



September 13, 2017

MEMORANDUM FOR: Ron S. Jarmin
Performing the Non-Exclusive Functions
and Duties of the Director
U.S. Census Bureau

Carol N. Rice

FROM: Carol N. Rice
Assistant Inspector General for Economic
and Statistical Program Assessment

SUBJECT: *2020 Census: Evaluation of Interactive Review Address Canvassing
Operation Revealed Issues with Quality Assurance Controls*
Final Report No. OIG-17-030-1

This memorandum provides the results of the Office of Inspector General's (OIG's) evaluation of the Census Bureau's (the Bureau's) Interactive Review (IR) Address Canvassing operation. The objective of our review—which began in December 2015—was to gain an understanding of the IR process and evaluate the quality control procedures developed to ensure accurate results. This review supplements the previously issued 2016 Address Canvassing Test audit report, which can be found on OIG's website.¹ For details regarding our objective, scope, and methodology, see appendix A.

Background

The Master Address File (MAF) and Topologically Integrated Geographic Encoding and Referencing (TIGER) systems—combined into a single MAF/TIGER database (MTdb)—serve as the Bureau's national repository for all spatial, geographic, and residential address data needed for census and survey data collection. To prepare for the 2020 Census, the Bureau seeks to ensure that all addresses are captured, correctly recorded, and assigned to a map location (geocoded) in MTdb. To achieve this for the 2010 Census, the Bureau spent \$444 million to hire and deploy nearly 149,000 temporary employees to walk every block in the United States and identify every location where someone lived or could live. To improve and refine the address list in advance of the 2020 Census enumeration, the Bureau intends to conduct a 100 percent in-office address canvassing operation and reduce field operations. The Bureau developed the in-office process in FY 2015 with a goal to identify geographic areas that

- are stable and do not require address or geospatial updates, or
- will require field verification through the In-Field Address Canvassing operation.

¹ U.S. Department of Commerce, Office of Inspector General, May 11, 2017. *2020 Census: The Address Canvassing Test Revealed Cost and Schedule Risks and May Not Inform Future Planning as Intended*, OIG-17-024-A. Washington, DC: OIG.

The Bureau's goal as of December 31, 2015, was to reduce the number of housing units² in the United States requiring in-field address canvassing to no more than 25 percent. As a result of the Bureau's field testing, this percentage was increased to 30 percent in April 2017. Reductions in 100 percent in-field address canvassing could result in significant cost savings.

The Bureau's in-office address canvassing process originally consisted of two sequential operations: IR followed by active block resolution (ABR). Our evaluation focused on IR, which uses the Block Assessment, Research, and Classification Application (BARCA) software application to assist clerks in assessing present, past, and future block³ changes for a set of geographic work areas. The software was developed by the Bureau and targeted for staff with little geographic information system experience. As of March 7, 2017, the Bureau stopped the ABR operation. During the scope of our analysis, the ABR operation was still in effect.

The objective of IR is to compare vintage imagery of MTdb blocks (typically from 2009 when address canvassing for the 2010 Census was completed) to more recent imagery, and then to categorize blocks as experiencing housing unit growth, decline, or having no changes. Blocks containing changes were categorized as "active" and sent to ABR through March 6, 2017. After that date, "active" blocks immediately became candidates for in-field address canvassing.⁴ Those blocks without changes are categorized as "passive," requiring no further review unless subsequent imagery or field operations identify changes. If the imagery is unclear or inconclusive (e.g., cloud cover obscuring housing units), the affected blocks are marked "hold" and evaluated again when new imagery becomes available. To ensure clerks correctly categorize block statuses, a sample of blocks undergoes a double-blind review. After the initial review, a second clerk performs an independent review of the same block. If the two clerks concur on the status of the block during the double-blind analysis, no additional reviews are performed. If they do not agree, a third reviewer—known as the adjudicator—makes the final determination on the block and may charge errors to clerks.

The Bureau started the IR operation in September 2015 at the National Processing Center (NPC) located in Jeffersonville, Indiana. The operation involved hiring 136 clerks and had an estimated cost of \$12.9 million. The IR workload consists of approximately 11 million blocks, and the Bureau confirmed that, as of June 8, 2017, all blocks have been reviewed at least once.

