined with the Machine Tabulation Division to form the Data Processing Systems Division.

Field Division was responsible for the collection of the data. For this purpose, it established 399 temporary District Offices and hired an army of enumerators, crew leaders, and other temporary field personnel. The work of the District Offices was coordinated by the 17 regular Regional Offices of the Bureau which were under the direction of Field Division. (For a detailed description of the field organization, see the section on "Establishing the Field Organization" in chapter 6.)

Geography Division determined the boundaries of the various geographic areas used in the enumeration and in the presentation of the statistics, and prepared maps for the enumerators and other field personnel and also for the published reports.

Housing Division was primarily concerned with the subject content of the housing census. The major functions carried out by its staff members were meeting with census users to determine the type of data needed; participation in planning the enumeration procedures; design of the housing portions of the questionnaires and schedules; preparation of instructions for manual and machine editing and coding; planning the housing census publications and writing the analytical and explanatory texts; professional review of the tables before publication; and providing consultation and services to other divisions on matters requiring expert understanding of the subject content of the housing census.

Machine Tabulation Division conducted the processing on punchcard equipment of some special areas and groups, notably the outlying areas of American Samoa, the Canal Zone, Guam, and the Virgin Islands, and the U.S. population overseas, and also provided instructions for the data-processing operation conducted in Puerto Rico. In September 1961, it was combined with the Electronic Systems Division to form the Data Processing Systems Division.

Personnel Division formulated personnel policies and prepared procedures to guide the various offices in applying personnel regulations. Recruitment, training, and orderly decrease of staff after completion of work were among its major activities for the decennial census. The division also classified jobs, reviewed changes in organization, and directed employee services.

Population Division was primarily concerned with the subject content of the census of population. Its major functions with regard to the census were consultation with census users on the types of data needed; participation in planning the enumeration procedures; design of the population portions of the questionnaires and schedules; preparation of instructions to enumerators; preparation of instructions for manual and machine editing and coding; planning the population census publications and writing analytical and explanatory text; professional review of the tables; and providing consultation and services to

other divisions on matters requiring an expert understanding of the population content of the census. In addition, the Publications Branch prepared the copy for the printer for both the population and housing census reports.

Statistical Methods Office (later called the Statistical Methods Division) developed methods and provided technical guidance for the application of sampling in the census, conducted the research and evaluation program, and designed the quality control program for the data processing beginning with quality control of the printing of the schedules.

Statistical Reports Division provided guidance on the publication policy and program and provided editorial review of the census publications for clarity, standard terminology, and statistical presentation. The division also advised on legislation for the census and on legal aspects of its various phases, and maintained a program of census documentation which included the history of census activities and a number of special reports on the census methodology.

Statistical Research Division, in cooperation with the Office of the Assistant Director for Statistical Standards, provided technical direction of the research, standards, and evaluation activities, and conducted research on the general census procedures during the 10-year interval between the 1950 and 1960 population and housing censuses. Their work included research on and initial development of innovations in enumeration procedures and data-processing equipment and techniques as well as the sample design and other phases of the censuses.

Operations Offices

A Census Operations Office was established at Jeffersonville, Ind., to handle the large-scale clerical operations of the population and housing censuses. Among these operations were the assembly and shipment of supplies for the field offices, the preparation of maps (by a branch of the Geography Division installed in Jeffersonville) and their reproduction, and, after the censuses, receipt of enumeration books from the field offices, and (under the direction of a branch of Decennial Operations Division) coding the sample schedules and microfilming all the enumeration books.

Another Operations Office was established in San Juan, P.R., to process the data from the 1960 Censuses of Population and Housing of Puerto Rico.

CENSUS LEGISLATION

The Constitution of the United States authorizes the census of population. Article 1, section 2, provides that "the actual enumeration shall be made within three years after the first meeting of the Congress of the United States and within every subsequent term of ten years, in such manner as they shall by law direct."

The basic census laws under which the Bureau of the Census operates were codified by the 83rd Congress in 1954, under Title 13 of the United States Code. In 1957 several amendments were enacted for the purpose of improving the Eighteenth Decennial Census. One permitted the census of agriculture to be taken in the fall of 1959, so that data could be collected immediately after the crop year. Another was an authorization for covering census topics by sampling, "except for the determination of population for apportionment purposes." A third permitted the Secretary of Commerce to designate items for coverage through preliminary or supplemental surveys in connection with censuses. Another amendment clarified the method of taking the censuses in the outlying areas such as Puerto Rico, the Canal Zone, etc.

¹ FOSDIC--Film Optical Sensing Device for Input to Computers (see chapter 8).

The census proclamation was signed by the President on March 15, 1960, and appeared in the Federal Register of March 19, 1960.

The census proclamation and the sections of Title 13 of the United States Code which related to the Eighteenth Decennial Census are reproduced in appendix A.

HISTORY OF U.S. NATIONAL CENSUSES

In the United States, official census-taking on a nationwide basis dates back to 1790, when U.S. marshals collected the data required by the Constitution for apportionment purposes, with some additional detail specified by the Congress. In each subsequent decade there was an enumeration. From time to time changes were made in the subject matter covered.

In 1810, inquiries on manufactures were added, and in 1840, inquiries on agriculture.

The first six censuses, 1790-1840, were taken by methods that by present standards appear crude. Inquiries were limited largely to the numbers of the population by age, sex, color, and whether free or slave. In 1810, 1820, and 1840, efforts were made to extend the census into more complex fields, such as industry, but the results were of very little value other than demonstrating the need for better methods. The first printed schedule was employed in 1830.

In 1850 a revision of enumeration methods took place. Schedules were printed as in 1830 and 1840, but for the first time written instructions explaining the inquiries in detail were provided, and illustrative examples of filled schedules were introduced. Information was obtained about each person instead of just the number of various classes of persons in each household.

The 1880 census is generally considered the first modern census of the United States. The enumeration responsibility was transferred to census supervisors appointed for each census district. A census office was

established. The number of inquiries was increased. This census marked the beginning of the modern era of census-taking not only in the methods of enumeration and their control but also in the subjects investigated and the completeness of detail of the results presented. The practice of first issuing the returns in the form of preliminary reports was introduced in 1880 and has continued to the present day.

Machine tabulation was introduced in 1890 by means of a Hollerith machine originally designed and developed for census purposes by Herman Hollerith, a census employee.

In 1902, the Census Office was created as a permanent agency of the Government. One of the advantages of this form of organization was that the workload could be spread over a decade, and various statistical inquiries were separated from the decennial census and taken at different times. Since the early part of the century, censuses of manufactures, business, governments, religious bodies, and other subjects have been scheduled for years other than those ending in "0." Another advantage of having a permanent statistical agency was that many inquiries could be taken on a current basis, at frequent and regular intervals.

A mid-decennial census of agriculture was initiated January 1, 1925, and a census of agriculture continued to be taken as part of the decennial census in the years ending in "0" through 1950. Under legislation enacted in 1952 and revised in 1957, the census of agriculture begins in the month of October in the years ending in "4" and "9," starting with the 1954 census. Censuses of agriculture taken for years ending in "9" are considered to be taken in conjunction with the decennial population and housing censuses.

In the 1940 census, sampling techniques were used, for the first time in U.S. census history, for collecting some of the items of information included in the census. There was still quite a concentration of major censuses in that year. Censuses were taken covering population,

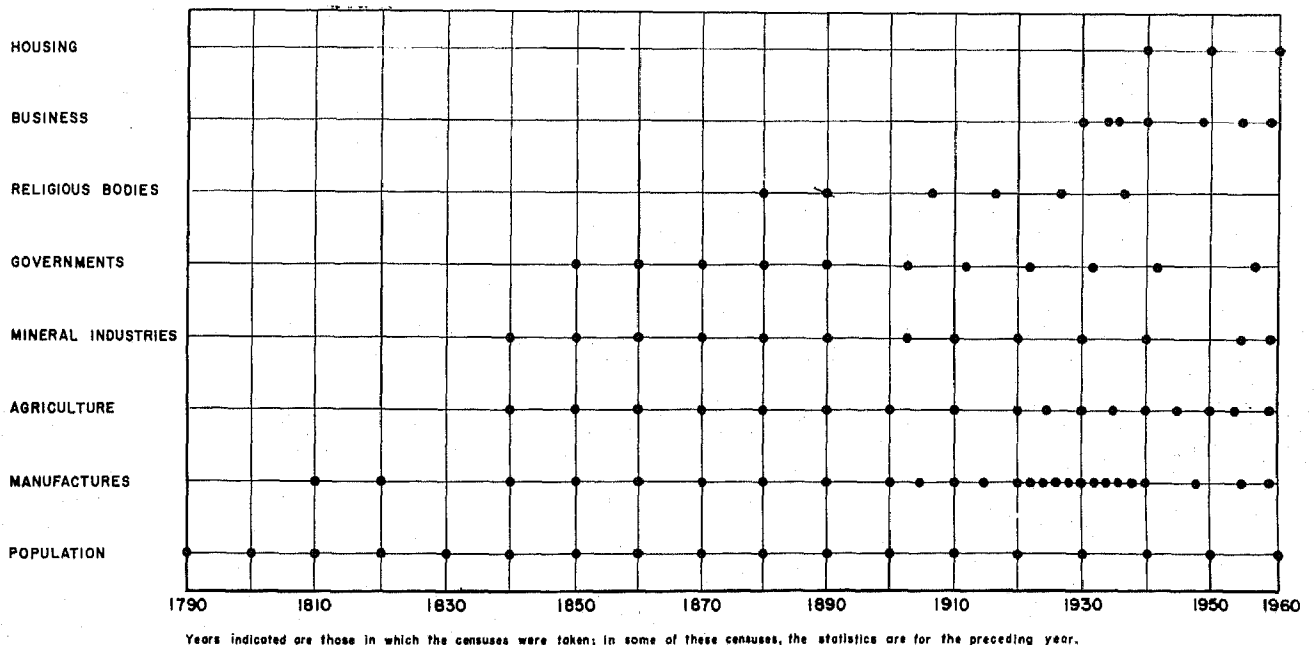


Figure 2.—U.S. National Censuses, 1790 to 1960.

housing, agriculture, manufactures, business, and mineral industries. The data for the last four of these censuses applied to 1939.

New legislation enacted in 1948 provided for taking the censuses of manufactures, business, and mineral industries on a quinquennial basis covering years ending in "3" and "8." (This was later changed, so that beginning in 1967 these economic censuses will be taken in the years ending in "2" and "7.") The major censuses taken in the year 1950 covered only population, housing, and agriculture. Increased use was made of sampling in the 1945 Census of Agriculture and in the 1950 decennial census. Some of the data in the 1950 Censuses of Population and Housing were tabulated on the Univac I, the first large-scale electronic computer designed for data processing. A major development for the 1950 censuses

was the research and evaluation studies, which had an important impact on the design of the 1960 censuses.

The Eighteenth Decennial Census of the United States included the 1959 Census of Agriculture and the 1960 Censuses of Population and Housing.

The principal national censuses² taken to and including the Eighteenth Decennial Census are shown in Figure 2, "U.S. National Censuses, 1790 to 1960."

²For a more complete listing of national censuses, including those of more limited subject coverage such as the census of electrical industries which was taken quinquennially from 1902 through 1937, see: U.S. Bureau of the Census and Library of Congress, Catalog of United States Census Publications, 1790-1945, Washington, D.C., U.S. Govt. Print. Off., 1950, 320 pp.

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Chapter 2. Planning the Censuses

In planning each census it is necessary to review the needs for the data and to balance them against the resources available and the time and costs involved. There are many demands for additional questions in the census, for more tabulations of the items covered, for greater timeliness of publication, and for improvements in quality of certain of the data collected, as well as for economy.

CONSULTATION ON THE CENSUS PROGRAM

The Bureau of the Census was able to call upon public-spirited individuals and organizations for assistance in planning many phases of the 1960 censuses. Many were authorities in specialized fields such as the use of visual aids in training or the use of various types of questionnaires in surveys or other techniques of data collection and field work. Others were users of population and housing data whose advice was sought particularly on matters of subject content and publication of the data. Much useful assistance was also received on sampling, quality evaluation, and quality control programs, on the design of equipment, on research studies, and on other major and minor aspects of the census program. Most of this help was unpaid. Frequently the consultants worked in groups, either in advisory committees which met at intervals or in ad hoc meetings of representatives of associations and organizations having a special interest in a particular field. However, if a problem of a limited nature confronted the Bureau, an expert well informed on that problem was called in for consultation. In addition, much informal consultation took place on an individual basis.

For a description of the principal conferences and meetings regarding the population and housing census program, see appendix C.

PLANNING CENSUS PROCEDURES

Major Goals

In planning the 1960 censuses, the Bureau was concerned not only with providing improved methods for the 1960 censuses but also with developing approaches that showed promise of providing additional gains in future censuses. The specific problem was to accomplish the following objectives:

- To improve the quality of the statistics
- To reduce the time between taking the censuses and publishing the results
- To achieve the needed results at relatively low cost per person and housing unit enumerated

After a review of the various resources that were available for the censuses, it appeared that advantageous use of the resources listed below offered the opportunity for considerable improvement in census methods:

1. Studies of census methods conducted during the prior decade.--A considerable amount of research and development work had been accomplished in the Bureau of the Census in such areas as sample survey and census methods, sources and control of response errors, the development and application of electronic equipment to large-scale data processing, and other operations research studies. These studies provided extensive guidance for planning the design of the 1960 censuses in an effort to improve quality and timeliness and reduce costs.¹

2. The educational level of the American people.--The rising educational level in the United States made it seem reasonable to call upon the people to fill out census forms, and improvements in accuracy thereby also appeared to be a reasonable prospect.

3. Electronic computers and associated equipment.--The Bureau had been in the forefront of the development and use of high-speed electronic equipment for data processing. Greater use of electronic equipment, including the design and development of new equipment for census purposes, not only offered opportunities for reductions in unit costs and for greater speed in processing and publishing the census results, but also reductions of errors in processing.

4. Sampling.--Since 1937 the Bureau has undertaken a pioneering role in the development and use of probability sampling, in which results of measurable precision are obtained under controlled conditions, for large-scale surveys. Extended use of sampling in the censuses promised lower costs and less time required for enumeration and processing.

Most of the innovations in census procedures for the 1960 censuses had been under study in the Bureau since before or during the 1950 censuses. Some of them had been tried out on a small scale in selected areas during the 1950 censuses. Experiences of other countries in taking censuses by various methods were reviewed. The major innovations were tested in one or more of the pretests made in the years preceding the censuses.

Enumeration Procedures

As in 1950 and earlier censuses, the enumerator in 1960 was charged with the responsibility for door-to-door canvassing of the enumeration districts (ED's) assigned to him, with finding and listing all the living quarters in the area, and with obtaining complete lists of people living in these quarters. The methods of canvass and of interview to obtain coverage were quite similar in 1950 and 1960. However, there were some changes in enumeration procedures in 1960 which were far-reaching in their effects on the census operation in all its phases as well as on the census takers and the general public.

¹ See, for example: U.S. Bureau of the Census, The Accuracy of Census Statistics With and Without Sampling, Technical Paper No. 2, Washington, D.C., 1960, 38 pp.; and The Post-Enumeration Survey: 1950, Technical Paper No. 4, Washington, D.C., 1960, 99 pp.

One major aim of the enumeration procedures for the 1960 censuses was to reduce the number of functions performed by the enumerators at one time, because it appeared that the great complexity of their jobs in the earlier censuses had led to insufficient emphasis on some of the more important aspects of coverage and content of the censuses.

The principal enumeration procedures used for the first time in the 1960 censuses, and the reasons for adopting them, were the following:

Advance Census Report form.--This form was a questionnaire which was delivered by the Post Office from 10 days to a week before the censuses to each residential address in the United States to which the Post Office made delivery and, in rural post offices, to each post office box for a residence. Householders were asked to fill out this form and hold it for the enumerator's visit. It contained the questions to be answered for the entire population.

There were several important reasons for using the Advance Census Report. One was that receiving the questionnaire before the censuses would provide an opportunity for members of households individually to supply information about their dates of birth and other characteristics, and also for records on household members to be consulted, so that the person who filled in the form could thereby reply more accurately to the questions about all members of the household, including lodgers, and about the housing unit. Also, filling out the advance form exposed the respondent to the instructions and questions on the form, and thus called attention, among other things, to who was to be covered and who was not to be covered at a particular household.

Another reason was that, to the extent that the public filled out this form and listed the members of each household on or about April 1, the errors of coverage which arise from a protracted period of enumeration--i.e., the failure to count some persons who moved during the enumeration period and the double-counting of others--would be reduced.

In addition, the Advance Census Report had effective publicity value in preparing the public to expect the enumerator's visit.

Separation of collection of sample data from collection of nonsample data.--There were two ways in which the collection of sample data was separated from the collection of 100-percent data. First, the data were recorded on different schedules. The principal reason for this was the desire to obtain more timely compilation and publication of statistics. All the items on the 100-percent schedules were readily precoded by the enumerators, i.e., the possible responses were provided on the schedule and the enumerator indicated which of them was appropriate instead of writing out answers. Thus it was possible to prepare the information from the 100-percent schedules for the electronic equipment without the lengthy clerical coding operation that was required to classify the responses for some of the sample items (such as occupation and industry) and put them into numerical codes that could be handled by the electronic equipment. This was one of the important steps taken to publish results much sooner after the enumeration than comparable data from the 1950 censuses were published.

In addition, in areas containing about 80 percent of the population and housing units of the nation, the collection of data was in two stages, the complete-count data being collected in the first stage and the sample data in a separate, second stage (see Chapter 7, The Enumeration). The first stage was designed to concentrate primarily on coverage, with the goal of providing improved

counts of people and housing units. Improved coverage was a major objective for the 1960 censuses because the results of the evaluation program after the 1950 censuses indicated that there might have been as much as 2 or 3 percent net underenumeration of population and housing units in the 1950 censuses. During the second stage, the enumerators concentrated primarily on obtaining acceptable sample information on the various subjects covered in the censuses.

The separation of the enumeration into two stages was intended to simplify the job of the enumerators. It was hoped that if the enumerators for each stage had fewer tasks to perform they would master them better.

Self-enumeration with the household questionnaire.--The form used for the collection of sample data was a "self-enumeration" questionnaire, called the Household Questionnaire, to be filled out by each sample household and then mailed to the Census District Office.

The use of self-enumeration was intended primarily to improve the quality of the data by allowing the respondents to give considered responses, to consult their records, and to consult members of the household to obtain accurate information and also by reducing the effects of differing interpretations and practices followed by various enumerators. Experimental evidence collected during the course of the 1950 censuses demonstrated that the variability of interpretations and performances of the enumerators could have an adverse effect on the quality of the data collected--especially on data for characteristics that are difficult to classify such as employment status and occupation. The "enumerator variability" as measured in the 1950 census research study may seriously affect the statistics for small areas or small tabulation cells--and obtaining statistics for small areas is one of the primary purposes of taking a complete census. (Interpretations introduced by different enumerators tend to balance out in statistics for large aggregates.) It was believed that "enumerator variability" could be significantly reduced by getting extensive respondent cooperation in a self-enumeration approach. It was also hoped that some of the systematic errors of response (or response biases) would be reduced thereby.

FOSDIC schedules.--The enumerators transcribed the information from the Advance Census Reports and the household questionnaires to specially designed schedules on which most of the information was recorded by filling in the appropriate circles. When these schedules were microfilmed, the information could be transferred to magnetic computer tape by electronic equipment constructed for the purpose. This equipment, a Film Optical Sensing Device for Input to Computer, was known as FOSDIC, and was developed by the National Bureau of Standards for the Bureau of the Census. The census pretest experience with this type of schedule and equipment was very favorable. An example of a FOSDIC schedule is reproduced in appendix I (forms 60PH-2 and 60PH-4).

The FOSDIC schedules were the basic schedules for the censuses. The enumerator recorded information directly on the 100-percent FOSDIC schedules while at each household during his field canvass, obtaining the information either by transcription from the Advance Census Report when it had been prepared by the household, or by direct interview, or, in the case of some housing items, by observation. The FOSDIC schedules for the sample information were filled by the enumerators by transcription from the household questionnaires that were mailed back, or by telephone or personal interview as necessary. In the areas in which the censuses were accomplished in a one-stage canvass, the FOSDIC sample schedules were enumeration documents for the sample information.

Extension of sampling.--The use of sampling was extended to include most content items, including all items that required a clerical coding operation.² Those that were included in the 1950 censuses on a 100-percent basis but were changed to a sample basis in the 1960 censuses included the items on place of birth and detailed relationship to head of household, and the labor force items--labor-force status, occupation, industry, and class of worker. Because of the use of sampling, the volume of coding work for these items--including the complex coding of industries and occupations--was cut 75 percent compared with the 1950 procedure, with substantial reductions in both costs and time spent on the operation.

Use of the household as a sample unit.--For the 1960 censuses, the housing unit was the sampling unit, and the sample population information was collected for every member of the household³ in an occupied sample housing unit, so that statistics on population characteristics such as education and employment status could be obtained from the sample for all members of families and households. In the 1950 censuses, the sampling unit had been the individual person, so that the sample data were not obtained for all members of a family or household. In addition, use of the housing unit as the sampling unit facilitated respondent cooperation through self-enumeration, because only the sample households had to fill out and mail in the sample questionnaires and one questionnaire covered all members of a household.

Separate listing book.--Enumerators used a separate listing book for listing addresses of the residences in an enumeration district, as a part of the enumeration procedure. This was done to provide better control on the callbacks at households where no one was at home on the first visit, and to help insure that the enumerators would list households in the appropriate order of canvass, for purposes of improving coverage and the designation of every fourth household as a sample household, and to help the stage II enumerator locate the sample households. It was expected that the listing book would result in some improvement in coverage and in keeping biases in sample selection at a low level, even with the sample designation being done during the census canvass.

Callback and closeout procedures.--The callback procedure in the 1950 censuses depended a great deal on the discretion of the individual enumerator. The instruction in the 1950 enumerator's manual was the following:

"If, after several calls, you have not been able to get in touch with a suitable respondent, return to the dwelling unit and get as much information as possible from the best sources available. However, in preference to obtaining information from unreliable sources, it is advisable to leave an ICR [Individual Census Report form] for each member of the household with the request that each be filled out, sealed, and left with a neighbor."

For the 1960 censuses, explicit instructions were given the enumerators regarding the number of callbacks to be made and the action to be taken when no respondent could be found at the household after the prescribed number of callbacks. The 1960 census enumerator for the 100-percent phase of the work was instructed to obtain information from neighbors after three calls, but for the sample questionnaire the 1960 enumerator was instructed to obtain most information only from acceptable household members and, except for a few specified

items, to leave the sample items on the schedule blank after the designated number of calls rather than to obtain the information from neighbors or other sources. The intent was to insure coverage for the 100-percent items by using neighbors or other sources where necessary, but to discourage obtaining the more complex sample information from neighbors.

The callback problem has been an important source of enumerator discontent and of difficulty in maintaining control over costs. The increased number of women in the labor market, the increased freedom from household chores arising from the introduction of labor-saving devices, and the increase in off-farm work by farmers and their families all result in greater difficulty in finding people at home. Determining the maximum number of callbacks to be made for any one household and giving precise instructions for closeout procedures were an effort to get the callback problem under control. The closeout procedures provided for hourly-rate enumerators to work out of the field office on some of the more difficult followup work instead of having the enumerators paid on a piece-rate basis followup indefinitely.

Quality control.--For the first time in a major U.S. census, a formal program of quality control was instituted for the field enumeration. (This program is described in Chapter 7, The Enumeration.) It provided supervisory personnel with definite procedures for detecting and, when necessary, rejecting unacceptable work.

Other procedures considered.--A number of other changes in enumeration procedures were seriously considered. Two methods were under active consideration for increasing the completeness of coverage of housing units in the censuses: (1) the use of post office personnel to examine the listings made by enumerators and to identify housing units that were omitted from the listings, or (2) the use of crew leaders to make an independent listing of all housing units in every enumeration district under their supervision, to compare later with listings made by the enumerators. Both methods were rejected because of budgetary considerations. The post-office method, however, was tested in a probability sample of areas throughout the United States as part of the 1960 evaluation program (see Chapter 10, Evaluation and Research Program).

Processing and Publication Procedures

The 1960 population census was the first for which the final 100-percent counts required to be submitted to the President of the United States within 8 months after the census data were obtained by machine processing instead of hand counting.

As noted above, a major reduction in data-processing time and costs was achieved by collecting on a sample basis the information regarding those items which would require a separate clerical coding operation. Nonetheless, the coding of the sample information was the largest clerical operation involved in processing the data from the 1960 censuses. It had been discovered in processing the 1950 censuses that verifiers examining the codes assigned by clerks missed or failed to report a substantial proportion of the errors. Therefore, a marked change in concept and procedures for the quality control program of the coding work was introduced for the 1960 censuses. The system used for quality control of the 1960 coding required that samples of the schedules be coded independently by different clerks, and then a comparison was made of the codes assigned. For a description of this system, see the section on "Quality Control" in Chapter 8, Processing the Data.

² See The Accuracy of Census Statistics With and Without Sampling, op. cit.

³ A household was defined as consisting of all the occupants of a housing unit.

The other major innovations in procedures for processing and publishing the data were accomplished primarily with high-speed electronic equipment. All of them were adopted to reduce the time and cost of making the census statistics available, below what they would have been if 1950 census procedures had been used again, and also to achieve improvements in accuracy through a reduction in the number of errors previously introduced into the data during the clerical operations. The innovations in data-processing equipment used were the following:

FOSDIC.--The use of the FOSDIC equipment required that the data be recorded on schedules designed for the purpose. These were microfilmed, and FOSDIC then transferred the information from the microfilmed schedules to magnetic tape for input to the computers. (See Chapter 8, Processing the Data.) The microfilm-FOSDIC process eliminated the necessity for a card-punching operation which would have involved the rental or purchase of large quantities of equipment and the hiring and training of many punchcard operators. There was thus a considerable saving of both time and money involved. In addition, census pretest evidence indicated that the FOSDIC equipment would transcribe the data more accurately than would key punch operators. The output of the FOSDIC was magnetic tape that contained the information recorded by the census enumerators (and coders, in the case of the sample questionnaires), ready for direct high-speed input to the computers.

Computers.--Electronic computers are much more versatile, more accurate, and faster than the traditional punchcard equipment. Their potential for making consistency checks on the reported data and for assigning values where no answers were recorded was an important consideration in their use. (As a worthwhile byproduct, the use of computers for this work made it possible to inform users of the statistics in the published reports of the extent to which inconsistencies were corrected and imputations for missing data were made.) The electronic equipment provided much tighter control over the reliability of the tabulation processes than processing by punchcard equipment, as well as higher speed processing at lower costs.

High-speed printers.--The use of high-speed printing equipment as an integral part of the electronic computer system also contributed to reducing costs and reducing the time between taking the censuses and issuing the results. The high-speed printer was programed and adjusted to print out final tables, which, after certain manual steps, were then used as publication copy for photo-offset printing of census reports.

DETERMINING THE DATA TO BE COLLECTED

General Method

Soon after the results of the 1950 censuses became available, the staffs of the Population and Housing Divisions as well as other parts of the Bureau began to study the use of the data from those and previous censuses and the requests for new information. They examined not only the extent to which the data were used but also the shortcomings revealed when the figures were applied to specific problems. New questions for the 1960 censuses were evaluated in terms of the need for information and the problems and costs that would be involved in getting it. Tests were made to see if respondents could provide the new information with reasonable accuracy.

Criteria for Inclusion of Items

A nationwide census is a large-scale, complex, and expensive operation. It involves sending a large body of temporary personnel, which has had only brief training in its duties, into every place where people may be living, to interview persons of widely varying educational, cultural, and language backgrounds. Its successful completion depends to a great extent upon keeping the questions simple enough that they can be understood by both the enumerators and the respondents, and few enough that the schedule can be completed in a reasonably short interview. On the other hand, a great many agencies and groups, both governmental and private, are interested in obtaining a wide variety of census data as a basis for their planning and policy for the next several years. Thus there are conflicting pressures on a census, both to keep the list of items short enough that the census operation is feasible and to expand it to meet as many needs as possible at the time that the interviewers are in the field.

Some of the general criteria for the selection of items of inquiry for the census, which have been adopted on the basis of more than a century and a half of experience in taking censuses and with the advice of many government, business, and professional groups, are the following:

1. The data are needed for public policy
2. The data serve the general interest by enabling a wide segment of private industry or the public to plan more effectively
3. The information can be obtained by one or two or at most a very few questions
4. The questions should be simple and unambiguous, so that both enumerator and respondent understand what information is wanted

It is preferable that there be enough variation in the information obtained on an item so that the same response is not given in almost every instance. For example, the question on literacy was dropped after the 1930 census because such a small proportion of the population was illiterate, and a question on educational attainment was substituted. If an overwhelming proportion of the answers are the same, then the question essentially obtains information about the few exceptions. Also, it has been observed that if the enumerators receive the same response in almost all cases, as the enumeration progresses some of them may begin to enter that response on the schedule without asking the question.

The information should not be of such a type that much of the public would object strongly to giving responses, partly because the data obtained would be invalid. However, any question may be objectionable to some respondents, and the importance of the information has some bearing on this consideration. For example, the age composition of a population is so important for public planning and other purposes that a question on age is included even though difficulties are sometimes involved, and a body of knowledge has grown up about tendencies of respondents to exaggerate or understate age at various ages and in various situations.

Items of information will be of little use if the situations which they describe are greatly changed by the time the data are published or soon after. Small-scale sample surveys which can be taken and processed in a very short time, and can be repeated as frequently as necessary, are preferred for rapidly changing subjects.

Considerations of cost, anticipated reliability, and the effect on timing of the census program are also important in the selection of items.

Each item included in the censuses is chosen as a result of a balancing of the various factors involved and a determination based finally on judgment as to its need, suitability, cost, etc. There is no firm yardstick by which to measure the many complex considerations.

Population Items

Most of the questions asked in the 1960 Census of Population were essentially the same as in the 1950 census. There were, however, some important changes. A list of the population items in the 1960 census is shown in table A. The principal differences from the 1950 items are summarized below.

100-percent and sample items.--The only population items collected for 100 percent of the population in 1960 were on relationship to head of household, sex, race, date of birth, and marital status. All the other population items were collected on a 25-percent sample basis.

New and revised items.--Because of interest in commuting patterns, two new questions were asked, on place of work and on means of transportation used in getting to work.

In the field of population mobility, a new question on length of residence was asked, on when the person moved into his present dwelling, and the question on migration was in terms of place of residence 5 years earlier, as it had been in the 1940 census, rather than 1 year earlier as in 1950. The item on place of residence was refined by the addition of a new question, for persons who had lived in a different house in 1955 and who named a city or town as their place of residence in that year, on whether the person had lived inside the city limits.

The data on educational characteristics were expanded by an additional question, for persons enrolled in school, on whether the school was public or private. Provision was made for the first time for separately identifying those persons who had attended 6 or more years of college. Information on enrollment was recorded for persons 5 to 34 years old in 1960 instead of persons 5 to 29 years old as in 1950; the extended age coverage for publication of enrollment data reflects the increasing number of persons in their early thirties who have been attending regular colleges and universities in recent years.

Table A.--Population Items of Data Collected

| Item number ¹ | Item ² | Items collected for 100 percent of the population ³ | Items collected for a 25-percent sample of the population ⁴ | Item number ¹ | Item ² | Items collected for 100 percent of the population ³ | Items collected for a 25-percent sample of the population ⁴ |
|--------------------------|---|--|--|--------------------------|--|--|--|
| P3 | Relationship to head of household..... | ✓ | ..... | P22-25 | Employment status (including hours worked, P23)..... | ..... | ✓ |
| P4 | Sex..... | ✓ | ..... | P26 | Year last worked..... | ..... | ✓ |
| P5 | Color or race..... | ✓ | ..... | P27a,b, and c | Industry..... | ..... | ✓ |
| P6 | Month and year of birth..... | ✓ | ..... | P27d | Occupation..... | ..... | ✓ |
| P7 | Marital status..... | ✓ | ..... | P27e | Class of worker..... | ..... | ✓ |
| P8 | Place of birth..... | ..... | ✓ | P28 | Place of work..... | ..... | ✓ |
| P9 | Mother tongue of foreign born..... | ..... | ✓ | P29 | Means of transportation to work..... | ..... | ✓ |
| P10 | Country of birth of father..... | ..... | ✓ | P30 | Worked or did not work in 1959..... | ..... | ✓ |
| P11 | Country of birth of mother..... | ..... | ✓ | P31 | Number of weeks worked in 1959..... | ..... | ✓ |
| P12 | Year moved into this house..... | ..... | ✓ | P32 | Income in 1959 from wages or salary..... | ..... | ✓ |
| P13 | Place of residence on April 1, 1955..... | ..... | ✓ | P33 | Income in 1959 from self-employment..... | ..... | ✓ |
| P14-15 | Highest grade of school completed..... | ..... | ✓ | P34 | Income in 1959 from other sources..... | ..... | ✓ |
| P16 | School attendance since Feb. 1, 1960..... | ..... | ✓ | P35 | Military service of men..... | ..... | ✓ |
| P17 | Attended public or private school..... | ..... | ✓ | P36 | Citizenship ⁵..... | ✓ | ..... |
| P18 | Whether married more than once..... | ..... | ✓ | HL7-18 | Farm residence ⁶..... | ..... | ✓ |
| P19 | Date of first marriage..... | ..... | ✓ |  |  |  |  |
| P20 | Children ever born to ever married women..... | ..... | ✓ |  |  |  |  |

¹ Numbering of items as shown on the FOSDIC schedules and on many, but not all, of the other data-collection forms.

² See forms for exact wording of the items, in appendix I.

³ Forms 60PH-1, 60PH-2, 60PH-5, and 60PH-6.

⁴ Forms 60PH-3, 60PH-4, 60PH-7, and 60PH-8.

⁵ This item, which was collected only in New York State and Puerto Rico, was covered on a 100-percent basis. It appears on FOSDIC schedules 60PH-1NY and 60PH-2NY and on Advance Census Reports 60PH-5NY and 60PH-6NY.

⁶ This item, which was included in the housing section of the appropriate data-collection forms, was covered on a 25-percent sample basis. It appears on FOSDIC schedule 60PH-3 and Household Questionnaire 60PH-7.

In the field of employment statistics, the coverage of the questions on occupation, industry, and class of worker was broadened to include persons not in the labor force at the time of the census who had worked at any time in the preceding 10 years. The addition of a new question, "for whom did he work," made possible the use of "Company Name Lists" by the coders. These lists included the names of all manufacturing employers of 50 or more employees and all businesses having 100 or more employees and the associated industry code for each, thus making the industry coding faster and more precise. A question on "year last worked" was included in the census for the first time in 1960, primarily to provide a means of evaluating the current applicability and significance of the inventory of occupational skills for those persons not currently in the labor force and of presenting basic data for analysis of the labor reserve. It provided some indication of the duration of unemployment for persons currently seeking jobs, at least for those who were regular members of the labor force. Finally, it served as a basis for editing the entries for some persons who were erroneously reported as "having a job but not at work" even though they had not actually worked for some time.

Data on mother tongue of the foreign born were obtained in 1960. Data on mother tongue were collected in 1940 and in several preceding censuses but not in 1950. This question was included again to supplement the data on country of origin and to provide some information on language facility.

In order to help improve the quality of the age statistics, the 1950 question on age at last birthday was replaced by one on month and year of birth. It was believed that the use of self-enumeration coupled with the wording of the question in terms of date of birth would result in fewer errors in age reporting.

A question on date of first marriage was substituted for the 1950 question on duration of current marital status.

In the 1950 census, members of a household were classified in the farm population if the householder answered affirmatively the question "Do you live on a farm?" In 1960, the farm population included the people who lived on farms as defined by the twin criteria, developed for the census of agriculture, of acreage and value of sales of farm products. The questions used to determine whether a household was on a farm were in the housing portion of the schedule.

Essentially unchanged items.--Inquiries which were much the same or the same in 1960 as in 1950 were the following: relationship to head of household, sex, color or race, marital status, whether married more than once, place of birth, country of birth of parents, number of children ever born to women ever married, hours worked in preceding week, occupation, industry, class of worker, weeks worked in preceding year, income, and veteran status.

1950 items omitted in 1960.--The question on citizenship of the foreign born was dropped. However, citizenship data were obtained in New York State, at the expense of the State, to meet State constitutional requirements for State legislative apportionment. The question on duration of unemployment was omitted in 1960, primarily because of the problem of timeliness of the data, and partly because of the high nonresponse rate in 1950. The question on whether a migrant previously had lived on a farm was dropped, partly because of problems in defining farm residence 5 years earlier.

New items considered but not included in 1960.--A great many new population items were suggested. The most seriously considered of those which were omitted from the 1960 census was a question on religion. The inquiry on religion was omitted because of the opposition of some persons and groups, as a matter of principle, to the inclusion of such a question in a decennial census for which replies are mandatory, and the possibility of delays to the whole census operation from court cases, or lack of cooperation in some geographic areas, or requests that answers to this and other questions be made voluntary.

A number of education items were proposed but not accepted for inclusion in the census. These included enrollment in adult education programs and in correspondence courses, academic degrees ever received and fields of study, and academic attainment in other than regular schools and colleges. These subjects were rejected as census items largely because pretests and other information had shown that there would be special problems in definition and classification, in recalling such information, and in reporting these types of data for other persons.

A proposal to obtain separate data on income from farming was omitted largely because the cost would have been more than seemed justified by the utility of the item. Also, the 1960 data do show the total income of persons living on farms, though this includes income from other sources.

A question on secondary occupations was omitted because of the very high expense that would have been involved since the responses would have had to be clerically coded into the detailed occupational classification if the data were to be of much use for analysis.

A question on medical insurance was omitted because of the high cost of obtaining and classifying the information; it was expected that many people would answer by naming a company or program or by saying their office carried some type of insurance for them but they did not know just what was covered.

An item on wealth was rejected because of problems of clarifying the concept enough to obtain the information with simple questions.

A question on blood type, desired particularly by health and civil defense authorities, was omitted because most people would not have known their blood type.

Separate identification of migratory farm workers was not attempted in the census because of severe problems in identifying them.

Housing Items

A list of the items in the 1960 Census of Housing, and the percent of housing units for which each item of information was collected, is shown in Table B, "Housing Items of Data Collected."

Items H43-H46 were the following:

- Monthly cost of electricity (in addition to rent)
- Monthly cost of gas (in addition to rent)
- Monthly cost of water (in addition to rent)
- Annual cost of other fuel (in addition to rent)

These items were used in computing gross rent, and the data collected were not published separately.

Table B.--Housing Items of Data Collected

| Item number ¹ | Item ² | Items collected for 100 percent of the housing units | | Items collected for a sample of housing units ⁶ | | | |
|--------------------------|---|--|-----------------------------|--|-------------------------------|--------------------------------|--------------------------------|
| | | | | General | | "Block city" ⁵ | |
| | | General ³ | "Block city" ^{4 5} | 20-percent sample ⁷ | 5-percent sample ⁸ | 20-percent sample ⁹ | 5-percent sample ¹⁰ |
| H3 | Type of housing unit..... | ✓ ¹¹ | ✓ ¹¹ | ..... | ..... | ..... | ..... |
| H4 | Access to unit..... | ✓ ¹¹ | ✓ ¹¹ | ..... | ..... | ..... | ..... |
| H5 | Kitchen or cooking equipment..... | ✓ | ✓ | ..... | ..... | ..... | ..... |
| H6 | Condition of housing unit..... | ✓ ¹¹ | ✓ ¹¹ | ..... | ..... | ..... | ..... |
| H7 | Occupancy..... | ✓ ¹¹ | ✓ ¹¹ | ..... | ..... | ..... | ..... |
| H8 | Number of rooms..... | ✓ | ✓ | ..... | ..... | ..... | ..... |
| H9 | Running water..... | ✓ | ✓ | ..... | ..... | ..... | ..... |
| H10 | Flush toilet..... | ✓ | ✓ | ..... | ..... | ..... | ..... |
| H11 | Bathtub or shower..... | ✓ | ✓ | ..... | ..... | ..... | ..... |
| H12 | Tenure..... | ✓ | ✓ | ..... | ..... | ..... | ..... |
| H13 | Vacancy status..... | ✓ ¹¹ | ✓ ¹¹ | ..... | ..... | ..... | ..... |
| H14, H39 | Description of property ¹²..... | ..... | ✓¹¹ | ✓ ⁱⁱ | ✓ ⁱⁱ | ..... | ..... |
| H15, H40 | Value of property ^{12 13}..... | ..... | ✓ | ✓ | ✓ | ..... | ..... |
| H16, H41 | Rent ¹³..... | ..... | ✓ | ✓ | ✓ | ..... | ..... |
| H17, H18, and H42 | Farm residence ¹³..... | ..... | ..... | ✓ | ✓ | ..... | ..... |
| H19 | Number of bedrooms..... | ..... | ..... | ..... | ✓ | ..... | ✓ |
| H20 | Year structure was built ¹³..... | ..... | ..... | ✓ | ✓ | ..... | ✓ |
| H21 | Heating equipment ¹³..... | ..... | ..... | ✓ | ✓ | ..... | ✓ |
| H22 | Fuels used for heating, cooking, hot water..... | ..... | ..... | ..... | ✓ | ..... | ✓ |
| H23 | Washing machine..... | ..... | ..... | ..... | ✓ | ..... | ✓ |
| H24 | Clothes dryer..... | ..... | ..... | ..... | ✓ | ..... | ✓ |
| H25 | Television..... | ..... | ..... | ..... | ✓ | ..... | ✓ |
| H26 | Radio..... | ..... | ..... | ..... | ✓ | ..... | ✓ |
| H27 | Air conditioning..... | ..... | ..... | ..... | ✓ | ..... | ✓ |
| H28 | Food freezer..... | ..... | ..... | ..... | ✓ | ..... | ✓ |
| H29 | Number of units in structure..... | ..... | ..... | ✓ | ..... | ..... | ..... |
| H30 | Number of bathrooms..... | ..... | ..... | ✓ | ..... | ..... | ..... |
| H31 | Source of water..... | ..... | ..... | ✓ | ..... | ..... | ..... |
| H32 | Sewage disposal..... | ..... | ..... | ✓ | ..... | ..... | ..... |
| H33 | Basement..... | ..... | ..... | ✓ | ..... | ..... | ..... |
| H34 | Elevator in structure..... | ..... | ..... | ..... | ..... | ..... | ..... |
| H35 | Telephone available ¹³..... | ..... | ..... | ✓ | ✓ | ..... | ✓ |
| H36 | Automobiles..... | ..... | ..... | ..... | ✓ | ..... | ..... |
| H37 | Mobility of trailers ¹³..... | ..... | ..... | ..... | ✓ | ..... | ..... |
| H38 | Duration of vacancy ¹³..... | ..... | ..... | ✓¹⁴ | ✓ ¹⁴ | ..... | ✓¹⁴ |
| H43 to H46 | Utilities and fuel paid in addition to rent (to compute gross rent) ¹³..... | ..... | ..... | ✓ | ✓ | ..... | ✓ |

¹Numbering of items as shown on the FOSDIC schedules and on many, but not all, of other data-collection forms.

²See forms for exact wording of the items.

³Forms 60PH-1 and 60PH-5.

⁴Forms 60PH-2 and 60PH-6.

⁵Cities for which data were to be published by city block.

⁶The sample data were collected from 25 percent of the households, but most were transcribed and tabulated for only a 20-percent sample, on FOSDIC schedules 60PH-3(20) and/or 60PH-4(20), or a 5-percent sample, on FOSDIC schedules 60PH-3(5) and/or 60PH-4(5). Items for which a 25-percent sample was tabulated were transcribed on both FOSDIC schedules 60PH-3(20) and 60PH-3(5), in "general" areas, and/or 60PH-4(20) and 60PH-4(5) for "block cities".

⁷Forms 60PH-3(20) and 60PH-7.

⁸Forms 60PH-3(5) and 60PH-8.

⁹Forms 60PH-4(20) and 60PH-8.

¹⁰Forms 60PH-4(5) and 60PH-8.

¹¹Not on Advance Census Reports 60PH-5 and/or 60PH-6. Information entered by enumerator on FOSDIC schedules 60PH-1 and/or 60PH-2 on basis of observation.

¹²Collected for housing unit if "owned or being bought" or "vacant--for sale only".

¹³Items with a "✓" in both the 20-percent and the 5-percent columns were tabulated on a 25-percent basis.

¹⁴Not on Household Questionnaires 60PH-7 or 60PH-8. Information entered by enumerator on FOSDIC schedules 60PH-3 and 60PH-4.

The question on elevators, item H34, dealt with the presence of a passenger elevator for housing units in buildings of four stories or more. It was preceded by a screening question on the number of stories.

The item on farm residence (H17, H18, and H42) consisted of several questions designed to determine whether the housing unit was on a farm (see below).

New and revised items.-- There were 17 new housing items. Two of them, on access to unit and on cooking equipment, were used for identification of a housing unit. Ten of the new items were on facilities and equipment: water heating fuel, clothes washing machine, clothes dryer, air conditioning, home food freezer, number of bathrooms, source of water, sewage disposal, telephone, and automobiles. Four items were to provide new structural statistics: number of bedrooms, basement, elevator, and mobility of trailers. A new item on duration of vacancy of vacant housing units was included to provide new information on occupancy and utilization of housing units.

The items used to determine farm residence dealt with (1) whether the housing unit was on a city lot, (2) acreage, (3) gross sales of agricultural products in 1959, and (4) if the housing unit was rented, whether the rent included land used for farming. These questions, which were asked in designated ED's only, were designed to determine whether the housing unit was on a farm, for identification of the farm population and for classification of the housing unit as rural farm or rural nonfarm. They replaced the 1950 census questions, "Is this house on a farm (or ranch)?" and "(if no) Is this house on a place of three or more acres?"

Ten items which were similar in substance to questions asked in 1950 were somewhat modified for the 1960 census, either by dividing or combining categories or, in one case, by a change in screening questions.

In the item on "type of housing unit," the 1950 category tent, boat, railroad car was combined with house, apartment, flat. The 1950 category nondwelling unit quarters . . . was changed to some degree by the change from "dwelling unit" to "housing unit" as the unit of measurement in 1960, and was renamed group quarters.

For the item on condition of housing unit, the 1950 category not dilapidated was divided into sound and deteriorating. The 1950 category dilapidated was unchanged in 1960.

For information on occupancy, categories were added to determine whether vacant units were (1) year-round units, (2) units for migratory workers, or (3) seasonal units.

The 1950 categories flush toilet outside this structure and privy, outhouse, or chemical toilet were combined with no toilet for this unit. The 1950 category flush toilet inside this structure was divided into for exclusive use and shared. (Sharing was covered by a separate item in 1950.)

To obtain data on vacancy status, the 1950 category not for sale or rent was divided into rented or sold--not occupied, occasional use, and other vacant.

For the item on "description of property," the screening questions to eliminate multiunit properties, and properties with business premises from the tabulation on value of property were consolidated and simplified. The item was unchanged in concept.

The categories were changed from those used in the 1950 census for the question on the year the structure was built.

For data on heating equipment, the 1950 category warm air furnace was divided into warm air furnace with registers in individual rooms and floor, wall, or pipeless furnace. A new category, built-in electric units, was separated from the 1950 category other means without flue. Information on heating equipment was collected for vacant as well as occupied units in 1960, but only for occupied units in 1950.

For both the radio and television items, a distinction was made in 1960 between one set in the housing unit and two or more sets.

Unchanged items.-- There were 13 items which were the same in 1960 as in 1950. They were on number of rooms, water supply, bathing facilities, tenure, heating fuel, cooking fuel, number of units in structure, value, contract rent, monthly cost of electricity to renters (in addition to rent), monthly cost of gas to renters (in addition to rent), monthly cost of water to renters (in addition to rent), and annual cost of fuel oil, coal, wood, etc. (in addition to rent).

1950 items omitted in 1960.-- Six questions asked in 1950 were omitted in 1960: Three of them were omitted because improved housing since 1950 had resulted in their no longer being of importance in most localities, two were omitted because experience showed they did not yield useful data, and one was omitted because it was in the field of residential finance for which information was being obtained otherwise.

The first of these groups consisted of questions on the presence of a kitchen sink, presence of electric lighting, and type of refrigerator. They were omitted in 1960 because they had ceased to be effective indicators of housing quality.

The items omitted because of lack of usefulness were screening questions for rented units, the first of which had inquired whether the unit was rented furnished or unfurnished, and which was followed by a question for the furnished units, "What would it rent for monthly if unfurnished?" These questions were omitted in 1960 because the figures for hypothetical rent on an unfurnished basis were regarded as unreliable and hence of comparatively little value, and because of the diversity of services and facilities included in monthly rent (garage or parking lot space, announcement of callers, equipment items such as dishwashers, etc.) for which accurate adjustment was impossible.

The 1950 question asked of owner-occupants of non-farm dwelling units, "Is there a mortgage (trust) on this property?" had no counterpart in the 1960 general census of housing. Information on residential finance was obtained for 1960 in the sample survey called Survey of Components of Change and Residential Finance (see part II, chapter 3).

New items considered but not included in 1960.-- Many new items were proposed for inclusion in the 1960 Census of Housing. A considerable number of them were given careful consideration by the Housing Advisory Committee and the Bureau staff, and some of them were tested in the field in census pretests, or in small-scale tests in or near Washington. Other proposed items were not given serious consideration for any of several reasons, the most common of which were that the item was of insufficient general usefulness to justify inclusion or that accurate responses would require more knowledge than could be expected of respondents and enumerators in a general census.

Two items omitted would have been designed to give information on the environs of the housing unit. One, to distinguish, in unincorporated communities, between housing units in open country and housing units in communities of less than 1,000 inhabitants, was omitted because of unsolved problems in defining small rural unincorporated communities. Another, to evaluate the neighborhood, was omitted because no meaningful criteria were developed which were simple enough and specific enough for use by enumerators.

Questions to obtain counts and information on characteristics of residential structures, distinguishing between garden-type apartment buildings and other multifamily buildings, were omitted because of budgetary limitations, as were questions to obtain counts and information on characteristics of nonresidential structures.

An item on exterior materials of structures was omitted because it would have presented difficulties in enumeration and tabulation with resulting uncertainties in interpretation of the data. Specific problems foreseen included cases of mixed construction (part frame and part masonry or masonry veneer), the covering of exteriors with stucco or materials made in imitation of stone and brick, and the inability of enumerators to distinguish some of the newer materials (factory-finished aluminum drop siding, for example) from conventional materials which they resemble.

A question on basement shelter areas was omitted because of problems in enumeration. In a field test, enumerators and respondents had great difficulty in using Civil Defense Administration criteria on what to classify as a basement shelter area.

A question on floor area was regarded as potentially valuable, but was omitted because of the problems of taking measurements and the inaccuracy of area figures not based on measurements.

An item to obtain additional information on dormitories and other living quarters for migrant farm workers was omitted because of (1) additional training that would have been required by enumerators, (2) problems in identifying the units during enumeration, (3) the complexity of the screening procedures that would have been required to include this special type of group quarters but to exclude other types, (4) the necessity of either having several additional questions on the general schedule or using additional schedule forms to obtain the information, (5) the additional complexity of the tabulation procedures that would have been required, and (6) the small number of such living quarters.

A similar item on dormitories and other living quarters for college students was omitted for much the same reasons as the one for migrant farm workers.

Questions on public housing units as a type of living quarters to be tabulated separately were omitted because these housing units have no unique physical characteristics whereby they differ from others and the occupants require basically the same type of housing accommodations as do other households. This distinction, therefore, would have been basically unlike any other recognized by the census.

There were a number of items on facilities and equipment which were considered. One on type of hot water heater was omitted because many respondents and enumerators probably would not have known the answer and because of complications presented by summer-winter systems as well as the relatively minor importance of the item. One on whether the supply of piped hot water was continuous was omitted because of lack of precision in the concept (what interruptions are consistent with a continuous supply?).

A question on household dishwashers was omitted because it was considered less important than others that were competing for space on the schedule. One on home parking facilities was omitted because the detail needed to make this item useful to its sponsors (local planning officials) would have required more schedule space and interview time than could be assigned.

A question on sink garbage disposal units was omitted because these devices are illegal in a number of places, and it would have been undesirable to ask a respondent to identify himself as violating a local law or ordinance.

An item on the incidence of septic tank failures was omitted because of the extremely high cost of enumeration. Small-scale field testing of the item supported previous opinion that the data would be easy to collect, but virtually all of the respondents who had experienced septic tank failure wanted to narrate their experiences in detail, often with requests for advice on remedial action and on legal action against those from whom they had purchased houses, etc.

THE PRETESTS

Extensive testing of alternative census procedures had been carried out as a part of the 1950 census operations. In addition, the evaluation and research program conducted as part of the 1950 censuses provided valuable guides in planning the 1960 censuses.

From early 1957 through the fall of 1958, several formal pretests of both population and housing were carried out in the United States--in Yonkers, N.Y., Philadelphia, Pa., Memphis, Tenn., Lynchburg, Va., Dallas, Tex., and Martinsburg, W. Va.--and in February 1959 the procedures planned for the 1960 censuses were tried out in North Carolina. Population census pretests were conducted in Indianapolis, Ind., in October 1957, and in Hartford City, Ind., in November 1957; and housing census pretests were conducted in Ithaca, N.Y., in April 1958, Danville, Ill., in July 1958, and Washington, D.C., in September 1958. There was also a population and housing pretest in Puerto Rico (see Chapter 11, Puerto Rico).

In most cases the pretests were conducted in connection with a special census undertaken by the Bureau at the request and expense of a city, with the supplemental costs of the pretest paid by the Bureau. By taking advantage of the fact that a special census was being taken, the Bureau saved some money and gained some advantage from the fact that the special census situation simulated as closely as possible the decennial census situation.

Advantage was taken of special supplemental inquiries to the Current Population Survey, a monthly sample field survey conducted by the Bureau, to test some questions and some procedures.

An agriculture census pretest conducted in several counties in November 1958 included a test on farm-nonfarm residence questions.

Each of these pretests required preparation before the field enumeration--schedules were printed, manuals and training materials prepared, enumerators hired, and time and cost records maintained--and work after the enumeration, with the data and the records, for summarizing and analyzing the results.

There were also numerous small-scale tests consisting of a number of interviews conducted by the Washington staff, to try out the various forms of question wording prior to their use in more formal, large-scale tests.

The major pretests of census procedures are described in appendix B.

BUDGET AND COST ALLOCATIONS

Financial considerations were fundamental in the planning and management of the censuses. To avoid budgetary uncertainties during planning, the Bureau in 1956 initiated work to develop a cost target acceptable to the Secretary of Commerce, the Bureau of the Budget of the Executive Office of the President, and Congress. At that time the cost of repeating the 1950 decennial census, including the census of agriculture as well as the censuses of population and housing, was estimated at about \$120 or \$125 million, at current price levels and taking into account the anticipated increase in the population. After consideration of alternative plans ranging from a minimal census which would cost approximately \$80 million to an expanded census which would cost approximately \$162 million, the Secretary of Commerce and the Bureau of the Budget agreed in 1957 to a cost target of \$110 million proposed by the Bureau of the Census and representing a census of approximately the same size, scope, and data content as the 1950 census taking into account anticipated savings from (1) greater use of sampling, (2) extensive use of new electronic equipment, and (3) increased efficiency in clerical and other operations. The Congress accepted the plan.

Financial control in the Bureau was achieved by subdividing the total cost target into cost targets for specific activities and programs. These amounts were allocated for planning purposes to the officials responsible for directing the various activities. A Budget Clinic, com-

posed of officials of the divisions and offices involved in the census work, regularly reviewed the budget allocations in relation to work plans and objectives and made recommendations for changes in the levels of operation and in the balance between competing programs when it appeared desirable. A number of changes were made in the budget allocation by program during the course of the work; some were dictated by actual cost experience, others by planned changes in the methods of operation or in the program, and some by statutory increases in pay and allowances.

An increase from the original target figure of \$110 million to the December 1958 estimate of \$118 million was due to the general Government pay raise of June 1958. A second increase to an estimate of \$128 million was due partly to a pay raise but principally to higher costs of the field enumeration than had been expected. Serious enumeration problems in the large cities made completion of the population and housing enumeration much more difficult and time consuming than had been anticipated, and resulted in substantially increased costs over those included in budget estimates and amounts appropriated for payments to enumerators and other field personnel and for field office operating expenses. The Congress granted relief with a supplementary appropriation of \$8.5 million.

The amounts appropriated by Congress each year for the Eighteenth Decennial Census (which included the censuses of agriculture, population, and housing) are shown in appendix H, table 1.

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Chapter 3. Sampling and Estimation

SAMPLE DESIGN

Basic 25-Percent Sample

The basic sample for the 1960 Censuses of Population and Housing was a 25-percent sample selected from the complete listing of all housing units and group quarters. For housing units and for persons living in housing units, the sampling unit was the housing unit and all its occupants. For persons living in group quarters such as barracks and institutions, the sampling unit was the person.

The enumerator was instructed to assign a key letter (A, B, C, or D) sequentially to each housing unit in the order in which he first visited the units, when he recorded the address in his listing book. He assigned the key letter at this time whether or not he completed an interview. Each enumerator was given a random key letter (determined from the last two digits of the enumeration district (ED) number) to be assigned to the first housing unit visited. Each housing unit which was assigned the sample key letter "A" was designated as a sample unit and all its occupants were included in the sample. The order of canvassing was indicated in advance, although the instructions were not so explicit but that some latitude was allowed in the order of visiting individual units at an address.

In group quarters, the sample consisted of every fourth person in the order listed. Asterisks printed in the first column of lines 2, 6, 10, 14, and 18 on the 100-percent FOSDIC schedules designated as sample persons the persons in group quarters who were enumerated on those lines. No housing data were collected for group quarters.

Subsamples

The 25-percent sample of housing units and persons was subsampled for either one of two purposes: (a) collection of additional information, or (b) efficient tabulation of data for large areas.

Housing, 5-percent and 20-percent samples.--The FOSDIC schedules for the 25-percent sample of households and housing units were bound in enumeration books which were so arranged that every fifth schedule carried housing questions comprising the 5-percent sample housing items; the other four-fifths carried housing questions comprising the 20-percent sample housing items. Questions which appeared on both types of schedules comprised the 25-percent sample items. Data for sample housing items, therefore, were collected for 5, 20, or 25 percent of the housing units.

Population, 5-percent sample.--While the bulk of the tabulations for the 1960 Census of Population are from the complete count and the 25-percent sample of population, a subsample of one-fifth of the original 25-percent sample schedules was selected for some of the subjects in volume II. The subsample was selected on the computer, using a stratified systematic sample design. The basic strata used comprised 38 groups for each of the weighting areas. The 38 groups were the following: For persons in regular housing units there were 9 groups by size of household--from 1 to 9 or more members--each group divided into 4 parts, by tenure (owner, renter) and by color (white, nonwhite); for persons in group quarters there were 2 groups, by color (white, nonwhite). The selection of the 1-in-5 sample of each group was continuous from one area to another within a State.

Some tabulations which include both population and housing items for volume II of the population census results are based on either a 1-percent sample or a 4-percent sample instead of the full 5-percent sample. This subdivision of the 5-percent population sample arises from the fact that some of the persons in the sample were in housing units which were in the 20-percent housing sample and others were in housing units which were in the 5-percent housing sample.

Subsampling for tabulation and publication.--Data for an item collected on a 100-percent basis were usually but not always tabulated on a 100-percent basis. The exceptions were usually tabulations for large areas or cross-tabulations of an item collected on a 100-percent basis with one collected on a sample basis. Similarly, data for an item collected on a sample basis were usually but not always tabulated for the full sample collected. Consequently, the same item was sometimes tabulated at different sampling rates; i.e., all the data collected for a particular item were tabulated for some tables and only a sample of the data collected for the same item was tabulated for other tables. For example, for volume I of the Census of Housing, data on number of rooms, which were collected on the 100-percent schedules and transcribed to the sample schedules, were tabulated on a 100-percent basis for vacant housing units but only the data in the 25-percent sample were tabulated for this item for occupied units.

Sampling ratios of the tabulations in the major census publications are as follows regardless of the percent of the units for which the data were collected:

| Publication | Complete-count data | 25-percent sample | 20-percent sample | 5-percent sample |
|-----------------------|---------------------|-------------------|-------------------|------------------|
| Population | | | | |
| Volume I: | | | | |
| Chapter A..... | ✓ | | | |
| Chapter B..... | ✓ | | | |
| Chapter C..... | ✓ | | | |
| Chapter D..... | | ✓ | | |
| Volume II..... | | ✓ | | ✓ ¹ |
| Volume III..... | ✓ | ✓ | | |
| Housing ² | | | | |
| Volume I..... | ✓ | ✓ | ✓ | ✓ |
| Volume II..... | | ✓ | ✓ | ✓ |
| Volume III..... | ✓ | | | |
| Volume VI..... | | ✓ | ✓ | ✓ |
| Volume VII..... | | ✓ | ✓ | |
| Census tract reports | | | | |
| Population items..... | ✓ | ✓ | | |
| Housing items..... | ✓ | ✓ | ✓ | ✓ |

¹ The 5-percent population sample was independent of the 5-percent housing sample. Some tabulations were based on 1- or 4-percent samples. See section above.

² Volumes IV and V of the Census of Housing contain the results of the Survey of Components of Change and Residential Finance (SCARF). The SCARF samples are described in part II of this Procedural History.

Comparison with 1950 Sampling Plan

The use of the housing unit as the basic sampling unit provided a better basis for tabulating household and family statistics than did the sampling plan for the 1950 censuses. In 1950, the population sample was designed to include every fifth person regardless of his living arrangements.¹ Thus, only one member of a household containing 5 or fewer persons could be included in the sample, and only one or two members of a household containing 6 to 10 persons were included in the sample. This handicap to the analysis of household and family statistics was overcome in 1960 by selecting for the population sample all persons in the sample housing units. However, collecting sample data for whole households had the effect of "clustering" persons, which increased the sampling variability of the data for some items. This was one of the factors that led to the enlargement of the basic sampling fraction from 20 percent in 1950 to 25 percent in 1960.

The 20-percent housing sample in the 1950 censuses was selected in a different way from the 20-percent population sample. In 1950 the housing sample questions were divided into five groups, and each group of items was asked at one-fifth of the housing units. The result was five 20-percent samples, each providing sample data for a different group of housing items. This procedure meant that cross-tabulations of sample items were limited to those housing items obtained for the same one-fifth of the housing units. This limitation was removed to a large extent for the 1960 sample data. All of the items collected for the 25-percent sample were obtained for the same households and housing units. The 20-percent and 5-percent sample housing items were subdivisions of the 25-percent sample, and therefore cross-tabulations between items from these two samples were not possible. However, because both the 20-percent and 5-

percent samples were subsamples of the 25-percent sample, cross-tabulations were possible between 20-percent and 25-percent sample items and between 5-percent and 25-percent sample items.

Summary of Sampling Ratios Actually Obtained

Although the 1960 sampling procedure did not automatically insure an exact 25-percent sample of persons or housing units in each locality, the sample design was unbiased if the sample selection was carried out according to instructions. However, the selection of the sample by the enumerator at the time he was canvassing and listing housing units created opportunities for undetected biases to occur, and made control more difficult. In multiunit structures especially, where the enumerator's instructions as to the order of listing the individual units did not cover all situations, and to some extent in regard to other housing units also, the enumerator had some opportunity to determine which housing units were selected for the sample, and might, for example, have altered the order of enumeration (consciously or unconsciously) to include in the sample, or to exclude from the sample, a household where no one was at home or where he might have some reason to anticipate difficulty in getting cooperation. In planning the census the decision was made to take the risks of such biases, and to attempt to introduce controls that would insure that they were small. The alternative was to draw the sample after the initial census canvass was completed in an area, and this would have substantially increased costs.

For large areas the deviation from 25 percent was generally found to be small. Small biases arose, however, where enumerators failed to follow exactly the instructions for listing housing units and for selecting every fourth housing unit for the sample. The unweighted sample comprised 24.71 percent of the total population in the United States as a whole and 24.53 percent of the total households.

¹ However, in the 1950 census, to obtain information on income of families, the income questions were repeated for the other family members as a group if the person in the 20-percent sample was the head of a primary or secondary family.

The sample data finally processed contained some adjustments of the original sample data received from the field. Before the final processing, some sample schedules were duplicated and others were cancelled to compensate for detected bias. The magnitude of these adjustments was relatively small. The ratios of some final processed sample population and housing groups, before ratio estimation, to the complete counts for the United States as a whole are shown below. These figures provide an indication of the sampling ratios that were actually obtained at the U.S. level.

| Group | Ratio, processed sample to complete count |
|---------------------------------------|---|
| Total population | .2494 |
| Heads of households | .2482 |
| Other members of households | .2499 |
| Males | .2488 |
| Females | .2500 |
| Whites | .2497 |
| Nonwhites | .2468 |
| Total housing units | .2486 |
| Owner-occupied | .2492 |
| Renter-occupied | .2466 |
| Vacant | .2524 |

CHECKING THE SAMPLE

Quality Control of Sample Selection

The initial control on the sampling was done by the crew leader (the enumerator's immediate supervisor) and by the field office, as part of the quality control system established for the enumeration. (See section on "Quality Control Procedures" in chapter 7.

Telegraphic Clearance of Preliminary Field Counts

The District Supervisors telegraphed the preliminary field counts of population and housing units to Washington headquarters of the Bureau for clearance before announcing them to newspapers and local officials and before shipping the enumeration books to the data-processing center in Jeffersonville. (See section on "Preliminary Population Announcements" in chapter 7.)

The telegrams contained counts of total population, total housing units, sample population, and sample housing units for each of the 3,583 prefix areas² in the United States.

For a check on possible significant bias in the sample data, the counts of sample population and housing units were multiplied by 4. If the difference between the inflated sample and the complete count fell within a predetermined range (3 sigma), the inflated sample and the complete count were considered internally consistent.

Cases of inflated sample counts that fell outside the tolerance limits were reviewed. Counts which were only slightly above or below the tolerance limits frequently were cleared for release immediately upon review. For other areas, telegrams were sent to the District Office

²A prefix area consisted of either a complete county, a city of 50,000 inhabitants or more, or that portion of a county which lay outside a city of 50,000 inhabitants or more. For an explanation of the term "prefix area," see the section on "Numbering ED's" in chapter 4.

supervisors requesting that they defer shipment of the enumeration books for the area in question. District Offices were then asked to verify the totals from the ED Control Register, which was a list of all the enumeration districts (ED's) in the prefix area with the counts of total and sample population and housing units for each ED. If this procedure did not result in a corrected figure, the District Offices were asked to examine the ratio of sample cases to the complete count for each ED, to identify the problem ED's, and then to review the material for these ED's to determine the nature of the problem. Whenever possible, the problems in these areas were resolved by the District Office before the stage I complete-count materials were shipped to the processing office.

Household-Size Bias Check

General.--In general, when a household sample is selected, the percentage distribution of sample households by number of persons per household should vary from the corresponding distribution for all households in the same area only because of sampling variability. Past experience of the Bureau had indicated that bias in sample selection by household size might be due to the work of a small number of enumerators and, therefore, concentrated in local areas. Since many characteristics vary in proportion to household size, it was considered desirable to identify any areas where an inadequate size distribution occurred in the sample and reduce the effect of this bias, if possible.

One method considered was to have the electronic computers perform the household-size bias check as a stage of ratio estimation. Since it would have been impractical to select only problem areas for such an additional stage of ratio estimation, it would have been necessary to use this additional stage in the estimation procedure for all areas in the United States. However, it was decided to use characteristics other than household size in the ratio-estimation procedure because of greater potential advantage. The approach used for the 1960 censuses was to identify local problem areas for clerical correction prior to computer processing.

For those areas for which the population or housing sample was not within acceptable limits, the individual ED's producing the observed deviations were identified. A sufficient number were adjusted, by means of cancelling some households and duplicating others, to bring the samples for the area within the accepted limits. This cancellation and duplication was done in accordance with expected frequencies of household size based on the complete counts.

This procedure produced changes in the sample data for slightly less than 3,000 ED's, or about 1 percent of the ED's in the United States. Although the number of changes for the United States was relatively very small, the affected small local area statistics are believed to be significantly improved.

Procedure.--For purposes of the household-size bias check, a "separate publication area" (SPA) was defined as (1) any incorporated place of 2,500 or more population and (2) the remainder of the county or equivalent civil division.

In order to proceed with the project, using materials in almost constant use for other phases of the census processing, either of two sources of data was used in the compilation of SPA counts, depending on availability: the ED Control Registers sent in from the District Offices giving total and sample population and housing counts for each ED (with the ED's listed by geographic areas), or the Advance Transmittal Listings from the District

Offices giving the same population and housing counts for each ED (with the ED's listed by ED number within each prefix area).

In order to provide a basis for rapid decision on the acceptability of the sample for an SPA, two tables of tolerances were developed. The first, for population totals, showed 3σ (standard deviation) values for testing whether the sample population departed by greater than sampling variability from the complete count. These values of 3σ were estimated from the approximation $4\sqrt{P_t} (P_t/H_t)$ where P_t is the complete count of the population of the area and H_t is the complete count of the number of housing units. These values of 3σ for various values of P_t and P_t/H_t were entered in the table. In the other table of tolerances, for housing units, the values in the table were simply three times the number of ED's in the SPA.

In general, SPA totals were used for checking whether the sampling in the entire SPA and its components should be considered acceptable. For the population sample, the absolute value of the difference between P_t and $4P_s$ (where P_s was the sample count of population for the SPA) was compared with the tolerance value in the table. If this difference was equal to or less than the tolerance value, the population sample for the SPA was accepted; if the difference was greater, the SPA was designated for further review.

For the housing sample, the absolute value of the difference between H_t and $4H_s$ (where H_s was the sample count of housing units for the SPA) was compared with the tolerance value. The decisions to accept or reject were made in a manner similar to that for population.

In those cases where SPA totals were not available from the ED Control Registers, the county totals were checked. If these comparisons proved acceptable, no SPA totals within the county were cumulated. If the comparisons indicated that the sample counts required further checking, separate SPA totals were obtained and checked.

When SPA totals of the sample counts were unacceptable, a listing was made of the minimum number of ED's within the SPA whose deviations between actual and expected samples, taken jointly, were sufficient to account for the difference beyond tolerance levels in the SPA.

Each of the ED's which had to be investigated was listed on a problem worksheet that contained identification information for the ED. A determination was then made of a subset of those ED's in which adjustment was to be made. For each ED selected, the frequency distribution of households by size was marked to indicate the number of households to be selected at random in a given household-size class for cancellation or replication in order to bring the actual sample frequency in line with the expected.

Since the number of households needed for replication was not always available in a given household-size class, some substitutions were necessary. Substitutions of different household sizes were avoided for the "0" (vacant housing unit), 1-person, and 2-person classes. A deviation of ± 1 was permitted for other classes up to and including 5-person households, and ± 2 for classes of 6-person to 9-person households. Larger households were found so infrequently that a wider range of substitutions had to be used for households containing 10 or more individuals. When replications could not be made within the ED after allowing substitutions, other ED's within the same SPA were selected to yield the necessary replications.

RATIO ESTIMATION

General

In general, the 1960 estimates based on samples were derived by use of a ratio-estimation procedure.³ This procedure has a standard form which is expressed algebraically as:

$$x'' = \sum \frac{x'_i}{y'_i} Y_i$$

where x'' is the estimate resulting after ratio estimation,
 x'_i is the estimate of the characteristic obtained by multiplying the number of persons having the characteristic in the i th ratio-estimation group by the reciprocal of the sampling ratio,
 y'_i is a comparable estimate for all members of the ratio-estimation group, and
 Y_i is the complete count of the ratio-estimation group.

This formula provides an approximate description of the ratio-estimation procedure as actually applied.

History and Purpose

For the 1950 census, the basic sample was a 20-percent sample of persons. Estimates from the sample were obtained by applying a uniform weight of 5 to all sample records.

