

Assessment of Field Verification

FINAL REPORT

This evaluation study reports the results of research and analysis undertaken by the U.S. Census Bureau. It is part of a broad program, the Census 2000 Testing, Experimentation, and Evaluation (TXE) Program, designed to assess Census 2000 and to inform 2010 Census planning. Findings from the Census 2000 TXE Program reports are integrated into topic reports that provide context and background for broader interpretation of results.

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U S C E N S U S B U R E A U

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EXECUTIVE SUMMARY

This operational assessment focuses on the Be Counted/Telephone Questionnaire Assistance Field Verification operation in Census 2000.

Enumerators visited the location of units without a confirmed census address (i.e., addresses without an assigned census identification number) to verify their existence before Census 2000 included the addresses. These responses came from the Be Counted program, Telephone Questionnaire Assistance, Service Based Enumeration, Special Place Group Quarters Enumeration, Military/Maritime Crews of Vessels Enumeration, Military Unit Enumeration, and In-Movers/Whole Households programs.

The operation also included addresses deleted in two or more previous operations but for which the U.S. Census Bureau received a mail return (double deletes with a mail return).

If the enumerator located the address, he/she entered a checkmark on the assignment listing for each unit verified as a residential address. If the address was not a living quarters or was a duplicate of another address on the assignment listing, the enumerator coded it accordingly. The local census offices keyed the results of the Field Verification into the Operations Control System 2000. The Decennial Systems and Contracts Office and Geography Division used the information to update the Decennial Master Address File and the Master Address File.

The non-ID questionnaire process for Census 2000 was a very complex operation consisting of many components. This operational assessment only discusses one aspect of that overall process, that is, the verification of addresses which could not be matched to the Master Address File but could be geocoded to a census block. No conclusions can be made regarding any other component of the non-ID questionnaire process.

Did Field Verification contribute valuable information to the census?

Yes. The enumerators provided information about the assigned addresses that was useful to the overall census address files.

- 884,896 cases went to Field Verification for Census 2000.
- Enumerators coded fifty-one percent of the assigned addresses as valid living quarters.
- Enumerators coded 35 percent of the assigned addresses as nonexistent.
- Enumerators coded 14 percent of the addresses as duplicates.
- Overall, 49.18 percent of the addresses without a confirmed census address (the non-ID cases) were coded as valid census addresses.
- Overall, 52.86 percent of the addresses deleted in two or more previous operations but for which we received a mail return (the double deletes) were coded as valid addresses.

Recommendations

The Census 2000 procedures are a good model for planning a field verification operation for Census 2010, with the following recommendations:

- The Census Bureau should redesign the Field Verification procedures to capture enough information for duplicates to provide a link between the two addresses. This information is useful for quality assurance purposes and for future research into the causes of census duplicates.
- We need to clarify the procedures concerning how far to extend the search for assigned addresses so enumerators do not erroneously delete addresses located in adjacent blocks.
- We need to conduct further research into the sources of the double deletes since nearly half of them were coded as valid units.
- We need to consider a way to independently validate the accuracy of the results to determine if Field Verification improves the census files.
- We need to determine the effect that additional response options in 2010 might have on Field Verification.

1. BACKGROUND

This operational assessment focuses on the Be Counted/Telephone Questionnaire Assistance (BC/TQA) Field Verification operation in Census 2000.

1.1 Definition of Field Verification

The Census 2000 Operational Plan included a Be Counted Campaign designed to make it easy for people to obtain a census questionnaire if they believed the census missed them. In addition, the Census 2000 Operational Plan included a Telephone Questionnaire Assistance Program to assist persons with completing the census questionnaire. While providing these alternative response options made it easier to count persons, they also increased the possibility that a given person or address might generate more than one response and that the Census Bureau would receive a large number of records for new addresses.

During BC/TQA Field Verification, enumerators visited the location of units without a confirmed census address; that is, units without an assigned census identification number, to verify their existence before Census 2000 included the address. These responses came from the Be Counted program, Telephone Questionnaire Assistance, Service Based Enumeration, Special Place Group Quarters Enumeration, Military/Maritime Crews of Vessels Enumeration, Military Unit Enumeration, and In-Movers/Whole Households programs.

The Field Verification operation also included units which were deleted in two or more previous operations but for which the Census Bureau received a mail return (double deletes).