² A housing unit is a house, apartment, group of rooms, or single room intended for occupancy as a separate living quarter. Separate living quarters are those in which the occupants live separately from any other individuals in the building and have direct access from the outside of the building, such as through a common hallway.

³ Census blocks are areas circumscribed by visible features, such as streets, roads, streams, and railroad tracks, as well as by nonvisible boundaries, such as selected property lines and city, township, school district, and county lines. For example, a city block is circumscribed on all sides by streets. Blocks in suburban and rural areas may be large, irregular, and surrounded by a variety of features, such as roads, streams, and transmission lines. Census blocks nest within all other tabulated census geographic entities and are the basis for all tabulated blocks.

⁴ The final In-Field Address Canvassing operation workload will not be created until Spring 2019. Between March 6, 2017, and the development of the final In-Field Address Canvassing workload, blocks could return to IR for various reasons. For example, the Bureau may return blocks to IR based on new data provided by their partners or updates to the U.S. Postal Service's Delivery Sequence File (DSF).

Findings and Recommendations

During our review of IR procedures and practices, we found that the Bureau drafted, but did not finalize, a quality assurance plan for the IR operation. Furthermore, the draft plan did not address two specific issues. First, neither the draft quality assurance plan nor the *2020 Census Detailed Operational Plan for the Address Canvassing Operation* documented the methodology used to calculate the operational and individual error rates. Because neither plan defined the error rate, Bureau staff and other stakeholders may make incorrect assumptions about the criteria used to determine whether a clerk's performance warrants additional oversight. Secondly, the draft plan did not describe how the practice of forgiving clerks' errors affected the Bureau's ability to achieve the targeted operational error rate. Bureau guidance allows adjudicators to forgive coverage errors when imagery data is highly ambiguous. We found that this practice interferes with an internal control established to ensure that the Bureau does not exceed a 5 percent targeted error rate for the operation.

I. Quality Assurance Calculations Are Not Clearly Documented

The Government Accountability Office's (GAO's) guidance on internal controls⁵ states that management should maintain documentation of its internal controls that can be communicated to external stakeholders. However, we found the Bureau did not clearly document quality assurance controls and its potential impact on data quality. Specifically, the Bureau failed to define how error rates were calculated in its documentation, resulting in misleading information about the quality control process established to evaluate whether a new clerk correctly identified changes in block status (e.g., growth as denoted by new housing unit construction, or decline as represented by the absence or demolition of old housing units).

One hundred percent of a clerk's first 500 blocks go through a double-blind analysis. Thus, as a clerk completes his or her first 500 reviews of blocks, another clerk conducts an independent review of the same 500 blocks. If the second clerk disagrees on the status of any block, an adjudicator makes a final determination on the block. The Bureau refers to the 100 percent inspection of the first 500 blocks as the clerk's baseline period. The *2020 Census Detailed Operational Plan for the Address Canvassing Operation* states that:

Once the clerk establishes a baseline, the error rate for the blocks in the clerk's baseline group is compared to the targeted error rate, currently [5] percent. If the clerk's error rate is lower than the targeted level, future inspections are conducted based on a sample of the clerk's work. If the clerk's error rate is too high, the clerk receives feedback and the 100 percent inspection resumes.⁶

In other words, if the clerk has an error rate that is better than 5 percent, only a sample of his or her subsequent cases will go through the double-blind review; however, if he or she has worse than a 5 percent error rate, all of his or her future cases will go through the

⁵ Government Accountability Office, September 2014. *Standards for Internal Control in the Federal Government*, GAO-14-704G. Washington, DC: GAO, Sec. 3.09, p. 29.

⁶ U.S. Census Bureau, December 31, 2015. *2020 Census Detailed Operational Plan for the Address Canvassing Operation*, Version 1.0. Suitland, Maryland: Census, 44.

double-blind review. The plan also clarifies that a clerk will go into 100 percent inspection if his or her error rate exceeds 5 percent at any point after the baseline period.

