THE NEW MEXICO 2006 POST ELECTION AUDIT REPORT

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EXECUTIVE SUMMARY OF COMPLETE REPORT

During the 2007 legislative session, the New Mexico Legislature passed a bill and Governor Richardson signed it into law, which provides for random voting system audits after every statewide general election (see §1-14-13.1, NMSA). Specifically, the law provides that county clerks are to compare the total votes tallied in the general election for the office of president or governor from a random selection of 2% of the voting systems used during the election throughout the state to a hand count of the ballots cast on that system. A voting system is defined as a vote-tabulating machine (§1-9-1(B), NMSA). In the event the hand count varies from the total system count by more than 1.5%, the Secretary of State is required to conduct a recount of the specified office in the precincts of the legislative district in which the discrepancy occurred. The random system audit is to be completed within five days of the county canvass board certification of the county election results to the Secretary of State. (See Part II of this report for a copy of the New Mexico law).

The purpose of the law is to verify the accuracy and efficacy of the voting systems or vote tabulating machines in tabulating votes. Thus, the audit is meant as a performance audit of the voting machines. The New Mexico law is similar to laws that have been passed or are being considered in legislative committees across the country that require manual counts of paper ballots and voter-verifiable paper records in randomly selected units (e.g. precincts or voting systems) and comparing them to the corresponding electronic or manual tallies, for the purpose of verifying the election result with a high level of confidence.[1] The broader purpose of these measures is to strengthen voter confidence in the administration process and its outcomes.

In the spring of 2008, we had the opportunity to develop and test audit procedures in Bernalillo County, New Mexico for the purpose of recommending specific recommendations and guidelines to the New Mexico Secretary of State in preparation for the 2008 post election audit and more broadly to consider and test methods that would be effective for other states and localities as they grapple with this issue. At the same time, our study is also meant to inform the public debate on the accuracy and integrity of the new optical scan voting systems deployed for the first time in the 2006 election.

Therefore, we simulated the 2006 election using a random sample of 25% of the ballots cast (47,481 ballots) and recounted those ballots by 2-person and 3-person hand counts and by a second machine count. Bernalillo County, along with all other counties in New Mexico, uses an optical scan paper ballot system to administer their elections. Bernalillo tabulates its ballots using the ES&S M100 optical scan precinct ballot counter for Election Day and early ballot processing and the ES&S M650 for absentee ballot processing. Early voting machines and the M650 are programmed with 431 ballot styles and 78 unique ballot combinations, while Election Day voting machines usually are programmed with only 1 ballot style. Our election audit focused on the race for governor and land commissioner.

[1] H.R. 811 (op cite) also has provisions in it for post-election audits in federal elections.

This study allowed us to evaluate, assess and experiment with procedures to provide recommendations on post election performance audits. During our study we experimented with counting procedures, developed sampling procedures, chain of custody procedures and carefully examined all of the parameters necessary for a successful and complete post election audit. This included: ballot reconciliation, pre-election preparation for the post election audit, the importance of transparency to the voting process, sampling methods, example forms, audit team selection standards, reporting of audit outcomes, voter intent standards and various hand counting procedures. These recommendations, along with explanations and justifications, are presented in Part I.

Part II of our report provides a detailed description of our study, research design, and process. We provide background information on the New Mexico election administration context, the election audit law and the location and set-up for our study. We also describe the documents that we relied on to account for our work (e.g. tally sheets, audit logs, forms) chain of custody rules, sampling methods, the data we collected and the machine and hand-counting procedures.

Part III of our report examines the machine and hand count data that were generated over the course of our study and allows us to answer a number of questions about the reliability and precision of machine and hand counts across different counting modes. We compare the machine count to the actual number of ballots processed, machine to hand counts, hand counts to hand counts and machine to machine counts to assess the reliability and validity of the various counting methods. We also examine how long machines and humans took to count ballots, providing information on how long audits can take.

Each part of our study is prefaced with an executive summary that briefly discusses the major findings. We also provide an extensive appendix that documents all aspects of our research design, provides examples for suggested forms, and provides detailed information on the data we collected.

We hope that our research is a useful tool as election administrators across New Mexico and the country prepare for the upcoming elections in 2008 and beyond. Our detailed examination of the audit process is meant to provide practitioners and stakeholders with valuable information in preparation for their own election audits.

We wish to make clear that this work was a partnership between the non-profit sector, government, and academia and the strength of these relationships was key to a successful study design. As scholars we learned much about the election administration process over the course of our work and have a deeper understanding of the complexities of election administration. We hope our experiences, detailed throughout this report, provide useful information to practitioners. This study's primary financial sponsors were the Pew Charitable Trusts, Center for the States, and JEHT Foundation's "Make Voting Work" Initiative. Without their support this project would not have been completed. In addition, it is important to recognize that our partnership with local and state government both financially and administratively was also critical to our success.

Bernalillo County Clerk, Maggie Toulouse Oliver and her Deputy Clerk Robert Adams, provided valuable financial resources to support the election audit at the Voter Warehouse, provided us with the training and background to operate machines and gave us the freedom, in a potentially politically sensitive situation, to perform our task independently and experiment with a variety of methods. Her staff was incredibly supportive before, during and after the audit and made our jobs both productive and fun. The Secretary of State Mary Herrera also provided key financial and administrative support and observed our process throughout. Her staff provided key input on the New Mexico law and on the process of elections in the State of New Mexico and was a needed asset and ally throughout our work. The partnership has provided important insights for all parties in creating a stronger, more efficient and confident election system.

In addition to these individuals, the University of New Mexico, the University of Utah and the California Institute of Technology also provided key financial and administrative support. A detailed listing of all of the individuals involved in making this project a success are listed in the acknowledgement section at the end of this document.

PART 1. RECOMMENDATION SUMMARY

Based on our research in Bernalillo County, we offer the following recommendations for how post-election audit procedures can be developed for use in upcoming elections in New Mexico. We offer recommendations in twelve different areas:

- Ballot reconciliation - Create simple forms to reconcile the number of voters with the number of ballots cast and the number of ballots provided to a voting location with information on what happened to those ballots.
- Ballot organization in preparation for an audit - Because some jurisdictions process large numbers of absentee ballots on one machine, absentee ballots that are included in a post-election audit need to be organized into smaller batch units in preparation for an audit that includes all voting modes (e.g. Election Day, absentee and early).
- Transparency - Transparency and openness are critical for any post-election audit process. To the extent possible, all steps and aspects of any post-election audit process must be open to public input and observation, and the results of all post-election audits should be made easily available to the interested public.
- Audit team selection - A competent, independent, and effective audit team is required to perform the audit efficiently and accurately. Team members need to have good counting and focus skills.
- Sampling of voting systems for audit - The process of sampling of voting systems should be transparent, open to public participation, use simple random sampling, and should be done late on Election Day or as soon as possible after the election. Sampling should include all jurisdictional units and all voting modes. County election officials should consider "over sampling" voting systems when they believe that doing so will improve the integrity of the process or have reasons to believe that there might have been some sort of problem involving those voting systems.
- Chain of custody procedures - All counties should develop chain of custody procedures for their post-election audits and make them available to the public.
- Audit forms and logs - Develop audit forms for the post election audit to facilitate a smooth audit process and provide quick results to the public upon completion. These include a log of the Election Day machine count as provided by the poll workers and judges for each counting machine and the hand-count audit forms for the post election audit. Also, develop a log and procedure for hand counters to check out and return ballots to ensure the integrity of the ballots during the audit period.
- Reporting - The results of the audit should be released as soon as possible after completing the audit on the County Clerk's website or other public place and be provided to the Secretary of State. The Secretary of State should provide a standard format for the audit report so they are easily

comparable across counties and so the Secretary of State can combine the county files and place the entire state's results on the Secretary of State's website. Both files should be downloadable for public examination. The results should show the total number of ballots recorded by machine, the total number of votes cast for each candidate by machine, the parallel data from the hand count, and the percentage difference between the machine and hand count.

- Voter intent standards - Election officials should develop precise voter intent standards, and these voter intent standards should be communicated to audit team members as part of their training.
- Hand counting procedures - An audit supervisor should be placed in charge of the audit to coordinate and facilitate the hand count in a timely and efficient manner, monitor and train the counting team(s), summarize the findings and provide that information to the County Clerk, and maintain chain of custody rules over the course of the audit. Counting teams should not have any information about the totals from the machine counts to prevent the appearance of coercion or influence of readers and counters in their count. Counting teams should have a minimum of two people –one counter and one reader.
- What to do when problems arise - Additional procedures should be developed for resolutions of problems found over the course of the audit so they can be resolved.

These recommendations are based on our experience conducting multiple machine and hand counts of nearly 50,000 ballots as a part of our post election audit project. We also relied on our knowledge and expertise in elections and election administration in producing these recommendations.

This part of our report provides our specific recommendations. For each of the twelve areas where we have recommendations, we provide a brief introduction to the area, our specific recommendations, and then a discussion of our rationale behind each recommendation.

PART I. SPECIFIC RECOMMENDATIONS

1. Ballot Reconciliation

For the integrity of the election process, strong chain of custody procedures need to be integrated into the election operations that keep track of ballot activity. Such procedures ensure that the ballots counted in a post-election audit are the ballots that were cast by the voters. Therefore, we propose that Election Day precincts and early voting sites use simple forms that will reconcile ballots and voters; in Appendix A to this report we provide a series of proposed ballot reconciliation forms. The information provided by reconciliation forms provide quick and important information on the quality of Election Day and early voting management and immediate information on precinct or early voting sites that should receive additional post election assessment, including the possibility of an audit.

Specific Recommendations

1. Create a simple form or use or modify current forms to reconcile the number of precinct voters with the number of ballots cast.
2. Create a simple form or use or modify current forms to reconcile the number of early voters at each early voting location with the number of ballots cast.
3. Create a simple form or use or modify current forms to reconcile the number of ballots provided to a precinct on Election Day with information on what happened to those ballots.

Discussion

The Precinct Ballot Reconciliation Form (see Appendix A) has the poll workers walk through the election accounting process. It starts by comparing the number of voters who signed into the precinct with the number of ballots cast in that precinct. Obviously, unexplained differences in these two figures may suggest a problem with the voting process. All ballots—machine counted, provisional, and in-lieu of ballots—are included in this analysis.[2] The second part of the Precinct Ballot Reconciliation Form checks that the number of ballots cast plus the number of ballots unused equals the total number of ballots received in the precinct.

[2] In-lieu of ballots are for designated absentee voters who did not receive or vote their ballot and therefore may vote on Election Day using an in-lieu of absentee ballot. Voters must sign an affidavit testifying that they have not already voted and the county clerk must verify this fact before that ballot is counted.

Form 1 and Form 2 are simple ballot reconciliation forms that should be filled out by poll workers and/or poll judges at early and Election Day voting locations. Form 1 is designed for precinct reconciliation in Election Day voting locations and tracks the total number of voters based upon the number of voter signatures in the precinct voter roll. Poll judges would sum the total number of voters at a precinct and note the total number of ballots read by machine as provided by the M100 scanning device.[3] The poll judge would then subtract the number of voters from the number of ballots; this difference should equal zero. If the difference between voters and ballots cast is not zero, it suggests the possibility of machine or other administrative problems for this precinct and offers a quick reference for the County Clerk on where post election auditing or other post-election examination may be necessary. Reconciliation of voters and ballots also helps develop voter and stakeholder confidence in the electoral process by providing evidence of administrative integrity.

The form also provides other useful information about Election Day operations and procedures for ensuring an honest and fair election process. Form 1 provides an accounting of the total number and type of ballots cast for future reference. Poll judges simply note on the form the total number of ballots cast and read by machine, cast provisionally and cast as in-lieu of ballots providing the total number of potentially viable ballots.

We have also designed a similar form for early voting sites that would be filled out at the end of early voting on the Saturday prior to Election Day. Because early voting locations have multiple machines the workers would include the serial number for each machine. In our example, Form 3, we have included 5 machines, but the sheet could be expanded or contracted based upon each county's administrative requirements.