1.2 What this assessment includes

This report provides a summary of the results of the Field Verification and provides an overall assessment of the Field Verification operation for Census 2000.

Field Verification was one component of a multi-faceted operation for handling non-ID questionnaires in Census 2000. This report is limited to the BC/TQA Field Verification operation and is not an evaluation of the overall process for handling non-ID questionnaires. The results and conclusions in this report cannot be generalized to other aspects of the non-ID operation. This evaluation also does not address any issues related to pre-census address field verification operations, such as the Local Update of Census Addresses Field Verification.

1.3 How the 1990 Census handled responses with an unconfirmed address

- The Census Bureau relied on a series of clerical processes and the United States Postal Service to verify that an address was valid before adding it to the census files.
- Forms generated from such operations as the Were You Counted campaign and Whole Household Usual Residence Elsewhere were processed through a clerical search/match procedure after first being geocoded to a census block.
- If an address could not be coded to a census block (geocoded) no further processing was done for the case.
- If the address was geocoded, clerks determined if the address already appeared in the Address Control File.
- If clerks did not find the geocoded address on the Address Control File, they sent it to the Postal Service for verification that the address was complete and deliverable.
- If the address was still not found in the Address Control File, it was added to the file and the case was sent to the next stage of processing.
- Approximately 35,000 housing units were added to the 1990 Census Address Control File as a result of the search/match operations.

1.4 How Census 2000 handled responses with an unconfirmed address

- The Census Bureau used field enumerators rather than the Postal Service to verify the status of potentially missed addresses before the address was counted in the census.
- This decision reflected the fact that we had already used the Postal Service's Delivery Sequence Files to help build the Census 2000 Master Address File.
- A Field Verification program was developed and implemented for the 1995 Census Test, the 1996 Census Test and the Census 2000 Dress Rehearsal.
- While there are some limited data available from these tests, there were no formal evaluations of those Field Verification programs.

1.4.1 The three types of non-ID addresses

For Census 2000, the intent was to rely on a computerized and clerical system to geocode and match records without a census ID number to the Master Address File (MAF). As discussed in the Program Action Plan for Non-ID Questionnaire Processing, we expected to geocode many of these records to a census block but not find them in the MAF. For Census 2000 three types of responses did not have a census ID number:

- **Type A** - respondent-provided address. These responses came from the Be Counted (BC) program, Telephone Questionnaire Assistance (TQA), Service Based Enumeration (SBE), Special Place Group Quarters (SPGQ) Enumeration, Military/Maritime Crews-of-Vessels Enumeration, Military Unit Enumeration, and In-Movers/Whole Households programs. Individual Census Reports (ICRs/ICQs) and Military Census Reports (MCRs) provided addresses for respondents who had a usual place of residence elsewhere on Census Day but the reported address was not found in the MAF. These cases were eligible for Field Verification.
- **Type B** - a BC Questionnaire on which the respondent marked the box to indicate they had no fixed address on April 1, 2000. These cases went through a special processing operation and were included as part of the overall SBE procedures for counting the population in shelters and service based facilities.
- **Type C** - enumerator-filled forms. These addresses came from questionnaires for units added during the Update/Leave, Urban Update/Leave, Nonresponse Followup, Coverage Improvement Followup, and other field operations. These addresses did not go to the Field Verification because an enumerator had already verified their existence.

1.4.2 How we processed Type A addresses

- The Geography Division (GEO) conducted an automated matching and geocoding operation for both city-style and non-city-style addresses derived from non-ID questionnaires.
- The GEO established an interactive telephone/computer operation in the National Processing Census (NPC) to determine geocodes for those addresses that the automated process did not geocode.
- The NPC conducted a clerical geocoding operation for both city-style and non-city style addresses.
- The clerks compared the addresses against a commercial data base to determine a telephone number (if missing), the correct county, and whether the address was complete/correct.
- The clerks attempted to correct any errors by telephone if a telephone number was available.
- If necessary, the NPC conducted an interactive geocoding interview with the respondent to attempt to geocode the address to a block.

1.4.3 The Field Verification Cases

- To determine whether to include the Type A addresses in the census, the Census Bureau conducted the Field Verification operation on addresses that had a census block code but did not match an address on the MAF.
- In addition to verifying the non-ID questionnaires, we used the Field Verification operation to check on the validity of the double deleted addresses. These were addresses which seemed to be nonexistent but for which we received a mail return; for example, addresses which appeared on an early version of the United States Postal Service's Delivery Sequence File but not on the more recent versions.