OIG tested this internal control and found that, in practice, no clerk will go into 100 percent inspection after completing the first 500 blocks. Regardless of the number of mistakes a clerk makes during the baseline period, the official error rate for each clerk at the 501st block is close to zero due to the specific method by which the Bureau calculates the error rate. Thus, the description of the control in the *Detailed Operational Plan* is misleading because a reader could mistakenly assume that a clerk could continue to be in 100 percent inspection immediately after the baseline period based on the number of mistakes he or she made. Without additional context on how and why the operation’s official error rate works in practice, staff and external stakeholders are likely to misunderstand the criteria used to evaluate a clerk’s performance. Because all clerks are eligible for sampling after the first 500 blocks, fewer quality control checks are performed on clerks that had previously made errors, which could negatively impact data quality.

The simplest way to calculate the error rate is to divide the number of cases with errors by the total number of cases reviewed through the double-blind analysis.⁷ In contrast, the Bureau informed OIG that it first calculates this simple error rate *and then* multiplies it by an “inspection adjustment factor,” which is 1 minus the percentage of the clerk’s cases that were inspected through the double-blind analysis.

To illustrate, a clerk reviews 501 blocks, and the first 500 blocks go through the double-blind analysis. As part of this quality assurance process, an adjudicator notes that 125 of the first 500 blocks had errors. In this example, we assume that there are no blocks pending inspection through the double-blind analysis.

Figure I. Description of Bureau’s Official Error Rate Formula

Variable	Workload	Example	
A	Blocks with errors ^a	125	Simple error rate = A/(B-D) Inspection adjustment factor = 1 – (B/C)
B	Blocks required to go through double-blind inspection	500	
C	Total blocks reviewed by the clerk	501	
D	Blocks pending inspection	0	
Bureau’s official error rate = Simple error rate * Inspection adjustment factor = (A/(B-D)) * (1 – (B/C))			

Source: OIG-developed formula based on the Bureau’s error rate

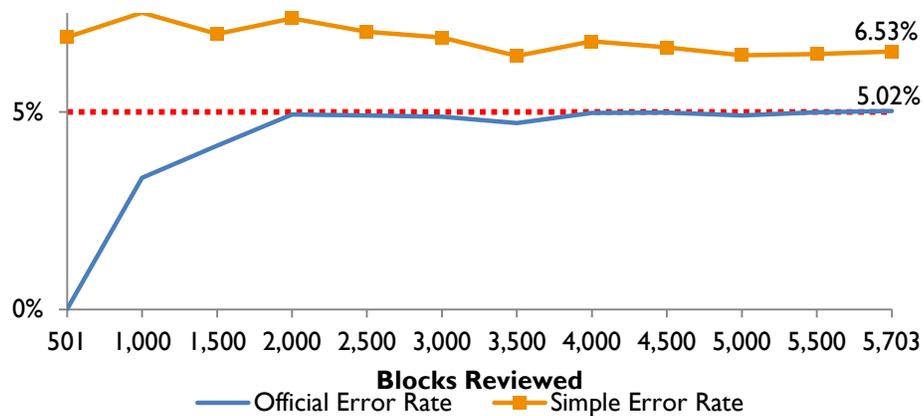
^a Blocks where an adjudicator assigned an error to a clerk.

⁷ We refer to this approach as a *simple error rate*, while the Bureau refers to it as the *error-in-rate*.

In this example, the inspection adjustment factor would be $1 - (500/501)$ or 0.002. With 125 blocks containing errors, the simple error rate would equal 25 percent ($125/(500-0)$). The Bureau would multiply that 25 percent error rate by 0.002, arriving at a 0.05 percent official error rate. As a result, every single clerk qualified for sampling after his or her first 500 blocks. Even a clerk with a 99 percent error rate during the baseline period would initially qualify for sampling rather than continuing with 100 percent inspection.

Figure 2 illustrates how using the Bureau’s official error rate rather than the simple error rate affects the determination as to whether the clerk exceeded the 5 percent targeted error rate. The horizontal red-dotted line denotes a 5 percent error rate in this figure. For this given clerk, the simple error rate—represented by the orange line—was always greater than 5 percent after the baseline period. In contrast, a clerk’s official error rate—represented by the blue line—did not exceed 5 percent until block 5,703. Although the difference between the official error rate and straightforward simple error rate decreases as more blocks are reviewed, the official error rate is always lower than the simpler error rate.