In addition, we have also included a form that provides for precinct-based ballot reconciliation. The County Clerk provides ballots to precincts, but currently there is no reconciliation of these ballots with what happens on Election Day in each and every precinct. We propose an accounting of the total number of ballots received against the total number of ballots used and unused. Used ballots include paper ballots read by machine, in-lieu of ballots, provisional ballots and spoiled ballots. Large numbers of spoiled ballots in a precinct, for example, might suggest that poll workers need additional training or voters need more education. Any differences between total number of ballots received and total number of ballots used and unused would be a clear red flag indicating that a closer examination of a precinct's activities is in order. Finally, by ensuring ballot reconciliation at this level voter and stakeholder perceptions of administrative integrity should be enhanced.

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[3] The M100 optical scanning device is used in New Mexico counties for scanning and tabulation of ballots in early and Election Day voting locations. Some of the larger New Mexico counties use a high-speed central scanning device for tabulation of absentee ballots, the M650 optical scanning device. In the text, we will routinely refer to each scanning device by the trade name, M100 or M650.

We also recommend that unused ballots be returned to a central location for destruction. Unused ballots destroyed at the polling location create chain of custody and potential accounting problems. Destroying ballots elsewhere also prevents the accidental destruction of used ballots during the precinct closedown procedure.

2. Transparency

Transparency and openness are critical for any post-election audit process. To the extent possible, considering resource constraints, all steps and aspects of any post-election audit process must be open to public input and observation, and the results of all post-election audits should be made available to the interested public. Transparency and openness will help ensure confidence in the integrity of the auditing process and its outcome.

Specific Recommendations

1. All pre-auditing steps and procedures should be announced to the interested public, well in advance of their occurrence. In particular, this includes the selection of voting systems for an audit, and/or voting systems in precincts, early voting locations, or particular sets of absentee ballots that might be subjected to an audit; as well as the setting up and testing of equipment to be used in the post-election audit. Election officials should encourage that, as much as possible, representatives from each political party observe some part of the audit process. Election officials should consider policies that expand public transparency of the election process and accessibility to databases and forms produced during the process.
2. The time and location of the actual audit should be announced to the public as far in advance of the audit as possible.
3. The actual audit should be held in an easily accessible public location.
4. To the extent that resources permit, election officials should consider utilizing technologies such as videotaping or web casting of the audit, to make these recordings available and accessible to members of the public who may not be able to attend the audit in person.
5. Public observers should be provided with instructions regarding any regulations or rules regarding their ability to observe the audit, and be clearly instructed about their ability to observe --- but not interfere with --- the conduct of the audit.
6. Public observers should be allowed to provide feedback and ask questions regarding the audit, however, such feedback and questions must not interfere with the operations or implementation of the audit. One way in which public observers could provide feedback is with a form provided by the county clerk and available at the audit location, on the county clerk website, or in some other way. Election

officials should work to respond to the questions and comments in a timely manner.

7. The results of the audit, including all data collected as part of the audit and any reports or documents generated by the audit process, should be made available to the public. Materials describing the audit procedures, as well as any steps taken by the election officials in light of audit results, should also be made available to the public.

Discussion

During our audit study in Bernalillo County, we took many of these steps to maintain openness and transparency regarding the audit project. These steps included a public announcement of the project, a press conference at the initiation of the project, a procedure that allowed members of the public to observe the audit project personally, live web casting from the audit project site for the duration of the project, and attempts by the project's Principal Investigators to respond to all comments and questions from the public regarding the audit project in a timely manner. These steps are important because they promote voter confidence through an open examination of the election process.

3. Audit Team Selection

A competent, independent, and effective audit team is required to perform the audit efficiently and accurately. A good audit team is necessary to maintain the integrity of the election process. An effective audit team will perform a quality audit that will enhance voter confidence in the election process.

Specific Recommendations

1. Audit team members should not be engaged, or engaged as little as possible, in regular election processes before, during and after the election. Individuals who are permanent employees of the County Clerks' offices or the Secretary of State's office should not participate in the preparation and counting of the audit ballots.
2. Audit team members need to meet certain standards to perform their job well including:
    a. Good counting skills.
    b. Concentration and focus skills.
    c. The ability to "read" ballots clearly and "count" by listening to the reader.

Discussion

The first recommendation is based upon GAO recommendations on public audits and norms developed in the accounting and auditing fields.[4] Audit integrity relies on the independence of the auditors. Auditors must be free from personal impairments to independence and external threats to independence. Auditors should be impartial participants in the process and should not bring their own biases to the process. Auditors need to be free from conflicts of interest that could arise from their active participation in the process of election administration.

For an audit to meet acceptable standards, auditors must be free from interference or influence that could improperly limit or modify the scope of an audit or threaten to do so. This freedom is normally ensured by not allowing individuals to audit themselves—audits are inherently a third-party activity. They must be free of external interference with the selection of transactions to be examined. Therefore, we recommend that employees hired to perform an audit be those who are least invested in the workings of the election process.

Recommendations under item #2 are necessary to ensure that audit team members have the basic skills required to perform the audit. Audit team members must be able to read ballots and speak those results clearly as well as be able to effectively receive that information.

4. Sampling of Voting Systems for Post-Election Audits

There are many different ways that one could produce a sample of voting systems for a post-election ballot audit. One important issue is how to consider sampling voting systems from sample precincts, as well as early and absentee systems. Recall that a voting system is defined in New Mexico Law as the vote-tabulating machine.

Specific Recommendations

1. The process of sampling of voting systems should be transparent, open to public participation, and use simple random sampling. For example, the Secretary of State's office could have all of the voting system serial numbers be placed in a container, and have voting system numbers be pulled at random from that container until the necessary 2% of voting systems, as required by New Mexico law, was reached. This random lottery selection method should be done in a public location (and could be web cast to allow for broad public observation).

[4] See, for example, Donald H. Taylor and G. William Glezen, *Auditing: Integrated Concepts and Procedures, 6th ed.,* New York: John Wiley & Sons (1994); United States Government Accountability Office *Government Auditing Standards*, July 2007.

2. The process of sampling voting systems for inclusion in the post-election audit should be conducted late on Election Day, after the voting is complete, or as soon after the election as possible. If after the election, procedures must be in place to assure that problem precincts are not sampled around. This means County Clerks must provide a list of voting systems used for early, Election Day and absentee ballot processing to the Secretary of State the Friday before Election Day. If a voting machine is selected for audit in which machine failure occurred, a replacement machine should be substituted. The goal is to avoid bias either on the front end—election officials know which machines are to be audited before they are deployed—or on the back end, where election officials can potentially sample around "problem" precincts. For example, in Utah, the sample is drawn toward the end of Election Day, based on information supplied by the counties to the state regarding which machines are deployed on Election Day.
3. The sampling process used should take into consideration the relative distributions of ballots that are being tabulated by different types of voting systems in New Mexico: some are tabulated in the early voting process, some as part of the absentee voting process, and some are tabulated in polling places on Election Day. One approach that would ensure coverage of all modes of voting in a post-election audit would be to produce a sample of two percent of the voting systems used for precinct voting on Election Day, two percent of the voting systems used for absentee voting, and two percent of the voting systems used for early voting. This ensures that a robust check of all voting systems used for tabulating ballots is undertaken.
4. The sampling process should also take into consideration that counties administer elections and that, to ensure that all counties are operating effectively, all counties should be included in the post election audit. Counties, however, have large differences in population, so we also need to be sensitive to the density of voters as well. Therefore, our primary recommendation is that 2% of each counties voting systems be sampled. Alternatively, we recommend that the Secretary of State first sample 2% of all voting systems (as described in #3) and then oversample counties that were not included in the initial 2% draw to ensure that each county audits at least one machine.
5. County election officials should consider "oversampling" voting systems when they have incident reports or other indications that there might have been some sort of problem involving those voting systems while in use in a particular election.

Discussion

New Mexico state law provides that (§ 1-14-13.1 NMSA): "The secretary of state shall direct the county clerks to compare the total votes tallied in the general election for the office of president or governor from two percent of the voting systems in the state with total votes tallied by hand from the voter verifiable and auditable paper trail from those voting systems." A voting system is defined as (§1-9-1(B)): "'voting system' means a combination of mechanical, electromechanical or electronic equipment, including the software and firmware required to program and control the equipment, that is used to

case and count votes; equipment that is not an integral party of a voting system, but that can be used as an adjunct to it, is considered to be a component of the system. One interpretation of this regulation is that all voting systems, regardless of whether they were used for early, absentee or Election Day precinct voting, would be sampled until two percent of those voting systems were selected. Given that all of the voting systems used in New Mexico are Election Day optical scan systems, it would be likely that under this interpretation a preponderance of the sample would be Election Day voting systems. This would be despite the fact that any particular Election Day voting system might have tabulated many fewer ballots than a scanning system used to tabulate early or absentee ballots, as many fewer voting systems are used to scan what in recent elections has been a very large fraction of ballots cast in New Mexico.

Thus, to ensure that a post-election audit is not conducted with a sample that does not have any representation of voting systems used for early or absentee voting (or that the sample includes a disproportionately low fraction of these voting systems relative to Election Day voting systems), we recommend that voting systems used for each mode of voting in New Mexico (early, absentee and Election Day precinct) be considered an independent population, and that a two-percent sample of voting systems be drawn independently from each of these three samples. This will ensure coverage of voting systems used for early and absentee voting.

In addition, we recommend that the election administrative unit, counties, also be considered in the sampling process. Because voters are not spread equally across counties, we need to be sensitive to voter density and therefore sample more voting systems in areas where there are larger numbers of voters. But, we also need to ensure that all administrative units are part of the audit for election integrity issues. Thus, we recommend that 2% of each counties voting systems be sampled. Alternatively, the initial 2% sample could be selected and then add to that total an oversample of voting systems in counties that were not part of the initial 2% sample.

Also, we note that the current regulations are silent on the method of sampling, what entity does the sampling, when the sampling is done, and whether the sampling process is open to the public. As sampling is a key component of the post-election audit as it is currently conceptualized in New Mexico, we strongly recommend that the sampling be done using simple random sampling, which, while a technical term used in the statistical literature on sampling, is quite descriptive.[5] Simple random sampling means that one simply selects units for a sample in a completely random way, so that each unit has a known and identical probability of being picked for the sample.[6] Simple random

[5] In actuality, our recommendation is for a stratified random sample, stratified by county. However, we keep the simple language here so it is accessible and easily understood by the public and election officials.
[6] See Leslie Kish, *Survey Sampling*, New York: Wiley 1995; Paul S. Levy and Stanley Lemeshow, *Sampling of Populations: Methods and Applications, Third Edition***.** New York: Wiley, 1999.

sampling is easy to conceptualize, easy to explain to the public and stakeholders, and easy to implement.[7]

Furthermore, as sampling is critical for a post-election audit, it should be done in a public, open and transparent manner. If conducted in such a way, it will be difficult for criticisms to be raised during the audit that the sampling process was done incorrectly, inappropriately or purposefully maliciously.

Finally, we recommend that the Secretary of State conduct the sample, and that it be done late on Election Day, after the polls close, or as soon as possible after the election. This is necessary for two reasons. First, if the sample is taken before the election then fraudulent election activities may stay clear of selected precincts. Early sampling breeds fear in some individuals that fraud was directed away from machines that had been chosen for auditing and toward those that were not being audited. Sampling immediately after the election poses a different problem in that the sampling process may be compromised by knowing which precincts had "problems" and therefore are somehow systematically removed from the process. Of course, public random sampling should help to dispel these perceptions, especially in a post-election environment. By placing the audit sample selection process late on Election Day, the possibility of sample manipulation and early sample knowledge problems is minimized.

5. Ballot Organization in Preparation for Audit

Some counties process large numbers of absentee ballots on one machine, (often as much as 25% of all ballots cast) which could lead to difficulties completing the audit in the specified period of time if this machine was randomly chosen for post election auditing. Therefore, we recommend that absentee ballots should be organized into smaller batches preparation for an audit that includes all voting modes (e.g. Election Day, absentee and early).