1.4.4 How we conducted Field Verification

- The enumerators received a listing of all the addresses in their assignment area with the addresses that required verification clearly marked.
- The enumerators used various map products to help locate the addresses which required Field Verification.
- They were not instructed to search for the addresses outside of the specific block shown on the map although it is not clear how closely they followed those instructions.
- If the enumerator located the address he/she conducted a short interview with occupants or neighbors to determine if the address was a residential unit that did not duplicate another address on the assignment listing.
- He/she entered a checkmark on the assignment listing for each unit verified as a residential address.
- If the address was not a living quarters or duplicated another address on the assignment listing, he/she coded it as D1 (Delete) or D2 (Duplicate), respectively.
- A small number of cases came back coded as "Unknown" because the enumerator was unable to determine the status.
- There was a formal quality assurance on the field work to ensure that the enumerators performed at a satisfactory level (see Section 4.4.3, page 14).

1.4.5 What we did after Field Verification

- The Local Census Offices keyed the results of the Field Verification operation into the Operations Control System (OCS) 2000,
- They transmitted a file to the Decennial Systems and Contracts Management Office (DSCMO).
- The DSCMO updated the Decennial Master Address File (DMAF) with the results.
- The DSCMO then provided the results to the GEO for updating the MAF.

2. METHODS

This section describes the methodology used for this operational assessment. We obtained the data for this assessment from several sources. The data provided information on the Field Verification workload and the results of the field work. In addition it provided insight into the types of cases assigned for Field Verification and operational problems. The data allowed us to assess how the enumerators coded the cases assigned for Field Verification.

- Shortly after the completion of the Field Verification operation, the DSCMO provided the Decennial Statistical Studies Division (DSSD) with a file identifying the cases sent to Field Verification and the code assigned to each case. This file provided the baseline workloads and field verification results. We used it to access additional information about the cases from other files.
- The GEO provided summary tallies of the results of the automated and clerical geocoding and the results of the field verification for the non-ID cases.
- The Technology Management Office (TMO) Data Warehouse provided information from the Operations Control System 2000 on workloads and verification codes by various levels of census geography and provided other useful administrative information.
- The DMAF and the Hundred Percent Census Unedited File contain information on the characteristics of the addresses included in the census. In addition, staff in Field Division (FLD), DSCMO, GEO and DSSD provided feedback related to operational problems.

3. LIMITATIONS

This section outlines the limitations in this operational assessment.

3.1 This assessment only covers Field Verification results

The non-ID questionnaire process for Census 2000 was a very complex operation consisting of many components such as automated matching and clerical geocoding. This report only discusses the verification of geocoded addresses which did not match to the MAF. The data cannot be used to draw conclusions about any other components of the non-ID questionnaire process. For example, Table 8 shows that the enumerators located city style and non-city style addresses during Field Verification with equal success, but this result does not say anything about the Census Bureau's overall ability to geocode and match non-city style addresses. The other components of the non-ID process are beyond the scope of this assessment.

3.2 Lack of detailed qualitative information

We did not conduct any formal debriefing of the field staff. The qualitative information in this report reflects anecdotal information provided by headquarters staff.

3.3 Inconsistency in the application of the field procedures

- The training and reference materials did not clearly state how far to search for an assigned address.
- The materials imply that the enumerator should limit the search to the assigned block.
- The review test at the end of the training included a question on how to change a map if an address is found in a nearby block.
- Thus it is not clear whether the enumerators coded cases as deletes even though they were located in an adjacent block.

3.4 Identification of duplicates in the field

Field Verification identified addresses as duplicates but did not capture enough information to link the duplicate addresses. This was a concern because the FLD needed this information to conduct a thorough review of the enumerators' work. In addition, this information is valuable for future research into the nature and causes of census duplicates. This assessment cannot make any conclusions regarding how accurately the enumerators identified duplicates.

3.5 Validation of the process

This operational assessment does not address the overall validity of the Field Verification. The quality assurance conducted on the enumerator's work suggests that the work was of acceptable quality but an independent validation of the process would be needed to determine whether the field work improved the census files.