For the 1960 censuses, with the aid of high-speed computers, it was feasible to use a ratio-estimation procedure. Ratio estimation reduces the components of sampling error arising from variation in size of household and achieves some of the gains of stratification, the strata being the groups for which separate ratio estimates are computed. The net effect is a greater reduction in the sampling error and bias of most statistics than would be obtained by weighting the results of the 25-percent sample by a uniform factor of 4, the 20-percent sample by 5, or the 5-percent sample by 20. The reduction in sampling error is trivial for some items and substantial for some. The ratio-estimation procedure used provided estimates from the sample that generally are in agreement with the counts obtained on a 100-percent basis for total population and housing units for individual small areas; to some extent, estimates from samples are also in agreement with the 100-percent counts for the separate ratio-estimation groups.

Tabulation Areas (Smallest Weighting Areas)

The smallest weighting area (SWA) for which ratio estimates were produced was defined as one or more ED's having geographic contiguity within a State, county, place of 2,500 inhabitants or more, urbanized area, standard metropolitan statistical area (SMSA), or census tract. The SWA's were defined in this manner so that whole SWA's could be combined for the tabulation of data for larger areas.

³For an explanation of ratio estimation, see: Hansen, Morris H., William N. Hurwitz, and William G. Madow, Sample Survey Methods and Theory, Vol. 1, Methods and Applications, New York, John Wiley & Sons, Inc., 1953, pp. 158-177 and 189-200.

Ratio-Estimation Groups

The ratio-estimation plan used for the 1960 censuses involved the determination of integral weights in each of 44 categories of persons and 7 categories of housing units within each of approximately 33,000 geographic areas. The census provided sample counts as well as complete counts of the population by age, sex, and color, and, for heads of households, by whether owners or renters of the housing units occupied. Both complete counts and sample counts of housing units were available by color of the heads of households and whether they were owners or renters, and, for vacant housing units, by whether the unit was (1) for sale only, (2) available for rent, or (3) "other." For each SWA, this information was tabulated separately for the sample and for the complete count of each of these groups, as shown below.

Procedure

The procedure for determining the weights for the 25-percent population sample was as follows: For each of the 44 groups, the ratio of the complete count to the sample count of the population in the group was determined within each SWA. Each specific sample person in the group was assigned an integral weight such that the sum of the weights would equal the complete count for the group. For example, if the ratio for a group was 4.2, one-fifth of the persons (selected at random) within the group were assigned a weight of 5, and the remaining four-fifths a weight of 4. The use of such a combination of integral weights was adopted to avoid the complications involved in rounding for the final tables, even though there was a modest increase in the sampling variability as a result.

The individual weights in one ratio-estimation group for one SWA were summed to produce a "target number." The target number thus was ordinarily the complete count of the population in a particular ratio-estimation group within an SWA, but occasionally differed from this total.

A ratio estimate may be subject to a bias in certain circumstances such as when units have been sampled in clusters, as was the case in the 1960 census population sample which included all persons in a sample household. This bias ordinarily is trivial, but is not necessarily trivial for very small samples. In order to decrease any such bias of the estimation procedure, it was specified that there be at least 50 persons in the complete count in a group and that the weights resulting from the ratio estimates be 16 or less for each person. When these requirements were not met, the original 44 estimation groups were combined in a specific order until each resulting group met both requirements. If any combining was necessary, it was done in the following order until the criteria were met: (a) 25 to 44 years old, and 45 and older; (b) white, nonwhite; (c) 14 to 24 years old, 25 and older; (d) less than 5 years old, and 5 to 13 years old; (e) male, female; (f) for heads of households; owner, renter; (g) for all other members of households except heads: under 14 years old, and 14 and older. Groups of heads of households were never combined with groups of other household members. If the requirements were still not met for one of these two groups after the other combinations had been made, the ratio-estimation criterion requiring 50 cases in the 100-percent data was relaxed. However, a weight of 16 for any one person or housing unit was still the maximum weight used in

RATIO-ESTIMATION GROUPS FOR POPULATION

| Item | Male | | Female | |
|------------------------|-------|----------|--------|----------|
| | White | Nonwhite | White | Nonwhite |
| Under 5 years..... | ✓ | ✓ | ✓ | ✓ |
| 5-13 years..... | ✓ | ✓ | ✓ | ✓ |
| 14 years and over: | | | | |
| Heads of households | | | | |
| Owners | | | | |
| 14-24 years..... | ✓ | ✓ | ✓ | ✓ |
| 25-44 years..... | ✓ | ✓ | ✓ | ✓ |
| 45 years and over..... | ✓ | ✓ | ✓ | ✓ |
| Renters | | | | |
| 14-24 years..... | ✓ | ✓ | ✓ | ✓ |
| 25-44 years..... | ✓ | ✓ | ✓ | ✓ |
| 45 years and over..... | ✓ | ✓ | ✓ | ✓ |
| All other | | | | |
| 14-24 years..... | ✓ | ✓ | ✓ | ✓ |
| 25-44 years..... | ✓ | ✓ | ✓ | ✓ |
| 45 years and over..... | ✓ | ✓ | ✓ | ✓ |

RATIO-ESTIMATION GROUPS FOR HOUSING

| | |
|--|---|
| Vacant housing units | |
| For sale only..... | ✓ |
| Available for rent..... | ✓ |
| Other..... | ✓ |
| Owner-occupied housing units having-- | |
| White heads of households..... | ✓ |
| Nonwhite heads of households..... | ✓ |
| Renter-occupied housing units having-- | |
| White heads of households..... | ✓ |
| Nonwhite heads of households..... | ✓ |

any one sample group in a weighting area. When any distinction was dropped from the classification scheme, modified sample estimates were produced for each of the groups involved by a preliminary ratio-estimation procedure. This involved, essentially, applying to the sample estimates for these groups the ratio of the total of the 100-percent counts of the groups to the total of the sample estimates for these groups. After target numbers for the final combined groups were produced, they were allocated back to the original 44 groups in proportion to the number of adjusted sample cases resulting from the preliminary ratio estimates.

The housing-unit ratio-estimation procedure was similar to that for population, but was independent of the population procedure for an SWA except that the target number for all occupied housing units in the SWA was made to equal the target number for all heads of households in the SWA. For the 25-percent housing sample, the criteria were the same as for the 25-percent population sample, i.e., there had to be at least 50 housing units (complete-count data) in the group, and a weight of 16 was the maximum weight used. If these criteria were not met, the groups of occupied units were combined independently of the groups of vacant units. For the occupied units, the groups of units having white and nonwhite owners were combined, if necessary, and the groups having white and nonwhite renters were combined, if necessary, after first producing preliminary ratio estimates for the groups involved. If either of the resulting ratio-estimation groups failed to meet the criteria, they were combined to form a single group of all occupied housing units. If any of the three groups of vacant units did not meet the criteria after preliminary ratio estimation, they were combined into one category.

The criteria for the 20-percent housing sample were (1) at least 65 housing units in the 100-percent data for a group, and (2) a maximum weight of 20 for any sample housing unit. The criteria for the 5-percent housing sample were (1) at least 275 housing units in the 100-percent data, and (2) a maximum weight of 80 for any sample housing unit. (In all cases, population as well as housing, the maximum weight accepted was four times the inverse of the probability of selection.)

The reason for combining groups was that, although ratio estimates are efficient in reducing the sampling error, they may be statistically biased estimators. With the use of a ratio-estimation procedure, trivial biases in each of the approximately 33,000 separate publication areas could occur and be additive. Preliminary studies indicated that a single modification in the ratio-estimation procedure--i.e., combining groups when the total population in a group was quite small, and controlling the maximum weight--would virtually eliminate the effect of the biases.

Effects of ratio estimation.--There is exact agreement between the estimate of the number of heads of households in an SWA (smallest weighting area), based on the 25-percent population sample, and the estimate of the number of occupied housing units in the SWA, based on the 25-percent housing sample. This is true because the sum of the target numbers for occupied housing units in the SWA was made to equal the sum of the target numbers for heads of households in the SWA.

There is agreement between sample estimates and complete counts of each of the following: heads of households, other household members, occupied housing units, and vacant housing units. Theoretically, there could have been agreement between the sample estimates and the complete counts of each of the 44 population groups and 7 housing-unit groups if there had been no combining of groups in the ratio-estimation procedure. In fact, how-

ever, the procedure virtually always combined the 44 population groups into at most 10 groups in any given SWA, and the combinations of groups determined the only possible exact agreement. In some SWA's no combining of housing-unit groups was necessary, so there was exact agreement between the sample estimates and the complete counts for all 7 housing-unit groups in these SWA's.

Estimates for the entire rural portion of an area were inflated to the complete counts. In tabulations for rural-nonfarm and for rural-farm housing units and persons, farm residence was based on a 25-percent sample. The estimates of rural-nonfarm and rural-farm housing units and persons, therefore, are subject to some sampling variability.

For housing subjects tabulated from the 20-percent or 5-percent sample, the estimates may not add precisely to the totals estimated from the 25-percent sample, since the estimation procedure was independent for the three housing samples.

In some SWA's, target numbers were produced which would have required a larger weight than the maximum allowable weight of 16 (for the 25-percent sample) in order to expand the sample to agree with the complete count. In a few cases the 100-percent counts for the SWA's had been discovered to be slightly in error, and the sample counts inflated by 4 were used as target numbers instead of the 100-percent counts (see below). In these SWA's, therefore, and in the corresponding areas for which data were published, there is not exact agreement between sample estimates and complete counts.

Control and problem solution.--The principal control for the ratio-estimation procedure was a review of the diary tape (see Chapter 8, Processing the Data) which was printed out after the first computer operation for computing the target numbers for the ratio-estimation groups. The diary showed the complete count, the inflated sample, and the target numbers for the 25-percent population sample and the 25-, 20-, and 5-percent housing samples, for each ratio-estimation group for each SWA (smallest weighting area) in the United States.

By a review of this diary it was possible to learn if an average weight for the units in an SWA varied greatly from the expected value of 4. When the weights did deviate significantly from 4, a check of the input records was made to see if the complete count and the inflated sample were correct. One of them would be in error if, for example, some of the sample or some of the 100-percent schedules had not been microfilmed. If the discrepancy was in the sample data, it was left to the weighting procedure to compensate for the error within the limits of the maximum weight. If the complete count was wrong, it was usually because of an omission rather than a duplication of some part of the complete count. In this situation, it was usually found that the inflated sample was of approximately the correct magnitude; the target numbers were changed by substituting the inflated sample in their place. In these cases, the sample estimates are greater than the published complete counts. It was not feasible to correct the target numbers for either the population groups or the housing groups in an SWA without changing both; substitution of the inflated sample as new target numbers was done for all samples in the problem SWA. The net effect for the United States as a whole of all changes made for the population estimates was to add 2,500 more persons to the sample-based estimate than there were in the complete count, and the effect of the changes made for the housing estimates was to add 2,685 units. However, the changes had considerably more impact on a few local area statistics.

Ratio estimation for the 5-percent population sample.--The ratio estimation for the 5-percent population sample followed the same procedure as for the 25-percent population sample with the exception of the SWA's (smallest weighting areas) used. For this sample the SWA's within each State were:

1. Central cities of each urbanized area of 1,000,000 inhabitants or more. (Two or more such cities within the same urbanized area were combined into one SWA)
2. The remainder of each urbanized area of 1,000,000 inhabitants or more
3. The combined total of all central cities of all urbanized areas of less than 1,000,000 population within the State
4. The combined total of the portion outside central cities of all urbanized areas of less than 1,000,000
5. The urban portion of the State outside urbanized areas
6. The rural portion of the State

SAMPLING VARIABILITY

Since figures from sample tabulations are subject to sampling variability, it was considered necessary for their proper interpretation that a statement on the reliability of the statistics accompany them in census publications. The estimates of sampling variability described here do not reflect the effect of response variance, processing variance, or any bias arising in the collection, processing, and estimation steps.

For most population characteristics, the use of the household as the sample unit slightly increased the standard error above what would have been expected for a simple random sample of persons taken with the same sampling fraction. The increase was substantial for a few characteristics. In particular, data on characteristics which tend to be the same for all members of a household (e.g., race, and residence in 1955) have a considerably higher variance than if a simple random sample of persons had been used. However, for many population characteristics as well as for many housing characteristics, the standard error is equal to or less than what would be expected for a simple random sample of persons or housing units because of geographic stratification in the selection of the systematic sample in the prescribed order of listing by enumerators and because of the use of ratio estimation.

Because the measures of sampling variability were to be published along with the tabulations, and the tabulations were to be published as soon as possible after the censuses, it was necessary to have the measures of sampling variability ready at the same time as the tabulations. This made it necessary, in making variance estimates, to use sample data that had not gone through all the regular census processing steps.

The data used were taken from the FOSDIC schedules before they had undergone any processing. These data had not been reviewed by the clerical groups and had not had the regular computer edits and allocations or weights from ratio estimation. The data were coded as necessary and transcribed from the FOSDIC schedules to document-sense cards. The accuracy of the transcription was checked by the independent-verification method. Punch-cards were then produced mechanically from the document-sense cards, and all items necessary for ratio estimation were edited by a special computer operation. Some of the missing data were imputed, either mechanically or by hand; blanks and inconsistencies for the balance of the data were counted but not corrected.

It would not have been practical to produce estimates of sampling variability for each area for all the population and housing characteristics to be presented in the census publications. The computation of the sampling variability for so many items and areas would have been tremendously costly and time consuming, and many volumes would have been required to present the results. Therefore, some items were selected from a sample of areas for obtaining estimates of standard error. The choice of population items depended on three factors, and the choice of housing items depended on the second and third of these factors. The first factor was the speculated intraclass correlation between elementary units (persons) within primary units (households). The second factor was the speculated correlation of the characteristic being estimated with the relevant ratio-estimation groups. The third was the proportion of the universe having the characteristic. Characteristics for which data were to be published were sorted into a 3-by-3 cross classification depending on the proportions and on the sizes of the two speculated correlations. A sample of items believed to be representative of each of the nine possible combinations was selected.

The sampling variability of the items selected was computed for a sample of geographic areas. The area of the United States was stratified by four regions. Within each region, one State was selected from the territory of each of the Census Regional Offices, with probability proportionate to size of population. (For this purpose, California was treated as the only State under the Los Angeles Regional Office, and Hawaii and Nevada were included with the States under the Seattle Regional Office.) Next, from these selected States in each of the four regions, the following were selected, with probability proportionate to size: 10 cities of 50,000 inhabitants, 10 urban places of 2,500 to 49,999 inhabitants, and the rural balance of 10 counties. (Sampling at this stage with probability proportionate to size of population permitted a selection of a relatively small number of areas without the problem of cumulating measures for the large subuniverse.) There was no control to distribute these selections among the different States sampled in one region. Within each of the resulting 12 strata--three types of areas (large cities, smaller urban places, and rural areas) within each of the four regions--10 SWA's were selected by simple random sampling.

The estimation of the sampling variability was accomplished through the use of the random-group method. This consists primarily of computing the variability between the estimates of totals in each of a number of random groups--in this case, 10. The 10 random groups for each stratum were formed by randomly sorting the households from the 10 SWA's selected into one of the 10 random groups so each random group contained one-tenth of each of the 10 original SWA's. Characteristics were tabulated for each of the 10 random groups.

The ratio-estimation procedure to provide weights was similar to the one used for the census results except that (1) no preliminary ratio estimates were made prior to combining groups, (2) the original 44 groups were combined into 10 groups, and (3) nonintegral weights were used. The net effect of these deviations from the regular census estimation procedure was to produce estimates of variances which were slightly higher than they would have been otherwise.

In the census publications, variances are presented in an abbreviated form. Tables of standard errors for both absolute numbers and percentages are the basic tables published. The tables represent an average standard error for most characteristics. The census publications also present a table of adjustment factors to be applied to standard errors for the particular

characteristics on which data are given in the publication. Each of these factors represents the increase or decrease in the level of the standard error for the characteristic as compared to the average value in the basic tables. For example, most tabulated population characteristics--e.g., age, marital status, etc.--had a decrease in the standard error of approximately 10 percent as compared to the standard error of a simple random sample of persons. The factor times the figure in the appropriate basic table is the approximate standard

error for the characteristic. The chances are about 2 out of 3 that the difference due to sampling variability between an estimate based on a sample and the figure that would have been obtained from the complete count is less than one standard error. The chances are about 19 out of 20 that the difference is less than twice the standard error. The amount by which the estimated standard error must be multiplied to obtain other odds deemed more appropriate can be found in most statistical textbooks.

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Chapter 4. Geographic Work

Maps of small administrative areas called enumeration districts (ED's) were provided the field personnel to show the individual areas to be separately canvassed by the enumerators. The ED's were used as work units and control units not only in the field operation but also in the various processing operations.

The ED's were so planned that the individual ED's could be grouped to comprise the areas for which statistics were to be published. Data for ED's were added together to obtain totals for cities, towns, villages, boroughs, unincorporated places, and other areas. The totals for minor civil divisions or census county divisions were added together to obtain totals for counties. Totals for other areas were obtained in a similar fashion. The areas for which statistics were to be presented were determined in advance so that the ED's could be delineated within them, without crossing boundary lines, and the ED data could be used as building blocks to make up totals for those areas.

The objective of the geographic work in preparation for the censuses was to define and make maps of ED's for the field work during the enumeration. Geographic identification of the data was provided also for the data-processing phase of the census, by means of ED listings. Maps and charts were prepared for the census publications. The work was in seven broad and overlapping stages: (1) collection of maps and boundary information; (2) definition and delimitation of statistical areas; (3) preparation of base office maps; (4) designation of ED's; (5) preparation of maps for enumerators and other field personnel; (6) preparation of a geographic listing of ED's, to be used for data-processing control and to provide precise identification for the data for each of the political and statistical areas for which separate statistics were to be tabulated and published; and (7) preparation of maps and charts for the census publications.

COLLECTION OF MAPS AND BOUNDARY INFORMATION

The Bureau obtained information about boundaries of political subdivisions by correspondence with responsible local officials or by reference to the governing law or ordinance. Political subdivisions for which data were tabulated were the following: States; counties (parishes in Louisiana, election districts in Alaska); minor civil divisions (townships, magisterial districts, etc.); cities, towns, villages, and boroughs; wards and in some instances other subdivisions of cities; and congressional districts.

To prepare maps for the census enumerators, maps were needed which would (1) show the entire area of the United States without omission or duplication of area and (2) show adequate detail for the guidance of the enumerator. Maps needed for the purpose included a complete overall map for each of the 3,072 counties and parishes, a detailed map for each of 18,088 incorporated places, a set of detailed maps for the area adjacent to each city with an estimated population of

50,000 or more, and a map for each of the 2,379 unincorporated places delimited for the 1960 censuses.

Collection of maps and information on boundary changes began in April 1958. The permanent Regional Field Offices of the Bureau conducted the canvass for maps and up-to-date boundary information for all the counties and incorporated places of the United States. Questionnaires were mailed to officials of every county and incorporated place in the United States, requesting up-to-date maps and information on boundaries, annexations, and areas of unusual population growth. Later, a second request and two mail followups were dispatched to all who had not replied.

For counties, maps drawn on a scale of 1 inch to the mile or larger (1/2-inch to the mile for a few Mountain States), and showing all existing roads, railroads, streams, lakes, and similar features and also names of those features, were requested. A map showing the location of rural dwelling units was better for census purposes than one that did not show them. Most county maps were procured from State highway departments. Most were purchased, though some were obtained free of charge.

For municipalities, maps on a scale of 1 inch to approximately 800 feet which clearly showed the correct corporate limits, and, preferably, which delineated streets with double lines, were requested. Maps at larger and smaller scales were also used.

The county officials were asked to correct spelling and names if necessary, to list any changes in the boundaries, to note new minor civil divisions created or old minor civil divisions abolished, and to indicate any new municipal incorporations or disincorporations. Finally, they were asked to keep the Bureau informed of any changes made before April 1, 1960.

As replies began to arrive at the Regional Field Offices, editing procedures were inaugurated to screen maps and reports for acceptability and to correct discrepancies. Additional maps and information were obtained by personal and telephone followup. The collected maps were forwarded to Washington headquarters until July 1, 1958. On this date the Jeffersonville Census Operations Office was opened and subsequently all maps were forwarded to that location.

By November 14, 1958, when the map procurement program in the field offices terminated, maps had been obtained for some 85 percent of the cities and other incorporated places in the United States (including maps for 97 percent of all municipalities having a population of 10,000 or more in 1950 and 94 percent of all municipalities with a population of 1,000 to 10,000) and for 70 percent of the total number of counties of the United States. The effort was continued from the Jeffersonville Operations Office, and by the end of May 1959 questionnaires had been returned by all counties and incorporated places. Maps were finally secured for all but 689 of the 18,088 incorporated places.

Maps for the urban fringe of urbanized areas and for unincorporated places were obtained by Washington headquarters of the Bureau, working with local governments, utility companies, and other private and governmental sources. Other maps were made by drafting from information obtained from these sources.

Questionnaires were sent to 556 Army and Air Force installations to secure information concerning boundaries and housing facilities. The Navy Department supplied detailed maps of all of its shore installations. The U.S. Coast Guard office reviewed a listing of Coast Guard installations to be recognized as separate ED's and assisted in locating them correctly.

A list was prepared of nonmilitary institutions such as State and Federal prisons, hospitals, and other institutions under State and Federal control. Their locations were determined and they were recognized as separate ED's. Other large dwelling places that were separate ED's in 1950 (institutions, apartment houses, etc., having 300 residents or more in 1950) were checked to determine whether or not they were still in existence before they were again established as separate ED's.

Several hundred maps of overseas territories and possessions were received from the U.S. Geological Survey, the Army Map Service, the U.S. Coast and Geodetic Survey, and the Aeronautical Chart and Information Center. Other maps were obtained from the Governments of the territories.

The Bureau compared the new maps and boundary information with those obtained for previous censuses to see which changes resulted from legal action and which resulted from new and better maps or more accurate reporting. Problems arose from the fact that the most recent maps were not always sufficiently detailed, and that many of the changes appeared questionable, especially when compared with maps of adjacent areas and with earlier maps for the same areas. Doubtful cases were cleared up by correspondence. By the end of December 1959, the checking of boundaries and mapping information was completed for all areas--except for further changes in boundaries that occurred after that date.

The collection of map and boundary information for political areas was the first major operation of the decennial census. It required correspondence with nearly 25,000 State, county, and local officials and the matching to prior map records of the information they supplied in order to identify incomplete and erroneous replies.

DEFINITION OF SPECIAL STATISTICAL AREAS

In addition to publishing census data for administrative and political areas such as States, counties, and cities, the Bureau also presents data for areas which are delimited and defined for statistical purposes. Statistical areas have been developed to delineate areas with special characteristics, areas with no political boundaries, and other special areas for which data are desired. The special statistical areas recognized in the 1960 censuses are explained below.

Standard Metropolitan Statistical Areas

A standard metropolitan statistical area (SMSA) consists of a county or group of counties containing at least one city (or twin cities) having 50,000 inhabitants or more, plus adjacent counties that are metropolitan in character and economically and socially integrated with the central city.

Standard definitions of metropolitan statistical areas were first issued in 1949 for "standard metropolitan areas." They were developed to replace four different terms with four different sets of definitions then in use for various statistical series of the Bureau of the Census and other agencies: "metropolitan districts," "metropolitan counties," "industrial areas," and "labor market areas." Because of the use of different definitions, it was not possible to relate the statistics on population, industrial production, labor markets, and other series for a metropolitan area because each series included a slightly different territory. The word "statistical" was added before the 1960 censuses to emphasize that the areas were defined for statistical purposes. The definitions of the areas in terms of geographic boundaries were established by the Bureau of the Budget with the advice of the Federal Committee on Standard Metropolitan Statistical Areas, which is composed of representatives of major Federal statistical agencies.¹

The list of SMSA's was prepared for the 1958 economic censuses and published in 1959. It was revised for the 1960 population and housing censuses to include new areas with any city or pair of twin cities which reached a population of 50,000 in the 1960 population census. For the 1960 censuses, there were 215 SMSA's of which 3 were in Puerto Rico.

Urbanized Areas

In the 1950 censuses, statistics were presented for 157 new statistical areas, called urbanized areas, which were established primarily to distinguish the urban from the rural population in the vicinity of large cities. They differed from SMSA's principally in excluding the rural portions of the counties composing the SMSA's and excluding those towns which were separated by a strip of rural territory from densely populated fringe around the central city.

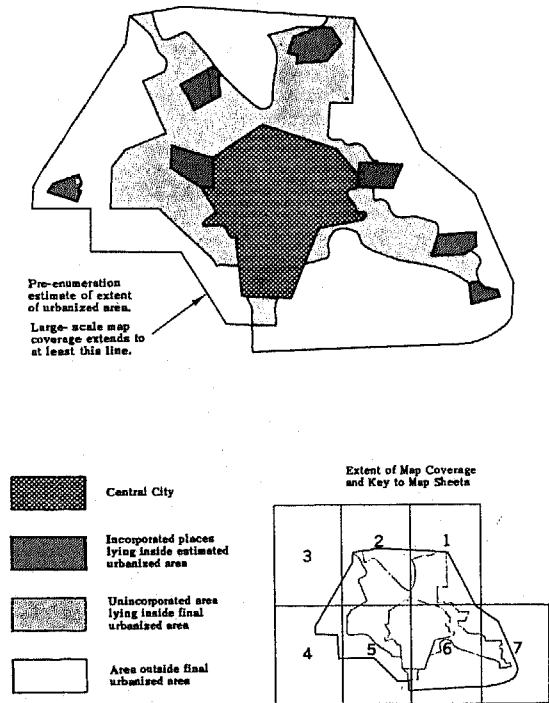


Figure 3.—Components of the Urbanized Area.

¹ For specific criteria for SMSA's, see: U.S. Bureau of the Budget, Standard Metropolitan Statistical Areas, Washington, D.C., U.S. Govt. Print. Off., 1959, pp. 2-3.

To delineate these areas for the 1950 censuses, the limits were determined for the closely settled urban fringe around cities which had had 50,000 or more inhabitants in 1940 or in special census between 1940 and 1950. This work was performed in the field from 9 to 18 months before the 1950 census enumeration.

For the 1960 censuses, it was decided to delineate the urbanized areas in terms of the 1960 census results rather than prior to the census as was done in 1950. For this purpose, a peripheral zone around each 1950 urbanized area and around cities that presumably were approaching a population of 50,000 was divided into especially small ED's estimated to include not more than 250 inhabitants each, or about 75 housing units, and not more than a square mile in area. Those ED's on the urban fringe which in 1960 met specified criteria of contiguity and population density (1,000 or more inhabitants per square mile in unincorporated area) were then included within the final urbanized area boundaries. The land area of each of these ED's, excluding large nonresidential tracts, was measured by the parallel line method, and after the census the population density for each ED was computed.

Urbanized areas were also established in the 1960 censuses for any pair of cities that was the nucleus of an SMSA in accordance with the new criteria for the SMSA's.

There were 213 urbanized areas in the 1960 censuses in the United States.

The preparation of maps for the urbanized areas presented some difficult geographic problems, because these areas were changing rapidly, contained many municipalities, and most of their area, especially the urban fringe, was not adequately mapped. Good local maps were obtained for a few of the urbanized areas; for the remainder, maps were compiled with the use of all available map sources to insure inclusion of new housing developments, communities, and streets insofar as it was possible to do so.

Census Tracts

Census tracts are small areas delineated for statistical purposes in many large cities and SMSA's. In general, the boundaries of the tracts are kept constant so that comparisons can be made from one census to another. For the most part, each is designed originally to include an area generally homogeneous with respect to race, economic status, and living conditions of its population. Local groups delineate the tracts, subject to review and modification by the Bureau.

Immediately after the 1950 censuses, the Bureau began to work with local tract committees on the establishment of census tracts in heretofore untraced areas. Each new plan for census tracts was reviewed by the Bureau to determine that criteria of population size, boundaries, homogeneity, and geographic size and shape were observed, and was returned to the local committee with questions and suggestions for change.² When the plan was approved, descriptions of the final census tract boundaries were prepared.

There were 23,365 tracts recognized in the 1960 censuses, almost twice as many as there had been in the 1950 censuses. The expansion of the tract program occurred not only in SMSA's which previously had been

completely untraced but also in the outlying portions of SMSA's in which the central cities and occasionally some adjacent area had been traced for the 1950 censuses.

In 1960, census tracts were recognized in 178 SMSA's in the United States and Puerto Rico, of which 136 were completely traced and 42 were partially traced. The 178 SMSA's included 279 cities of 50,000 or more inhabitants; all of these cities were completely traced. In addition, there were two traced areas--Somerset County, N. J., and Middlesex, N. J.--which were not in SMSA's.

Blocks

Statistics for each separate city block were provided for all cities and other urban places which had 50,000 inhabitants or more in 1950 or in a later special census. This group comprised a total of 295 places including one county, two townships, and three New England towns that were classified as urban. Statistics were also provided for blocks in 172 smaller cities or areas that supplied maps and paid the additional costs of collecting and publishing the block data.

Each block in these places was given a number which was entered on the base maps before reproductions were made for use in the censuses. When the enumerator canvassed the block, he was to enter the block number on the schedule for every housing unit in the block.

By the end of November 1959, the block numbering of the cities was completed. There was a total of 736,602 blocks in the block-numbered cities. Some of these blocks were split for the enumeration, and the parts numbered separately, so the total of numbers used was somewhat larger.

Unincorporated Places³

As in the 1950 censuses, the Bureau delineated boundaries for densely populated but unincorporated population centers. The residents of these places lived in closely spaced housing units; the places had streets and usually had block patterns and, in general, had the same physical characteristics as incorporated places of comparable size but did not have legally established boundaries.

Each unincorporated place was designated by a generally recognized place name or, for the comparatively few places for which there was no generally recognized name, by one that indicated the place location.

Outside urbanized areas, places with an estimated population of 800 were identified and delimited, and data were published for those places with 1,000 or more inhabitants. Inside urbanized areas, boundaries were established, and data published, for unincorporated places with 10,000 or more inhabitants if the places were locally recognized and that recognition was communicated to the Bureau.

Changes introduced into the program for the 1960 censuses were: (1) recognition of unincorporated places delimited by local agencies; (2) recognition of unincorporated places with 10,000 inhabitants or more in urbanized areas; (3) decreased use of hyphenated place names and the separation of places where possible;

² For specific criteria for defining census tracts, see: U.S. Bureau of the Census, Census Tract Manual, Fourth ed., Washington, D.C., U.S. Govt. Print. Off., 1958, 47 pp.

³ The term "place" as used for the decennial censuses refers to any concentration of population, regardless of the existence of legally prescribed limits, powers, or functions.

(4) omission of delimitation and submission of maps by the State highway departments, because of lack of time; (5) preparation of maps for all unincorporated places recognized, instead of use of aerial photographs for some; and (6) recognition, after the enumeration, on the basis of enumerated population, of unincorporated places located in areas which had been included in urban fringe maps but which turned out to be outside urbanized areas.

Comprehensive listings and individual forms were prepared between April and October 1958 for more than 11,000 places. The primary sources used were previous Bureau publications and listings and the 1957 Rand McNally Atlas. Additional sources were field work maps and reports made for establishing census county divisions, local requests and information, Postal Guides, and a few others.

Maps were prepared for 2,379 unincorporated places, of which 601 were in the peripheral zones of urbanized areas. Of the 2,379 unincorporated places, more than 600 failed to attain a population of 1,000 or more; at least 100 others were deleted due to annexation of area to municipalities or new incorporations; and at least 26 places were delimited after the enumeration. Data were published for 1,576 unincorporated places.

In delimiting places, great care was used to designate as boundaries readily identifiable features such as roads, streets, streams, power lines, or clearly defined ridge lines in mountain areas. Imaginary lines were used only when there was no alternative.

Census County Divisions

In a number of States, the minor civil divisions are not satisfactory units for reporting statistics, either because they have lost nearly all meaning locally or because they are changed frequently and do not provide comparable areas from one census to the next. For example, most counties in the State of Washington are subdivided into election precincts whose boundaries change frequently. To provide divisions with stable boundaries, the Bureau before the 1950 censuses established specially created census county divisions as permanent statistical areas in the State of Washington. In the years preceding the 1960 censuses, the program was extended to 17 more States in which the pattern of minor civil divisions was not well suited for statistical purposes--Alabama, Arizona, California, Colorado, Florida, Georgia, Hawaii, Idaho, Kentucky, Montana, New Mexico, Oregon, South Carolina, Tennessee, Texas, Utah, and Wyoming--as well as Washington.

All counties in these States were subdivided into census county divisions. The boundary lines were established in cooperation with State and local groups, by extensive field work by members of the Bureau staff.

In delimitation, consideration was given to recognizing the trade or service areas of principal settlements and in some cases to major land use or physiographic differences. The boundaries normally followed physical features such as roads, highways, railroads, power lines, streams, and ridges. The larger incorporated places were recognized as separate divisions, and the boundaries of these divisions changed when annexations occurred.

In the 17 States for which census county divisions were newly established for the 1960 censuses, there was a total of 6,084 census county divisions, whereas there had been 14,044 minor civil divisions in the same States for the 1950 censuses. The decrease in number of divisions was a byproduct of establishing census county divisions, and was accounted for by 13 of the States.

In the other 4 States, the number increased by 176. The overall decrease in the number of reporting units resulted in a considerable saving to the Bureau by reducing the number of areas for which data were separately tabulated and published.

A total of 642 census county divisions, all in one State, were used in the 1950 censuses. The number was increased to 6,558, in 18 States, in the 1960 censuses.

Urban Towns, Townships, and Counties

Towns in New England and townships in Pennsylvania and New Jersey correspond in general to the minor civil divisions in other States but some of them have characteristics similar to municipalities, therefore special criteria were adopted in order to recognize as urban those that were large in population size and density. A town in New England or a township in Pennsylvania or New Jersey was recognized as an urban place in the 1960 censuses if it met the following criteria: (1) It contained no incorporated municipalities as subdivisions, and (2) it had at least 25,000 inhabitants or had a population of 2,500 to 25,000 and a density of 1,500 persons per square mile. Counties in other States were recognized as urban places if they contained no incorporated municipalities and had a population density of 1,500 persons per square mile.

PREPARATION OF OFFICE BASE MAPS

Office base maps, or master maps, containing all the political and statistical boundaries to be observed during enumeration, were prepared for all the United States. The office base map was the ultimate source of geographic reference during the census. It was also the map on which the ED's were delineated, and the map from which all the maps for the field work were reproduced.

There were four categories of office base maps: (1) county maps, (2) incorporated place maps, (3) urbanized area vicinity maps, and (4) unincorporated place maps.

The county was the largest work unit in the geographic work, and the office base map of a county contained reference by area and ED number to those portions of a county which were delineated on one or more of the other three map categories. (In cases where a county was completely occupied by all or part of an incorporated place, the incorporated place map was the base map for the county.)

The first base maps prepared were for those counties which presented no special mapping problems, that is, counties which were not part of any SMSA and which contained no unincorporated places for which boundaries would have to be determined. As boundary information became available, the other county maps and the maps for other areas were prepared.

For an office base map, a map of suitable scale, detail, and reproducibility was procured or prepared. Most of the county base maps were direct reproductions of the maps obtained by the map procurement program. An effort was made to obtain the latest map series and the latest revisions. Of the more than 3,000 county map sets used, approximately 7.5 percent had not been revised in the 10 years preceding the census. The remainder had been issued or revised in the years from 1950 to 1959, and approximately 50 percent had been issued or revised from 1954 to 1959.

Many of the incorporated place maps secured from local officials were reproduced and used as base maps.

However, for many incorporated places and for the vicinity of all urbanized areas, it was necessary to select and piece together the best maps obtained or prepared for the various parts of the area. The maps secured by the map procurement program were of every different type, quality, and age. Some pieces were topographic maps, others were aerial photographs, others were transit company maps, etc. They were enlarged to the same scale, then the lines were traced off and reproduced on black and white transparencies. The transparencies were laid over the detailed geographic or other types of maps, and major street names and other types of information were written in on the transparencies.

By the end of October 1959, virtually all the maps had been selected for the 18,088 known incorporated places.

An "urbanized area vicinity map" was one which covered the unincorporated portion of a 1950 urbanized area, plus that adjacent territory considered as potential 1960 urbanized area. This map series included over 2,000 sheets and was compiled from various sources including photographic enlargements of U.S. Geological Survey topographic maps, utility company maps, city and county planning commission maps, and transportation maps. Urbanized area vicinity maps were prepared, at scales varying from 1"=500' to 1"=1,500', for all or part of approximately 450 counties.

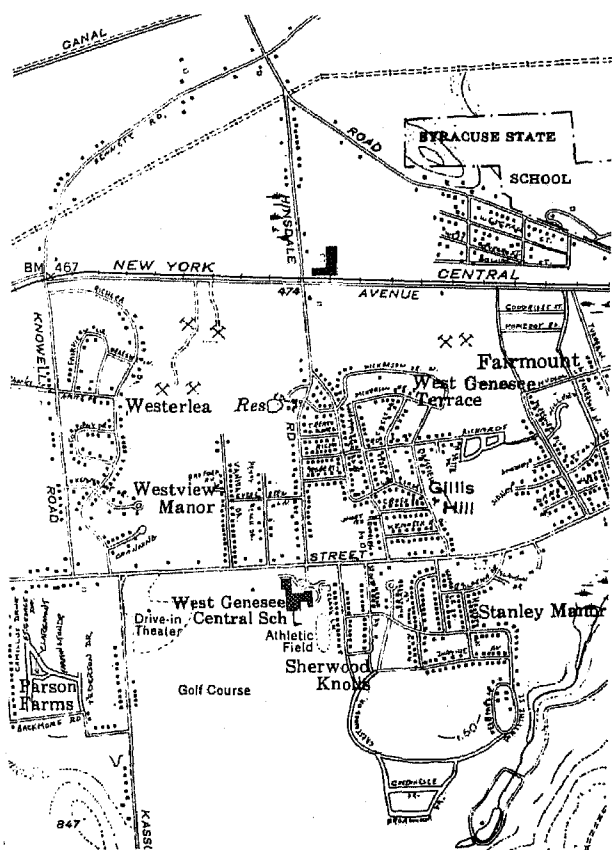


Figure 4.—A Portion of an Urbanized Area Base Map.

Most unincorporated place maps were traced from topographic maps and aerial photographs, though other types of compilation data were also used. There was no procurement source as such for maps of these places, since their boundaries existed only insofar as they were established by the Bureau of the Census. The boundaries of the areas for which census data were to be tabulated were delineated on the final set of office base maps.

These included 3,134 counties and county equivalents, 426 congressional districts, 31,309 minor civil divisions (townships and similar areas), 6,558 census county divisions, 18,088 incorporated places, approximately 2,400 unincorporated places, 23,365 census tracts, 243 prospective urbanized areas, and 736,602 individual city blocks. The total area was divided into approximately 240,000 ED's.

The boundaries of certain types of areas were drawn in color on the office base maps, following a color code. For example, boundaries of States, counties, and minor civil divisions and census county divisions were red, boundaries of incorporated places and of wards were green, etc.

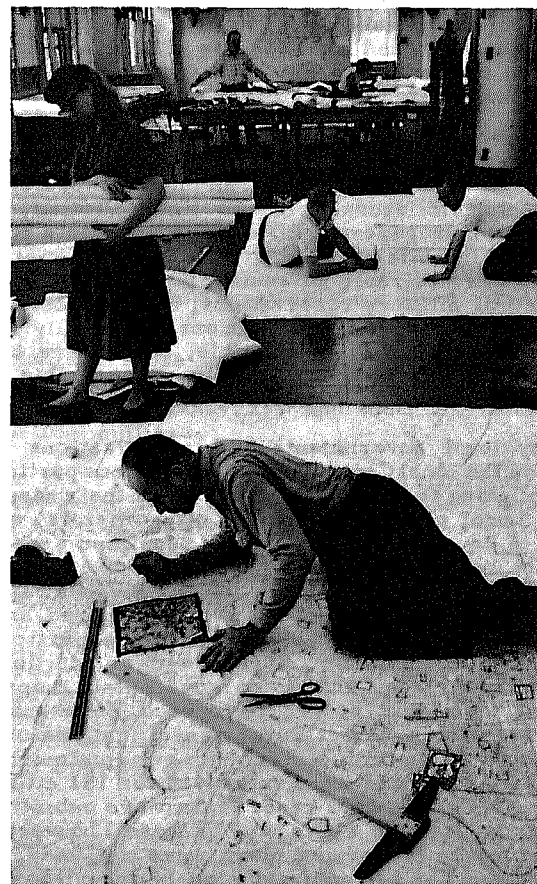


Figure 5.—Compiling 1960 Census Urbanized Area Base Maps. (Courtesy National Geographic Magazine, (c) National Geographic Society).

The complete set of office base maps prepared for the censuses totaled approximately 250,000 square feet, and included approximately 25,000 separate sheets ranging in scale between 1"-to-50' and 1"-to-20,000'.

DESIGNATION OF ENUMERATION DISTRICTS

Delineation of ED's

Once the necessary material for a county was obtained--maps, boundary information, 1950 population or more recent special census figures or estimates, location of institutions such as military barracks or hospitals, etc.--ED's could be defined. The ED's were delineated by outlining them on the office base maps.

The major consideration in delimiting ED's was that no ED could cross any of the boundary lines for any of the different types of areas for which data were to be

published. Areas which had to be considered in establishing ED's were the following:

- Counties
- Minor civil divisions and census county divisions
- Incorporated places
- Prospective unincorporated places
- Congressional districts
- Prospective urbanized areas
- Wards and other subdivisions of cities (e.g., assembly districts)
- Census tracts
- Area annexed to cities having 2,500 or more inhabitants in 1950

The annexed area of all incorporated places with 2,500 or more population in 1950 or a subsequent special census was assigned to separate ED's, so that 1960 population figures could be shown for the 1950 area and for the area annexed between 1950 and 1960.

Within a given political or statistical area, problems of enumeration determined the criteria for ED designation: No ED was to be larger than one enumerator could be expected to canvass in the time allotted for the enumeration. In general, ED's were to contain no more than 1,500 inhabitants. There were also special areas which it was desirable to enumerate separately. These consisted of military reservations, Indian reservations, national parks, and large institutions, especially prisons and hospitals. Insofar as possible, ED's were to have boundaries which would be readily recognizable by the enumerators, such as rivers, highways, streets, etc.

Many local governments and organizations represented on the local Census Tract Committees participated in establishing the boundaries of ED's in their respective areas. Local planning agencies, city officials, and officials of counties having densely populated areas were given the opportunity to submit maps showing proposed ED boundaries for use in the 1960 censuses. Detailed specifications and instructions were prepared and sent to interested local groups. The agencies participating were asked to supply the Bureau with an additional set of unmarked maps, and some good detail maps were received from this source. Proposed ED's submitted were used when they met Bureau specifications or could be made to do so with a minimum of adjustment. Proposed ED boundaries were submitted for 151 cities, and of these 108 plans were used. Plans were submitted for 177 counties outside cities, and of these 112 were used. In those instances where plans were not used, it was because they did not conform closely enough to Bureau specifications or were received too late to be used.

The Governor of the Panama Canal Zone and the Governor of Guam assumed responsibility for the delineation of ED's in these territories, following detailed instructions supplied by the Bureau.

The designation of ED's in the large cities was completed in December 1959, and the designation of ED's in all other areas was completed in early January 1960. Between that time and the census date, 3,000 changes in ED boundaries were made because of late annexations, new incorporations, or boundary changes not brought to light in the previous months.

Enumeration Assignments

In previous decennial censuses there were thousands of ED's which were far below the optimum population size. This was largely because each minor civil division or other area unit, no matter how small its population, was made at least one ED. For the 1960 censuses, small adjacent ED's were grouped into larger areas called enumerator assignments (EA's). Only one map was sup-

plied to each enumerator for his enumerator assignment; if it included more than one ED, the boundaries of each were clearly shown.

A study was completed in January 1958 of the application of this procedure to the State of North Dakota, one of the States in which it offered the greatest gains. The results of the North Dakota study indicated that fewer than 800 enumerator assignments would be sufficient for the State, in comparison with the 2,615 ED's in the State in the 1950 censuses.

In addition to greatly reducing the number of maps which had to be prepared for the field work, this procedure permitted the delineation of especially small ED's wherever they were desirable. For example, in the urban fringe of urbanized areas, the ED's were designed to have only one-fourth the estimated population of the average ED in other areas.

The 240,000 ED's originally delineated for the 1960 censuses in the 50 States and the District of Columbia⁴ were grouped as necessary to establish a total of 159,321 EA's. The number 160,000 had been predetermined as the maximum number of enumerators to be trained and put into the field by the census date, and the plan was to provide an EA as the work assignment for each enumerator. A maximum of 1,500 estimated population and 500 housing units was established for each EA.

Numbering ED's

Enumeration districts were numbered in a fixed sequence within each State to permit better control of the field work and the data processing. The first part of the ED number referred to the county, city, or, in the case of counties containing "block" cities, to the part of the county outside the city. This part of the ED number was referred to as the "prefix," thus the area assigned one prefix number was referred to as a "prefix area." There were 3,628 prefix areas in the 50 States and the District of Columbia.

Within a prefix area, the basic ED numbers, each containing four digits, were assigned, as a general practice, beginning with 0001 for the ED in the upper left of the map of the prefix area and with the succeeding numbers following in serpentine fashion.

Letter suffixes (N, P, R, S, T, U, W, X, Y, and occasionally Z) were used to distinguish different ED's in the same EA.

PREPARATION OF MAPS FOR THE FIELD WORK

After a complete set of up-to-date office base maps had been prepared, copies were reproduced for the field staff. The maps issued for use in the enumeration of the population and housing censuses were the following:

1. One map of each enumerator assignment, for the enumerator
2. One complete set of maps of the area covered by each Census District Office--county maps, urbanized area vicinity maps, and incorporated and unincorporated place maps--for the District Supervisor
3. One or two more complete sets of maps of the area covered by each Census District Office, to be cut up for maps of crew-leader districts and distributed to the crew leaders

⁴ Some ED's were split during the enumeration and the data processing; the final number of ED's was 272,600.

4. One map for each first, second, or third class post office, covering the area served by the post office, to be used in assigning ED numbers to Individual Census Reports which were mailed to the home communities of visitors and transients from the districts in which they were enumerated

The supervisors' and crew leaders' copies of the county maps were prepared by hand-copying the ED boundaries in color from the office base maps to diazo prints, following the same color system on the copies as on the base maps.

The supervisors' and crew leaders' copies of urbanized area vicinity maps and of incorporated and unincorporated place maps were supplied on diazo-type black-and-white reproductions on which the different types of boundaries were shown in different monochrome symbols. For example, ED boundaries which were not also boundaries of other areas were drawn with wiggly lines. This eliminated many hours of labor which would have been expended if 1950 census procedures had been used, because any number of identical prints of the maps could be made without additional hand-copying and verification operations.

Maps for enumerators were prepared by microfilming the office base county map and, after developing, processing the negative microfilm on Xerox electrostatic reproduction equipment. Instead of having the reproduction work done on contract by a private firm, as was done for the 1959 Census of Agriculture, the equipment used for the population and housing censuses was located in the Jeffersonville Operations Office and was operated by Bureau personnel. The main purpose of this was to maintain control over the quality of reproduction for each individual map. There was not much difference in cost.

This method of reproduction was used on practically all of the county maps to which any one of several pre-designated enlargement ratios could be applied. There were a few deviations from these standard ratios, and in these instances prints were made with photocopy equipment. The photocopy method was also used for areas where the scale of the county map had to be reduced instead of enlarged, and for a small number of county maps for which the microfilm-Xerox method did not provide an acceptable product because the original maps were of inadequate clarity.

The preparation of enumerators' maps required close attention to problems of scale and size. Typically, an ED on a county map scaled at 1 inch = 1 mile was photographed on microfilm at a ratio of 1/10 of the original linear size and then reproduced on the electrostatic printer at a magnification of 20, resulting in a finished product twice the original scale, or 2 inches = 1 mile. To the extent possible, the finished prints were held to approximately 18" x 24" in size and also to a scale of 2 inches = 1 mile. Different microfilming and enlargement ratios were used for various States depending on the scale of the original maps and also on the density of population. For sparsely settled areas in the West, the ED's tended to be larger in area, and therefore the enumerators' maps were often reproduced at the same size or even at reductions to one-half of the original scale.

The enumerators' maps of incorporated places and unincorporated places were made in the same way except that a different original document was photographed instead of the office base map, which was opaque. It was decided after a series of tests that better reproductions could be obtained by microfilming the reproducible intermediate copies. The intermediate copy was placed

over an illuminated surface for microfilming, so that the microfilm negatives and resulting prints included both the map detail which was on one side of the intermediate copy and also the boundaries which were on the reverse side. Another advantage of this procedure was that the work of completing the maps for a given city could be assigned to a larger group of clerks than would have been possible had the operation been performed in the same way as for the county maps, because it was not necessary for a clerk to have the office base map in front of him in order to outline the ED's in color when the print to be used carried the monochrome symbol in the proper location.

The urbanized area vicinity maps were also microfilmed from reproducible intermediate copies if the original base map was suited to the symbolic monochrome delineation of boundaries. Otherwise, the base map was microfilmed.

Most of the enumerators' maps prepared for large-city areas were enlarged during reproduction, whereas map areas for small cities and urbanized area vicinities were often reproduced at the same size because the original scale was large enough for field use.

Each map of an enumerator assignment was attached to a map backing card which carried appropriate legend identification for interpreting the symbols appearing on the map.

If two or more adjacent ED's were grouped into a single enumerator assignment, the map clearly showed the boundaries of the ED's and their ED numbers and alphabetical suffixes.

For the Post Office allocation of Individual Census Reports, each of 24,000 post offices had to be supplied with a copy of all the maps for its delivery area. This meant that boundary information on rural routes was needed as well as information on delivery areas within the metropolitan centers. Postal route maps purchased from the Post Office Department were the only source available for such information. These postal route maps were reviewed and lists were prepared by county showing how many copies of each base county map were required to supply the post offices located within the county boundaries and also those post offices located in adjacent counties which had delivery routes entering the county.

After this was done, a list of the incorporated places included in each post office delivery area was prepared, and this list was reconciled with the prefix area codes in order to insure complete ED coverage.

Copies of incorporated and unincorporated place maps and urbanized area vicinity maps were prepared for the post offices in the same manner as the copies for census supervisors and crew leaders.

In order to supply the large number of county maps required for the post offices, a monochrome symbol for boundaries was devised for use directly on the county base map, which was then microfilmed and reproduced on the electrostatic printing equipment.

By January 18, 1960, complete sets of maps for the District Supervisors and crew leaders had been shipped from the Jeffersonville Operations Office. The last of the enumerators' maps was completed and ready for shipment on February 15, 1960.

Map reproduction in the Jeffersonville Office was carried on continuously from August 1958 to the beginning of enumeration on April 1, 1960, and continued even beyond that date in order to supply maps with last minute changes referred from the field.

Approximately 4 million square feet of map copies were prepared, enough to equal in area a 3-foot-wide sidewalk reaching for almost 275 miles.

LISTING OF ENUMERATION DISTRICTS

For the 1950 censuses, two complete listings of ED's were prepared. One listing included identification of each ED by county, minor civil division, incorporated or unincorporated place, ward, tract, urbanized area, and congressional district, along with a detailed boundary description for each ED. The second listing included the same identification by area, did not include boundary descriptions, but did include footnotes showing changes or corrections to the boundaries and names of counties, minor civil divisions, and incorporated places.

For the 1960 censuses, there was a single listing containing the same types of information as the two listings except that 1960 ED boundary descriptions were omitted. A separate list was prepared for each county and the following identification was shown, as applicable, for each ED: whether in a single-stage or two-stage enumeration area and whether or not a "block" city (so that correct type of schedules could be inserted in the enumerator's portfolio); minor civil division or census county division, and incorporated or unincorporated place in which located; ED number, including prefix, basic number, and suffix if any; location by congressional district, tracted area, ward, SMSA, urbanized area; and whether within an area annexed to a municipality. A narrative description of the area included in the ED was supplied only for the relatively few ED's which (1) were special dwelling places, (2) excluded a special dwelling place located within the ED boundaries, or (3) were small incorporated places for which no suitable maps were available.

The 1960 listing was completed in January 1960 and the information was placed on magnetic tape for the computer. Four types of lists of ED's were printed out on the high-speed printer from the single computer tape: (1) ED's by minor civil divisions and census county divisions; (2) ED's in numerical order by ED number; (3) the Advance Transmittal Listings; and (4) ED Control Registers. The latter two were used for control purposes during the enumeration and the data processing. The Advance Transmittal Listing was in numerical order by ED and the ED Control Register was in alphabetical order by minor civil divisions and census county divisions.

Preparation of a single list instead of two lists and elimination of ED boundary descriptions lowered the cost of the geographic preparatory work several hundred thousand dollars.

LATE CHANGES OF BOUNDARIES

A major problem in the geographic work for the censuses was the conflict between the requirement that boundaries of areas for which data were to be published had to be those in effect at midnight April 1, 1960, and the need to have ED maps in the hands of field personnel long before that date. Each change in boundary made after January 18, 1960, meant that corrected maps had to be prepared for the District Office, the crew leader, and the enumerators affected.

As April 1 approached, annexations were rushed through city councils or other responsible local authorities in order to have the annexed areas included in the incorporated places on the census date. One such annexation was approved by a State legislature at 1 minute

past midnight on April 1. There were more than 2,000 changes in boundaries in the last 6 weeks before the enumeration.

This has become an increasingly serious problem in recent censuses because the number of boundary changes has increased greatly through the years. There were more annexations to cities reported in the 6 weeks preceding the 1960 censuses than in the entire decade between the 1930 and 1940 censuses. In the county of Los Angeles, Calif., there were over 500 annexations to incorporated places in the decade preceding the 1960 censuses, and in one extreme case, Santa Clara County, Calif., there were well over 1,000 annexations during the same decade.

PREPARATION OF MAPS AND CHARTS FOR PUBLICATION

Before the work on maps for field enumeration ended, a small staff had begun work on maps for the publications. For each final State report containing population counts, in Series PC(1)-A, Number of Inhabitants, three sets of maps were prepared: (1) maps showing the minor civil divisions or census county divisions and all incorporated and reported unincorporated places of all counties in the State; (2) a map of the State showing county boundaries, SMSA's, and places with 25,000 or more inhabitants; and (3) a map of each urbanized area in the State. The maps of urbanized areas required delineation of the final boundaries of urbanized areas on the basis of area measurements and 1960 preliminary census figures, because population density in 1960 was a criterion for inclusion. By the end of February 1961, these three sets of maps were complete.

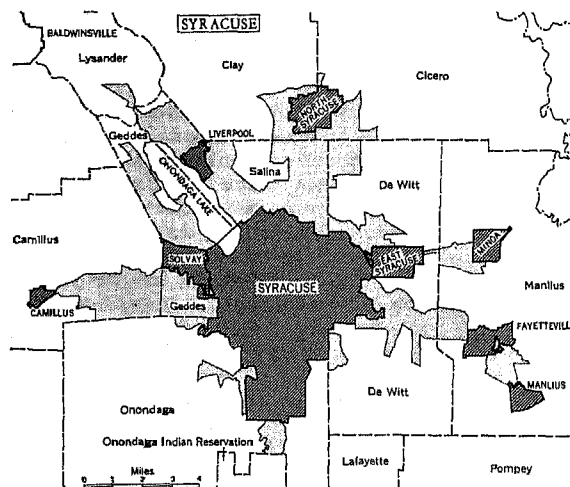


Figure 6.—An Urbanized Area Publication Map.

For the U.S. Summary report on number of inhabitants, PC(1)-1A, 36 pages of maps and other graphics, many in two colors and black, were prepared to show the distribution and change in total population, urban and rural population, metropolitan and nonmetropolitan population, and other demographic and geographic information.

At the same time that maps were begun for the population reports, maps for the identification of city blocks were begun for the housing reports in Series HC(3), City Blocks. These maps included the number and boundaries of each block in the particular city and the number and boundary of each census tract or part of a census tract within the city, as well as the total number of blocks within the city. Maps of SMSA's showing census tracts were begun soon after.

The first step in the preparation of maps for publication was to make pencil tracings, depicting only the information to be shown on the published maps, from the office base maps. The tracings were then reduced through photocopy processes, frequently with different reduction ratios for different parts of the maps, and the photocopies were assembled into a compilation in the precise format and arrangement of the final map but at a substantially larger scale. Next, the boundary information was traced, using appropriate symbols for streets, corporate limits, minor civil division lines, or other kinds of boundaries. After the line work was completed and verified, composition was applied, that is, the names of boundary features, any identification numbers, and similar information were attached to the tracing. Later phases included the application of titles and legends, and final verification.

For the census tract reports, lists indicating the composition of 1960 tracts in terms of 1950 tracts were prepared.

For the housing census reports, the State maps used for the population census reports, showing counties, SMSA's, and places of 25,000 or more inhabitants, were

revised to show in addition all places with populations of 10,000 or more.

For the housing census U.S. Summary for volume I, a series of 21 maps and graphs illustrating the distribution and changes in housing were prepared. For volumes II, IV, and V, maps showing the SMSA's were prepared.

COST, MAN-HOUR, AND PRODUCTION DATA

Table 2C in appendix H shows the cost of the various phases of the geographic work on the 1960 population and housing census.

The time spent by Geography Division personnel per unit of work for the major phases of geographic work in preparation for the 1950 and 1960 population and housing censuses and the number of work units involved are shown in table 7. The number of man-hours spent by Geography Division personnel on the various phases of the work on the 1960 censuses through fiscal year 1962 are given in table 8 in appendix H.

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Chapter 5. Other Preparatory Work

As soon as decisions were reached about the most important features of the censuses, the staff of the Bureau began the intensive work necessary to prepare for the enumeration and the processing and publication of the data. Questionnaires and other forms and manuals were prepared and arrangements were made for having them printed and distributed to the field personnel. The permanent field organization was augmented by a large number of temporary census offices, and personnel were recruited and trained. An operations office was established to handle the large-scale clerical operations. An extensive publicity program was undertaken to inform the public about the part the householders were requested to play in filling the questionnaires. The major steps in the preparatory work for the census enumeration, in addition to the geographic work discussed in the preceding chapter, are described below.

Establishing the Progress Reporting System

In 1959 a Progress Reports Office was established in the Bureau to develop an overall progress reporting system to keep the executive staff and the operating officials informed of the progress of all phases of the censuses from the preparatory work through the publication of results. The system that was established required the preparation of a plan for each phase of work in terms of units of production and a time schedule. The progress reported at a given date by an operating office or offices was plotted on a chart which also showed the expected progress at the same date, so that if any phase of the work was behind schedule it could be seen at a glance and prompt corrective action could be taken.

In general, the system provided a pyramid of detailed and summary progress reports designed to be useful at the various levels of administration and responsibility. For example, the progress of the enumeration throughout the nation was summarized on one chart which was supported by 36 supplementary charts on various aspects of the enumeration. The reporting system for the data processing and the preparation of publications was similarly designed, with one summary chart showing the status of the work for the principal series of publications, and a number of supplementary charts giving more detailed information on the progress of the work.

Time Studies

Time-study engineering was used to facilitate planning and control far more than for any previous census in the United States. Detailed time studies of alternative enumeration forms and procedures were made as an aid in determining the most efficient forms and procedures and in setting piece rates for payment of enumerators. Time studies were also made to determine time allowances and costs for training of enumerators and for planning the time schedule for the training. Production standards based on time studies were developed for more than 200 clerical data-processing operations. Time-study engineering was also used to assist in developing layout and procedures for many operations, including prepara-

tion of maps for enumerators, microfilming of census schedules, and preparation of publications. It was also used to expedite the completion of the enumeration by field offices which encountered special enumeration problems. In addition, time studies were made during the field enumeration to obtain data for future analysis for planning other censuses.

PUBLICITY AND INFORMATION PROGRAM

The public information program for the 1960 population and housing censuses was on its 1,000th day when the enumeration began on Friday, April 1. The purpose of the information campaign was to prepare as many of the 179,323,175 people of the United States as could be reached by press, radio, television, and word of mouth, for their part in the census.

In many large cities there was a story about the censuses in each day's newspaper, frequently on the front page, for 2 or 3 weeks before the censuses and at the beginning of the enumeration.

The March 12, 1960 issue of the Saturday Evening Post contained an article about "The Big Count." The November 1959 National Geographic Magazine published an article, "Census 1960: Profile of a Nation," and a digest of this article was presented in the February 1960 Reader's Digest. "The Things They Tell the Census Taker" was presented in the March 1960 issue of Family Circle Magazine. Scores of other magazines carried similar stories.

One of the most helpful aids to the census public information program was the work done by the Advertising Council, Inc. With the Cleveland advertising firm of Meldrum and Fewsmith serving as volunteer agency, kits were prepared for distribution to newspapers, radio stations, television stations, and other advertising media. There were 11,789 mats, totaling 4,260,840 lines of space, ordered by newspapers for sponsorship by themselves or their advertisers. In January and February, some 55,000 car cards were displayed in public transit vehicles throughout the nation, through the cooperation of the member companies of the transportation advertising industry. A specially prepared announcement was run by the Reader's Digest in its April 1960 issue. Beginning the week of February 7, the major television networks showed brief films about the censuses in their sustaining and open-end programs, and advertisers incorporated messages into more than 60 sponsored shows including many popular favorites; the estimated circulation of this support was 440,005,000 "television home impressions." A television kit that included film spots, slides, announcements, etc., was distributed to every local station in the country; on the basis of surveys made by the Council, it is estimated that this kit resulted in an average of 27 census messages on each station or a total of more than 15,255 on all stations. Beginning February 8, all four national radio networks scheduled census messages on the sponsored and sustaining programs; it is estimated that more than 120 announcements were carried on network programs totaling over 29,299,000 "radio home impressions." In addition, a kit

of "live" and recorded announcements including dramatizations, musical spots, etc., was distributed to over 4,000 local radio stations. There were also posters and displays which were widely used. The Council's estimate, based on traceable advertising support only, is that national and local advertisers and media contributed advertising space and time valued at over \$6 million to the 1960 census campaign.

The National Association of Radio and Television Broadcasters and the organization of American Women in Radio and Television also gave excellent support to the information program.

Other contributions to the census publicity were a 15-minute film entitled "Census Sixty" produced by Remington-Rand, Inc., and a series of nine 30-minute films entitled "The Big Count," produced by the National Educational Radio and Television Center. The Bureau of the Census purchased 400 copies of the "Census Sixty" film and made it available to all television stations through the Bureau's field offices. Nearly all of the more than 450 television stations in the nation presented this film at least once, and many of them gave it showings two or more times. The series of nine 30-minute programs in "The Big Count" were first shown at weekly intervals during February and March on the nation's more than 40 educational television stations. The Bureau of the Census then obtained prints of the films and made them available to selected commercial television stations throughout the country.

The Georgetown University Forum produced a 30-minute radio program presenting Bureau officials in a panel discussion on the scope and purpose of the 1960 censuses. Four hundred copies of this radio tape were obtained by the Bureau and placed with radio stations throughout the country for presentation in late March and early April. Each tape was used by several radio stations on a rotation schedule arranged by census field offices, and more than 1,000 presentations are estimated to have been made. When a considerable number of copies of the television and radio programs were recovered after the campaign, the Bureau initiated a loan service to schools and other interested groups that wished to use them to study census activities.

Paralleling the public service contributions, the Bureau conducted a comprehensive publicity campaign which was presented through news columns of newspapers (spot news and features), magazines, and news programs on radio and television. The materials were distributed nationally through wire services, Washington news correspondents, and radio and television networks. Materials prepared especially for each local area were furnished to the Census Regional and District Offices for local distribution.

The major wire services transmitted scores of news stories, dealing with all the different phases of the 1960 censuses, from Washington to their clients, and gave the censuses pictorial treatment several times in their illustrated feature services.

Hundreds of thousands of columns of news space were devoted to informing the public about the 1960 censuses. One of the notable contributions of the newspapers was the publication of the "Were You Counted?" form just before the enumeration ended, to provide a means of obtaining names of persons missed by the enumerators. With very few exceptions, this notice was printed in all of the newspapers of the country.

One portion of the public information campaign from Washington was directed to the women's clubs throughout the country. More than 100,000 copies of a special kit for women's clubs were distributed. National officers of such

women's club organizations as the General Federation of Women's Clubs, the American Legion Auxiliary, and the Business and Professional Women's Clubs urged their clubs to devote part of their study programs to the 1960 census.

Another important outlet for news about the 1960 census program was publications which circulate in schools. Scholastic Magazines, Inc., the American Education Publications, the Civic Education Service, and the National Education Association contributed space to a series of articles in the several school magazines and newspapers published by them.

A number of leaflets were prepared and given general distribution during the public information program on the 18th Decennial Census. These included the following titles:

18th Decennial Census of the United States
The Bureau of the Census: A Brief Description of Its Work
The Nation's Five-Foot Shelf
Women Count
How the Public Will Participate in the Census
Your Name is Somewhere in the Census Records
Inquiries for the 1960 Census of Population
Inquiries for the 1960 Census of Housing
Uses of Census Bureau Statistics
Census Inquiries Made--1790 to 1960

ESTABLISHING THE JEFFERSONVILLE OPERATIONS OFFICE

Early in 1958, it became apparent that neither adequate office space nor a sufficient labor force would be available in the Washington area for the large-scale clerical operations of the 1960 censuses, and it would be necessary, therefore, to establish an operations office elsewhere. Surveys were made of Federally owned space outside Washington which might be available on a rent-free basis, along with evaluations of the size and quality of the labor market available at such locations.

The site chosen was in Jeffersonville, Ind., adjacent to the city of Louisville, Ky. An Army Quartermaster Corps Depot which had been in operation in Jeffersonville had closed down in June of 1958 leaving a number of vacant buildings and some furnishings and supplies.

In addition to obtaining the use of 527,867 square feet of space at the Jeffersonville Depot, of which 311,658 square feet were warehouse or storage space, the Bureau of the Census acquired a considerable amount of surplus property without cost from the Depot and from nearby Federal agencies.

The Jeffersonville Operations Office opened in July 1958 to process the data from the 1958 economic censuses. This work was completed about the time that the operations for the 1960 population and housing censuses began, so that many of the people who had been employed on the economic censuses were assigned to work on the censuses of population and housing with little or no interruption in their employment.

Except for a small force of experienced key managerial and technical personnel assigned from the Washington office, recruitment for the Jeffersonville operations was from local sources. It was carried out in accordance with the Civil Service Commission's regular competitive requirements. The Bureau's Board of Civil Service Examiners conducted a special examination in the Louisville area to obtain an adequate register of clerical applicants. All of the personnel were hired on a temporary basis.

Decentralizing the clerical processing operations to Jeffersonville had many advantages for the Census Bureau. The availability of space and the abundant supply of qualified clerical workers made it a good location for a processing office.

The principal disadvantage was the difficulty in maintaining constant contact between the managerial, planning, and research staffs in Washington and the operating officials in Jeffersonville. Two direct telephone tie-lines between the Operations Office and the Bureau were in almost constant use, and Bureau personnel made frequent trips between Washington and Jeffersonville.

PREPARATION OF THE SCHEDULES AND OTHER FORMS FOR THE ENUMERATION

The enumeration schedule--which was to be micro-filmed and then read by FOSDIC (Film Optical Sensing Device for Input to Computers)--had to be designed to meet the special requirements of FOSDIC. Some of these special requirements were: The maximum size of the reading area could not exceed 14" vertically and 21" horizontally and the minimum document size was 12" vertically by 4" horizontally, with no minimum restriction on the reading area. FOSDIC would perform more reliably if only black ink were used in printing the schedules. The index marks (black squares on the schedule which served as the "takeoff" points from which the FOSDIC beam moved) had to have at least a 1-inch (center to center) minimum separation, vertically and horizontally. Other elements that had to be considered included spacing of circles, the size of the circles, and the thickness of the circle lines, each requiring precision to about 1/1000th of an inch. (See forms 60PH-2 and 60PH-4 in appendix I.)

The effectiveness of FOSDIC depended, in part, on the quality of printing of the FOSDIC schedules. The Government Printing Office printed all of the FOSDIC schedules in its own plant. The offset printing was done with copper plates because copper plates are noted for long wear. While the quantity printed was large--56 1/2 million schedules--it did not represent an unusual number when compared to some other forms that are used by Government agencies. The precision required throughout the printing for such a large printing job did represent an unusual requirement for the Government Printing Office.

A quality control system was used during the printing operation. Two sample sheets were selected each time 5,000 sheets were printed by a press. (A pair of consecutive sheets were chosen so that printing defects could be distinguished from such things as paper defects.) They were first visually inspected for such defects as broken or missing circles, light index marks, or missing text. The sample sheets were then microfilmed and run through FOSDIC to measure the uniformity of answer circles and to decide whether size and intensity of index marks were acceptable. This procedure was in addition to the standard inspection and control procedures regularly used by the Government Printing Office.

An additional visual inspection was made in Jeffersonville on a "shadow-graph" table (a glass table with the outline of the schedule and some place marks etched on it and a light underneath it). The top and bottom schedule of each package of schedules received were placed on the shadowgraph to see if the printing and cutting were standard. More than two million schedules were discarded as a result of these inspections.

In Jeffersonville, the FOSDIC schedules were bound into enumeration books. The determining factor in the choice of binding was the need to keep schedules flat and unwrinkled during the enumeration process and the

later microfilming. A loose-leaf type of binding, consisting of hard covers and a series of wire loops down the back of the book, was chosen. It held the schedules and covers together but permitted them to be swung around under the schedule being written on.

The steps in the bookbinding were: (1) punching holes in the left margins of the schedules, covers, and instruction sheets; (2) collation of the 25-percent sample books, in each of which there were two slightly different types of schedules, four of one type to one of the other, for the 20-percent and 5-percent samples on some items; (3) "spooning," or stabbing a spindle a given distance into a pile of sheets through the holes in the margins, to obtain approximately a predetermined number of sheets for a book; (4) inserting the strip of wire loops by hand then closing the wire in a "closing machine"; (5) inspection; and (6) labeling. Every step in the operation underwent quality-control inspection.

Almost a million enumeration books were bound, of which almost 60 percent were for 100-percent enumeration and a little more than 40 percent were for the sample enumeration.

More than 172 million population and housing questionnaires and schedules were printed for the 1960 census. The two-stage census procedure, combined with the use of Advance Census Reports and sample household questionnaires to be filled in by householders as well as FOSDIC schedules filled in by enumerators, resulted in a great increase in the quantity of forms and the amount of paper handled. For every schedule used in 1950, some 12 to 15 questionnaires and schedules were required in 1960--for example, for seven households of an average of four members each that might have been enumerated on one 1950 schedule, the 1960 procedure required seven Advance Census Reports, two 100-percent FOSDIC schedules (i.e., two pages, or one sheet, in an enumeration book), one or two sample household questionnaires, one or two "extra-person forms," and one or two sample FOSDIC forms.

It may be noted that this was still less than one questionnaire or schedule per person in the United States. The use of individual questionnaires, or of both individual and household questionnaires, which is customary in many countries of Europe, would have required many more forms.

An additional 47 million pieces of supplemental material, such as listing books, internal-use forms, training materials, etc., were used in the field. They were printed by the Government Printing Office and shipped to Jeffersonville for storage until needed for distribution to the field offices.

Including the regional and State variations, there were approximately 250 different forms and manuals used in connection with the enumeration, nearly 200 of which were prepared especially for the censuses. (Additional forms and manuals were prepared for the pretests, for the data processing and preparation of publications, for the post-enumeration evaluation program, and for the Survey of Components of Change and Residential Finance.)

The principal types, quantities, and costs of printed material used in the field are shown in appendix H, table 5.

SUPPLIES, EQUIPMENT, AND LOGISTICS

Several years prior to 1960, the Bureau began to make plans to acquire the large volume of supplies and equipment needed for the censuses, to distribute them to the field offices, and to dispose of them after the enumeration was completed.