On the other hand, Election Day ballots are already essentially batched by precinct and hence by the voting system or machine used to tabulate ballots in that precinct. Likewise, early ballots are batched by the early voting machine on which the ballot was counted. Thus, non-absentee ballots are already bundled into easily manageable and auditable units.

[7] Levy and Lemeshow (1999) describe the process of taking a simple random sample: "The first step in taking a simple random sample is to assign a number from 1 to *N* to each element in the population. The next step is to pick a sample of *n* of these numbers by use of some random process such as a table of random numbers, a computer, or a calculator with a random number generator. Whatever procedure is used must ensure that the numbers selected are all different and that none are greater than *N*. Once the numbers are chosen, the population elements corresponding to these numbers are taken as the sample" (page 48). This general process could be adapted for selection of voting systems for inclusion in a post-election ballot audit.

Specific Recommendations

1. Absentee ballots could be presorted by precincts and voting systems that are selected in the random sample for auditing that are associated with precincts would also include the absentee ballots from those precincts for counting.
2. Or, batch absentee ballots into units of size equal to the average number of ballots cast in Election Day precincts in the last similar election. Thus, presidential election years would randomly batch absentee ballots into units of size equal to the average number of Election Day ballots cast in the previous presidential election across precincts. Likewise, gubernatorial election years would randomly batch absentee ballots into units of size equal to the average number of Election Day ballots cast in the previous gubernatorial election year across precincts. Two percent of these batches would then be selected for post election auditing.

Discussion

In recent New Mexico elections, roughly one-quarter of ballots were cast absentee; thus, when conducting an audit to ensure election integrity, it is necessary to include absentee ballots in the audit process. Given the trends in convenience voting nationally, this percentage is likely to rise in 2008 and beyond. Also, because large New Mexico counties rely on only one or two fast processing optical scan machines (M650) for these ballots, it is necessary to batch these ballots into smaller and more manageable units for the audit. If absentee ballots are not separated into batches and the M650 is chosen for auditing, the number of ballots to process could be overwhelmingly large and possibly difficult to complete within the 5-day window prescribed by the law. Bernalillo County, for example, processed approximately 48,788 absentee ballots in the 2006 general election, mostly using one M650 machine.[8] Even smaller counties that process their absentee ballots using the slower M100 machine may benefit from the manageability provided by the batching and processing of a subset of ballots.

The natural voting unit is the precinct level because precincts determine ballot configuration and is, therefore, the administrative unit that counties use for election preparations and for calculation of election results. Therefore, the precinct is a meaningful way to organize ballots and process them for auditing of voting systems. It also provides for important comparisons across voting modes (absentee versus Election Day) that could provide information about problem precincts if the two voting modes

[8] Ballots rejected by the machine count are hand counted.

showed very different election results. In addition, if a recount is requested by a down-ballot, non-statewide candidate, sorting of ballots will have to be undertaken. Sorting ballots by precinct on the front end instead of the back-end is procedurally more efficient. Both factors are strong reasons for a precinct level method to ensure election integrity across all voting modes. Thus, our preference is for the precinct method of sorting. We recognize, however, that not all jurisdictions have the resources to sort absentee ballots and therefore offer the "batch" method, which creates a simpler process.

6. Chain of Custody

Strong chain of custody procedures is essential for a secure auditing process, and will ensure a high degree of integrity for the audit. The Principal Investigators have studied chain of custody procedures for election administration, and worked to develop a chain of custody procedure for our audit project.[9] Our chain of custody procedure is attached to this report for reference (see Appendix B); we offer it as an example of what might be done in New Mexico counties as they develop procedures for their post-election audits, but realize that appropriate chain of custody procedures will need to be sensitive to the local context and thus might need to be adapted from what we present below.

Specific Recommendations

1. All counties should develop chain of custody procedures for their post-election audits, which should be submitted to the Secretary of State for review.
2. The Secretary of State, or another appropriate entity in the State of New Mexico, should be given each county's chain of custody procedure well in advance of any post-election audit. The Secretary of State, or another appropriate entity, can work with each county to ensure that they have a secure and effective chain of custody procedure.
3. Chain of custody procedures should be made available to the public well in advance of any post-election audit. They can be made available by county election officials themselves, the Secretary of State, or other state entities.
4. All chain of custody procedures should follow these basic procedures:
    a. Ensure that all election materials that are part of the post-election audit are transported and stored in sealed containers that ensure the integrity of those materials.
    b. All sealed election materials should be periodically inspected to ensure that their seals are intact.
    c. All election materials inside the sealed container should be delineated on a log attached to the container, in particular basic information like the voting

[9] See, for example, "Building Secure and Transparent Elections through Standard Operating Procedures" R. Michael Alvarez and Thad E. Hall. *Public Administration Review,* 2008, 68(5) 2008, pages 828-838.

location from which the ballots originated, total number of ballots in the container, and information regarding any other information in the container.

d. All seals should be recorded and the record of the serial numbers and when they were broken should be kept as part of the audit procedure.

e. More than one individual should witness all movement of ballots, and all movement of ballots through the audit process should be logged.

f. All log materials should be made available to the public for review upon completion of the audit.

g. Each time that ballots are removed from, or returned to, a sealed and secure storage container, the number of ballots should be determined and compared to the number of ballots that should be in that particular container as stated on the ballot storage container log.

Discussion

Ensuring the integrity of election materials requires that election officials develop and follow a clear and detailed chain of custody procedure in their post-election audits. Election jurisdictions that currently use post-election audits have developed strong chain of custody procedures, and the Principal Investigators have studied these chains of custody procedures. The chain of custody procedures we developed and used in our Bernalillo County post-election audit study were based on the procedures used in these other election jurisdictions, and adapted for the particular context of Bernalillo County's election administration practices and procedures.

Strong chain of custody procedures will help ensure the security and integrity of all election materials. They will also make it possible to document completely the precise path of all election materials as they go from the location where the election jurisdiction keeps election materials, to the location of the audit, thorough the auditing process, and then back to their original storage location. Being able to document all election materials absolutely will prevent inadvertent problems, or efforts to interfere with the auditing process.

7. Audit Forms and Logs

Based on the experience of conducting a large election audit, we recommend the following forms and logs (see Appendix A) be maintained during any post-election audit.

Specific Recommendations

1. Develop audit forms for the post election 2% machine audit to facilitate a smooth audit process and provide quick results to the public upon completion. These include a log of the Election Day machine count as provided by the poll workers

and judges for each counting machine and the hand-count audit forms for the post election audit.

2. Develop a log and procedure for hand counters to check out and return ballots to ensure the integrity of the ballots during the audit period.

Discussion

We developed and used a variety of tally sheets and log forms for the initial machine count and hand tallies as shown in the audit overview section of this report. Many of these forms were adapted from similar forms we obtained from other election jurisdictions that conduct post-election ballot audits. We used colored paper to easily distinguish between forms. Our experience suggests that those forms were helpful for a quick determination of the reliability of the machine count and therefore we encourage their deployment for post election auditing. We have developed Form 1 and Form 3 for precinct and early voting machine batch hand counts that requires information that could easily be filled out by a precinct judge or poll worker. The form includes the total number of ballots read by the machine and the breakdown by the office being audited (president or governor).

Form 5 and Form 6 were developed for the hand-count. Form 5 would be used when counters copy the data from a tally sheet onto a separate audit sheet. Alternatively, we have also included Form 6, which combines all the necessary data onto the tally sheet. In this case, only this form is necessary for completing the audit. We found that there were quite a large number of mistakes made in copying data from one form to another and so one single form solves this problem and reduces the overall amount of paperwork associated with the audit. We include both here, recognizing that jurisdictions may prefer a separate sheet from tallying for the information about the audit. However, it is our recommendation that one form be used for tallying and summarizing the audit information because it is the most efficient method and therefore the better choice administratively. Both forms contain information about the identity of the counters and the ballot box seal number on the opening and closing of the ballot box to maintain strong chain of custody procedures. We recommend that the hand count also include a confirmation of the number of ballots that were placed in the ballot box on Election Day or when those ballots are boxed after early voting has ended and absentee voting has been completed. The form includes the total number of ballots manually and the breakdown by the office being audited (president or governor).

8. Reporting

Although the law does not stipulate in what manner audit data should be released, it is important to consider how audit data should be released to the general public.

Specific Recommendation

1. The results of the audit should be released as soon as possible at the end of the 5 day period for completing the audit by voting system on the County Clerk's website or other public place and be provided to the Secretary of State. The results should show the total number of ballots recorded by machine, the total number of votes cast for each candidate by machine, the parallel data from the hand count, and the percentage difference between the machine and hand count.
2. The Secretary of State should combine the county files and place the entire state's results on the Secretary of State's website. Both files should be downloadable for public examination.

Discussion

New Mexico provides that (§ 1-14-13.1) that, "The check of the voting systems shall occur within 5 days of the completion of the county canvass," thus providing a time-line for completion of the audit. After the audit it is necessary to release the data as quickly as possible to increase the integrity of the process and voter confidence in the election results. Of course, if the audit shows a discrepancy greater than 1.5%, additional counting will have to be undertaken and should be instigated as soon as possible.

9. Voter Intent Standards

Election officials should develop precise voter intent standards, and these voter intent standards should be communicated to audit team members as part of their training. Any effort to hand count ballots as part of a post-election audit requires that all members of the auditing team conducting the hand count agree exactly on what constitutes an expression of voter intent on that ballot.

Specific Recommendations

1. Clear voter intent standards for post-election hand tallying of ballots should be developed, perhaps similar to or based upon the standard provided in existing §1-1-9-4.2 (B) of the Election Handbook of the State of New Mexico (2007 Edition).
2. These standards of voter intent in the post-election hand tally should be communicated to all members of post-election hand-tallying teams during their training.

3. All members of post-election hand-tallying teams should be provided with a voter intent guide that they could use as a reference during their hand-tallying process. This guide should state the voter intent standards as well as provide examples to make it quick and easy for team members to determine voter intent in all cases.
4. A procedure should be developed for determining voter intent in situations where the hand-tally team does not unanimously agree on a particular voter's intent.

Discussion

S. 1-14-13.1 ("Post-election duties; random voting system check; recount") mandates that "The secretary of state shall direct the county clerks to compare the total votes tallied in the general election for the office of president or governor from two percent of the voting systems in the state with the total votes tallied by hand from the voter verifiable and auditable paper trail from these voting systems." However, this section does not discuss what exactly constitutes the standard for assessing voter intent in the case of this post-election hand tally.

However, S. 1-9-4.2 ("Definition of a vote; counting of hand-tallied ballots") states the following:

A. A vote on a paper ballot used on an electronic vote tabulating system, optical scan vote tabulating system or high-speed central count vote tabulator consists of a voter's selection of a candidate or answer to a ballot question indicated in the voting area of the paper ballot marked in accordance with the instructions of that ballot type.
B. For paper ballots that are hand-tallied, a vote shall be counted if one of the following occurs:
    1. The ballot is marked in accordance with the instructions for that ballot type;
    2. The preferred candidate's name or answer to a ballot question is circled;
    3. There is a cross or check within the voting response area for the preferred candidate or answer to the ballot question; or
    4. The presiding judge and election judges for the precinct unanimously agree that the voter's intention is clearly discernable.

In many states, either state law or state regulations include actual photographs or diagrams that illustrate marks that are a vote or are not a vote. Consideration should be given to developing similar detailed voter intent standards that help in the conduct of post-election audits.

10. Hand Counting Procedures

Based upon our experience in the Bernalillo Post Election Audit, we recommend the following hand counting procedures.

Specific Recommendations

Timing:

1. The audit must be completed within five days of completion of the County Canvass.
2. The Friday before Election Day, each county clerk should provide the Secretary of State with a list of optical scan voting systems, M100s and M650s and their assigned precincts, early voting site or absentee designation, that are to be used to count ballots; the day after the election, each county should inform the state if any machines were not used and the serial number for the replacement machine that was used. Each machine has a unique serial number and so we recommend that these numbers be transmitted to the Secretary of State.
3. The Secretary of State, upon receiving all the information, should publicly sample using the voting machine list and provide that information to the county clerks in a timely manner so that they can prepare for and complete the audit in a timely manner.