Figure 2. The Difference between the Simple Error Rate and Official Error Rate^a



Source: OIG analysis of Census Bureau data

^a The data used in this example is from an NPC clerk. Results will vary depending on the number of errors a clerk makes and the number of blocks pending inspection.

Because neither the *Detailed Operational Plan* nor the draft quality assurance plan define the official error rate, Bureau management and other stakeholders may make incorrect assumptions about how the official error rate works in practice. Bureau staff clarified that they adopted this more complicated error rate formula to achieve a 5 percent *undetected* error rate, and the formula accounts for the fact that adjudicators detect and correct errors identified during the baseline period. When determining which approach to follow, the Bureau noted that using another formula—such as a 5 percent simple error rate—would have required more quality assurance reviews, thus reducing production.⁸ While the

⁸ Our analysis also found that there were not unreasonable delays before clerks would go into 100 percent inspection, if needed. If clerks continue to commit errors at a high rate after the baseline period, their work undergoes 100 percent inspection after several hours, days, or weeks depending on their performance.

Bureau can make business decisions that balance productivity and quality, we found that the Bureau did not meet GAO standards to ensure that quality assurance controls were well documented for both internal and external stakeholders.

II. Census Performed Fewer Quality Assurance Reviews Because Adjudicators Forgave Coverage Errors

The Bureau developed guidance that allows adjudicators to forgive errors when imagery data is highly ambiguous,⁹ and this led to fewer quality assurance reviews than needed to meet the operation's targeted error rate of 5 percent. Specifically, the Bureau allows adjudicators to forgive a type of error known as a *coverage error*.¹⁰ Internal Bureau guidance states that a coverage error involves incorrectly categorizing an active block (e.g., a block in which there has been housing growth) as passive. Coverage errors are serious because they preclude rectifying the mistakes in later address canvassing operations. For example, staff from the ABR and In-field Address Canvassing operations will not review a block that an IR clerk determines to be passive.¹¹ Because of this mistake, new housing units may not be added to the master address list before 2020 Census field operations begin and, therefore, will not be mailed census questionnaires and identified as a non-responding household.

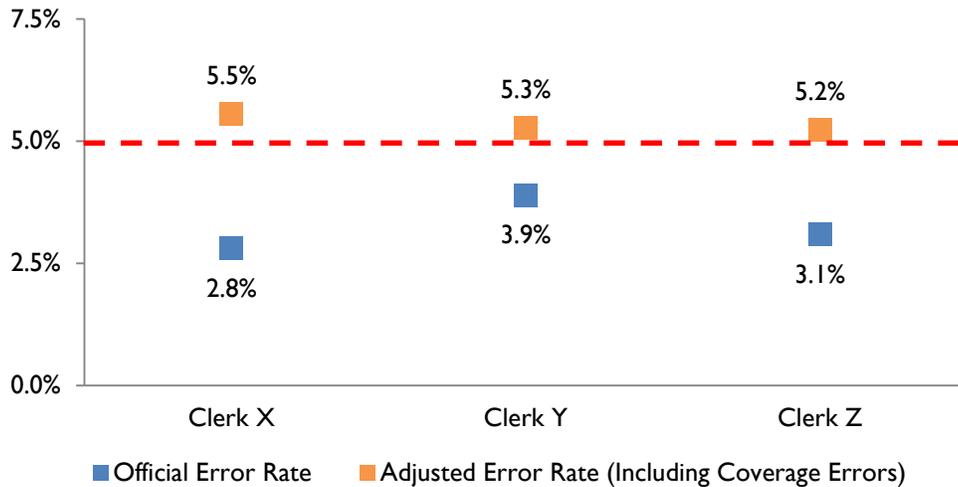
While it is reasonable for the Bureau to establish a rule not to penalize a clerk for categorizing a block as passive when the imagery is highly ambiguous, we found that this practice also interferes with business processes established to ensure the operation meets its 5 percent maximum operational error rate. As noted earlier, clerks with an individual error rate greater than 5 percent have their work undergo a 100 percent inspection. However, when adjudicators forgive a clerk's coverage errors, these mistakes do not count towards the clerk's official error rate (see figure 3). Since the clerk's official error rate does not include all of the coverage errors forgiven by an adjudicator, a clerk's work would not undergo a 100 percent inspection even though the actual error rate would be greater than 5 percent.