Intensive research was started in 1957 for the development of specifications for such major items as shipping containers, folding tables to be used in place of desks, briefcase portfolios for use by enumerators in the field, and filmstrip projectors for use in the training of the field personnel. To develop specifications that would meet the Bureau's needs required a great deal of research and also consultation with specialists in other Government agencies and with various manufacturers, because many standard commercial items were not entirely suitable for the particular uses for which they were needed for the censuses.

The Bureau's requirements for filmstrip projectors were unique in that the projectors had to be shipped to all parts of the country, used a few times during the training program, and then disposed of after the enumerators were trained. Standard commercial projectors were much more elaborate and costly than the Bureau needed. Available Federal specifications called for a heavy-duty projector designed for a long life and for various applications. In order to obtain projectors for the census training program at the lowest possible cost, it was necessary to revise the Federal specifications to eliminate many features which were not needed. For example, for the training program, projectors were needed for only single-frame filmstrips, and only one size of lens was to be used, so the specifications were changed to delete the requirement that projectors be able to handle double-frame filmstrips and be equipped to accommodate other sizes of lens. However, the Bureau specified that the projectors be packaged in individual cartons, which could be used to hold the projector and also the phonograph records and filmstrips for a complete training-program kit.

In the case of shipping containers, among the materials considered were steel, wood, various plastics, and fiberboard with a plastic center. To insure the confidentiality of the census records and to protect them from damage, the material had to be strong, water repellent, and fire retardant. A letter was sent to manufacturers in various industries explaining the problem and asking for recommendations as to materials and construction of the containers. Working closely with the manufacturers, containers were tested under actual census field conditions to develop the one most suitable for the census operations. Eighty-two thousand special corrugated fiberboard containers were purchased for use as shipping containers and also for use as sorting and storage bins. Two hundred thousand removable sleeve-type inserts were purchased to convert the cartons into temporary sorting and storage bins for use in the field offices in lieu of additional filing cabinets. A sheet with drawings showing the method of assembling the cartons for use as sorting and storage bins was prepared and furnished each office. A comparison of the cost of shipping these fiberboard boxes to the field offices with the estimated cost of shipping wooden boxes like those which were used for the 1950 census indicated a saving in the initial shipping cost alone of more than \$100,000.

While the FOSDIC schedules did not require use of any particular writing instrument, it was regarded as worthwhile to attempt to get reasonably uniform marks with a readily available writing instrument. Consequently, a series of tests of writing instruments was made. Since there would be more than 150,000 enumerators, a writing tool was needed which was low in cost, easily replaced, convenient to use, and consistent as to quality of work. It was also necessary for the enumerator to be able to erase marks made by error on the schedules. After testing ball-point pens and automatic and regular pencils of different degrees of hardness, a first-quality, wood-encased No. 2-1/2 pencil with a suitable eraser was selected. Each enumerator received several pencils, and the same type of pencil was used when circles on the

FOSDIC schedules were filled during coding operations. Use of these pencils was not required but the enumerators were requested to use them to the extent possible.

During fiscal years 1959 and 1960, the Bureau issued a total of 50 invitations for bids, awarded 1,731 contracts, and issued 10,074 purchase orders. Examples of the volume of items purchased were 187,000 portfolios, 19 million special envelopes, 8,350 gross of special pencils, 5,960 projectors, 1,200 mobile-bin file units, 1,900 folding tables, and over 500,000 boxes of all types and sizes.

Most of the materials for the field work were sent to the Jeffersonville Operations Office as soon as they were prepared or acquired, and were distributed from there. As the materials were received in Jeffersonville, they were stored in roughly the order in which they would be needed. A total of 250,000 square feet were used for storing the supplies.

Kits of training and enumeration materials, each containing all the supplies that would be needed by a particular type of worker for a particular phase of the operation, were assembled and packaged in Jeffersonville. Assembly started with prepackaging: the materials for a kit were grouped in a design room and the best packaging determined. Four conveyor belts were used for feed lines for the actual assembly.

There were five types of portfolios for enumerators in continental United States--for "block cities" (for which housing data were to be published by block), for other areas, for both block cities and other areas in New York State (because of the question on citizenship which was omitted in the other States), and for single-stage areas. In addition to the other materials, all the portfolios for the two-stage District Offices were tailored to contain 100 envelopes, preaddressed to the particular District Office, to be left with the sample household questionnaire which the respondent was to mail in.

There were 14 different types of crew leader kits, containing recruiting forms, training materials, administrative forms and supplies, and geographic check material. A total of 36,245 were prepared and shipped.

Other kits prepared and shipped for use by personnel of the District Offices contained some office supplies (though basic office supplies for the District Offices were shipped from General Services Administration), recruiting forms, personnel forms, control and reporting forms, and training materials including filmstrips, records, and projectors. The 5,900 projectors were shipped from Jeffersonville.

The maps and all the kits were sent to the 399 District Offices. The District Offices distributed those for crew leaders and enumerators to the crew leaders, and the crew leaders distributed the enumerator kits.

Assembly of the kits started on January 4, 1960, and the bulk of this work ended 8 weeks later, though some additional material was sent out as long as the District Offices were open.

The enumerator portfolio, which was both the crucial kit and the one prepared in largest quantity, was the only one for which assembly production records were kept. Peak production of 94 kit assemblers was 9,080 portfolios stuffed in 1 day of two 8-hour shifts, or an average of 6 seconds per portfolio, each containing an average of 10 items.

The number of portfolios prepared for the different types of enumeration districts (ED's) was as follows:

| Type of Enumeration in the ED | No. |
|---|---------|
| Single-stage | 32,500 |
| Stage I of two-stage, "nonblock"..... | 72,800 |
| Stage I of two-stage, "nonblock," New York State..... | 6,200 |
| Stage I of two-stage, "block cities"..... | 50,000 |
| Stage I of two-stage, "block cities," New York State..... | 10,300 |
| | 171,800 |

The Advance Census Reports were prepared for 36,000 post offices. The Jeffersonville Office received all of the post offices' annual reports for the preceding year. From the number of families served by each postmaster, a number intended to represent sufficient Advance Census Reports for each carrier route was calculated. Sixty million Advance Census Reports were packaged into cartons that had printed instructions to the postmaster on each side, and the cartons were addressed to the individual postmasters and shipped to Post Office distribution centers.

Large supplemental shipments of Advance Census Reports had to be made to all the distribution centers. In many cases this was because postal carriers gave out the forms to hotels and other institutions along their routes; the postal bulletin which explained where the Advance Census Reports should be left by the carriers failed to specify the types of dwelling places at which they should not be left. In many other cases, the number of families served by a post office as reported by the postmaster proved to be an inadequate basis for calculat-

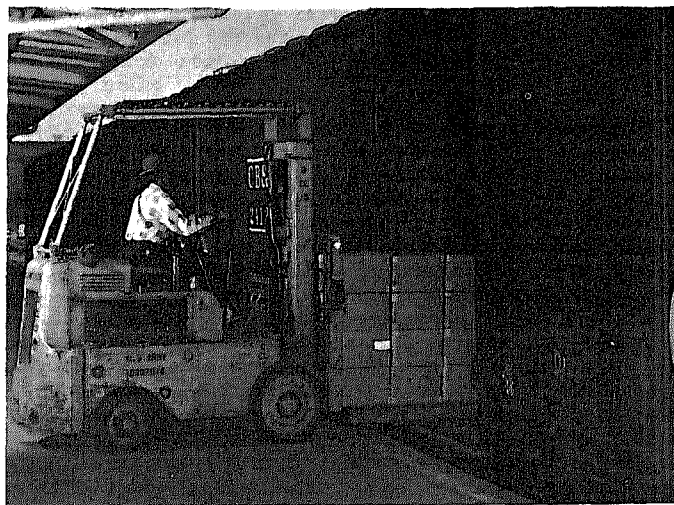


Figure 7.—Shipment of Enumerators' Portfolios and Other Supplies for the Field Work of the 1960 Censuses from the Jeffersonville Census Operations Office to the Temporary District Offices.

ing the number of Advance Census Reports needed; many of the families contained more than one household according to census definitions, and in addition the holders of post office boxes in towns and cities were not included in the figures.

Forms for persons overseas were mailed to consulates and embassies abroad.

The assembly, packing, and shipping of the material needed in the field for enumeration was completed by March 17, two weeks before the census.

The last item shipped from Jeffersonville was the "Were You Counted?" form on newspaper mats and reproduction proofs which were sent to field offices for distribution to local newspapers.

In 1958, the Bureau began to acquire excess office furniture from other Federal agencies, for use in the 399 District Offices and in the Census Operations Office in Jeffersonville. By April 1, 1960, the Bureau had acquired and distributed to these offices more than 8,700 desks, 6,500 tables, 20,000 chairs, and 2,000 file cabinets, at no cost to the Bureau other than the transportation and handling charges. The furniture was assembled at 20 stockpile locations throughout the country and was shipped from these locations to the field offices when the offices were ready to open.

One thousand and thirty-seven typewriters were rented locally by the District Offices, as were 1,068 adding machines.

Special procedures were established to dispose of the property in the District Offices quickly after the enumeration, because most of the offices had to close and vacate the premises promptly in accordance with lease commitments and in order to keep costs to a minimum. Immediately following the initial shipment of the property from the stockpile locations to the temporary field offices, a report listing the property at each office was sent to the proper General Services Administration regional office for review for possible future Federal utilization. A State Agency for Surplus Property of the Department of Health, Education, and Welfare also reviewed the list to see if any of the local State institutions authorized to obtain surplus Federal property had any need for any of the material reported. If any agency needed any of the property, the Bureau was notified. If the Bureau had not received a request for the property from either Federal or State agencies immediately prior to the time the district field office was to close, the supervisor of the office was authorized to contact officials of the local school system to ascertain if they were willing to acquire the property and to remove it from the office premises. If the property could not be disposed of by any of these procedures, the supervisor was authorized to sell the property to local office equipment dealers. If no dealers were interested, he was authorized as a last resort to receive bids and to sell the remaining property to local junk dealers.

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Chapter 6. The Field Organization and Training

ESTABLISHING THE FIELD ORGANIZATION

The Structure of the Field Organization

When preparatory work for the 1960 censuses began, the Bureau had 17 permanent Regional Field Offices which were responsible for collection of data not only for major censuses but also for special censuses of small areas and for regular surveys such as the monthly Current Population Survey and the National Health Survey. These offices reported to the Field Division in Bureau headquarters in Washington. It was on this base of 17 Regional Offices that the Bureau built the field structure for the 1960 population and housing censuses.

A total of 399 temporary District Offices were established in the 50 States and the District of Columbia. Of this number, 315 districts corresponded in boundaries to congressional districts. The remainder were formed by combining congressional districts or splitting them for census purposes.

The 399 temporary District Offices reported to the 17 Regional Field Offices. The number of District Offices within each region varied considerably, the principal factor being the density of population in the region. The Denver Regional Office, for example, had only 12 District Offices under its jurisdiction for five States of considerable size (Arizona, Colorado, New Mexico, Utah, and Wyoming), whereas the Chicago Regional Office supervised 30 offices in only two States (Illinois and Indiana).

Insofar as possible, the District Offices were situated to permit easy access to all parts of the district. In the large rural districts they were usually in towns near the center of the workload and having good communication with the rest of the district and with the Regional Office. The location of the District Office and its date of opening were generally considered local news and given publicity in the local newspapers and on radio and television--which helped in recruiting personnel.

The territory under the supervision of each District Office was divided into crew leader districts, and each crew leader district was divided into enumerator assignments (EA's). An EA included one or more enumeration districts (ED's). They varied in size from 23 EA's to a square mile, in New York City, to one EA per 400 square miles in some Western districts.

Arrangements for the District Offices

In order to develop estimates of the personnel and supplies that would be needed for the census enumeration, population estimates were prepared for each prefix area¹ in each district or for that part of a prefix area

¹A prefix area was a county, a city, or, in the case of counties containing "block" cities, the part of the county outside the city. For an explanation of the term "prefix area," see the section on "Numbering ED's" in Chapter 4, Geographic Work.

which was in a district. From these population estimates, the number of enumerators required in each district was estimated on the basis of 1,125 persons per enumerator, and then the number of crew leaders required if each were to supervise 15 or 16 enumerators. With these estimates as a basis, the necessary amounts of office space, office equipment, office personnel, supplies, schedules, forms, and mileage to be traveled were approximated for each of the 399 offices.

Each of the 17 Regional Directors was responsible for obtaining office space, supplies, and equipment for the District Offices in his region.

One hundred and six offices were obtained rent free, and most of the training space in all the districts was obtained rent free. Two hundred and ninety-three offices containing 612,000 square feet of floor space were leased at an average rate of \$2.03 per square foot per year--ranging from 21 cents per square foot in West Palm Beach, Fla., to \$5.00 per square foot in Anchorage, Alaska. The total rental cost for the District Offices was approximately \$621,000.

Two main telephone lines with an extension on each were authorized for each office. The telephone numbers of these were listed in telephone directories. In addition, an unlisted telephone line and an extension, primarily for crew leader communications, was authorized for each office for every 17 crew leaders reporting to the office.

Each District Supervisor was given a form authorizing a definite number of employees of each classification and specifying their rates of pay, the dates they were to enter on duty, and their length of employment. A definite amount was authorized for each district for salaries, travel, and other expenses. Each office was expected to complete its assignment within the limits of the time and money authorized.

Staffing

Washington headquarters.--The staff of the Field Division in Washington headquarters of the Bureau of the Census was augmented by the assignment of personnel from other divisions of the Bureau to assist for varying periods of time in writing instructions, developing training procedures, conducting training classes for supervisors and crew leaders, and other work which required subject specialists or training specialists. Also, four additional clerks and typists were required for about 6 months.

Regional Offices.--The 17 Regional Offices required 7 temporary Regional Assistant Directors and 68 temporary Program Technicians, to assist in preparing for and supervising the enumeration. The Program Technicians to some extent supervised the technical aspects of the censuses while the Regional Directors and Assistant Directors handled the administrative aspects, but the individual Regional Directors, who assigned and distributed the work, established various patterns of responsibilities.

During the busiest period, 356 payroll and travel clerks and 95 progress-reporting and other clerks and typists were working in the Regional Offices all or part time on the censuses.

Nearly all the temporary employees of the Regional Offices were taken from the Civil Service lists of eligible candidates. Some of the 1959 agriculture census employees were given extended appointments to help in the population and housing censuses.

District Offices.--More than 170,000 employees, including enumerators and crew leaders, were recruited for the District Offices in 3 months.

The number of employees needed for each position in the 399 districts, and the essential functions of each, were as follows:

District Supervisor (399)--Responsible for supervision of a district. Recruited all other District Office personnel except the Technical Officer, and recruited the crew leaders. Primarily an administrative position.

Assistant District Supervisor (72)--Assistance to the District Supervisor in administrative duties. The position existed only in the largest District Offices.

Technical Officer (405)--Technical assistance to the District Supervisor, and technical supervisor of the enumeration. Trained and supervised the crew leaders. For a few large offices, two Technical Officers were authorized.

Administrative clerk (399)--Handled all correspondence, reports, and payrolls. Usually trained and supervised the supply clerk and clerk-typists.

Supply clerk (399)--Made up enumerator and crew leader assignment kits and recorded receipt of completed work, flow of work, and transmittal to the data-processing office in Jeffersonville.

Clerk-typists (465)--Assistance to administrative clerk in routine duties.

Crew leaders (10,348)--Supervision of an average of 15 to 16 enumerators each, with one additional reserve crew leader in each District Office.

Field reviewers (9,948)--Assistance to the crew leaders in reviewing the work of the enumerators. There was one field reviewer for each crew leader (except the reserve crew leaders), selected by the crew leader from among the enumerators at the end of enumerator training.

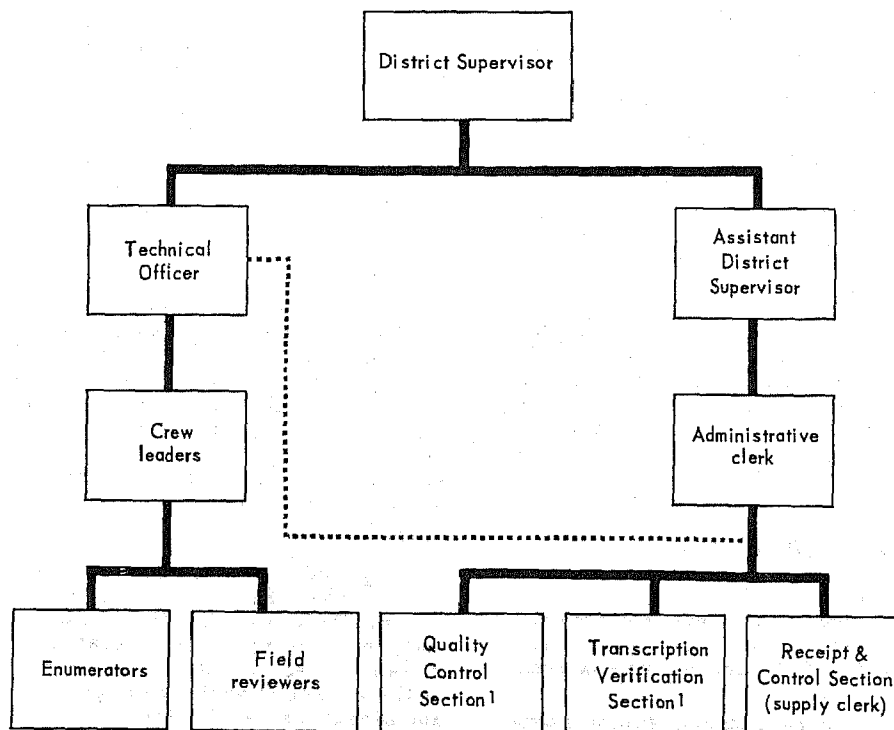
Enumerators (159,321)--The "census takers." One enumerator was authorized for each 1,125 estimated population. After adjustments because of geographic features, political boundaries, or areas more heavily populated than expected, the actual workload of the enumerators ranged between the extremes of 100 and 2,000 population.

Quality control and transcription verification clerks and supervisors (3,532)--Recruited for the most part from enumerators who had completed their enumeration assignments.

Not all of these positions were filled, and some employees left and had to be replaced. The largest number of enumerators reported at work on a single day during the enumeration was 156,966, on April 7; of these, 125,049 were stage I enumerators and 31,917 were single-stage enumerators. The largest number of crew leaders reported at work was 10,271, on the same day, April 7; 8,097 were stage I crew leaders and 2,174 were single-stage crew leaders. (Peak employment on stage II was reported on May 5, when there were 40,110 stage II enumerators and 2,948 stage II crew leaders at work.)

District Supervisors and Assistant District Supervisors for the District Offices were selected by the Regional Directors on the basis of background and personnel interview. The Regional Directors considered approximately 900 candidates before selecting the 399 District Supervisors.

Rigid qualifications were established for the Technical Officers, who were to be responsible for the technical



¹Staffed for the most part by enumerators who had completed their enumeration assignments.

Figure 8.--District Office Organization Chart.

direction of the enumeration, and the Regional Directors were given a free hand in the recruitment for these positions. Nearly all of the 405 Technical Officers had had teaching or training experience and the great majority held college degrees.

The District Supervisor interviewed and selected his office personnel and crew leaders.

The crew leaders generally selected the enumerators. In many of the large cities, however, the District Supervisors centralized enumerator recruitment in order to expedite it.

Applicants for positions as crew leaders and enumerators were given written tests (see below). Each supervisor selected his personnel from the group who passed the test, using such additional criteria as physical condition, appearance, reputation, and, in some areas, automobile ownership, language abilities, or other special requirements.

As in previous censuses, most of the enumerators were housewives or retired persons.

The District Office positions, because of their temporary nature and the large number of employees needed, were outside the Civil Service system. By tradition, decennial census recruitment is carried out under a referral system, with the national Administration designating the referral sources. District Supervisors in 1960 were in most instances recommended by Senators and Representatives in Congress. Other District Office personnel were recommended by local persons designated by the national referral authorities.

Referral authorities contributed substantially to the recruiting task, but were in many instances--particularly in the larger cities--unable to supply sufficient qualified candidates to meet the total need. District Offices utilized the facilities of the U.S. Employment Service, schools, churches, civic organizations, etc., to obtain candidates. A special enumerator recruitment plan, utilizing newspaper advertising and radio and television, was developed for 38 large metropolitan areas. This was necessary since the referral system alone could not provide nearly enough qualified enumerator candidates.

Testing Applicants

The applicants for positions as crew leaders and enumerators were given a test designed to measure their abilities to perform the various duties of the positions, and the personnel were selected from among those that made acceptable scores.

The test used was prepared by the Bureau on the basis of previous experience in testing personnel for census field work. It was intended to weed out applicants who would have difficulty reading, understanding, and following instructions at a level of difficulty comparable to the instruction manuals for the field work, and to provide a group of eligible candidates who could be expected to learn the essentials of the work in the time allotted for their training. The same test was given for both enumerators and crew leaders, but crew leaders were required to make a higher minimum score.

Most of the questions in the test were to be answered by choosing one from several possible answers, and the others were answered with numbers or by placing an "x" in the proper location on a map; there was a single correct answer to each question, so the scoring could be consistent in all the localities where the test was given.

The test included questions on vocabulary and reading comprehension, and also included a section on map reading which proved to be especially difficult for the candidates. Since the map in the test was similar to maps of EA's furnished to enumerators, ability to understand the map and the explanations of map symbols was crucial to adequate performance as an enumerator or a crew leader.

Approximately 50 percent of the applicants passed the test, on a nationwide basis. The percent of applicants that passed the test in particular localities varied a good deal from one locality to another.

Two different versions of the test were prepared, and both were used in each group of candidates tested, alternating by seat in the rooms in which the tests were given, so that every candidate was answering different questions from the candidates in seats adjacent to him. Having two versions also provided that different questions could be used if it were necessary to retest an applicant for any reason.

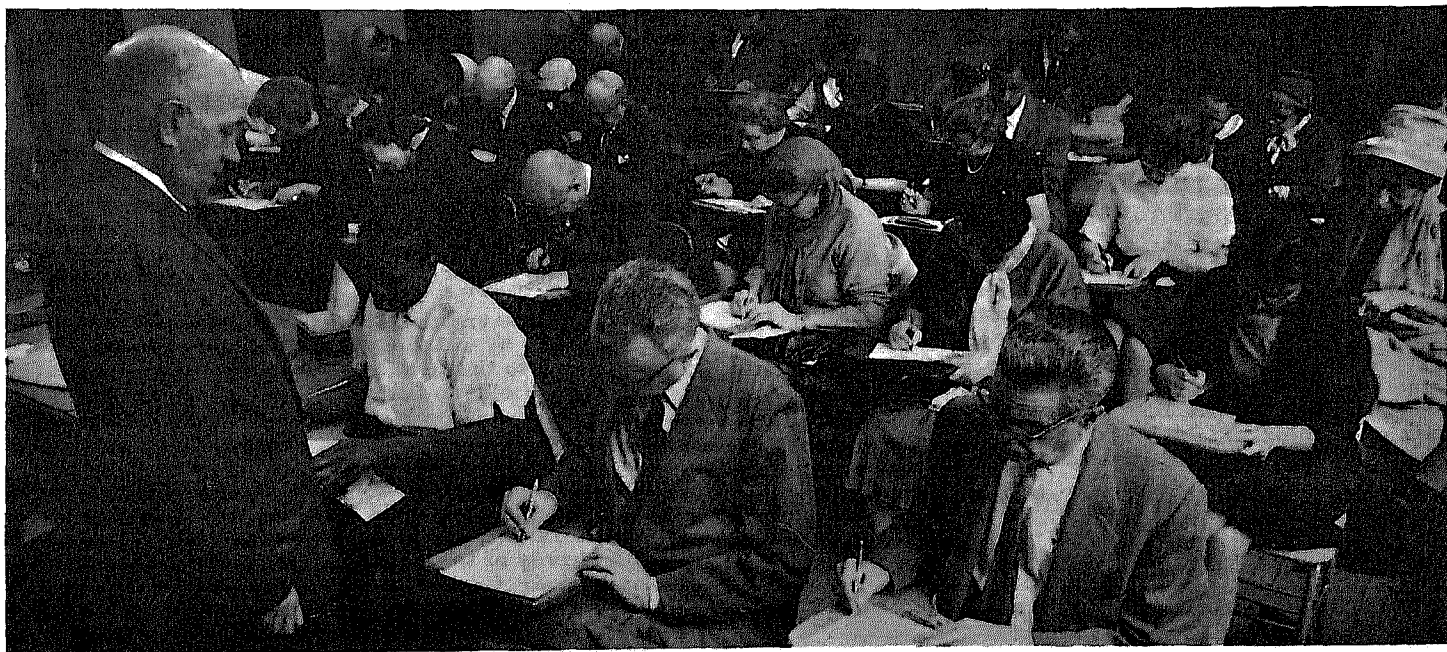


Figure 9.—Applicants for Jobs as Enumerators Being Tested in Vocabulary, Reading Comprehension, and Ability to Interpret Maps.

The value of using a screening test for applicants had been indicated by results of the Enumerator Variance Study conducted in connection with 1950 censuses. It was found then that enumerators who had made higher scores on the 1950 tests tended to leave fewer questions unanswered on the census schedules they filled out than did lower-scoring enumerators. On a smaller scale, for analysis of a later health survey pretest, enumerators were divided into two groups, the top and bottom halves by score on the selection test. In comparing enumeration results obtained by the two groups for selected statistics, it was found that although the means were about the same, the variances associated with the lower-scoring group were significantly higher.

Compensation of Field Personnel

All temporary field personnel except the enumerators and field reviewers² were classified by Civil Service grades and were paid accordingly. Crew leaders were grade GS-5, and were paid \$1.95 an hour, as were administrative clerks. Technical Officers were either grade GS-8 (\$2.65 an hour) or grade GS-9 (\$2.85 an hour), except for one grade GS-5, and District Supervisors were grade GS-9, GS-10 (\$3.10 an hour), or GS-11 (\$3.35 an hour), depending on the size of the District Office. All 72 Assistant District Supervisors were grade GS-9. All other office personnel--typists and clerks--were grade GS-3 (\$1.70 an hour).

Supervisors, crew leaders, and clerks were paid biweekly. The enumerators were not paid until their assignments were completed and had been accepted by their respective crew leaders. With few exceptions, enumerators received payment for their services within 4 weeks of completion of their assignments.

In order to expedite payment to the field personnel, because of the desirability of prompt payment of the many short-term employees, the payroll operations were decentralized into the 17 Regional Offices. These offices hired and trained clerks to process all field payrolls. This procedure was adopted in preference to repeating the 1950 procedure of paying in each of the temporary District Offices because of the difficulty of training and reviewing the work of employees in so many locations. The new procedure worked reasonably well at all Regional Offices, in part because of carefully prepared instructions and training. After a central training course for the Regional Office personnel involved, the finance and internal audit staff of the Bureau visited each Regional Office to review the operation and to conduct the necessary retraining and make any required modifications in the instructions.

THE TRAINING PROGRAM

Preparation of the Program

A year before the censuses, a five-man Decennial Census Training Techniques Committee was established in the Bureau to prepare a training program and training materials for the enumeration of the 1960 Censuses of Population and Housing. Members were drawn from the five divisions of the Bureau most concerned with the census training--Field, Personnel, Population, Housing, and Statistical Research Divisions.

The first result of the Committee's deliberations was the determination of the areas in which major policy decisions were needed before a program could be pre-

² See next chapter for explanation of basis of payment of enumerators and field reviewers.

pared. The resulting decisions, which provided a basis for the planning of the training program, were the following:

1. The person responsible for the performance of a group was to have the responsibility for training that group. Thus crew leaders would train enumerators, and Technical Officers would train crew leaders.
2. The training was to be very detailed and was to cover all the on-the-job procedures as well as all definitions of the terms and concepts underlying the classification schemes used for collecting the data.
3. Each trainee was to be paid for participating in training.
4. Expenditures for training were not to exceed \$3 million.

Operating within this framework, the Committee next had to arrive at decisions regarding the following essential conditions of the training:

1. The total length of the training session. It was decided to have a 9-hour training session for the first stage of the censuses and an 8-hour training session for the second stage. The decision was based on the budgetary limitation in combination with the large quantity of material to be presented, and the choices were within a narrow range.
2. The number of hours of training per day. The presentation of stage I training in short sessions on successive days was largely determined by the large number of essential items of information to be presented. It was felt that 4 hours of concentrated training was about as much as could be absorbed in one day.
3. The method of training. The principle that the crew leader should be responsible for training his enumerators was considered to have as a corollary that the crew leader personally should present significant portions of the materials (thus eliminating from consideration, for example, a training program consisting entirely of filmstrips).

There was general agreement that, as in previous censuses --

1. A combination of different media--filmstrips, lectures, etc.--would be used.
2. Training materials, including lectures, would be prepared by the Bureau, to reduce the variations in training which could result from several levels of instruction and a large number of instructors.
3. A considerable portion of the training sessions would be spent in practice exercises.
4. Enumerators would not be expected to learn all the details during the training sessions. They were to rely on an enumerator's reference manual to answer their questions on handling special situations.

There were two rather important innovations relative to training methods employed in previous censuses. The first was the "induction of enumerators." By scheduling the training for the 3 days immediately preceding the beginning of the enumeration, it was possible to institute the procedure by which each of the enumerators was to be accompanied to the first few households by either a crew leader or a field reviewer, either on the last day of the training, March 31, or on the first day of the enumeration, April 1.

The second innovation was the preparation of a home-study booklet, "Let's Talk Census," which was given the enumerators as soon as they were appointed, to give them a brief survey of their future responsibilities before they attended their first training class. This was suggested by the staff of the Dominion Bureau of Statistics of Canada, which had discovered that such a booklet stim-

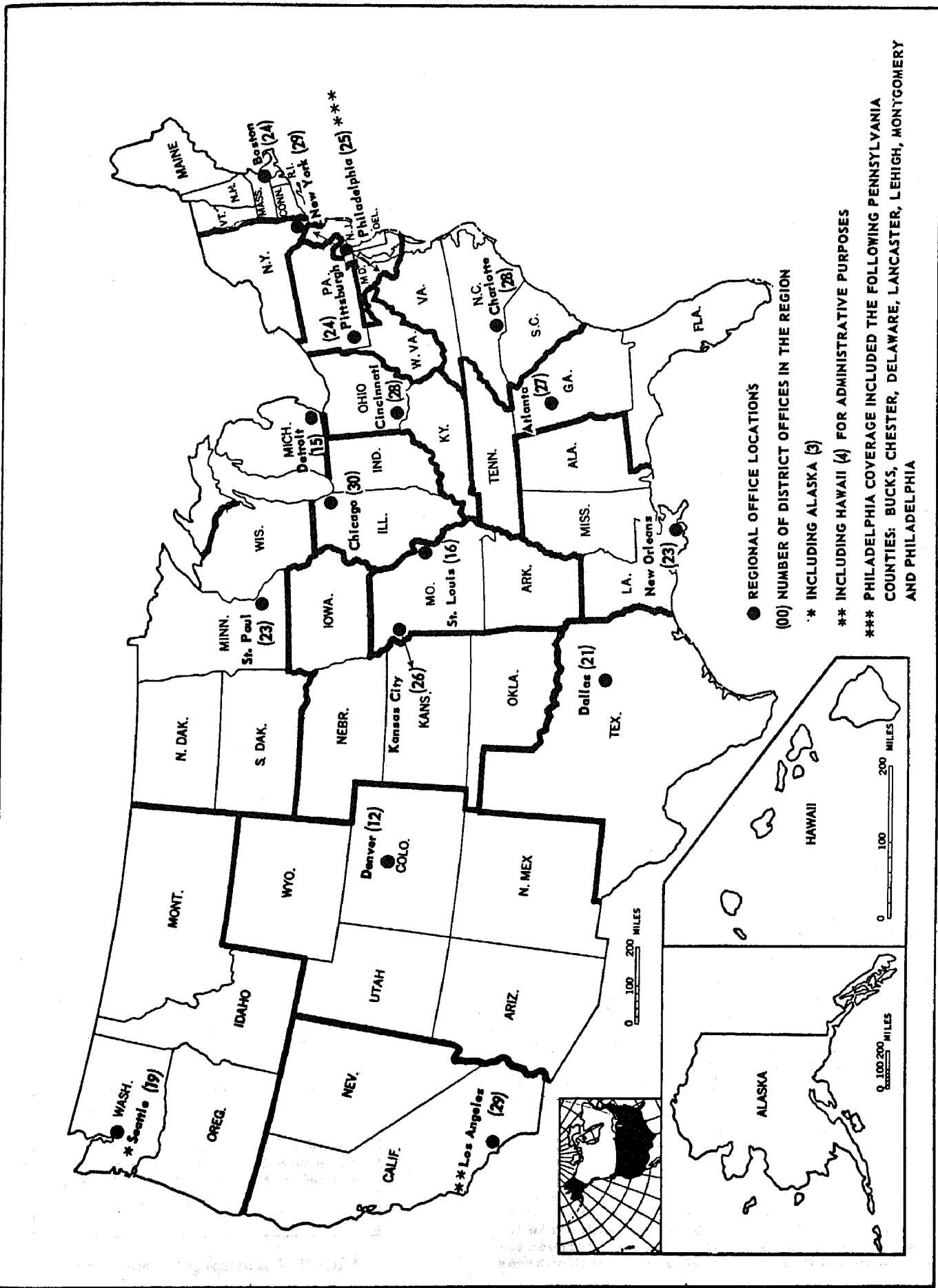


Figure 10. -Regional Office Coverage, 1960 Censuses of Population and Housing.

ulated considerable interest in advance and, more important, that many enumerators seemed to learn more readily because of it.

Organization of the Training

Technical training.--The plan adopted for the technical instruction was for a small group of persons to receive the training initially and for them to train a larger group who in turn trained a still larger group who then trained the enumerators.

The first persons to receive the training were called **Chief Instructors**. These were 39 professional people (15 two-person teams and 9 replacements), most of them members of the staff of the Bureau who had been working on one aspect or another of the census preparations, who were trained in Bureau headquarters in Washington. They received 5 days of intensive training by specialists in the subject content and procedures of the census and in training techniques.

After the first half-day of training, the Chief Instructors for the single-stage enumeration areas and those for the two-stage enumeration areas met separately for the remainder of the training period.

The Chief Instructors were teamed in pairs, and each pair conducted training sessions in two different locations in the United States. Their job was to explain to the **Technical Officers** their responsibilities and train them in their technical functions as well as to prepare them to train the crew leaders. The 22 Chief Instructors for the two-stage enumeration areas started February 22 on the first assignments and February 29 on the second. The 8 Chief Instructors for the single-stage enumeration areas began the first assignments on February 29; only 6 Chief Instructors, or 3 teams, were required for the second assignments beginning March 7. They gave 5 days of training to the 405 Technical Officers from the District Offices and 68 Program Technicians from the 17 Regional Offices. (The Program Technicians were to be stand-by reserves for the Technical Officers during the enumeration.) The 399 District Supervisors and their assistants, administrative clerks, and other office personnel attended the training sessions as their jobs permitted.

At the completion of the training, the trainees were given a "Test for Technical Officers." The test papers were sent to Washington with forms designated as "Chief Instructor's Report of Technical Officers' Training" which contained the name of each trainee, his District Office, and the Chief Instructor's rating as average, above average, or unsatisfactory, with notes of explanation. Thirty-three trainees were considered unsatisfactory and were replaced. Replacements were trained in Washington, D.C., and in St. Louis, Mo.

Crew leaders for single-stage enumeration areas received 4 days of technical training from the Technical Officers, beginning March 14 or March 21. Crew leaders for two-stage enumeration areas received 3 days of technical training beginning March 16 or March 22, and those selected for stage II enumeration received 2 additional days of training beginning April 8, 14, or 21, along with the field reviewers that were to be used in the stage II enumeration.

The Technical Officers also trained transcription verification supervisors and quality control supervisors for the District Offices.

The enumerators received their administrative and technical training from the crew leaders in 5,604 training centers. Almost all training centers were utilized in the forenoon for one training group and in the afternoon for another. Enumerators for single-stage enumeration areas

received 4 hours of training each day for 4 consecutive days beginning March 28. Enumerators for two-stage enumeration areas received 4 hours of training on each of 3 consecutive days beginning March 28, and 41,900 who were later selected for the stage II enumeration received 8 additional hours of training on April 18 and 19 or April 25 and 26.

Enumerators selected for the enumeration of transients in hotels, motels, etc. on the evening of March 31 ("T-night") received an hour or more of special training from their crew leaders earlier that same day. Those selected for the enumeration of missions, flophouses, etc. on April 20 or April 26 ("M-night" in their respective districts) received their instruction on April 18 and 19 or April 25 and 26 during the training sessions for the stage II enumeration. Few T-night or M-night areas were located in single-stage enumeration areas.

On March 31, the last day of the training of enumerators for stage I and for single-stage enumeration, about 50 percent of the enumerators enumerated three to five households each as a part of the training program. A "Household Change Report" was left with each household enumerated, with the request that the schedule be completed and dropped in the mail if any change occurred during the remainder of the day, i.e., before April 1.

The crew leader selected as his field reviewer the enumerator whom he thought best qualified at the close of the training sessions. The field reviewer received additional training in editing the listing books and enumeration books for completeness of coverage and quality of responses, in checking the sample selection, and in closeout procedures when no respondent could be found at home after repeated visits to a household. He also received instructions for examining the work records and expense records of the enumerators.

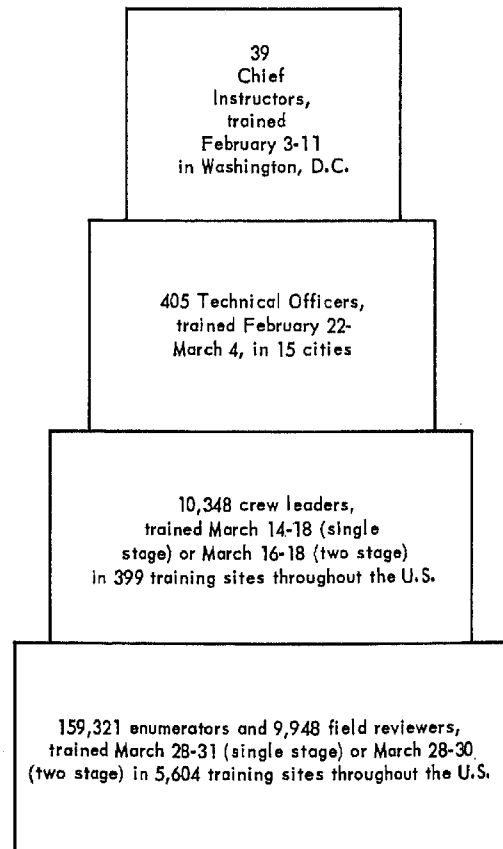


Figure 11.—Organization of Technical Training.

A total of 167,827 persons completed the enumerator training in March, 133,805 for two-stage areas and 34,022 for single-stage areas. Most of them became enumerators and some became field reviewers. A number dropped out after completion of the training and 5,751 persons were trained as replacements.

The diagram on the preceding page shows the main outlines of the organization of the technical training.

Administrative training.--The administrative personnel of the District Offices were trained in the Regional Offices by Regional Office personnel. The District Supervisors, Assistant Supervisors, and administrative clerks all received 4 days of training beginning on the day they entered on duty in their respective positions. The District Supervisors entered on duty Janu-

ary 11 or 18, the Assistant Supervisors January 18, and the administrative clerks January 18 or 25.

The remainder of the District Office personnel received their administrative training from their supervisors in the offices. These included the 405 Technical Officers who entered on duty February 1 and received their administrative training from their respective District Supervisors. The Technical Officers then assisted in organizing the offices and recruiting crew leaders. The crew leaders received training from the District Supervisors or Assistant Supervisors on such administrative duties as recruiting enumerators, obtaining space for enumerator training, reporting progress, etc.

Training calendar.--The complete schedule for the training of District Office personnel for both administrative and technical functions is given below.

TRAINING CALENDAR

| Trainees | Trainers | Place | Date |
|--|---|----------------------|---------------------------------|
| Two-Stage Enumeration Areas | | | |
| District Supervisor | Regional Office Technician | Regional Office | Jan. 11-14 or Jan. 18-21 |
| Assist. District Supervisor | Regional Office Technician | Regional Office | Jan. 18-21 |
| Administrative clerk | Regional Office Technician | Regional Office | Jan. 18-21 or Jan. 25-28 |
| Technical Officer (adm. functions) | District Supervisor | District Office | Feb. 1 |
| Clerk-typist | Administrative clerk | District Office | Feb. 8 |
| Supply clerk | Administrative clerk | District Office | Feb. 15 |
| Technical Officer (tech. functions) | Chief Instructor | Regional Office | Feb. 22-26 or Feb. 29-Mar. 4 |
| Stage I crew leaders (adm. functions) | Technical Officer and District Supervisor | District Office | Mar. 9 or Mar. 14 |
| Stage I crew leaders (tech. functions) | Technical Officer | District Office | Mar. 16-18 or Mar. 22-24 |
| Stage I enumerators | Crew leader | Crew leader district | Mar. 28-30 |
| T-night enumerators | Crew leader | Crew leader district | Mar. 31 |
| Field reviewers | Technical Officer or crew leader | District Office | Mar. 31 |
| Quality control supervisor | Technical Officer | District Office | Apr. 6-8 |
| Quality-control clerks | Quality-control supervisor | District Office | As required |
| Stage II crew leaders | Technical Officer | District Office | Apr. 8-9 or Apr. 21-22 |
| Stage II enumerators | Crew leader | Crew leader district | Apr. 18-19 or Apr. 25-26 |
| Stage II field reviewers | Technical Officer or crew leader | District Office | Apr. 19-20 |
| Single-Stage Enumeration Areas | | | |
| District Supervisor | Regional Office Technician | Regional Office | Jan. 18-21 |
| Administrative clerk | Regional Office Technician | Regional Office | Jan. 25-27 |
| Technical Officer (adm. functions) | District Supervisor | District Office | Feb. 1 |
| Clerk-typist | Administrative clerk | District Office | Feb. 8 |
| Supply clerk | Administrative clerk | District Office | Feb. 15 |
| Technical Officer (tech. functions) | Chief Instructor | Regional Office | Feb. 29-Mar. 4 or Mar. 7-11 |
| Crew leaders (adm. functions) | Technical Officer and District Supervisor | District Office | Mar. 7 |
| Crew leaders (tech. functions) | Technical Officer | District Office | Mar. 14-17 or Mar. 21-24 |
| Enumerators | Crew leader | Crew leader district | Mar. 28-31 |
| T-night enumerators | Crew leader | Crew leader district | Mar. 31 |
| Field reviewers | Technical Officer | District Office | Apr. 1 |
| Quality-control supervisor | Technical Officer | District Office | Apr. 6-8 |
| Quality-control clerks | Quality-control supervisor | District Office | As required |

Training Materials

The two most basic training materials were the Enumerator's Reference Manual, which was intended for use both during the training and during the enumeration, and the Crew Leader's Guide for Training Enumerators. Much of the time of the Training Committee was devoted to the preparation of these two documents, and they were tested extensively during the census pretests and reviewed and revised after each pretest.

To the extent possible, the Enumerator's Reference Manual contained all the detailed information necessary to handle all the situations that might arise during the enumeration--explanations of concepts and procedures and definitions. As the note on the inside cover said, an enumerator was not expected to remember all the details in the manual but was expected to learn to use it whenever he had a census problem.

The Crew Leader's Guide for Training Enumerators contained the lectures which the crew leaders read verbatim during the enumerator training. It also contained suggestions for questioning the class at specific points in the exposition, and for having members of the class conduct mock interviews, and for showing filmstrips. It included a section of explanations for the instructor on the time schedule of the training, trainer-trainee relations, how to use the film projector and record player, how to conduct practice interviews, how to get the training room ready, and similar items of information and instruction.

An innovation was the Training Workbook, a 17" x 14" spiral-bound sheaf of practice exercises and examples of forms. There was also a Practice Exercise Booklet consisting of several partly-filled census schedules, stapled together in the form of a booklet, for practice enumeration and for use in mock interviews.

For training the crew leaders, the same materials were used with the addition of a Technical Officer's Guide for Training Crew Leaders which contained material specifically on the duties of crew leaders during the enumeration, and a Crew Leader's Manual. There was also a District Supervisor's and Technical Officer's Guide for Preparatory Training which covered subjects on which the crew leaders had to be trained well ahead of the enumeration, e.g., how to recruit, select, and test enumerators, how to check ED's before enumeration, public relations functions, etc.

The Crew Leader's Manual gave explicit instructions on what the crew leader was to do before, during, and after the enumeration. The manual featured a crew leader activity calendar on the inside front cover. The appendixes contained exhibits of forms and also included instructions for enumeration of general hospitals and other institutions, a crew leader's checklist for map review and preparatory work, and agreements with Federal agencies for the enumeration of special areas.

For the training of the Technical Officers there was a Chief Instructor's Guide for Training Technical Officers. As stated in the introduction, "there is only one major subject presented to the Technical Officer which he, in turn, does not pass on to the Crew leader." The subject was quality control. This Guide was a slim pamphlet which served, for the most part, simply as a launching pad for the other materials.

Filmstrips employed in the training program were the following:

1. The Big Count (containing general background information)
2. Where and How Many (general background on coverage procedures)
3. Condition of a Housing Unit (illustration of housing units which were "sound," "deteriorating," and "dilapidated," and their distinguishing features)
4. The Ground You Cover (shown to enumerators only in cities for which data were to be published by city block, to illustrate coverage procedures)
5. The Ground You Cover (shown everywhere except in cities for which data were to be published by city block)
6. Enumerators at Work (shown in two-stage enumeration areas)
7. Enumerators at Work (shown in single-stage enumeration areas)
8. Industry, Occupation and Class of Worker (illustration of the concepts)
9. Income (illustration of the concepts)

Each filmstrip consisted of a series of "still" pictures, some of which were photographs and some drawings. A recording, containing explanations and comments and instructions for showing the next picture, accompanied each.

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Chapter 7. The Enumeration

ENUMERATION PROCEDURES

In the interval between March 9 and April 1, 1960, each crew leader was to travel over the enumeration districts (ED's) for which he was responsible. During the reconnaissance he was to perform the following steps:

1. Verify the accuracy of the enumerators' maps and the descriptions of ED's
2. Mark on each enumerator's map the route the enumerator was to follow
3. Make an advance listing, or "prelisting," of the initial 25 housing units (15 in rural areas) to be canvassed by each enumerator, in order to check later on the completeness of the enumerator's work
4. Estimate the number of housing units in each enumerator assignment to determine if it needed to be divided into smaller assignments so that the stage I enumeration could be completed on time. For this purpose, in cities and towns laid out in blocks, crew leaders were to make separate estimates for each block in an enumerator assignment. These block estimates provided a basis for an additional check on coverage during the review of the stage I enumerator's work
5. Identify places such as hotels and hospitals requiring special enumeration procedures

General

During the last 10 days of March 1960, the Post Office Department distributed two documents to occupied housing units throughout the country: (1) a brief questionnaire called an Advance Census Report, and (2) a statement requesting that the questionnaire be filled in and held for the enumerator's visit. The documents were also placed in post office boxes and were available at General Delivery windows and at counters in post offices.

The Advance Census Reports contained the questions on population and housing that were asked on a 100-percent basis in the enumeration district. The questions on population covered only name, relationship to head of household, age, sex, color or race, marital status, and, in New York State, citizenship. The questions on housing in those cities for which data were to be published by city block were slightly different from the questions asked in the rest of the country: the questionnaire used in the "block cities" (i.e., cities of 50,000 or more inhabitants and some other cities which had specially contracted for data to be published by block) included questions on rent or value of housing unit whereas the questionnaire used elsewhere omitted these questions. There were 11 housing questions that appeared on both "block city" and other Advance Census Reports.

Because the Advance Census Report was received by each household at least a few days in advance of the

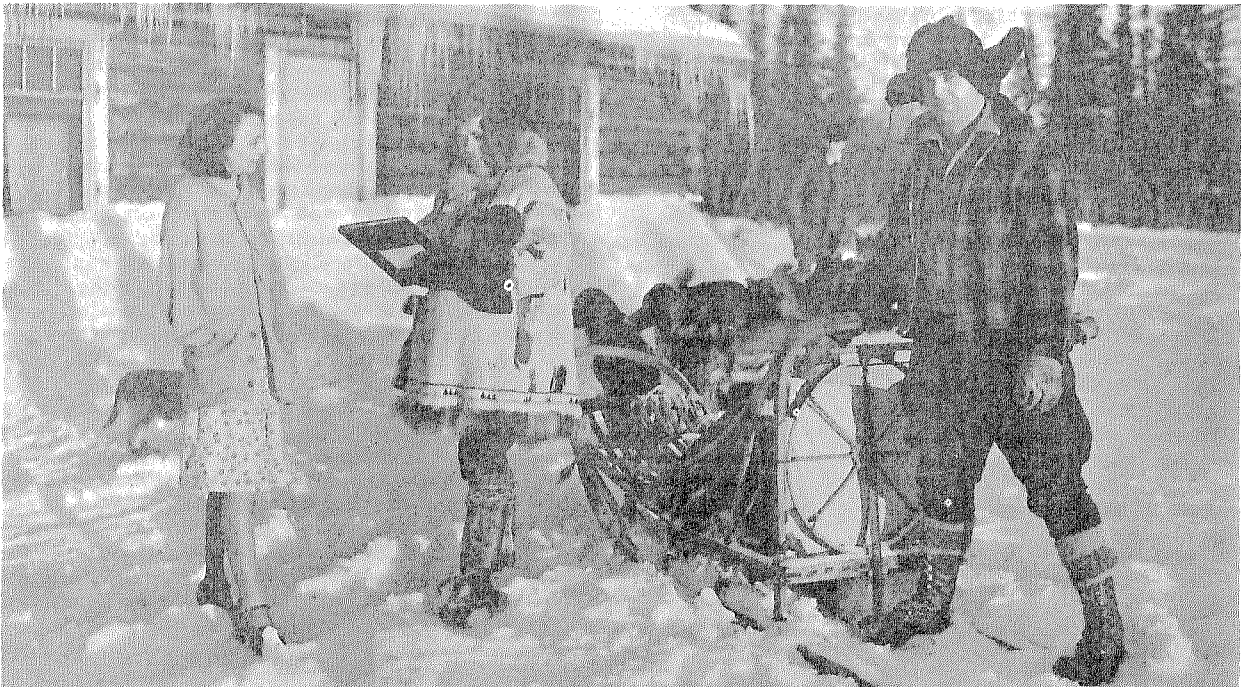


Figure 12.—Census Taking in Alaska.

enumerator's visit, household members had an opportunity to consult one another and their records and thereby to respond more accurately to the questions. In addition, the Advance Census Report had effective publicity value in preparing the public to expect the enumerator's visit.

Beginning on April 1 in most of the country, each housing unit was visited by an enumerator. (In the interior of Alaska, school teachers who had been trained by mail began enumeration in remote villages as early as January because melting snow and ice make travel virtually impossible in those areas in April and May.) If the Advance Census Report had been filled in by the household when the enumerator called, the enumerator was to transcribe the information to a schedule known as a "100-percent FOSDIC schedule" (see example in appendix I) which had been designed for use with the high-speed electronic data-processing equipment. The enumerator recorded responses to the questions on this schedule by filling in the appropriate small blank circles in specified sections of the schedule.

If the Advance Census Report had not been filled in, the enumerator was to obtain the information by questioning a responsible member of the household, and enter the information directly on the FOSDIC schedule; he was not expected to complete the Advance Census Report. The enumerator was instructed to collect the Advance Census Reports that had been filled out by the households, to insure that the information entered on them was treated as confidential. The Advance Census Reports were later destroyed, except for a sample retained for further study.

The extent to which the Advance Census Reports had been filled out when the enumerator called varied greatly in different areas. In some areas the enumerators reported that most of the households had their Advance Census Reports ready, whereas in other areas enumerators found that relatively few households had filled them out. A sample of 250 enumerators found that 59 percent of the occupied housing units had Advance Census Reports completed.

The 100-percent FOSDIC schedule included some items on housing which did not appear on the Advance Census Report. The enumerator obtained information for these items by observation. They were on type of housing unit, occupancy, vacancy status, description of property, and whether the structure was sound, deteriorating, or dilapidated.

The 100-percent FOSDIC schedule used in block cities, like the Advance Census Report used in block cities, contained questions on rent or value of housing unit. The one used elsewhere did not.

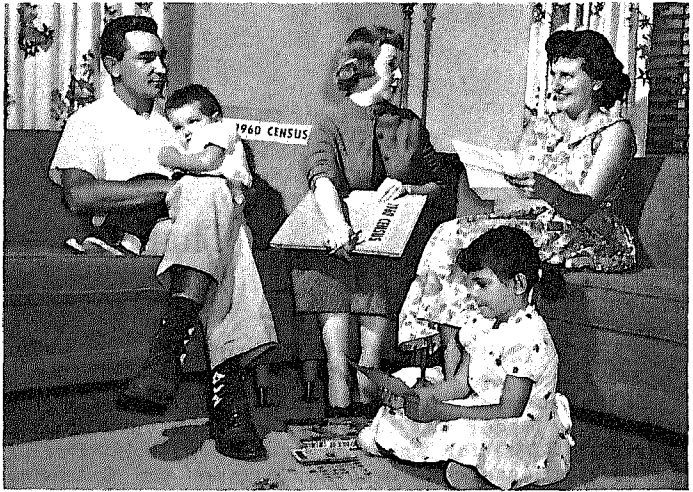


Figure 14.—Enumerator on the Job .

The enumerator carried with him a listing book in which he recorded each place visited and the name of the head of the household, the number of persons enumerated in the household, or the fact that no one was home so that another visit would be required or that the housing unit was vacant, and other pertinent information about the visit.

In urban areas, the enumerator's map showed each block in the ED, and the blocks were numbered in the order in which he was to cover them. He was instructed to start enumerating at the northwest corner of each block, to proceed clockwise around the block until he reached his starting point, and then go on to the next block. In rural areas, the enumerator was to begin at a point designated by his crew leader and to cover every road; roads were numbered on the map in the order of visitation.

A crew leader or field reviewer was to visit every enumerator at the beginning of the enumeration. He was expected to check coverage by comparing the enumerator's listing with the checklist the crew leader had prepared prior to the enumeration, and to review the information obtained to see that it was complete and appeared reasonable and consistent. Any errors were to be recorded and checked on the next visit to insure that they had been corrected.

Most of the items of information obtained in the 1960 censuses were collected on a sample basis. Every fourth housing unit visited was selected for the sample. The enumerator was to assign the letters "A," "B," "C," and "D" serially, in his listing book, to each successive housing unit in order of visitation, whether interviewed or not; each "A" housing unit was designated as a sample unit. The first unit in the listing book was pre-designated with one of the four letters, selected in rotation and given to the enumerator, to avoid always including in the sample the first housing unit enumerated by each enumerator.

In group quarters, that is, places such as institutions and lodgings, the sampling plan was based on the selection of every fourth person. Asterisks printed in the first column on lines 2, 6, 10, 14, and 18 of the 100-percent FOSDIC schedules designated the persons in group quarters who were to be included in the sample.

Two-Stage Enumeration Procedures

The basic process of enumeration in the 1960 Censuses of Population and Housing was a two-stage approach.



Figure 13.—Enumerator on the Job .

The information required for every person and housing unit in the enumeration district was obtained in the first stage. Sample data were collected at a separate and later stage. Eighty-two percent of the population of the country was in census districts in which the two-stage method of enumeration was used. Persons living in less densely settled areas were covered under a single-stage plan.

In the two-stage procedure, when the enumerator visited the household to collect the Advance Census Report and to fill in the 100-percent FOSDIC schedule, he left a questionnaire containing the sample population and housing questions at every fourth ("A") household. This was called a Household Questionnaire (see example in appendix I). The householder was asked to answer the questions and mail the questionnaire to the District Office.

The primary purpose of this procedure, like that of the Advance Census Reports, was to allow the householder to see the questions as worded, to consult members of the household and household records in order to ascertain the correct answers, and to give considered replies. For some of the sample questions, in particular, improvement in the accuracy of the results was expected because earlier research, especially in connection with the 1950 censuses, indicated that some enumerators tended to introduce consistent errors in the answers they recorded. For some questions these variations among enumerators contributed heavily to the total errors found in the responses recorded. It was expected that this source of errors would be greatly reduced, to the extent that householders wrote the replies to the questions on the questionnaires.

The stage I enumerator filled in the identification items on the household questionnaire, including the name of each person in the household. He also filled in two housing items from observation--the number of housing units in the structure, and, for owner-occupied units, whether the property was one unit without a business conducted on the premises, one unit with a business, or contained two or more units.

Since the household questionnaire contained only enough space for information on four persons, an additional form was used for each additional member of the household. This form, known as an Individual Questionnaire, or Extra Person Form, contained the same population questions as the household questionnaire. When nonrelatives such as lodgers were present in the household, the individual questionnaire was left for each to fill in, together with an envelope which could be sealed to insure confidentiality of the replies. The individual questionnaire was also left with sample individuals in group quarters, such as barracks and lodginghouses.

The stage I enumerator initiated and partially filled a sample FOSDIC schedule for each sample household and vacant housing unit and for each sample person in group quarters by transcribing the information from the 100-percent FOSDIC schedule.

For the second stage of the two-stage enumeration, approximately one-third of the original enumerators in two-stage areas were retained and given additional training. The stage II enumerator was given the enumeration book containing the sample FOSDIC schedules which had been initiated and partially filled by the stage I enumerator. He was also given the accumulation of filled-in sample household questionnaires and individual questionnaires which had been received in the mail from the enumeration district. He then transcribed the responses from the sample household questionnaires and individual questionnaires to the sample FOSDIC schedules. If a household questionnaire or individual ques-

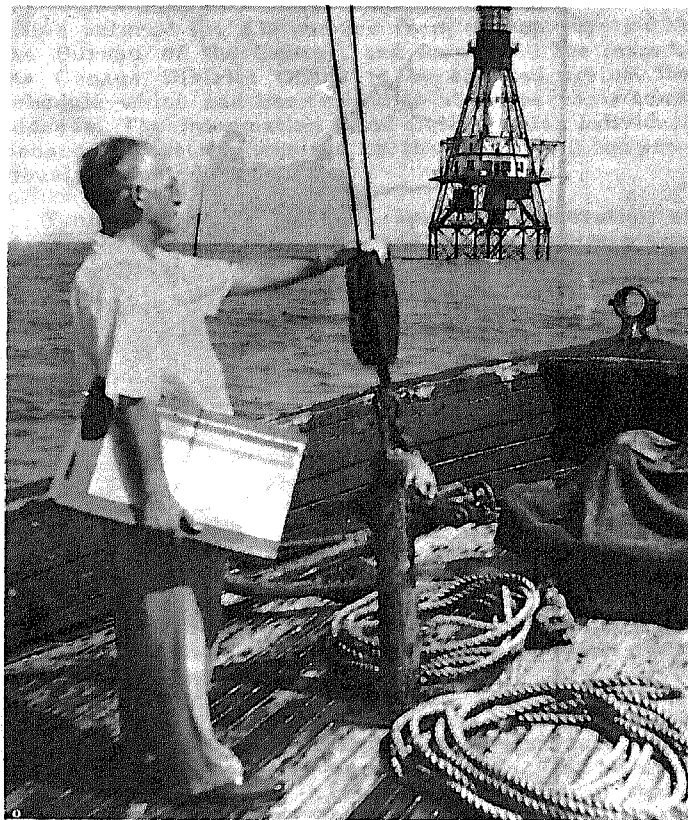


Figure 15.—Enumerator on the Job.

tionnaire was incomplete, the enumerator was to obtain the additional information required by telephone or by a visit to the household. In the case of a vacant sample housing unit where no household questionnaire had been left, the stage II enumerator was to obtain the appropriate information about the housing unit by interviewing the person indicated by the stage I enumerator in his listing book as the most reliable source of information--owner, agent, manager, or neighbor--or by obtaining information from other sources as necessary.

A few housing questions were asked in block cities which were not asked elsewhere, and a few were not asked in block cities which were asked elsewhere, so two slightly different household questionnaires were used. Also, in both cases, some of the housing items were to be tabulated for only a 5-percent sample and others for only a 20-percent sample, so four versions of the sample FOSDIC schedules were required. In the enumeration book for block cities, one FOSDIC schedule for the 5-percent housing sample was inserted after each four FOSDIC schedules for the 20-percent sample; an item appearing on both the 5-percent and 20-percent sample FOSDIC schedules in the enumeration book was, of course, thereby obtained for a 25-percent sample of housing units in the block cities. The same system, but with some different questions on the schedules, was used to obtain 5-percent, 20-percent, and 25-percent samples of housing units outside block cities. (See Table B, "Housing Items of Data Collected," in chapter 2.)

Single-Stage Enumeration Procedures

In the single-stage plan of enumeration, the enumerator was to collect the Advance Census Report, fill in the 100-percent FOSDIC schedule, and obtain and enter the information from every fourth household for the sample FOSDIC schedules, at the time he made his round of visits. The same Advance Census Reports and FOSDIC

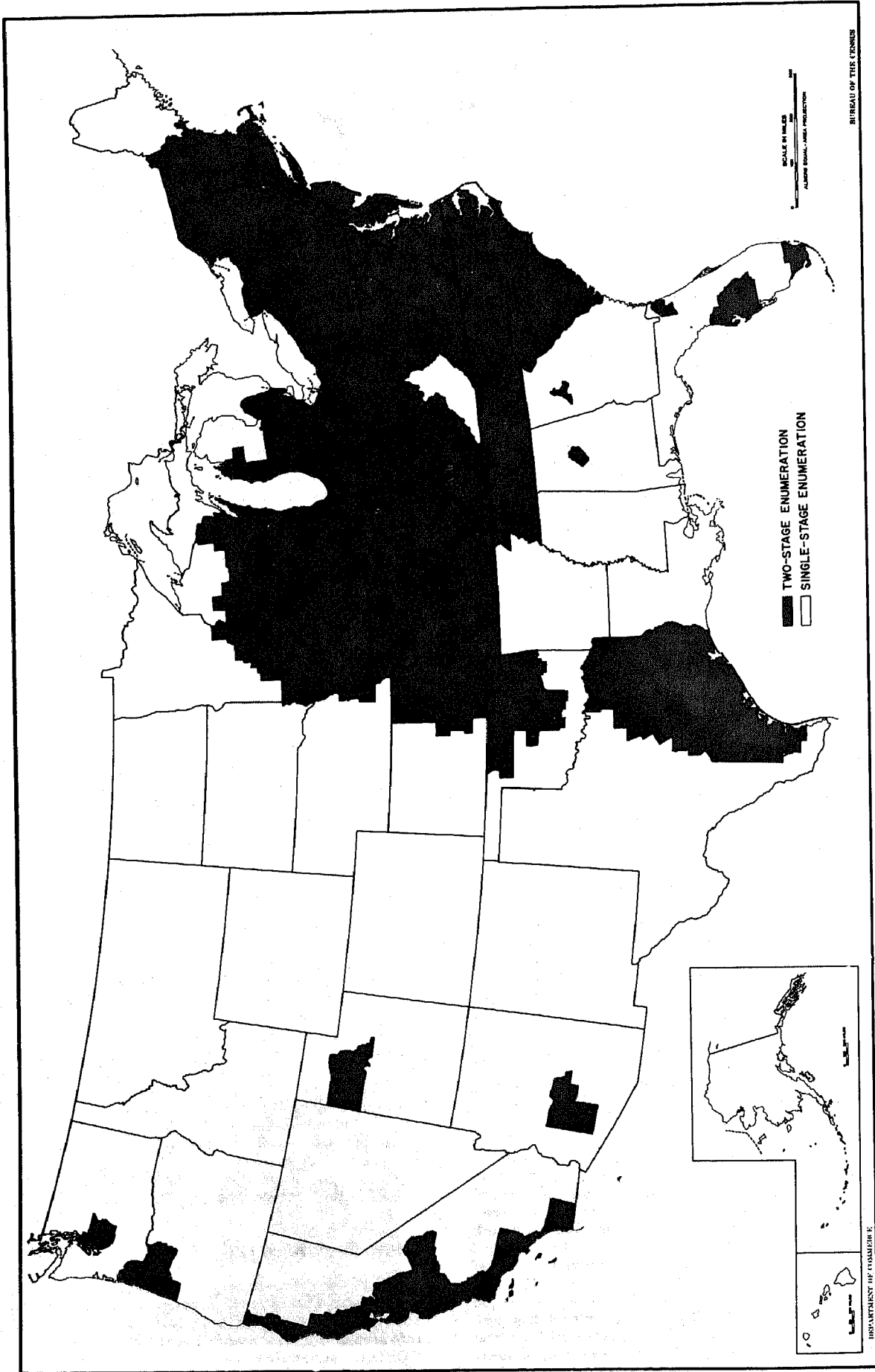


Figure 16. - Two-Stage and Single-Stage Procedure Enumeration Areas, 1960 Censuses of Population and Housing.

schedules were used as in the two-stage procedure. However, since the enumerator obtained all of the sample information by interview and entered it directly on the sample FOSDIC schedule, the sample Household Questionnaires were not used.

The single-stage method of enumeration was used in the less densely settled areas of the United States which, although they included over half of the land area of the country, contained only 20 percent of the population. (See map, "Two-Stage and Single-Stage Procedure Enumeration Areas.")

Procedures for Special Situations

Individuals in group quarters.--In both the two-stage and single-stage enumeration procedures, a special questionnaire called an Individual Census Report (form 60PH-10) was used to obtain population information for persons in group quarters. Individual Census Reports were left by the enumerator at households containing lodgers, and with the heads of general hospitals and other types of institutions as well as such places as missions, flophouses, and hotels having nontransient residents. They were to be distributed to the respondents and picked up by the enumerator the next day. This form had a gummed flap so that it could be sealed after it had been filled in, to preserve confidentiality of the replies. Only the few questions that were asked on a 100-percent basis were on this form. The information was transcribed to the 100-percent FOSDIC schedules by the enumerator. For a 25-percent sample of these persons, an Individual Questionnaire (form 60PH-9) containing the sample questions was left with the household or the manager of the place.

Closeout procedures for households.--If, after making three calls, the stage I or single-stage enumerator was unable to find an acceptable respondent at a housing unit, he was to obtain all the information he could on the 100-percent items from a neighbor, hired help, or the apartment house manager. The enumerator then notified the householder that the household had been enumerated by leaving a Notice of Enumeration (form 60PH-12) which contained the 100-percent population questions. If the householder believed incorrect information might have been furnished, he could fill in the form and mail it to the District Office. The form had a gummed flap, was preaddressed, and postage free.

If the stage II enumerator did not receive a completed Household Questionnaire from a sample household and was unable to obtain the information by telephone, he was to make no more than three visits to the household. On his third visit, if he still found no one at home, he was to obtain as much of the missing housing information as possible from observation and from neighbors, resident managers, or others. He was not to attempt to obtain sample population information for the absent household by inquiry. He left a "Notice of Required Information" and a Household Questionnaire at the household, and if they were not received in the mail he made a final telephone call (if he had obtained a telephone number for the household) before closing out the case.

In single-stage enumeration areas, if the enumerator was unable to find a suitable respondent at a sample household, he left a Notice of Required Information (form 60PH-17), which contained both the 100-percent and the sample questions, together with a preaddressed, postage-free return envelope.

Visitors.--Visitors who said they would not be enumerated at their usual place of residence and persons in general hospitals were enumerated on Individual Census Reports which were sent to the post office of

the community in which they lived. There the post office entered the ED number from a map supplied by the Bureau of the Census, and forwarded the form to the Census District Office to be checked against the schedule which had been filled in at the person's home address. The information found on the mailed Individual Census Report was entered on the schedule if not previously reported.

T-night and M-night.--A special enumeration of transients in hotels, motels, and other establishments having accommodations for at least 50 transient guests was conducted the night of March 31, referred to as T-night. (Places with fewer than 50 rooms or apartments for transients were enumerated during the regular canvass.) The transient guests in the establishments covered on T-night were enumerated on a questionnaire called Report for Guests of Hotels, Motels, Etc. (form 60PH-11). These forms, like the Individual Census Reports for visitors, were forwarded to the community in which the person usually lived, to be checked against the schedules which had been filled in at the person's usual residence. Transients with no fixed address were included in the ED where they were found. The non-transient guests and the employees living on the premises with no place of residence elsewhere were enumerated as residents of the ED in which the structure was located, on the regular schedules used for other residents of the district.

Another special enumeration covered missions, flophouses, and similar places having 50 or more accommodations for rent at \$1.25 or less a night. This M-night enumeration, as it was called, also included those jails, detention centers, reception centers, and diagnostic centers in which the average length of stay was less than 30 days. The occupants were enumerated on the regular enumeration schedules used for residents of the ED, with every fourth person being enumerated on a sample schedule. An Individual Census Report was left with the management for persons who were out or for any newcomer registered that night after the enumerator had left. These forms were picked up the next morning by the enumerator, who entered the information on the FOSDIC schedule. M-night was April 8 in most of the single-stage areas and April 20 in most two-stage areas.

Military and maritime personnel.--"Report for Military and Maritime Personnel" questionnaires (form 60PH-13) were shipped in bulk to the various branches of the Armed Forces, the Coast Guard, and the Maritime Commission. These agencies shipped packages of the forms to military installations for the enumeration of military personnel living in barracks or similar quarters, and to American vessels, whether in harbor or at sea on April 1, 1960, for the enumeration of officers and crew members who were living aboard ship. Arrangements were made between Census District Offices and military installations for census enumerators to pick up the filled-in questionnaires. Forms distributed by the Maritime Commission were returned directly to the Census Operations Office in Jeffersonville by the master of each ship.

Americans abroad.--Americans living abroad were reported on a special questionnaire, the "Overseas Census Report" (form 60PH-15). In addition to the population questions asked of all persons, this form contained some of the sample questions and some special questions on education and training, knowledge of local languages, duration of stay in the country, and whether the person was in the Armed Forces or was a civilian. The Department of Defense distributed and collected the forms for members of the Armed Forces and for its own civilian employees overseas and their families. The Department of State handled the enumeration of other

Government employees and other civilians residing abroad, through the U.S. embassies and consular offices which distributed and collected the questionnaires.

"Were You Counted?" forms.--Toward the end of the enumeration period, many newspapers in the United States published "Were You Counted?" forms (60PH-16) which contained the questions asked of 100 percent of the population. The reader was urged to fill in this form and send it to the Census District Office if he believed that he or members of his household had been missed in the enumeration. Mats and glossy prints of the forms had been prepared by the Bureau of the Census and supplied to the newspapers by the District Offices.

State variations in procedures and forms.--There were some variations of the basic procedures or items of information collected in three States--Alaska, Hawaii, and New York.

In remote areas of Alaska where the enumerators did not receive the standard training course given elsewhere, conventional household schedules, on which responses were to be written in longhand, were used, and the information was later transcribed to FOSDIC schedules in the District Office.

The FOSDIC schedules for the 100-percent data in Alaska had two additional categories in the item on race or color, for Aleuts and Eskimos, and those in Hawaii had two additional categories for Hawaiians and part-Hawaiians.

In New York, a special question on citizenship was asked of the entire population in the State, at the expense of the State, to fulfill a requirement of the New York State constitution for reapportionment of the State legislature on the basis of the number of citizens in each area.