Background procedures:

1. An audit supervisor should be placed in charge of the audit. His/Her role is to coordinate and facilitate the hand count in a timely and efficient manner, monitor and train the counting team(s), summarize the findings and provide that information to the County Clerk, and maintain chain of custody rules over the course of the audit. The audit supervisor should not be engaged, or engaged as little as possible, in regular election processes before, during and after the election in keeping with GAO auditing guidelines.
2. Counting teams should not have any information about the totals from the machine counts to prevent the appearance of coercion or influence of readers and counters in their count.
3. Counting teams should have a minimum of two people –one counter and one reader. Counting teams could also consist of 3 person teams (one reader and two counters) or four person teams (two readers and two counters), depending on resources and complexity of the hand counting task.

4. Counting teams require the following supplies: pens (or indelible pencils) and tally sheets. Additional recommended supplies include rubber fingers, a scratch pad and a calculator.
5. Reader(s) and counter(s) should sit across from each other at a table.

Chain of custody procedures:

1. To ensure chain of custody standards are met during the auditing process, counting teams will check out the appropriate ballot container batch (precinct, early or absentee machine read votes), indicating an exchange of possession of the ballots from audit supervisor to the counting team. This record should include the signatures of the counting team members and the audit supervisor.
2. The counting team should take the ballots (in the ballot container) to their table where they will break the seal, note the seal number on their counting log form and place it into the ballot box. They then can remove the ballots from the ballot container.
3. The counting team should first count the number of ballots in the container, confirming the number of ballots in the container matches the number of ballots that are supposed to be in that batch (per one of our recommendations above, this information should be on an easily accessible log form attached to the outside of the ballot container). To count the ballots, team members should stack the ballots in units of 25 until they get to the final ballot. Grouped ballots can be stacked in a crisscrossed manner if needed for space conservation.
4. The total number of ballots found in the ballot box should be placed on the manual hand count form.
5. If the number of ballots inside the container does not match the expected number of ballots that should be in the ballot container, the audit supervisor should be immediately informed and a search for any missing ballots or a finding of why there are additional ballots in the container should commence. When this issue is resolved, the counting team can begin their counting charge. If the number of ballots in the container matches the expected number of ballots counting team members can begin counting ballots.
6. All log materials should be kept and provided to the County Clerk to be retained for the public record.

Counting Procedures:

1. For counting votes, counting team should sort the ballots first into three groups: straight party Democrat, straight party Republican and everything else.
2. If desired, ballots can be further separated into 2 sub-straight party options: straight party ballots with no additional marks on candidates being selected by

voters, and straight party option with bubbles indicating a change in voter preference from the straight party option.

3. Tally sheets shall be provided for the hand count for only those races being recounted: governor or president and should include under vote and over vote category options.
4. First, each straight party ballot should be read and counted in groups of 25.
5. The reader should clearly state the voter intent by reading aloud the candidate's name (e.g. Smith, Garcia) or if the voter chose not to vote in the contest being audited the counter should read "under vote." If the voter voted for 2 or more candidates, the reader should read "over vote."
6. The counter shall make a tally or chicken mark, 5 to a box, in the traditional style. We recommend that tally cells be filled in a vertical as opposed to horizontal form for counting ease. Thus, counters move down and then across the tally sheet as opposed to across and down. For an example, see Form A.6 in Appendix A.
7. When the counter completes reading all the straight party options, the counting team should check to determine that the number of ballots they have counted matches the number of straight party ballots.
8. If there are too many or too few tally marks, the count should be voided and begin again.
9. If the number of ballots processed is correct, the counting team should then begin counting the remaining votes.
10. Upon completion of the count, the counter shall sum the total number of votes for each candidate as well as any under votes or over votes. Reader shall confirm these amounts. Both counter and reader will sign the tally form.
11. Totals should be placed on a manual count form so this data can be easily transferred to an electronic database for comparison with the original machine count.
12. Counting team should then return ballots to their original ballot container.
13. Counting team then returns the ballot container to the audit supervisor and re-checks in the ballots, sealing them in the process. This seal should be noted on a log form and signatures of all the parties should be obtained.

Hand counting procedures when the number of ballots is large (over 500):

1. When the number of ballots to be counted is large, we recommend first sub-dividing them into smaller units, not exceeding 500 ballots per batch. Chain of custody procedures developed for the audit should be followed when sub-dividing large numbers of ballots for the audit count. This means that audit team members who sub-divide the ballots should sign the ballots in and out; also, an audit supervisor should witness this activity.

2. If necessary, these smaller batches can be counted by different teams, using the same procedures as above, and then combined for totals. In this case, each smaller batch would be considered independent by the counters, but supervisors could combine totals onto one new form to determine total counts for the voting machine.
3. If large numbers of ballots exist and the subdivision option is not available, we recommend placing the ballots into smaller units for confirmation as the count is in process. Smaller units could be as small as 100 or 200 ballots.

Reconciliation Procedures:

1. The audit supervisor will reconcile the machine count with the hand count and turn that information over to the County Clerk.

We recommend the use of simple electronic spreadsheet files for the data entry. The column categories should include: county, batch identification, serial number of voting machine, total number of ballots counted by hand and by machine, total number of votes cast for the Democratic candidate by hand and by machine, total number of votes cast for the Republican candidate by hand and by machine, total number of votes for other candidates by hand and by machine, and total number of uncounted votes by hand and machine (under votes and over votes). Several columns should subtract the various hand count totals from the machine count totals, providing the difference. And, several final columns should calculate the percentage difference between the hand and machine counts.

Discussion:

New Mexico Law provides that (§ 1-14-13.1, Post-election duties; random voting system check; recount):

A. The Secretary of State shall direct the county clerks to compare the total votes tallied in the general election for the office of president or governor from two percent of the voting systems in the state with total votes tallied by hand from the voter verifiable and auditable paper trail from those voting systems. The check of the voting systems shall occur within 5 days of the completion of the county canvass.

Furthermore, the New Mexico Law provides that (§ 1-13-13 NMSA Post-election duties; county canvassing board; certifying results):

A. The County Canvassing Board shall complete the canvass of the returns and declare the results within 10 days from the date of the election.

The county canvassing board is responsible for scrutinizing the county's election returns to determine that they contain the properly executed certificates and whether any

discrepancy, omission or error appears on the face of the election returns (see §1-13-1 through §1-13-5 NMSA). These rules stipulate a short time frame for completing the audit after the election. Therefore, the necessary information for sampling must be provided to the Secretary of State as quickly as possible. Likewise, the Secretary of State must be prepared to complete the sampling procedures publicly as quickly as possible, (we recommend that this be done after the close polls on Election Day), and return that information to the County Clerks for preparation of the audit. These dates and times should be posted before the election so all parties know their obligations prior to the election so they can appropriately administer this process quickly and efficiently.

Because the audit happens rather quickly, audit team members and the audit manager should be identified before Election Day so preparations can be made for the post-election audit. Preparations should include chain of custody procedures and counting rules and guidelines.

The remaining procedures are derived from our experience and the feedback provided by our counters in the Bernalillo audit, our general knowledge of auditing processes elsewhere, and our study of the private and government sector performance auditing. Over the course of the audit, audit teams found that sorting ballots by straight party option made for an easier and more confident counting process. It also provided for natural checkpoints in the process to confirm the correct number of ballots.

When the number of ballots to be counted is large, separating them into smaller units helps the counting process go smoothly and with greater accuracy. It also allows natural checks in the process to ensure that all the ballots in the ballot box are included in the hand count.

11. Recommendations on What to Do When Problems Arise

If the audit shows a discrepancy or problem, plans must be in place to resolve them.

Specific Recommendations

1. If the difference between the hand count and the machine count is more than 1.5% a full recount must be completed for the office in question for the problem precinct, early voting machine or absentee batch.
2. Procedures should be developed for resolution of any other problems found over the course of the audit.

Discussion

New Mexico law in S 1-14-13.1(B) states the initial procedure reproduced in 1 above: " if the difference is more than 1.5 percent, then do a full recount for the office in question in the precincts where the machine was used (or for all of the absentee ballots)." However, it does not state what to do if a discrepancy still remains after this is completed or if other discrepancies revealed in the audit are noted. For example, if the audit were to find that the number of ballots is significantly off or there are other procedural oddities, the law is silent about what action might be taken in such instances. For example, in one Election Day precinct in the Bernalillo audit we found that creative poll workers used masking tape to cover up what we believe were over votes or voter errors on a number of ballots so they would be read by the M100 scanning devices. This suggests that the poll workers were actively intervening in the election process in an inappropriate manner. If the audit uncovers such irregularities there is no process in the current law to resolve them. The law provides for the county canvassing board to be the check of the election process and to search for and rectify irregularities, but the canvass board meets and makes these determinations before the audit even begins, so this route is not open for resolution. Therefore, we recommend that additional procedures be developed for resolution of these problems, other than litigation.

PART II. AUDIT PROCEDURES

PART II. SUMMARY

The audit procedures part of our report describes the objectives of our project and explains our research design and methodology. It reports our procedures and details the preparations, decisions and management issues we faced in designing and implementing our study. We cover the following eleven areas:

- Audit Project Overview
- The New Mexico Audit Law
- Research Design
- Audit Layout
- Sampling
- Chain of custody procedures
- Machine Count #1
- Hand Count #1
- Hand Count #2
- Machine Count #2
- Data Collected

Audit Project Overview

The objective of this pilot project was to develop, implement, and analyze a post election ballot audit in New Mexico's largest populated county, Bernalillo. The Pew Charitable Trusts and the JEHT Foundation's Make Voting Work Initiative, the Bernalillo County Clerk, and the New Mexico Secretary of State funded this project. Research teams and election experts from the University of New Mexico, the University of Utah, and the California Institute of Technology carried out the research. The rationale for this pilot project arose because New Mexico, like a number of other states, has mandated post election audits beginning in the 2008 general election. Our project developed procedures for a pilot post-election audit and then implemented a countywide machine and hand recount of paper ballots from the 2006 gubernatorial general election race in Bernalillo County. We also replicated the procedures in a machine and hand recount of the down-ballot race for land commissioner in that election.

Our goal is to inform both the public debate on the accuracy and integrity of the new statewide paper ballot voting system, which was implemented in 2006, and the public

policy process, by piloting procedures to implement a post election audit. This information is critical not only to New Mexico, which has already adopted post-election audit requirements, but to other state and federal policy makers as they consider comprehensive, but previously untested, audit legislation. The larger purpose of this study is to develop methodologies to assess the integrity and accuracy of our election administration process and to disseminate those methods and information to researchers, administrators, and other stakeholders. The New Mexico project provides critical information to policy makers in New Mexico, and nationally, on how to most effectively implement the post-election audit comparing vote totals across machine and hand counts and provide key information on how voters interact with their ballot. Such information should assist in building voter confidence and in understanding voter intent and voter education issues. The results of the project in New Mexico also dovetail with the work that is being done studying election audits in Utah, also as part of the Pew-JEHT Make Voting Work Initiative. The Utah project has identified that election audits, as currently construed, are quite narrow in scope and do not reflect audits as conducted in other areas. Therefore, in both projects, we incorporate information and recommendations to develop a broader administrative definition and understanding of the value of larger audit practices.

The New Mexico Audit Law

New Mexico's post-election audit law is stated in § 1-14-13.1 NMSA of the state's election regulations, "Post-election duties; random voting system check; recount." To quote directly from the statute:

> A. The secretary of state shall direct the county clerks to compare the total votes tallied in the general election for the office of president or governor from two percent of the voting systems in the state with total votes tallied by hand from the voter verifiable and auditable paper trail from those voting systems. The check of the voting systems shall occur within five days of the completion of the county canvass. Canvass observers shall be allowed to observe the audit under the same conditions and restrictions as for observing the county canvass. In the event that one of the randomly selected voting machines is used for absentee voting, then the prescribed certification procedure shall be used to verify the accuracy of that machine's vote total.
>
> B. For voting machines not used for absentee voting, if the vote totals for the voting system and the voter verifiable and auditable paper trail differ by more than one and one-half percent, the secretary of state shall have a recount conducted for the office in the precincts of the legislative district in which the discrepancy occurred. For voting machines used for absentee voting, if the results of the re-certification process produce an error rate that

> exceeds one and one-half percent or the error threshold approved for that machine, whichever is more restrictive, the ballots counted on that machine shall be recounted.