⁹ The Bureau gives examples of what constitutes a scenario involving *highly* ambiguous imagery data and moderately ambiguous imagery data. If the clerk is unable to: (1) decide the correct block status even after using street view imagery; (2) determine if a new or demolished structure is residential or not using any resource; or (3) determine over coverage or under coverage because of the number of addresses without map spots—then the Bureau refers to this as highly ambiguous imagery data. A map spot indicates where a housing unit is located (along with the geographic coordinates) in MTdb. Scenarios involving *moderately* ambiguous imagery data include situations when alternative views—such as the street view—make it possible to determine the correct decision regarding changes to the block.

¹⁰ The Bureau also allows other errors to be forgiven. However, we did not include minor errors, errors that would have resulted in subsequent analysis during ABR, or any block that was already slated for ABR in our testing. The Bureau allows adjudicators to forgive these errors as well, but we specifically focused on coverage errors that would have not been caught downstream by later address canvassing operations.

¹¹ A block may be reviewed again during IR if a “trigger” (such as an update from the U.S. Postal Service or local government) indicates that there has been housing growth.

Figure 3. Impact of Forgiving Coverage Errors in the Official Error Rate^a



Source: OIG analysis of Census Bureau data

^a The official error rate is determined by this formula: (Blocks marked as errors by an adjudicator / (Blocks required to go through double-blind inspection – Blocks Pending Inspection) * (1 – (Blocks required to go through double-blind inspection / Total blocks reviewed by the clerk))).

Note: the calculations assume no lag between when errors are made and inspected.

We found that if the coverage errors forgiven by adjudicators had counted towards the error rate, 40 percent of the clerks would have had their work undergo 100 percent inspection at different points in time following the baseline period, resulting in more quality reviews to meet the operation’s targeted error rate. Overall, we found that adjudicators forgave high impact coverage errors in 2.8 percent of the blocks that went through double-blind review.¹² These errors were not accounted for in the Bureau’s calculations of clerks’ official error rates. Because it has not finalized a quality assurance plan and the draft operational plan does not address the practice of forgiving errors, the Bureau has not developed business procedures that would allow it to meet its targeted error rate for the IR operation while concurrently forgiving errors.

¹² The Bureau established a target of errors in no more than 5 percent of all blocks that undergo the double-blind analysis. However, we found that 2.8 percent of blocks that went through the double blind-analysis had coverage errors that were forgiven by adjudicators. We cannot extrapolate what the error rate would have been if these errors had not been forgiven because we do not know how clerks would have performed once they went back into 100 percent inspection.

Recommendations

We recommend that the Acting Director of the U.S. Census Bureau

1. Finalize the quality assurance plan for in-office address canvassing and provide clear explanations of the error rate in this document and other plans that describe the internal controls.
2. Ensure that current practices for forgiving errors is addressed when devising business rules to meet the 5 percent undetected error rate in the final quality assurance plan.

On August 28, 2017, OIG received the Census Bureau's response to the draft report's findings and recommendations, which we include here as appendix B. Bureau management agreed with all two recommendations and noted actions it will take to address them.

In accordance with Department Administrative Order 213-5, please submit to us an action plan that addresses the recommendations in this report within 60 calendar days. This final report will be posted on OIG's website pursuant to sections 4 and 8M of the Inspector General Act of 1978, as amended (5 U.S.C. App., §§ 4 & 8M).

We appreciate the cooperation and courtesies extended to us by your staff during our review. If you have any questions or concerns about this memorandum, please contact me at (202) 482-6020 or Terry Storms, Division Director, at (202) 482-0055.