Enumerators' Portfolios

The portfolio which the enumerator carried with him when he visited all the housing units in an ED contained the following:

- ED map
- Listing Book (form F201 in two-stage ED's, F201A in single-stage ED's)
- Enumerator's Reference Manual
- Enumeration book containing FOSDIC schedules for data collected on a 100-percent basis (form 60PH-1 in "nonblock" areas, 60PH-2 in "block cities")
- In single-stage ED's only, an enumeration book containing FOSDIC schedules for sample data (60PH-3 in "nonblock" areas, 60PH-4 in "block cities")
- In two-stage ED's only, Household Questionnaires to be left at sample households (60PH-7 in "nonblock" areas, 60PH-8 in "block cities")
- Individual Questionnaires (Extra Person Forms), form 60PH-9, and envelopes, to be left at sample households when needed (60 in portfolios for two-stage areas, 10 in single-stage areas)
- Individual Census Reports, form 60PH-10 (25 forms)
- Notice of Enumeration forms (60PH-12) to be left at households when "100-percent" information was obtained from neighbors, servants, etc. (25 forms)
- In single-stage areas only, Notice of Required Information forms (60PH-17), and envelopes, to be left at sample households where no one was found at home after three visits (10 forms)
- Pencil and eraser
- Pencil sharpener
- Pad of scratch paper, 3½" x 8"

The portfolio itself was a large cardboard envelope. When filled, it weighed from 10 to 15 pounds, depending on the type of ED.

QUALITY CONTROL PROCEDURES

General

The quality of field enumeration during the 1960 Censuses of Population and Housing was controlled at two levels. First, the work of enumerators was reviewed by crew leaders. Second, quality control clerks in the District Offices inspected completed schedules received from the field to determine whether crew leaders were doing an adequate job of inspection.

In order to make the program as specific as possible, the following steps were taken:

1. "Errors" were defined as precisely as possible. By an enumerator "error" the following was meant:

- a. Failure to obtain required information; that is, "blanks" left in population and housing items on the census schedules (excluding schedules completed by closeout procedures, which were handled separately)
- b. FOSDIC marks which were too light to be read by the machine or which were so badly made as to generate FOSDIC reading errors
- c. Certain inconsistencies, such as males recorded as daughters of heads of households

2. Detailed instructions for selecting samples of work and for performing the inspection were prepared for both levels of inspection.

3. Quantitative acceptance standards were established so that crew leaders could determine readily whether enumerators were doing acceptable work, and were also established so that office clerks could determine when crew leaders were sending in work which they had not reviewed adequately.

4. Detailed instructions were provided to inspectors at both levels for action to be taken when work was found to be unacceptable.

The system did not control errors resulting from inaccurate but consistent information given by a respondent as distinguished from contradictory or inadequate information. Neither did it control information recorded incorrectly by enumerators if it could not be detected by simple consistency checks.

Crew leaders and field reviewers in each field office were trained in the field review work by Technical Officers who were also responsible for training and supervising the office quality control clerks concerned with checking to see whether first-line reviewers were doing an adequate job.

Separate quality control programs were prepared for those sections of the United States where the census was taken by means of a single-stage procedure, and a separate quality control program was also prepared for Puerto Rico.

The various quality control procedures were tested in an effort to insure that the amount of time allowed for each procedure was sufficient and, consequently, that the entire program could be completed within the available resources.

The procedures described below were specified, and steps were taken to help insure that they were followed. However, as in the case of other procedures, they were

not always carried through adequately or as specified. Samples of the various forms completed during the field review and office quality control activities were selected for analysis, for evaluation of the performance of the quality control system and of the procedures used to control the quality of the field work during the 1960 censuses. Such analysis, as well as a discussion of the mathematics of the various plans, will be part of an expanded treatment of the quality control of the field work which is planned for separate publication.

Quality Control Preparations before the Enumeration

An essential part of the quality control program was the advance listing by crew leaders of a number of housing units in each enumeration area and their advance estimates of the number of housing units in each block in their districts. Both the advance listing and the block estimates were used to check on the enumerator's coverage of the housing units in his area. A printed checklist was used by crew leaders for doing this advance work.

Crew leaders sent in the results of preparatory work each day to their Technical Officers who determined from them whether crew leaders were following instructions. Technical Officers also reviewed the crew leaders' reports to determine whether a crew leader would require assistance to complete this phase of the work on schedule.

Technical Officers arranged to observe crew leaders during the preparatory phase in order to evaluate and help insure adequate quality of this work. A form, "Evaluation of Map Review and Preparatory Work," was used for this purpose.

Stage I Quality Control

Field review.--Crew leaders and field reviewers arranged to inspect the work completed on the first day by each enumerator as soon as practicable after the censuses began. Stage I enumerators were paid a fee of \$4.00 for time spent in field review, to avoid reducing their expected earnings which were based on piece rates. Attempts were made to review each enumerator's work before the evening of April 3.

When an enumerator brought in his work for review for the first time, the reviewer made the following checks:

1. A check for missed units (from the advance list prepared by the crew leader)
2. A review of the listing book for major defects such as errors in sample key designation
3. A check of the listing book for minor defects such as incorrectly recorded callbacks
4. A review of the population and housing items on the FOSDIC schedules for omissions or bad marking
5. A check to see that the canvassing information recorded in the listing book agreed with the information in the enumeration book

A form called a "Record of Field Review," was used for this purpose.

During the review, the enumerator recorded any errors found, so he could correct them. At subsequent reviews, reviewers checked to see that these errors were corrected.

After performing the sundry checks in sections I through VI of the review form, the reviewer then compared the number of errors found in each with an acceptance number preprinted on the form. Depending

on the number of times an enumerator exceeded an acceptance number for any one check, the reviewer took one of three actions:

1. Instructed the enumerator that no further review would be necessary until his assignment was completed, at which time a final review would be made
2. Scheduled another review
3. Took steps to terminate an enumerator's appointment because he made more than the acceptable number of errors

During stage I, it was possible for one enumerator's assignment to be inspected as many as four times. The acceptance criteria were made tighter for each successive review as the enumerator gained experience.

Closeout review and transcription verification.--Following the final review of an enumerator's work, the crew leader was to make two additional checks. The first was a check for the number of cases which an enumerator had completed by closeout procedures, that is, where he had obtained limited information from neighbors or other sources after making three visits to a housing unit without finding a suitable respondent at home. When the crew leader determined that an enumeration assignment had more than an acceptable number of closeouts, he assigned it to an enumerator who was paid on an hourly rate basis for further visits to such households.

After the closeout check was completed, the crew leader checked on how well enumerators had transcribed stage I information for sample households to the stage II enumeration books. He was instructed to review the transcription of information for the last unit for which sample data were obtained on each page of the listing book, i.e., the last sample housing unit or the last sample individual in group quarters. This meant that on the average the transcription was reviewed for about 13 units per EA, or about 17 percent of the sample households. If transcription quality was not acceptable, the crew leader arranged for all necessary corrections to be made before sending the enumeration books to the District Office.

Crew leaders and field reviewers reported to the Technical Officer on the amount of field review completed each day and the results of such field review.

Technical Officers made appointments to observe crew leaders and field reviewers reviewing work brought in by enumerators and evaluated how well the field reviews were conducted.

Stage I District Office quality control.--Quality control clerks in District Offices reviewed samples of the work in each enumeration book, in accordance with procedures specified in detail in their instruction manual, to insure that crew leaders and field reviewers were doing an adequate job of inspection. Enumeration books which were rejected by the office clerks were returned to crew leaders for correction. In addition, upon determining that an enumeration book failed quality control, the quality control supervisor notified the Technical Officer so that he could take appropriate corrective action.

The first time that an enumeration book from a particular field reviewer was rejected, the Technical Officer notified the crew leader so that arrangements could be made either to give the field reviewer further training or to release him. The second time a book from the same reviewer was rejected, the field reviewer was relieved of his field review functions. The first time a crew leader submitted an enumeration book which was rejected by the office, the Technical Officer observed him conduct a final field review and determined whether

he needed further training or whether his field review function should be assigned to someone else.

Stage II Quality Control

Selection of crew leaders and enumerators for stage II.--Crew leaders and enumerators were selected for stage II work on the basis of their performance during stage I. Crew leaders' recommendations for stage II enumerators included reports on whether these enumerators did well in field review during stage I. The selection of crew leaders for stage II work depended in part on the results of the office inspection of work from their districts.

Field review.--During stage II of the enumeration, crew leaders and field reviewers reviewed the work of enumerators in much the same fashion as they did during stage I. Enumerators were paid a fee of \$2.00 per assignment for time spent in field review, to avoid reducing their expected hourly earnings computed on the basis of piece rates. Instructions for inspecting the stage II enumerator's work and for using the stage II field review form were given in the stage II crew leader's manual.

Part of the inspection of the stage II enumerator's work consisted of checking the accuracy of transcription of information from Household Questionnaires to stage II FOSDIC schedules, and part was on the enumerator's follow-up to obtain information from households that did not return questionnaires or that returned questionnaires with incomplete or contradictory information.

Again, as in stage I, the Technical Officer was required to visit with crew leaders and field reviewers to observe the way in which they conducted their field reviews, and to prepare an evaluation of the review.

Stage II District Office quality control.--During stage II, as in stage I, office clerks reviewed the work received from each crew leader district, and similar inspection procedures were followed. Technical Officers took corrective action upon being informed that stage II work failed inspection in the District Office.

The Role of the Regional Program Technician

Throughout the entire census period, Technical Officers were visited periodically by the permanent Program Technicians of the Regional Offices. The Program Technician examined the various evaluation forms prepared by the Technical Officer and reviewed the quality control reports received by the Technical Officer from crew leaders and field reviewers. He made a formal report of his observations to the Regional Field Director on a set of evaluation forms similar to those used by Technical Officers for evaluating crew leader activities.

Reporting Quality Control Results

Twice weekly the Technical Officer prepared a summary of the results of the various quality control activities in his District Office. The District Supervisor submitted this report to the Regional Field Director on a form prepared for the purpose.

Establishing Acceptance Standards

The basic data for establishing acceptance standards are shown in table C.

Columns 1 and 2 are brief descriptions of the various checks made by field reviewers and office clerks during stage I and stage II enumeration. The section numbers in column 1 refer to sections on the forms.

Columns 3 and 5 show the number of elements inspected and the acceptance numbers (i.e., the maximum number of errors that could be found if the work were to pass the inspection) for each check. However, the "effective" sample size was less than the actual estimate, because the elements inspected were sampled in clusters instead of being independently selected. Consequently, corrections were necessary in order to arrive at the adjusted numbers shown in columns 4 and 6. Where estimated and adjusted numbers are the same, independence was assumed for "successive trials," that is, among the elements selected for inspection.

To adjust for the intraclass correlation within elements inspected both by reviewers and office clerks, a judgment factor was used in order to reduce the actual sample to an "effective number" and the acceptance number was reduced proportionately. Conceptually, the reduction factor was the ratio of the variance assuming independence between elements and the variance increased by the effect of the intraclass correlation of elements in the inspection sample.

The kind of action that the crew leader or field reviewer was to take after reviewing an enumerator's work depended on two things: (1) the number of separate checks for which the number of errors exceeded the acceptance number, and (2) whether the enumerator's work was being reviewed for the first time, second time, or third time.

The following table shows the conditions which determined each of three possible actions a crew leader could take after inspecting an enumerator's work:

| Number of checks failed during stage I field review visits | | | Action taken |
|--|---------------------|--------------------|--|
| First field review | Second field review | Third field review | |
| - | - | - | No further inspection until final review |
| 1 or 2 | 1 | - | Further inspection required Enumerator's appointment terminated |
| 3 | 2 | 1 | |

- Represents zero

Table D shows the probability of an enumerator's surviving each field review (assuming his having survived any requisite prior review). For example, a stage I enumerator whose error rate was such that he could pass the review sections with an average of .75 as shown in column 1 had a probability between .08 and .11 of being terminated at the first review, as shown in column 3. The probability of acceptance was the sum of the probability of not failing any sections and the probability of failing one or two sections. In this example, the probability of not failing any sections was between .21 and .24 and the probability of failing one or two sections, so that a further review was considered necessary, was between .65 and .71.

When this kind of plan was tested in 1959 in the North Carolina pretest, it was found that an enumerator's probability of acceptance improved after the first review if his errors were pointed out to him and he was told to go over his work before the next review to correct all similar errors.

Table C.--Basic Data for Establishing Quality Control Acceptance Standards

| Description of checks shown on records of review and on office quality control forms | Unit inspected | Number of sample units inspected | | Acceptance number | | Enumerator's error rate when probability of acceptance is: | | |
|--|--|----------------------------------|--|-------------------|--|--|-----|-----|
| | | Estimated | Adjusted for intra-class correlation of errors | Estimated | Adjusted for intra-class correlation of errors | .95 | .50 | .10 |
| | | | | | | | | |
| Stage I (form F-243) | | | | | | | | |
| Sec. I, Check for missed units | Housing unit listings | 25 | 25 | 2 | 2 | .03 | .11 | .20 |
| Sec. II, Listing book, part 1 | Listing book columns on 1 page | 5 | 5 | 1 | 1 | .07 | .32 | .58 |
| Sec. III, Listing book, part 2 | Listing book columns on 1 page | 5 | 5 | 3 | 3 | .34 | .69 | .89 |
| Sec. IV, Population content | Population items ¹ | 288 | 175 | 16 | 10 | .04 | .06 | .09 |
| Sec. V, Housing content | Housing items ¹ | 180 | 110 | 12 | 7 | .04 | .07 | .10 |
| Sec. VI, FOSDIC book-listing book agreement | Completed housing units recorded | 12 | 12 | 1 | 1 | .03 | .13 | .27 |
| Sec. IX, Transcription to stage II books | Population and housing items ² | 600 | 360 | 15 | 9 | .02 | .03 | .04 |
| Stage II (form F-244) | | | | | | | | |
| Sec. I, Listing book | Listing book columns on 4 pages | 40 | 25 | 2 | 1 | .02 | .07 | .13 |
| Sec. II, Household questionnaire transcription | Population and housing items on 2 household questionnaires | 93 | 55 | 5 | 3 | .02 | .07 | .12 |
| Sec. III, Housing content | Housing items ³ | 58 | 35 | 3 | 2 | .02 | .08 | .15 |
| Sec. IV, Population content | Population items ⁴ | 223 | 135 | 10 | 6 | .02 | .05 | .08 |
| Sec. V, FOSDIC book-listing book agreement | First 4 completed housing units recorded | 4 | 4 | 0 | 0 | .01 | .13 | .36 |
| District Office quality control | | | | | | | | |
| Stage I, basic content (form F-267) | Population and housing items ⁵ | 245 | 147 | 15 | 9 | .04 | .07 | .10 |
| Stage I, transcription to stage II (form F-278) | Population and housing items ⁶ | 675 | 405 | 24 | 15 | .02 | .04 | .05 |
| Stage II, sample content (form F-280) | Population and housing items ⁷ | 240 | 145 | 15 | 9 | .04 | .07 | .10 |

¹ All items on 5 pages of stage I enumeration book.

² All items for last housing unit, and persons in it, on each page of stage I enumeration book.

³ All items for 4 completed housing units in stage II enumeration book.

⁴ All items for persons in 4 completed housing units in stage II enumeration book.

⁵ All items on 1 in every 30 pages of stage I enumeration book.

⁶ All items for 1 in every 4 sample units in stage I enumeration book.

⁷ All items on 1 in every 12 pages of stage II enumeration book.

The final review required that an enumerator not fail any of the sections of the review. Although this may seem stringent, the sample of work inspected on the final review was not taken from the most recent work completed by the enumerator, but was a sample of all the work he completed. This included work which he had had an opportunity to correct on the basis of additional training received during earlier reviews. There was another aspect of the final review which was different from earlier reviews: Since the final review was made after the assignment was completed, "termination" at this point was not the same as in early reviews. The practical consequences of an enumerator's failing the final quality control review may be summarized as follows:

1. If the reviewer believed that the enumerator could make the necessary corrections, he returned the work to him with instructions to do so before he could

be paid. Otherwise, the work was reassigned to another enumerator for correction, usually at an hourly pay rate.

2. Stage I enumerators who failed final review ordinarily were not recommended for stage II work.

3. Stage II enumerators who failed final review of an assignment were not generally allowed to work on other assignments. (In general, stage II enumerators were assigned three or four times as many ED's as they had had during stage I, since each stage II ED included only the households and persons in the sample.)

PROGRESS OF THE ENUMERATION

By the end of the first week of the enumeration, April 7, about one-third (33.1 percent) of the population

had been enumerated by stage I enumerators in two-stage areas and by single-stage enumerators. By the end of the second week, almost three-fourths (73.8 percent) of the population had been enumerated, and by the end of the third week, 90.0 percent. At the end of the sixth week, 99.1 percent of the population had been enumerated. Another 2 months were required to complete the enumeration by single-stage and stage I enumerators. By this time, most of the stage II sample data also had been obtained and within the next 2 weeks, by July 25, the remainder of the stage II sample data had been obtained. All of the Census District Offices were closed by the end of July. (See table 10 in appendix H for summary of District Office closing dates by region.)

A sample of 250 stage I enumerators who were accompanied by observers during their working hours spent an average of 6.2 hours a day on the canvass and completed the canvass of an average of about 32 housing units per day. The average time spent at each housing unit was 8.1 minutes; the average time spent between housing units was 2.6 minutes. Some time in addition to that spent on the canvass was spent on transcription of the data from stage I to stage II questionnaires, field review of their work, progress reporting, etc. The total average time per housing unit in stage I was 16.7 minutes, including this additional time, some of which may not have been spent on the same days as the canvassing.

The total number of Household Questionnaires received in the field offices from the sample households was 11,840,669. Of this number, 9,683,597, or 81.8 percent, were received by mail. Of those received by mail, 82 percent were received by the local offices before the close of the third week of enumeration, April 21. The stage II enumerators were assigned April 20 or later. They obtained information by telephone or visit for the remaining 2,157,072 (18.2 percent) of the Household Questionnaires. They also reviewed the Household Questionnaires received in the mail and when necessary obtained missing items of information by telephone or visit.

A sample of stage II enumerators whose work was observed spent an average of 12.7 minutes per housing unit on those questionnaires received in the mail which were complete and consistent and which therefore did not require followup. Forty-five percent of all the Household Questionnaires were in this category. Stage II questionnaires that were completed by telephone followup required an average of 20.7 minutes per housing unit and those completed by personal visit required 28.8 minutes. The average time for all stage II questionnaires mailed in to the District Offices was 16.17 minutes per housing unit. The average time for stage II questionnaires not returned in the mail, and for which all the required information was obtained by telephone or visit, was 19.0 minutes per housing unit.

Table D.--Probability of an Enumerator's Passing Each Field Review

| Average probability of passing a review section at various error rates ¹ | Kind of action taken by reviewer ² | Probability of kind of action shown in column 2 | | |
|---|---|---|---------------|------------------------------|
| | | First review | Second review | Third and subsequent reviews |
| 1 | 2 | 3 | 4 | 5 |
| .99 | AN | .97 | .97 | .97 |
| | AF | .03 | .026 - .03 | 0 |
| | T | 0 | 0 - .004 | .03 |
| .95 | AN | .770 - .775 | .770 - .775 | .770 - .775 |
| | AF | .223 - .228 | .196 - .207 | 0 - .005 |
| | T | 0 - .002 | .023 - .029 | .225 - .230 |
| .90 | AN | .58 - .59 | .58 - .59 | .58 - .59 |
| | AF | .397 - .411 | .330 - .344 | 0 - .01 |
| | T | .009 - .013 | .076 - .080 | .41 - .42 |
| .75 | AN | .21 - .24 | .21 - .24 | .21 - .24 |
| | AF | .65 - .71 | .41 - .44 | 0 - .03 |
| | T | .08 - .11 | .35 | .76 - .79 |
| .50 | AN | 0 - .03 | 0 - .03 | 0 - .03 |
| | AF | .48 - .50 | .08 - .19 | 0 - .03 |
| | T | .49 - .50 | .81 - .89 | .97 - 1.00 |
| .10 | AN | 0 | 0 | 0 |
| | AF | 0 - .01 | 0 | 0 |
| | T | .99 - 1.00 | 1.00 | 1.00 |

¹ Average taken over all five sections of the review; for example, if the average probability of passing any one of the five sections of the second review was .90, then the probability of being terminated as a result of this review was between .076 and .080.

² AN - Accepted; no further review until stage I or stage II final review.
AF - Accepted; further review scheduled.
T - Enumerator's appointment terminated.

A comparison of the progress of the enumeration of the population during the 1950 and 1960 censuses at selected dates after April 1, as reported by the field offices, is given in table 9 in appendix H.

PROGRESS REPORTING

The enumerators were instructed to report to their crew leaders on the progress of the enumeration twice a week by telephone. Summaries of these reports were relayed by crew leaders and by District Offices to the Regional Offices which consolidated the information and telegraphed reports to the Chief of the Field Division at headquarters in Washington, D.C.

Reports on the progress of the enumeration covered (1) the number of persons enumerated in stage I of the two-stage enumeration and in the single-stage enumeration (which together constituted the total population enumerated in the United States), (2) the number of sample housing units enumerated in stage II of the two-stage enumeration, (3) the number of housing units at which no respondent was found and at which callbacks would have to be made, (4) the hours worked at hourly rates, (5) the automobile mileage for which allowances would have to be paid, (6) the number of enumerators working, and (7) the number of enumerator assignments completed.

PAYMENT OF ENUMERATORS

Enumerators were generally paid on a piece-rate basis. It was expected that a diligent enumerator would average about \$1.60 an hour. In sparsely populated areas (particularly the Rocky Mountain area) an hourly rate of \$1.60 an hour was authorized. This hourly rate was also used for the enumeration of large institutions and in areas of low population such as the central business districts of cities. There was provision for changing an enumerator from a piece-rate to an hourly rate basis when it was seen that a fair payment would not be received otherwise.

The basic data for piece rates were developed for the most part from time studies conducted during the 1950 censuses and later surveys and tests, including the Hickory, N.C., pretest which closely approximated the methods and procedures that were to be used during the 1960 censuses. The problem was to establish piece rates that would compensate the enumerator adequately for work performed under the varying conditions that would be found in different parts of the country. The three principal elements were considered to be (1) the time the enumerator would spend within a household, (2) the time he would spend going from one household to the next, and (3) the time he would spend on callbacks to households where no one had been at home on his first visit. Essentially, once an estimate was established for time to be spent within a household, this factor was considered to be constant throughout the Nation. Because more time would be required between households in rural areas, additional compensation was provided by an allowance of 5 cents a mile for travel time in rural areas. Additional compensation was provided, in the piece rates, for the greater amount of time that would be required in urban areas for numerous callbacks.¹

The enumerators on a piece-rate basis received the following basic compensation:

¹For a detailed report on the time spent on the various elements of the enumeration and the average hourly compensation received by enumerators in different types of districts in two-stage enumeration areas, see: U.S. Bureau of the Census, *United States Censuses of Population and Housing, 1960: Enumeration Time and Cost Study*, Washington, D.C., U.S. Government Printing Office, 1963, 175 pp.

IN SINGLE-STAGE ENUMERATION AREAS

\$0.03 per housing unit
 .11 for housing items for each housing unit on 60PH-1 or 60PH-2 schedules (i.e., in the "100-percent" enumeration)
 .04 per person
 .14 per sample housing unit
 .10 per sample person
 20.00 training fee (or \$8.00 fee if hired as a replacement after the enumeration began)

IN TWO-STAGE ENUMERATION AREAS

\$0.03 per housing unit
 .11 for housing items for each housing unit on the 60PH-1 or 60PH-2 schedules (i.e., in the "100-percent" enumeration) in areas for which payment for mileage was not authorized (urban areas)
 .13 for each housing unit on the 60PH-1 or 60PH-2 schedules in areas for which payment for mileage was authorized (rural areas)
 .04 per person
 .20 per sample housing unit entered on the 60PH-3 schedule
 .16 per sample housing unit entered on the 60PH-4 schedule
 .10 per sample person
 .025 for transcription of each person and each housing unit
 10.00 training fee (or \$4.00 fee if hired as a replacement after the enumeration began)

The enumerators were also paid \$6 for each field review check in single-stage enumeration areas, or, in two-stage areas, \$4 for each stage I field review check and \$2 for each stage II field review check.

The persons who were selected to be field reviewers at the end of their enumerator training were paid on an hourly basis and received \$1.60 an hour in addition to their training fee.

Piece-rate enumerators were allowed 5 cents per mile for travel time and 7 cents per mile for the use of their cars when authorized. All other personnel were allowed 7 cents per mile for the use of their cars and \$12 per diem for authorized travel.

An early check on the average hourly earnings of enumerators working on a piece-rate basis was developed from a sample of data collected by special clerks accompanying 250 enumerators in both stages of the two-stage enumeration. Average earnings of these enumerators during stage I were \$1.41 an hour for the time worked, which was less than had been anticipated. Enumerators in cities for which data were to be published by city block, including all cities with 50,000 or more inhabitants, averaged \$1.40 an hour; those in other urban areas and also those in rural areas averaged \$1.42 an hour.

On April 30, a memorandum was sent by the Bureau to the Regional and District Offices stating that many enumerator assignments which were classified for piece-rate pay should have been classified for hourly rates. The supervisor was instructed to examine all areas presenting specified types of difficulties, and if, in his opinion, the enumerator assignment had been wrongly classified, he was to apply for supplementary payment equal to the difference between the piece-rate earnings and what the enumerator would have received on an hourly basis.

PRELIMINARY POPULATION ANNOUNCEMENTS

Each District Supervisor was directed to make a preliminary announcement of the population of each county and of each incorporated place of 10,000 or more inhabitants, after the preliminary figures had been approved by Washington headquarters of the Bureau. He was also authorized to issue preliminary population counts for smaller incorporated places upon receipt of a written request from an official of the place.

Forms were provided the District Office for recording the total and sample counts of each enumerator's assignment. When the enumeration of a prefix area was completed, a telegram was sent to Washington giving the total population counted, the total number of housing units, and the number of persons and housing units in the sample. If the population figure was lower than the 1950 figure for the same area, the District Office was to send to the Regional Office an explanation of any local circumstances that might have accounted for a decrease.

In Washington the counts were checked against population estimates or recent special census figures for the area, and the ratio of the sample data to the total counts was checked. The figures that fell outside the established tolerance limits were reviewed and, if no explanation was apparent on the basis of information available in Washington headquarters, the District Office was asked for an explanation by telephone or telegraph.

If the District Office did not hear from the Bureau headquarters within 5 days after sending in the preliminary counts, it was authorized to release the figures to local officials and the press, and to send the enumeration books for the prefix area to the Jeffersonville Operations Office.

The review in Washington of the preliminary figures was not concerned with the quality of the enumeration; it was designed to eliminate errors in the reporting of the counts (e.g., reporting the population of a complete county as the population of a part of the county) before they were announced to newspapers and local officials and before they were published in the preliminary reports.

RECHECKS

From June through October 1960, rechecks of selected ED's were conducted in New York City, Chicago, and Philadelphia, where there was reason to believe the problems of coverage were unusually great. In New York City, a random sample of 300 ED's was selected in two districts; in Chicago and Philadelphia, samples of approximately 100 ED's at each place were selected to be recanvassed.

In each case, the ED's in the problem districts were stratified into those which appeared to have been well enumerated and those which were suspect for one or more of the following reasons:

1. The ED's were in tracts for which the 1960 preliminary population counts were below the expectation of the city planning groups
2. The ED's were those which had excessive numbers of closeout cases
3. The various field quality-control checks indicated that the ED's had been poorly enumerated

The results of the recanvass in each of these three cities indicated that the completeness of coverage was at least as good as that of the 1950 censuses. The estimate of missed housing units for the suspect stratum

in the two New York districts, for example, was 2.15 percent with a standard error rate of plus or minus 0.52.

When the preliminary population counts were released by the field offices to local government officials, a number of places requested recounts.

The Bureau cooperated whenever evidence indicating an undercount was presented, by making further use of "Were You Counted?" forms, spot checks of specific areas, recheck of computations, checking of boundary changes or errors in boundaries as shown in the maps used, and followup on persons reported to have been missed. Whenever errors in the count were found at this point, before the final State counts were certified and presented to Congress, even very minor corrections were made.

There were approximately 50 protests which required additional field work by the Bureau. The largest number of persons added was in Cincinnati, where a missed-person campaign, field recheck, and records recheck added approximately 8,000 to the preliminary figures. In most instances many fewer persons were added to the population as a result of field work, and in several cases none were. (However, there were many instances where the preliminary population count was considerably altered as a result of the discovery of errors in boundaries or of ED's having been included in the wrong places.)

As always after a population census, a number of places attempted independent counts as a check on the Bureau's figures. In Saginaw, Mich., where off-duty firemen were sent to search for residents missed by the census enumerators, city officials pointed out that the cost of the check, estimated at \$8,000, would be recovered over a 10-year period in locally shared State revenues amounting to \$115 per person if just 70 uncounted residents were found. (Not that many were found.) When the Bureau was informed of such an independent check, it cooperated as fully as it could, by making available ED maps and explaining the definitions of residents and transients and otherwise supplying assistance or advice as requested.

As in the case of previous censuses, most of the local recounts after the 1960 population census failed to find as many inhabitants as the census enumerators had found. The experience of Louisville, Ky., probably is more or less typical. An independent recount by a private firm, in seven ED's of the city as defined by Census Bureau maps, counted a total of 4,359 persons and 1,336 dwelling units as compared with the census count of 4,474 persons and 1,355 dwelling units. In two of the seven ED's somewhat more persons were found in the recount, and in five fewer were found. The staff of the firm mentioned that the differences between their figures and the regular census figures could be accounted for by normal movement in and out of neighborhoods between the census in April and the recount early in June.

Many of the protests regarding the census figures came from communities which were found to have lost population in the decade even though the enrollment in their schools had increased and there had been an increase in the number of phone, water, and electric connections. The final results of the census showed that the increase in the school-age population of the Nation had been so large in comparison with the rest of the population that any increase of less than about 30 percent in that age group was consistent with a decline in the total population of a community. A great increase in the number of one-person dwelling units had more than offset an increase in the size of families, with the result that there had been an increase in public utility

connections in many areas where total population had declined.

In one city the census count was considerably less than the count appearing in the city directory which was based on a canvass conducted in the late summer and fall of 1960. It was found that most of the difference was due to a defect in the directory procedure which led to a substantial overstatement of the number of persons under 18 years of age: No listing of names of these persons was made for the directory. The Bureau has found that it is impossible to get an accurate count of persons without listing each individually by name. The error was noted when it was realized that the directory figures for persons 18 years old and over were about 10 percent lower than the census figures but that directory figures for persons under 18 were about 70 percent above the census figures. To get more specific evidence, the Bureau conducted a house-to-house check in two areas of the city in which the differences between the directory and the census figures were particularly large. Even though the check was carried out about 10 months after the date of the census, the totals coincided closely with the original census figures, and the differences between the results of the Bureau's house-to-house canvass and the directory figures were concentrated among persons under 18 years of age. In addition, it was found there was some duplication of whole households in the directory, that some persons living outside the city limits were included, and that some married women were listed both at home and at their place of work.

Some relatively low preliminary figures, which were based on census field counts, were raised when the reports for residents temporarily away from home, crews of vessels, and military personnel were added to the final counts. For example, the preliminary count for the City of San Francisco was 716,276 and the final count was 740,316. The preliminary count for New York City was 7,710,346 and the final count was 7,781,984.

EVALUATION OF PROCEDURES BY FIELD PERSONNEL

District Office Reports

Each District Supervisor, as his last act before closing the District Office, prepared a report on the enumeration of his district. In addition to calling attention to phases of the work which had presented special difficulty, he was requested to submit suggestions for improving the field work in future censuses. The reports were sent to the Regional Offices, where they were reviewed and the comments were coordinated. Inasmuch as the District Supervisors, almost without exception, had had experience with only one census procedure, their suggestions tended to be within the framework of this procedure.

Enumerator Opinion Survey

In June 1960, questionnaires were mailed to a sample of 1,785 enumerators who had worked on the 1960 censuses. Most of the questions were of the multiple-choice type; in most cases the choice was in stages from one extreme to another (e.g., "Was the work in general: Much easier than expected___; Somewhat easier than expected___; Somewhat harder than expected___; Much harder than expected___"). For a few questions, one in a list of different items was to be checked, and for some the enumerator was asked to write in the answer.

In reply to the question, "What made you decide to take the job?" 65 percent selected "To earn some

money" as the principal reason. The alternatives were: "To do some interesting work," checked by 19 percent of the enumerators in two-stage areas and 23 percent of those in single-stage areas as the most important reason; "To help the government or my community," checked by 10 and 6 percent of the two-stage and single-stage enumerators, respectively, as the principal reason; and "To do a favor for some person or group" or "Some other reason."

The major difficulty encountered in getting the work done was that "Respondents were not at home." This reply was checked by 80 percent of the stage I and 71 percent of the stage II enumerators and by 76 percent of the single-stage enumerators.

Most of the stage I and single-stage enumerators found the work either somewhat harder or much harder than they had expected, but the stage II enumerators were divided on the question with 51 percent finding the work easier than expected. Most of the enumerators made less money than they had expected. Most found the work more interesting than they had expected.

Most enumerators felt that the training was "just about adequate" or "definitely adequate," but most would like to see a few hours more spent in classroom training for the next census.

Of the stage I enumerators who were offered stage II assignments, only 49 percent accepted. Those who refused mentioned personal reasons such as illness, another job, etc. (33 percent); low pay for stage I work (39 percent); dislike of either stage I or stage II work or some aspect of it (28 percent); and miscellaneous other reasons.

Regional Post-Census Evaluation Conferences

In the summer and fall of 1960, post-census conferences were held by each of the Regional Field Directors to discuss with selected District Office personnel the ways in which future censuses might be improved. In general, participants at each conference included, in addition to the Regional Director and key members of his staff, one or two District Supervisors, Technical Officers, administrative clerks, and crew leaders, chosen on the basis of their ability to make a constructive contribution to the conference.

Two-stage census procedures were discussed by the conferences held by 11 of the Regional Offices, in Boston, Charlotte, Chicago, Cincinnati, Dallas, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, and St. Louis. Single-stage census procedures were discussed by the conferences held by 6 Regional Offices: Atlanta, Denver, Kansas City, New Orleans, St. Paul, and Seattle.

A series of three interregional conferences for Regional Field Directors was then held, at which the Regional Field Directors reviewed and compared the opinions expressed at the conferences in their respective regions. The first two, in Cincinnati, August 8-10, and Philadelphia, September 14-16, were on two-stage enumeration procedures. The third, in Denver, September 26-28, dealt with single-stage enumeration procedures.

The comments and suggestions made at the regional and interregional conferences reflected the wide differences of experiences during the enumeration in the various regions. For example, it was noted that at the St. Paul regional conference the general attitude of the participants was that the job had been easy but perhaps they could find ways in which it could have been improved, whereas some of the participants at the New York regional conference would have preferred to change most of the census procedures.

There was general agreement on a few points. Perhaps the principal one was that more preparatory time was needed by the field personnel, particularly for the areas of rapid population growth such as urban fringe areas, and for the very large cities. There were numerous suggestions for a redistribution of functions, most of them aimed at relieving the crew leader of what was apparently an excessively heavy load in 1960. A number of suggestions were made for provision and training of some additional technical personnel (Program Technicians for the Regional Offices, Technical Officers for the District Offices, etc.) who could be assigned wherever a need developed during the course of the work; it was pointed out that the people in these positions in 1960 were usually tied to the weakest office under them and were unable to give adequate supervision to the rest.

ENUMERATION PROBLEMS AND COSTS

Problems encountered during the enumeration were summarized in the Bureau's statement in August 1960 in support of its request for a supplemental appropriation. The essential elements of the statement are given below:

"Serious enumeration problems, far beyond those anticipated, made completion of the population and housing enumeration much more difficult and time consuming, and resulted in substantially increased costs over those included in budget estimates and amounts appropriated. . . .

"The problems encountered by the enumerators were particularly significant in the major metropolitan areas. Here there was substantial increase in the number of one and two person households in which every member was in the labor force and consequently there was difficulty in finding anyone at home during normal working hours, and other times as well. There was also an increase in the number of areas where the enumeration is difficult because of the concentration of persons who are normally difficult to enumerate and because of the spread of commercial development into residential areas.

"The loss in population in most of the large cities (of the 10 largest cities in 1950, 9 lost population between 1950 and 1960) although their metropolitan areas showed substantial increases, came as a shock to most local officials and civic leaders. Although the Bureau was aware of a continuing shift in population, the magnitude of such shifts and the resulting problems greatly exceeded expectations. In a number of large cities, the problems were so great that not only was enumeration slowed down, but also, in order to assure a correct

count additional work was necessary to recheck and even re-enumerate problem areas. These actions were time consuming and costly. In some cities, it was very difficult to recruit and retain enumerators.

"Originally it had been planned to have all temporary District Offices closed by the end of May. However, by that time, the work was not completed in more than 200 offices. As of June 30, 25 District Offices were still open, and 1,100 enumerators, plus 138 crew leaders, were at work completing the enumeration. As late as July 22, there were still 170 enumerators and crew leaders completing the enumeration in New York City. The net effect was a substantial increase in the direct cost of enumeration, and a proportionate increase in crew leader expense and local office costs."

The data in appendix H, table 3, line 5, for each type of District Office show that the unit cost of all enumeration compared to the unit cost of piece-rate enumeration, including piece-rate payments, training and field review fees for enumerators, and 5¢ per mile for time en route where appropriate, was significantly higher for District Offices in large SMSA's than for District Offices outside SMSA's having cities of 100,000 or more. District Offices outside SMSA's having cities of 100,000 or more, however, still showed about a 10-percent higher combined unit cost of enumeration than the unit cost of the piece-rate enumeration.

For District Offices outside large SMSA's, the increase in the unit cost of enumeration shown in the table was about the same whether the office used the two-stage or single-stage procedure. (Comparison for other types of offices are not possible because only 6 of the 107 single-stage District Offices were in metropolitan areas with cities of 100,000 or more population.)

The table indicates that--

1. Increases in field costs were significantly greater in the large metropolitan areas, but were by no means confined to such areas.
2. Increases in field costs were not particularly related to use of the two-stage or single-stage procedure.

Single-stage offices closed about two weeks earlier than comparable two-stage offices (see table 10, appendix H). This difference was consistent with the field planning; the plan had called for single-stage offices to close during the period May 2-6 and two-stage offices during the period May 16-20.

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Chapter 8. Processing the Data

BASIC APPROACH TO THE DATA PROCESSING

Steps in the Data Processing

The major purpose of census data-processing operations is the production of statistical tables containing the results of the censuses. The processing of the data from the 1960 Censuses of Population and Housing was accomplished by the following principal steps:

1. Receiving, from the census field offices, enumeration books containing the schedules filled in by the enumerators
2. Checking enumeration books against control records
3. Coding those items on the sample schedules to which there could be so many different responses that the enumerators had been instructed to write the answers in longhand on the schedules. (These were in all cases items of population data which had been collected on a 25-percent sample basis)
4. Microfilming the schedules--first those containing data collected on a 100-percent basis, then those containing the sample data
5. Putting the microfilm through FOSDIC (Film Optical Sensing Device for Input to Computers) which converted the marks on the microfilm into magnetic signals on computer tape
6. Feeding these tapes, together with instruction tapes known as computer programs, into an electronic computer which edited and tabulated the data
7. Running the tapes containing the tabulated data through the computer with tapes containing the requisite historical data and with instructions to the computer. The computer arranged the data in publication table format. The tables were then printed on a high-speed electronic printer, for offset reproduction

The first four steps involved large-scale clerical operations and were conducted at the Jeffersonville Census Operations Office. The last three steps were performed on high-speed electronic equipment at Washington and the other computer installations.

General Plan of Tabulation Procedures

In the interest of maintaining comparability from one census to the next, it was agreed that the arrangement of the data and the table formats would not be radically different from that of the 1950 censuses. It was also decided early in the planning that population statistics and housing data would be published separately, the only major exception occurring in the case of reports for census tracts where both population and housing data would appear.

The law requires that the Bureau of the Census report the final population count of each State to the President of the United States within 8 months of the census date, for purposes of reapportionment of the House of Representatives. Of necessity, these figures

had to be obtained from the data collected on a 100-percent basis. In selecting questions to be included on the 100-percent schedules, it was decided to include only those which could be answered by direct and simple entries that could be precoded on the schedule filled by the enumerator. For example, in the case of responses to the question on marital status, the enumerator marked a circle corresponding to the appropriate one of five possible categories: married, widowed, divorced, separated, or never married.

These 100-percent data, as a result, required no coding prior to processing on the electronic equipment, so they could be processed rapidly to permit early publication of total population and housing counts. It was possible to obtain on a single run of the tapes through the electronic computers not only the basic information required for the total counts of population and housing but also statistics for the population and housing characteristics collected on a 100-percent basis. Therefore, when the final population counts were transmitted to the President on Nov. 15, 1960, the basic tabulations of the population and housing characteristics which had been collected on a 100-percent basis were also available. This meant that the publications containing total counts by area could be rapidly followed by publications on population and housing characteristics.

Responses to some of the sample population questions--e.g., occupation--were recorded on the schedule with a written answer, necessitating a clerical operation to translate the response into a code which could be used by the tabulating equipment. Certain other items were of an intermediate type; an example is the question on "residence in 1955," for which responses such as "this house," "this city," etc., were precoded by the enumerator, and later manual coding was required only for the minority of persons who had resided elsewhere. Detailed manual coding was done for the 25-percent sample of those responses to questions on relationship to head of household which had been precoded as "other" or "non-relative" for the 100-percent data and those responses to the question on race or color which had been precoded as "other" for the 100-percent data. Because the enumeration books containing the sample data were processed through a clerical coding operation, the sample data took longer to process.

As in previous census publications, the larger the area, the more tabulation detail was provided. For the smallest areas, such as minor civil divisions, only so-called inventory-type data, e.g., counts of persons by age and sex, were published, whereas detailed cross-tabulations were tabulated and published for the *United States as a whole, for States, for large standard metropolitan statistical areas (SMSA's), and for large cities.*

Geographic Area Work Units

The enumeration districts (ED's) served as basic building blocks in the data processing. Data for single ED's or small groups of ED's constituted the statistics

for the smallest reported geographic places such as towns, tracts, wards, or townships. Data for these ED's were then combined to provide statistics for progressively larger geographic entities such as cities, counties, SMSA's, States, regions, and, finally, U.S. totals.

There were approximately 240,000 ED's established originally for the 1960 censuses in the 50 States and the District of Columbia, ranging in size from a part of a city block to hundreds of square miles. However, in both the field operation and the processing operations, it was sometimes necessary to "split" ED's into two or more parts. This was done during enumeration because of annexations and other changes in place boundaries, or to reduce the enumerators' workloads, or for various other reasons. It was done during processing because the computers were programed to handle only ED's having populations of 4,000 or less, and an ED having a population of more than 4,000 was arbitrarily split. The total number of ED's, including splits, was 272,600.

For geographic identification and control purposes, the ED's were grouped by "prefix areas." These usually consisted of either a complete county, a city of 50,000 inhabitants or more, or that portion of a county which lay outside a city of 50,000 inhabitants or more. There were 3,628 prefix areas in the 50 States and the District of Columbia.

Processing for both the 100-percent and sample data was conducted on a State-by-State basis, i.e., one major phase of the operation was performed for all parts of a State before that State was released for the next major phase.

CLERICAL OPERATIONS

Receipt and Check-In of Enumeration Books

Cartons of enumeration books from the field offices throughout the United States were delivered by truck to the receiving area in the Jeffersonville Census Operations Office. Ten to twelve truckloads arrived daily during June 1960, shortly after the census enumeration had terminated in most of the districts.

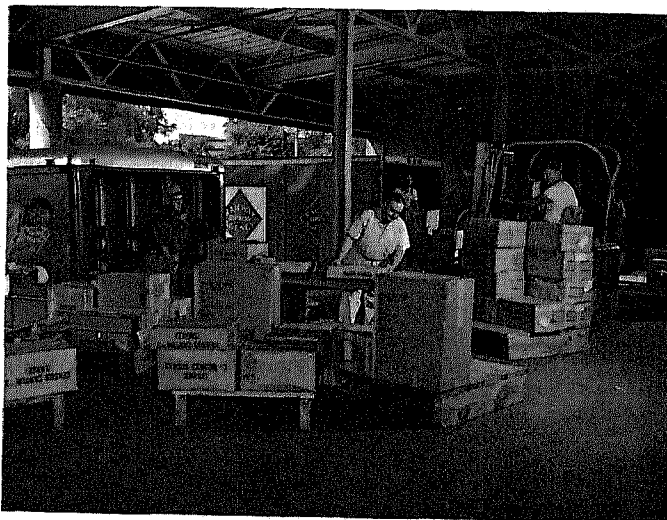


Figure 17.—Receipt of Enumeration Books from the Field Offices.

Some 814,000 enumeration books were received and checked in by the Jeffersonville office—one or more books containing 100-percent data and one or more containing sample data for each ED in the United States.

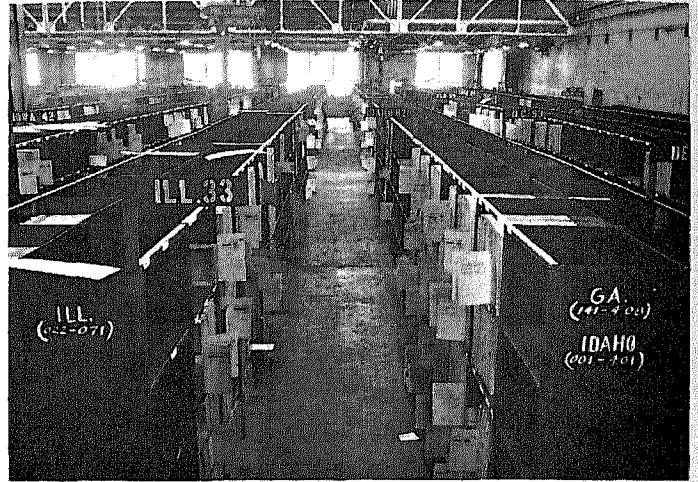


Figure 18.—Shelves of Enumeration Books.

Mechanical devices, assembly-line procedures, and specialization of tasks were utilized to expedite the handling of the enumeration books and to reduce costs of the receipt and check-in operations.

Checking in the enumeration books received from the field offices involved verifying that all identification items, population counts, housing counts, and number of pages listed were identical on the enumeration book label and on the transmittal listing.

Since the ED's served as the basic building blocks for the various geographic areas for which data were to be published, and also served as the control units in the various processing operations, it was essential that all changes affecting boundaries of ED's during the field enumeration be acceptable to the Bureau and that such changes be reflected in all related control records. Accordingly, whenever it was found during the check-in that an ED had been split or that two or more ED's had been combined in the course of the field work without the approval of Bureau headquarters, or when there was an extra or missing ED, the problem was directed to a team of specialists in the geographic and field work of the censuses, for correction of discrepancies, inconsistencies, or omissions. In some cases enumeration books and maps were returned to field offices for rechecking.

Preliminary Reports

The preliminary reports of 1960 population and housing figures were based on the 1960 field counts reported on a form called the ED Control Register.

The ED Control Register was used in the processing office as a worksheet for cumulating the ED counts for the areas for which figures were to be published. After the 1960 totals had been established on the ED Control Registers, they were transferred to worksheets on which the 1950 data for these areas had previously been posted. The percent of change from 1950 to 1960 was computed and entered on the worksheets. These worksheets were verified 100 percent before the tables were typed.

The following tables were prepared and issued for each State:

1. Population by counties
2. Population of all incorporated places with 1,000 inhabitants or more
3. For the three Middle Atlantic and the six New England States, population by counties and minor civil divisions and for New York, population of all incorporated places regardless of size

4. Population of SMSA's by component areas
5. Population of SMSA's inside and outside central cities
6. Population of the two standard consolidated areas around and including New York City and Chicago
7. Total housing units in urban places of 10,000 inhabitants or more

(See also the subsection on "Correction of Preliminary and Final Counts" in the section on "Data-Processing Problems and Solutions," below.)

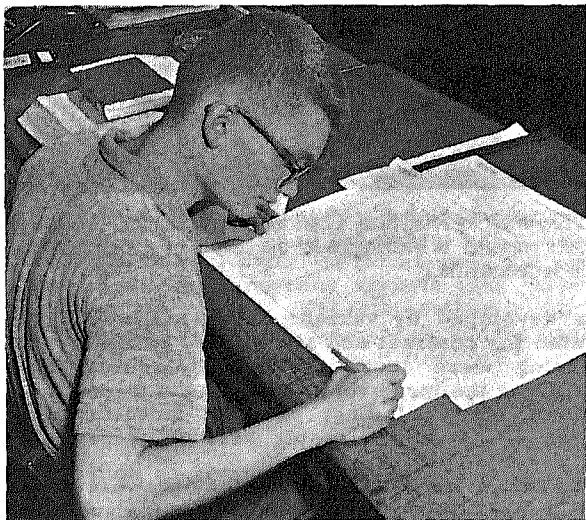


Figure 19.—Posting Preliminary Population Figures.

Preparation of Breaker Sheets

A special form called a breaker sheet was prepared and inserted as the first page of each enumeration book to identify the ED, to record preliminary counts of population and housing, and to separate one ED from another. Entries on the breaker sheet, like those on the schedules, were made by marking appropriate circles, so they could be read by FOSDIC.

The breaker sheet was prepared from information contained on a form called the Advance Transmittal Listing which was sent to Jeffersonville by the field office at the same time the enumeration books were shipped. Since the Advance Transmittal Listing was sent by airmail, it arrived in advance of the enumeration books, hence the designation.

The coded entries on the breaker sheets were verified by computing a "nonsense total" from the entries--i.e., adding the ED number to the number of persons enumerated and to other numbers appearing on the breaker sheet in code for FOSDIC--and comparing it with the nonsense total computed by adding corresponding entries on the enumeration book label. If there was a discrepancy, its cause was located and corrected.

After the breaker sheet had been ascertained to be correct, the verification clerk inserted it face up on the inside front cover of the enumeration book and fastened it in position with pressure-sensitive tape. At the time the breaker sheets were inserted, any blank pages at the end of the enumeration book were sealed to the back cover with tape, to prevent their being microfilmed.

Coding

Coding and editing of some of the population items on the stage II schedules was the largest clerical operation in the processing of the 1960 censuses.



Figure 20.—Coding in Enumeration Books at Jeffersonville Census Operations Office.

Coding consisted of converting written entries made by the enumerator to numbers (codes), and marking the corresponding circles on the FOSDIC schedules. Editing consisted of the examination and correction of incomplete or inconsistent entries.

Although most of the editing was done in the course of the electronic processing, some entries were supplied or corrected manually by the coders in the process of the manual coding operation during which it was possible to take advantage of the written entries. For example, if it was found during the manual coding of detailed relationship to head of household that two persons in a household had been entered as wives of the head, their names in combination with the other entries might have indicated which was the wife and what the relationship of the other to the head of household really was.

The work was divided into (1) the coding of entries for industry and occupation, and (2) the coding of all other items (referred to as general coding). Separate units were established for these two types of coding.

The general coders coded the following items on the sample schedules:

- Relationship to head of household of nonrelatives and "other relatives"
- Family and household composition
- Type of institution (for group quarters)
- Entries for "other races," which were specified on the sample schedules, and also, for five Southwestern States, Spanish surnames
- Place of birth
- Mother tongue
- Parent's place of birth
- Migration (year person moved to present residence, and place of residence in 1955)
- Place of work
- Income (from wages and salaries, from own business, and from other sources)

The industry and occupation coders coded entries for only those persons over 14 years of age who reported employment within the past 10 years. In addition to coding instructions, the coders had indexes of occupations and industries and "Company Name Lists." A Company Name List was prepared for each county from the returns of the 1958 economic censuses. It consisted of names and industry codes of all manufacturing establishments employing 50 or more people and all businesses with 100 or more employees. If the company name entered on the

population schedule was also found on the Company Name List, the code on the list was used. When the code could not be determined by using the Company Name List, it was determined from the enumerator's entry describing the person's industry and, if necessary, by reference to other items on the schedule.

Critical Review of the Sample

While the coding operation was going on, a critical review of the sample to detect biases in selection of households by size of household was being carried out. (See Chapter 3, Sampling and Estimation.) Only about one percent of the ED's required special handling to correct for the biases detected by this review. Corrective action consisted of cancellation of specified sample households, or duplication of others, in accordance with the expected frequencies by household size based on 100-percent data, to bring the distribution of sample households by size of household within the tolerances of the household distribution in the 100-percent data.

Microfilming

Over a 6-month period in late 1958 and early 1959, the Bureau conducted intensive studies to determine the combination of microfilm camera, type of schedules and enumeration books, intensity of markings on schedules, quality of printing, type of film, and method of filming operations and of film development that would result in a film input to the FOSDIC machine which could be read most clearly and accurately by FOSDIC. All types of commercially available cameras and film which met the following basic requirements were investigated:

1. Photograph on 16mm. film at a reduction of 28 to 1
2. Consistent location of image on the film
3. Ability to control minimum spacing between frames
4. Ability to control film density (the darkness of the background on the negative, on which the enumerator's marks appeared white) to a standard established by the engineers who developed FOSDIC

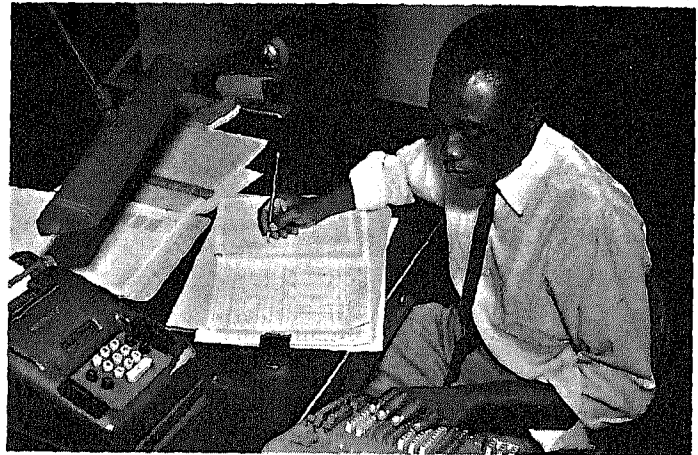


Figure 21.—Preparing Analytical Chart for Quality Control (Analytical charts were prepared in Washington for the control of the microfilm operations in Jeffersonville.)

Films developed by various processing methods were evaluated for contrast and sharpness. Facilities for film processing were investigated to determine adequacy for handling the large volume of census microfilm. As a result of these studies, detailed specifications for cameras, film, and processing were developed.

Various other items of equipment were necessary in the microfilming operation. Voltage regulators were installed on each camera to eliminate camera light fluctuations due to power surges. Since shutter speed and the condition of the lens also affect film density (and these vary from camera to camera), light meters were installed on each camera, and the light meter reading which would result in film density closest to the required standard was determined for each. To avoid deterioration of the unprocessed film, air conditioners were installed in the building used for the microfilming operation. To obtain control of lighting intensity, each microfilm camera location was screened with black curtains.



Figure 22.—These Files Contain on Microfilm All the "100-percent Schedules" for the Entire Population of the United States.

A high degree of specialization was utilized in the microfilming operation. Camera operators photographed the breaker sheets and the schedules in the enumeration books; camera-loaders loaded, unloaded, and tested the cameras; laborers delivered enumeration books to the cameras and removed them after microfilming.

A unit of work was one 100-foot reel of microfilm, usually containing 100-percent data for 20 to 25 ED's or sample data for about 10 ED's. A work unit always contained ED's from the same State.

Processing Forms for Crews of Vessels

Reports for Military and Maritime Personnel from naval and coast guard vessels were mailed directly by each ship's captain to Jeffersonville. The Maritime Administration transmitted to Jeffersonville the completed forms for merchant marine crews.

The location of each vessel on the date of enumeration, April 1, 1960, was checked. If the vessel was not berthed in a U.S. port on this date, the forms were included for processing with the overseas reports (see "Overseas Crews of Vessels," below). Vessels berthed in U.S. ports on this date were assigned ED numbers, and the packages of forms for each vessel were identified by ED.

These crews-of-vessels data were transcribed to separate enumeration books and were treated as separate ED's through all the processing operations, then the information in them was added to the tallies for the basic ED's.

During the 100-percent transcription operation, every crews-of-vessels form transcribed to a sample FOSDIC line (every fourth line) was marked and separated for transcoding. ("Transcoding" was the term used for a combined operation in which some items were transcribed whereas the codes for others were assigned and entered directly in the FOSDIC enumeration book without being entered on the original forms.)

A single industry code was used for all merchant marine personnel in the 25-percent sample, and only a few occupation codes were needed for this water transportation industry. After industry and occupation coding, the sample crews-of-vessels forms were turned over to verifiers who used a 50/10 "dodge" plan in their verification. Under this plan, the first 50 forms in each ED were verified on a 100-percent basis; if no errors were found in the first 50 forms, only every 10th form thereafter was verified. When an error was found during the verification of every 10th form, the verifier reverted back to 100-percent verification for the next 50 forms.

After verification of industry and occupation coding, the sample crews-of-vessels forms were assigned to general coding clerks for transcoding to sample FOSDIC enumeration books. These clerks copied the industry and occupation codes when they transcribed the other information from the forms. Verification of the transcoding was accomplished with a 50/10 "dodge" plan similar to the one described above for the industry and occupation coding verification.

Processing Forms for Overseas Population

Two types of forms were received from Americans residing abroad. One was the Report for Military and Maritime Personnel on which both military and civilian crews of vessels on the high seas or in foreign ports were reported (as distinct from those for crews of vessels berthed in U.S. ports, the treatment of which is described above). The other was the Overseas Census Report, on which other Americans living outside the United States were requested to report.

Overseas crews of vessels.--The forms for all crews of vessels on the high seas and in foreign ports were mailed to Jeffersonville by the ships' masters. After check-in, the forms were sent for editing and coding. The items which were edited and coded on these forms were as follows: color or race, date of birth, marital status, place of birth, mother tongue, parents' birthplace, year moved onto ship, residence in 1955, highest school grade attended, date of marriage, hours worked, occupation, place of work, means of transportation, weeks worked, income, veteran's status.

Unknown ages and unknown marital status for crews of vessels were allocated using separate allocation charts for military personnel and civilians; for all other items, "not reported" was an acceptable entry, or the missing entry was inferred from other items on the schedule.

Upon completion of the coding operation, the forms were transmitted to Washington for card punching and tabulation.

Overseas census.--Overseas Census Reports were sent to Jeffersonville from U.S. embassies (which had distributed and collected them from U.S. citizens abroad) and from military installations outside the United States. As the forms were received, they were counted and listed on control sheets by country and by name of service unit. The major additional editing task for these forms which was not required for crews-of-vessels forms was the elimination from these questionnaires of information on foreign nationals who were living as dependents in households of American citizens. The same items were coded and edited except for some items not included on the Overseas Census Report (e.g., income, place of work, means of transportation, etc.), and items required only from the persons reporting on the Overseas Census Report (e.g., when the person last left the United States, college degrees held, local language spoken, etc.). The Overseas Census Reports were sent to Bureau headquarters in Washington for card punching and tabulation.

Processing Supplemental Forms Received Late

Although most of the forms containing information for transients and persons who were away from home during the enumeration were sent to the Census District Office of the person's permanent residence and were transcribed to FOSDIC schedules if a search of the enumeration books failed to find the person recorded, some forms not assigned to specific ED's either by the local post offices or the Census District Offices were sent to Jeffersonville. Supplemental forms received in the District Offices after the enumeration books had been mailed to Jeffersonville were also mailed to Jeffersonville.

The largest group of supplemental forms received in Jeffersonville for transcription of information to the enumeration books consisted of the following:

1. Advance Census Reports. (Some people mailed their Advance Census Reports to the census office in their district)
2. Individual Census Reports
3. Reports for Guests at Hotels, Motels, Etc.
4. "Were You Counted?" forms

Where possible, samples of these forms were examined as a basis for taking action. In this initial review, the criteria used to determine the need for further processing were (1) whether the number of persons on these forms represented a statistically significant percentage of the population of an area, or (2) whether these persons were from a "critical" area which might move

from one size class to another, in the size classes to be used in the published reports, if the persons on the supplemental forms were added to the population of the area.

In the case of Advance Census Reports and "Were You Counted?" forms, when it was decided that it was necessary to investigate to see if some of the persons on the forms should be added to the area, a sample of the forms was drawn for search in the enumeration books. Upon completion of the search, the percentage of persons not found was used to determine how many persons were to be added. Persons to be added were selected on a random basis from the forms received. They were added to those ED's having above the average population of all ED's in the area. Additions to an ED never exceeded five percent of the average ED population of the area.

In the case of Individual Census Reports and Reports for Guests at Hotels, Motels, Etc. that had not been given ED numbers in the field, all the persons listed were added to an area, once the decision was made to transcribe data for persons on supplemental forms to the enumeration books. These forms were not allocated and searched to establish a proportion for addition because (1) Individual Census Reports had been obtained only for the visitors who believed they would not be reported at their usual addresses, and (2) most of the Reports for Guests of Hotels, Motels, Etc. which were received in Jeffersonville were for persons whose reported addresses were inadequate for the assignment of an ED number by the local District Office.

In most cases, especially if the original enumeration books had already been microfilmed, the information on the supplemental forms was transcribed to special enumeration books, referred to as ICR-ED books (Individual Census Reports enumeration books). The ICR-ED books

were treated as separate ED's through all the processing operations, and the data were added in the computer to the tallies for the basic ED's.

ELECTRONIC DATA PROCESSING

FOSDIC

Equipment. -- Research and planning aimed at replacing manual card punching with high-speed electronic equipment was initiated early in 1951. The Bureau's search for a solution to this problem was made in conjunction with the National Bureau of Standards. Late in 1953, engineers of the National Bureau of Standards delivered the first model of FOSDIC to the Bureau for testing.

FOSDIC can be described as a machine which is capable of "reading" information from a negative microfilm copy of an appropriately designed schedule and transferring it to magnetic tape for processing on electronic computers. This reading is done by a moving beam of light. The information read is recorded by FOSDIC on the magnetic tape. The tape containing the information is later fed into a computer. Basically, this is how FOSDIC operates: The beam of light scans the microfilm negative looking for an index mark (printed on the FOSDIC schedule as a black square). In the vicinity of the index mark there is a series of circles printed on the schedule (see appendix I). The beam of light then scans each circle to determine the one filled in. A code indicating which circle was filled is then recorded on the magnetic tape by FOSDIC.

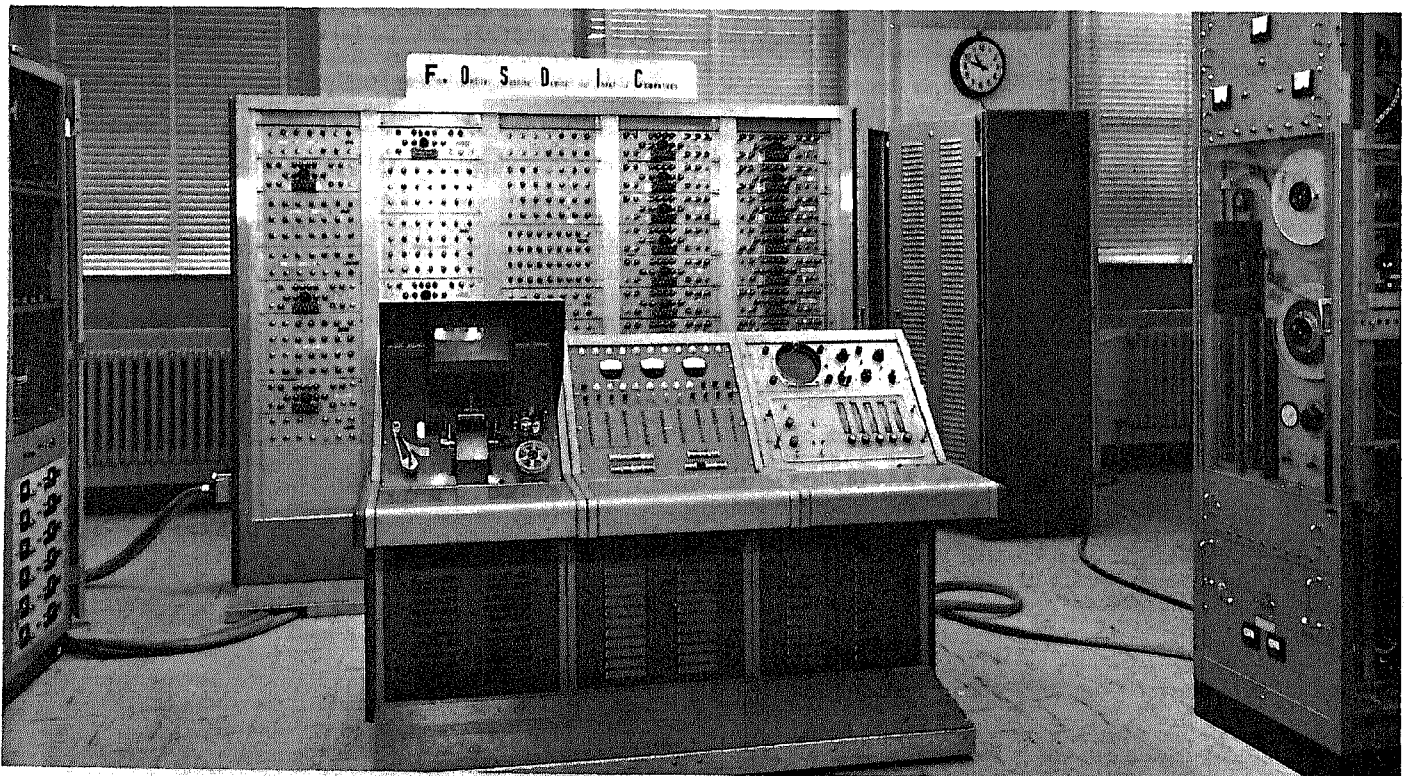


Figure 23.—FOSDIC (Film Optical Sensing Devices for Input to Computers). This equipment transfers data from the reels of microfilmed schedules to magnetic tape which is fed into the electronic computer. In the foreground is the operator's console; behind it is the scan unit; to the left is the program control unit; to the right are the power supply unit (under the clock) and the magnetic tape servo.

FOSDIC consists of four separate units:

1. The tape unit, which holds the magnetic tape, drives it at a constant rate, records on magnetic tape, and, at the end of a run, rewinds the tape for computer use.
2. The console, which contains all the operating switches, recording dials, cathode ray tube, light beam, film drive mechanism, and an oscilloscope for testing the strength of electrical impulses.
3. The scanning unit, which measures the distances the beam must travel, both horizontally and vertically, and "decides" where a mark has been made.
4. The program unit, which "tells" the machine what to do. This includes instructions on calibration of the document, on the order in which the questions will be scanned, and on the distances to travel to find the questions and the marking areas.

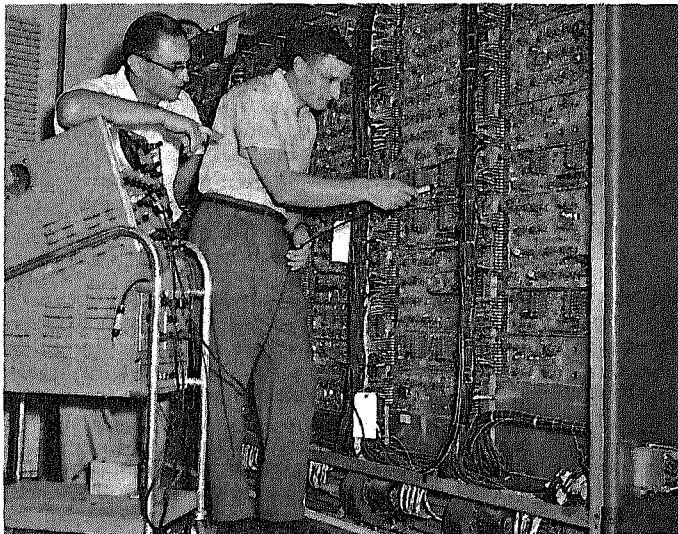


Figure 24.—Making an Adjustment on the Back of the FOSDIC Scan Unit .

Much was learned about the abilities and weaknesses of the first model of FOSDIC when it was placed in operation on special censuses, the Census of Governments, and the National Housing Inventory. This knowledge led to the development of a new version, FOSDIC Model III. (Model II had been designed and built for the U.S. Weather Bureau in the interim.)

Test results on FOSDIC III were most encouraging and it was decided, in the spring of 1957, to build four production models for use during the 1960 censuses. Actual construction was begun about July of 1957 in the Census Bureau. With the completion of construction, testing, and correction, the four FOSDIC's were ready in time for processing the 1960 census data.

FOSDIC operations.--FOSDIC processing was an integral component of the electronic processing system. Operation and maintenance of the FOSDIC system included the following broad classes of operations:

1. Recruiting and training operators for the FOSDIC equipment
2. Maintenance of the FOSDIC equipment
3. Control of the microfilm after shipment of the exposed film from Jeffersonville, through development, receipt in Washington, issuance of microfilm to FOSDIC, and retention of microfilm after FOSDIC processing
4. Transfer of the data from microfilm to magnetic tape, and sending the tapes, labeled as to content, to be processed through the computer

5. Developing and testing FOSDIC programs for conversion of data on microfilm to FOSDIC output tapes

FOSDIC can read and record from microfilm very rapidly. One enumeration schedule for 100-percent data contained about 4,500 small circles arranged in groups, or "fields," between index marks (see example, appendix I). Under the directions of the program unit, the scanning section of FOSDIC found the first index mark, scanned each of the circles in a field to determine whether or not it had been marked by the enumerator, recorded those that had been (or, if two had been marked, determined the denser marking and recorded that one only--a feature of FOSDIC which permitted erasures and corrections to be made on the FOSDIC schedules), then went on to the next index mark and repeated the operation.

On the average, only 10 or 11 of the 20 lines provided for population data on a 100-percent schedule and some fraction of the 4 blocks provided for housing data were used by the enumerators because of the rules for associating data for each housing unit with data for its occupants and other rules for the enumeration. To speed up the FOSDIC machine processing, FOSDIC was programed to first make a quick scan of a line and then to read each separate marking circle only if the quick scan indicated the line contained marked circles; otherwise, FOSDIC skipped to the next line.

During the processing of the 100-percent data, FOSDIC scanned the microfilm at the rate of about 100 frames per minute (each frame was a microfilm of one 100-percent schedule) and recorded the data as magnetic impulses on computer tape.

A total of 9,100 hours of time on the FOSDIC equipment were used in a 17-week period for processing the

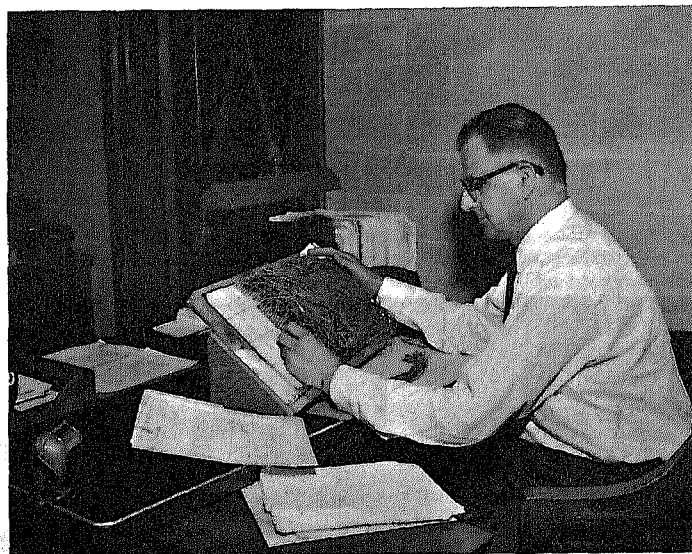


Figure 25.—Wiring a FOSDIC Board for a Data Program .

100-percent data. Of these, 3,700 were for production runs, and the remaining 5,400 hours were for scheduled and emergency maintenance of the machines, testing, and other nonproductive purposes.

A total of 18,400 hours of time on the FOSDIC equipment were used during the 34-week period of major processing operations for the sample data, from mid-

September 1960 to mid-May 1961. There was some subsequent use of FOSDIC time, but it was sporadic and production was comparatively minor. Approximately 8,900 hours FOSDIC time were used for production; the remainder were used for scheduled and emergency maintenance of FOSDIC, testing, and other nonproductive purposes. Production per hour on FOSDIC was four reels of film, as it was also for the 100-percent data.