The procedures we developed for our pilot post-election ballot audit project represent our attempt, working with both state and local election officials, to translate this statute into practical steps that could be implemented by our research audit teams; and, ultimately be useful guidelines for county jurisdictions as they prepare and implement their own post election audits. We note that, based on the research that is being conducted in Utah's Make Voting Work project, that the New Mexico law mirrors many state laws and regulations that require election audits.

Research Design

Background and Overview

Although the New Mexico law focuses on presidential or gubernatorial races for machine auditing, our study focused on the 2006 general election gubernatorial contest and the 2006 general election race for land commissioner. The down ballot race was chosen to examine differences across contests and, because it was a statewide race, all Bernalillo County voters had the option to cast a vote in this race.

In the 2006 general election, 198,611 voters cast ballots in Bernalillo County. About 25% (49,788) of ballots were cast absentee, another 21% (41,734) were cast early, and the remaining 54% (107,089) were cast in precincts on Election Day. To conduct a comprehensive audit of the ballots' cast using the optical scan voting system used in Bernalillo County, we wanted a sufficiently large number of ballots to determine where discrepancies might exist in hand to electronic and electronic to electronic counts. In addition, because very little empirical work has been done on discrepancies in ballot counting methods, we required a large sample of ballots to determine the scope and cause of any differences. Therefore, we sampled approximately 25% of all ballots including early, absentee and Election Day ballots, yielding a sample of roughly 50,000 ballots from the Bernalillo County 2006 general election. We used the identical machines (M100s) that were used on Election Day to count the ballots chosen by our sampling of voting systems in the precincts and early voting sites. The ballots from these early and Election Day precincts were stored in ballot storage containers and were taken directly from these containers for counting purposes. Because the absentee ballots are stored en masse, we sampled a subset of these ballots for inclusion in the study. Although we observed and assisted in the counting process, the sample of selected absentee ballots was counted on an M650 optical scan reader, which was operated by an AES staff member. The audit was performed at the Bernalillo County Voter Warehouse at 2400 Broadway SE, Albuquerque, New Mexico between February 22 and March 18, 2008.

On Friday, February 22, 2008, the absentee ballots were counted by machine with our small staff consisting of the research team and a few temporary workers who had been preparing the warehouse and ballots for the audit. On Monday, February 25, 2008 se same workers and members of our audit ballot counting team conducted a dry run of the audit. On Tuesday, February 26, the formal audit began with all team members, temporary staff and county employees present. To enhance the integrity of our process, the audit was web cast live from http://electionaudit.unm.edu. Nearly 600 individuals visited our web site and viewed our activities, averaging nearly 20 visits/day over the course of our study. Although many visitors were local, such as the University of New Mexico or Bernalillo County, there were many other visitors attracted to our cite including the US Department of Health and Human Services, the National Institute of Standards and Technology and many other state and national government entities and private networks. These data are detailed in Appendix C. The audit ended on Tuesday March 18, 2008.

Although we created procedures for the election audit, we also allowed hand counters to experiment with different counting methods. This was important to determine best procedures and practices for audit counting and qualitatively assisted us in the recommendations we provide in this report.

Research Audit Preparation

There was a significant amount of preparation required by the Bernalillo County Clerk's Office staff prior to the audit team's arrival.

Ballots from the 2006 election were in ballot storage containers since the 2006 General Election. Generally, the ballots were organized by voting type --Election Day precinct voting, early voting and absentee voting-- however consolidation and inventory was required to ensure that the ballots would be turned over to the audit team in an organized manner. This was a very time consuming process that required 12 temporary staff members working two full weeks. Over this time we learned many ballot organization and post election storage lessons.

Once the ballots were organized by precinct and voting type, they were double counted by hand by teams of two temporary employees. The total number of ballots processed in a precinct or by machine, in the case of early and absentee ballots, were then compiled and that information became part of the chain of custody document that was provided to the audit team at the beginning of the audit.

In addition to preparing ballots for the audit, the M100 and M650 tabulators needed to be prepared since the audit required two machine counts. Tabulator preparation (certification) consisted of:

1. Coding of the PCMCIA Cards or audit machine memory cards with the 2006 General Election Definition and,
2. Logic and Accuracy testing of each machine selected for audit. This determines that the machine is reading the optical scan ballots correctly.

A sub-contractor of the Bernalillo County Clerk's Office—Automated Election Services (AES)—performed the Coding of the PCMCIA Cards with the 2006 General Election Definition. AES had retained the 2006 General Election Definition from November, so the database did not need to be re-created. It was necessary, however, to recode the PCMCIA Cards for each machine to be audited. This took approximately two days.

Bernalillo County Clerk's Voting Machine Technicians performed [Logic and Accuracy] testing of each machine selected for audit. We used the same [Logic and Accuracy] testing used in the 2006 General Election that included:

1. The M100 tabulators were removed from the ballot bins and placed on a table. By removing the tabulators from the bins, the ballots' integrity was protected and the order was maintained.
2. For Election Day precincts/machines, the ballot test deck was composed of a ballot marked for each position (candidate) on the ballot as well as a ballot marked straight party for each party and one over-voted ballot, one blank ballot and one ballot with the code channels marked out.
3. For early voting machines, the test deck was composed of the first precinct from each ballot combination for each party (96 combinations for each party). Each precinct combination selected included all positions voted once for each candidate. The test deck was split into four equal parts with each part being turned into one of the four ballot orientations. One blank ballot and one over-voted ballot from the first precinct of the first combination were also included in the test deck.
4. For absentee voting, using the M650 central tabulator, the test deck was composed of all ballot styles. Each ballot style selected included all positions voted once for each candidate, a blank ballot and an over voted ballot.

Logic and Accuracy testing on the tabulators took approximately two weeks utilizing four technicians.

The Bernalillo County Clerk's Office was responsible for hiring all temporary employees who were part of the audit team (see Appendix D for a copy of the position summary). For pre-audit preparation activities, we used 16 temporary employees. Once the audit

started we had an additional 10 employees on hand. Due to staff issues, that number dwindled to 24 consistent audit counters.

Lastly, preparations were made to provide for security of the voting machine warehouse and ballots during the audit process. A Bernalillo County Sheriff's Deputy was on site at all times when ballots were being handled.

Audit Layout

Prior to the start of the audit, the audit team designed, and county employees arranged, the warehouse in a manner that was both efficient for the counting process as well as accommodating to the web cams (see Appendix E).[10] The space that the county warehouse provided for the audit process was approximately 80 feet by 120 feet, which provided plenty of space for audit activities and public observations. There were two emergency exit doors located along the west wall, which were occasionally opened to allow in light and fresh air. The overhead lighting was bare florescent bulbs, which proved to be very tiring on the eyes for the counters during the audit process. In the center of the room was a large heater suspended from the ceiling. This heater was both extremely noisy and powerful. Both of these factors could potentially cause stress on counters. The heater would run for hours on end and create a large amount of background noise, which in some cases could impede the ability to hear if one was sitting too close to the heater. Shortly after beginning our audit, we lowered the thermostat on the heater so that it would no longer interfere with audit activities. The floor was polished concrete. There were steel beams located every twenty feet within the workspace. The web cams were strategically placed on four of these beams within the workspace to allow for a view of the entire counting process.

All of the ballots were stored in the north end of the workspace. The ballot boxes were arranged in rows, in numerical order by precinct number and type (early, absentee, and Election Day), to allow for easy location of a particular precinct. There was a barrier of worktables created between the ballot boxes and the rest of the room so that only the audit team had access to the ballot boxes during the process. Counting teams would approach the audit team from one side of the table; the audit team would then bring the ballot box around and sign it out to the counters. Four eight-foot tables were used to create the barrier, as well as provide workspace for the audit team.

The two types of machines used in the audit were separated. The M650's, or absentee ballot counting machines, were placed in the northeast corner of the audit space (see Appendix E for a the layout of the Voter Warehouse). The M650's were placed in a location that was generally out of the workspace because it was used only two days

[10] A visual tour of the audit layout, process, and of the ballots is at http://electionupdates.caltech.edu/NM_Audit_Project_sound.mov

during the audit process, the first and last days of counting. The two M650's were placed next to each other, with a rolling work cart next to each machine to place the ballots on. Also in the area was a folding table and chairs for counters to log the results as well as fill out a form to identify any ballots rejected by the voting machine as problem ballots.

The M100's, used in Bernalillo County for Election Day and early voting, were placed in rows along the west side of the room. The machines were placed back to back to allow for walking, space for the ballot box and room enough for a chair. Counters were allowed to take chairs to the machine counting area, however most stood for the machine counting process. There were seven rows total, six rows of Election Day machines, each containing approximately 17 machines and one row of 14 early voting location machines. The machines were arranged in numerical order by precinct so the counters and audit team could easily locate them. The camera was placed on a column at the north end of the rows so that the entire area could be seen with one camera view.

The hand counting area was located directly in front of the audit team and took up the majority of the workspace. There were twelve hand-counting workstations. Each workstation was made up of two tables joined together lengthwise, or side by side, to allow the counters more room to work with the large ballots and tally sheets. There were chairs located at each workstation. The county provided very comfortable, well padded, rolling chairs for the counters. Each table had a 12-inch ruler, a small calculator, pencils, rubber fingers, fingertip moistener, paper clips, a scratch pad and Post-It notes.[11]

There was only one entrance into the workspace. It was located at the far south end of the room and was guarded by a sheriff's deputy from 8 a.m. to 5 p.m., Monday through Friday, during the entire audit process. If counters were still present after 5 p.m., the sheriff's deputy stayed until all counters left for the day. The sheriff signed in observers as well as checked to make sure that only authorized personnel were allowed in the workspace. The sheriff had a desk and chair at the entrance.[12] At the end of each day county personnel would pull down a large rolling garage door to seal the room. The room would not be accessible in the morning until at least one member of the audit team was present.

Sampling

The first step towards implementing our pilot ballot audit was to identify a sample of ballots for recounting (see Appendix F for detailed information on Election Day, early and absentee samples). For the purposes of the study, the sample drew on ballots cast in

[11] Counters were also provided clipboards on which they kept their ballot logs and time sheets. The clipboards were extremely useful for filling out the machine logs and problem ballot logs in the machine counting area because there is very limited writing surface available on the M100's.

[12] It is worth noting that there were doors located on the east wall of the workspace that allowed access to an adjacent part of the Voter Warehouse. These remained closed during the entire audit process.

all voting modes including: (1) in-person early voting, (2) absentee voting, and (3) in-person Election Day voting. Each voting mode was sampled at 25% by voting machine. We chose a large sample of 25% for our test audit because we anticipated that discrepancies between the machine count and the hand count to be very low, likely less than 1% and therefore needed a large number of ballots to systematically determine where the discrepancies exist.[13] At the precinct level there was one voting machine per precinct so approximately 25% or 107 out of 423 precincts were randomly sampled.[14] There were 14 early voting locations. Sixty-five voting machines were spread across these 14 early voting locations. Three of the 65 machines were not included in our sample because they logged zero votes. Thus, we sampled 14 of 62 vote-tabulating machines or voting systems.[15] Before the audit began absentee ballots were randomly batched into units of 455 and identified with a batch number from 1 to 66. The batch N was based upon the average number of ballots cast by precinct across Bernalillo County. Twenty-eight (28) absentee batches were sampled to account for the total number of absentee ballots cast, three (3) absentee batches consisted of ballots that could not be run through the optical scan readers because of problems with the ballots that prevented them from being machine readable.

The sample of ballots included in the study was 47,481, with the following breakdown for each voting mode:

- 12,589 absentee ballots were included, 11,204 of which were machine readable on Election Day,
- 8,085 in-person early voting ballots and
- 26,807 in-person Election Day ballots.