4. RESULTS

The Field Verification improved the accuracy of the census files and was conducted within budget and on schedule.

4.1 Did Field Verification provide useful information?

Yes. The Field Verification provided useful information for the census files.

- 884,896 cases went to Field Verification for Census 2000.
- Fifty-one percent of the assigned addresses were coded as valid living quarters.
- Enumerators coded 35 percent of the assigned addresses as deletes.
- Enumerators coded 14 percent of the addresses as duplicates.
- Overall, 49.18 percent of the addresses without a confirmed census address (the non-ID cases) were coded as valid census addresses.
- Overall, 52.86 percent of the addresses deleted in two or more previous operations but for which we received a mail return (the double deletes) were coded as valid addresses.

4.2 What cases went to Field Verification?

The workload was 884,896 cases. Table 1 shows the workload by type of case.

Table 1
The Field Verification workload

Type of Case	No.	%
Be Counted (Non-ID)	195,812	22.13
Telephone Questionnaire Assistance (Non-ID)	155,148	17.53
Individual Census Report (Non-ID)	101,458	11.47
Military Census Report (Non-ID)	16,131	1.82
Double-Deletes	416,347	47.05
Total	884,896	100.00

- The workload was split almost evenly between non-ID cases and double-deletes.
- Be Counted records provided the largest number of non-ID addresses in the Field Verification process.
- The Telephone Questionnaire Assistance provided a large number of responses.
- The other sources of non-ID addresses contributed fewer cases to the workload.

Table 2 provides the percent of the total Field Verification workload by RCC, as extracted from the TMO data warehouse summaries.

Table 2
The Field Verification workload by RCC

RCC	Percent of Total Workload	Percent of Non-ID Workload	Percent of Double Delete Workload
Boston	7.77	6.11	9.96
New York	9.37	11.93	5.97
Philadelphia	8.15	6.02	10.98
Detroit	6.30	5.48	7.38
Chicago	13.21	12.48	14.16
Kansas City	5.50	5.04	6.10
Seattle	6.64	7.45	5.57
Charlotte	9.97	10.95	8.67
Atlanta	10.93	9.81	12.42
Dallas	8.79	9.14	8.33
Denver	5.01	4.91	5.14
Los Angeles	8.36	10.66	5.31

The Chicago region had the largest percentage of both the non-ID workload and the double delete workload while the Denver region had the smallest percentage of both components.

The Decennial Cost and Progress System for Field Verification only provides workload numbers at the Assignment Area (AA) level. The Cost and Progress System showed that the workload was spread across 419,953 Assignment Areas. Table 3 shows the breakdown of the AA's that contain the Field Verification workload by type of local census office (LCO).

Table 3
Field Verification assignment areas by type of local census office

LCO Type	Number of AA's containing FV cases	Percent of AA's
Large Urban areas	69,064	16.45
Mid-size Urban areas	34,981	8.33
Less populous Cities and Rural areas	281,959	67.14
Rural, Sparsely Settled Areas	33,359	7.94
Puerto Rico	690	0.16
Total	420,053	100.00

The bulk of the AAs were in the less populous cities and suburban areas which is consistent with the notion that addresses in these areas are harder to computer match since they often are non-city style addresses. However it is possible that this reflects a larger number of non-ID cases in these types of areas. Sixteen percent of the AAs were in centralized cities which is consistent with the placement of Be Counted sites.

Table 4 shows the breakdown of the workload by the type of enumeration area (TEA).

Table 4
Field Verification workload by type of enumeration area

TEA	Cases Sent To FV	
	No.	%
Mailout/Mailback	759,187	85.79
Update/Leave	111,467	12.60
List/Enumerate	2,973	0.34
Remote Alaska	33	0.01
Rural Update/Enumerate	3,328	0.38
Military in Update/Leave	2,209	0.25
Urban Update/Leave	2,111	0.24
Urban Update/Enumerate	279	0.02
Update/Leave Converted From MO/MB	3,309	0.37
Total	884,896	100.00

- The bulk of the cases were in mailout/mailback areas.
- The addresses in update/leave areas were generally non-city style addresses which may have been difficult to accurately geocode in the automated and clerical processes.
- The Census Bureau did not expect to have a large number of addresses requiring verification in rural list/enumerate areas since there were no Be Counted sites in those areas and the addresses were compiled at the time of enumeration.
- The remaining types of enumeration areas had few housing units in the workload.