For the 1950 censuses, the card punching required about 200,000 man-days, with a peak of about 3,000 operators. The microfilm-FOSDIC complex, with a peak of about 100 camera and machine operators, accomplished virtually the same job for the 1960 censuses for both the sample and the 100-percent data, for an 18.5 percent larger population, in about 28,000 man-days.

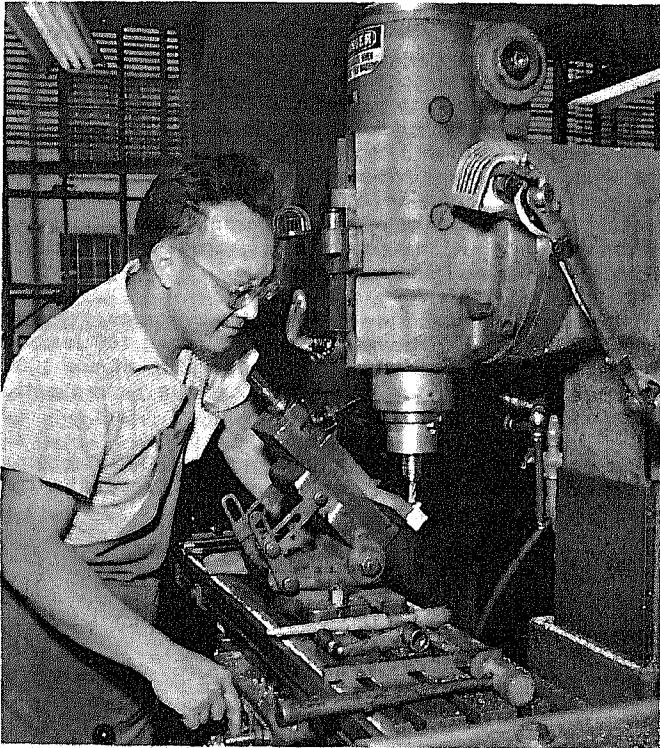


Figure 26.—Making Parts for the Maintenance of FOSDIC.

Univac 1105 Computers

Any general purpose computer comprises the following parts: control, input, memory, arithmetic, and output. The control part of the computer is the electronic circuitry that interprets the program of instructions and directs the other parts of the computer to perform the desired functions.

The input part consists of devices which feed information into the computer.

The memory of a computer is the storage section which is used to store the instructions and data until they are needed. Storage is necessary because the computer can perform only one step at a time, e.g., select a number from storage, then select another number from storage, then compare the two numbers, then store the larger of the two numbers again, etc. Magnetic cores or magnetic drums are among modern computer memory elements. A magnetic core is a tiny metal bead which can be influenced by an electric current to maintain one of two distinct states of magnetization. A drum has a special surface which can be influenced similarly in small local areas. One basic memory element represents one "bit" (binary digit) of information. Many of these bits in association form a computer "word." Instructions in a computer program usually direct the system to manipulate words.

The arithmetic unit is the part of the electronic circuitry that, under program control, adds, subtracts, divides, or multiplies. It can also perform logical operations such as comparing, extracting, etc. The computer can derive numerical solutions for problems of higher mathematics, but this is accomplished by a series of minute arithmetic steps.

Output is the part of the computer that translates the computations into some form of presentation. This may be visual presentation which can be understood by the human eye and brain, such as statistical tables, or magnetic tape which can be used again by the computer or by other equipment, or some other type of presentation which is intelligible only to another machine.

For the 1960 censuses, the Bureau used Univac 1105 computers. The Univac 1105 is a high-speed, large-scale electronic computer. It is a binary machine capable of both scientific and data-processing applications. It can perform 41 different arithmetic and logical operations. It can execute an average of 20,000 instructions per second. Some portions of the programs must be repeated thousands of times in tabulating mass statistical data.

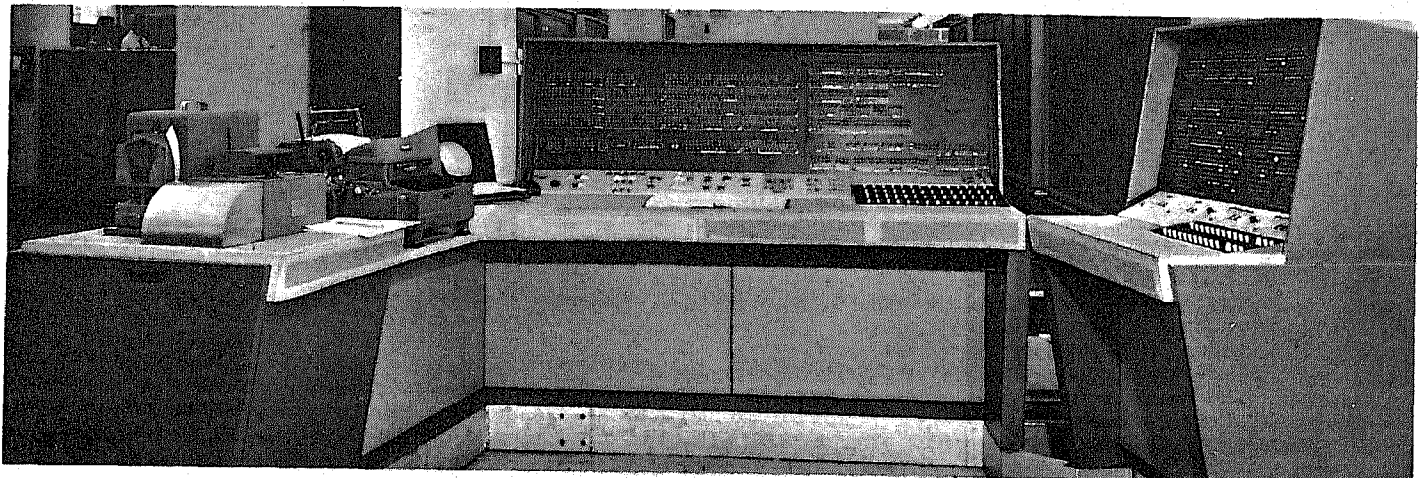


Figure 27.—Univac 1105. Electronic Computer and Related Equipment. In the center is the operator's console; in the left foreground is a Ferranti paper tape reader (punched paper tape is a secondary medium of communication with the computer, used for special purposes). Between the paper tape reader and the main console is a flexewriter. To the right is an auxiliary console associated with the magnetic tape system.

Each Univac 1105 computer at the Bureau has the following major components:

1. 18 Uniservo tape handlers with reading and writing rates of 20,000 binary coded alpha-numeric characters per second. (The Uniservos serve as both input and output functions for the computer.) For each nine Uniservo tape handlers there is a magnetic core input-output buffer
2. Two banks of magnetic core memory for a total of 8,192 words of high-speed memory, each word containing 36 bits
3. A 16,384-word magnetic drum memory
4. Associated arithmetic and control circuitry

Magnetic tape is used for computer input and output. (The preparation of data tapes for input to the computer for the 1960 censuses of Population and Housing was done by FOSDIC, and the translation of output tapes into printing was done by the high-speed printer.) Information is recorded on the tape in a binary code, a combination of only two different conditions, i.e., magnetic saturation in a north-south direction or magnetic saturation in a south-north direction. For example, the Univac code for A is 010100, or no-yes-no-yes-no-no, representing the two states of magnetization in six channels across the tape, and the code for 9 is 001100. In addition to the six information channels on the tape, a seventh channel is used as a "check" channel and an eighth channel is used as a sprocket channel. As many as 200 binary coded alpha-numeric characters can be recorded on one inch of tape, and the 1105 computer can read 100 inches of tape per second. Thus data can be transferred from magnetic tape to the computer memory at the rate of 20,000 characters per second.

For the 1960 census data, FOSDIC had recorded on the computer input tape a predetermined 6-position alpha-numeric character code, a 7th-position check bit, and an 8th-position sprocket or counting bit, for each set of circles for a response to a question on the enumeration schedules. The code pattern of the set of circles from

which FOSDIC selected and recorded marked answers consisted of a predesignated set of codes representing each possible answer to the particular question, FOSDIC read each schedule in a predetermined order, thus the relative position of each character code on the tape indicated the question to which it represented the answer.

The FOSDIC output, then, consisted of a set of uniformly patterned records for each person and each housing unit, the "records" consisting of a set of 6-bit character codes representing the answers to census questions for the individuals or housing units. These recordings of answers were not "numbers" in the arithmetic sense. It was the job of the computers to convert these records of the characteristics of persons and housing units to summaries or tallies of the number of persons or units having particular combinations of characteristics.

A computer has a repertoire of instructions, i.e., coded "commands" its circuitry is designed to interpret and execute. The computer can be instructed to enter serially into its memory the code patterns being received as a magnetic tape passes over a sensing mechanism, and the representations of different segments of data stored in the computer memory can be transferred, added, subtracted, compared, etc. A simple representation of an instruction sequence will illustrate:

The problem: The computer is to count the number of records representing white males, white females, nonwhite males, and nonwhite females in 1000 "words," or computer storage locations, numbered 500 to 1499, each of which contains a 6-character combination representing the record for one person. In position 2 of the 6 positions, the code 0 signifies male and 1 signifies female. In position 3, the code 4 signifies white and 5 signifies nonwhite.

The instructions: The program starts by having the computer execute the instruction stored in location 4 and continue as directed thereafter:

| Storage location | Instruction contained in the storage location | Result of action |
|------------------|--|--|
| 4 | Extract the digit in position 2 of location 500 and place in the arithmetic accumulator; then go to location 5. | The code indicating the sex of the first individual is placed in the accumulator, then the computer goes to location 5 for the next instruction. |
| 5 | Add the digit in the accumulator to the tally-counter-location indicator in the instruction in location 8; clear the accumulator; go to location 6. | By means of this action and the one called for by the instruction in location 7, the instruction in location 8 is altered to cause a "1" to be counted in the proper tally-counter location, thereby tallying the proper race-sex combination. |
| 6 | Extract the digit in position 3 of location 500 and place in the arithmetic accumulator. | The code indicating the person's race is placed in the accumulator. |
| 7 | Add the digit in the accumulator to the tally-counter-location indicator in the instruction in location 8; clear the accumulator; go to location 8. | By means of this instruction and the instruction in location 5, the instruction in 8 is altered so the proper sex-race combination will be tallied. |
| 8 | Count "1" in tally-counter location 10 (the last digit, indicating the proper tally-counter location--e.g., 104 for white males--has been filled in by previous execution of instructions 5 and 7); go to 9. | The person is tallied in the proper sex-race group. |
| 9 | Restore instruction 8 to its original form; go to 10. | The instruction in 8 is prepared for the next use. |
| 10 | Add 1 to location indicator in the instructions in locations 4 and 6. | Instructions in 4 and 6 are modified to deal with records of the second and subsequent persons stored in locations 500-1499. |

| Storage location | Instruction contained in the storage location | Result of action |
|-------------------------|---|---|
| 11 | If the location in the instruction in 4 is less than 1499, go back to 4; otherwise, go to 12. | The program is recycled through the 1000 consecutive records in locations 500-1499. |
| 12 | Restore the instruction in location 4 to its original form; go to 13. | By means of this and the next instruction, the program is restored for re-use. |
| 13 | Restore the instruction in location 6 to its original form; go to 14. | |
| 14 | Type out contents of location 24; go to 15. | By means of instructions 14 through 21, results of the program are typed out. |
| 15 | Type out contents of tally-counter location 104; go to 16. | |
| 16 | Type out contents of location 25; go to 17. | |
| 17 | Type out contents of tally-counter location 105; go to 18. | |
| 18 | Type out contents of location 26; go to 19. | |
| 19 | Type out contents of tally-counter location 106; go to 20. | |
| 20 | Type out contents of location 27; go to 21. | |
| 21 | Type out contents of tally-counter location 107; go to 22. | |
| 22 | Restore contents of tally-counter locations 104, 105, 106, and 107 to zero. | Tally-counter locations are restored for re-use. |
| 23 | Stop. | The program is brought to an end. |
| 24 | Contains typewriter characters for WH. -M. | |
| 25 | Contains typewriter characters for WH. -F. | |
| 26 | Contains typewriter characters for NW. -M. | |
| 27 | Contains typewriter characters for NW. -F. | |
| TALLY-COUNTER LOCATIONS | | |
| 104 | For white males | |
| 105 | For white females | |
| 106 | For nonwhite males | |
| 107 | For nonwhite females | |
| DATA-STORAGE LOCATIONS | | |
| 500-1499 | Each of the 1000 consecutive locations contains the 6-character record of a different person. The second of the six digits for each person indicates sex (0 or 1), the third indicates race (4 or 5). | |

For the 1960 censuses, the Bureau used two Univac 1105 data-processing computers in its Washington headquarters supplemented by two additional 1105 computers, one at the University of North Carolina, Chapel Hill, and one at the Armour Research Foundation of the Illinois Institute of Technology, Chicago. The Bureau shared in the cost of the latter two installations and received a proportionate share of the available computer time. In addition, for a short time, the 1105 computer at Griffiss Air Force Base at Rome, N.Y., and an 1105 computer at the Remington-Rand location in St. Paul, Minn., were used on a contract basis.

Studies begun in 1956 on the requirements for electronic computing equipment for processing the 1960 census data and other Bureau programs indicated that purchase of the equipment together with the plan for sharing the computers at the two universities would be the most economical way of meeting the need for equipment. On the basis of these studies, funds were requested and obtained for purchase of the two 1105 computers and for reservation of computing time on the two computers at the universities. For processing the data from the 1950 censuses, there were rental charges for the punchcard equipment. For processing the 1960 census data there were no corresponding costs for rental of equipment but there were instead costs for the acquisition of the electronic equipment. In the comparison of the costs of data processing for the 1950 and 1960 censuses, the figure for the 1960 censuses includes a prorated share of the cost of the capital equipment, to provide comparability with the 1950 figure which includes the cost of equipment rental.

Computer Operations

In computer processing language, computer "operation" is the process of producing an "output data file" from an "input data file" according to a "program" or set of instructions stored in and followed by the computer. The operation required (1) mounting a program tape, input data tapes, and blank tapes to receive output; (2) "loading" the program tape into the computer and putting the computer under the control of the stored program by means of which the input data were read into the computer and processed, resulting in output data on tape; and (3) demounting, labeling, and distributing the output tapes to the high-speed printer for printing or to storage for later use as input in further computer operations.

The computer operation involved the attendance of (1) a console operator who manipulated controls to read programs into the computer, in addition to his more general duties of attending to and controlling the computer; (2) an engineer or two who were available in case of breakdown of the equipment; and (3) three or four "monitors," or "computer production specialists," who directed and controlled the flow of tapes and programs to and from the 18 computer Uniservos. A control group prepared detailed computer operating instructions for each computer program for use by monitors at the computer console. The instructions specified input and output files, order of monitoring and manner of operations, and labeling and disposition of output tapes. The control group also received original input data tape from FOSDIC, "staged" the tape for use in specified programs in specified computer production shifts, controlled the flow of tape through the high-speed printer, distributed printouts, maintained control records, prepared reports based thereon, and filed and cataloged tape. The magnitude of the operation is indicated by the fact that more than 24,000 tapes were controlled through thousands of different operations consuming as many as 350 hours of computer time a week on six computers in five locations.

In developing the computer time schedule early in 1958, it was estimated that 6,400 hours of operating time on the Univac 1105 computers would be required for processing the 100-percent data. The actual operating time requirement proved to be 3,200 hours.

Although the actual computer time requirements for processing the 100-percent data fell considerably below the original estimates, the opposite proved true in processing the sample data. The original February 1958 projections assumed that about 13,300 computer hours would be sufficient to process the sample data. By the end of December 1961, a total of 12,800 hours of time on the 1105 computers had been used, and it was estimated that 13,500 additional hours would be required to complete the program (including the census evaluation and research program). This increase reflected a more extensive program of editing and of tabulation than had been envisioned when the original calculations of computer time requirements were made.

High-Speed Printers

The two electronic high-speed printers at the Bureau were 600-line-a-minute machines manufactured as an auxiliary to the Univac computers. Identical printers at each of the two university installations were also used for the 1960 census work. (See figure 33.)

Input to the printer consists of magnetic tape, primarily tape which was the output of computer processing. The magnetic tape is read by a tape handler similar to those serving the computer. As information is read from the tape, it is transferred to a small magnetic-core buffer memory. In the printer itself there is a revolving drum with 130 bands of fixed type on its surface, each band containing 51 different letters, numbers, and special characters. Univac codes for enough characters to print one line are transferred from the buffer memory to a vacuum-tube printer memory. The contents of the printer memory are interpreted, then as each band of type reaches the position in which the proper character for the line is in place behind the ribbon and paper, a hammer is activated which presses the paper and ribbon against the character on the wheel. When all characters for a line have been printed, the paper advances one line and the process is repeated--all at the rate of 10 lines per second.

Preparing Computer Programs

The computer's repertoire of instructions represents the arithmetic, transfer, and logical operations it is designed to carry out when it senses the code pattern of these specific commands. A computer program is a set of such instructions so arranged that, as the computer executes them in sequence, the desired manipulation of the data being processed is carried out. *Programing* is the preparation of a set of such instructions. Programing usually has four phases--planning, preparing flow charts, coding, and testing.

An important part of the planning phase of programing is the process of shaping the requirements and desires for certain published results from given data to the capacities and limitations of the computer system and to the limitations of resources and time made available for the operation. The desired results were usually expressed in the form of statistical table outlines, editing requirements, descriptive text, and other specifications furnished to the programers by subject matter specialists. The planning phase requires a considerable translation and reworking of the specifications into an order and mode of presentation which will conform to the computer order and mode of operation and, thus, facilitate a precise and complete translation to computer instructions.

Usually a device known as a flow chart is developed as an intermediate step between the planning of the various segments of a program and its actual coding. The flow chart is a diagram of the flow and logic of each step of the planned program. It assists the planner and the coder in ascertaining that all the logical steps required by a program have been accounted for. A simple illustration will demonstrate this device.

with major or minor modifications. Some techniques and coding sequences were used over and over again in constructing additional programs.

Basic Plan of Tabulation

All the data to be tallied from the 100-percent schedules were obtained in the first run of the FOSDIC

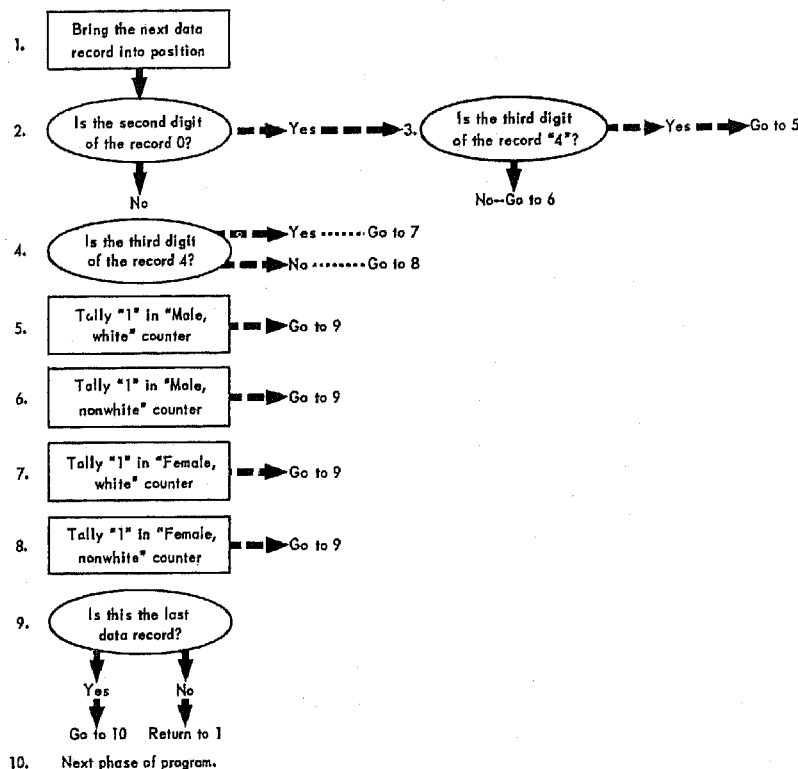


Figure 28.—Flow Chart .

Coding is the process of translating detailed specifications for an operation into a set of codes which can be interpreted by the computer as instructions. This phase requires an intimate knowledge of the computer system. Exact layouts of the formats of the input data file record, the output data file record, and the working and storage memory areas of the computer must be set up. Then the operation specifications must be broken down to simple step-by-step machine operations such as "add field x to field y" and written as an instruction in a code recognized by the computer.

Once a program, or set of computer instructions, for an operation has been prepared, a period of testing is required. Output from a test or from actual data input is examined closely in order to ascertain whether the output conforms to expectations, and, if not, the program is modified or corrected until the output does conform. Many programs are so complex that a rather lengthy period of testing and adjustment is required; the process is referred to as "proving in" a program. Once the program is "proven in," it is considered ready for use in production. However, even during production, unanticipated characteristics of the input data may require adjustments and rerunning of the program to ensure satisfactory output.

In the course of processing the 1960 data, more than a thousand programs, varying in length from 1,000 to 8,000 instructions per program, were required. Fre-

quently one program was developed by adapting another tapes through the computer. The basic processing of the 100-percent data through the computer involved the following steps:

1. The basic data tapes produced by FOSDIC from the information on the microfilmed schedules were used as computer "input tapes" and were fed into the electronic computer along with a program tape containing instructions for editing and tallying and an ED control tape. The ED control tape listed all ED's which were to be processed. As the data were processed on the computers, selected items of information for each ED were added to the ED control tape. The information included counts of total population and housing counts for each ED. (This run of the 100-percent data through the computer is designated "OP-1" on the chart "Processing 100-Percent Data.")

2. The computer run produced three outputs: (1) ED tally tapes containing counts obtained from the basic data tapes for each ED and each city block of the population and housing characteristics tallied on a 100-percent basis; (2) diary tapes, for diary review, which showed how many allocations of each type had been made in each ED as well as other information from which a decision was to be made as to the adequacy of the processing system as well as the quality of the data; and (3) a corrected ED control tape with final population and housing counts obtained from the computer run.

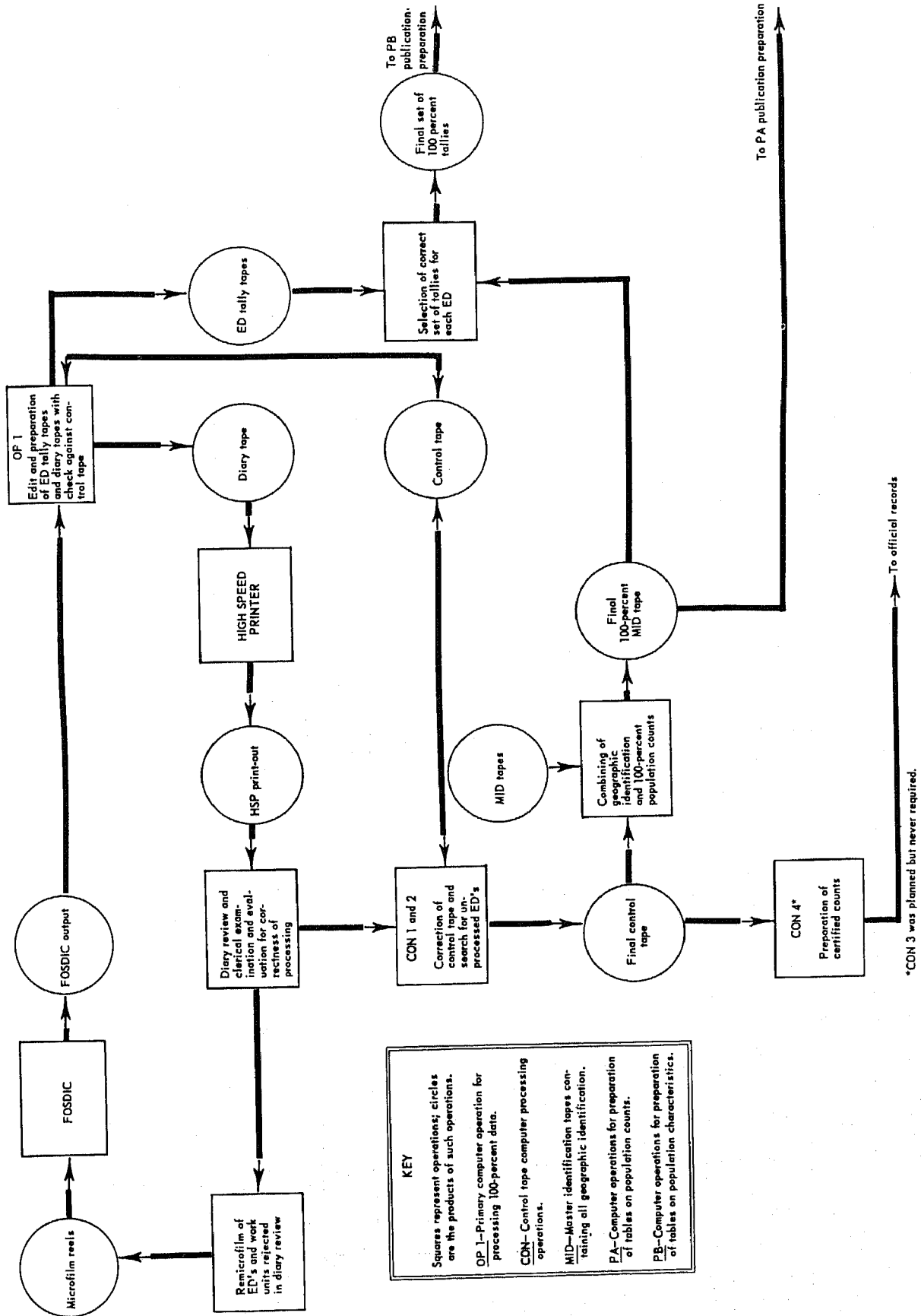


Figure 29.—Processing 100-Percent Data (Microfilm through Certified Counts).

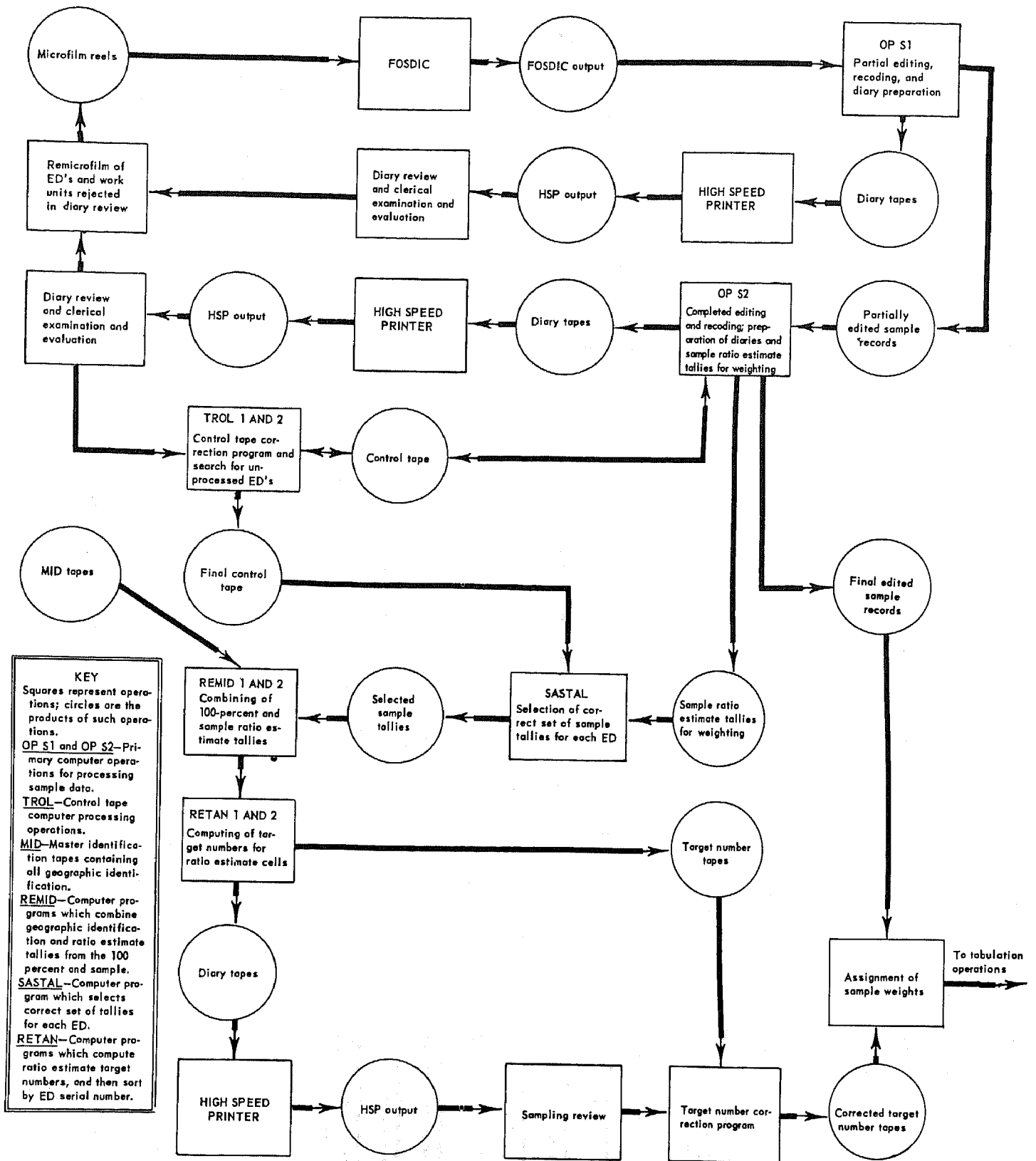


Figure 30.—Processing Sample Data (Microfilm through Sample Weighing).

3. The information on the diary tapes was printed out by the high-speed printer and reviewed (see "Reviewing the Diaries," below).

4. After the diaries were reviewed, some of the ED's had to be reprocessed. The ED control tape was corrected when the ED's were rerun through the computer. As soon as it was determined that the tally outputs were acceptable, the original input data tapes from FOSDIC were erased. The ED tally tapes contained all the 100-percent information that was to be tabulated from the censuses.

5. Master identification tapes, which contained all the geographic codes required for each ED, established the geographic areas for which data were to be published.

6. The tables containing final population and housing counts for each area were produced directly from the ED control tapes in combination with the master identification tapes.

7. The tables containing the 100-percent data on population and housing characteristics were produced from the data on the ED tally tapes. The ED tallies on the tally tapes were summarized for every geographic area for which 100-percent data were to be published, on "summary tapes." The summary tapes were put through the computers with instructions supplied by "table preparation programs" to produce the tables presenting 100-percent data. Separate sets of table preparation programs were required for the different series of publications containing the 100-percent data.

For the sample data, the FOSDIC output tapes went through two different edit runs on the computer (designated as OP S1 and OP S2 on the chart, "Processing Sample Data") and produced edited records and diary tapes. In the editing of the sample data, if the mark for sex had been omitted on the schedule for the wife of the head of the household, the tape was changed to indicate she was female, whereas in the case of the 100-percent data she would have been tallied as a female but her individual records on the 100-percent tape would not have been altered. The records of individuals in the sample were modified in this fashion, in accordance with the editing rules, because the sample records were to be used as computer input for a number of different tally operations. This was one of the numerous respects in which the treatment of the sample data was more complicated and more time consuming than that for the 100-percent data.

Next, the persons and housing units in the sample were weighted, weights being assigned to each individual record through the ratio-estimate procedure (see section below on "Weighting Sample Data").

The individual records were then tallied, and summarized for the tables, and when necessary the 100-percent data were picked up from the summary tapes of 100-percent data, for those tables which were to include both sample and 100-percent data.

The translation from magnetic impulses on the computer output table tapes to printed data was accomplished on the high-speed printers. After review by subject-matter specialists, the output of the high-speed printers was used directly as copy for the subsequent printing operations. Normally, only the insertion of page headings, page numbers, and table titles, and the ruling of column and heading lines, were required after the tables were printed out by the high-speed printer.

Weighting Sample Data

The computer carried out a ratio-estimation process for inflating the sample, by dividing the population and housing units in an area into groups by various charac-

teristics for which both 100-percent and sample data were available, then obtaining, for each group, the ratio of the 100-percent number to the sample number. Then each person or housing unit in the group was assigned an integral sample weight approximately equal to the ratio for his group.

To obtain sample weights for persons and housing units in an area for which data were to be published, all the population or housing units in a particular group--e.g., population aged 25-44--in all the ED's in the area were added together. Each resulting group for the area was then examined to determine if the 100-percent count of that group was less than 50 or if the weight was over 16. If either condition existed, the number of groups among which the total population had been distributed was reduced by successively dropping such distinctions between groups--e.g., between the population aged 25-44 and the population aged 45 and over, or between white and nonwhite--in a specified order, until the condition no longer existed.

Because the basic blocks of data on the tapes were for ED's, the target numbers for the area were then converted into target numbers for each ED in the area by apportioning the area target number in proportion to the corresponding sample counts in each ED.

After the target numbers for the ED were obtained, an integral weight was assigned to each sample person and housing unit in the ED such that, for each ratio-estimate group, the sum of the weights equaled the target number, and such that each of the weights differed from the theoretical (fractional) weight for the group by less than one. The assignment of integral weights was done to avoid the problems of inconsistency which can arise from successive tabulating and rounding of fractional weights in varying cross-classifications. Occasionally, an alternate weighting was adopted because of problems arising out of differences in the 100-percent counts, found after the control tapes were established.

See section on "Ratio Estimation" in Chapter 3, Sampling and Estimation, for a more complete explanation of the ratio-estimation procedure.

Editing and Allocation

General.--Editing the census returns involved identifying nonresponses and inconsistencies from whatever source by means of various checks and correcting the inconsistencies. The allocation process supplied entries where they were missing.

Inconsistencies and nonresponses in the basic data could result from several of the major census processes. For example, during the enumeration, some respondents furnished inconsistent answers and the enumerators sometimes failed to notice the inconsistencies. The enumerators sometimes failed to ask a question or failed to record the response or else recorded it in the wrong place on the schedule. Coders sometimes missed a response which was written on a schedule and sometimes entered an inconsistent code for one. Sometimes a mark on a schedule was so light that FOSDIC did not read it and sometimes an erasure was so poor that FOSDIC read a mark that should have been erased. All of the clerical operations of the census were subject to either 100-percent or sample inspection and correction, but some inconsistencies and nonresponses were still found in the data fed into the computer. The quantity of data collected in a census, the number of respondents, the number of enumerators and other census workers, and the number of different operations required are so large that it is considered inevitable that some errors will occur. Editing to correct obvious errors is a regular part of census operations. In some cases, the correct answer to a

missing or obviously incorrect response is provided by other items of information given about the person or housing unit; for example, a woman reported to be the wife of the head of the household should also be reported as married. In the case of items such as age, where any of a number of responses might be correct for a person having the other characteristics reported, one of the possible ages is allocated in accordance with the pattern of the distribution of ages among other such persons in the population.

Most of the editing and allocation was accomplished by means of the high-speed electronic computers, which performed edits and allocations of a highly complex nature with greater consistency than could have been achieved by clerical processing and with savings in both time and money.

The extensive use of electronic equipment in the editing process insured more uniform processing of the occasional faults in the data than could have been accomplished by clerical work. On the other hand, the inability of the electronic equipment to read persons' names, place names, and other forms of script, and its inability to perform certain other operations that can be done readily by clerks, introduced a measure of inflexibility in the computer edits.

Assignment of characteristics.--Whether a schedule really contained information for a person, rather than a spurious mark or two, was decided on the basis of the configuration of marks on a line provided for a person on the schedule. If the line contained marks for at least two of the general characteristics--relationship to head of household, sex, color, age, marital status--and at least one of these entries was for relationship to head of household, sex, or color, the inference was made that the line contained entries for a person. Names could not be used as a criterion of the presence of a person because the electronic equipment was unable to distinguish between a name and any other entry in the name space. If a person met the minimum requirements for being counted, however, any missing characteristics were supplied by assignment in the computer.

In this census, as in earlier censuses, the general procedure used to allocate entries for missing characteristics was to draw a value from a distribution of the characteristics for the appropriate subgroup of the population. In previous censuses, a person who was reported as a male relative of the household head, but for whom marital status was not reported, was assigned a marital status from a distribution of the marital status of male relatives of household heads in earlier censuses or surveys. The use of the electronic computer improved upon this procedure by making feasible the use of distributions implicit in the 1960 data being tabulated. In addition, the superior flexibility of the computer permitted the use of a greater number of homogeneous subgroups and thus improved the accuracy of the assignments.

The technique used for the 1960 censuses may be illustrated by the procedure used in the assignment of unknown ages. The allocation of unknown ages was carried out in the following steps:

1. The computer stored the reported age of a person in a subgroup of the population classified by sex, color or race, household relationship, and marital status.
2. This stored age was retained in the computer only until data for another person in the same subgroup--i.e., another person of the same sex, color or race, household relationship, and marital status--was processed through the computer. The new reported age then replaced the preceding one.
3. Whenever there was no entry for age of a person belonging to this subgroup, the current stored age was assigned.

This procedure ensured that the distribution of ages assigned by the computer for persons of a given set of characteristics would correspond closely to the reported age distribution of such persons in the current census.

When it was necessary to start with a "clean slate," with no stored values corresponding to characteristics of previously reported persons, values based on previous known distributions were stored.

The potential danger of this type of allocation process was the possibility that continuous strings of persons with the same characteristics in several respects would be assigned the same value because of nonresponses to an item. In some instances, where computer capacity was sufficient, provision was made for storage of two or more values to be assigned on a rotating basis to unknowns. Also, adjustments were made to break up continuous strings of assigned values in group quarters.

For institutions in which the inmates tended to have similar characteristics, such as homes for the aged, if a string of nonresponses was encountered, it was broken up by assigning values manually at intermittent intervals, to allow new and different values to be stored in the computer at periodic intervals for allocation to nonresponses. An attempt was made to do as much of this as possible prior to the mechanical processing.

Because of the interdependence of the various subject items, it was necessary to assign a prescribed order in processing the various subjects. For example, if there was an inconsistency between reported age and highest year of education completed--as in the case of a person reported as 10-years old and a college graduate--it was necessary that the computer be instructed that age as reported must be retained, and an appropriate highest grade of education for a 10-year old be assigned, rather than the reverse. The sequence of edits was in part dependent on the various characteristics required for the allocation for nonresponses in each of the subjects.

The items collected on both a 100-percent basis and a sample basis were edited in essentially the following order: relationship to head of household, sex, marital status, color, and age. Minor modifications were made in this sequence for various types of sub-families and secondary families and for persons in group quarters.

Thereafter, the sample items were edited in the following order, to the extent that a particular subject was applicable to the particular person: whether married more than once, date of first marriage, year moved into current residence, education, place of residence in 1955, number of children ever born, country of birth of parents, place of birth of respondents, mother tongue, employment status recode, hours worked, whether worked in 1959, year last worked, place of work, means of transportation, occupation, industry, class of worker, wage and salary and own-business income, other income, and veteran status.

Examples of other types of response assignment (or, allocation for missing entries) included the following: Allocations of color were made for household members who were relatives of the head of the household, by assigning the color of the household head; allocations of marital status and sex were automatically made for persons identified as wives of household heads or as heads of households with wife present; and allocations were made at random for missing information on quarter of year of birth. If the number of bedrooms was not reported or was inconsistent with other items (e.g., the number of bedrooms was reported as larger than the total number of rooms, or no bedrooms were reported for a unit containing four or more rooms), the number of bedrooms was made to be one less than the total number of rooms

in units having one or two rooms, and two less in units having three or more rooms. When the item on tenure of a housing unit was left blank and other entries on the schedule did not indicate the type of tenure, then the type of tenure of the preceding housing unit was assigned. There were other situations in which a number was assigned from the data for a preceding housing unit.

In certain instances, a specific value was assigned to a dependent item, regardless of the existing response or nonresponse, on the basis of other entries for the same person; e.g., a person with the occupation of "mail carrier" was always assigned the industry category of postal service.

No allocations at all were made for missing entries to items requiring specific geographic locations, such as specific country of birth of parent or birthplace of respondent, mother tongue, specific residence in 1955, and specific place of work, except in selected instances during the manual coding operation when the information was sometimes obtained from data on other family members. No allocations were made for means of transportation. Entries for birthplace of respondent or parent, residence in 1955, and place of work, as well as entries for the year last worked, occupation, and industry were supplied whenever there was sufficient evidence. For all other subjects, allocations were made for missing or inconsistent entries.

Substitutions and cancellations.--The editing and allocation procedures described above involved the assignment of values for one or more unknown or inconsistent characteristics for a person about whom information on other characteristics was available. However, because of enumeration or processing errors, it was sometimes necessary to allocate all characteristics for a person or for a household. Generally these allocations were made by means of various types of substitutions, as follows:

1. Defective stage I complete-count schedules.--In instances in which the control marks on the stage I schedule could not be read by FOSDIC, the schedule, which contained information for a maximum of 20 persons, was discarded. In its place, the previous schedule was duplicated.
2. Occupied housing units with no persons reported.--When no data were reported on a stage I schedule for persons in a housing unit which was reported as occupied, data for the persons in the last preceding occupied housing unit were duplicated to replace the occupants for whom there were no data.

3. Households with little or no sample data.--When an area contained an excessive number of sample households for which there was little or no sample information, data for other sample households of the same size in the same area were duplicated as a substitute. Most of these substitutions were made manually, prior to the computer processing, though a few corrections were made subsequent to the computer processing.

4. Bias in size of sample households.--If the size distribution of sample households showed a marked bias in comparison with the distribution for all households in a particular enumeration district, a rejection and duplication process took place. Thus, if there were too many large sample households, some were cancelled and an equivalent number of small households were duplicated to serve as replacements. (See section "Household-Size Bias Check" in chapter 3.)

The effect of the substitutions was to allocate all characteristics of the persons for whom substitutions were made. Though these were actually allocations, they are itemized and considered separately in all of the various evaluation tables published.

In the case of a sample schedule which could not be read by FOSDIC, it was necessary to remove the entire household from the sample. If the defective page included the beginning of a new household, then two households were cancelled. No substitution was made for these cancelled households; instead, it was left to the normal weighting by ratio estimation to inflate the acceptable sample households to the complete-count controls.

Extent of editing and allocation.--Specific limits were established for the number of substitutions and other allocations that would be permitted to be made automatically without further investigation. If the number of corrections for an ED was beyond the limits, the enumeration book in which the errors or omissions occurred was examined visually, and sometimes corrective action was necessary. For example, it was sometimes found that the enumerator had failed to make the marks on the schedule page sufficiently dark to be read by FOSDIC, or had made some other easily corrected error. In these situations, the pages were corrected, remicrofilmed, and rerun on FOSDIC.

The amount of editing performed on census data was small, but it varied from subject to subject and from one subject item to another and among geographic areas.

PERCENT OF ALLOCATION BY SIZE OF PLACE

| Item | U.S. total | Urban | | | | Rural | |
|---|------------|-----------------|--------------|--------------------------|---------------------------|--------------------------|-------------|
| | | Urbanized areas | | Other urban | | Places of 1,000 to 2,500 | Other rural |
| | | Central cities | Urban fringe | Places of 10,000 or more | Places of 2,500 to 10,000 | | |
| Persons substituted ¹ | | | | | | | |
| Due to noninterview..... | 0.4 | 0.6 | 0.3 | 0.3 | 0.4 | 0.3 | 0.4 |
| Due to mechanical failure..... | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Persons with one or more allocations... | 3.0 | 3.9 | 2.6 | 2.7 | 2.5 | 2.4 | 2.4 |

¹ This type of allocation consisted of cases where persons, and all their characteristics, were substituted for an estimated number of omitted persons. Omissions due to noninterview consisted of persons in households for which the enumerator obtained no population data. Omissions due to mechanical failure consisted of full schedule pages which were not properly recorded in the electronic processing system.

Much is known about the extent of the editing and allocations in the 1960 censuses because the computers prepared a record of the editing, and the figures on the amount of allocation and imputation are published along with the results of the censuses. Comparable information for earlier censuses on the number of errors and omissions and the amount of office editing is limited because the time and cost involved in keeping such records would have been prohibitive when the data were processed with card-tabulating equipment.

The extent to which substitutions and allocations were made by the computer for omitted persons or for missing characteristics, when an entry was missing, poorly marked, inconsistent, or could not be read by the electronic equipment, as well as the principal reasons for making the allocations and substitutions, and the variations in rates among urban and rural areas, are shown in the following table. The number of persons for whom allocations were made in each category is expressed as a percent of the total persons in that category.

Reviewing Computer Diaries

One of the outputs in the initial computer processing of raw data was a "diary" tape which provided, for each ED, information which indicated the quality of the data. Since more than 270,000 ED's were involved, the information on each was generally confined to 120 digits or less, or one high-speed-printer line. Primarily, two general types of information were supplied. One related to the identification and completeness of the data for each ED, the other to the quality of the data for the ED as indicated by the extent of allocation for missing information. Some other checks of the quality of the enumeration were also established; for example, the computer indicated the number of persons in an enumeration book who were not assigned to any household.

A diary review operation was set up to inspect the diaries printed from the diary tapes, to determine the acceptability of the data and to take corrective action where indicated. The first step was usually a comparison of ED numbers listed on an Advance Transmittal Listing with the ED numbers shown in the diary, to find cases where the ED number was misread by the microfilm FOSDIC system. At the same time, the computer counts of persons and housing units were compared with the counts shown on the breaker sheet at the front of the enumeration book. Marked differences between the counts might indicate that the wrong breaker sheet was attached to the enumeration book, or that not all data pages of the enumeration book were microfilmed, or that adjacent ED's were combined when a breaker sheet was missing for the second ED, etc.

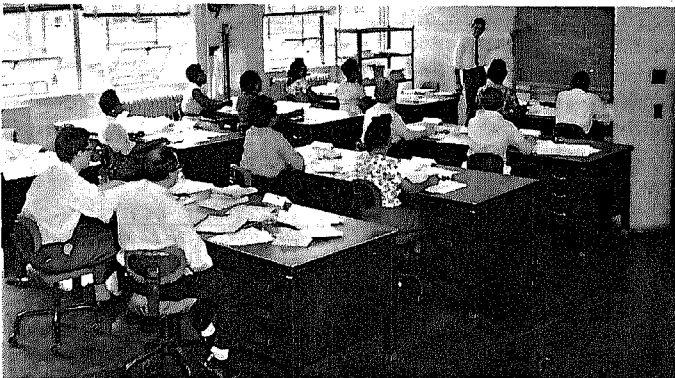


Figure 31.—Training Class for Review of Computer Diaries.

The second step in the operation concerned the evaluation of the quality of the data. The microfilms of ED's with high "NA" ("not available," or missing entry) rates

were inspected on a microfilm viewer in order to ascertain whether the enumerator failed to make the entries or whether FOSDIC failed to read them. In the former case, the ED was referred to a subject specialist who decided whether hand editing and reprocessing would improve the data for the ED. In the latter case, the ED was put through the microfilm-FOSDIC-computer process again.

The result of the diary-review operation was that ED's defective with respect either to identification or to quality and completeness were screened out, corrected or entries edited in, and reprocessed. In the stage I operation, roughly 10 percent of the ED's were reprocessed for one reason or another. For the sample, the reject rate was expected to be considerably higher, chiefly because of narrower tolerances in the processing operation, additional checks to discover sampling biases, and because many more characteristics were covered.

Review of Completed Tabulations

Before publication, a review of the statistical tables was made by subject specialists to detect any enumeration or processing errors which were reflected in the results. In the 1960 censuses, a major advance was made in shifting some of the burden of the professional review to the computer. Essentially, the review that the subject specialist wished to make was translated, insofar as was possible, and insofar as programing time was available, into a series of mechanical steps which were programed for the computer. Because of the unusual capabilities of the computer, very substantial savings could be made and a more efficient job of analysis could be done by having the computer prepare a corresponding set of tallies for analysis by the subject specialist, at the same time that basic publication tables were being produced. If the specialist in education statistics wished to examine the relationship of persons enrolled in elementary school to those enrolled in high school for the various age, sex, and color groups by geographic area, or if he considered it important to see what proportions of the various population groups were reported as enrolled in school, these requirements, along with all of the requirements of the other subject specialists, were incorporated into a special tabulation for critical review. This tabulation included specified tolerances of relationships for each of the checks to be made. The results of the checks were printed out by the high-speed printer and sent with the tables of data to the subject specialist, who was thus able to locate problem areas immediately.

The following ratios, which were prepared by the computer and reviewed to see if they were within limits previously determined to be acceptable, are typical examples of such checks:

- Ratio of persons of all ages not in the labor force to persons 14 years old and over in the labor force
- Ratio of white foreign-born to native-born of foreign and mixed parentage
- Ratio of specified mother-tongue groups to total foreign-born
- Ratio of persons living in a different house in the United States from the one lived in five years earlier, to population 5 years old and over
- Ratio of World War II veterans to total males 14 years old and over
- Ratio of private wage and salary workers in agriculture (i.e., non-owners not government employed) to total employed in agriculture
- Ratio of median income of unrelated individuals to that of families
- Ratio of median income of females to that of males
- Ratio of dilapidated housing units to total housing units

- Ratio of housing units in one-unit structures to total housing units
- Ratio of housing units with public sewage disposal to total housing units
- Ratio of housing units with more than one person per room to total occupied housing units
- Ratio of heads of households who moved between 1955 and 1960 to total occupied housing units

An extensive program of such checks was developed and included in the computer programs for some of the population sample data and 100-percent and sample housing data.

Time did not permit similar development and programming for any of the 100-percent population data, which were the first to be published, but a modest critical review program that relied on clerical postings and calculations made with adding and calculating machines was developed and carried out for 100-percent data on general population characteristics. For each of the general population characteristics for which tables were prepared for publication, a series of checks was made to see if the data fell within acceptable tolerance bands. The tolerance bands varied with each item and area. Typical examples of such critical review checks were the following:

- Nonwhite population as percent of total population
- Comparison of percent nonwhite in 1960 to percent nonwhite in 1950
- Comparison of 1960 percent distribution of the single, married, separated, widowed, and divorced population per household to the corresponding 1950 percent distribution
- Wives of heads of households as percent of total population
- Ratio of males to females
- Married males as percent of all males 14 years old and over

The tables of data for the first few States to be processed for each publication series were given an especially intensive professional review. This was done to insure against some residual programming errors which had not been revealed by earlier tests and to identify consistent errors that had been made in the enumeration. For example, it was found that enumerators tended to consider the unincorporated area adjacent to a large city as part of that city for purposes of recording answers to the questions on place of work and on residence in 1955. In this instance, the tabulation specifications were modified to rectify this bias. However, a more frequent reason for retabulation of data was programming error. After the

earlier production runs, retabulations were usually unnecessary except in the case of some mechanical failure. However, professional review was a continuing operation, for all the tables produced.

QUALITY CONTROL AND QUALITY CHECKS

General

Statistical quality control was applied during the clerical data-processing operations in Jeffersonville to the receipt and check-in of enumeration books, preparation of breaker sheets, coding, and microfilming.

Diary review of the computer output constituted the basic quality check during the tabulation stages of processing the population and housing data. As indicated above, diary procedures required an intensive review, in terms of pre-established tolerances, of (1) the accuracy of identification and the completeness of the data for each ED, and (2) the nature and extent of computer allocations for missing information. Further, they required a determination of corrective action when the tabulated data fell outside the tolerance limits.

In addition to the diary review checks during tabulation, the quality of the data was subject to review at various other stages during the microfilm-FOSDIC-computer processing. As the last step, displays of tabulated data and of the tables themselves, as well as the critical review output, were reviewed by population and housing subject specialists prior to the preparation of the final publication tables.

On the basis of prior experience in data processing as well as lessons learned in the census pretests, it was recognized that a substantial amount of reprocessing activity was an inherent part of the data-processing system for the 1960 censuses. For the operations on the 100-percent data, reruns through the computer for one reason or another required about 20 percent of the total production time on the computer. Approximately 8 percent represented reruns that were made in attempts to correct defects in the original enumeration or to make adjustments for enumeration errors. The remainder resulted from failures occurring within the data-processing system itself, such as FOSDIC output that could not be read by the computer or that proved to be faulty, etc.

The extent to which work units (reels of microfilm or computer tape) were rejected at various stages during processing of the 100-percent information, so that they had to be reprocessed, is indicated below.

| Operation | Number of work units processed ¹ | Rejected one or more times by FOSDIC or computer | | Remicrofilming required | |
|--|---|--|-----------------------------|-------------------------|-----------------------------|
| | | Number | Percent of total processing | Number | Percent of total processing |
| Pre-FOSDIC review (density check)..... | 15,021 | 556 | 3.7 | 556 | 3.7 |
| FOSDIC..... | 14,305 | 767 | 5.4 | 767 | 5.4 |
| Computer..... | 12,794 | 966 | 7.6 | 87 | 0.7 |
| Diary review..... | 12,604 | ² 480 | 3.8 | ² 87 | ² 0.7 |

¹ The total of work units processed through all operations was 12,604, but reprocessing of work units failing earlier operations resulted in increases in the total numbers processed through such operations.

² Excludes 21,034 ED's (7.3 percent of all ED's) which passed diary review at work-unit level but failed tolerances at ED level. Of these, 16,636 ED's were remicrofilmed in new work units.

The statistical quality control plans applied to the coding and microfilming operations are described briefly below.¹ Quality control methods used in the other data-processing operations generally consisted of conventional dependent verification either on a 100-percent or a sample basis. For a description of another type of verification, see the description of the breaker sheet preparation and verification activities, in the section "Preparation of Breaker Sheets," earlier in this chapter.

Quality Control of Coding

In earlier censuses in the United States, control of the quality of coding operations was based upon dependent verification. Under dependent verification, the verifier reviewed the work of a coder and determined whether or not the correct codes had been assigned to the coded items. The effectiveness of dependent verifiers in the 1950 censuses was evaluated by using a system of error planting and error noting. That evaluation indicated that a dependent verifier might fail to find as many as half of the errors in the work he verified.

A system which would eliminate the possibility of a verifier's judgment being influenced by entries the coders had made or by the coder's quality of output was developed for use in the 1960 census operations. Because the system required the services of three different coders for the same information, and because none of them saw the coding done by the coders, the system was called three-way independent verification. Under this system:

1. A sample of enumerated households was selected from each enumeration book. In general coding, the sampling rate was 1 household in 80; in industry and occupation coding, the rate was 1 household in 40. Since roughly one-half the persons in the households had worked in the past 10 years, the effective number of persons in the two samples was about equal.

2. For a given type of coding, three different coding clerks independently coded the data for persons included in the quality control sample. The first and second coders entered the codes on specially prepared cards called "pencil cards" by punching out perforated circles corresponding in position and size to the circles on the FOSDIC schedules. The third coder then entered the codes on the FOSDIC schedules by marking the circles on the schedules, during the regular coding operations. The third coder coded all schedules, those which fell into the quality control sample and those which did not.

3. A clerk called a matcher compared the pencil cards with each other and with the sample FOSDIC schedule by laying one pencil card over the other and laying both over the FOSDIC schedule, to determine differences between the codes entered by the three coders for the same item. Errors were defined in terms of a "majority rule," thus, where all three of the coders agreed on a code, all three were considered to be correct; if two of the clerks agreed and the third differed, the two agreeing were considered to be corrected and third was considered to be in error. Cases in which all three coders disagreed were excluded from the computation of errors; the proportion of such cases was very small. Another type of case excluded from the computations was that in which two of the coders referred the case as a problem to an expert.

¹ These two quality control plans, as well as those used for the other data-processing operations and for preparatory census activities, are described in detail in Quality Control of Preparatory Operations, Microfilming, and Coding, which was at the printer March 1965.

The system described above provided a means not only of measuring the quality of the census coder but also the quality of the two pencil coders who were used as the control device.

An error-planting scheme was used to determine the extent to which matchers were missing coding differences. For every twenty-fifth pencil card prepared by the first penciler, an erroneously penciled card was substituted before the matching operation. Following the matching operation, the planted error cards were removed, the original cards returned, and a record posted showing the total number of planted errors and how many of the planted errors had not been found by the matchers.

Quality Control of Microfilming

The procedures and techniques used during the 1960 censuses to control the quality of the microfilming operations were the following:

1. Dip tests, or the evacuation of spacing and focus. Dip tests were made in order to insure that the microfilm cameras were maintaining the required spacing between frames and that the images had the required clarity and sharpness. The dip test called for the following steps: A sequence of 46 test exposures was made on each microfilm camera once each shift. The developed test film was visually inspected for focus and spacing. If the focus and/or spacing of one or more exposures in the sample was out of the prescribed limits, the camera was stopped, further tests and adjustments were made, and the camera was kept out of production until it was again producing exposures within specification tolerances.

2. Density checks. Federal Standard Color Chips as well as work unit identifications were filmed several times at the beginning and ending of each roll of film. After development, the last two sets of chips and identification were cut off and measured on a "densitometer." The density measurements were used to decide whether or not to send the film to be run through FOSDIC, and whether or not the camera lights needed adjusting.

3. Review of reels which had to be remicrofilmed because FOSDIC could not read them. FOSDIC was equipped with counters that recorded the number of unreadable frames of microfilm in each film roll and the number of unlocatable positions on a frame encountered in reading a reel of microfilm. Both of these measures were direct indexes of the defects in the photography or development of the microfilm (bad lighting, operator errors, scratched film, improperly developed film, etc.). A reel was returned for reprocessing when the counts of these failures exceeded pre-established tolerance levels. This procedure short-cut the process of discovering certain types of defects and errors and provided for prompt recycling of the material on the defective films.

For the first 6 weeks of the microfilming of enumeration books containing 100-percent data, a sample of 30 exposures from each reel of film rejected by FOSDIC was inspected for operator defects. After the initial 6-week period, the formal inspection procedure was suspended because the error rate was so low that an informal system of assurance could be used. Early in the microfilming of enumeration books containing sample data, the rate of rejects by FOSDIC became excessive, and the control plan was reactivated for awhile to identify and remove those camera operators with unacceptably high error rates.

At all times, operator errors and machine faults were recorded on the basis of FOSDIC rejects. If the

record for either the operator or the camera started showing a large number of reels which required remicro-filming because FOSDIC had rejected them, the rejected film was analyzed and either the operator was notified of the errors or the camera was repaired.

CONTROL RECORDS AND PROGRESS REPORTS

The production controls used in the clerical data processing at Jeffersonville involved a system of document control and document routing designed to assure an orderly flow of millions of pieces of paper through the various processing operations and to permit location of required documents at any time. The progress reporting system was based upon the production control system, and was designed to utilize fully the data collected for other purposes such as maintaining production standards and administering the quality control systems. Such reports enabled management and operating officials to make decisions with respect to rate of progress of the work, the cost of work completed at any date as compared to the budget for the job, and the need for changes in staffing.

One of the basic problems encountered in establishing and maintaining an effective control record and progress reporting system was in determining the proper work units or measures to be used. A unit which was preferable during one phase of the processing sequence was not always meaningful at some later stage. Also, geographic units such as States or prefix areas, necessarily employed as work units for many operations, varied too much in size for use in judging work progress. Furthermore, some units, such as ED's, which were near enough the same size for judging work progress, varied too much for such purposes as measuring individual production. In Jeffersonville, the prefix area was decided upon as the basic unit to be used for controlling and moving batches of work from operation to operation, while ED's were selected as the common units to be used in reporting and evaluating total work progress in the major operations. Still more specific and detailed units of work were used within the various operations for production standards progress reporting, e.g., exposures, in the microfilming operations, and population coded, in the coding operations. The various units of measure could, when necessary, be converted to approximations of other measures, e.g., 25 ED's per stage I work unit.

For the operations at Jeffersonville, the Advance Transmittal Listing mailed in by the Census District Office was used as an inventory record of the ED's and enumeration books in the prefix area, and it accompanied the enumeration books through the various processing operations.

When an Advance Transmittal Listing was received, a routing slip was prepared and stapled to it. The routing slip, known as the ATL Routing Record, consisted of a set of detachable coupons, each representing a major operation in the processing work. As each operation was completed, the corresponding coupon was detached, signed and dated, and sent back to the progress reports unit. As coupons were received by this unit, completion dates were posted to a control record which was maintained for each State and which listed each prefix area (in the stub) and each operation (in column headings). Thus, the location of the enumeration books of any particular prefix area could be determined from this record. Information on the coupons was tabulated daily to provide the data for a daily summary report on operations and a weekly summary report on operations.

The production control system at Jeffersonville for processing the sample data was basically the same as the system described above for the 100-percent data. However, the ATL Routing Record for enumeration books for the sample households and housing units included

two additional coupons corresponding to general coding and to industry and occupation coding.

A comprehensive system of control records was established in Washington to cover all aspects of the FOSDIC, computer, and diary review activities. Detailed control records were maintained showing the receipt, location, and contents of microfilm reels after their processing by the film development center. Other records documented the release of microfilm to FOSDIC for processing and its return. Daily reports were prepared and summarized to indicate the progress of work through FOSDIC, the reject rates, and the like. Control records were maintained to show the location, flow, and progress of the FOSDIC output tapes and other computer tapes through the various computer edit and tabulation programs on the equipment in the Bureau and at Chicago, Ill., Chapel Hill, N.C., and Rome, N.Y. Control records were kept on the receipt and movement of computer diaries through the Washington diary review operation, on the diary review work in Jeffersonville, and on receipt of diary review materials by and from the Jeffersonville office. At the end of each week a summary report, Work Units Processed by State, was prepared. The work progress indicated by that report was periodically evaluated in terms of its relationship to the work schedules for stage I processing of 100-percent data and stage II processing of sample data. Weekly reports were also developed showing the rate and nature of rejects.

As work moved through the edit and tabulation phases and reached the point where tabulation runs were made in final table format, control records and reports were developed and maintained showing the location and status, by State, of work on each publication series--population counts, population characteristics, housing counts, block statistics, etc.

A weekly Summary of Status of Computer Programming Activities, showing key dates for completion of major programs and the current status (in terms of percentage completed) of the various computer programs, was prepared.

In addition to the general control records and periodic progress reports described above, the responsible operating units maintained more detailed, supplemental work records used as operational tools and for day-to-day work control.

PRODUCTION STANDARDS

Production standards were prepared for those operations (all in Jeffersonville) which required the work of a number of people for a fairly long period of time and for which the output could be measured objectively. Production standards technicians used the written procedures, standard time data, and information obtained through on-the-job time-study observations, to develop the standards. The written standards were given to the clerks and supervisors, with a transmittal letter explaining how the standard was to be used in evaluating an individual's performance.

As many clerical operations as possible were measured by production standards. Operations were excluded only when--

1. There was no homogeneous, measurable product; e.g., supervisory, administrative, and professional work, record keeping, and maintenance of files were not under production standards
2. The job was to be of such short duration that it did not merit the development of production standards
3. The job involved so few employees that it did not merit production standards

The following operations were subject to individual official production standards:

Check-in of stage I enumeration books
 Check-in of stage II enumeration books
 Screening for replication of households for the sample
 Replication of households for the sample
 Breaker sheet preparation, stage I
 Breaker sheet preparation, stage II
 Breaker sheet verification, stage I
 Breaker sheet verification, stage II
 Counting and sealing enumeration books
 General coding (separate standards by State)
 First general punch coding
 Second general punch coding
 General coding match
 General match--key punch
 Industry and occupation coding
 First industry and occupation punch coding
 Secondary industry and occupation punch coding
 Industry and occupation coding match
 Industry and occupation match--key punch
 Microfilming, stage I
 Microfilming, stage II
 Remicrofilming, stage II
 Reloading microfilm cameras
 Survey of Components of Housing Inventory Change preenumeration transcription
 Survey of Components of Housing Inventory Change transcription verification

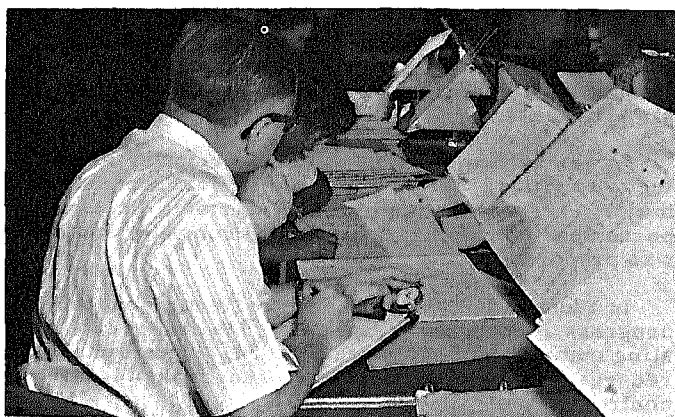


Figure 32.--Production Standards Analyst Making Observations.

In some cases the standard for an operation included a number of workload elements for which work counts had to be reported to obtain composite performance rates; e.g., exposures, ED's, and prefix areas, for microfilming. In both general coding and industry and occupation coding, standards for States and for SMSA's were accepted as a compromise between a single U.S. coding standard, which would have had serious geographic inequities, and production standards for still smaller units, such as counties, which would have been excessively burdensome to administer.

Operations to which production standards were applied were also subject to quality control to assure that acceptable levels of accuracy were maintained. Employees who failed to maintain minimum acceptable levels of either production or accuracy were given warnings, and if they failed to improve they were removed from the operation. In selecting employees for promotion, incentive awards, and separation, both productivity and work quality were considered.

Production standards were used as an aid in budgeting, staffing, work scheduling, controlling, and evaluating the

Jeffersonville operations. Generally speaking, the standards were accepted as accurate measures by the management staff, supervisors, and employees.

TRAINING AND INSTRUCTION

Instruction Manuals

Manuals of procedures, each dealing with a broad aspect of operations, were prepared. The manuals were maintained on a loose-leaf basis so that revised pages could be inserted easily, and also so that brief sections devoted to single subjects could readily be reproduced in sufficient quantities that each clerk could have a copy of the section pertaining to his work without having to be supplied with the entire volume. The manuals were also used as a basis for the training of clerical personnel. When assembled, the manuals consisted of five volumes comprising approximately 1,500 pages. They were supplemented by technical and administrative memoranda which were reproduced and distributed to appropriate staff members, and which together constituted some 450 pages.

Jeffersonville Training Program

The clerical processing of the 1960 census data in Jeffersonville involved the training of approximately 1,500 employees for many different assignments. Since training costs are high and since experience shows that people constantly improve as they stay on one job, a serious attempt was made to train people for only one job. In the coding operations, for example, a change from work on the schedules of one State to those of another often seriously impaired the individual's production until he learned the codes most frequently used for the new State. Insofar as practicable, after a clerk was trained he remained on the assignment until the work was completed. In nearly all cases, the Washington personnel responsible for developing the written instructions for an operation came to Jeffersonville to train the first people assigned to the work. This permitted the writer of the instructions to evaluate personally the quality of his instructions and to improve them. After this first training session, the supervisor in charge of the operation usually trained any additional people. There were, however, three major exceptions to this policy:

1. For the microfilming operation, training was conducted by a specialist from Washington. The uniformity of operation necessary for this work required that uniform training be given to the microfilm camera operators.

The initial training of camera operators required about one day of classroom time. For the next two or three days the trainee assisted and watched a trained operator perform the work. Then the trainee was assigned to a camera and started practice work. As soon as his practice work was acceptable, he was assigned to regular production work. The entire training period usually covered from 7 to 10 days.

2. For training in general editing and coding, the records of all employees were examined, and a large number of people were found to have had teaching experience. Those best qualified who expressed a desire to conduct training were assigned to this work.

Two classes of approximately 25 people each were trained each week and a total of 17 classes were conducted. Each class required about four and one-half days to complete the training course. It was standard practice to have two trainers for each class. One trainer conducted the class for one hour while the other prepared his materials for the next period, corrected tests, and maintained records.

3. The training of industry and occupation coders also required two classes of approximately 25 people each week, and a total of 22 classes were conducted. Washington personnel conducted these classes, since the concepts and rules for this type of coding are more complex than those for general coding and experience is an important factor. Industry and occupation training included many short tests to measure the progress of the trainees and to keep them alert to the mass of information and instructions being directed to them. Several films obtained from large industrial firms provided excellent materials for illustrating the almost limitless number of occupations. Industry and occupation training took a full week to complete.

Washington Training Program

Throughout the processing period, there existed an acute shortage of computer programmers and especially of experienced senior programmers. In recognition of this, the Bureau developed and conducted, periodically, a classroom training course in the fundamentals of computer programming. Tests were administered to Bureau personnel in grades GS-5 to GS-9 to identify persons with aptitude for programming work. Such persons, as well as recent college graduates recruited from Civil Service registers, were assigned to the 6-week training course and, upon successful completion of the course, entered on duty as apprentice programmers.

In general, it required a period of about one year's on-the-job training for inexperienced persons to become productive programmers. During this period, they worked under the very close supervision of experienced programmers.

Persons hired for other Washington office positions received on-the-job training as required in view of their particular experience and general background.

DATA-PROCESSING PROBLEMS AND SOLUTIONS

The following were among the principal problems that had to be dealt with in the course of the data processing.

Adjustments for Errors in the Field Work

The most common situations resulting from inadequate enumeration and requiring time-consuming and costly rectification during data-processing operations were the following:

Missing or incorrect designation of block numbers.--The program for publication of characteristics of housing units by city blocks for each of 466 cities was made more difficult because some of the enumerators failed to indicate block numbers properly. If the enumerator had failed to enter a block number, or had entered the same number for all blocks in his ED, or had entered numbers that were different from those assigned in advance by the Bureau, the computer identified the errors and noted them on the diary print-out. Corrective action required a time-consuming clerical comparison of the addresses and block numbers shown on the original schedules with those indicated on the enumerators' maps, correction of erroneous entries, and retabulation.

Occupied housing units with no population.--For roughly one-half of one percent of all households enumerated, but for a much larger proportion in certain ED's, it was found in the early stages of the processing that on the schedule there was information indicating the existence of an occupied housing unit but no marking that could be read by FOSDIC in the population section of the

schedule to indicate that there were persons in the housing unit. After a great deal of study, including revisits to a sample of such households, a revision of the standard computer program was written to provide for allocation of the population characteristics of another household recorded elsewhere, in such situations. A precautionary step was introduced, however, that provided that if more than a very small proportion of such allocations were made by the computer in any one ED, this fact was to be noted on the diary, and a careful clerical review was made during diary-review operations. Such a review included examination of hand-written entries on the schedule, which FOSDIC and the computer could not read, and also included examination of entries in the enumerator's listing book. Usually it was possible to determine whether in fact the enumerator had correctly enumerated an occupied housing unit and failed to get information about the occupants or whether the housing unit was in fact vacant even though perhaps fully furnished.

Failure to observe ED boundaries.--Occasionally an enumerator or his supervisor failed to appreciate the importance of following ED boundaries and enumerated some households for one ED in the enumeration book for a different ED, or enumerated two or more ED's in the same enumeration book, or redefined boundaries of one or more ED's, and unwittingly violated standard geographic rules. Any of these and numerous similar variants could result in incorrect population and housing counts for places and minor civil divisions. Corrective action could sometimes be taken by matching addresses on the schedules with those on listing books and matching both of them with the ED maps and with city directories, to discover the correct ED for each address shown. The data were then transcribed to a new set of enumeration books which were properly labeled and identified and then reprocessed.

Inadequate enumeration of sample households.--The existence of underenumeration in a book of sample schedules for an ED could be most easily determined by comparing the sample population count on the enumeration book label with the population count for the same ED as previously determined from the count of the 100-percent schedules. Since a 25-percent sample was being used, the sample count should have approximated one-fourth of the official 100-percent count. If it was substantially below this fraction, there was a strong presumption of underenumeration, and a check of the sample enumeration book in such cases usually revealed a number of households for which the only information which appeared had been transcribed from the 100-percent schedules.