The ballots cast in in-person early voting and in-person precinct voting was already stored in black sealed containers, where the outer seals contained the number of ballots cast on Election Day. The absentee ballots were stored in the same ballot containers in batches of 455 ballots. Absentee ballots were initially stored in larger containers. The ballots were randomly pulled from the containers, counted, and bundled into 66 batches of approximately 455 ballots per batch. These batches were placed in sealed containers

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[13] [13] See Stephen Ansolabehere and Andrew Reeves, "Using Recounts to Measure the Accuracy of Vote Tabulations: Evidence from New Hampshire Elections, 1946-2002", January 2004, (http://vote.caltech.edu/media/documents/wps/vtp_wp11.pdf); R. Michael Alvarez, Jonathan N. Katz, and Sarah A. Hill, "Machines Versus Humans: The Counting and Recounting of Pre-Scored Punch card Ballots," September 2005, (http://vote.caltech.edu/media/documents/wps/vtp_wp32.pdf); Michael C. Herron and Jonathan Wand, "Assessing Partisan Bias in Voting Technology: The Case of the 2004 New Hampshire Recount," *Electoral Studies*, 2007, 26, 2, 247-261.; Bruce E. Hansen, "Recounts From Undervotes: Evidence from the 2000 Presidential Election," *Journal of the American Statistical Association*, January 2003, 98, 462, 292-298.

[14] For precinct level analysis we oversampled precincts that had administrative problems based on Election Day reports of incidents provided by the Bernalillo County Clerk. Thus, we randomly sample 103 out of 423 precincts and then added 4 "problem" precincts to our sample.

[15] Rounding and differences between the number of votes we found in a ballot box upon arriving and the number we were provided with when our sampling process began created slightly lower or higher sampling rates then the anticipated 25% for each voting mode.

by the audit team, with the number of ballots noted on the outside. The batch *N* was based upon the average number of ballots cast in precincts across Bernalillo County. The final batch had only 298 ballots.

Chain of Custody

The audit maintained strict chain of custody rules for ballots. When the ballots were initially transferred to the audit team, they were sealed in black containers with plastic locks that contained serial numbers for security. In addition, the audit team was provided with a letter that indicated the number of ballots per ballot container being transferred to our custody. Upon completion of the audit, we provided the Bernalillo County Clerk with a similar letter, noting the number of ballots per ballot container being returned to the county.

Throughout the counting process, we maintained tight internal ballot security. First, whenever a ballot container was transferred to a counting team or back to audit supervisors that action was witnessed and logged by an audit supervisor. The log included the batch/precinct number, the date it was checked in/out, the time it was checked in/out, the initials of the audit supervisor checking in or out the ballots, the seal number from the lock that sealed the container upon its return, and the total ballot N upon return (see Appendix G, Form F.1). A second supervisor log was also kept that noted, by a supervisor initials, when each machine or hand count was completed as well as the lock serial numbers after each closing of the ballot box (See Appendix G, Form F.2).

Counters kept track of their daily activities by noting their jobs on the Activity log throughout the day (see Appendix H, Form H.1). Log forms were also kept for each count in the process (e.g. hand count 1, machine count 1, *etc*.). We used colored paper for these forms, distinguishing between different logs with different colors. This was extremely helpful to counters and supervisors.

Machine Count 1

The first ballot count completed was a machine count and its purpose was to essentially reenact the 2006 election with our sample of ballots. This was necessary because one of our study's goals was to assess the accuracy of machine counts through a comparison of machine-to-machine counts. Because the ballots were 16 months old we were concerned that some ballot degradation may have taken place since Election Day, possibly resulting in machine counts that would be lower than the number of ballots processed on Election Day. Given that we wanted to compare specific office totals, it was necessary for us to re-run the election to get a "new" machine count for each precinct in our sample. This enabled us to determine an "Election Day" count for each precinct that could be compared with our hand counts and our second machine count.

From the worker's perspective, the machine counting procedure started with the worker signing out the ballot container on the check out log. The worker was given the appropriate forms and noted the date and time of start on the worksheet titled 1st Machine Count Machine Counter Batch Log (see Form H.2 in Appendix H). The worker took the ballots to the specified machine and noted the precinct number and machine number off the cover of the machine, and then wrote this information on the worksheet log. The worker looked at the tag on the ballot container and noted the number of ballots that should have been in the container and noted this information on the worksheet. The worker broke the seal on the ballot box and noted the seal number on the worksheet.

The worker opened the container and took out the envelope of supplies. In that envelope was a smaller envelope that contained the keys to the machine. The worker removed the keys and inserted them into a lock to open the machine cover. The machine cover was then set to the side. The worker then proceeded to check all the bin areas to ensure that there were no ballots inside. This included the tray below the cover and side doors. After these checks, the worker turned the machine on by inserting the key and turning the lock to "open polls." A zero report was printed to ensure that ballot totals for all races equaled zero. The key then turned the lock to "Vote." After this step was completed, the worker removed the keys and they were ready to begin inserting ballots.[16]

At this point, the worker would start the first machine count. The worker would remove ballots from the container and would insert them individually into the tabulator. If any ballots were rejected, they were inserted in all 4 orientations before being defined as a rejected or problem ballot. Each problem ballots was logged individually. Log information included the ballot error message, the precinct number, the time, and an identification number. The identification number was assigned based upon the precinct or batch id and from 1 to N where N represents the number of rejected ballots in each batch. For example, precinct 100, problem ballot 1 would be given the number 100/1. Each problem ballot was given its own form titled, "Problem Ballot Log for Machine Counts" (see Appendix H, Form H.6) and placed into a separate folder, so it could be identified in the hand count as unreadable by the machine.

Once all the ballots were inserted into the machine, the worker would insert the machine key and turn it to "close polls"; the worker would then also request a poll report that listed the total number of machine-counted ballots for each ballot office.[17] The worker would note the number of votes for the governor's race, votes for the land commissioner

[16] In the rare event that the machine would not turn on correctly, or the zero tape did not print correctly, the worker was instructed to summon a member of the research team who would then typically work with one of the county election staff to rectify the problem. There were two cases where the optical scan tabulator had to be replaced or reprogrammed.

[17] For early machines, which contain ballot images for all precincts, we requested the summary report and not a breakdown by precinct. This was necessary due to time constraints and did not limit our analysis.

race, and the total number of machine counted votes on the worksheet log. The worker was responsible for summing the number of machine counted ballots and the number of rejected problem ballots to produce the total number of ballots. This number should equal the number of ballots that were initially reported to be in the container. The worker then turned the machine off, removed the keys, and took all ballots out of the bins under the machine, straightened them, and counted them to ensure that the same number of ballots were returned to the container as it originally contained. The container was closed with all materials except the worksheet log. All problem ballot sheets were left in the container. The machine was then powered off, the key was removed, the machine cover replaced, and the machine cover was locked down. The ballot container was returned to the check-in station. The worker signed the check-in log and re-sealed the container as described in the chain of custody section. This process was repeated until all ballots were counted.

Hand Count 1

The first hand count was done using a two-person team. Audit team members were provided with guidelines on determining voter intent. The audit procedure started with the workers signing out the ballot container on the check out log. The worker was given the appropriate forms (see Appendix H, Form H.3) and noted the date and time of start on the work sheet. The workers took the ballots to the worktable and noted on the form the total number of ballots the container allegedly contained, as well as the seal number. The seal was broken and all of the ballots were removed from the container and counted to ensure that the total count equaled the total count listed on the container. The number of problem ballots from the machine count was also noted.

The two workers divided their tasks so that one worker was calling the races on the ballot and other worker was marking the votes on the tally form. There were three items called: (1) straight party votes, (2) the governor vote [if there was no vote, “under vote” was called], and (3) the land commissioner vote [if there was no vote, “under vote” was called]. The tally form had empty cells and workers were told to make five vote marks in each cell.

After every ballot was marked, the tally marks for each race were totaled (the cells allow for the marks to be counted by five) and the workers noted the total number of marks for each candidate and the total for each race (including under votes). The workers checked to make sure that the totals for each race equaled the total number of ballots. If they did not the count was considered void and a new count was started. This information was then transferred to the worksheet log and the tally sheets were signed.

On occasions where there were questions as to how a ballot was marked, the two workers examined the ballot to determine the voter’s intent. If they could not determine voter intent, they noted this and flagged the ballot on a form (see Appendix H, Form H.5). All

ballots that could not be machine counted were also counted by hand to determine if the intent could be readily discerned. [18]

Once the process was completed, the container was closed with all materials except the tally sheet. The container was returned to the check-in station. The worker signed the check-in log and re-sealed the container, noting the seal's serial number. This process was repeated until all ballots were hand counted.

Hand Count 2

The second count followed identical procedures. The only difference was that two individuals tallied the votes on separate tally sheets and those two counts had to match each other, as well as match the total number of ballots contained in the container (see Appendix H, Form H.8 and H.9).

Machine Count 2

The second machine count replicated the first machine count process (see Appendix H, Form H.4).

Data Collected

The data collected from this process varied across each stage of the process, and included:

- First, the ballot tag gave the total number of ballots in the container, as counted on Election Day and confirmed in the pre-audit preparation period.
- Second, the first machine count produced a count of ballots, a tally of votes, and also an identification of ballots that were "problematic" in that the machine could not read the ballots.
- Third, the first hand count produced a count of ballots, a tally of machine counted and non-machine counted votes, and an identification of ballots that were "problematic" because voter intent was difficult to discern. The hand count also yielded data on the difficulty of conducting hand counts (e.g., the number of precincts that had to be counted more than once) and data on the hand tally of votes that could be compared to the machine tally of votes.
- Fourth, the second hand count produced a count of ballots, a tally of votes, and a second identification of ballots that were "problematic" for voter intent reasons.

[18] Unlike machines, humans almost always (maybe there was as many as 3 cases where there was disagreement) could determine voter intent. Keep in mind, however, that these were non-partisan counters; partisan judges and counters would likely have greater disagreement and bias.

This second count again provided data on the difficulty of counting ballots by hand (this time with two individuals marking the totals) as well as another hand tally that could be compared to the machine tally.

- Fifth, the last electronic count can be compared to the other counts. In addition, the number of problem ballots may be different now because of ballot handling. This fact will also be helpful in considering the durability of ballots.

PART III. ANALYSIS OF ELECTION AUDIT

PART III. SUMMARY

Our study allowed us the opportunity to develop and test audit procedures in Bernalillo County, New Mexico as well as to inform the public debate on the accuracy and integrity of the new optical scan voting process instituted in the 2006 election. We simulated the 2006 election using a random sample of 25% of the ballots and recounted those ballots by 2-person and 3-person hand counts and by a second machine count. Our design focused on an examination of two ballot questions, the race for governor and land commissioner. This process allows us to answer a number of questions about the reliability and precision of machine and hand counts across different counting modes. Given that we counted ballots multiple times, we were able to compare differences in vote totals between machine counts and the actual number of ballots, machine counts and hand counts, hand counts and hand counts, and machine counts and machine counts. We were also able to examine questions related to potential bias to determine if differences existed across counts, and whether those differences favored a particular party or candidate. We were also able to examine how much time both machines and counters took to tabulate ballots. Finally, we also examined machine rejected problem ballots, which provided us with insights into ballot design problems. From these observations, we made a number of recommendations on best practices for audits in Part I, and provide a detailed analysis of counting procedures in Part III.

Some of our more important conclusions from this analysis are:

- Infrequently the optical scan vote tabulators either over or under count ballots. This appears to happen randomly, given that results were not reproducible between the first and second machine count and do not favor any particular party or candidate.

- Early voting machines, which contained over 400 ballot styles, compared to 1 ballot style in most precinct locations, although infrequent, were more likely to over count ballots.

- When over counting or undercounting occurred it did not favor one candidate or party over another and thus appears random and therefore would not likely influence election outcomes.

- Average differences between first machine count candidate totals and the 2-person hand count candidate totals averaged .19% and differences between the first machine count and the 3-person hand count averaged .13%.

- A majority of ballot totals matched perfectly between the machines and both hand counts, although it varies by voting mode. Election Day votes had the highest percentage of perfect matches between the machines and both hand counts.