4.3 What was the outcome of Field Verification?

The DSCMO and the GEO provided files showing the status for each address assigned for Field Verification. We also obtained this information by examining the FVS variable on the DMAF. Table 5 shows the Field Verification outcome for the 884,896 cases flagged as Field Verification addresses in the DMAF.

Table 5
Status of addresses after Field Verification

Status After Field Verification	Number	Percent
Address coded as valid	450,476	50.91
Address coded as delete (nonexistent)	312,098	35.27
Address coded as duplicate of another address.	122,322	13.82

- Enumerators coded 51 percent of the assigned cases as residential addresses.
- Enumerators reported that the remaining cases either did not exist (deletes) or duplicated another address in the assignment listing.
- The deletes include the 1,113 cases returned with “status unknown”.
- The enumerators were not instructed to search for an address outside of the assigned census block. It is possible that some of the deleted units exist in another block.

Table 6 shows the results by the source of the address; that is, whether the address was generated on a non-ID questionnaire or a double delete with a mail return.

Table 6
Results of Field Verification for each type of assigned address

Type of Case Assigned	Number Assigned	Coded as valid unit		Delete		Duplicate	
		No.	%	No.	%	No.	%
Non-ID Questionnaires							
Be Counted	195,812	93,898	47.95	68,690	35.08	33,224	16.97
TQA	155,148	83,408	53.76	45,840	29.55	25,900	16.69
ICR	101,458	48,720	48.02	42,480	41.87	10,258	10.11
MCR	16,131	4,385	27.18	4,986	30.91	6,760	41.91
Double Deletes	416,347	220,065	52.86	150,102	36.05	46,180	11.09
Total	884,896	450,476	50.91	312,098	35.27	122,322	13.82

- Enumerators coded the Be Counted and TQA addresses as valid units approximately fifty percent of the time.
- The usual residences reported on ICRs were found much more frequently than the usual residences reported on MCRs.
- Overall, 49.18 percent of the non-ID cases were found in the assigned block and included in the census.
- Overall, 52.86 percent of the double deletes with a mail return were found to be valid housing units. This result suggests that the Bureau may need to conduct additional research into the source of the double deletes with a mail return to try to determine why they were deleted in two or more previous operations.

Table 7 shows the results by Type of Enumeration Area (TEA). The TEA represents the area containing the block to which each assigned address was geocoded.

Table 7
Results by type of enumeration area

TEA	Number Assigned	Coded as valid unit		Delete		Duplicate	
		No.	%	No.	%	No.	%
MO/MB	759,187	388,142	51.13	268,764	35.40	102,281	13.47
U/L	111,467	55,300	49.61	38,857	34.86	17,310	15.53
L/E	2,973	2,202	74.07	762	25.63	9	0.30
Remote Alaska	33	9	27.27	24	72.73	0	0.00
Rural U/E	3,328	1,297	38.97	1,195	35.91	836	25.12
Military U/L	2,209	585	26.48	320	14.49	1,304	59.03
Urban U/L	2,111	1,205	57.08	786	37.23	120	5.69
Urban U/E	279	171	61.29	61	21.86	47	16.85
U/L from MO/MB	3,309	1,565	47.30	1,329	40.16	415	12.54
Total	884,896	450,476	50.91	312,098	35.27	122,322	13.82

- The bulk of the assigned addresses were in mailout/mailback areas (MO/MB).
- The enumerators coded about 50 percent of the MO/MB addresses as valid.
- A similar result occurred in the update/leave areas.
- The enumerators reported that nearly 75 percent of the assigned addresses in rural list/enumerate areas were valid addresses.
- In Urban Update/Enumerate areas enumerators reported that a high percentage of the assigned addresses were valid.

4.4 What are the characteristics of the addresses?

As part of this evaluation we examined some characteristics of the units retained in the census after Field Verification based on several DMAF variables.

Table 8 shows the results of Field Verification for units with city style addresses compared to units with non-city style addresses (i.e., rural route and box). The categorization of city style address versus non-city style address was approximated from the MS (map spot) variable on the DMAF. Primarily only units with a non-city style address have a map spot assigned during address listing.