A system was devised by the Bureau's sampling experts, and put in effect by the data-processing staff, whereby in ED's in which five or more households were found with no sample data, the 100-percent data already entered for such households were cancelled from the sample, and both 100-percent and sample data for a household of the same size in the same ED were substituted. Such cases were also identified at three different stages in the standard data-processing operations--during breaker sheet preparation, during general coding, and during diary review. The percentage of sample households requiring substitution was in general extremely small. However, in a few cities there were some areas where the percentage was fairly high and represented a rather substantial processing job.

The identification, cancellation, and replication necessary to correct for bias in size of household, where it appeared that the enumerator for some unknown reason had included an inordinately large number of either very large or very small households in the sample,

were considerably more complex, and were done by sampling statisticians.

Correction of Preliminary and Final Counts

One necessary data-processing activity is that of correcting mistakes in published figures.

This type of error was most frequently uncovered after local officials first received preliminary announcements of the population of their municipalities.

The most common causes of errors in population and housing-unit counts, in addition to failure to observe ED boundaries during enumeration, discussed above, are listed below. Although some of these were not processing errors, their correction was an integral part of the processing operation.

1. Failure of local officials to notify the Bureau of the Census of one or more recent annexations of territory to a municipality
2. Failure to enumerate a small geographic area such as an entire city block, or apartment building. This was rarely identified as a source of difficulty
3. Failure to include an ED among those totaled to obtain the total count for the place. This resulted either from faulty listings of ED's by place or from clerical failure to adhere to the correct listings
4. Erroneous identification labels which resulted in accidental substitution, for instance, of data for an ED in South Carolina for the South Dakota ED of the same number
5. Failure to microfilm several pages of a schedule book or, in a few cases, even an entire book
6. Electronic processing system errors, such as:
 - a. Failure of FOSDIC to recognize the beginning of a new ED, with the result that data for that ED were combined with those for the preceding ED
 - b. Substitution of the data on a supplementary ICR-ED in place of the regular ED (instead of their being added to the regular ED) because of computer control tape errors
 - c. A fault in the computer program used

The processes required to correct the errors varied according to type of error and the status in the processing of the ED affected. In some cases minor clerical changes were required, but in other instances the simplest and easiest method to correct an error was a complete new computer run of all tables for an entire State.

Establishing Priorities

Under the system of electronic data processing used in the Bureau, the time required between the date of final determination of the exact contents of any given series of statistical tables and the date by which computer programs could be written, tested, and tried out varied from six months to one year or more. The necessity for a long period of planning made imperative (1) firm decisions on content of tabulations, and (2) early determination of priorities.

Although the equipment and methods used permitted simultaneous tabulation of a much wider variety and volume of data than was possible during any preceding census, it was still necessary to determine the specific items and general types of information that would be required first and then gear the processing system to meet these priorities.

The sequence and approximate duration of work on each of the principal data-processing operations is shown in appendix E.

Physical Facilities

The availability of adequately heated, lighted, and for some operations, air-conditioned space was, of course, important; and equally important was adequate equipment--tables, chairs, desks, filing cabinets, microfilm cameras, adding machines, calculators, etc. It was necessary to plan and estimate requirements, lay out floor plans, and devise special racks, mobile bins, and other equipment.

Special Projects

The data processing of the 1960 population and housing censuses included some supplemental projects which were recognized as fulfilling important needs. Some of the more significant supplemental data-processing projects (in addition to research and evaluation studies which were carried out separately) were the following:

1. Tabulation of data on citizenship for the State of New York
2. Listing of all ED's by area name with selected geographic codes, for users of special tabulations
3. Tabulations making available unpublished data for 100-percent and sample population characteristics for urban places and the remainder of minor civil divisions in areas in which census tracts had not been established
4. Mortality Survey for the University of Chicago.--Match of death certificates issued during May-August 1960 to census records, to obtain and tabulate population characteristics of the deceased persons and their families
5. Mental Health Survey for Maryland and Louisiana.--Match of mental patient records against census data, to obtain and tabulate population characteristics for these persons
6. Tabulation of data on housing unit vacancies in six cities in upstate New York
7. Processing data for a special national sample of 600 ED's, through all 100-percent and sample operations, to obtain advance information on population and housing characteristics at the national level, primarily for use by the Bureau staff for planning publications and other purposes
8. Local Housing Authority Survey.--Tabulations based on the census data plus supplemental data on substandard housing obtained by a special field enumeration in most cases, prepared for 139 local housing authorities
9. Hand tally of the number and characteristics of persons and couples 65 years of age and over in selected income classes in the State of California
10. Preparation of duplicate computer tapes to be used by a private data-processing organization in preparing cross-classifications for market, economic, and social research purposes, providing data on approximately 40 different personal, household, and housing characteristics for each county, SMSA, and State in the United States and for the United States as a whole
11. Tabulation of industry group of the employed by occupation and sex for every county and SMSA in the United States. These tabulations for the larger SMSA's were published but the ones for the smaller SMSA's and all the counties outside the SMSA's were not. The work was sponsored by the Illinois Bureau of Employment Security

PERSONNEL, BUDGET, COSTS, AND MAN-HOURS

Personnel

The peak employment of personnel in each part of the Decennial Operations Division, and the month in which it was reached, is shown in table E. Table F shows monthly employment during the census period for the Decennial Operations Division's Washington office and the six decentralized installations. A large number of persons in other divisions of the Bureau spent varying amounts of time on the data processing; of these, only a relatively few who worked full time on data-processing activities for a considerable period were officially assigned to Decennial Operations Division and thus included in the tables.

Budget, Costs, and Man-Hours

The early budget projections assumed that improved processing methods (the microfilm-FOSDIC-computer system), more extensive use of sampling, and the application of production standards would enable the processing work to be done for about 40 percent of the cost of processing the 1950 censuses, after adjustments for increases in population and salary rates. The fiscal projections provided about \$7 million less than the total spent for processing the 1950 censuses.

The processing budget consisted of three primary and separate elements. They were the basic census processing job (a total of about \$13 million); the Survey of Components of Change and Residential Finance (SCARF) processing work (about \$700,000); and the Puerto Rico census processing (\$400,000). The costs of these pro-

grams were distributed over 5 fiscal years (fiscal 1959 through the first half of fiscal 1963) with peak expenditures estimated to occur in fiscal year 1961.

The two largest items in the processing budget were to cover (1) the cost of time on the computer and high-speed printer, which was estimated at over \$3 million, of which \$150,000 was for the SCARF work, and (2) clerical coding of selected items on the sample questionnaires. This latter activity cost almost \$2.5 million--a unit cost of about 5-1/2 cents for each of the 45 million persons in the sample. The third most costly element was computer programming, monitoring, work scheduling, and record keeping by the Decennial Operations Division staff; these activities cost almost \$1.7 million (see table 2C, appendix H).

The cost of "personal services," or direct salaries for direct salaries for Decennial Operations Division employees in Washington and Jeffersonville, accounted for nearly 75 percent of the total budget.

Some of the larger expenditures for supplies and equipment were the following: over \$500,000 for the purchase of 22,000 reels of computer tape; \$257,000 for 58,000 reels of microfilm and microfilm development; \$90,000 for the rental of microfilm cameras; \$159,000 for the purchase of mobile bins and steel shelving for use in Jeffersonville (in addition to the steel shelving already Government-owned), and \$15,000 for microfilm viewers. Most of this equipment that was purchased continued to be used by the Bureau after its use for the 1960 census data processing was over. For example, the mobile bins and steel shelving are still in use in Jeffersonville, as are the microfilm viewers, and much of the computer tape is reusable.

Table E. --Decennial Operations Division Peak Personnel Strength (April 1960 - June 1963)

| Office and organizational unit | Peak strength | Office and organizational unit | Peak strength |
|--|-----------------|--|------------------|
| <u>Washington, D.C.</u> | | <u>Jeffersonville, Ind.--Con.</u> | |
| Office of the Chief..... | 8 (Apr. 1961) | General Coding Unit..... | 450 (Aug. 1960) |
| Administrative Management Branch..... | 16 (June 1960) | Occupation and Industry Coding Unit... | 496 (Sept. 1960) |
| Special Programs Branch (including SCARF)..... | 18 (Apr. 1961) | <u>Puerto Rico</u> | |
| Computer Programming Branch..... | 146 (Apr. 1961) | Office of the Chief..... | 2 (May 1960) |
| Methods, Procedures, and Quality Control Branch..... | 31 (Sept. 1961) | Receipt and Distribution Section..... | 5 (May 1960) |
| <u>Jeffersonville, Ind.</u> | | Administrative Section..... | 8 (June 1960) |
| Office of the Chief..... | 5 (June 1960) | Coding Section..... | 42 (Aug. 1960) |
| SCARF Unit..... | 192 (Apr. 1960) | Machine Tabulation Section..... | 37 (Sept. 1960) |
| Receipt Unit..... | 122 (May 1960) | Result Work Section..... | 13 (Oct. 1960) |
| Files and Schedule Distribution Unit..... | 71 (May 1960) | <u>Chicago, Ill.</u> | |
| Special Projects Unit..... | 101 (May 1960) | Computer Processing Unit..... | 6 (Feb. 1961) |
| Administrative Section..... | 58 (June 1960) | <u>Chapel Hill, N.C.</u> | |
| Methods, Procedures, and Quality Control Branch..... | 12 (June 1960) | Computer Processing Unit..... | 3 (Feb. 1961) |
| Breaker Sheet Verification Unit..... | 56 (June 1960) | <u>Rome, N.Y.</u> | |
| Microfilming Unit..... | 96 (June 1960) | Computer Processing Unit..... | 2 (May 1961) |
| Compilation Unit..... | 25 (June 1960) | <u>St. Paul, Minn.</u> | |
| Breaker Sheet Preparation Unit..... | 45 (July 1960) | Computer Processing Unit..... | 2 (Dec. 1961) |
| Diary Review Unit..... | 95 (Aug. 1960) | | |

Table F. --Decennial Operations Division Monthly Employment

(Figures for end of month)

| Month and year | Total | Washing- ton, D.C. | Jefferson- ville, Ind. | Puerto Rico | Chicago, Ill. | Chapel Hill, N.C. | Rome, N.Y. | St. Paul, Minn. |
|----------------|-------|-----------------------|---------------------------|----------------|------------------|----------------------|---------------|--------------------|
| 1958 | | | | | | | | |
| July..... | 17 | 17 | - | - | - | - | - | - |
| August..... | 18 | 28 | - | - | - | - | - | - |
| September..... | 32 | 32 | - | - | - | - | - | - |
| October..... | 37 | 37 | - | - | - | - | - | - |
| November..... | 38 | 38 | - | - | - | - | - | - |
| December..... | 40 | 40 | - | - | - | - | - | - |
| 1959 | | | | | | | | |
| January..... | 44 | 44 | - | - | - | - | - | - |
| February..... | 45 | 45 | - | - | - | - | - | - |
| March..... | 44 | 44 | - | - | - | - | - | - |
| April..... | 47 | 47 | - | - | - | - | - | - |
| May..... | 48 | 48 | - | - | - | - | - | - |
| June..... | 53 | 53 | - | - | - | - | - | - |
| July..... | 60 | 60 | - | - | - | - | - | - |
| August..... | 115 | 66 | 49 | - | - | - | - | - |
| September..... | 108 | 69 | 39 | - | - | - | - | - |
| October..... | 109 | 70 | 39 | - | - | - | - | - |
| November..... | 116 | 75 | 41 | - | - | - | - | - |
| December..... | 166 | 74 | 92 | - | - | - | - | - |
| 1960 | | | | | | | | |
| January..... | 197 | 74 | 123 | - | - | - | - | - |
| February..... | 197 | 78 | 119 | - | - | - | - | - |
| March..... | 203 | 90 | 113 | - | - | - | - | - |
| April..... | 294 | 98 | 192 | 4 | - | - | - | - |
| May..... | 841 | 106 | 702 | 32 | - | 1 | - | - |
| June..... | 1,298 | 131 | 1,090 | 73 | 3 | 1 | - | - |
| July..... | 1,487 | 151 | 1,249 | 82 | 3 | 2 | - | - |
| August..... | 1,602 | 157 | 1,353 | 87 | 3 | 2 | - | - |
| September..... | 1,310 | 154 | 1,075 | 76 | 3 | 2 | - | - |
| October..... | 1,290 | 156 | 1,073 | 56 | 3 | 2 | - | - |
| November..... | 1,237 | 152 | 1,029 | 51 | 3 | 2 | - | - |
| December..... | 1,191 | 166 | 972 | 46 | 5 | 2 | - | - |
| 1961 | | | | | | | | |
| January..... | 1,232 | 170 | 1,012 | 43 | 5 | 2 | - | - |
| February..... | 1,115 | 180 | 893 | 33 | 6 | 3 | - | - |
| March..... | 705 | 195 | 469 | 32 | 6 | 3 | - | - |
| April..... | 436 | 196 | 201 | 31 | 6 | 2 | - | - |
| May..... | 352 | 187 | 125 | 30 | 6 | 2 | 2 | - |
| June..... | 381 | 191 | 150 | 30 | 6 | 2 | 2 | - |
| July..... | 340 | 172 | 138 | 21 | 5 | 2 | 2 | - |
| August..... | 318 | 160 | 137 | 15 | 4 | 2 | - | - |
| September..... | 229 | 139 | 82 | - | 6 | 2 | - | - |
| October..... | 214 | 124 | 83 | - | 5 | 2 | - | 2 |
| November..... | 207 | 113 | 86 | - | 4 | 2 | - | 2 |
| December..... | 201 | 112 | 80 | - | 5 | 2 | - | 2 |
| 1962 | | | | | | | | |
| January..... | 95 | 61 | 25 | - | 5 | 2 | - | 2 |
| February..... | 93 | 61 | 25 | - | 5 | 2 | - | - |
| March..... | 91 | 56 | 29 | - | 4 | 2 | - | - |
| April..... | 94 | 57 | 27 | - | 6 | 2 | 2 | - |
| May..... | 88 | 56 | 22 | - | 6 | 2 | 2 | - |
| June..... | 88 | 58 | 20 | - | 6 | 2 | 2 | - |
| July..... | 84 | 58 | 20 | - | 4 | 2 | - | - |
| August..... | 70 | 53 | 11 | - | 4 | 2 | - | - |
| September..... | 65 | 49 | 10 | - | 4 | 2 | - | - |
| October..... | 58 | 42 | 10 | - | 4 | 2 | - | - |
| November..... | 58 | 42 | 10 | - | 4 | 2 | - | - |
| December..... | 56 | 40 | 10 | - | 4 | 2 | - | - |
| 1963 | | | | | | | | |
| January..... | 33 | 27 | - | - | 4 | 2 | - | - |
| February..... | 36 | 30 | - | - | 4 | 2 | - | - |
| March..... | 35 | 30 | - | - | 3 | 2 | - | - |
| April..... | 42 | 37 | - | - | 3 | 2 | - | - |
| May..... | 42 | 37 | - | - | 3 | 2 | - | - |
| June..... | 42 | 37 | - | - | 3 | 2 | - | - |

- Represents zero.

Insofar as possible, budget plans for the Decennial Operations Division were developed on the basis of production standards data, and cost controls were integrated into the overall progress reporting plan so that the consolidated reports permitted a continuing review of work completed, stafftime invested, and costs incurred.

Fiscal project accounts were developed on a major activity basis, i.e., with separate allotments provided for major activities such as receipt and distribution of enumeration books, coding, microfilming, review of computer diaries, and the like. Fiscal reviews and budgetary revisions were undertaken as necessary on the basis of the latest information contained in the official Bureau monthly cost statements, special biweekly machine tabulations of personal service charges by activity, and changes in procedures, methods, productivity, or work priorities.

In summary it may be said that 1960 census processing costs were very substantially reduced from equivalent 1950 costs by changes in methods and other innovations.

The cost of the major clerical activities, and the personnel time involved, were as follows:

Receipt and check-in of enumeration books.--The first enumeration books were received and checked in April 22, 1960, and the check-in of all 344,553 stage I, 100-percent, enumeration books was completed by the end of August 1960. The entire stage I check-in operation required 163 clerical man-weeks at a total cost of \$11,739. The stage II, sample, check-in operation, involving 469,379 books, began April 29, 1960, required 163 man-weeks of labor, cost \$11,705, and was also completed by the end of August 1960.

Breaker-sheet preparation and verification.--A total of 348,597 breaker sheets were prepared for enumeration books containing 100-percent data, at a cost of \$19,043 and 271 man-weeks of labor. A total of 478,898 breaker sheets were prepared for enumeration books containing sample data, at a cost of \$31,417.

Breaker sheet verification for stage I, 100-percent, enumeration books, began April 29, 1960, and was completed by mid-August 1960. This operation cost \$28,456 and required 419 man-weeks of labor. Breaker sheet verification for stage II, sample, enumeration books, was completed by April 21, 1961, at a cost of \$28,164 and 382 man-weeks of labor.

Coding and verification.--General coding started in late May 1960 and was completed in April 1961. Peak employment on general coding reached 335 in late August 1960. On the average, each clerk coded the entries for 1,309 persons per day. In addition, the verification of the general coding employed approximately 25 people.

Industry and occupation coding started late in May 1960, when the first schedules became available from the general coding sections, and was completed in April 1961. At the peak of operations, in October 1960, there were

approximately 365 people engaged in industry and occupation coding. The average population coded per clerk-day of work was about 1,300. In addition to the clerks engaged in industry and occupation coding, approximately 70 people were required for the sample verification of the coding. Additional personnel were used for 100-percent dependent verification and for correction of work rejected as unsatisfactory by the quality control system.

Microfilming.--Microfilming the 100-percent enumeration schedules required 11,112,995 exposures. This operation cost \$103,239 for labor and consumed 1,515 man-weeks. The initial round of microfilming the stage II schedules containing the sample data was completed on April 28, 1961. It required 27,128,788 exposures, at a cost of \$187,625 for labor and 2,377 man-weeks. About 3,000 of the reels containing the sample data, or 1,350,000 exposures, had to be remicrofilmed as a result of the review of computer output. For the entire period of data processing, a total of 947 miles of microfilm was used.

Diary review.--The Washington diary review unit had a peak employment of about 50, while the Jeffersonville diary review unit reached a maximum employment of 95. The total cost of the diary review operation for both stage I and stage II was \$590,700.

Quality control.--The cost of the quality-control program varied widely from one operation to another, depending in part on how critical the operation was and in part on the type of operation and type of verification activity developed. The quality control and verification activities for the coding operation required an estimated 25 percent of the total budget expenditures for the coding. For breaker sheet preparation, the verification operation cost about half of the total budget for the operation, or about \$57,000 of \$107,000 (the cost of verification alone is not known since the \$57,000 includes the cost of inserting breaker sheets into the books and of sealing blank pages to the backs of books). Assuring exceptionally high quality of output of this operation was necessary because a single error on a breaker sheet required costly corrections at subsequent data-processing operations.

Production standards.--During peak operations in Jeffersonville approximately 700 employees were under production standards, spending on the average approximately 90 percent of their total available time under standards. Substantial amounts of time and money were invested in the preparation of production standards records and reports. The staff of standards technicians ranged from 2 to 6 employees. Approximately 15 employees were engaged full-time in preparing and maintaining the production standards data. Some additional costs of the program were fragmentary and diffused throughout the organization, e.g., the cost of employees' preparation of individual daily time and production reports.

A summary of data-processing costs by major objects of expenditure and by fiscal year is shown in table 2C, appendix H.

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Chapter 9. The Publication Program

TIMELINESS OF THE DATA

The goal of the publication program for the 1960 censuses, like that of previous censuses, was to make the data available as soon as possible after the census was taken, and to do so while maintaining the Bureau's standards relating to the quality of the statistics issued and the way presented. To achieve this goal, the following basic decisions were reached regarding the census publications:

1. The output of the high-speed printer of the Bureau's computer complex would be used as reproduction copy for offset printing, to the extent feasible, with a minimum of manual processing.
2. All published reports were to be produced by photo-offset. (The text for the final reports was first typeset then the pages of text were reproduced by offset along with the rest of the report.)
3. The data were to be issued in four successive waves of publications--preliminary reports containing counts sent in by the field offices; advance reports containing selected final figures; final paperbound reports; and, for some series of reports, clothbound volumes containing groups of final reports.

An outstanding accomplishment of the 1960 Censuses of Population and Housing was the issuance of publications of census results several months earlier than the corresponding results from previous population and housing censuses had been available. Dates of publication of some of the principal series of final census reports of the 1950 and the 1960 censuses are shown in table 12, appendix H. Although the contents of the reports for the 1960 censuses varied somewhat from those for the 1950 censuses, the figures given correctly reflect the gains in the time of public issuance of final figures from the 1960 censuses in comparison with the 1950 census program.

Part of the price for timeliness of publication of the census results was the cost of issuing preliminary and advance reports. Preparing these reports also delayed somewhat the issuance of the final reports. However, there was considerable public demand for preliminary figures to appear soon after the census, and it was decided to issue those that were available from the field counts. It was determined also that selected final figures to serve important needs could appear several weeks or, in some cases, several months earlier in advance reports than in the detailed final reports, and it was decided to issue them in advance reports provided they were developed from established tabulations and did not divert manpower or machine time from data processing for the final reports. It was decided not to draw an advance sample for preliminary reports, as was done for the 1950 censuses because the use of high-speed electronic equipment for processing the data made it possible to publish final results of the 1960 censuses almost as soon as preliminary sample results could have been published.

In general, the report series were scheduled so that the basic counts were issued first, followed by the detailed breakdowns and cross-classifications of the data. Because

the responses to the questions asked on a 100-percent basis were precoded on the schedules, it was possible to process the 100-percent data rapidly, and the publications containing total counts by area could be followed soon by population and housing characteristics for the 100-percent items. In the case of the housing census, the demand for data on small areas was such that effort was concentrated first on issuing the numerous reports for city blocks. The sample data required much more time for processing and publication than the 100-percent data, though not so much time as was required for the sample data from the 1950 censuses.

QUANTITY OF 1960 STATISTICS PUBLISHED

The quantity of statistics published for the 1960 censuses was greater than that of earlier censuses. One of the major policy decisions resulting from consultation with the Census Advisory Committees and with the Conferences of Census Users was that more data should be published for small areas, both for use by local communities and for detailed research on variations of characteristics within larger areas. Users of the census data could then group the data for small areas to build statistics for whatever larger area was appropriate for their purposes, such as a homogeneous economic area or the area served by a particular facility. In addition, there was an increase in the subject matter for which statistics were published.

There were a total of approximately 138,000 pages of 1960 census reports (including duplicate pages, e.g., pages appearing in a separate pamphlet and later appearing in an assembled clothbound volume), compared with a comparable figure of about 73,000 for the 1950 population and housing reports.

After allowing for roughly 20 percent additional space required by the use of high-speed printer output for publication copy for the 1960 reports, because the high-speed printer prints 10 characters to an inch instead of the 12 characters to an inch found on typewritten copy for Bureau reports, there remains an increase of about 50 percent in the number of pages published for the 1960 censuses as compared with the 1950. Page counts for the various series of reports are given in table 11, appendix H.

USE OF HIGH-SPEED PRINTER OUTPUT AS CAMERA COPY

The outstanding advantages of using high-speed printer copy for reproduction were the savings in time and manpower. In earlier censuses, tables had to be posted by hand, reviewed, typed (or sent to the printer for composition), proofread, and machine checked. For the 1960 censuses, the computer output was programmed so that it fell into columns on the output of the high-speed printer. The original copy was sent to a copy-preparation unit and a carbon to the appropriate subject specialist. The copy-preparation operations consisted of spraying the sheet to protect the copy from smearing, inserting

preprinted page headings, page numbers, and table titles, and ruling column and heading lines. If no corrections were needed after subject review, the tables were usually ready at this point for reproduction by photo-offset. The electronic equipment was considered so accurate as to eliminate the need for the proofreading and machine checking required for typewritten or typeset copy.

Although the high-speed printer copy for diary review and other internal use was produced at the rate of 600 lines a minute, publication copy was produced at 400 lines a minute to insure the clarity of the imprint and satisfactory alinement.

Although the advantages of using the high-speed printer output for camera copy for offset reproduction far outweighed the disadvantages, this technique also raised some problems:

1. Loss of space.--The high-speed printer type printed 10 characters or digits to the inch as compared with 12 to the inch for material prepared on a typewriter with elite type. In addition, the overall width of the printer output was 120 units in 130 spaces, while the standard size page for census reports (9-1/8" x 11-3/8") could accommodate 150 spaces of high-speed printer copy (or 180 spaces of typewritten copy). To avoid a severe loss of space and to increase the amount of data published on each page, the full 150 spaces on each page were used by having two "passes" through the printer--a technique originally developed for the 1958 economic censuses. While this technique required extreme care in the alignment of the two portions of each line, the cost in printer time and manpower was justified by the more efficient use of the space on each page.

Another factor that tended to cost space was that, unlike a typewriter which could provide half spaces

between lines, the high-speed printer furnished only full spaces between lines.

All in all, the use of high-speed printer output as camera copy accounted for a loss of approximately 20 percent of space per page.

2. Presentation problems.--High-speed printer output was limited to capital letters. The printer had no lower case, no bold face, and no italics.

In addition, the high-speed printer had no superior numbers to use to identify footnotes and only one symbol--the asterisk--for standard footnotes. To counteract this limitation, footnote symbols were inserted manually on a typewriter with type matching that of the high-speed printer.

Another peculiarity of the printer output was the large black imprints made by periods. In the case of leaders used in the stubs of statistical tables, the heavy imprint and uneven alignment of the periods did not meet presentation standards. This problem was solved by dropping every other period.

Unsatisfactory positioning of commas by the high-speed printer, which printed them midway between lines rather than on the line, led to the decision to eliminate the comma in numbers and to substitute a space in its place.

3. Time required for planning.--The planning of the format of each table--boxheads, width and depth and number of columns, pagination, etc.--took much longer than if the tables were to have been typed manually on preprinted forms.

One group of important 1960 census reports that did not use high-speed printer output as camera copy was Series PC(1)-A, Number of Inhabitants. The decision to use typewritten copy was based on the fact that this series included a considerable amount of historical data that could be inserted in the tables before the 1960 data were available and in a more economical manner than if electronic equipment had been used.



Figure 33.--A High-Speed Printer.

GROUPING AND BINDING REPORTS

The chapters for a single State were issued as separate paper-bound reports, each in a different series; e.g., chapter A for volume I of the population census results for each State was issued as a report in series PC(1)-A, chapter B as a report in series PC(1)-B, etc. The different chapters for a State were subsequently assembled and bound into a single clothbound volume for the State. This arrangement of State chapters into State volumes was first used for the 1950 population census. Prior to that, the chapters for all the States in one series were bound together, so that the user wanting all the census data for one State, or one region, had to buy all the census volumes. There was considerable variation in the sales of the different State volumes of 1950 census results, which supported the belief that many users were interested in data for only a single area.

Most of the 1960 population census reports were issued on a State basis, but only one series of final 1960 housing census publications was planned to be issued as separate reports by States--series HC(1), later assembled as Volume I, States and Small Areas. Housing experts considered that the housing market was not divided by States, and that users of most housing data were more interested in particular urban or rural areas.

The final reports on census tracts and on city blocks have never been bound for any U.S. census. They have not been bound together because the average user of these publications is interested in only one area, and no feasible way to group them usefully has been found. They have not been bound separately because there have been too many of them; in addition, many have been too thin for binding and some have been too thick.

CORRECTION OF ERRORS IN PUBLICATIONS

An advance report for the 1960 censuses typically had a typed preliminary text with final tables of figures, but any corrections found after the issuance of the advance reports were made in the tables in the detailed final reports.

If an error was found on number of inhabitants after publication of a final report and before publication of the corresponding report on detailed characteristics, it was handled by a footnote in the later report. Tabular portions of clothbound volumes are identical with the separate paperbound final reports, but the text may include a list of corrections to be made in the figures.

The correction of census figures when errors are discovered goes on without any time limitation on how long after a census corrections will be made. The Bureau of the Census maintains one set of bound volumes in which corrections are entered as they are found throughout the years. Some corrections of 1950 figures appear in the 1960 reports where they are given for comparison; some of them were found in the course of taking the 1960 censuses.

PRINTING, PRICING, AND DISTRIBUTION

The decennial census publications conformed to the printing, pricing, and distribution policies for all Bureau publications, and these conformed to Government-wide policies. General U.S. Government policy is that all printing of Federal publications is done by the Government Printing Office. However, arrangements have been made for limited printing facilities in the various Government departments, and some Bureau publications are printed at Commerce Department. These are always publications which are small, relatively simple, and

needed soon--e.g., preliminary and advance reports of the 1960 censuses. These publications do not have the advantage of the distribution and sales facilities given publications by the Superintendent of Documents.

The Government Printing Office subcontracted the final 1960 census publications to three private printers, but the Superintendent of Documents handled sales and distribution. An innovation was the fact that the contracts with the private printers covered any population and housing census reports which were ready for printing. Earlier practice had been to establish contracts for specific series of reports, with the result that reports were sometimes delayed because the printing facility under the contract covering that particular series was overloaded even though the facility available for another series was idle or running at a fraction of its capacity.

For the PC(1)-A, -B, -C, and -D reports for the population census and the HC(1) reports for the housing census, the number of copies of each page required for the chapter issued as a separate publication and the number required for the assembled clothbound volume were estimated in advance and sufficient copies for both editions were printed at one time. Other reports appearing in two editions were reprinted from the negatives saved from the original press runs.

Photo-offset was first used for the 1940 census publications. It was used for the major portion of the 1940 and 1950 census publications, and was used for all the 1960 census publications.

The cost of printing the results of the 1960 censuses is shown in table 4, appendix H.

All U.S. Government publications have a subsidized price: the originating agency pays all the costs for preparation of a publication and the printing of copies for its own use, so that all the purchasers pay is the cost of printing extra copies plus the cost of handling. The result is that the Bureau, like all Federal agencies, makes information available to the public at a nominal charge. Prices of publication are based on a schedule maintained by the Government Printing Office; prices of Bureau publications not prepared by the Government Printing Office are equivalent to prices of those that are.

The Bureau also has the responsibility for making some free distribution of all reports for certain uses including consultation and reference in libraries. It maintains lists of people entitled, by virtue of their positions or functions, to receive publications free. The Superintendent of Documents sends the Bureau's publications to 600 depository libraries for Government publications; this puts copies in the major reference libraries of the country. In addition, there are about 150 other depository libraries for census publications in places with a large population and usually with a large educational institution. The depository libraries in both programs indicate which classes of publications they wish to receive. All of the 600 receive the annual Statistical Abstract of the United States, which includes summary figures from the most recent censuses. Most of the libraries receive at least the U.S. Summary reports of the major censuses and the reports pertaining to their particular States, and many receive all the reports of the population and housing censuses. A few receive all or almost all publications of the Bureau of the Census.

The Bureau works with the Superintendent of Documents, the Department of Commerce and its field offices, and other organizations to publicize the availability of census reports. It also publishes a quarterly catalog of publications, issues press releases, and issues announcement forms and distributes them widely. Statements on

the publication programs of both the population and housing censuses were prepared and distributed from time to time throughout the census period. They included brief descriptions of each series of reports and the anticipated publication dates.

Responsibility for the storage and distribution of preliminary and advance reports was assigned to the Jeffersonville office, and all requests for copies (paid and free) were forwarded from Bureau headquarters in Washington to Jeffersonville. In the case of final reports, the storage and distribution of copies for sale were handled by the Superintendent of Documents, Government Printing Office. A supply of the final reports was also maintained in Jeffersonville for Bureau use as well as for filling requests for free copies.

THE PUBLICATIONS COMMITTEE

Because the publication of the results of the 1960 censuses involved many of the Bureau's subject, operation, and administrative divisions, a 1960 Census Publications Committee was established in January 1959 to furnish a central point for the development and coordination of policies and the resolution of problems. The use of the committee as a coordinating body and the definition of the scope of its activity were based to a large extent on the Bureau's experience with similar committees for the publication programs of the 1954 and 1958 economic censuses.

The committee included representatives of Administrative Service Division, which arranged for printing the publications; Decennial Operations Division, which prepared the tabulations; Geography Division, which prepared the maps and graphs for the reports; Housing Division and Population Division, which were concerned with the subject content of the census reports; the Public Information Office, which supplied announcements of census results to the public in many ways but primarily through releases of information to newspapers; and Statistical Reports Division, which had general responsibility for coordinating Bureau publication programs and developing standards for statistical publications. Representatives of the Office of Publications Management of the Department of Commerce usually attended the monthly meetings. In addition, other divisions of the Bureau, such as Personnel, Budget and Management, and Electronic Systems Divisions were invited to send representatives when subjects pertaining to their areas were on the agenda.

Among the concerns of the committee, especially during the early months of its existence, were the designation of series of reports, procedures for combining series into final reports, choice of preparation and printing methods, design of covers and other parts of the publications, use of graphic materials, standardization of style, format, and arrangement of the publications of the population and housing censuses and their relation to the publications of other censuses, and the planning of special reports.

After the completion of the census enumeration, the principal function of the committee was reviewing progress of the publications program to insure that all operations were proceeding on schedule and that target dates were met and to discover any areas of confusion or unnecessary delay which needed to be corrected in order to expedite publication of the results. This monthly reporting served for continuous evaluation of the procedures and time schedules and provided a convenient forum for the discussion and coordination of decisions by all interested divisions.

Late in 1959, an outline of publication steps for the 1960 censuses (see appendix F) was prepared and

distributed by the committee. This outline was patterned after a similar outline which had been used for the 1958 economic censuses. It consisted of two parts, one listing the steps required once at the beginning of each series and the other listing the steps required for individual reports. From the beginning of 1960, a weekly progress report covering the crucial steps was prepared by the Bureau's progress reporting office.

In several instances where technical problems were involved, the committee established task forces and subcommittees to evaluate the difficulties and recommend solutions. Accomplishments made in this manner included adoption of a system for the designation and numbering of report series, establishment of standards of presentation for typewriter and high-speed printer copy, and standardization of publication terminology, as well as numerous others.

PRELIMINARY REPORTS

Preliminary reports were prepared from the Advance Transmittal Listings sent in by the field offices with the enumeration books. (See section on "Preliminary Reports" in Chapter 8, Processing the Data.) Because the processing of the data was done State by State, the population and housing reports usually appeared about the same time.

Census of Population

Series PC(P1), Preliminary Reports: Population Counts for States, by Counties, presented preliminary counts of the 1960 population of each State by counties and of each incorporated place of 1,000 inhabitants or more in the State, and also reports for the District of Columbia and outlying areas. Comparisons for 1950 were also given. Most reports consisted of from 2 to 6 pages, though a few were longer. The first, for South Dakota, was issued in May 1960, and the last State report, for Connecticut, was issued in September 1960. Most of the reports were issued in July and August. The reports for American Samoa and the Canal Zone were issued the middle of July and those for Guam, the Virgin Islands, and Puerto Rico appeared in August. The U.S. Summary was issued in September 1960.

Series PC(P2), Preliminary Reports: Population Counts for Standard Metropolitan Statistical Areas, consisted of one report for each of the 192 SMSA's listed in the U.S. Bureau of the Budget publication Standard Metropolitan Statistical Areas (1959). Most of the reports consisted of a single page. The first four appeared in May 1960; the last, in August 1960.

Series PC(P3), Preliminary Reports, consisted of four special reports, each summarizing the preliminary population counts for a particular type of area--congressional districts, cities of 100,000 inhabitants or more, cities of 25,000 inhabitants or more, and SMSA's. The first was issued in August 1960, and the last in October 1960.

Census of Housing

Series HC(P1), Preliminary Reports: Housing Unit Counts for Places of 10,000 or More, consisted of a report for each State and outlying area, the District of Columbia, and the United States, containing preliminary counts of housing units in urban places of 10,000 inhabitants or more. Most reports consisted of one or two pages. The first, for South Dakota, was issued in May 1960, and the last was issued in September 1960. Most

appeared in August. The reports for Guam, the Virgin Islands, and Puerto Rico appeared in September 1960. The U.S. Summary also was issued in September 1960.

ADVANCE REPORTS

Advance reports presented selected final figures in advance of their publication in the census volumes. Most appeared one or two months prior to the complete report.

Census of Population

Series PC(A1), Advance Reports: Final Population Counts, contains a portion of the data that later appeared in reports in Series PC(1)-A, Number of Inhabitants, which were subsequently issued as volume I, chapter A, of the final population reports. The advance reports contain final figures on the number of inhabitants by counties, minor civil divisions, all incorporated places, and unincorporated places. One was issued for each State and for the District of Columbia. None were issued for the outlying areas. The first, for Vermont, appeared in August 1960, and the last nine State reports all appeared in December 1960. Most (32) of the State reports appeared in November. The U.S. Summary was issued in November 1960. The reports vary from 3 to 32 pages in length; each costs 15 cents.

Series PC(A2), Advance Reports: General Population Characteristics, contains a portion of the data that later appeared in series PC(1)-B, which were later issued as volume I, chapter B, of the final population reports. The advance reports contain final figures on age, sex, race, marital status, household relationship, and the institutional population, for the States and summaries of these characteristics for the urban and rural parts of States and for SMSA's, urbanized areas, urban places, and counties. There is one for each State and the District of Columbia, none for the outlying areas. The first appeared in October 1960, and the last in March 1961. Most (35) of the State reports and the U.S. Summary were issued in March 1961. The reports are from 5 to 11 pages in length; each costs 10 cents.

Series PC(A3), Advance Reports: General Social and Economic Characteristics, consists of 52 reports presenting selected final figures from the 1960 Census of Population in advance of their publication in series PC(1)-C, which constituted volume I, chapter C, of the final population reports. The first, for Vermont, was issued in July 1961; the second, for Montana, in September 1961. The final State report, for California, was issued in March 1962, and the U.S. Summary was issued in April 1962. None were issued for the outlying areas. The reports vary in length from 5 to 10 pages; each costs 10 cents.

Census of Housing

Series HC(A1), Advance Reports: General Characteristics of Housing, contains selected final figures collected and tabulated on a 100-percent basis for all SMSA's and places of 10,000 inhabitants or more. The data are on housing units by tenure, color of occupants, and vacancy status; number of rooms; number of occupants; contract monthly rent; value of property; and housing condition and plumbing facilities. There is a report for each State and the District of Columbia, and a U.S. Summary. None was issued for the outlying areas. The first two reports appeared in November 1960; the last State report, for Indiana, appeared in April 1961. Most (36) of the reports were issued in February and March. The U.S. Summary was issued in April 1961. The reports vary in length from 5 to 26 pages; each costs 15 cents.

Series HC(A2), Advance Reports: Housing Characteristics for Standard Metropolitan Statistical Areas, like series HC(A1), contains a portion of the figures that were later published in volume I of the final housing reports. They consist of final figures on total housing units, and on occupancy characteristics, such as tenure, color, vacancy status, population per occupied housing unit, number of persons, and persons per room; structural characteristics, such as number of rooms, number of bedrooms, type of structure, year built, condition and plumbing facilities; financial characteristics, such as contract rent, gross rent, and value; and equipment and facilities, such as heating equipment, cooking and heating fuels, clothes washing machines, clothes dryers, home food freezers, telephones, automobiles, air conditioning, source of water, television sets, and radios. The first report, for Utah, appeared in November 1961, and the last State report, for California, appeared in April 1962; the report for Puerto Rico appeared in July 1962. The U.S. Summary was issued in June 1962. The reports vary in length from 8 to 62 pages; each costs 25 cents.

Series HC(A3), Advance Reports: Housing Equipment--Counties, like series HC(A2), contains a portion of the figures that were later published in volume I of the final housing reports. It contains figures for counties, on total housing units, heating equipment, clothes washing machines, clothes dryers, home food freezers, telephones, automobiles, air conditioning, television sets, and radios. The first report, for Vermont, appeared in August 1961, and the last three reports were issued in March 1962. The U.S. Summary was issued in May 1962. The reports are from 2 to 23 pages in length and cost 15 cents apiece.

FINAL REPORTS

Census of Population

Volume I, Characteristics of the Population, consists of separate parts for the United States, each of the 50 States, the District of Columbia, American Samoa, the Canal Zone, Guam, Puerto Rico, and the Virgin Islands. For each of these parts, the data were first issued in four separate paperbound chapters, designated as A, B, C, and D (except that, for American Samoa, the Canal Zone, Guam, and the Virgin Islands, the material normally contained in chapters B, C, and D was included in chapter B). Chapters A were issued as series PC(1)-A; chapters B, as series PC(1)-B; chapters C, as series PC(1)-C; and chapters D, as series PC(1)-D. The four chapters for each area, or the two chapters for each of the outlying areas noted in the preceding sentence, were then assembled and issued as a clothbound numbered part of volume I.

There are 54 separate bound volumes (numbered 1 to 57; parts 54-57 for the outlying areas of Guam, Virgin Islands, American Samoa, and Canal Zone, were combined into one volume). The first 15 State reports were issued in July 1963; the last part, the U.S. Summary appeared in March 1964. For a list of parts, and for a list of reports in series PC(1)-A, -B, -C, and -D, with date of issuance, number of pages, and price of each, see appendix G.

All of the 57 chapters A were assembled and issued also in a clothbound edition designated as Part A.

Chapter A, Number of Inhabitants (designated also as Series PC(1)-1A to 57A), presents final population counts for States and counties and their urban and rural parts, and for SMSA's, urbanized areas, all incorporated places, unincorporated places of 1,000 inhabitants or more, and minor civil divisions.

A feature of the U.S. Summary report for the PC(1)-A series is the inclusion of a 36-page graphic summary in three colors.

The first report, for Vermont, appeared in September 1960; the second, for Nevada, in November 1960. The last report, the U.S. Summary, was issued June 30, 1961. The last State report, for Louisiana, appeared in May 1961.

Chapter B, General Characteristics of the Population (Series PC(1)-1B to 57B), presents final figures on age, sex, marital status, color or race, and relationship to head of household, for States and counties and their urban and rural parts, and for SMSA's, urbanized areas, places of 1,000 or more inhabitants, and minor civil divisions.

The first report, for Vermont, appeared in November 1960. The last State report, for Texas, appeared in July 1961. The U.S. Summary was issued in September 1961.

Chapter C, General Social and Economic Characteristics (Series PC(1)-1C to 53C), covers nativity, parentage, State of birth, country of origin of foreign stock, mother tongue, place of residence in 1955, year moved into present house, school enrollment by level and type, years of school completed, families and their composition, fertility, veteran status, employment status, weeks worked in 1959, year last worked, occupation group, industry group, class of worker, place of work, means of transportation to work, and income of persons and families. Each subject is shown for some or all of the following areas: States and counties and their urban, rural-nonfarm, and rural-farm parts, and SMSA's, urbanized areas, and urban places.

The first report, for Vermont, appeared in August 1961, and the second, for Montana, in November 1961. The last State report, for California, was issued in May 1962. The U.S. Summary appeared in July 1962.

Chapter D, Detailed Characteristics (Series PC(1)-1D to 53D), presents most of the subjects covered in chapter C, above, cross-classified by age, color, and other characteristics. Additional information on families, household relationship, and the institutional population is included, as well as data on single years of age, detailed occupation data, detailed industry data, and data on hours worked and year last worked. Each subject is shown for some or all of the following areas: States and their urban, rural-nonfarm, and rural-farm parts; and large counties, cities, and SMSA's. There is a report for each State, the District of Columbia, and Puerto Rico, and a U.S. Summary. The first report, for Vermont, was issued March 1962, and the last State reports were issued in November 1962. The U.S. Summary appeared in April 1963.

Volume II, Subject Reports (Series PC(2)), consists of 23 reports¹ devoted essentially to detailed cross-relationships for the United States and regions for such subjects as national origin and race, mother tongue of the foreign born, fertility, families, marital status, migration, education, employment, unemployment, occupation, industry, and income. On some subjects (e.g., migration), statistics are also shown for SMSA's or States. In addition, reports were issued on veterans, the geographic distribution and characteristics of the institutional population, and on the characteristics of teachers and professional workers. For a list of the reports in this series, see appendix G.

¹ Six more reports in this series were in preparation, February 1965; see appendix G.

Volume III, Selected Area Reports (Series PC(3)), consists of five reports showing selected characteristics of the population (1) for state economic areas, (2) according to the size of place where the individuals resided, (3) Americans overseas, (4) standard metropolitan statistical areas, and (5) type of place. See appendix G.

Supplementary Reports (Series PC(S1)), consists of 46 reports. The first 9 reports provide final figures on the population of particular kinds of areas. Other reports in the series present miscellaneous types of data, such as data issued in advance of their publication in volumes II and III, selected tables from previously published large reports to permit distribution of the figures in an inexpensive format, and special-use statistics of public interest. For a list of reports in this series, see appendix G.

Census of Housing

Volume I, States and Small Areas (Series HC(1)), consists of 55 reports, one for each State, the District of Columbia, Guam, Puerto Rico, and Virgin Islands, and a U.S. Summary. Data are presented for the States as a whole and for the following area groupings: urbanized areas, SMSA's by counties and urban places of 50,000 inhabitants or more, the urban balance of the SMSA, the rural total of the SMSA, places of 25,000 to 50,000 inhabitants, places of 10,000 to 25,000, places of 2,500 to 10,000, places of 1,000 to 2,500, counties not included in SMSA's, and nonfarm housing and occupied farm housing in rural portions of counties.

The data vary by area groupings. Subjects included are the following: occupancy characteristics, such as tenure, color of occupants, vacancy status, population per occupied housing unit, number of persons, and persons per room; structural characteristics, such as number of rooms, number of bedrooms, type of structure, year built, condition in combination with a summary of data on plumbing facilities; equipment and facilities, such as heating equipment, cooking and heating fuels, air conditioning, source of water, sewage disposal, radios, television, automobiles, etc., and detailed data on plumbing facilities; financial characteristics, such as contract rent, gross rent, and value.

These reports supersede the advance reports in series HC(A1), HC(A2), and HC(A3).

The first State report, for Vermont, appeared in December 1961. A total of 49 reports appeared during the first half of 1962. The U.S. Summary and the reports for Puerto Rico and Guam appeared in 1963. Volume I was also issued in nine separately bound parts, variously paged and priced. See appendix G.

Volume II, Metropolitan Housing (Series HC(2)), consists of 202 reports, for the United States, each of the nine geographic divisions, each SMSA with 100,000 inhabitants or more, and separate reports for the San Juan SMSA and the Ponce SMSA in Puerto Rico. Volume II was also issued in seven separately bound parts, variously paged and priced. See appendix G. Cross classifications of housing and household characteristics are presented separately for owner-occupied and renter-occupied housing units. There are separate tables for each city of 100,000 inhabitants or more.

Subjects covered include value, rent, income, number of rooms, condition and plumbing, household composition, number of persons, type of structure, etc. For SMSA's or cities with 25,000 or more housing units occupied by nonwhites, selected data are shown for those units. Selected data also are shown for cities and SMSA's with 25,000 or more housing units occupied by white

household heads with Spanish surnames in Arizona, California, Colorado, New Mexico, and Texas. For other States, similar data are published for cities and SMSA's with 25,000 or more housing units occupied by household heads of Puerto Rican birth or parentage.

Volume III, City Blocks (Series HC(3)), consists of 420 reports, one for each city with 50,000 or more inhabitants in the 1950 census or in a subsequent special census conducted by the Bureau and one for each of 172 places that arranged to be included in the block statistics program. Data are presented by individual city blocks for occupied housing units on owner-occupied and renter-occupied units, condition of units, plumbing, average number of rooms, average rent or value, persons per room, number of units occupied by nonwhite persons, and total population in each block.

The first 34 reports appeared in June 1961, and the last three reports, for San Juan, Ponce, and Mayaguez, P.R., were issued in March 1962. For a list of reports in this series, see appendix G.

Volume IV, Components of Inventory Change, Part 1, 1950 to 1959, United States and Selected Metropolitan Areas, was published in two sets of reports for each of 17 metropolitan areas and the United States.

Part 1A, 1950 to 1959 Components (Series HC(4), Part 1A), presents basic 1950 and 1959 data, with emphasis on the counts and characteristics of the components of change such as new construction, merger, and demolition. Part 1B, Inventory Characteristics (Series HC(4), Part 1B), presents additional information on characteristics of the inventory, including characteristics of the current and previous residences of recent movers.

The first report, for Washington, D.C.-MD.-Va., SMSA, appeared in December 1961. All other reports in the series were issued during 1962. See appendix G for list of reports in this series.

Volume IV, Components of Inventory Change, Part 2, 1957 to 1959, United States and Selected Metropolitan Areas (Series HC(4), Part 2), consists of 10 reports, 1 for the United States by regions and 1 for each of 9 selected metropolitan areas (standard metropolitan areas defined for the 1956 National Housing Inventory). These reports include measurements of change since 1956 and characteristics of the units involved in each type of change and of units which did not change.

The first report, for Los Angeles-Long Beach SMSA, appeared in December 1962, and the remaining reports appeared during the first half of 1963. See appendix G.

Volume V, Residential Finance, Part, Homeowner Properties, United States and Selected Metropolitan Areas, appeared February 1963 as a single report including data on financing and characteristics of owner-occupied 1-dwelling-unit properties for the United States by region and for each of 17 metropolitan areas (15 standard metropolitan statistical areas and 2 standard consolidated areas). This report contains 417 pages and costs \$4.00.

In addition, Part 1, Supplement 1, Nonwhite Families, was issued June 1963. It contains 7 pages and costs 10 cents.

Data are given on method of financing, size of outstanding mortgage debt, and such mortgage characteristics as amount of loan, interest rate, government insurance status, method and amount of mortgage payments, and type of lender, and on such property characteristics as value, purchase price, year built, year acquired,

and taxes, and such computed characteristics as amount of loan as a percent of purchase price, and outstanding debt as percent of market value.

Volume V, Residential Finance, Part 2, Rental and Vacant Properties, United States, appeared in May 1963 as a single report presenting data similar to that in part 1 but for rental and vacant properties for the United States. This report contains 99 pages; the price is \$2.00.

Volume VI, Rural Housing, appeared in April 1963 as a single volume containing tables for 121 economic subregions and the United States, showing interrelationships between selected housing and household characteristics of occupied units. Statistics were presented separately for nonfarm and for farm units. This volume contains 797 pages; the price is \$6.00.

Volume VII, Housing of Senior Citizens, includes cross tabulations of housing and household characteristics of units occupied by persons 60 years old and over, for the United States, each of the 50 States and the District of Columbia, and selected SMSA's. Issued in November 1962; 327 pages; price, \$2.00.

Special Reports for Local Housing Authorities (Series HC(S1)), consists of 140 reports, one for each participating locality, made at cost for local housing authorities and other agencies and a U.S. Summary. This series was requested by, and planned in cooperation with, the Public Housing Administration. Items shown are the following: all housing units, and housing units classified as substandard by PHA criteria, by color and tenure of occupants; number of rooms, condition and plumbing facilities, number of persons, persons per room, presence of elderly persons, presence of nonrelatives, and selected characteristics for primary families by color and tenure of occupants; the same for housing units with household head 65 years old or over; distribution and median for gross rent and for contract rent for substandard units occupied by primary families, by color of head; income of primary renter families in substandard housing units by number of persons in family, by color; income of primary renter families in substandard units by rent-income ratio, by color.

The first report appeared in June and the last in October 1961, and the U.S. Summary in July 1962. For a list of reports in this series, see appendix G.

Census Tract Reports

Census Tract Reports (Series PHC(1)-1 to 180), present both population and housing data. There is one report for each of 180 tracted areas in the United States and Puerto Rico.

The population subjects include age, race, marital status, country of origin of the foreign stock, relationship to head of household, school enrollment, years of school completed, place of residence in 1955, employment status, occupation group, industry group, place of work, means of transportation to work, and income of families, as well as certain characteristics of the nonwhite population in selected tracts.

The housing subjects include tenure, color of head of household, vacancy status, condition and plumbing facilities, number of rooms, number of bathrooms, number of housing units in structure, year structure was built, basement, heating equipment, number of persons in unit, persons per room, year household head moved into unit, automobiles available, value of property, and gross and contract rent, and also, for selected tracts, certain characteristics of housing units with nonwhite household heads.

In addition, for selected tracts, these reports contain data on certain population and housing subjects for persons of Puerto Rican birth or parentage and for white persons with Spanish surnames. The first, for Ogden, Utah, appeared October 10, 1961. The last, for New York, N. Y., appeared in August 1962. For a list of the reports in this series, see appendix G.

County, City, and Congressional District Reports

County and City Data Book, 1962. A Statistical Abstract Supplement. Issued June 1962. Contains selected 1960 census results, as well as other statistical data, for each county and city of the United States. 669 pp. \$5.25.

Congressional District Data Book (Districts of the 87th Congress). A Statistical Abstract Supplement. Issued June 1961. Includes 100-percent data from the 1960 censuses on population and housing characteristics of each congressional district, as well as statistics on other subjects. 175 pp. \$1.00.

Congressional District Data Book (Districts of the 88th Congress). Issued February 1964; 603 pages; price, \$4.75.

Congressional District Atlas of the United States. Issued July 1960. Presents State maps and inset maps depicting boundaries of congressional districts at the time of the 1960 censuses, April 1. 103 pp. 55 cents.

Geographic Reports and Maps

Series GE-10, Geographic Reports. The following three reports have been issued in this series:

1. Population Within 50 Miles of Selected Points, 1960. Presents estimates of the 1960 population of the United States residing within 50 miles of each of 686 points. Each point represents a city with 25,000 or more inhabitants, or one of the six smaller cities classified as "central cities" of standard metropolitan statistical areas, with separate points for each of the five boroughs of New York City. Issued April 1963 (Revised); 20 pages; price, 15 cents.

2. Congressional District Identification of Counties and Selected Places (Districts of the 88th Congress). Provides a list of counties and selected places, by States, with the Congressional District identification of each. Issued June 1963; 24 pages; price, 15 cents.

3. Zones of Equal Population in the United States, 1960. The two maps in this report illustrate the comparisons between population and land area of the United States within 10 north-south zones and 10 east-west zones. The tables provide statistics on the approximate land area, percent of the total U.S. land area, total population, and percent of U.S. population for each of these zones. Issued November 1963; 4 pages; price, 5 cents.

Series GE-20, Area Measurement Reports, provide statistics on the total, land, and inland water area, and on population (total and per square mile) by county and by census county divisions and places of 1,000 or more inhabitants within each county. An additional table presents statistics on land area and population by place of 1,000 or more inhabitants.

This series consists of one report for each State (statistics for the District of Columbia will be included in the report for Delaware) and a United States summary. A bound volume combining all of these 51 reports is

planned at the completion of the series. The first three reports appeared in August 1964, for the areas of Kentucky, Oregon, and Tennessee, and cost 15 cents each.

Series GE-50, United States Maps. The first, "Population Distribution, Urban and Rural, in the United States, 1960," appeared in November 1963. This map of the United States is printed in four colors and black, and shows the distribution of the population, urban and rural, by size classes, and also shows State and county boundaries and major water areas. 1 page, 30x42 inches; price, 50 cents. Other maps will be issued in this series.

Minor Civil Division (or Census County Division) Maps, 1960. There are 47 maps in this series (one sheet for each State except for the following combinations: Massachusetts, Connecticut, and Rhode Island, 1 sheet; Vermont and New Hampshire, 1 sheet; and Maryland and Delaware, 1 sheet). The sheets are 36 x 48 inches; price, 35 cents each; complete set of 47 maps, \$16.45.

These maps show the subdivisions of counties (census county divisions, townships, districts, etc.) and the location of all incorporated places and those unincorporated places for which separate population figures are published. Each map contains a county name-finder to help in locating the individual counties. Copies of these maps, on a smaller scale, appear in Series PC(1)-A, Number of Inhabitants.

U.S. County Outline Maps as of April 1, 1960. There are two maps. One map shows State outlines and county names and boundaries in black ink. The other map shows State outlines in black ink, but county names and boundaries in blue ink. Each is 41 x 26 inches, and costs 50 cents.

Popular Presentations

Series GP60, Graphic Pamphlets, presents results of the 1960 Censuses of Population and Housing in simple text with summary tables and plentiful use of charts and illustrations. The first, "Our Growing Population," appeared August 1961 (12 pp., 10 cents per single copy and \$5.00 per hundred). The second, "How Our Income is Divided," appeared November 1963. (12 pp., 15 cents per single copy and \$11.25 per hundred).

Methodological Publications

United States Censuses of Population and Housing, 1960: Principal Data-Collection Forms and Procedures. Issued April 1961. Presents facsimiles of the principal enumeration forms, together with a brief description of census field procedures. 66 pp., 45 cents.

Survey of Components of Change and Residential Finance of the United States Census of Housing, 1960: Principal Data-Collection Forms and Procedures. Issued January 1962. Includes reproductions of the enumeration forms used in the Survey of Components of Change and Residential Finance (SCARF), which was taken in connection with the 1960 Census of Housing. It also includes a brief description of the office and field procedures. 35 pp., 30 cents.

United States Censuses of Population and Housing, 1960: Processing the Data. Issued May 1962. Describes the various methods used and steps taken in processing the data, including receipt and check-in of enumeration books, coding, microfilming, processing of forms for overseas and outlying-area population, and others. One chapter is devoted to electronic data processing; others, to personnel (recruiting and training), management, and to

processing of data for Puerto Rico. Appendixes provide information on cost of data processing, facsimiles of selected data-processing forms, and a glossary of technical terms. Much but not all of the information in this report is included in the present volume. 73 pp., 50 cents.

United States Censuses of Population and Housing, 1960: Enumeration Time and Cost Study. Issued August 1963. This report provides information on the time spent by field personnel in the various activities connected with the enumeration of the 1960 Censuses of Population and Housing. It represents results of the study and describes the method of data collection for the study and problems encountered in office operations and administrative work. Tables show, by enumeration stages, interview time, between-housing-unit time, hours worked, hourly earnings, field review time, telephone followup time, and other pertinent items.

The appendixes provide reproductions of forms, daily record sheets, and instructions for observation of enumerators, crew leaders, field review, and office work. 175 pp., \$1.00.

Censuses of Population and Housing in Puerto Rico, 1960: Processing the Data. Issued December 1963. Describes the operations involved in processing the data obtained by the 1960 Censuses of Population and Housing of Puerto Rico, and is an expansion of the chapter on the subject which appeared in United States Censuses of Population and Housing, 1960: Processing the Data. 51 pp., 40 cents.

Methodology and Scores of Socioeconomic Status. Bureau of the Census Working Paper No. 15. Issued August 1963. Describes two measures of socioeconomic status which were used in connection with 1960 census program: (1) a multiple-item socioeconomic status score, and (2) a status consistency type which is designed to indicate whether the components of the multiple-item score (occupation, educational attainment, and level of family income) are at about the same or different levels.

This report also covers previous census experience with the measurement of socioeconomic status, the methodology used in the derivation of the two new measures, definitions and explanations of component items, and distributions of the socioeconomic status score and status consistency type for family heads.

The appendixes provide scores for categories of the detailed occupation component, of major occupation groups, of years of school completed, and of family income. 15 pp., 25 cents.

Procedural Report on the 1960 Censuses of Population and Housing. Bureau of the Census Working Paper No. 16. Issued September 1963. This report was the first part of the present report on the methodology of the Eighteenth Decennial Census. It covers the procedures of the 1960 Censuses of Population and Housing from the early stages of planning and pretesting through the tabulation and publication of final reports. It is superseded by the present volume. 291 pp., \$3.00.

Series ER60, Evaluation and Research Program of the U.S. Censuses of Population and Housing, 1960, is a series of evaluation and research reports providing measures of quality of the 1960 Censuses of Population and Housing. Five reports have now been issued in this series, as follows:

1. Background, Procedures, and Forms contains a brief description of each of the projects constituting the evaluation and research program, and reproductions of the principal forms and form letters used. Issued September 1963. 112 pp., 70 cents.

2. Record Check Studies of Population Coverage presents the results of a group of record check studies designed to provide estimates of the number of persons omitted from the 1960 Census of Population. Issued May 1964. 14 pp., 20 cents.

3. Accuracy of Data on Housing Characteristics presents information on the accuracy of data for selected characteristics of occupied housing units reported to 1960 census interviewers, based on reinterview data obtained in a special sample survey. Detailed tables contain cross-classifications of the reinterview and census data, using the categories for which census data have been published. Issued August 1964. 28 pp., 25 cents.

4. Accuracy of Data on Population Characteristics as Measured by Reinterviews presents information on the accuracy of data for selected population characteristics reported to the 1960 census interviewers, based on reinterview data obtained in a special sample survey. Detailed tables contain cross-classifications of the data obtained in response to the census and to the reinterviews, using the categories for which census data have been published. Issued August 1964. 27 pp., 25 cents.

5. Accuracy of Data on Population Characteristics as Measured by CPS-Census Match is primarily devoted to the effect on the quality of the census data of content errors. The quality of the census data was measured by utilizing Bureau records from the Current Population Survey (CPS) and the 1960 Census of Population for identical persons. These records were matched and recorded entries for selected items from the CPS--for essentially the same time period as the census--were then compared. Tables are presented showing both absolute data and indexes of response variance and bias for each of the subjects under study. Issued January 1965. 63 pp., 40 cents.

6. The Employer Record Check presents the results of a study on the accuracy of data on occupation, industry, and place of work, as reported in the 1960 Census of Population, based on a comparison with the same information secured from the employers of persons in a sample of households originally enumerated in the census. The report does not include any analysis of the data presented. (Analytic studies of the results of the 1960 census evaluation and research program will be presented in later reports in this series.) Issued March 1965. 18 pp., 25 cents.

Other methodological publications on the evaluation program, quality control, and sampling in the 1960 censuses are in preparation.

Alphabetical Index of Occupations and Industries (Revised). Issued May 1960. This index was designed for use in classifying the occupation and industry returns from the population censuses and demographic surveys conducted by the Bureau of the Census. It lists occupation and industry titles as they appeared on the census and survey schedules, together with a numerical or letter code indicating the appropriate occupation or industry category in which each title was to be classified. The occupation and industry titles shown here in alphabetical arrangement are presented according to the category in which each title belongs in its companion volume, the "Classified Index of Occupations and Industries," described below. 673 pp., \$4.75.

Classified Index of Occupations and Industries. Issued November 1960. For use in classifying responses on occupations and industries on questionnaires and schedules from population censuses and demographic surveys conducted by the Bureau. 403 pp., \$3.25.

Finding Guides

Series PHC(2), United States Censuses of Population and Housing, 1960: Geographic Identification Code Scheme, consists of 52 reports, one for each State (the District of Columbia and Delaware are in a single report, but numbered as two reports) and one for the United States. For each a detailed list is given of the codes which were assigned to the various political and statistical areas for which population and housing census data were tabulated. The reports are primarily for use in connection with unpublished data and unpublished tabulations available from the censuses. All of the State reports were issued between March 20, 1961, and April 21, 1961. They cost 35 cents apiece. The U.S. report appeared July 10, 1961. 1,231 pp., \$7.75.

For a list of reports in this series, see appendix G.

Series PHG(3), Census County Division Boundary Descriptions, consists of a report for each of 18 States, describing the boundaries of the census county divisions established to take the place of election precincts or other minor civil divisions whose boundaries changed frequently thus presenting problems in the comparisons of data from one census to another. The reports list for each county within the State (1) the division names (or numbers, in the State of Washington), (2) the names of the incorporated and unincorporated places within the division, and (3) the names of the roads, streams, ridges, etc., that form the boundaries of the division.

All of the reports appeared during July, August, and September 1962. The reports vary in length from 8 to 93 pages and in price from 10 to 55 cents; complete set of 18 reports costs \$4.50. For a list of reports in this series, see appendix G.

U.S. Census of Population: 1960; Availability of Published and Unpublished Data, Revised October 1964. Contains four outline tables itemizing the detail available for each subject in the population census, for each level of geographic area, and indicating whether it is available (1) in a printed report, (2) in an unpublished listing or tabulation (usually available on microfilm), or (3) on magnetic computer tape in a form suitable for further summarization and processing on computers. The report also includes a description of the publication program and an outline of all the tabulated and unpublished data available as well as an indication of costs. 36 pp., 50 cents.

U.S. Census of Housing: 1960; Availability of Published and Unpublished Data, Issued July 1962. For each published volume, shows all the subjects covered as well as any cross-tabulations, and the tables in which each appears, and shows the areas for which the data are available, the types of housing units and households for which the tabulations were made. There is also a description of unpublished tabulations. An appendix shows maximum and minimum detail for the categories and class intervals of the individual items. 13 pp., 25 cents.

Availability of Published and Unpublished Data for Small Areas from the 1960 Census of Population and Housing. A 4-page description of the data available for small areas from both the population and housing censuses. Issued April 1961. Free on request to the Bureau.

UNPUBLISHED DATA AVAILABLE

Computer Tapes

Of the large quantity of unpublished data on tape, some have already been printed out for one purpose or

another, and in some cases the printouts have been microfilmed; these data therefore are more readily available than those which are available only on tape.

These unpublished data are available to users, subject to restrictions on disclosure of confidential individual records, on a reimbursable cost-of-preparation basis upon arrangement with the Chief of the Population Division or the Chief of the Housing Division, Bureau of the Census.

Population publication tallies on computer tape.--At one stage in the data processing, the basic tallies required for a population census report for volume I were assembled in a format which was used as input to a computer program which added tallies for many small areas to produce the tables for larger areas to be shown in a printed publication. These tally tapes have, in many instances, been retained. These tallies are useful for further computer work in preparing derived measures for specific geographic areas or subjects, and in adding together tables equivalent to printed publication tables for combinations of areas not shown in the published reports.

The subject matter of the tallies is described, in effect, by reference to the description of volume I, chapters A-D, of the 1960 population census, in this chapter.

Reels are available for purchase. The number of reels varies from State to State. (Inquiries concerning possible applications of these files should contain a brief description of the computer system on which the tally tapes would be used, as well as a description of the anticipated project.)

Population and housing weighted basic records of 25-percent sample.--Individual records of the 25-percent sample of the 1960 census are maintained in a file by States. The tapes are not available for purchase, but this file can be used for the preparation of special tabulations on a reimbursable basis. The tabulations can cover the full range of subjects collected in the 1960 census. Within each State, records are by enumeration district, with the ED record first, followed by the record of the first housing unit enumerated, then the records of the persons in the unit, then the record of the second housing unit, etc. ED's are not sequenced, either numerically or by geographic area. The order in which they appear is the order in which they were processed through the computer.

Also maintained are files containing subsets, such as a 5-percent sample of households with one or more nonwhite members, a 5-percent sample of males, a 5-percent sample of persons in the labor force, etc. Tabulations based on a specific subset can also be prepared on a reimbursable basis.

Population and housing 1-in-1,000 and 1-in-10,000 sample.--Individual records on reels of magnetic tape or sets of punchcards for samples of the population of the United States in 1960 are available for purchase. (The 1-in-10,000 sample is available on punchcards only.) The names of respondents and detailed address information do not appear on the records. Therefore, it has been determined that making records available in this form will not violate the law under which the census was conducted, which specifies that the records must be treated as confidential.

These samples enable research workers and students to prepare additional analytical tabulations of the characteristics of the population of the United States. The records contain virtually all of the information collected for persons in 1960. In addition, each person's

record contains selected characteristics of the household, family, and subfamily (if any) of which he is a member. The record contains a few of the characteristics of an "associated person," that is, the spouse of a married adult, or the father or mother of a child. In addition, the record contains selected characteristics of the housing unit in which the person lives. The record for the head of the household is followed by the records for the other members of the household. Thus, it is possible to prepare tabulations in which the characteristics of any person in a family are associated with characteristics of the family or household as a whole, or of the housing unit in which he lives. For the 1-in-1,000 sample, there are 7 reels compatible for use with an IBM computer, 13 reels compatible for use with Remington-Rand computer, and about 18,000 punchcards compatible for use on 80-column punchcard tabulating equipment. For the 1-in-10,000 sample, there are 17,956 punchcards compatible for use on 80-column punchcard tabulating equipment.

Population and housing (100-percent tallies).-- These tapes contain tallies of population and housing data asked on a 100-percent basis made for every enumeration district (ED). The population characteristics (age, sex, race, marital status, and household relationship) are contained in the first block and housing characteristics in the second block. All housing units are classified by condition and plumbing, water supply, toilet facilities, and rooms; occupied units classified by size of household, persons per room; owner-occupied units classified by value; units occupied by nonwhites classified by condition and plumbing, size of household, rooms, persons per room; vacant units classified by vacancy status, condition and plumbing; number of rooms classified by available for rent, available for sale and other, contract rent, and value. In the permanent file of tapes, no State shares a tape with any other State. Within the State, the records are sequenced by ED, within wards, within places, within minor civil divisions, and within counties. Computer tapes (175 reels) are available for purchase.

Housing volume I (100-percent tabulations).-- These tapes, providing tallies for every enumeration district, present condition and plumbing data for all units, owner-occupied units, renter-occupied units, vacant available for rent and vacant available for sale units; rooms data for all units and units occupied by nonwhites; persons and persons per room data for all occupied units and units occupied by nonwhites; tenure and color data; vacancy status; value of vacant available for sale units; and contract rent of vacant available for rent units. This tally matrix was used in preparing the 1960 Census of Housing, Volume I, States and Small Areas. Computer tapes (51 reels) are available for purchase.

Housing block statistics edited output (100-percent tabulations).-- These records are in sort by State in ascending order by prefix area and enumeration district (ED) within prefix area. The last record of each ED is an ED totals record. These tapes contain the 20-word edited output record made for blocks in each block city showing total housing units classified by condition and plumbing; occupied units classified by tenure by rooms; total owner-occupied reporting value; total renter-occupied reporting rent; total value reported; and total rent reported. Aggregate data, from which averages were obtained for the 1960 Census of Housing, Volume III, City Blocks (also identified as series HC(3) of the housing census), are available on these tapes. Computer tapes (88 reels) are available for purchase.

Housing block statistics summary record (100-percent tabulations).-- These 20-word, XS3 language block statistics summary records are in sort by city, tract number, and city block number. The first record of each tract group is the tract total record which is identical

in format to the city block number record. The reels contain the block statistics data as they appear in the published report. The 20-word summary records for blocks in each block city show total housing units classified by condition and plumbing; occupied units classified by tenure by rooms; average value of owner-occupied units; average contract rent of renter-occupied units; and units occupied by nonwhites. Averages were suppressed if there were less than five housing units for the particular categories (owner-occupied reporting value, renter-occupied reporting rent; and for average rooms, owner-occupied housing units, renter-occupied housing units). If there were less than five housing units in a city block, all characteristics were suppressed. Although averages were suppressed, the tallies themselves were added to tract and city totals for computation of area averages and totals. Computer tapes (48 reels) are available for purchase.

Housing matrices (100-percent tabulations).-- One set of matrices for enumeration districts (ED's) and the other for tracts and pseudo tracts. The ED file is not retained in permanent data storage but can be created, if desired. The records in this recreated file, within each State, would be sequenced by ED, within wards, within places, within minor civil divisions (MCD's), and within counties. The tract and pseudo tract tallies are retained in permanent data storage. Within each State, the tract records are grouped together by county. The pseudo tract records are in sequence, within a State, by county, MCD, place, ward, and ED number. Tallies are provided for the following items: condition and plumbing; color; rooms; persons; and value. The tapes (51 reels for tracts and 86 reels for pseudo tracts) are available for purchase.

Housing volume II and volume VI detail records (25-percent sample).-- These tapes contain the detailed housing records used to produce tallies for housing Volume II, Metropolitan Housing, and Volume VI, Rural Housing, Economic Subregions. They include all sample housing information available from the census questionnaire as well as selected characteristics for the oldest person in the household, 60 years old or over, excluding the household head. Tapes are prepared separately by State but are not necessarily in any specified sequence within the State. Computer tapes (862 reels) are not available for purchase, but special tabulations may be made from them.

Population and housing tract consolidation.-- These tapes contain the weighted tallies that were used to produce the series PHC(1) tract reports and some unpublished sample population and housing tabulations for census tracts, minor civil divisions (MCD's), and similar areas in the untraced portion of the United States. The data for each tract or pseudo tract are in an 8-block matrix. On the pseudo-tract tapes the matrices are sequenced by wards and remainders within places, MCD's, and counties. On the tract tapes the matrices are sequenced by tract, within places, counties, and standard metropolitan statistical areas (SMSA's). Tract reels (78) and pseudo tract reels (108) are available for purchase.