Other Matters

The Bureau Did Not Complete a Formal Cost Estimate for the IR Operation

Although NPC requires its customers to complete a formal cost estimate (through a form known as "Request a Cost Estimate" or RACE) for their projects, the Bureau's Geography Division did not complete one. IR falls under the overall cost estimate for In-Office Address Canvassing which is included in the program estimate. The IR portion of the estimate is not broken out at a low enough level and managed at this level. Our review of calculations and discussions with NPC management found that cost estimate decisions were based off verbal conversations, which were not documented. As a result, the method used to estimate cost for the IR operation is not transparent and discrepancies between estimated and actual costs, if found, cannot be researched and identified.

cc: Enrique Lamas, Performing the Non-Exclusive Duties of the Deputy Director
and Chief Operating Officer
Lisa M. Blumerman, Associate Director for Decennial Census Program
Timothy P. Olson, Associate Director for Field Operations
Colleen Holzbach, Program Manager for Oversight Engagement
Corey Kane, Program Analyst

Appendix A.

Objective, Scope, and Methodology

The objective of this review was to gain an understanding of the IR process and the quality control procedures developed to ensure accurate results. Our evaluation included a site visit to the Bureau's NPC in Jeffersonville, Indiana, in August 2016. In addition, we analyzed BARCA data for the period August 2015 through December 31, 2016.

To accomplish our objectives we

- interviewed officials at the Census Bureau headquarters and NPC to gain an understanding of the in-office address canvassing process
- reviewed the following documents:
 - *2020 Census Detailed Operational Plan for the Address Canvassing Operation*, dated December 31, 2015
 - *Interactive Review (IR) Adjudication Procedures*, dated September 25, 2015, and updated version provided by the Bureau in December 2016
 - *Draft Quality Control plan for the In-Office Address Canvassing Operation*, provided by the Bureau in December 2016
 - *In-Office Address Canvassing QC Glossary and Flow Diagram Details*, dated October 20, 2015
- analyzed BARCA data to identify processing anomalies

Additionally, we used computer-processed data to evaluate the IR process. To assess whether data were sufficiently reliable to conduct this analysis, we performed electronic testing on the data and interviewed staff familiar with the programming of the system. We found the data to be sufficiently reliable for testing internal controls.

Based on our review, we found two issues that required reporting related to internal controls over documentation and the number of quality assurance reviews. Additionally, we noted another matter related to the collection of costs.

We conducted this review between December 2015 and February 2017 and conducted fieldwork at Census Headquarters in Suitland, Maryland, and Jeffersonville, Indiana. This evaluation was conducted under the authority of the Inspector General Act of 1978, as amended, 5 U.S.C. App., and Department Organization Order 10-13, dated April 26, 2013. We conducted our fieldwork in accordance with the *Quality Standards for Inspection and Evaluation* (January 2012) issued by the Council of the Inspectors General on Integrity and Efficiency.

Appendix B. Agency Response



UNITED STATES DEPARTMENT OF COMMERCE
Economics and Statistics Administration
U.S. Census Bureau
Washington, DC 20233-0001

AUG 28 2017

MEMORANDUM FOR: Carol Rice
Assistant Inspector General for Economic
and Statistical Program Assessment
Office of the Inspector General

From: Ron S. Jarmin 
Performing the Non-Exclusive Functions
and Duties of the Director
U.S. Census Bureau

Subject: *2020 Census: Evaluation of Interactive Address Canvassing
Operation Revealed Issues with Quality Assurance Controls*

The attached comments are in response to your July 28, 2017, draft report titled "2020 Census: Evaluation of Interactive Address Canvassing Operation Revealed Issues with Quality Assurance Controls." The Census Bureau appreciates the opportunity to review and provide comments on this draft report.

Attachment

cc: Pam Moulder

Census Bureau Comments on OIG Draft Report:
*"2020 Census: Evaluation of Interactive Address Canvassing Operation
Revealed Issues with Quality Assurance Controls"*
August 2017

The U.S. Census Bureau appreciates the opportunity to comment on this draft report. We have no fundamental disagreements with any of the findings or recommendations, and will soon prepare a formal action plan to document the steps we will take in response to those recommendations.

We will address both recommendations when we update the In-Office Address Canvassing Interactive Review Quality Control Plan later this year. To address the first recommendation, we will ensure that both the error rate, and all internal controls are clearly defined. To address the second recommendation, we will revise the quality assurance business rules to ensure we accurately measure outgoing quality.

72CENSU72295