- Deviations between machine and hand counts are generally small, clustering around 0 (no deviation) and tapering off as the number of differences increases. For example, 76% of Election Day batches were identical across the first machine and hand counts and 9% of deviations between the machine and hand count were either 1 vote higher or lower than the machine count. The remaining 7% of deviations are a successively smaller percentage as the differences move away from 0 with a maximum Election Day difference of 3 votes higher or lower than the machine count.

- Differences between machine counts and hand counts are more likely to occur when batch sizes are large than when they are small.

- Two and three person hand counts largely produce the same results. Thus, in terms of counting differences between machine and hand counts, it does not matter whether 2 or 3 person counting teams are used.

- Machine to machine counts produce fewer differences between count totals than hand to hand counts.

- Humans averaged about 13 seconds to count 2 ballot questions; Election Day machines with 1 ballot style averaged about 18 seconds to count an entire ballot; early voting machines with 420 ballots styles averaged about 27 seconds to count an entire ballot; and, absentee voting machines averaged about 1.5 seconds to count a ballot. Calculated times include the time associated with checking out and in a ballot box.

- Machine or rejected ballots were mainly due to five types of problems: over votes, ballot structure, torn ballot, machine unreadable marks or unclear voter intent.

Introduction and Background

Elections seem simple. Individuals vote and at the end of Election Day ballots are counted and the winners are declared. However, operationally elections are not so simple because votes are recorded and counted in different polling sites (across precincts or voter centers on Election Day), over a period of days (early versus Election Day voters), across different modes (absentee versus precinct versus early voting) and across different voting systems (e.g. optical scan and by hand), creating opportunities for problems that could change election outcomes as well as reduce voter confidence and election integrity.[19] The 2000 presidential election in Florida was a shocking testament to this problem that led to the passage and implementation of the Help America Vote Act (HAVA) in 2002.

Since the 2000 presidential election many states have modified their electoral processes, often getting rid of old and unreliable voting equipment in favor of newer systems such as touch screen machines or optical scan paper ballots. Such changes were necessary because faulty equipment, registration mix-ups and problems with absentee ballots led to the loss of as many as 6 million votes in the 2000 election.[20] However, the introduction of new voting systems has raised new concerns about their accuracy and fairness. Post election audits in Ohio, for example, showed discrepancies between the vote-memory cards and electronic voting machine ballot tallies of 100 or more votes and the electronic memory card counts and the paper tape count of 25% of precincts.[21] Though academic studies conducted so far suggest the error rate is much lower, any errors, especially in a close electoral contest, raise the perception of a compromised and unfair electoral process.[22] Elections, as the foundation of the democratic process, must be fair and above partisan manipulation or voter confidence could decline. And as voter confidence decreases, voter participation might also decrease if some voters decide not to vote because they question the legitimacy of the election process.[23]

The potential for election outcome problems, arising from voter errors, machine glitches, or mistrust in the process on the part of key stakeholders, can lead to concerns about the integrity and accuracy of our election process, potentially eroding voter confidence and

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[19] The complexity of election administration in the United States is discussed in more detail in R. Michael Alvarez and Thad E. Hall, "Controlling Democracy: The Principal-agent Problem in Election Administration." *Policy Studies Journal* 5(1): 40-56.

[20] Caltech/MIT Voting Technology Project, 2001, "Voting: What is, What Could Be" (http://vote.caltech.edu/2001report.htm).

[21] Election Sciences Institute, "DRE Analysis for May 2006 Primary, Cuyahoga County, Ohio," August2006,http://bocc.cuyahogacounty.us/GSC/pdf/esi_cuyahoga_final.pdf.

[22] Ansolabehere and Reeves 2004; Alvarez, Hill and Katz 2005; Herron and Wand 2007; Hansen 2003.

[23] Preliminary evidence that such concerns might have some validity is in R. Michael Alvarez, Thad E. Hall and Morgan Llewellyn, 2007, "Are Americans Confident Their Ballots Are Counted", 2008, *The Journal of Politics*, 70(3), 754-766. The authors show that Democrats and African-Americans are less confident that their ballots were counted as intended in the 2004 election and that decreasing confidence in the electoral process decreases turnout. Similar arguments and analysis are in Alvarez, Hall and Llewellyn's forthcoming paper, "On American Voter Confidence" (University of Arkansas Law Review, 2007).

trust in our governing institutions. In response to such concerns, at least twenty-six states have added paper audit trails to their balloting process and many states have moved to optical scan paper ballots that also provide a vote record. In addition, there are a number of federal proposals that might require paper audit trails for election machines used in federal elections.[24] The purpose of these measures is to strengthen voter confidence in the administration process and its outcomes. These procedures provide an important defense against election fraud and promote voter integrity because paper trails provide a means to audit the election process to detect counting errors or fraud through a reconstruction of the election totals. If, however, such processes go untested voter confidence in the system may not follow. Therefore, some states have adopted, and many more are considering, more comprehensive, but untested, audit legislation promoting a more transparent and open electoral process that ensures the integrity of election outcomes and strengthens voter confidence in the administration process.[25]

The state of New Mexico is a good example where circumstances existed that prompted election reform. In New Mexico close races and problems in post election vote count procedures were evident in the 2000, 2004 and 2006 general elections. In 2002, for example, problems with the new Sequoia touch screen machines led to a loss of nearly 13,000 ballots that were "recovered" by Sequoia representatives after taking the voting memory card to their corporate offices.[26] These problems led to a voter lawsuit to end the use of electronic voting machines in elections that do not provide for a voter verifiable and auditable paper trail.[27] The combined effect of these events, agitation by political activists, and executive leadership led in 2006 to the adoption of a statewide voting system standard—the ES&S M100 and M650 optical scan voting system. Prior to that there were at least six different voting methods used throughout the state. The purpose of moving to the statewide optical scan paper ballot system was to provide the means to ensure voter accuracy through a voter verifiable and paper audit trail.

Review of Audit Methodology

In the spring of 2008, we had the opportunity to develop and test audit procedures in Bernalillo County, New Mexico and at the same time inform the public debate on the accuracy and integrity of the new voting process by simulating the 2006 election using a random sample of 25% of the ballots and recounting those ballots by 2-person and 3-person hand counts and by a second machine count. Our hand counts focused on the race for governor and land commissioner. The gubernatorial contest was the third office on the ballot, after US Senate and US House, and the land commissioner was the eighth office on the ballot. Both were located in the first of three columns on the front page of

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[24] See electionline.org's "2007 Paper Trail Legislation" list: http://electionline.org/ResourceLibrary/ElectionAdministrationHotTopics/2007PaperTrailLegislation/tabid/1131/Default.aspx. The federal bill is sponsored by Representative Rush Holt, the "Voter Confidence and Increased Accessibility Act," (H.R. 811).

[25] H.R. 811 (op cite) also has provisions in it for post-election audits in federal elections.

[26] Personal interview with attorney John Boyd by Lonna Atkeson, May 21, 2007 and affidavit of Jim Noel, New Mexico Democratic Party Election Day attorney.

[27] The Associated Press State & Local Wire, January 14, 2005, Friday, BC Cycle, accessed via Lexis-Nexis on May 31, 2007.

the ballots (see Appendix I to examine a sample ballot). This process allows us to answer a number of questions about the reliability and precision of machine and hand counts across different counting modes.

To conduct a comprehensive audit of the ballots cast using the optical scan voting system used in the 2006 general election in Bernalillo County, we sampled ballots cast in all voting modes (Election Day, early or absentee). Each voting mode was sampled at 25% by voting machine. At the precinct level there was one voting machine per precinct so approximately 25% or 107 out of 423 precincts were randomly sampled.[28] For early voting, there were 65 early voting machines spread across 14 early voting sites. However, 3 early voting machines logged zero (0) votes. Therefore, we sampled 14 of 62 early voting machines.[29] Before the audit began absentee ballots were randomly batched into units of 455 and identified with a batch number from 1 to 66. The batch N was based upon the average number of ballots cast by precinct across Bernalillo County. Twenty-eight (28) absentee batches were sampled to account for the total number of absentee ballots cast, three (3) absentee batches consisted of ballots that could not be run through the optical scan readers because of problems with the ballots that prevented them from being machine readable. In terms of total ballots we examined 26,807 in-person Election Day ballots, 12,589 absentee ballots, of which 11,204 were machine readable, and 8,085 in-person early ballots for a total of 47,481. The audit was performed at the Bernalillo County Voter Warehouse at 2400 Broadway SE, Albuquerque, New Mexico between February 22 and March 18, 2008.

The first step in the counting portion of our research design was to simulate the general election campaign by feeding the ballots through the identical machines used in 2006 with our sample (data from all of our counts can be found in Appendix J). Because one research question was to assess the reliability of machine-to-machine counts, we could not simply rely on the totals from the November 6 election count to make this comparison as we expected some amount of ballot degradation over the 16 month storage period. Although the ballot degradation was small, it did exist. This is seen in Table 3.1, which shows the total number of ballots we counted by machine across voting mode: Election Day, early or absentee. We found that overall 99.4% of ballots processed during the 2006 general election could still be tabulated by machine even after months of storage. Absentee ballots had the highest rate of rejection with only 98.3% of ballots processed during our election simulation. Absentee ballots were processed with an M650, which offers a high-speed, up to 300 ballots per minute, central location option for optical scan ballot counting and tabulating. The sensitivity of the machine, due to its high-speed throughput of ballots, may be responsible for the slightly higher rate of ballot rejection compared to ballots processed either on Election Day or in early voting, both of

[28] For precinct level analysis we oversampled precincts that had administrative problems based on Election Day reports of incidents provided by the Bernalillo County Clerk. Thus, we randomly sample 103 out of 423 precincts and then added 4 "problem" precincts to our sample.

[29] There were discrepancies between the number of votes we found in a ballot box upon arriving and the number we were provided with when our sampling process began causing sampling rates that were slightly lower or higher then the original 25% targeted.

which use the ES&S M100 optical scan machines, which are designed for precinct use and for voter ballot insertion.

Table 3.1. Total Number of Ballots Read by Machine and Examined by Election Mode

	Total Number of Actual Ballots	Total Number of Machine Unreadable Ballots	Total Number of Machine Readable Ballots	Percentage of Ballots Read by Machine
Election Day	26807	69	26738	99.7
Early Voting	8085	18	8067	99.8
Absentee*	11204	195	11009	98.3
Total	46096	282	45814	99.4

* Does not include 3 absentee batches of ballots that were originally unable to be processed by machine.

The next step in our research design was a two-person hand count in which ballots read and not read by machine were counted separately so that comparisons could be easily made with the first machine count. Two person hand-counting teams divided their tasks so that one worker was calling the races on the ballot and other worker was marking the votes on the tally form. There were three items called: (1) straight party votes, (2) the governor vote [if there was no vote, "under vote" was called], and (3) the land commissioner vote [if there was no vote, "under vote" was called]. The tally form had empty cells and workers were told to make five vote marks in each cell.

After every ballot was marked, the tally marks for each race were totaled (the cells allow for the marks to be counted by five) and the workers noted the total number of marks for each candidate and the total for each race (including under votes). The workers checked to make sure that the totals for each race equaled the total number of ballots. If they did not the count was considered void and a new count was started. They then transferred this information to their worksheets, signed the tally sheets, and turned in the audit forms and ballots to the supervisor.

Each batch was then subjected to a second hand count that followed identical procedures as the first hand count. The only difference was that two individuals tallied the votes on separate tally sheets and those two counts had to match each other, as well as match the total number of ballots contained in the container.

After completing the two hand counts, a second machine count was conducted. The second machine count replicated the first machine count process.

Machine Count Under Counts and Over Counts

We begin by focusing on an important issue we found in the processing of ballots. We noted that, infrequently, the M100 optical scan machines—but not the M650s—could over count or under count the total number of ballots processed. Table 3.2 examines just

the machine counts where we know there was an error due to this problem. Each column shows a specific factor in the counting process.