Housing volume I (25-percent tabulations).-- These tapes contain tallies made for each of the following geographic groups: (1) each county, (2) each SMSA, (3) each urbanized area, (4) each place (size 1,000 or more), (5) each area considered urban by special rule, and (6) each rural balance within county. Tapes are prepared separately by State but are not necessarily in any specified sequence within the State. The subjects presented in this file appear in Volume I, States and Small Areas. Computer tapes (77 reels) are available for purchase.

Housing volume II.-- These reels contain the tally matrix for housing Volume II, Metropolitan Housing, including tallies for the United States, each of the nine geographic divisions, each of the 212 standard metropolitan statistical areas (SMSA's), and each place with 100,000 inhabitants or more. There are also separate tallies for housing units with nonwhite household heads for all the above areas.

Cross-classifications of housing and household characteristics for analytical use are contained separately for owner-occupied and renter-occupied housing units. Principal subjects covered include value, rent, income, number of rooms, condition and plumbing, household composition, number of occupants, type of structure, etc. Computer tapes (54 reels) are available for purchase.

Housing volume VI tally record layout.-- The record layout of the housing Volume VI, Rural Housing, tally record is shown on this file. It contains data on housing and household characteristics for rural housing units in the United States and each of the 121 economic sub-regions, separately for nonfarm and farm housing units, and for owner-occupied and renter-occupied units. Principal subjects cross-classified are number of rooms, condition and plumbing facilities of the unit, income of the primary family, and year structure was built. Other cross-classified subjects include persons, persons per room, household composition, year moved into unit, number of bedrooms, heating equipment, heating fuel, cooking fuel, source of water, sewage disposal, and the number of units having special equipment such as air conditioning, clothes dryer, washing machine, food freezer, and number of automobiles available, etc. Computer tapes (103 reels) are available for purchase.

Housing volume VII.-- This is the record layout of the matrix serving as input for the preparation of the tables for housing Volume VII, Housing of Senior Citizens. It contains tallies for the United States, inside and outside standard metropolitan statistical areas (SMSA's), each State, 212 SMSA's, and all places of 100,000 inhabitants or more. In addition, there are separate tallies for nonwhite senior citizens for the United States and places of 100,000 or more. Housing subjects include tenure, number of rooms, number of persons in unit as well as number 60 years old and over, units in structure, year built, condition and plumbing facilities, presence of elevator, value of property, gross rent, and rent-income ratio. Population subjects include age, relation to household head, household composition, and individual and household income. Computer tapes (51 reels) are available for purchase.

Housing final block statistics control tape.-- A listing of block numbers that appear in each ED for the United States. Only one State appears on each tape. Within each State the tapes are in sequence by ED within prefix area (county, city, or, in the case of counties containing large cities, that part of the county outside the city) and prefix area within publication code. The block numbers as they appear on these tapes are not arranged in any particular sequence within the ED. This listing was used to control the production of the city block reports. Computer tapes (48 reels) are available for purchase.

Components of Housing Inventory Change, Characteristics Sample records.-- This is the record layout of the edited "Characteristics" schedule from the 1959 Components of Housing Inventory Change survey for the United States and 17 selected SMSA's. Data include such items as components of change classifications for both the 1950-1959 and 1956-1959 periods, selected 1959 inventory characteristics including items on present and previous residence for recent movers (households which moved in 1958 or 1959) and selected 1950 and

1956 housing characteristics for units classified as "same" during each comparison period, 1950-1959 or 1956-1959. The computer tapes (28 reels) are not available for purchase, but special tabulations can be made from them.

Display of tapes.-- The published reports of the 1960 Censuses of Population and Housing required electronic computer work in several stages. At one stage the basic tallies required for a report were assembled in a format which was used as input to a program which added tallies for many small areas, thus producing the result needed for a printed publication. The tally tapes have, in many instances, been retained and can be displayed. A display is a printout of a computer tape containing tallies in the same order as they appear on the tape, not organized in table format and with no alphabetic identification of the tallies.

Purchasers of displays of tapes are provided with a technical memorandum, which acts as a guide to the contents and organization of the display, and supplies identification for the tallies. Inquiries concerning possible use of the tally tapes or displays of tapes should contain a brief description of the computer system on which the tapes would be used, as well as a description of the anticipated project.

Examples of displays of tape which have been prepared are the following:

Display of tallies for tables 6 and 8 of the 1960 census report PC(2)-2D, Lifetime and Recent Migration, for each State, showing central city (cities) and the ring of each SMSA, and the balance of the State.

Display of tallies providing, for 101 cities for which statistics are unpublished, data similar to those published in tables 101 and 102 of the 1960 census PC(1)-D reports.

Special Tables

Following are descriptions of the content of special tables PH-1 to PH-11, which present data similar to those appearing in the census tract reports PHC(1):

Special table PH-1 contains data for ED's, census tracts in tracted areas, and, outside tracted areas, for wards in cities of 25,000 or more where wards were established, each urban place of 2,500 or more, and remainder of minor civil divisions (or census county divisions). The table presents population data as follows: total population of white, Negro, and other races; relationship of population in households, population in group quarters (inmates of institution and others), and population per household, total and nonwhite; age by single years through 20, and by 5-year age groups for the total and nonwhite population, by sex; marital status of persons 14 years old and over, total and nonwhite. The housing characteristics included are tenure of housing units by color of occupants and vacancy status; condition (sound, deteriorating, or dilapidated) and plumbing of all housing units, with separate data for units occupied by nonwhite; number of rooms, number of persons in the unit, and persons per room, total and nonwhite. Value of owner-occupied units and contract rent (average) are shown for areas located in cities of 50,000 or more. The cost of table PH-1 for ED's is \$20.00 per 100,000 population, with a minimum charge of \$100.00 per order. Cost of this table for minor civil divisions and similar areas is \$4.00 per county. A microfilm file of tracts, minor civil divisions and similar areas for the entire United States costs \$100.00. No microfilm is available for ED's.

Special table PH-2 presents, by census tracts, the tabulations, based on the 25-percent sample, of selected characteristics which do not appear in the series PHC(1) reports. The table shows data on farm-nonfarm residence of the rural population, place of residence in 1955, characteristics of persons 14 years old and over not in the labor force, persons employed in farm occupations, and place of work. The table also contains housing data on rural farm-nonfarm units by tenure, stories and elevators, trailers, source of water and sewage disposal, as well as year structure was built and year occupant moved into unit for owner-occupied units. The cost to reproduce special table PH-2 is \$4.25 per 100 tracts or fraction thereof. A microfilm file of this table is available for the entire United States at a cost of \$750.00.

Special tables PH-3 to PH-11 contain statistics for wards of cities of 25,000 or more, urban places, and remainder of minor civil divisions, as outlined in the description of table PH-1. The content and cost of these tables are as follows:

Special table PH-3 presents data on general characteristics of the population, based on the 1960 census. The table contains information on urban, rural, rural nonfarm, and rural farm population, race and origin, married couples and children, school enrollment, years of school completed, residence in 1955, and family income in 1959. The cost to reproduce this table is \$4.00 per county. The cost of microfilm copy is available upon request.

Special table PH-4 contains information on labor force characteristics of the population, covering employment status, occupation and industry, means of transportation and place of work. For areas of residence within SMSA's, each central city of the SMSA and the remainder of each county in the SMSA are recognized as a separate category in the tabulation by place of work. The remaining categories are used to identify central cities of other SMSA's, the remainder of other SMSA's, and separate counties. For areas of residence outside SMSA's, separate categories are used to identify the county of residence as a place of work, the central city of an SMSA, the remainder of an SMSA or separate counties. The same place-of-work categories are used for all areas of residence within a county. For areas of residence in New England, a place-of-work category may represent a ring of towns surrounding the central city of an SMSA, the remainder of an SMSA within a county, or the portion of a county outside an SMSA. The cost to reproduce this table is \$4.00 per county. The place-of-work code sheets needed to interpret this table cost 50¢ each for the first 10 counties, 40¢ thereafter. The cost of a microfilm copy is available upon request.

Special table PH-5 presents data on characteristics of the nonwhite population. Data are shown only for areas with 200 or more nonwhite persons. The table shows information on married couples and children, years of school completed, residence in 1955, family income in 1959, employment status, and occupation. The cost to reproduce this table is \$4.00 per county. The cost of microfilm copy is available upon request.

Special table PH-6 contains information on characteristics of the white population with Spanish surname, by age, marital status, years of school completed, employment status, and family income in 1959. This table is available for untraced areas in Arizona, California, Colorado, New Mexico, and Texas. Data are shown only for areas with 200 or more white

persons with Spanish surname. Although age and marital status were enumerated on a complete-count basis, information on these subjects is presented in this table on a sample basis, since white persons with Spanish surname are identified only in the sample. The cost to reproduce this table is \$4.00 per county. The cost of microfilm copy is available upon request.

Special table PH-7 shows characteristics of the population of Puerto Rican birth or parentage, in the same detail as table PH-6. This table is available for untraced areas outside the States of Arizona, California, Colorado, New Mexico, and Texas. Data are shown for areas with 200 or more Puerto Ricans. Although age and marital status were enumerated on a complete-count basis, information on these subjects is presented in this table on a sample basis, since Puerto Rican birth and parentage are identified only in the sample. The cost to reproduce this table is \$4.00 per county. The cost of microfilm copy is available upon request.

Special table PH-8 contains statistics relating to characteristics of all housing units. Some of these items were enumerated for a 25-percent sample of all housing units, some for a 20-percent sample, and some for a 5-percent sample. Statistics on automobiles available are based on a 20-percent sample of housing units for cities of 50,000 or more and on a 5-percent sample of housing units outside such areas. Statistics on stories and elevators are presented only for cities of 50,000 or more, while statistics on source of water and on sewage disposal are presented only for areas outside the larger cities and selected urban places. Also included in this table are items on year structure was built, year occupant moved into unit, number of units, bathrooms, basement, heating equipment, value, gross rent, and median contract rent. The cost to reproduce this table is \$4.00 per county. The cost of microfilm copy is available upon request.

Special table PH-9 presents data on characteristics of housing units occupied by nonwhite household heads. Data are shown only for areas with 200 or more housing units occupied by nonwhite household heads. The table contains information on urban and rural units, farm and nonfarm, by tenure, number of units in structure, year structure was built, year occupant moved into unit, value, and gross rent. The cost to reproduce this table is \$4.00 per county. The cost of microfilm copy is available upon request.

Special table PH-10 presents items on characteristics of housing units occupied by white household heads with Spanish surnames. This table is available for untraced areas in Arizona, California, Colorado, New Mexico, and Texas. Data are shown only for areas with 200 or more housing units occupied by white household heads with Spanish surnames. Although tenure, condition and plumbing, and rooms were enumerated on a complete-count basis, these subjects are presented in this table on a sample basis, since white persons with Spanish surname are identified only in the sample. Other items presented in this table are number of units in structure, year structure was built, number of persons in unit, number of persons per room, year occupant moved into unit, value, and gross rent. The cost to reproduce this table is \$4.00 per county. The cost of microfilm copy is available upon request.

Special table PH-11 contains data on characteristics of housing units occupied by household heads of Puerto Rican birth or parentage, in the same detail as table PH-10. This table is available for

untracted areas outside the States of Arizona, California, Colorado, New Mexico, and Texas. Data are shown only for areas with 200 or more housing units occupied by household heads of Puerto Rican birth or parentage. Although tenure, condition and plumbing, and rooms were enumerated on a complete-count basis, these subjects are presented in this table on a sample basis, since Puerto Rican birth or parentage of the occupants is identified only in the sample. The cost to reproduce this table is \$4.00 per county. The cost of microfilm copy is available upon request.

Special Tabulations

Special tabulations of 1960 census data in the files of the Bureau of the Census are undertaken on a cost basis as requested, provided there is no serious interruption of the regular work program of the Bureau. The data for these special tabulations are based on censuses which were paid for by public funds and are, therefore, public property. The purposes for which such tabulations are obtained must not be contrary to the public interest nor must they be used to give unfair commercial or other advantage to any person or group. All unpublished data furnished by the Bureau are accompanied, so far as feasible, by appropriate statements relative to the limitations of the data. Following are some examples of selected special tabulations that have been furnished:

A recoded and reduced 5-percent sample pretally tape, based on the 1960 population census, containing selected labor force characteristics, but no identifying detail.

Housing characteristics for renter-occupied private housing units in 20 selected cities, separately for all such units and for units built 1959 to March 1960, including the following: year structure built, by units in structure, rooms, bedrooms, bathrooms, elevator, air conditioning, persons, year moved into unit, color, income, vacancy status and duration, gross rent, and automobiles available; persons by bedrooms by gross rent and persons by bedrooms by income for units in structures with 5 or more housing units; household composition by income, persons, and gross rent; and elevator in structure by units in structure, persons, bedrooms, and gross rent. For owner-occupied 1-unit properties in nonfarm areas: source of water by sewage disposal by value of property by year structure built, for counties and States; source of water by sewage disposal by value of property by bathrooms, for States; sewage disposal by basement by value of property, for counties; and basement by value of property by year structure built, for States. For units in multiunit structures in nonfarm areas: source of water by sewage disposal by units in structure, for States.

Tabulations based on 5-percent sample records from the 1960 population census and matching death certificates, to relate socioeconomic factors to rates and causes of death.

Special digest of derived measures (e.g., percentages, means, medians, ratios, or standardizations of such measures) for State economic areas (EA's), developed from the PC(1)-C tally tape files, collapsed to urban, rural nonfarm, and rural farm portions of SEA's.

Special tables hand-posted to show characteristics associated with poverty for all counties in the United States, based on an integration of data from the PC(1)-C reports, Selective Service data, and data from Public Assistance in the Counties of the United States, June 1960.

Special tables, identical in content to the published 1960 census tract tables, prepared for selected

groupings of census tracts for health areas in New York City and community areas in Chicago.

Special tabulation based on the 0.1-percent sample of the population census showing the total population in each region cross-classified by race, industry, occupation, employment status, and class of worker.

Special tabulation cross-classifying income, family size, education, and age, by standard metropolitan statistical area type, for civilian females over 18 years old in each region, based on the 0.1-percent sample of the population census.

Special tabulation of data for small standard metropolitan statistical areas (SMSA's) and counties outside SMSA's, similar to data published in table 125 of the report PC(1)-D for large SMSA's, based on the 25-percent sample.

Special tabulation of data from the census of housing, from the 1-in-1,000 sample, showing condition and plumbing facilities, by tenure, by one- and two-or-more-person households, and by income, for the United States, classified by whether inside or outside SMSA's, and for regions.

Special tabulation of nativity, parentage, and mother tongue for States and regions, based on the population census 25-percent sample.

Special tabulation of occupation, salary, education, and employment status by industry for whites and nonwhites in the District of Columbia, based on the population census 25-percent sample.

Special tabulation to show detailed cross-classification of socioeconomic characteristics of veterans in the United States, based on the population census 5-percent sample.

Special tabulations of data on senior citizens (in addition to data published in the 1960 Census of Housing, Volume VII, Housing of Senior Citizens) are available for each State, 212 SMSA's, and all places of 100,000 inhabitants or more. Tabulations for nonwhite senior citizens are also available for the places of 100,000 inhabitants or more. The housing subjects include tenure, number of persons in unit as well as number of persons 60 and over in unit, year structure was built, year household head moved into unit, gross rent, and rent-income ratio. The population subjects include age, relation to head of household, household composition, and individual and household income. In addition to the areas cited above, a later program provided senior citizen tabulations for places of 10,000 to 100,000 inhabitants for 33 States--Alabama, Alaska, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Montana, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Virginia, Washington, West Virginia. For these places of 10,000 to 100,000 inhabitants, separate tabulations are not available for housing units with nonwhite household heads.

Tabulations from the survey of the health characteristics of British and Norwegian migrants to the United States based on the population census.

Tabulations of the characteristics of five foreign-born groups (British, Norwegian, Finnish, Swedish, and Danish) at the time of the population census.

Many other special tabulations have been prepared which contain selected items of information for specific areas such as a State or group of States, a city, or several minor civil divisions, etc.

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Chapter 10. The Evaluation and Research Program

OBJECTIVES AND CONCEPTS

A series of studies was organized to evaluate the procedures and the results of the 1960 Censuses of Population and Housing. Also, some studies were designed as experiments and as research projects in aspects of census taking.

The Evaluation and Research Program had three broad objectives:

1. To measure the accuracy of statistics of the 1960 censuses, primarily to guide the user of the data in the appropriate application of the statistics
2. To attempt also to identify sources of error in census results, primarily as an aid to producers of census and survey statistics in their efforts to reduce errors. Knowledge of sources of error should also aid users in interpreting census results
3. To determine the relative accuracy and cost of alternative census methods and methods of evaluation

These objectives had the common goal of guidance for the Bureau of the Census in planning future censuses and surveys to meet the needs of users more adequately.

There are two categories of error in the population and housing census figures. The first is error in the total count of population or housing units, or coverage error, resulting from persons and housing units having been missed and from persons and housing units having been counted more than once. The second is error in the characteristics reported for those persons and housing units that are counted, or content error. The errors in the statistics on characteristics may be affected by coverage error as well as by content error; for example, even if the age of every person enumerated were reported correctly, a greater undercoverage in the enumeration of infants than of the rest of the population would result in a distorted picture of the age structure of the population. For this reason, an attempt is made not only to determine the total coverage error but also to determine how much the coverage varies among areas and groups in the population.

The term "response error" is used to refer to either coverage error or content error. The response errors of a particular census or sample survey result arise from the joint effects of response bias and response variance. In the definition of these terms,¹ a census or survey is regarded as being repeatable, under the same general conditions, in such a manner that repetitions relate to the same point or period in time and in such a manner that carrying through the operation once does not influence results obtained in repetitions of the operation. The particular results observed in a census or survey are the results of one such trial. This conception provides the basis for defining a variance and bias due to the record-

¹Precise definitions are not attempted here. The references at the end of the chapter provide more exact definitions and fuller explanations.

ing or processing of responses or to other sources of measurement errors.² Such a model can reasonably approximate actual conditions for a single census or survey. A single census or survey is regarded as a random sample of one trial from among such a set of repetitions, even though, in practice, independent repetitions of the census or survey may be impossible because the first process of obtaining responses may have an effect on responses obtained in a repetition. For example, a respondent may remember his first answers and make subsequent answers consistent with them.

The concepts of response variance and response bias are illustrated by considering the following table, which describes a situation where independent repetitions of a complete census are assumed to be possible.

| Persons in population | Trial (or repetition of census) | | | | | | Average for a person over a large number of trials |
|---|---------------------------------|----------------|----------------|---|---|----------------|--|
| | 1 | 2 | 3 | . | . | M | |
| 1 | x_{11} | x_{12} | x_{13} | . | . | x_{1M} | \bar{x}_1 |
| 2 | x_{21} | x_{22} | x_{23} | . | . | x_{2M} | \bar{x}_2 |
| 3 | x_{31} | x_{32} | x_{33} | . | . | x_{3M} | \bar{x}_3 |
| . | . | . | . | . | . | . | . |
| N | x_{N1} | x_{N2} | x_{N3} | . | . | x_{NM} | \bar{x}_N |
| Average for a trial over all persons | $\bar{x}_{.1}$ | $\bar{x}_{.2}$ | $\bar{x}_{.3}$ | . | . | $\bar{x}_{.M}$ | $\bar{x}_{..}$ |

The first column of figures (for trial 1) represents the responses obtained in a complete census of the population of N persons. Other columns in the table are for independent repetitions of the census. The entries in the table may represent, for example, whether or not a person is unemployed (or has some other specified characteristic), with x having the value 1 if the person is recorded as unemployed, and 0 if not. Then the averages at the bottom of the table would be percent unemployed (or having the specified characteristic).

Response bias.--If $\bar{x}_{..}$ is defined as the average of $\bar{x}_1, \bar{x}_2, \dots, \bar{x}_m$ over a large number of independent repetitions of the census, and if \bar{U} is the unknown average that would be measured if the census were accomplished under ideal conditions and without error, then the bias of \bar{x}_t , the statistic obtained on a particular trial, is $\bar{x}_{..} - \bar{U}$. Ordinarily the bias cannot be known in a practical problem, but sometimes useful approximations to it can be obtained if measurements are available from some sources that can be regarded as a standard.

²In this Evaluation and Research Program, estimates of response variance are limited almost entirely to content error. Estimates of response bias are available for both coverage and content error.

The approximations to the bias that are obtained are generally referred to as "net differences" or "net errors." For an estimate of \bar{X}_t , we use the initial census or survey statistic itself, $\bar{x}_{.1}$. For an estimate of \bar{U} , we use a statistic, $\bar{y}_{.1}$, derived from a measurement process (evaluation survey, record check, etc.) that is regarded as "better" or "improved" in comparison to the initial survey or census. Thus, the "net error" approximation to the bias is defined as $\bar{x}_{.1} - \bar{y}_{.1}$.

Response variance.--The response variance of $\bar{x}_{.t}$, the statistic obtained on a particular trial, is the variance among the trial means (that is the variance among $\bar{x}_{.1}$, $\bar{x}_{.2}$, ..., $\bar{x}_{.M}$) over a large number of trials. The response variance can be shown to have two main components--the simple response variance (σ_d^2) and the correlated response variance ($\sigma_d^2 \rho$). They are combined as follows to form the total response variance (σ_d^2) of the census statistic, $\bar{x}_{.1}$ =

$$\sigma_d^2 = \frac{\sigma_d^2}{N} + \frac{\sigma_d^2 \rho}{N} \quad (N-1) \quad (1)$$

$$= \frac{\sigma_d^2}{N} [1 + \rho (N-1)] \quad (2)$$

where N = total number of persons shown in the table above and the other terms are defined below.

The concepts of response variance and response bias are illustrated by considering the following table, which describes a situation where independent repetitions of a complete census are assumed to be possible.

The simple response variance (σ_d^2) can be defined as the variance of response deviations. A response deviation is the difference between the response recorded for a person on a particular trial and the average of the responses over all trials for the same person. In the table above, for example:

- the response deviation for the first person on the first trial would be: $d_{11} = x_{11} - \bar{x}_{.1}$;
- the response deviation for the second person on the third trial would be: $d_{23} = x_{23} - \bar{x}_{.2}$.

The simple response variance (σ_d^2) is defined as the average of the squares of the response deviations--averaged over all persons and all possible trials. In the evaluation work carried out by the Bureau of the Census to date, in general it has been possible to provide approximations to the simple response variance in terms of the gross difference (or gross error) rate. The gross difference rate is estimated for a particular class of a characteristic (for example, the age class, 0-4) after conducting an initial survey or census and replicating it on a sample of the persons in the initial enumeration:

| Replication (y) | Census or survey (x) | | |
|--------------------------------|----------------------------|--------------------------------|-------------|
| | Number of persons in class | Number of persons not in class | Total |
| Number of persons in class | a | b | a + b |
| Number of persons not in class | c | d | c + d |
| Total | a + c | b + d | n = a+b+c+d |

The gross difference rate (g) is defined as the proportion of cases that are classified differently in the initial survey or census and its replication;

that is: $g = \frac{b + c}{n} \quad (3)$

It can be shown that, if the response deviations of the replication are independent of those of the initial survey and if the replication and the initial survey are conducted under the same conditions, one-half of the gross difference rate is an unbiased estimate of the simple response variance.

In the summary of the results presented in the second half of this chapter, the gross difference rate is presented in the form of an index of inconsistency (\hat{f}). In terms of the above table:

Let $p = \frac{a + c}{n}$ that is, p is the proportion (based on the initial survey or census) of the population in the specified class.

Then $\hat{f} = \frac{g}{2p(1-p)} \quad (4)$

The index of inconsistency varies between 0 and 1; a high index of inconsistency is associated with a high level of response error.

There are other forms of the index of inconsistency.³

Under some circumstances, the response errors may have patterns that depend on the interviewer and how he affects the survey, or on the supervisor or coder or others--each of whom may introduce consistent errors in one direction or another in the responses for a large number of persons. These consistent errors, which vary in direction from interviewer to interviewer, or from coder to coder, etc., result in correlations among the response deviations--the ρ of equations (1) and (2) above--for the different persons in the census or survey. Equation (2) above expresses the fact that the correlations of response errors can have a large effect on the simple response variance and can increase the total response variance to many times what it would be if only uncorrelated response errors were involved.

Appropriately designed experimental studies are required in order to separate the total response variance into (a) the contributions associated with the individual persons for which information is recorded, i.e., the simple response variance; and (b) the added effect of correlations associated with interviewers, coders, and others.

METHODS

An important device used by the Bureau of the Census for evaluation programs, beginning with the 1945 Census of Agriculture, has been the post-enumeration survey, which is a reenumerative sample survey taken after a census to check on census results. Because it is much smaller than a census, the post-enumeration survey can be conducted on a more intensive basis. Also, it can take joint advantage of information collected in a census and in the reenumeration.

Another important device in evaluation studies is the comparison of individual records from the census with records available from other sources, as in the checking

³ These forms are discussed in: Hansen, Morris H.; William N. Hurwitz; and Leon Pritzker, "The Estimation and Interpretation of Gross Differences and the Simple Response Variance." In: Contributions to Statistics. Presented to Prof. P. C. Mahalanobis on the Occasion of his 70th Birthday, Pergamon Press, June 1964.

of census returns against birth records, school records, etc. Record checks constituted an important part of the planned evaluation program for the 1950 censuses, but problems of matching were exceedingly serious and the plans and resources available did not provide for extensive field followup to resolve questions of identification and matching. Consequently, most of the published results have been based on the 1950 reenumerative surveys, and on comparisons with independent aggregates as distinguished from record checks on an individual basis.

Analysis of the results of the 1950 evaluation program suggested important changes for the 1960 census procedures. For example, the discovery of serious under-enumeration led to procedures to improve coverage. Information on the ability of respondents to fill questionnaires and on the enumerators' influence on responses resulted in the extensive use of self-enumeration. (See section on "Planning Census Procedures" in chapter 2.)

Another important result of the 1950 evaluation program was that it revealed many difficulties in measuring census errors. In consequence, for the 1960 censuses, although the post-enumeration survey, record checks, and independent comparisons were again used in the evaluation program, steps were taken to develop improved evaluation procedures to reduce some of the problems encountered in the 1950 studies.

A summary of the 1960 evaluation-program results available at the time of writing this report is presented at the end of this chapter, after a brief description of the various phases of the program. In this brief summary and description, some presentations are over-simplified. Fuller and more careful descriptions of methods and results will be found in the references, which include listings of the publications to date of the evaluation and research program.

SCOPE OF THE EVALUATION AND RESEARCH PROGRAM

The individual projects adopted for the 1960 program were decided upon with the advice of the Panel of Statistical Consultants which meets with the staff of the Assistant Director for Research and Development from time to time. In addition, in February 1959 a group of nine additional advisers met with the permanent panel to advise on specific proposals for the 1960 Evaluation and Research Program.

From the many evaluation and research studies proposed and considered in the planning stages of the 1960 censuses, 22 were eventually selected for the Evaluation and Research Program. These 22 studies were then grouped into 8 separate projects, as follows:

- Project A, Measurement of response variability
- Projects B and C, Measurement of coverage error by "reverse record checks"
- Project D, Reenumerative studies of coverage error
- Project E, Measurement of content error in data collection
- Project F, Studies of processing error
- Project G, Analytical studies
- Project H, Post-office coverage improvement study

The above classification describes the principal objective of the studies included in each class. Some of the studies, however, had secondary objectives that could place them in other classes. For example, the studies in Project E will provide estimates of some components of response variability (the principal objective of Project A).

Each project except Project H included two or more related studies. Some of these studies were started at

the same time as the census enumeration, e.g., the experimental studies and a few control studies. Other studies measuring coverage and content error were conducted in the field after the enumeration. A number of studies concerning processing and analysis were later office operations. The studies are now at various stages, ranging from the early phases of planning to the publication of results. The present status of each study is indicated in the following descriptions.

PROJECT A, MEASUREMENT OF RESPONSE VARIABILITY

General

The studies of Project A were designed to measure the variance in census statistics that can be associated with respondents, enumerators, crew leaders, and coders. (There are many other possible sources of response variability, but Project A covered only those mentioned.)

Response Variance Study I: Correlated Response Variance

The largest in this group of studies of response variance was Response Variance Study I, one of the more complex studies included in the Evaluation and Research Program. Its mathematical principles are explained in a separate paper.⁴

The design of Response Variance Study I was influenced by a large-scale experiment conducted as part of the 1950 censuses in four areas in Ohio and Michigan including 24 counties covered by 700 enumerators. The 1950 experiment was designed to provide estimates of correlated response variances associated with enumerators. These estimates were used in constructing estimates of the response variability for small areas--areas containing an average of 6,500 persons and enumerated by an average of seven enumerators.

The effect of the estimated correlated response variances turned out to be quite large for small area statistics. This finding had an important influence not only on the 1960 Response Variance Study but also on the design of the 1960 censuses.⁵ Self-enumeration forms--the Advance Census Reports and the Household Questionnaires--were used to reduce the effect of enumerators on the statistics for small areas.

The design of the 1950 enumerator variance survey permitted estimates of "between-enumerator" variances

⁴ Hansen, Morris H.; William N. Hurwitz; and Max A. Bershad, "Measurement of Errors in Censuses and Surveys," *Bulletin de l'Institut International de Statistique*, Vol. 38, Part 2, Tokyo, 1961, pp. 359-374.

⁵ See also the following articles:

Hansen, Morris H.; William N. Hurwitz; and Leon Pritzker, "The Accuracy of Census Results," *American Sociological Review*, Vol. 18, No. 4, August 1953, pp. 416-423.

Eckler, A. Ross, and William N. Hurwitz, "Response Variance and Biases in Censuses and Surveys," *Bulletin de l'Institut International de Statistique*, Vol. 36, Part 2, Stockholm, 1958, pp. 12-35.

Hanson, Robert H., and Eli S. Marks, "Influence of the Interviewer on the Accuracy of Survey Results," *Journal of the American Statistical Association*, Vol. 53, No. 283, September 1958, pp. 635-655.

U.S. Bureau of the Census, *The Accuracy of Census Statistics With and Without Sampling*, Technical Paper No. 2, Washington, D.C., 1960, 38 pp.

(correlated response variances). However, these estimates were themselves subject to considerable variability, even though there were a large number of enumerators in the study. This was because the smallest assignments to pairs of enumerators in the experiment were enumeration districts (ED's), which contained relatively large and variable numbers of housing units. The study was limited geographically, and was designed to measure only "enumerator" effect.

Response Variance Study I of the 1960 census was designed to have the following additional properties beyond the experiment of 1950:

1. It would provide more reliable variance estimates because the smallest unit of assignment in the study was the household rather than the ED.

2. It was based on a probability sample of the entire area of the United States included in the two-stage census enumeration procedure, instead of only four areas in two States.

3. It would provide some estimates of the correlated response variances associated with crew leaders as well as enumerators.

In general, the basic plan in Response Variance Study I was to conduct enumeration strictly in accordance with the usual census rules (except for the Response Variance Study I assignment pattern).

Response Variance Study I was conducted in 50 sample areas selected on a probability basis from the 290 two-stage census field districts in the United States. The first stage of sample selection resulted in a distribution of the 50 sample areas in 26 States.

In each sample area, two stage II crew-leader districts were selected, and the enumeration assignments (EA's) within the selected crew-leader districts were reduced to two-thirds of the original number (the remainder were assigned to census personnel who were not in Response Variance Study I).

This area-sample selection resulted in the following study dimensions: 50 sample areas; 100 crew leaders (2 per sample area); 1,600 enumerators (16 per crew leader); 320,000 sample housing units (200 per enumerator); and approximately 1,000,000 persons.

To estimate the correlated response variance associated with enumerators and crew leaders, the EA's in the study were grouped into clusters of four neighboring EA's, and two enumerators were assigned to each cluster. Within the cluster, the sample households to be enumerated in stage II of the census were divided into two random sets, and one set was assigned to one enumerator and the other set to the second enumerator.

In half the clusters, both enumerators were supervised by one crew leader. In the other half, one of the pair of enumerators was under the supervision of the crew leader of the neighboring district.

This arrangement created an interpenetrated assignment pattern for the collection of stage II census information.

At this writing, estimates of both the enumerator and the crew-leader contributions to the response variance of selected statistics are available. Some of the principal results are included in: Pritzker, Leon, and Barbara A. Powell, "Effects of Variation in Field Personnel on Census Results," to be published in *Demography*, Vol. II, 1965. A Census Bureau report containing more detailed information will be issued at a later date.

Response Variance Study II: The Replication Study to Estimate Simple Response Variance

The Replication Study followed the completion of the census enumeration, and was designed to yield estimates of simple response variance, i.e., of the variance associated with respondents, through replicated self-enumeration and through reinterviews.

The responses obtained by such replicated approaches are not completely independent of the initial responses in the census. Such independence would be necessary to obtain valid estimates of the simple response variance. Nevertheless, replicated responses can provide considerable information on the simple response variance.

The Replication Study was divided into two parts:

In the first experiment, enumerators were assigned to a subsample of 5,000 of the households from which census sample data had been collected in the Response Variance Study. These households were asked to report again by means of direct enumeration by the enumerators.

In the second experiment, 1,000 households were asked to report again by means of a self-enumeration questionnaire to be mailed in, as in the original census, and with interviewer followup as necessary to obtain a high proportion of the returns.

The 6,000 housing units in the Replication Study were drawn in clusters of 10 from among the EA's in Response Variance Study I. Thus, there were 600 clusters of 10 housing units in the Replication Study, selected from all 50 pairs of crew-leader districts; 12 clusters were drawn from each pair of crew leader districts. There were 200 enumerators, or 4 per pair of crew-leader districts. Each enumerator was responsible for 30 sample housing units, or 3 clusters of 10 housing units.

During Response Variance Study I and the Replication Study, an Experiment Program Specialist was assigned to each of the 50 sample areas to control technical study conditions according to an instruction manual prepared for the purpose.

At this writing, the planning of the computations needed to estimate the simple response variance has begun; no results are available.

Results of Response Variance Study I and the Replication Study can be combined to yield estimates of response variability associated with the census enumeration, excluding variability associated with coders.

Response Variance Study III: The Coding Variance Study

The third study in Project A was the replication of stage II census coding for a probability sample of one-fourth of the enumeration assignments in Response Variance Study I. For each sample area, two clusters of the EA's in which each of the pair of enumerators worked for a different crew leader were selected.

Before the regular census coding took place; two photographic copies of the stage II enumeration books for the EA's in this subsample were made for the coding replication experiment. Pairs of coders were then assigned to code the entries in the copies, each coder independently making his coded entries in a blank enumeration book. Thus two complete sets of independently coded enumeration books were created for each sample area.

At this writing, the tasks of planning and carrying out the computations necessary to estimate the between-coder variances remain to be done.

PROJECTS B AND C, MEASUREMENT OF COVERAGE ERROR BY REVERSE RECORD CHECKS

Introduction

Coverage errors may result from failure to count persons or housing units, from duplication of enumeration of persons or housing units, or from erroneous identification of the separateness of housing units. Each mistake of this nature contributes to the total, or gross, error. However, errors of under- or overenumeration are to some extent compensating.

The best available evidence indicates that the total population count in the 1950 census may have been deficient by about 2.4 percent. Coverage errors were more serious than this for some population groups such as young children, nonwhites, young adult males, and persons in rural nonfarm dwelling units. Some of the innovations in the 1960 censuses represented efforts to reduce the coverage error. (See section on "Planning Census Procedures" in chapter 2.)

The problem of evaluating coverage was one of the main concerns of the evaluation program for the 1950 census. The method employed was the post-enumeration survey, which simply reenumerated a sample of households thoroughly and carefully. The differences between this enumeration and the census enumeration were then checked to determine possible coverage errors in the census.

The best available evidence indicated that the post-enumeration survey found not much more than half of the underenumeration of the population in the 1950 census. The coverage of the post-enumeration survey appeared to be deficient among persons without a close attachment to a particular household or dwelling unit.

As a consequence of the results of the 1950 post-enumeration survey, new methods were sought to study coverage errors in 1960. No one method was relied upon exclusively for providing estimates of coverage error. An important objective of the evaluation program was to consider alternative methods of determining omissions, duplications, and identification errors in coverage. The major coverage checks are described below. In addition, special attempts were planned to measure the adequacy of enumeration of the transient population in hotels, motels, and other transient quarters.

Project B, Reverse Record Checks to Measure Undercoverage in General Population

The objective of Project B was to construct an independent sample of the population of the United States as of April 1, 1960, and to determine how many persons appearing in the sample were not enumerated in the 1960 population census. It was referred to as a reverse record check because this approach was the reverse of the more customary check of a sample of census returns against other sources of information about the same persons.

The independent sample was to be obtained by drawing probability samples of persons found in four sources of records, as follows:

1. Persons enumerated in the 1950 census
2. Aliens who entered the United States after April 1950 and were registered in January 1960 with the Immigration and Naturalization Service
3. Children born during the intercensal period whose births were registered
4. Persons missed by the 1950 census but detected by the 1950 post-enumeration survey

The plan was to try to determine the current address of each person selected for a Project B sample, and then to determine whether or not the person was enumerated in the 1960 census. This method was developed in an attempt to deal with the situation found in 1950, namely that the post-enumeration survey tended to miss some of the same kinds of people missed in the census itself. The check on 1960 coverage, therefore, was not to depend on a simple repetition of enumeration to discover missed persons, but would be accomplished by a search of the census records for specific persons identified through independent sources.

It was hoped that this approach would be particularly useful for measuring the coverage of some population groups having a high risk of underenumeration. For example, the sample would identify from the 1950 census records a group of persons who were 8-14 years old in 1950--a group for which the risk of underenumeration was relatively low--but who in 1960 would be 18-24--a group for which the risk of underenumeration would be relatively high.

A report on this project has been issued as: U.S. Bureau of the Census. Evaluation and Research Program of the U.S. Censuses of Population and Housing, 1960: Record Check Studies of Population Coverage. Series ER 60, No. 2.

Project C, Reverse Record Checks to Measure Undercoverage of Special Groups

Project C, like Project B, was concentrated on errors of undercoverage, but was related to selected parts of the population rather than the population as a whole. It comprised studies directed primarily toward evaluating the enumeration and the age reports of two special population groups, as follows:

1. Aged social security beneficiaries
2. Students enrolled in colleges and universities

The evaluation method for Project C was to be essentially the same as the one followed for Project B. For each person selected to be in the sample of the two groups, a current address was to be obtained. There was then to be an attempted match against the 1960 census records to determine whether or not the person was enumerated, and, if enumerated, to note any differences in reported ages and perhaps other characteristics.

The study of the sample of college and university students, in addition to providing data on completeness of coverage of one of the population groups which is particularly difficult to enumerate in a census, offered the opportunity to evaluate the special census rule for enumerating college and university students wherever they were living while going to school rather than at their homes.

At this writing, tabulations have been completed and a report on Project C is being written.

PROJECT D, REENUMERATIVE STUDIES OF COVERAGE ERROR

Introduction

Project D was the primary study planned to obtain estimates of coverage error, but, in contrast to Projects B and C which dealt with errors of undercoverage, Project D allowed for measurement of both under- and overenumeration.

The two studies comprising Project D required the use of specially trained enumerators to search for errors of both omission and duplicate reporting of persons and housing units. The data will yield both net and gross errors in counting the population and housing units in the United States.

The investigation of coverage error in the 1960 reenumerative studies, unlike that in the 1950 post-enumeration survey, was largely separated from studies of content error, thus allowing for more intensive training of enumerators and control of work on a more limited number of subjects.

Reenumeration of Housing Units Based on an Area Sample

One of the two studies comprising Project D was a reenumerative study of housing units based on an area sample. The sample was selected as a subsample of small areas (or "segments") previously canvassed for the Survey of Components of Change and Residential Finance (SCARF).

In the first phase of SCARF, lists of living quarters located in the segments were prepared several months in advance of the census. These lists were not used in the census, nor were the locations of the segments known to the census enumerators. The second phase of SCARF, after the census, identified the housing units on the original list that were enumerated in the census.

For the evaluation program, a reenumerative survey was conducted in a subsample of 2,500 of the SCARF segments. The 2,500 segments selected were reenumerated in a search for housing units omitted from the census or for structures erroneously identified in the census as housing units. Enumerators specially trained for this study had available both SCARF information and 1960 census data. Their job was to make a complete list of all the structures and housing units in the segments, and to reconcile their findings with SCARF and census results when differences occurred.

In addition to the coverage check, an intensive interview concerning some of the data on housing characteristics collected in the census was conducted in about 10,000 housing units, about half of which were sample households in the census.

Reenumeration of Persons and Housing Units Based on a List Sample

The second study in Project D was a reenumerative study of persons and housing units based on a list sample of housing units (and households) enumerated in the census. It had two separate purposes. The first purpose was to check on the quality of census coverage of persons in enumerated units. That is, the data collected in this study were to enable the Bureau to make estimates of overenumeration and underenumeration of persons within enumerated units. The second purpose was to make an additional check on the enumeration of housing units.

A national sample of about 15,000 living quarters (housing units and group quarters) was drawn from the census enumerators' listing books. These living quarters were located in about 2,400 ED's in the 333 primary sampling areas⁶ covered in the monthly Current Population Survey of the Bureau. The sample varied somewhat from ED to ED, but averaged a little more than two clusters per ED, with a typical cluster including three

⁶These 333 primary sampling areas include 641 counties and independent cities in the United States.

housing units. Hence, the 2,400 ED's were represented by 5,000 sample clusters of about three units each.

The check of persons within enumerated units consisted of collecting basic census information from sample households for two situations: (1) for all persons living in the selected sample housing units on a specific scheduled reinterview date in early May 1960 plus any persons staying overnight in that housing unit on any of the three dates preceding the scheduled reinterview date, and (2) for persons who should have been enumerated as residents of these same housing units during the census beginning April 1, 1960.

For nonresidents staying overnight on any of the three dates preceding the reinterview date in May, information was obtained on addresses at which they might have been enumerated during the original census period in April.

Searches of census records were conducted to verify the reinterview data, and, where differences existed, further field visits were made as necessary to reconcile differences.

Final results of the check will yield estimates of persons missed or counted twice in living quarters enumerated in the census.

Another check called the predecessor-successor check was carried through on the same sample, and for the most part the same interviews as for the within-household check. Its purpose was to obtain estimates of housing units and group quarters missed by the census. The units in the sample were designated as "reference units," from which the search for missed units began. The person making the search was to follow a prescribed path of travel so that the "predecessor" and "successor" units would be uniquely determined, that is, any unit had one and only one unit preceding it along the path of travel within the ED, and one and only one unit succeeding it. Units listed as predecessor and successor units were checked against census records to determine whether or not they had been properly enumerated.

If, after checking listed units against census records, a predecessor or successor unit seemed to have been missed, further field work was done. Another enumerator was sent out to verify the preliminary result and to continue a similar chain of canvass in the indicated direction until a housing unit enumerated in the original census was located.

At this writing, tabulations have been completed and a report covering both studies included in Project D is being written.

PROJECT E, MEASUREMENT OF CONTENT ERROR IN DATA COLLECTION

Introduction

Errors which are made in the assignment of persons or housing units to the correct classifications, for the census tabulations on characteristics of persons and housing units, are called content errors. Such errors may arise in reporting, recording, coding, and tabulating the data.

For example, if a person is in the age group 20-24, or a housing unit is in the value group \$10,000-\$12,400, then a content error may arise from an improper omission of the person or housing unit from the correct class and a corresponding improper inclusion of the person or housing unit in another class. For any one class, gross

content error is the sum of the units improperly omitted and those improperly included, and net content error is the difference between units improperly omitted and those improperly included. The estimated net content error provides a measure of response bias, and the gross content error provides a measure of simple response variance.

In the post-enumeration checks of the 1950 censuses, two approaches to the measurement of content bias were used: the reenumerative check, or post-enumeration survey, and the record check.

1950 Post-Enumeration Survey.--For the 1950 Post-Enumeration Survey, a sample of households was reinterviewed by a small group of carefully selected and specially trained enumerators. The questionnaires allowed for detailed questioning about some of the original census items, and information was obtained from the best respondents in the household instead of just any responsible member of the household. Enumerators were more closely supervised than in the census, and their pay was on an hourly basis rather than a piece-rate basis.

Post-Enumeration Survey enumerators were provided with transcriptions of the original data so that after independently doing a reinterview, they reconciled discrepancies between reinterview responses and original responses.

In brief, in this phase of the Post-Enumeration Survey, results obtained by an improved method of interview were expected to provide estimates of bias in census enumeration. Although there were some exceptions, resulting estimates of net error tended to be quite small, even in some situations where other evidence indicated it was not small.

1950 record checks.--Record checks conducted as part of the 1950 evaluation program included comparisons of 1950 census data with data on birth certificates, records of the 1920 census, income tax returns, social security records, alien and naturalization records of the Immigration and Naturalization Service, and records of the Veterans Administration. In general, however, with the procedures followed it was possible to locate check data for only about 50 to 80 percent of the persons in the samples investigated. Provision was not made for field work to identify and reconcile unmatched cases, and to a considerable extent the results were inconclusive.

Scope of the 1960 Content Error Studies

Five studies were included in Project E. Two were reenumerative studies and three were record checks. One of the reenumerative studies was directed primarily toward estimating the error in the statistics of demographic characteristics, and the other, the error in the statistics of housing characteristics. These studies also yielded some information on gross differences, or simple response variance.

Reenumerative Studies of Content Error.--The first reenumerative study of content error employed intensive interviews to measure error in population characteristics. It had some features in common with the 1950 Post-Enumeration Survey. Intensive interviews were conducted at 5,000 households which were in the 25-percent sample in the 1960 census. Specially trained enumerators probed intensively for the best possible answers concerning selected population characteristics. Most of the characteristics chosen for study were of a type that would not change or would change very little with the passage of a few months of time. Also, specified persons were designated to be respondents.

The first phase, covering about 1,500 households, was conducted in July 1960, and for this part of the study enumerators were not given access to the original census schedules. Data collected in the intensive interviews were then matched in the office with the data collected in the original census enumeration, and a review was made to determine which cases had sufficient discrepancies to be sent back to the field for reconciliation.

The second phase of the study covered a different sample of 3,500 households and took place in October 1960. For one-half of the sample, enumerators were given the original census responses and were instructed that any differences between the responses they obtained and the census responses were to be reconciled on the same visit after the independently conducted interview was finished. For the other half, independent, unreconciled interviews were conducted. For both, office examination of the data and careful editing procedures were employed to evaluate reinterview responses. Net differences between original responses and reinterview responses provided estimates of content bias with respect to population characteristics.

The second reenumerative study of content error concerned housing characteristics. An intensive interview by specially selected and trained enumerators was carried out for 10,000 housing units, about half of which were sample units in the census. Information was collected on tenure and rent, plumbing, and costs of water and fuel. Detailed questions were asked to attempt to determine the best answers and the factual basis for such answers.

Reports have been issued containing the major results of the phases of the population characteristics study involving reconciliation and of the housing content error study. Both are in the series of reports on the Evaluation and Research Program of the U.S. Censuses of Population and Housing, 1960. They are entitled Accuracy of Data on Population Characteristics as Measured by Reinterviews, Series ER 60, No. 4 and Accuracy of Data on Housing Characteristics, Series ER 60, No. 3.

CPS-Census match.--One study of content error was based on a match of individual returns obtained by the Current Population Survey (CPS) and the 1960 Census of Population. The CPS is the primary source of current data on the labor force and of periodic reports on other demographic data. Most information obtained by the CPS is generally regarded as being of higher quality than that obtained in the census because it is obtained by a permanent staff of highly trained and closely supervised interviewers and because of highly developed survey control methods. Therefore, CPS data were used to provide a standard for measuring the quality of census data on the labor force and other population characteristics.

The CPS is conducted monthly with a partially rotating sample of households; each month one-fourth of the households are dropped from the sample and replaced. It yields a sample of 35,000 interviewed households in any one month. Those households which were in both the 25-percent sample of the population census and the March or April 1960 CPS were included in the study.

The first step in the CPS-Census Match was to examine the census stage I enumeration books to determine whether the CPS households were in the census sample. Those CPS households identified as being in the 25-percent census sample were then matched to the census stage II returns, and procedures were set up to transcribe and code the census information and CPS identification items. Data were then tabulated for identical

persons as reported by the census and by the CPS enumerators.

Because the 25-percent sample of the population census was used, this percentage set the upper limit to the percentage of CPS cases that could be matched. Furthermore, various processing problems, timing, and coverage considerations precluded attaining this level. For the comparison of reported labor force status, the number of cases that eventually were matched amounted to 17,337 persons 14 years and over, or 92.9 percent of the possible match universe and 23.2 percent of the CPS panel as compared with the theoretical 25 percent. A report on this project has been issued as: U.S. Bureau of the Census, Evaluation and Research Program of the U.S. Censuses of Population and Housing, 1960: Accuracy of Data on Population Characteristics as Measured by CPS-Census Match, Series ER 60, No. 5.

Employer Record Check.--This study was designed to obtain information on the comparability of census reports made by respondents concerning their occupation and industry with corresponding information obtained from their employers.

Occupations as reported by employees were matched with occupations as reported by their employers for a sample of employees reported in the census. In addition, the classification of the industry of these employers was identified in records of the Bureau of Old Age and Survivors Insurance, and comparisons were made of these classifications with industry as reported in the population census. A report on this project has been issued as: U.S. Bureau of the Census, Evaluation and Research Program of the U.S. Censuses of Population and Housing, 1960: The Employer Record Check, Series ER 60, No. 6.

Internal Revenue Service Record Check.--This study was planned to yield an estimate of content error with respect to income. A sample of Internal Revenue Service returns was selected on a probability basis. Only about one-fourth of these, or about 2,500, were to be included in the study because census income data appear only for the stage II (sample) census households. Pertinent information was to be transferred from the census returns to magnetic tape and a similar operation was to be separately performed for the Internal Revenue Service returns. The electronic computer was then to handle the matching operations.

At this writing, this study is in the computer-processing stage.

PROJECT F, STUDY OF PROCESSING ERRORS

The word "processing" as used here includes all handling of data beyond the initial recording of a response. The two-stage method of census enumeration required copying or transcription at more than one stage. Responses were then edited and coded. The census documents were filmed and the data transferred to computer tapes.

Three areas of study, described below, were defined as having special importance for the measurement of processing error.

Field Transcription Error

In stage I of the two-stage census, there were two types of transcription: (1) the transfer of data from the Advance Census Report, which had been filled in by the householder, to the 100-percent FOSDIC schedule, and (2) the copying of data from the 100-percent FOSDIC

schedule to the sample FOSDIC schedule for sample households. In stage II of the enumeration, a key element in the procedure was the transfer of the sample data from the Household Questionnaires, which had been filled in by the householders, to the sample FOSDIC schedules. At this writing, the study designed to measure transcription errors is inactive.

Coding Error

As a part of Project A, Measurement of Response Variability, estimates are to be derived of the contribution to the correlated response variability arising from coding variability during the general coding and the industry and occupation coding of the sample data.

A separate coding-error study has been conducted, largely as a byproduct of the quality control scheme used in the 1960 census, with a sample of 1 in 40 households from the 25-percent sample for whom occupation and industry data were collected. Three different coding clerks with approximately the same training and coding experience all coded independently from the census schedule, but only one, the "census coder," entered his code on the census schedule. The coded results were then matched.

This Project F study has the additional objectives of providing estimates of coding bias and the simple response variance arising from coding. This involved examining the three sets of codes to attempt to establish the correct codes and to measure the extent to which the codes assigned by the census coders differed from the correct codes.

At this writing, a report⁷ has been written and a considerable number of tabulations have been completed relating to coding errors in occupation and industry. The tabulations are available on coding errors in "general" coding, i.e., all coding except industry and occupation coding.

Editing and Allocation

In the 1960 censuses, the microfilm-FOSDIC-computer complex performed jobs formerly done by editing and coding clerks and punchcard equipment. The close monitoring of this aspect of processing through a comprehensive program of quality control has been described (see chapter 8, Processing the Data). The high reliability of the electronic equipment assured that far fewer errors were made in accomplishing the specified steps in editing and tabulation than were produced by methods used in earlier censuses. Editing of the data was done uniformly, in accordance with rules and instructions supplied to the computer.

At this writing, an examination of the effect of editing and allocation rules is underway. A paper summarizing the analysis, "Computer Editing Methods - Some Applications and Results," is being written by Leon Pritzker, Jack Ogus, and Morris H. Hansen for presentation at the 35th Session of the International Statistical Institute, Belgrade, Yugoslavia, September 4-22, 1965.

PROJECT G, ANALYTICAL STUDIES

Analytical studies for the evaluation of the census data are to include demographic and actuarial analysis and various comparisons of the census results with data available from noncensus sources. The analytical studies

⁷Pasteau, Herman H.; J. Jack Ingram; and Ruth H. Mills, "Study of the Reliability of Coding of Census Returns," in: American Statistical Association, Proceedings of the Social Statistics Section, 1962, Washington, D.C., 1963? pp. 104-115.

were conceived for the general purpose of overall evaluation of the census data and also to contribute to the understanding of the strong points and limitations of the various measurements of coverage and content error made through other studies in the Evaluation and Research Program.

Some analysis of coverage error has been completed.⁸ Other analyses are now being worked on as parts of 1960 census monographs.

PROJECT H, POST OFFICE COVERAGE IMPROVEMENT STUDY

Project H involved the use of Post Office resources and personnel to identify households erroneously omitted from the census enumeration within a sample of areas. In addition, this project was directed toward study of the feasibility of carrying out this type of field work by a decentralized census-staff operation. Each of the District Offices in the sample conducted the study in its district with only written instructions, and the post offices in the study also operated on the basis of written instructions, without special training or supervision from Washington personnel.

Within each of the 15 postal regions of the continental United States, a sample area containing from 10,000 to 15,000 housing units was selected. Enumeration districts served wholly or in part by the post offices in the sample areas were identified. Within these ED's, the census enumerators, during the course of the census enumeration, filled out printed address cards, giving the name and address for each enumerated household. The cards, except for a small sample which was withheld, were turned over to the local post offices. There they were sorted like mail to be delivered by carrier route, and given to the postal carriers. The postal carriers were asked to make up new cards for any households on their routes that were not represented. Personnel of the local Census District Offices matched the new cards supplied by the postal carriers against the census schedules. Households that could not be located on the census schedules were visited and data equivalent to stage I information were collected from them for the dual purpose of checking on possible reasons for the enumerator's omission and for collecting information for analysis of the characteristics of missed units.

Duplication of enumeration or erroneous listing of housing units as separate could result in overcounts as well as undercounts, and provision was made in the study for field investigation of households where overcounts might have occurred.

A report summarizing the results of this study and including similar data for earlier studies on the same subject has been published as: U.S. Bureau of the Census. Tests of Use of Post Office Resources to Improve Coverage of Censuses, Working Paper No. 19.

A PRELIMINARY EVALUATION OF THE 1960 CENSUS OF POPULATION

Coverage

Considering the evidence now available (March 1965), it appears that a minimum reasonable estimate of the net underenumeration of the population in 1960 is in the range of 1.7 to 2.0 percent of the total as compared to the "minimum reasonable" estimate of 2.4 percent for the 1950 census. This amounts to a net undercount in

⁸Akers, Donald S., "Estimating Net Census Undercount in 1960 Using Analytical Techniques," 1962, 8, 5, 6 pp., processed (presented at the annual meeting of the Population Association of America, May 1962.)

1960 of 3,000,000 to 3,500,000 persons. Some modification of these estimates may be made when further evaluation results become available.

An analysis of the 1960 and 1950 counts of the total resident population and of estimates of the components of population change for the period suggest that coverage in the 1960 census was somewhat better than in the 1950 census:

(In thousands)

| | | |
|--|---------|--------|
| Population Apr. 1, 1960 | 179,323 | |
| Population Apr. 1, 1950 | 151,326 | |
| Net increase..... | | 27,997 |
| Components of population change, 1950-60: | | |
| Births (corrected for underregistration) .. | 40,963 | |
| Deaths..... | -15,608 | |
| Net movement of aliens and citizens .. | 2,695 | |
| Net movement of Armed Forces abroad .. | -330 | |
| Expected net increase | | 27,720 |
| Estimated increase in coverage based on above | | 277 |

If this estimated increase in coverage is subtracted from the 1950 net underenumeration as found by the 1950 post-enumeration survey (2,091,000 - 277,000 = 1,814,000), then the net underenumeration of 1.4 percent in 1950 would be reduced to 1.0 percent in 1960.

However, other evidence regarding the 1950 census suggested that the post-enumeration survey had failed to indicate all the underenumeration, and the Bureau of the Census accepted the figure of 2.4 percent or about 3,700,000 as the minimum reasonable estimate of net underenumeration. If the estimated increase of coverage of 277,000 is subtracted from this figure, then a 1960 net underenumeration of 1.9 percent of the 1960 population, or about 3,400,000 persons, is indicated as the minimum reasonable estimate.

Errors in the intercensal estimates of births, deaths, and military movement are not likely to be of sufficient magnitude to affect the general picture regarding the relative accuracy of the 1960 and 1950 counts. Estimates of net movement of citizens (exclusive of those moving between Puerto Rico and the Mainland) are subject to a very wide range of error. Two approaches to estimating this movement, neither of which can be regarded as highly reliable, yield estimates varying from a net in-movement of about 280,000 to a net out-movement of about 170,000. In the above estimate this net movement was taken as zero. There is another factor in the 1960 census count which might affect the picture: 776,655 persons were included through computer imputation of population of housing units for which there was evidence of occupancy though there were no FOSDIC-readable persons on the population schedule. There is some evidence that the computer may have "overimputed" persons. The amount of this overcount cannot be accurately determined, but it is estimated to be from 100,000 to 350,000.

A comparison of findings from the 1950 post-enumeration survey and of preliminary results from re-enumerative surveys (Project D) conducted as part of the 1960 census evaluation program shows the following estimates of coverage errors, as percents of census total population:

| Enumeration errors | 1960 | 1950 |
|---------------------------------------|------|------|
| Omissions of persons..... | 3.0 | 2.3 |
| In missed living quarters..... | 1.6 | 1.6 |
| In enumerated living quarters..... | 1.4 | 0.6 |
| Erroneous inclusions of persons | 1.3 | 0.9 |
| Net underenumeration of persons | 1.7 | 1.4 |

These estimates are not entirely comparable for 1960 and 1950. As a consequence of weakness detected in the 1950 post-enumeration survey procedures, steps were taken to strengthen corresponding procedures in 1960. Therefore, for 1960, there are higher, and perhaps more reasonable, estimates of numbers of persons missed or erroneously included. These higher estimates may also reflect differences in the coverage of the censuses.

A composite of demographic analytic methods⁹ gives some estimates of net undercounts for 1960 by sex, age, and color, in percentages:

| Age | Total | White male | White female | Nonwhite male | Nonwhite female |
|--------------------|-------|------------|--------------|---------------|-----------------|
| All ages..... | -2.3 | -1.1 | -1.7 | -10.3 | -7.1 |
| Under 5 years..... | -2.6 | -2.1 | -1.4 | - 7.9 | - 6.4 |
| 5 to 14 years..... | -2.1 | -2.3 | -1.3 | - 4.8 | - 3.8 |
| 15 to 24 years.... | -4.0 | -3.3 | -2.3 | -13.9 | - 9.5 |
| 25 to 44 years.... | -2.6 | -2.2 | -0.7 | -16.0 | - 6.2 |
| 45 to 64 years.... | -2.3 | -0.2 | -1.8 | -13.0 | -12.8 |
| 65 years and over. | +0.9 | +8.1 | -4.5 | + 7.9 | - 2.6 |

The table below shows a comparison of estimates for 1960 and 1950 for undercounts of children under one year of age and under five years, for whites and nonwhites. The results in both tables reflect the accuracy of age, color, and sex reporting as well as completeness of coverage. The figures below are based on estimates of survivors of births, using birth registration data and estimates of underregistration made by the National Office of Vital Statistics. Each of the age and color groups shown indicates considerable improvement in 1960.

| Census | Under 1 year old | Under 5 years old |
|-----------------|------------------|-------------------|
| 1960..... | 2.0 | 2.6 |
| 1950..... | 11.0 | 4.7 |
| <u>White</u> | | |
| 1960..... | 1.2 | 1.8 |
| 1950..... | 10.1 | 4.0 |
| <u>Nonwhite</u> | | |
| 1960..... | 5.8 | 7.2 |
| 1950..... | 16.6 | 9.7 |

Further evaluation of the 1960 census coverage (as part of Project G) will be possible as final results become available from the entire series of studies described earlier in this chapter.

Content

Nonresponse rates.--The table below provides a comparison of nonresponse rates in the 1960 and 1950 censuses for a few characteristics. Most of the nonresponse rates compared are higher in 1960 than in 1950.

In 1950, after an enumerator had made reasonable but unsuccessful efforts to obtain census information from a responsible member of the household, he was instructed to make inquiries from neighbors. This procedure was followed in 1960 only for the 100-percent

⁹ Estimates for ages under 25 are based on survivors of births; those for ages 25 to 64 on Coale's iterative method (see bibliography at end of this chapter); those for ages 65 and over on an iterative method using mortality data.

items for which it was presumed that neighbors might provide reasonably acceptable information. In 1960, for the sample items, the procedure involving self-enumeration and mail-in may have encouraged some failure to followup on nonresponse. The enumerators were instructed to followup as needed, but to obtain population information only from a responsible member of the household.

The 1960 procedures were based on the assumption that allowing information to be obtained from neighbors and other unqualified respondents encouraged poor standards and loose work, and that with a reasonably low response rate, mechanical imputation yielded more reliable data than inquiry of neighbors. In both 1950 and 1960 there may have been some informal imputation by enumerators. For some items (such as place of birth, mother tongue, occupation, place of work, and means of transportation), nonresponses were not imputed but were tabulated as NA's.

The alternative methods for dealing with nonresponses still need to be evaluated. (See the description of Project F above.)

As already indicated, moderate NA rates, of themselves, are not in general a satisfactory indicator of quality of the census measurements for characteristics. The NA rate for the monthly Current Population Survey, which is regarded as of high quality relative to the census, is approximately 4 or 5 percent for most items, and considerably higher for some. In part, this NA rate results from the fact that interviewing must be completed within a very short time.

On the other hand, where NA's run to 25 or 50 percent or more for a particular area, it can be interpreted as providing poor data for that area. This, for example, was the situation in the city of Chicago where, among census tracts having 1,000 inhabitants or more, there were tracts, each containing one or more ED's, in which allocation rates were 50 percent or more for a majority of the sample items.

| Characteristic | Percent nonresponse | |
|--|---------------------|------------------|
| | 1960 census | 1950 census |
| Age..... | ¹ 1.0 | 0.2 |
| State of birth..... | 2.7 | 1.0 |
| School enrollment (persons 5 to 34 yrs. of age)..... | 8.3 | ² 5.9 |
| Highest grade completed (persons 25 and over)..... | 4.9 | 4.6 |
| Employment status (persons 14 and over)..... | 3.1 | 1.0 |
| Occupation (employed persons)..... | 4.9 | 1.3 |
| Children ever born (to women ever married)..... | 6.0 | 9.0 |
| Income (persons 14 and over)..... | 6.2 | 6.7 |

¹ Year or decade of age not reported.

² Enrollment data available only for persons 5 to 29 years of age in 1950.

The increase in nonresponse for age, which was a 100-percent item, presumably resulted primarily from the collection of information in 1960 by date of birth instead of age in years as of the last birthday.

Analysis of Age Data.--In each census in which data on single years of age have been collected, there have been overstatements of ages ending in certain digits and understatements for other digits. In each census since 1880, this "age heaping" has declined, and another substantial reduction was achieved in the 1960 census.

The percentage distribution of ages by final digit for the population aged 23 to 99 years as reported in the 1960 census is the following:

| Ending digit of age | Percent in digit group in 1960 |
|---------------------|--------------------------------|
| All digits..... | 100.0 |
| 0..... | 9.9 |
| 1..... | 9.9 |
| 2..... | 9.9 |
| 3..... | 9.8 |
| 4..... | 10.1 |
| 5..... | 10.3 |
| 6..... | 9.9 |
| 7..... | 10.1 |
| 8..... | 9.8 |
| 9..... | 10.3 |

An index of age heaping can be constructed by taking one-half the sum of the deviations from 10.0 percent, each taken without regard to sign.¹⁰ For the 1960 census,

¹⁰ Myers, Robert J., "Accuracy of Age Reporting in the 1950 United States Census," *Journal of the American Statistical Association*, Vol. 49, No. 268, December 1954, pp. 826-831.

this index is 0.8. Comparisons with other censuses back to 1880 are shown below:

| Census | Index of age heaping |
|-----------|----------------------|
| 1880..... | 10.4 |
| 1890..... | 7.8 |
| 1900..... | 4.7 |
| 1910..... | 5.6 |
| 1920..... | 4.5 |
| 1930..... | 4.3 |
| 1940..... | 3.0 |
| 1950..... | 2.2 |
| 1960..... | 0.8 |

In 1960 and in 1900, "date of birth" rather than "age at last birthday" was the inquiry, and the improved question together with the opportunity for self-enumeration in 1960 may be largely responsible for the decrease in age heaping. The higher nonresponse rate in 1960 may also have contributed to the reduction in this index.

The reductions in 1960 compared to 1950 occurred for both males and females in both the white and nonwhite groups:

Table G.--Comparison of Employment Status According to 1960 Census of Population and April 1960 Current Population Survey (CPS)

| Employment status | 1960 | | | | 1950 | | | |
|------------------------------------|--------|-----------|------------|----------------------------|--------|-----------|------------|----------------------------|
| | Census | April CPS | Difference | Difference relative to CPS | Census | April CPS | Difference | Difference relative to CPS |
| All persons, 14 years old and over | | | | | | | | |
| In labor force..... | 55.5 | 57.0 | -1.5 | -2.7 | 53.7 | 56.9 | -3.2 | -5.6 |
| Employed..... | 52.6 | 54.0 | -1.4 | -2.6 | 51.2 | 53.7 | -2.6 | -4.8 |
| In agriculture..... | 3.5 | 4.4 | -.9 | -21.3 | 6.3 | 6.6 | -.3 | -5.0 |
| In nonagricultural industries..... | 49.2 | 49.6 | -.5 | -.9 | 44.9 | 47.1 | -2.2 | -4.8 |
| Unemployed..... | 2.9 | 3.0 | -.1 | -4.7 | 2.6 | 3.2 | -.6 | -19.9 |
| Not in labor force..... | 44.5 | 43.0 | 1.5 | 3.6 | 46.3 | 43.1 | 3.2 | 7.4 |
| White | | | | | | | | |
| In labor force..... | 55.3 | 56.6 | -1.3 | -2.3 | 53.4 | 56.5 | -3.0 | -5.4 |
| Employed..... | 52.7 | 54.0 | -1.3 | -2.4 | 51.1 | 53.5 | -2.4 | -4.6 |
| Unemployed..... | 2.6 | 2.6 | -.02 | -.8 | 2.4 | 3.0 | -.6 | -19.9 |
| Not in labor force..... | 44.7 | 43.4 | 1.3 | 3.0 | 46.6 | 43.5 | 3.0 | 7.0 |
| Nonwhite | | | | | | | | |
| In labor force..... | 57.0 | 60.7 | -3.7 | -6.0 | 56.6 | 61.2 | -4.6 | -7.5 |
| Employed..... | 52.1 | 54.6 | -2.5 | -4.5 | 52.1 | 55.6 | -3.5 | -6.3 |
| Unemployed..... | 5.0 | 6.1 | -1.2 | -19.4 | 4.4 | 5.6 | -1.1 | -20.3 |
| Not in labor force..... | 43.0 | 39.3 | 3.7 | 9.3 | 43.4 | 38.8 | 4.6 | 11.9 |
| Male | | | | | | | | |
| In labor force..... | 78.1 | 80.0 | -1.8 | -2.2 | 79.7 | 83.3 | -3.6 | -4.4 |
| Employed..... | 74.2 | 75.7 | -1.5 | -2.0 | 75.8 | 78.3 | -2.6 | -3.3 |
| In agriculture..... | 6.6 | 7.8 | -1.3 | -16.3 | 11.8 | 11.8 | -.1 | -.6 |
| In nonagricultural industries..... | 67.6 | 67.9 | -.2 | -.3 | 64.0 | 66.5 | -2.5 | -3.8 |
| Unemployed..... | 3.9 | 4.2 | -.2 | -6.0 | 3.9 | 5.0 | -1.1 | -21.6 |
| Not in labor force..... | 21.9 | 20.1 | 1.8 | 8.7 | 20.3 | 16.7 | 3.6 | 21.7 |
| Female | | | | | | | | |
| In labor force..... | 34.9 | 36.3 | -1.4 | -3.9 | 29.2 | 32.1 | -2.9 | -9.2 |
| Employed..... | 33.0 | 34.3 | -1.4 | -4.0 | 27.8 | 30.5 | -2.7 | -8.8 |
| In agriculture..... | .6 | 1.3 | -.6 | -50.0 | 1.0 | 1.6 | -.6 | -37.2 |
| In nonagricultural industries..... | 32.3 | 33.1 | -.7 | -2.2 | 26.8 | 28.9 | -2.1 | -7.3 |
| Unemployed..... | 1.9 | 1.9 | -.04 | -2.1 | 1.3 | 1.6 | -.2 | -15.8 |
| Not in labor force..... | 65.1 | 63.7 | 1.4 | 2.2 | 70.8 | 67.9 | 2.9 | 4.3 |

| Population group | Index of age heaping | |
|------------------|----------------------|------|
| | 1960 | 1950 |
| White: | | |
| Male..... | 0.55 | 1.56 |
| Female..... | 0.65 | 2.09 |
| Nonwhite: | | |
| Male..... | 2.45 | 5.18 |
| Female..... | 2.16 | 5.87 |

Comparison of Census Statistics and Independent Estimates.--Labor force data from the 1950 and 1960 censuses were compared with data from the April 1950 and April 1960 monthly Current Population Survey (CPS). The results are shown in table G.

Without exception, for all population groups shown, there is evidence, according to CPS results, of census undercount of persons in the labor force. However, except for persons employed in agriculture, the differences relative to CPS results are smaller for 1960 than for 1950. Differences for employment in agriculture may be especially affected by the variations in time reference.

For the census figures on enrollment in the public schools, comparisons were made with two independent estimates. The first was an estimate of total enrollment from kindergarten through the 12th grade, based on a questionnaire sent to all offices of State school systems in the fall of 1959 requesting enrollment figures as of Oct. 1, 1959, or as close to that date as enrollment stabilization appeared to have occurred. The census data referred to school enrollment between February 1, 1960, and the census date. The second independent estimate

was from a school enrollment question in the October 1959 CPS, and is subject to the usual CPS sampling error. The figures on public school enrollment, kindergarten through 12th grade, from the three sources are as follows:

| | |
|--------------------------------------|--------------|
| 1960 Census of Population..... | 35.3 million |
| 1959 Office of Education Survey..... | 35.2 " |
| 1959 October CPS..... | 34.9 " |

College enrollment data from the 1960 census can also be compared with the October 1959 CPS and with the information obtained from college and university officials in the 1959-60 biennial Office of Education survey:

| Type of college | Number enrolled in colleges (in millions) | | |
|-----------------|---|---------------|------------------------------------|
| | 1960 census | 1959 Oct. CPS | 1959-60 Office of Education survey |
| Total..... | 2.9 | 3.3 | 3.4 |

Although the CPS and Offices of Education figures are in close agreement, the census differs from both to a marked degree. A special inquiry concerning fall and spring enrollment, sent to the largest universities in the six States where the census figures fell appreciably below the Office of Education figures, showed that the attrition rate was very close to the difference between the two sets of figures.