Table 8
Results for city style address versus non-city style address

Address Style	Cases Assigned	Coded as valid unit		Deletes		Duplicates	
		No.	%	No.	%	No.	%
City Style	776,629	394,136	50.75	275,989	35.54	106,504	13.71
Non-City Style	108,267	56,340	52.04	36,109	33.35	15,818	14.61

The enumerators classified nearly the same percentage of each type of address into the categories of address exists, delete or duplicate.

We examined the number of units at the basic address on the DMAF for the addresses that were coded as valid units during Field Verification, as shown in Table 9.

Table 9
Number of units at the basic address for cases coded as valid units

Number of units at basic address	Number Assigned	Coded as valid unit		Percent of Total Coded as Valid Unit
		No.	%	
1	564,311	290,634	51.50	64.52
2	69,794	30,621	43.87	6.80
3	34,241	15,330	44.77	3.40
4	24,489	10,464	42.73	2.32
5	11,412	4,819	42.23	1.06
6	10,809	5,075	46.95	1.13
7	7,187	3,183	44.29	0.71
8	9,979	4,756	47.66	1.06
9	4,885	2,098	42.95	0.46
10	7,751	2,551	32.91	0.57
>10	140,038	80,945	57.80	17.97
Total	884,896	450,476	100.00	100.00

- Nearly two-thirds of the units coded as valid contained one unit at the address.
- Nearly 18 percent of the units coded as valid had more than ten units at the address.

4.5 What were the costs and operational aspects?

4.5.1 Cost and Timing Information

- The Census 2000 Cost and Progress System showed that the field work cost \$18.16 per assigned address which is very close to the \$18.58 budgeted in the cost model.
- The field staff used 91 percent of the direct field budget for the Field Verification.
- The work was planned for 20 days but was finished two days ahead of schedule.
- The LCOs conducted the work in three waves.
- The final workload was close to the expected workload, although the original workload estimate was based on conducting Field Verification only for non-ID cases. Because we received fewer non-ID cases than expected, the addition of the double deletes resulted in a workload that was comparable to the estimated workload in the cost model.

4.5.2 Operational Considerations For Field Staff

- The FLD did not conduct a formal debriefing of the Field Verification staff.
- The Census 2000 Field Manager's Debriefing Reports did not mention Field Verification as a source of operational problems.
- The FLD had sufficient staff to conduct the operation without significant problems.
- There were no substantial timing or logistical problems with conducting the field work.
- The field staff had a concern about the lack of information captured for duplicates and their inability to adequately check on the enumerators' identification of duplicates.
- The field staff was concerned about the lack of clarity in the procedures regarding whether the enumerators should search beyond the assigned block for an address.

4.5.3 Quality Assurance

- There was a formal quality assurance operation on the Field Verification.
- The crew leaders performed reviews of each lister's assignment registers.
- The crew leaders returned the completed assignment registers to the LCO on a flow basis where the assignment control unit reviewed them for completeness.
- Although the detailed results of the quality assurance operations are not yet available, the program was implemented according to the specifications.
- There is no indication of any quality problems in the Field Verification.

4.5.4 Operational Considerations For Processing Staff

- The LCO staff keyed the action code for each address into the OCS and transmitted a file to the DSCMO for MAF maintenance and updating.
- The DSCMO reported that everything went smoothly in updating the DMAF and reported no operational concerns.

5. CONCLUSIONS AND RECOMMENDATIONS

This assessment resulted in the following conclusions:

- The BC/TQA Field Verification provided useful information for Census 2000.
- Enumerators coded half of addresses as valid living quarters.
- The operation helped clarify the status of the double deletes.
- The staff conducted the operation within the schedule.
- The staff conducted the operation within the budget.
- There were no operational problems with the operation.

This assessment resulted in the following recommendations:

- The Census Bureau should capture information on duplicate addresses for use during quality assurance and for future research into the causes of census duplicates.
- The procedures need to clearly specify how far to search for the assigned addresses during Field Verification since we might find some cases in adjacent blocks.
- The Bureau should conduct additional research into the sources of the double deletes since enumerators coded about half of them as valid living quarters.
- It would be valuable to consider ways to independently validate the results of the Field Verification to determine whether the information improves the census files.
- The workload for Field Verification may be much larger in 2010 if there are more response options so the Bureau should conduct more research into this topic.

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