Data on income for both the 1960 and 1950 censuses were compared with CPS data and with estimates of the National Income Division of the Office of Business Economics. All figures relate to aggregate income for the United States in the years 1959 and 1949:

| Year and type of income | Census ¹ | | CPS ² | | National Income Division (OBE) ³ |
|------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|---|
| | Dollar amount (in billions) | Percent difference from OBE | Dollar amount (in billions) | Percent difference from OBE | Dollar amount (in billions) |
| <u>1959</u> | | | | | |
| Total income..... | \$331.7 | -5.6 | \$306.7 | -12.7 | \$351.4 |
| Wages and salaries..... | 246.5 | -1.0 | 233.5 | -6.3 | 249.1 |
| Self-employment..... | 47.9 | 13.5 | 38.3 | -9.2 | 42.2 |
| Income other than earnings.. | 37.3 | -37.9 | 32.7 | -45.6 | 60.1 |
| <u>1949</u> | | | | | |
| Total income..... | 173.2 | -9.3 | 159.8 | -16.3 | 191.0 |
| Wages and salaries..... | ⁴ 124.3 | -3.5 | 120.0 | -6.8 | 128.8 |
| Self-employment..... | ⁴ 31.1 | -0.6 | 26.5 | -15.3 | 31.3 |
| Income other than earnings.. | ⁴ 16.6 | -46.3 | 13.3 | -57.0 | 30.9 |

¹ Total population 14 years of age and over.

² Persons 14 years of age and over, excluding inmates and members of Armed Forces living on base.

³ Total population, all ages.

⁴ Estimates based on preliminary sample tabulations because final data do not contain distribution of income by type.

Table H.--Estimates of Bias and Indexes of Inconsistency for Selected Characteristics: 1960 Census of Population and Reinterview Survey

| Characteristic and category | 1960 census (percent) | 1960 bias (difference between census and reinterview survey) X 100 ¹ | 1960 relative bias X 100 ¹ | Difference from 1950 relative bias X 100 ² | 1960 index of inconsistency | Difference from 1950 index of inconsistency ² |
|-------------------------------------|-----------------------|---|---------------------------------------|---|-----------------------------|--|
| <u>Sex</u> | | | | | | |
| Male..... | 49.3 | +0.2 | +0.4 | (³) | .018 | (³) |
| Female..... | 50.7 | -0.2 | -0.4 | (³) | .018 | (³) |
| <u>Color</u> | | | | | | |
| White..... | 88.6 | +0.2 | +0.2 | (³) | .045 | (³) |
| Nonwhite..... | 11.4 | -0.2 | -1.7 | (³) | .045 | (³) |
| <u>Age class</u> | | | | | | |
| 0-4..... | 11.3 | +0.1 | +0.6 | +1.57 | .020 | +0.005 |
| 5-9..... | 10.4 | +0.2 | +1.6 | +76 | .029 | -0.001 |
| 10-14..... | 9.4 | +0.5 | +4.7 | -36 | .024 | +0.010 |
| 15-19..... | 7.4 | -0.7 | -1.00 | +64 | .029 | +0.011 |
| 20-24..... | 6.0 | -0.4 | -79 | -53 | .037 | +0.014 |
| 25-29..... | 6.1 | +0.8 | +1.53 | -1.50 | .036 | +0.026 |
| 30-34..... | 6.7 | -0.3 | -49 | -01 | .043 | +0.033 |
| 35-39..... | 7.0 | +1.2 | +1.85 | -1.07 | .058 | +0.017 |
| 40-44..... | 6.5 | +0.3 | +44 | +94 | .078 | +0.010 |
| 45-49..... | 6.1 | -1.2 | -1.85 | -1.78 | .071 | +0.030 |
| 50-54..... | 5.4 | +0.3 | +59 | -29 | .078 | +0.034 |
| 55-59..... | 4.7 | +1.0 | +2.11 | +1.00 | .063 | +0.040 |
| 60-64..... | 4.0 | -1.0 | -2.77 | -1.73 | .098 | -0.014 |
| 65-69..... | 3.5 | +0.9 | +2.63 | -2.11 | .078 | +0.012 |
| 70-74..... | 2.6 | -1.1 | -40 | -28 | .095 | - |
| 75 and over..... | 3.1 | -0.5 | -1.80 | -73 | .032 | +0.019 |
| <u>Mobility class</u> | | | | | | |
| Same house..... | 50.7 | +1.4 | +2.6 | -2.3 | .072 | +0.151 |
| Different house, same county..... | 30.3 | +0.3 | +1.2 | +4.6 | .125 | +0.135 |
| Different county, same State..... | 8.7 | -0.7 | +7.6 | -5.3 | .108 | +0.166 |
| Different State..... | 9.0 | -0.9 | -11.2 | -2.9 | .107 | +0.229 |
| Abroad..... | 1.3 | -0.2 | -13.3 | +265.0 | .187 | +0.397 |
| <u>Educational attainment class</u> | | | | | | |
| None..... | 2.3 | -0.01 | -0.7 | +28.3 | .238 | +0.316 |
| Elementary, 1-4 years..... | 6.1 | -0.5 | -8.5 | -4.9 | .309 | +0.051 |
| Elementary, 5-6 years..... | 7.5 | -0.8 | -11.0 | -5.3 | .333 | +0.146 |
| Elementary, 7 years..... | 6.4 | -0.8 | -11.1 | +3.2 | .399 | +0.205 |
| Elementary, 8 years..... | 17.5 | +0.7 | +4.6 | +2.7 | .300 | +0.100 |
| High school, 1-3 years..... | 19.2 | +0.7 | +3.6 | +0.4 | .240 | +0.135 |
| High school, 4 years..... | 24.6 | -0.5 | -1.9 | +0.7 | .186 | +0.077 |
| College, 1-3 years..... | 8.8 | +1.0 | +11.4 | +3.6 | .224 | +0.115 |
| College, 4 or more years..... | 7.7 | +0.2 | +3.1 | +5.6 | .074 | +0.096 |
| <u>School enrollment class</u> | | | | | | |
| Kindergarten and elementary..... | 37.8 | -1.0 | -2.2 | (³) | .038 | (³) |
| High school..... | 11.8 | -0.1 | -1.1 | (³) | .096 | (³) |
| College..... | 3.6 | +0.4 | +14.9 | (³) | .158 | (³) |
| Not enrolled..... | 46.9 | +0.7 | +1.9 | (³) | .041 | (³) |

- Represents zero.

¹ Minus sign indicates understatement in census; plus sign indicates overstatement.² Minus sign indicates higher level of error in 1960 census than in 1950 census; plus sign indicates higher level of error in 1950 census.³ A comparison of cases from the 1950 census and the 1950 post-enumeration survey is not available.

1960 CENSUSES OF POPULATION AND HOUSING

A comparison of the census and the Office of Business Economics (OBE) estimates by type of income shows that for both 1949 and 1959 there was close agreement for wages and salaries and that there was evidence of substantial underreporting of income other than earnings in the censuses. In each case the census was in closer agreement with the OBE estimate than were the CPS figures. There was a substantial reduction in underreporting in the 1960 census compared to the 1950 census.

Response variance.--The index of inconsistency (\hat{I}) has been discussed on page 114 of this chapter. The indexes of inconsistency for the labor force classifications in the 1960 and 1950 censuses as compared to CPS data for the identical populations 14 years old and over are shown below.

The intensive reinterview survey described earlier in this chapter (Project E) produced the estimates of bias and of indexes of inconsistency shown in table H for the specified characteristics in the 1960 census.

Where an equivalent comparison of cases was available from the 1950 census and the 1950 postenumeration survey, the differences between the 1950 and 1960 biases and indexes of inconsistency are shown.

The measurements of bias shown in table H result from comparisons of responses for persons enumerated in both the census and the reinterview survey. A larger bias for 1960 than for 1950 could result from an improved reinterview study in 1960, a reduced accuracy in the 1960 census, or both. Conversely, reductions in the indexes of inconsistency in 1960 compared with 1950 might have occurred as a result of improvement in the 1960 census or the 1960 reinterview survey, or both. The results are different to interpret. Generally, they are consistent with the view that either the 1960 census had less response error than the 1950 census, or the 1960 evaluation study had less response error than the 1950 evaluation study, or both.

The coding error study (Project F) provided a distribution of 149 industry codes and 296 occupation codes by size of the indexes of inconsistency, as given below. A substantially larger proportion of occupation codes have low indexes of inconsistency than do industry codes.

| Sex and labor-force status | Index of inconsistency | | Difference ¹ Col. (2) - Col. (1) |
|---|------------------------|----------------|---|
| | 1960 census | 1950 census | |
| | (1) | (2) | (3) |
| <u>Males</u> | | | |
| In the civilian labor force. | .177 | .205 | + .028 |
| Employed..... | .170 | .196 | + .026 |
| In agriculture..... | .224 | .144 | - .080 |
| In nonagricultural industries..... | .132 | .140 | + .008 |
| Unemployed..... | .500 | .513 | + .013 |
| Not in the civilian labor force..... | .177 | .205 | + .028 |
| <u>Females</u> | | | |
| In the civilian labor force. | .192 | .195 | + .003 |
| Employed..... | .175 | .180 | + .005 |
| In agriculture..... | .593 | .957 | + .364 |
| In nonagricultural industries..... | .156 | .145 | - .011 |
| Unemployed..... | .720 | .751 | + .031 |
| Not in the civilian labor force..... | .192 | .195 | + .003 |

¹ Minus sign indicates greater unreliability in 1960 census than in 1950 census; plus sign indicates greater unreliability in 1950 census.

Forty-eight percent of the occupation codes as compared with 39 percent of the industry codes had indexes between .001 and .100. For both types of coding, the .001 to .100 class accounted for 74 percent of the experienced civilian labor force. A further study, made of the 20 percent or so codes having the highest indexes, indicated that industry codes for wholesale trades were particularly troublesome.

| Index of inconsistency | Industry codes | | | Occupation codes | | |
|--------------------------------|--------------------|---------------------|---|--------------------|---------------------|---|
| | Number of codes | Percent of codes | Estimated percent of labor force ¹ | Number of codes | Percent of codes | Estimated percent of labor force ¹ |
| Total codes ² | 150 | 100.0 | 100.0 | ³ 296 | 100.0 | 100.0 |
| .001 - .100..... | 59 | 39.3 | 73.6 | 142 | 48.0 | 74.4 |
| .101 - .200..... | 56 | 37.3 | 18.8 | 93 | 31.4 | 22.4 |
| .201 - .300..... | 23 | 15.3 | 6.6 | 41 | 13.9 | 2.6 |
| .301 - .400..... | 6 | 4.1 | 0.8 | 11 | 3.7 | 0.2 |
| .401 - .500..... | 2 | 1.3 | 0.1 | 4 | 1.3 | 0.3 |
| More than .500..... | 4 | 2.7 | 0.1 | 5 | 1.7 | (Z) |

Z Less than .05 percent.

¹ Estimates based on a sample of 420,000.

² Includes the codes for "not reported."

³ Excludes code 000 "Accountants and auditors" because of programing error.

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Chapter 11. Puerto Rico

ORGANIZATION

Historical Background

The island of Puerto Rico was ceded to the United States by Spain in 1898 and acquired the status of a commonwealth in July 1952. A special census of Puerto Rico was taken by the War Department in 1899, and Puerto Rico has been included in every decennial census of the United States since 1910. The 1960 Censuses of Population and Housing of the Commonwealth of Puerto Rico were conducted as a joint project of the U.S. Bureau of the Census and the Puerto Rico Planning Board.

Special Agreement With the Commonwealth Government

In October 1958, a special agreement was concluded between the Bureau of the Census and the Commonwealth Government concerning the conduct of censuses in Puerto Rico. The purpose of this agreement was to provide the Commonwealth Government with a larger share of responsibility for the planning and conduct of the various censuses of Puerto Rico, to give full recognition to the special needs of the Commonwealth Government, and to assist in the development of statistical agency personnel in Puerto Rico through training and actual experience in census methods and procedures. This agreement and subsequent amendments included the following provisions: (1) that the 1960 Censuses of Population and Housing of Puerto Rico would be comparable in scope to the censuses of the United States, (2) that a substantial number of the census items would be covered on a sample basis, (3) that the U.S. Bureau of the Census would establish an operations office in Puerto Rico to process the results of the population and housing censuses, (4) that the field staff for the censuses would be recruited primarily from among teachers and administrative staff of the Puerto Rico Department of Education, and (5) that the Puerto Rico Planning Board would act as local representative of the Bureau in the distribution of the census publications.

Organization of the Work

The various phases of the census program were developed by members of the Bureau staff in consultation with representatives of the Puerto Rico Planning Board and other agencies of the Commonwealth Government. Within the Census Bureau, several divisions participated in the program. The Population and Housing Divisions (in cooperation with appropriate representatives of the Commonwealth Government) were responsible for the schedule content, for the development of tabulation specifications, and for the preparation of final reports. The Field Division was responsible for the selection and training of the field staff, and for the collection of the data. The Geography Division was responsible for the preparation of maps; the maps for the enumeration were prepared on a contract basis by the Puerto Rico Planning Board, and the Geography Division reviewed the ED boundaries and the block numbers shown on them.

The maps in the published reports were designed and prepared by the Geography Division. The Decennial Operations Division was responsible for processing the data and posting the results to table worksheets; it established an operations office in Puerto Rico to handle most of the data processing. Coordination of the various phases of the program was the responsibility of the Outlying Areas Branch of the Population Division.

PLANNING THE CENSUS

Census Calendar

Early in 1958, representatives of the Bureau of the Census met with local officials in San Juan to discuss plans for the 1960 censuses of Puerto Rico. After this meeting, a general plan for the censuses was prepared and the principal events in the census program were scheduled as follows:

1958

Development of specifications for the 1960 censuses with Advisory Committees and local officials
Preparation of agreement between Bureau of the Census and the Commonwealth of Puerto Rico regarding conduct of the censuses

1959

Census pretest in Puerto Rico
Drafting final census schedules and forwarding to Government Printing Office
Preparation of instructions and training materials
Reviewing and recording boundaries of barrios (minor civil divisions) and of urban places, and numbering blocks by tracts in the three largest cities
Preparation of enumeration maps for 1960 censuses

1960

Shipment of schedules, instructions, and training materials to San Juan
Organization and training of field staff
Enumeration
Establishment of Decennial Operations Office in San Juan
Recruiting and training of staff for processing operations
Manual processing operations
Punching of cards
Release of preliminary results

1961

Completion of processing operations
Tabulation of 100-percent data
Tabulation of sample data
Preparation of tables for publication
Publication and distribution of final reports

Although it was not possible to adhere exactly to the schedule outlined above, the various steps in the census program were performed essentially as planned. Final population reports on number of inhabitants and on general population characteristics were published in April 1961 and July 1961, respectively. The city block statistics reports for Mayaguez, Ponce, and San Juan were sent to the printer in January 1962. The final population report on general social and economic characteristics was published early in 1962, and the census tract reports for Puerto Rico were published in May and June of 1962. The final population report on detailed characteristics was published late in 1962. Volume I of the final housing census results and the reports on metropolitan housing were published in 1963.

Advisory Committees

To assist with the various aspects of program planning, several advisory committees were appointed in Puerto Rico for the 1960 censuses. These committees were composed of government officials, university staff members, research workers, and representatives of private enterprise. One group worked on the delineation of census tracts for Mayaguez, Ponce, and San Juan. Another group reviewed schedule items and tabulation plans for the demographic and social characteristics of the population. A third group reviewed schedule items and tabulation plans for the economic characteristics of the population. A fourth group studied the proposed schedule items and tabulation plans for the census of housing. In each case, the committee worked directly with members of the census planning staff and frequently submitted detailed recommendations.

Planning the Procedures

Several new procedures were adopted for the 1960 censuses of Puerto Rico. Among these were the introduction of sampling, the use of an Advance Census Report form, and field review of the enumerator's work.

Conventional schedules and standard punchcard tabulating equipment were used in Puerto Rico instead of FOSDIC schedules and electronic computers such as were used in the United States. The system developed for processing the 1960 censuses of Puerto Rico was essentially the same as that utilized for the 1950 censuses, although details of the program differed with respect to content and coverage.

Schedule Content

In recognition of the special needs of Puerto Rico, the questionnaire items used in the United States were modified for the Puerto Rican censuses to provide data of maximum utility for agencies of the Commonwealth Government and other users of census statistics. Insofar as possible, schedule items which were similar for Puerto Rico and the 50 States were phrased in the same manner and covered by the same instructions. Most of the questions were identical, and the resulting data are generally comparable. The principal variations in schedule content and subject treatment for Puerto Rico and the other outlying areas are indicated below.

Schedule design.--In general, the information was to be recorded on the schedules by checking the appropriate category or writing the answer in the space provided.

Since Spanish is the predominant language in the Commonwealth, enumeration schedules and instructional materials used in the 1960 censuses of Puerto Rico were printed in Spanish and English.

100-percent population items.--The 100-percent population items differed from the items used in the United States in the following respects:

1. No question on color or race was asked in Puerto Rico. This item was deleted from the original list of questions in accordance with a recommendation of the Census Advisory Committee in San Juan.

2. The question on place of birth, which was asked only in sample households in the 50 States, was asked of all persons in Puerto Rico. The enumerators were instructed to enter the name of the municipio of Puerto Rico, the State or territory of the United States, or the foreign country of birth. This item was placed on the 100-percent schedules at the request of the Advisory Committee to permit detailed studies of migration after the basic tabulation program for Puerto Rico was completed.

3. The following question on citizenship was asked for the foreign-born population of Puerto Rico:

If born in a foreign country - Is he a citizen of the United States?

Naturalized

Born abroad of American parents .

Alien

4. An additional category on marital status was added to the Puerto Rico schedule because of the frequency with which persons 14 years old and over reported in previous censuses that they were "consensually married." (The category "separated," used in the United States, was used also in Puerto Rico in 1960. This category had not been included in previous censuses of Puerto Rico, and it was believed that some persons who were actually separated were included in the category "consensually married." The proportion reported as consensually married in 1960 was substantially less than in 1950, probably in part as a result of the new classification.)

Sample population items.--One schedule form was used in Puerto Rico to enumerate all sample households. The following population items which were included on the sample household questionnaires for the United States were omitted from the sample household questionnaire for Puerto Rico:

For persons born outside the United States, language spoken in the home before coming to the United States
Country of birth of father
Country of birth of mother
If ever married, whether married more than once
Date of first marriage

The other items were omitted because they were considered to have only marginal value in Puerto Rico.

Two sample population questions which were not included in the census in the United States were added to the sample household questionnaire for Puerto Rico. These were:

Does he know how to read and write?
Does he know how to speak English?

They were considered to be of sufficient interest and value to warrant a substitution of these items for the questions which were omitted from the sample household questionnaire. (In 1950, only 74.5 percent of the population 10 years old and over reported that they were able to read and write, and only 25.9 percent reported that they were able to speak English.)

100-percent housing items.--The 100-percent housing items for Puerto Rico differed somewhat from those for the United States, as a result of recommendations submitted by the Census Advisory Committee in San Juan as well as direct observation and investigation of housing conditions on the island. The principal differences were as follows:

1. Kitchen or cooking equipment. In the United States, the question on kitchen or cooking equipment was to be answered by simply checking "for exclusive use" or "shared or none." In Puerto Rico, the facilities were further described as "inside this structure," "in another structure," or "outdoors."

2. Condition. In the United States, there were three categories for answers to the question on condition: "sound," "deteriorating," and "dilapidated." In Puerto Rico, these three responses were made subcategories of a class described as "adequate original construction," and a category was added for "inadequate original construction."

3. Occupancy. In the United States, each housing unit was to be classed as either "occupied" or "vacant," and vacant units were further classified as "year-round," "migratory worker," or "seasonal." In Puerto Rico no subcategories were provided for vacant units.

4. Number of rooms. In the United States, the question, "How many rooms are in this unit?" was asked for all housing units, and the number of bedrooms was asked only for sample units. In Puerto Rico, the treatment of these questions was reversed. The question, "How many bedrooms are in this unit?" was asked for all housing units and the question on total number of rooms was asked only in sample units.

5. Water supply. In the United States, the question was asked "Is there hot running water for this unit?" and the enumerator was instructed to check one of the following categories:

- Running water in structure:
- Hot and cold
- Cold only
- Running water outside
- No running water

In Puerto Rico, the category for "piped running water outside structure" was further classified as "on property" or "on road or highway."

6. Flush toilet. In the United States, the question on flush toilet provided three response categories: "for exclusive use," "shared," and "other or none." In addition to this classification, toilet facilities in Puerto Rico were classified as "inside structure," "outside structure," or "privy."

7. Vacancy status. In Puerto Rico, vacant units were reported as "for rent," "for sale only," "held for occasional use," or "other vacant." In the United States, an additional category was provided, "rented or sold, not occupied."

In Puerto Rico, as in the United States, additional questions were asked for 100 percent of the housing units in cities for which statistics by block were to be published. These questions, covering description of property, value, and rent, were identical for Puerto Rico and the United States with the following exception: The value categories for Puerto Rico ranged from "under \$500" to "\$20,000 or more"; in the United States, the value categories ranged from "under \$5,000" to "\$35,000 or over."

Sample housing items.--All sample housing units in Puerto Rico were enumerated on one schedule form to provide a 25-percent sample, whereas in the United States, two different schedules were used for block areas and nonblock areas and each had two variations providing a 20-percent sample for some housing items, a 5-percent sample for other housing items, and a 25-percent sample for housing items included on both forms. The following housing items which were asked for sample housing units in the United States were not included on the sample schedule for Puerto Rico:

- Whether home was on a city lot, on a place of less than 10 acres, or on a place of 10 or more acres
- Value of sales of farm products
- Year built
- How heated
- Clothes dryer
- Air-conditioning
- Home food freezer
- Number of bathrooms
- Whether building had 3 stories or less, or 4 stories or more (and, in latter case, whether it had an elevator)
- Telephone
- Trailer
- Duration of vacancy
- Whether rent included any land used for farming or ranching

Several housing items were asked for sample housing units in Puerto Rico which were not included on any of the schedules used in the United States. Statistics on these subjects were considered to be especially useful in describing housing facilities and tenure in Puerto Rico. The following questions which were not asked in the United States were included in the schedule for sample units in Puerto Rico:

- Type of construction -
- Masonry walls (poured concrete, concrete blocks, stone, hollow tile, etc.):
- With concrete slab roof
- With wood frame roof
- Wood frame walls:
- With masonry foundation (poured concrete, concrete blocks, concrete posts, stone, etc.)
- With wood post foundation
- Other construction
- Electric lighting - Does this unit have electric lighting?
- Yes
- No
- Refrigerator - Is there a refrigerator in this unit?
- Electric or gas
- Ice
- No refrigerator

Land tenure - Does the owner also own the land or does he rent the land?

Owns or is buying land

Rents land.

No cash rent paid for use of land.

If response to item above was "Rents land"--What is the monthly rent for land? \$ _____
(Nearest dollar)

Mortgage status - Is there a mortgage on this property?

Yes

No.

In addition to the variations in schedule content indicated above, a number of questions asked for sample housing units in Puerto Rico differed in scope or in the response categories provided for the corresponding questions in the United States. The principal differences of this nature are indicated below:

1. In the United States the question of fuel included three parts: What fuel is used most for --

- a. Heating this unit?
- b. Cooking?
- c. Heating water?

In Puerto Rico, the corresponding question was limited to cooking fuel.

2. The question on clothes washing machine on the U.S. schedules called for type of machine, while the corresponding question for Puerto Rico required a "Yes - No" answer.

3. The U.S. schedules asked for the source of water and provided three response categories: "public system (or private company)," "individual well," and "other." The corresponding question on the Puerto Rico schedule provided five response categories: "public water system," "private well," "cistern," "irrigation canal," and "spring or other."

4. The question regarding automobiles on the Puerto Rico schedule provided three response categories: "one," "two or more," and "no automobile." The corresponding question on the U.S. questionnaire had four response categories: "no auto," "1," "2," and "3 or more."

Tabulation Plans

The tabulation program for Puerto Rico was designed to provide data as nearly comparable as possible to the statistics published for the 50 States.

Early in 1960 a set of table outlines was prepared, reflecting the availability of data, the special needs of Puerto Rico, and the desirability of maintaining comparability with reports for the States in the United States. The table outlines were reviewed by the various advisory committees and interested individuals in Puerto Rico. The resulting tables are comparable to those for a State, although the method of processing the data for Puerto Rico imposed certain limitations on the tabulation program.

Census Pretest

A census pretest covering parts of Aguas Buenas, Carolina, Cayey, and San Juan municipios was conducted

in Puerto Rico in April 1959. The purpose was to test the proposed schedule design, the use of the Advance Census Report form, the method of selecting the sample, and tabulation procedures. Time did not permit more than a hand tabulation of the results, but the experience with the schedule format and the Advance Census Report led to important decisions regarding the 1960 program.

The pretest demonstrated that the sampling plan developed for the United States could be applied equally well in Puerto Rico. This plan required the enumerator first to list each housing unit in the order of visitation, and then to designate every fourth housing unit as a sample unit. Since different schedules were used in Puerto Rico for sample households and nonsample households, it was necessary to determine whether a given unit was in the sample before starting the interview.

It was found that the Advance Census Report forms were especially useful in urban areas, but less effective in rural areas where illiteracy rates were relatively high. Of approximately 3,300 Advance Census Report forms distributed in the pretest, slightly over 1,000 were filled by the householder before the enumeration. In many cases where the Advance Census Report was not filled, however, the householder had looked at the questions and was prepared to give the enumerator the answers.

PREPARATORY WORK

Map Preparation

Before the enumeration, maps were prepared showing the area to be covered by each enumerator, crew leader, and supervisor. Early in 1959, a contract providing for the collection of map data for Puerto Rico and the preparation of a set of enumeration maps was executed between the Puerto Rico Planning Board and the U.S. Bureau of the Census. At a cost of \$30,000, the Planning Board agreed to prepare and deliver to the Bureau of the Census the following:

1. Office maps (1 set)
2. Supervisors' maps (2 sets)
3. Enumerators' maps (1 set)
4. Listings of ED's, for control purposes
5. Other required listings and reports

Instructions were supplied by the Bureau. The last of the enumerators' maps was delivered to the Census Office in San Juan the last week in March 1960.

There were 2,967 enumeration districts (ED's) defined and delimited for the 1960 censuses of Puerto Rico.

Census tracts were established in Puerto Rico for the first time for the 1960 censuses. The tracted areas included the three SMSA's (Mayaguez, Ponce, and San Juan) plus Carolina municipio which is adjacent to the San Juan area. In all, there were 203 census tracts for Puerto Rico.

The three principal cities (Mayaguez, Ponce, and San Juan) were also included in the block statistics program for 1960. This required that each of the approximately 3,930 blocks in these cities be numbered and separately identified on the enumerator's map.

Urbanized areas were also recognized in 1960 for the first time in Puerto Rico. In order to provide a better separation of the urban and rural population, arrangements were made to include, within the urbanized area outside urban places, selected ED's which met specified criteria relative to population density in 1960. According to this classification, approximately 89,000

persons were included in the urban population who otherwise would have been classified with the rural population.

In Arecibo municipio, a special problem arose when the city annexed parts of four rural barrios just before the census. Meeting on the evening of March 31, 1960, the city officials voted to annex parts of Cambalache, Hato Abajo, Islote, and Tanama barrios. In the case of Hato Abajo, Islote, and Tanama barrios, the annexed area could be defined in terms of complete ED's. In Cambalache, however, the new urban limits cut through ED's and the population in the annexed area had to be estimated for the published population totals for the city of Arecibo; only two ED's and a small number of housing units were involved in the estimate.

Instructions and Training Materials

As soon as the schedule content was agreed upon, work was started on the preparation of the various instruction manuals and training materials for Puerto Rico. The basic document for the instruction and training of the field staff was the Enumerator's Reference Manual, which set forth the enumerator's duties and responsibilities, and contained technical instructions for each item on the schedule. Enumerators were required to carry their manuals with them during the performance of their duties and to refer to the instructions whenever questions arose in the field.

Other instructions and training materials included the Enumerator's Workbook, the Crew Leader's Manual and Crew Leader's Guide for Training Enumerators, the District Office Manual, the Technical Officer's Guide for Preparatory Training, a series of eight training films, "field employee selection aid tests," and other miscellaneous materials. Since the language of enumeration was Spanish, all of these materials were prepared in Spanish as well as English. To assist with the preparation of these materials, the Puerto Rico Planning Board detailed two members of its staff to the Census Bureau in Washington for approximately 3 months. Wherever possible, the standard U.S. instructions and training materials were adapted for use in Puerto Rico. However, many of the U.S. materials were unsuited to Puerto Rico or were not available in time to be translated and adapted for use in Puerto Rico.

Other Preparatory Work

A field organization plan was developed, field staff was recruited and trained, arrangements were made for printing the various forms, space and equipment for the field headquarters were located, and public information materials on the census were prepared and distributed. All of these activities were carried out during the early part of 1960.

To aid in the enumeration of group quarters, a list of all institutions and of certain other types of group quarters was prepared in advance of the censuses. For the enumeration, large institutions and group quarters were designated as separate ED's and assigned to special enumerators.

THE ENUMERATION

Sample Selection

As in the United States, only a small number of population and housing characteristics were enumerated on a complete-count basis and information on the re-

maining items was collected on a sample basis. This was the first time sampling was used in taking the decennial censuses in Puerto Rico. Following the same procedure established for the United States, every fourth housing unit was selected for the sample. The enumerator assigned a "sample key" letter (A, B, C, or D) to each housing unit sequentially in the order in which he first visited the address, whether or not he completed an interview. Each enumerator was given a random key letter to start his assignment, and the order of canvassing was indicated in advance, although the instructions allowed some latitude in the order of visiting addresses. Each housing unit which was assigned the key letter "A" was designated as a sample unit and all persons enumerated in the unit were included in the sample. In group quarters, the sample consisted of every fourth person in the order listed.

Enumeration Forms

Three principal forms were used to record information for population and housing units in the 1960 censuses of Puerto Rico. Form 60PH-1PR, used in all areas except the three largest cities--San Juan, Ponce, and Mayaguez--and form 60PH-2PR, used in those cities, were short household schedules containing the questions asked on a 100-percent basis. These two forms were identical except that form 60PH-2PR included three additional items, on description of property, value, and rent, which were asked on a 100-percent basis in the three largest cities. One or the other of these two short forms containing only the 100-percent items was used for the enumeration of three out of every four, or 75 percent, of the households and housing units in each ED.

Form 60PH-3PR was used for the 25-percent sample households and housing units throughout the island. This form contained the population and housing questions asked on a 100-percent basis as well as the sample questions which were to be asked for every fourth household and every fourth person in group quarters.

In addition to the three forms described above, a number of supplementary forms were used. These included the Advance Census Reports (forms 60PH-5PR and 60PH-6PR), the Individual Census Report (form 60PH-10PR), the Report for Military and Maritime Personnel (form 60PH-13), and the "Were You Counted?" questionnaire (form 60PH-16PR). The use of the Advance Census Report forms (60PH-6PR for San Juan, Ponce, and Mayaguez and 60PH-5PR for the balance of Puerto Rico) is described below. The remaining supplementary forms were used in special situations where it was not feasible to enumerate directly on the regular census schedule. Before the schedules were released to the Operations Office, however, the information on these supplementary forms was transcribed to the three regular census schedules. Crews of vessels were allocated to the ED's where their ships were berthed at the time of the census.

Advance Census Reports

The Advance Census Report form, which was used for the first time in 1960, provided for self-enumeration of the 100-percent population and housing items by members of the households. A few days before the census date, copies of the Advance Census Report were mailed to all households on postal delivery routes. The instructions on the form requested the householder to answer all of the questions for each member of the household and to have the form ready when the enumerator called. During his visit to the household, the enumerator reviewed the entries on the Advance Census Report with the respondent and then transcribed the information to

the census schedule. If the Advance Census Report was not filled, or if there were omissions or inconsistencies in the data reported, the enumerator asked the necessary questions and recorded the information directly on the schedule. For vacant housing units, the enumerator was instructed to obtain the information from the owner, the landlord, or a neighbor.

Field Organization

To collect the desired information for the 2,349,544 persons and 520,990 housing units in Puerto Rico required a temporary field staff of approximately 3,300. This included the Area Supervisor, who was detailed from Bureau headquarters in Washington, and his immediate staff consisting of two inspectors, an administrative assistant, a supply clerk and a secretary; six district supervisors; six technical officers; 210 crew leaders; 204 field reviewers; 24 office clerks; and 2,865 enumerators.

The Area Supervisor was responsible for recruitment and training of the field staff, obtaining space and equipment for the field offices, distributing supplies, supervising the collection of data, and preparing periodic reports on the progress of the enumeration. The six district supervisors were generally responsible for administering the census program within their assigned areas, while the technical officers were responsible for training crew leaders, handling technical problems, and supervising the field reviewers. The 2,865 enumerators were trained and supervised by the crew leaders, who reported directly to the district supervisors.

Under the terms of the special agreement between the U.S. Bureau of the Census and the Puerto Rico Planning Board, arrangements were made with the Department of Education to use school teachers and administrative staff of the Department as enumerators, crew leaders, and district supervisors. All candidates were given one of two selection aid tests prepared in the Bureau to determine eligibility for appointment. The use of school teachers and administrative staff of the Department of Education had the special advantage of providing the census with a well-qualified and well-organized field staff, including supervisory personnel, for the enumeration. Teachers often worked as enumerators under supervisors and crew leaders who were their own superintendents or principals. This fact greatly facilitated the training and increased the effectiveness of the field supervision. The arrangement with the Department of Education also included space in the school buildings for training and general administrative headquarters.

Field Review

One new feature of the 1960 censuses was a systematic field review conducted by a specially trained staff member at regular intervals during the course of the enumeration. The purpose of the field review was to verify the completeness of the enumeration, to discover any errors which had been made, and to see that errors were corrected.

In order to verify the completeness of the enumeration, the crew leader, before the enumeration, visited each ED under his supervision and made a partial pre-listing of addresses. This list was given to the field reviewer, who compared it with the addresses entered in the enumerator's listing book. In this way, it was possible to determine on a sample basis whether the enumerator was covering all housing units.

The field reviewer also checked the enumerator's work for accuracy, completeness, and consistency, and

to determine whether the enumerator was following his instructions properly for the selection of sample units and for handling callbacks.

Callbacks

When the enumerator found no one at home at the time of his first visit, he was to enter the following information in his listing book: address, name of head of household (obtained from neighbors or from letter boxes), sample key letter, housing unit number, and best time to call back. He was also instructed to reserve a blank schedule in his enumeration book for each unit at which he found no one at home, and to leave under the door a "Notice of Census Taker's Call" specifying the date and time of his next call. To avoid accumulating callbacks, the enumerator was advised to make his callback as soon as possible after the original visit and to have not more than 15 callbacks outstanding at the end of any workday.

Timing of the Enumeration

The enumeration began as scheduled on April 1, 1960. Previous to that date, the enumerators had completed an intensive training program, including practice exercises and household interviews. By the end of April the enumeration was 97 percent complete, and by the end of May only a few special cases remained to be completed.

The taking of the census coincided generally with the Easter vacation schedule. Normally, the schools in Puerto Rico are closed during the week preceding Easter. In 1960, Easter came on April 17 and, therefore, the regular vacation extended from April 9 to April 17. In order to meet the census schedule, teachers who served as census enumerators were released from classroom duties on April 1, eight days in advance of the regular vacation date. This enabled most of the enumerators to complete their assignments before the end of the vacation period and to return to their classes on April 18.

Special Problem with Block Numbers

One problem which required special attention was the confusion in the assignment of block numbers in the three largest cities--San Juan, Ponce, and Mayaguez. When the enumerators' map copies were reproduced from the master copy, some of the block numbers failed to print, and many of the enumerators had to improvise their own block numbering systems. As a result, there were duplicate block numbers in several areas, and the numbers on the schedules had to be corrected before the identification codes could be punched in the cards. The correction was made by comparing the enumerators' map copies with the master copies and substituting the numbers shown on the latter for the numbers entered on the schedules by the enumerators. This correction was handled by several staff members from the Bureau of the Census and a group of specially trained clerks.

PROCESSING THE DATA

General

After the entries on the schedules were inspected for completeness in the field office, they were transferred to the Decennial Operations Office in San Juan for processing.

The processing of the 1960 population and housing censuses for Puerto Rico included the following principal steps:

1. Receipt and check-in of enumerations schedules
2. "General" coding and verification
3. Occupation and industry coding and verification
4. Card punching and verification
5. Mechanical editing of punched cards
6. Ratio estimation
7. Tabulation
8. Result work: balancing of machine runs, posting, and computation of data

The Decennial Operations Office in San Juan was opened in April 1960 and closed in September 1961. Employment varied from 30 to 87 persons during the period of data-processing activity. Recruiting and appointment of personnel to positions in the Puerto Rico Office were carried out in accordance with regular Civil Service Commission competitive standards. All persons hired were given temporary appointments for a period not to exceed 1 year. The average length of employment was about 9 months. An experienced statistician and a machine tabulation supervisor were detailed from the Bureau of the Census in Washington to serve as Chief of the Operations Office and Chief of the Machine Tabulation Section, respectively. With the exception of these two persons, all other positions in the Operations Office were filled by locally recruited personnel. At various times, as special needs developed, specialists from Washington were sent to Puerto Rico to handle specific problem areas.

The Bureau rented the following equipment from International Business Machines Corporation for the Puerto Rico Operations Office:

| <u>Equipment</u> | <u>Quantity</u> |
|--|-----------------|
| Numerical Punch No. 024 | 20 |
| Punch Card Verifier No. 056 | 15 |
| Sorter No. 083 | 2 |
| Collator No. 077 | 1 |
| Electronic Statistical Machine No. 101 | 4 |
| Duplicating Summary Punch No. 524 | 2 |
| Alphabetic Accounting Machine No. 402 | 1 |

Receipt and Check-In of Enumeration Books

Prior to the enumeration, Minor Civil Division (MCD) Sheets were prepared which listed the ED's within individual areas (city, town, village, or barrio) in Puerto Rico. The MCD Sheets were used by the field offices to insure that each of the ED's was enumerated and that the basic enumeration book and sample enumeration schedules for each ED were submitted to the Operations Office.

The receipt and check-in operation involved comparing and reconciling any differences between the field office copy of the MCD Sheets and the original MCD Sheets, and checking in each enumeration book by verifying municipio and ED numbers on the enumeration book labels against those on the MCD Sheets.

Coding

After the enumeration books had been checked in, the data were coded. Coding involved preparation of entries on a schedule for transfer to a punchcard. Many codes could be punched directly from the schedule entries. Other codes were entered on the schedules by coders prior to punching.

General coding.--The general coders entered all required codes except those for occupation and industry (which were coded separately as described below) and also examined for completeness certain items which had been precoded by the enumerator. The following items were coded or examined by the general coders:

100-PERCENT ENUMERATION SCHEDULES

- Items coded:
 Relationship to head of household
 Place of birth
- Items examined:
 Marital status

SAMPLE ENUMERATION SCHEDULES

- Items coded:
 Relationship to head of household
 Marital status
 Place of birth
 Migration
 Place of employment
 Individual and family income from various sources
 Gross rent
- Items examined:
 Birth date relative to April 1946
 Date last worked
 Monthly rent for land
 Rent
 Monthly utility costs

In addition, group quarters were coded to differentiate between institutions, i.e., jails, mental hospitals, etc., and noninstitutions such as boarding houses, military installations, etc.

The coders used a manual, General Coding Instructions, which gave the codes in full detail, and a summary Code Card which listed the most commonly used codes.

General coding was checked by a system of quality control. The work of each coder was completely verified at first, and records were kept on his work. Coders who reached a specified level of accuracy were designated "qualified coders," and thereafter only a certain percentage of their work was verified.

Verification of the coding was also checked. The method used (following the pattern used in quality control of the 1950 U.S. censuses) was to make a note of coding errors before the portfolio of enumeration books went to the verifier; after the verifier completed his work, the errors he listed were compared with those previously noted.

General coding began June 1, 1960, and lasted 18 weeks. The coders processed the schedules at an average rate of 1,900 lines (persons enumerated) per man-day.

Industry and occupation coding.--Questions on industry, occupation, and class or worker were asked for persons 14 years old and over in every sample household enumerated in Puerto Rico, as in the United States. The industry and occupation coding clerks coded responses on industry, occupation, and class of worker and also entered codes for persons serving in the Armed Forces. The coders used a manual, Industry and Occupation Coding Instructions, which gave detailed instructions, an Alphabetical Index of Occupations and Industries, and "Company Name Lists" (one for each of the three SMSA's and one covering the remaining territory in Puerto Rico) to determine the codes for the schedule entries. The verification procedure used was basically the same as that for general coding.

Industry and occupation coding started in mid-June 1960 and proceeded at an average rate of 1,600 sample persons per man-day. This operation took 14 weeks to complete.

Card Punching

After the schedules were coded, information was transferred to punchcards. A card was prepared for each person and for each housing unit. Each column on a card represented a characteristic of that person or housing unit. For example, column 23 on the Complete-Count Population Card was for the sex of the person enumerated. On the card for a male, a hole was punched in the space allotted to "1," the code for "male." When such a card was tabulated, one male was counted.

Four separate punching operations were involved, consisting of:

1. Approximately 1,735,000 Complete-Count Population Cards, each requiring 39 columns of punching
2. Approximately 620,000 Sample Population Cards, each requiring 79 columns of punching
3. Approximately 398,000 Complete-Count Housing Cards, each requiring 40 columns of punching
4. Approximately 135,000 Sample Housing Cards, each requiring 72 columns of punching

The punchcard operators began work on the Complete-Count Population Cards in mid-June 1960 and completed this operation by October 1, 1960. The Complete-Count Housing Card punching operation started a week later and was completed by October 28, 1960. Punching for the sample data began the second week in July 1960 and was completed January 26, 1961. The entire card-punching operation required a total of 3,288 man-days of labor and cost \$32,566.

The punching was verified by a system of quality control. Initially, each punchcard operator's work was completely verified. When he met certain minimum standards of efficiency, he became a "qualified puncher," and thereafter, only a small percentage of his work was verified.

Mechanical Editing

Mechanical editing involved inspection of the punchcards by machine to detect errors in punching, coding, or enumeration. The machines made three types of checks: (1) checks for impossible codes, (2) checks for inconsistent code combinations, and (3) checks of quantitative data for relationships, magnitudes, and arithmetic.

For example, only two entries in the column for "electric lighting" had meaning--a "1" if the housing unit had electric lighting, and a "2" if it did not; any other numbers punched in that column were impossible codes, and the cards having them were withdrawn and corrected.

Mechanical editing greatly simplified examination for errors. For most of the card types, unusual or inconsistent reports could be detected in one run through the 101 Electronic Statistical Machine, and the cards removed for investigation.

The selected cards were machine-listed, and the listed items were examined for possible errors. Other items on the card sometimes explained the entry or indicated the correct one. If they did not, the enumeration book was examined. If changes were necessary,

new cards were punched. If no change was necessary, an explanation was entered on the listing sheet. Then, if the figures were questioned in the critical examination of the tabulations, the listing sheets usually provided the explanation.

Inflating the Sample: Ratio Estimates

The selection during enumeration of every fourth housing unit and its occupants for the sample, after a random start in each ED, resulted in collection of sample data for approximately 26.4 percent of the total population and 25.7 percent of the housing units in Puerto Rico.

The procedure established for inflation of the sample required specified counts for population and for housing from both the 100-percent and the sample punchcards. For this purpose, the cards containing only items collected on a 100-percent basis (representing approximately 75 percent of the population and housing units) were grouped into weighting areas, by municipio and city (selected larger cities) and, in the three largest cities (e.g., San Juan, Mayaguez, and Ponce), by groups of barrio.

For each weighting area, the cards were sorted and counts were obtained for each of the following classifications:

Male:

- Heads of households
- Other members, 14 years old and over
- Other members, under 14 years old

Female:

- Heads of households
- Other members, 14 years old and over
- Other members, under 14 years old

Housing units:

- Owner occupied
- Renter occupied
- Vacant

While these operations were being carried out, a similar series of operations was being performed on the punchcards containing both 100-percent and sample items for the 25-percent sample of population and housing units. First, complete clerical editing, coding, and verification operations were performed, then card punching and verification, followed by a mechanical edit covering the same items as in the corresponding edit of the basic cards.

The cards for the sample were grouped into weighting areas, and the cards were sorted into, and counts obtained for, the identical classification established for the basic cards. For each weighting area, the counts obtained were posted on a "Ratio Estimate Control Record."

For each weighting area--municipio, or group of barrios and subbarrios--the total card count for each of the ratio-estimation groups was required to be at least 50. If it was not, the ratio-estimation groups were compressed in a specified order until each remaining group contained 50 or more cards.

The 100-percent data for each weighting area were checked for consistency between the number of heads of households and the number of occupied housing units. The number of occupied housing units was adjusted to agree with the total count of cards for heads of households.

Within each ratio-estimation group, the sample cards were adjusted by duplication or elimination so that the sample cards were one-fourth of the complete count. Thus the sample could be tabulated with a constant weight of 4. In this processing, no sample card was duplicated more than 4 times (i.e., the greatest weight for a card originally in the sample could not exceed 16). The file of cards for persons and housing units that were not in the sample was adjusted so that the adjusted numbers were three-fourths of the complete count. The total counts of population and housing units as obtained from the sample cards thus agreed with the total count of population and housing units obtained from all cards for each weighting area.

It was necessary to provide the sample with a uniform integral weight--in this case 4--in order to permit the cards to be tabulated on the IBM 101 (unit count) equipment. The machine then would count each card once, but the resultant tabulations could be clerically multiplied by 4 to obtain the inflated sample results.

Individual tracts, places of 2,500 to 10,000 inhabitants, and the rural balances of municipios were not weighting areas, therefore population and housing-unit estimates derived from the sample differed from the complete-count data for some tracts, small urban places, and rural balances of municipios.

An additional level of ratio estimation was carried out for some statistics published for Puerto Rico, when the class in question formed part of a larger group for which both a sample estimate and a complete count were available. The improved estimate was made by multiplying a proportion based on the sample data by the figure which represented the complete count of the base of the proportion. The improvement was more important when the characteristic being estimated was a substantial part of the larger group; when the proportion was small, the improvement was relatively minor. Each published report describes the particular tables affected.

Tabulating

The data collected by the enumerators reached the tabulating process in the form of punchcards. The tabulating machine counted the number of entries in each classification and printed the results.

The subject specialists put the general requirements into the form of table outlines which were translated by the machine specialists into tabulation specifications. The specifications indicated how the cards should be grouped and how the control panels on the machines should be wired to provide the data for the proposed publications.

The more than 3,000,000 cards punched from the enumeration schedules were sorted mechanically into the groups for which totals were needed. The cards for each municipio were tabulated as a work unit, and each tabulation sheet carried separate totals for each group into which the cards had been sorted. Totals for the municipio were obtained by adding the printed totals for each barrio, sub-barrio, city, etc. The figures on the tabulation sheets were critically examined by the subject specialists before they were transferred to final publication tables.

All tabulation work for the censuses of population and housing of Puerto Rico was completed in the Puerto Rico Operations Office except the series PC (1)-53D population report on detailed characteristics and the series HC (2) reports on metropolitan housing. These two reports were tabulated in Washington on Bureau of

the Census equipment--simultaneously with the tabulation of the other reports in Puerto Rico--in order to make these data available at the earliest possible date.

Preparation of Tables

To transform the figures on the tabulation sheets into tables for the final published reports, four steps were required before printing:

1. Tabulations were reviewed to detect possible machine failure and also errors in enumeration, editing, coding, and punching.
2. Final tables were prepared on worksheets.
3. A machine check was made, when the tables were in final form, to locate arithmetic errors in the original figures and also typing or type-setting errors.
4. Related figures on the tables were checked to see if they were consistent, and the 1960 data were compared with those for 1950.

The table preparation which was carried out in Puerto Rico produced the tables for the reports tabulated in Puerto Rico. Table preparation for population series PC(1)-D and housing series HC(2), which were tabulated in Washington, was carried out in Jeffersonville.

PUBLICATION PROGRAM

Unlike the U.S. reports, which were prepared by utilizing preprinted texts and tables printed directly from the computer tapes by electronic high-speed printers and then reproduced, the reports for Puerto Rico were typed by hand. The final reports were published in both Spanish and English.

Preparation of Final Reports

After the tabulated data were posted to the table worksheets and the various measures (percentages, medians, and rates) were computed, the work sheets were forwarded to Washington for review and typing. The final reports were prepared in several steps as follows:

1. Preparation of first draft of text in English
2. Review of posted tables for internal consistency and general acceptability
3. Preparation of final text and translation into Spanish
4. Typing of text and tables for reproduction
5. Machine check of tables
6. Review of tables by subject specialists
7. Final correction of tables
8. Paging, addition of running titles, final correction of text, etc.
9. Printing

The time required for preparing the final reports for printing after the posted tables were received from the Operations Office was originally estimated at 5 to 6 weeks, depending on the size of the report. In practice, however, it was necessary to correct inconsistencies among tables and occasionally to retabulate the cards. In the PC(1)-53C report on general social and economic characteristics, for example, preliminary tabulations of the employment data for Puerto Rico resulted in labor force participation rates which were lower than expected. The census schedules were examined, and it was found that many families were reported with no member in the current labor force but with earnings in 1959. Apparently the various labor force concepts had been

misinterpreted, and many persons who were reported as "not in the labor force" should have been classified as "with a job but not at work" or "unemployed." The misinterpretation seemed most obvious in the case of school employees, agricultural workers, and self-employed workers. It was decided that the labor force situation would be described more accurately if an adjustment were made to compensate for the error. Accordingly, on the basis of an analysis of related schedule entries, some 18,000 males originally classified as "not in the labor force" were reclassified as "with a job but not at work" and approximately 7,000 males originally classified as "not in the labor force" were reclassified as "unemployed."

Published Reports

The results of the population and housing censuses for Puerto Rico were published in the following reports:

- 1960 Census of Population:
 PC(1)-53A, Number of Inhabitants
 PC(1)-53B, General Population Characteristics
 PC(1)-53C, General Social and Economic Characteristics
 PC(1)-53D, Detailed Characteristics

1960 Census of Housing:

- HC(1)-53, States and Small Areas
 HC(2)-201, Metropolitan Housing, Ponce; and
 HC(2)-202, Metropolitan Housing, San Juan
 HC(3)-419-421, City Blocks

1960 Censuses of Population and Housing:

- Census Tract Reports--PHC(1)-178, Mayaguez;
 PHC(1)-179, Ponce; PHC(1)-180, San Juan

Availability of Unpublished Data

Most of the data tabulated for Puerto Rico were to be included in the publications listed above. For some items, however, the data were tabulated in somewhat greater detail than will be shown in the published reports. Unpublished but tabulated data are available to interested persons and agencies for the cost of reproducing the desired information. If special tabulations of the punchcards or schedules are desired, these may be undertaken by the Bureau on a reimbursable basis.¹

¹ Further information regarding the availability of unpublished data may be obtained by writing to the Director of the Bureau of the Census in Washington.

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 Reel 1. Puerto Rico, 1960 Censuses of Population and Housing: Forms and Instructions (Part 1). One reel of microfilm, 981 frames.
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 Vol. VI, Administrative Procedures--Puerto Rico Decennial Operations Office. 1960. 18 pp., and 2 pamphlets in back pocket: (1) "Information for Supervisors About Position Classification"; and (2) "Timekeeping Procedures, Jeffersonville Processing Office."
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Chapter 12. American Samoa, Canal Zone, Guam, Virgin Islands, and Other Outlying Areas

This chapter relates primarily to the censuses of American Samoa, Guam, the Virgin Islands, and the Canal Zone. The censuses of Midway, Wake, Canton and Enderbury Islands, Johnston Island and Sand Island, the Swan Islands, the Corn Islands, and the Trust Territory of the Pacific Islands are also discussed briefly here. The census of the Commonwealth of Puerto Rico is covered in chapter 11.

ORGANIZATION

Legal Authority

Title 13 of the U.S. Code, which was the legal authority for the 1960 censuses, states that the censuses of population shall include "each State, the District of Columbia, Alaska, Hawaii, the Virgin Islands, Guam, and the Commonwealth of Puerto Rico, and, as may be determined by the Secretary [of Commerce], such other possessions and areas over which the United States exercises jurisdiction, control, or sovereignty." The Census Act further specifies that the inclusion of these "other possessions and areas" shall be subject to the concurrence of the Secretary of State. Accordingly, discussions were held early in 1958 with representatives of the Department of State, and it was agreed to include in the 1960 censuses all of the areas mentioned in the preceding paragraph. Other areas which come under the jurisdiction of the United States were to be listed in the census reports even if they were not inhabited at the time of the census.

Special Arrangements

For American Samoa, Guam, the Virgin Islands, and the Canal Zone, contracts were negotiated with the respective Governors to collect the desired information. The Bureau of the Census agreed to furnish the schedules, instructions, maps, training materials, and other census materials. The Governor of each area, or his designated assistant, was to recruit and train his own staff, handle appointments and payrolls, arrange for space and equipment, and submit regular reports on the progress of the enumeration.

For Wake Island, and for Canton and Enderbury Islands, arrangements were made with officials of the Federal Aviation Agency stationed on the islands to conduct a census of their respective areas as of April 1. The Island Manager of Wake Island was appointed as a Special Agent of the Bureau of the Census to enumerate the population, and the Island Manager of Canton Island was appointed as a Special Agent to enumerate the population of Canton and Enderbury Islands. The population of the Midway, Johnston, and Sand Islands was enumerated by the Department of Defense. The population of the Swan Islands was enumerated by the Coast and Geodetic Survey.

A census of the Trust Territory of the Pacific Islands was conducted by the High Commissioner in 1958.¹ The results of this census were tabulated by the Bureau of the Census and included in the published figure for the aggregate population of the United States for 1960.

For the Corn Islands, which the United States holds on a 99-year lease from the Republic of Nicaragua, an estimate of the population was obtained from the Government of Nicaragua and this figure (1,872) was also included in the aggregate total for the United States.

Scope of the Census Program

The census program for the outlying areas varied in accordance with the character and requirements of each area. In Guam and the Virgin Islands, the census program included population, housing, and agriculture; in American Samoa, the census covered only population and agriculture; and in the Canal Zone the census was limited to population.

For Midway, Wake, Canton and Enderbury Islands, Johnston Island and Sand Island, and the Swan Islands, the population was enumerated on Overseas Census Report forms (60PH-15). Only complete-count data on age, sex, color or race, and marital status were tabulated for these areas.

PREPARATION FOR THE CENSUSES

Schedule Content

The first step in preparation for the population and housing censuses was the determination of the schedule content and design. In order to simplify the processing operations, it was agreed to use a standard household schedule for American Samoa, Guam, the Virgin Islands, and the Canal Zone. Furthermore, because of the relatively small populations in these areas, it was agreed that all questions should be asked on a complete-count basis.

The schedules were designed for tabulation on punch-cards rather than by the FOSDIC-computer method. In general, the information was recorded on these schedules by checking the appropriate category or writing the answer in the space provided.

Drafts of the proposed schedules were prepared and submitted to the Governors of each of the four areas for review and comment. The schedules, as finally printed, contained 22 population items and, for Guam and the Virgin Islands, 21 housing items.

¹Pacific Islands (Trust Territory), High Commissioner, Census Report, 1958, Agana, 1959, 39 pp.

The population items were identical for the four areas except for minor variations in the response categories for the questions on race and country of birth, which were adapted to the particular area, and, in the case of the Virgin Islands, the addition of the category "consensually married" to the question on marital status. The concepts, definitions, instructions to enumerators, editing and coding procedures, and tabulation specifications for the population items in the outlying areas were essentially the same as in the United States.

The following population items were included on the schedules:

1. Name of person
2. Relationship to head of household
3. Sex
4. Color or race
5. Month and year of birth
6. Marital status
7. For ever-married women, number of babies ever born
8. Place of birth
9. Highest grade of school attended
10. Whether person completed the highest grade of school attended
11. For persons born after March 1925, attendance at school since February 1, 1960
12. Whether born before April 1946
13. Whether worked in preceding week
14. If "yes" to number 13, number of hours worked
15. If "no" to number 13, whether looking for work or on layoff from a job
16. If "no" to number 15, whether person currently had a job at which he usually worked
17. If "no" to number 16, year last worked
18. For persons who worked in 1950 or after, industry, occupation, and class of worker

For persons who worked in 1959, questions 19-21:

19. Number of weeks worked
20. Earnings in wages or salary
21. Earnings from self-employment
22. For all persons, income other than earnings in wages or salary or from self-employment

The housing items for the two areas included in the housing census--Guam and the Virgin Islands--were selected to meet local interests and requirements. For this reason, the schedule for the Virgin Islands included such additional items as electric lighting, potable water, and type of refrigerator; while the schedule for Guam included such items as type of construction, cooking fuel, and clothes washing machine. In general, individual housing items for the outlying areas were treated in the same manner as the corresponding items for the United States.

The following housing items were included on the schedules:

IN BOTH GUAM AND THE VIRGIN ISLANDS--

- Whether a housing unit or group quarters
- Number of units in structure
- Number of rooms in unit
- Type of water supply
- Toilet facilities
- Whether toilet was shared or for exclusive use
- Bathub or shower in the unit
- Occupancy
- Tenancy
- If owner-occupied, whether one unit with no business, one unit with business, or two or more units

If owner-occupied one unit with no business:

- Value of property
- Whether land was owned or rented
- Amount of rent for land, if rented

If rented:

- Amount of monthly rent for unit
- Whether utilities were included in rent, and, if not, average monthly cost of each

IN GUAM ONLY--

- Type of construction
- Number of bedrooms
- Whether anyone living in unit operated a farm
- Electric refrigerator
- Type of fuel used for cooking
- Clothes washing machine

IN THE VIRGIN ISLANDS ONLY--

- Kitchen or cooking equipment
- Access to unit
- Salt water or potable water used for flush toilet
- Whether house was on a farm
- Electric lighting
- Refrigerator

Map Preparation

Enumeration maps for each of the four areas were prepared by the Bureau of the Census from information furnished by the Governor's office. A separate map was prepared for each enumerator, crew leader, and supervisor in the area, and office copy maps were prepared for each of the four areas. For Guam and the Canal Zone, the ED's were planned under the supervision of the respective Governors and this preliminary work was transmitted to the Bureau along with a sufficient number of detailed maps to prepare the final office base maps. For American Samoa and the Virgin Islands, ED delineation was based on information supplied by the Governors.

In both American Samoa and Guam, a special problem arose in connection with the enumeration maps. Because the original shipments of maps for both places were lost in the mails, duplicate sets of maps were prepared and airmailed. In Guam, because of the late arrival of these maps, it was not possible for the crew leaders to check their accuracy before distributing them to the enumerators. This resulted in some confusion during the enumeration, but no serious problems were reported.

Selection and Training of Field Staff

In accordance with the terms of the contract, the recruitment, training, and supervision of the field staff in each area was the responsibility of the Governor or his designated assistant. However, certain requirements for employment were established by the Bureau of the Census, including the following: (1) all members of the staff had to be citizens of, or owe allegiance to, the United States; and (2) candidates for appointment had to have a high school education and had to attain a grade of 60 percent or better in the Field Employee Selection Aid Test. In some areas, it was necessary to waive the education and test-score requirements in order to fill all positions, but an attempt was made to select the best qualified candidates for appointment.

Instructions and Training Materials

With a standard questionnaire for the four areas, it was possible to standardize the instructions and training materials, with only minor variations for a few items such as geographic identification, race, and place of birth. The basic document for the instruction and training of the field staff was the Enumerator's Reference Manual, which included a statement of the enumerator's duties and responsibilities together with instructions for each item on the schedule. Enumerators were required to carry their manuals with them while they were working and to refer to the instructions whenever questions arose in the field.

Another basic document for the training program was the Guide for Training Enumerators. This guide served as a detailed lesson plan for the 4 half-day training sessions. It included an explanation of the principal points in the instruction manual, questions and answers for classroom discussion, home exercises, and practice interviews.

Other instruction materials prepared for American Samoa, Guam, the Virgin Islands, and the Canal Zone included the Crew Leader's Manual and the Supervisor's Office Manual. These two manuals contained background material on the history of the census, legal authority, value of census information, the census organization, confidentiality of census data, and general plan of operations. They also contained an outline of the respective duties and responsibilities of crew leaders and supervisors.

Although the training films prepared for use in the United States were not entirely suited to the outlying areas, copies were sent to each of the four areas, and the supervisors were instructed to disregard parts which did not apply to their program.

Tabulation Plans

The tabulation program for the outlying areas was limited by the size of the areas, the scope of the various censuses, and the method of tabulating the results. Early in 1960, a set of population table outlines was designed which, insofar as possible, was standard for the four areas. Copies of the table outlines were sent to the four Governors for review and comment before the tabulation program became final. Valuable comments were received from several areas, and the outlines were revised accordingly. Every effort was made to provide data of maximum utility to local officials and, at the same time, to keep the tabulation program for the four areas as nearly standard as possible. The tabulation plans for the housing census were also reviewed by local officials in Guam and the Virgin Islands.

All of the data for American Samoa, Guam, the Virgin Islands, and the Canal Zone were transferred to punchcards and tabulated on standard punchcard tabulating equipment.

THE ENUMERATION

Enumeration Forms

The principal forms used to record information for population and housing units in the 1960 censuses of the outlying areas were the household schedule (forms 60PH-1AS for American Samoa, 60PH-1GM for Guam, 60PH-1VI for the Virgin Islands, and 60PH-1CZ for the Canal Zone); the Individual Census Report (forms 60PH-

10AS, 60PH-10GM, 60PH-10VI, and 60PH-10CZ); and the Report for Military and Maritime Personnel (form 60PH-13).

The population and housing schedule used in the outlying areas was a household schedule designed in the form of a booklet with the area identification items on the front, the population questions for each person on separate pages, and, for Guam and the Virgin Islands only, the housing questions on the back. The schedule format proved to be very convenient for the field enumeration, but somewhat cumbersome in the processing operations.

The Individual Census Report was used for the enumeration of visitors in private households, for transient guests in hotels, for persons in institutions, and in special situations where it was not possible to enumerate directly on the regular household schedule. The information recorded on the Individual Census Reports was transcribed to the regular census schedules before the data were processed.

The Report for Military and Maritime Personnel was used to enumerate members of the Armed Forces living in barracks or other group quarters. Members of the Armed Forces living in family quarters were enumerated on regular household questionnaires.

Field Organization

The field organization for each of the four areas followed the same general pattern, although the size of the staff varied in accordance with the number and distribution of the population. The field staff for the four areas is indicated below:

| Field Staff | American Samoa | Guam | Virgin Islands | Canal Zone |
|------------------------------|----------------|------|----------------|------------|
| Supervisor (Governor) | 1 | 1 | 1 | 1 |
| Assistant Supervisor | 1 | 2 | 1 | 1 |
| Administrative assistant | 1 | 1 | 2 | 1 |
| Crew leader | 4 | 4 | 2 | 3 |
| Editing and tabulating clerk | 1 | 4 | - | 3 |
| Enumerators | 24 | 56 | 31 | 42 |

The Supervisor in each area was responsible to the Director of the Census in Washington for all phases of the census program including the following:

1. Securing office space and equipment
2. Releasing public information on the census program
3. Recruiting and training enumerators, crew leaders, and office staff
4. Supervising the enumeration and field edit operation
5. Submitting periodic progress reports on the enumeration to the Director of the Census

Most of these functions were actually performed by the Assistant Supervisor, who was a member of the Governor's staff assigned full time to the census program.

The crew leaders in each area assisted with preparations for the census and provided direct supervision and control of the enumeration. The crew leader's functions included the following:

1. Checking the maps of each enumeration district (ED) in his area
2. Prelisting a sample of addresses in each ED, before the enumeration, to serve as a check on the enumerator's coverage

3. Making special arrangements for the enumeration of hotels, institutions, and other special dwelling places

4. Assisting with the training of enumerators

5. Preparing assignments for the enumerators and distributing supplies and equipment

6. Reviewing each enumerator's work in the field and providing supplemental training where necessary

7. Submitting periodic progress reports on the enumeration to the Census Supervisor

The functions of the administrative assistant consisted of the distribution and control of supplies, compilation of reports, and general clerical assistance to the Supervisor.

In American Samoa, Guam, and the Canal Zone, the editing and tabulating clerks were responsible for reviewing the completed schedules for completeness and consistency before they were forwarded to Washington for processing. In the Virgin Islands, this function was performed by the crew leaders and the administrative assistants.

Field Review

As indicated above, one of the duties of the crew leader was to conduct a systematic review of each enumerator's work in the field. The purpose of this review was to verify the completeness of the enumeration, to discover any errors which had been made, and to see that these errors were corrected.

In order to verify the completeness of the enumeration, the crew leader visited each ED in his assigned area and made a partial prelisting of addresses. Later, as part of the field review, he compared the addresses on this list with the addresses on the schedules to determine whether the enumerator had omitted any of these units. The field reviewer also checked each enumerator's work for accuracy and consistency.

Callbacks

Occasionally, the enumerator found no one at home at the time of his first visit. In such cases, he was instructed to list the address on his "Callback Record" and indicate the best time to return. (Often this information could be obtained from neighbors.) In order to prevent an accumulation of callbacks, the enumerator was instructed to make his second call as soon as possible after the first visit--preferably on the same day or the day following. As soon as the callback was made, this fact was also to be noted on the Callback Record, as was the date of completion when the information was obtained for the household. This record was designed to show the enumerator (or crew leader) at a glance how many callbacks remained outstanding at any particular time during the enumeration. The enumerator was advised to have not more than 10 callbacks outstanding at the end of any work day.

Progress of the Enumeration

The enumeration began in each of the four areas on April 1, 1960.

It was completed in the Canal Zone on April 27, in Guam on May 4, in American Samoa on May 7, and in the Virgin Islands on July 9. Difficulties in recruiting qualified staff and a severe flood that made country roads impassable for several weeks were the primary factor accounting for the delay in the Virgin Islands.

PROCESSING THE DATA

Receipt and Check-In

The first step in processing the data for the outlying areas was the receipt and check-in of the completed schedules. As soon as the schedules were received in Washington, they were packaged in portfolios by ED, labeled for future operations, and assigned a geographic code. Also, as part of this operation, a hand count of population and housing units was made for each ED and compared with the field count to make sure that all ED's and all schedules were accounted for.

The population and housing schedules were forwarded to Jeffersonville for the next step in the processing.

Editing and Coding

A special section was organized in Jeffersonville to handle the editing and coding of the schedules for American Samoa, Guam, the Virgin Islands, and the Canal Zone. The editing and coding operation generally provided the final opportunity to correct errors on the schedules before the data were transferred to punchcards. For some items, it was necessary to code manually the entries made by the enumerator for each person on the schedule. For other items, the most common entries were precoded on the schedule, and still other items were completely precoded and required manual editing and coding only for blanks and multiple entries.

In the general coding operation, the coders were required to edit and/or code the items shown in the table on page 143.

Industry and occupation coding was almost identical to that for the FOSDIC schedules used in the United States.

Verification of both coding operations was done on a 100-percent basis, and all errors discovered by the verifier were corrected.

Data for approximately 160,000 persons from the four outlying areas were edited and coded. The editing and coding operation for the outlying areas began in July 1960 and was completed in September.

Card Punching

After the manual editing and coding operations were completed in Jeffersonville, the schedules were shipped to Washington for the card punching and tabulation operations. The information for each person and, for Guam and the Virgin Islands, for each housing unit, was transferred to a separate card. The card punching operation began in September 1960 and was completed in November 1960.

Mechanical Edit and Tabulation

After the information on the schedules was transferred to punchcards, the cards were processed through a series of mechanical edits to correct inconsistencies and unacceptable codes. For example, the entry for highest grade of school completed was compared with the age of the person and impossible combinations were corrected in accordance with a list of acceptable grades for each year of age. Other consistency edits which were handled by machine involved consistency of entries for income and employment status; for relationship to head

| Item | Coding and editing required |
|--|--|
| Relationship to head of household..... | A 2-digit code was assigned identifying both household and family relationships for persons in regular households and groups quarters. Coders were required to infer probable relationship where the enumerator had failed to make this entry. |
| Sex..... | No coding was required. Missing entries were inferred from name and relationship. |
| Color or race..... | This was precoded on the schedule for the most common categories; the coder assigned "other race" codes. Race was inferred from entries for other members of the family if the enumerator had failed to make this entry. |
| Month and year of birth..... | Blanks in this item were referred to the unit supervisor for allocation from a distribution of ages in the 1950 censuses. |
| Marital status..... | For married persons, the coder was required to assign a code if the spouse was absent from the household. Missing entries were inferred on the basis of other entries for this person and entries for other members of the family. |
| Place of birth..... | Coded for all entries written in on the schedule. |
| Whether under 14, or 14 and over..... | Precoded by enumerator; if blank, age entry was used to complete this item. |
| Year last worked..... | Entries here were used to determine whether industry and occupation coding was required. |
| Income..... | The individual income items were edited and totals established for individual earned income, total individual income, and family income. |

of household, sex, and marital status; and for education and school attendance.

Another purpose of the mechanical edit was the elimination of nonresponses for the following items: relation to head of household, sex, age, color or race, marital status, employment status, and work in 1959. The cards were checked for blanks in any of these items and entries were supplied in accordance with fixed procedures.

When the machine editing process was completed, the punchcards were tabulated on standard tabulating equipment to provide the data required for the final reports.

Preparation of Final Reports

As the various tabulations were completed, they were checked for consistency and general acceptability. The data were then posted to table worksheets, and the necessary computations--percentages, medians, etc.--were made for the final tables. The final tables were typed from the worksheets, machine checked, and then reviewed by the subject specialists. At the same time, the text was prepared, and maps for each area were prepared, for inclusion in the published reports. When all of these steps were completed, the report for each area was assembled and sent for printing.

THE PUBLICATION PROGRAM

Reports Published

The results of the censuses of population and housing of American Samoa, Guam, the Virgin Islands, and the Canal Zone are published in the following reports:

American Samoa:

- 1960 Census of Population:
 - PC(1)-56A, Number of Inhabitants
 - PC(1)-56B, General Population Characteristics

Canal Zone:

- 1960 Census of Population:
 - PC(1)-57A, Number of Inhabitants
 - PC(1)-57B, General Population Characteristics

Guam:

- 1960 Census of Population:
 - PC(1)-54A, Number of Inhabitants
 - PC(1)-54B, General Population Characteristics

- 1960 Census of Housing, HC(1)-54

Virgin Islands:

1960 Census of Population:
 PC(1)-55A, Number of Inhabitants
 PC(1)-55B, General Population Characteristics

1960 Census of Housing, HC(1)-55

The reports in the Census of Population PC(1)-A series (Number of Inhabitants) for the above areas are also included in volume I, part A, for all of the United States. Population counts for the remaining outlying areas are included in the U.S. Summary which appears in this same volume. The reports on American Samoa, the Canal Zone, Guam, and the Virgin Islands in the Census of Population PC(1)-B series (General Population Characteristics) were bound with the four reports in the PC(1)-A series in a single book, volume I, parts 54-57. The PC(1)-B series reports for these four areas include

data on general social and economic characteristics and on detailed characteristics corresponding to those published in the PC(1)-B, PC(1)-C, and PC(1)-D reports for the United States.

Availability of Unpublished Data

Most of the data tabulated for the outlying areas are included in the publications listed above. For some items, however, the data were tabulated in somewhat greater detail than is shown in the published reports. Unpublished data are available to interested persons and agencies for the cost of reproducing the desired information. Special tabulations of the punchcards or schedules may be undertaken on a reimbursable basis.²

² Further information regarding the availability of unpublished data may be obtained by writing to the Director of the Census in Washington.

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 Part I, Introduction. 5 pp.
 Part II, Receiving, Check-In, and Distribution. 9 pp.
 Part III, General Coding Instructions. 26 pp.
 Part IV, Verification of General Coding. 2 pp.
 Part V, Industry and Occupation Coding. 2 pp.