1. Column 1 is the precinct number.
2. Column 2 shows the total number of actual ballots in each batch. At the start of the machine count the employee counted the ballots in each box at least once and often multiple times to confirm the actual number of ballots in each ballot box. Information had been provided to us by the county staff on the number of ballots they believed were in each ballot box. When our count did not match their count, we repeated the count, often multiple times, to ensure that our count was correct.
3. Column 3 shows the total number of ballots reported counted by machine, plus uncounted machine "rejected" ballots. Ballots that were not machine tabulated would be tabulated separately in the hand count.
4. Column 4 shows the difference between the total number of actual ballots and the number reported read by the machine plus those rejected by the machine. A positive number indicates that the machine count plus the hand count is higher than the total number of ballots in the precinct. A negative number means that the machine count plus hand count was lower than the total number of ballots.
5. Column 5 shows the candidate for governor who benefited from the count differences.
6. Column 6 shows the candidate for land commissioner who benefited from the count differences.
7. Column 7 shows the count in which the discrepancy occurred. "MC1" indicates the difference was produced in the first machine count. Likewise, "MC2" indicates a difference was generated during the second machine count. For example, early voting machine *E215801* is not reported here because the first machine count (MC1) matched the actual number of ballots processed. However, the second machine count produced a count that was one different from the total as shown by the notation MC2.

There were 107 Election Day Voting Systems. We counted each voting system at least twice giving us a minimum total of 214 batches processed (107*2). Six machine counts, or about 2.8% of machine counts, did not process the correct number of ballots. The largest difference is in precincts 55 (machine count #3 (MC3)) and 411, which each show an over and under count respectively. Note that the tabulator used in precinct 55 appears twice in the table because it incorrectly counted the total number of ballots during the first and third machine count.[30] The bias, however, appears to be random, sometimes favoring a Democratic candidate, sometimes favoring a Republican candidate, and sometimes canceling out to favor neither party's candidate. The difference also appears to be random in terms of whether ballots are under or over counted.

[30] On rare occasions, we processed a ballot box with a machine a 3rd time because of differences between matches across machine and hand counts. Precinct 55 was one of these rare cases.

Table 3.2. Examination of All the Machine Count Differences from Total Number of Ballots and Bias

1	2	3	4	5	6	7
	Total # of Actual Ballots	Total # of Ballot Reported Counted by Machine + Rejects	Difference	Potential Bias For Governor	Potential Bias for Land Commissioner	Count
Election Day						
Precinct 55	476	477	1	+1 Dendahl	+1 Lyons	MC1
Precinct 55	476	478	2	None	+2 Lyons	MC3
Precinct 87	384	385	1	+1 Richardson	+1 Baca	MC2
Precinct 183	286	285	-1	-1 Richardson	-1 Baca	MC1
Precinct 329	149	150	1	+1 Richardson	+1 Baca	MC1
Precinct 411	184	182	-2	-1 Richardson	None	MC1
Total Precinct	**1571**	**1572**	**2**			
Early Voting						
E215801	346	347	1	+1 Dendahl	+1 Lyons	MC2
E219458	1972	1987	15	+1 Dendahl	+15 Lyons	MC1
E219476	439	440	1	+1 Richardson	+1 Lyons	MC1
E220617	706	709	3	+3 Richardson	+1 Baca	MC1
E220690	717	721	4	+1 Richardson	+2 Baca	MC1
E220766	587	590	3	+1 Dendahl	+1 Baca	MC1
Total Early	**4767**	**4794**	**27**			

Early voting uses the same M100s, but with one important difference. Early voting M100 optical scan machines are programmed to read all ballots styles within a county. Early voting machines and the M650 are programmed with 420 ballot styles and 78 unique ballot combinations, while Election Day voting machines usually are programmed with only 1 ballot style. Our election audit focused on the race for governor and land commissioner. We examined 14 voting systems used in early voting, counting each batch electronically at least twice for a minimum total of 28 batches tabulated, and found that 6 batches (or about 21.4%) of the time, the early voting system counted additional ballots. This ranged from a low of 1 additional ballot to a high of 15. Interestingly, these differences occurred in predominantly large batch sizes, as shown in Table 3.2 (346, 439, 587, 706, 717, 1972). Batch sizes of 62, 137, 246, 277, 288, 428, 935, and 945 ballots returned no difference between machine counts, suggesting that larger batch sizes are a likely influence on miscounting. However, it is important to note that these machine count differences predominantly happened on our first machine count and only two differences were processed on the second machine count, suggesting that some user error may also be a likely factor. However, given that voters are untrained and inexperienced users of the M100 machine, just as our workers initially were, suggests potential, though generally rare, problems with machine counts. The difference, however, that does exist appears to be purely random with the difference sometimes favoring the Republican candidate and sometimes favoring the Democratic candidate. This is an important

finding because it demonstrates when the machine count is different from the actual ballot count the differences are random, with no partisan bias.

These results show that sometimes the counting and tabulating machines generate differences across counts by processing a ballot more than once or by not processing a ballot at all. This appears to happen randomly given that results were not reproducible between the first and second machine count. *This result demonstrates the importance of ballot reconciliation procedures to ensure the integrity of the process.* Because machines, infrequently, will count a ballot twice or not count one at all, it is important to have strong voter reconciliation measures. These procedures should measure the amount of accuracy between the number of actual ballots distributed to voters and the number of actual ballots processed by the machine, spoiled by voters, and provided for provisional voters. Any differences between these two numbers should be a red flag for any particular precinct or other voting site and suggest areas where county clerks or other local administrative officers may want to audit. Good accounting measures to ensure that the number of ballots fed into the machine and the actual number of ballots counted and read by the machine assist in creating election integrity. Because sometimes devices fail to count accurately, it is important that this information be used to examine the process carefully to determine if bias, from fraud or faulty equipment, altered the election outcome. Our data suggests strongly that when these types of errors occur, they are random in nature, favoring no particular party or candidate.

These results also support our recommendation that post election vote audits include all of the different types of voting systems used to count votes. There are differences between machine types and errors and to ensure that the systems are operating effectively, comparisons need to be made within all vote tabulation settings.

Comparison of First Machine Count to Hand Counts

We begin by focusing on the comparison of the first machine count to the hand counts because historically the primary focus of post-election auditing has been to compare the results of an electronic vote tabulating system with a hand count to ensure the integrity of the voting systems and the election outcome. Post election ballot audits are premised on the notion that counting a random sample of ballots from a given voting system for their accuracy after the election by hand with a paper ballot trail will provide fair information on the performance of the machines. Fortunately, our study provided an opportunity to examine this question directly.

In our study, we followed our simulated election count with two hand counts for each voting batch defined as an Election Day precinct voting system, early voting system or absentee system. The counting principles used were as follows:

1. In each batch the number of ballots was defined by the number of ballots processed by that machine or voting system, except for absentee batches, which

were all processed by 1 M650, but in batches that predominantly contained 455 ballots each.[31]

2. The first hand counts were 2-person hand counts with 1 person reading the ballot and the second person tallying.
3. The second hand counts were 3-person hand counts with 1 person reading the ballot and the second and third person tallying.

Table 3.3 compares the aggregated results for the first machine count with the first and second hand counts by voting mode and by office. [32]

1. Column 1 defines the ballot question under examination and whether those ballots were cast on Election Day, by mail-in absentee or at early voting locations.
2. Column 2 contains the total number of ballots counted in the first machine count.
3. Column 3 reports the total from the first hand count of ballots.
4. Column 4 reports the total from the second hand count of ballots.
5. Column 5 reports the difference between the first machine count and the first hand count. A positive number indicates that more ballots were counted in the machine count than in the hand count. A negative number indicates that fewer ballots were counted in the machine count than in the hand count.
6. Column 6 reports the absolute percentage difference between the first machine count and the first hand count.
7. Column 7 reports the difference between the first machine count and the second hand count. A positive number indicates that more ballots were counted in the machine count than in the hand count. A negative number indicates that fewer ballots were counted in the machine count than in the hand count.
8. Column 8 reports the absolute percentage difference between the first machine count and the second hand count.

In our analysis, we find very small differences between the two types of counts, regardless of whether we use 2 or 3 person counting teams. The absolute average difference between the machine and hand count 1, regardless of voting mode, is .19%, with a minimum difference of .02% and a maximum difference of .39%. The absolute average difference between the machine and hand count 2, regardless of voting mode is approximately the same at .13% with a minimum difference of 0% and a maximum different of .38%. The largest differences are between the early voting machines and the hand counts. This is likely due, in part, to the increase in over counts on these machines, which are not seen in the hand counts. Even so, these ballot differences do not reach above a .5% threshold. Thus, machine counts and hand counts appear to produce similar results. The differences between them are extremely small, suggesting that the New Mexico law, which calls for a recount when the difference between the two counts is greater than 1.5% is unlikely to generate many automatic recounts. Even if the legal rate of deviations between the two counts was one-half of one percent, our data suggest that on average a recount would not be called under these conditions.

[31] Absentee batches were created randomly and thus each batch could possibly contain all possible ballot styles.
[32] These include machine counts where the machines over or under counted ballots.

Table 3.3. Aggregate Comparison of Machine To Hand Counts by Contest and Voting Mode

1	2	3	4	5	6	7	8
	Total Machine Count (MC1)	Total Hand Count (HC1)	Total Hand Count #2, (HC2)	Dif-ference MC1-HC1	% Dif-ference	Difference MC1-HC2	% Difference
Election Day							
Dem Gov.	18433	18448	18440	-15	0.08	-7	0.04
Rep Gov.	8008	7993	7994	15	0.19	14	0.17
Dem LC	11758	11769	11759	-11	0.09	-1	0.01
Rep LC	14548	14541	14539	7	0.05	9	0.06
Average					**0.10**		**0.07**
Absentee*							
Dem Gov.	6990	6981	6990	9	0.13	0	0.00
Rep Gov.	3868	3879	3867	-11	0.28	1	0.03
Dem LC	4739	4734	4753	5	0.11	14	0.11
Rep LC	6120	6121	6104	-1	0.02	16	0.00
Average					**0.13**		**0.03**
Early Voting							
Dem Gov.	5128	5114	5114	14	0.27	14	0.27
Rep Gov.	2824	2813	2816	11	0.39	8	0.28
Dem LC	3842	3831	3833	11	0.29	9	0.23
Rep LC	4159	4144	4143	15	0.36	16	0.38
Average					**0.33**		**0.29**
Total Average					**0.19**		**0.13**

*3 of the absentee batches were unable to be counted by machine and are excluded from this analysis.
Note: Percentage difference = 1 - (Count A/Count B), where Count A is always smaller than Count B.

Of course, aggregate examinations of the data may hide deviations between counting modes due to the possibility of one batch count results being offset by the count from another batch set. Thus, we also examined the difference between the machine and hand count by batch across each office. For example, we subtracted the machine count for Governor Richardson for each batch with the hand count for Governor Richardson for the same batch. We did this for each candidate (e.g. the Democratic gubernatorial candidate, the GOP gubernatorial candidate, the Democratic land commissioner candidate and the GOP land commissioner candidate) giving us a negative or positive difference between the two. A positive difference indicates that the machine count had a higher total for a candidate and a negative difference indicates that the machine count had a lower total for a candidate. For purposes of summary, we have summed these differences across all 4 candidates by voting mode and graphed them in Figure 1a for hand count 1 and Figure 1b for hand count 2. We included both candidates because there was a 3rd ballot option of under vote, which could also have been marked. The raw data for each batch (precinct,

absentee, or early) by candidate, voting mode and hand count is in Table A.4 in the appendix.

The graphs show that the vast majority of batch counts across counting method were identical and that there were relatively small differences between counts. For example, Election Day batches had the highest identical matches with about 76% of candidate counts identical between the first machine and first hand count. Deviations around 0 were generally small and cancelled out, suggesting no bias either for or against a party or candidate. For example, Election Day batches in Figure 1 show that about 9% of differences were either -1, indicating the hand count was 1 vote lower than the machine count, or 1, indicating the machine count was 1 vote higher than the hand count. Differences above 1 or below -1 are a successively smaller percentage of batches and the total ballot deviations are very small with, for example, a maximum range of difference between -7 and 4 for Election Day batches.

For other voting modes the data show a very similar pattern, a large percentage of batches show no counting differences between the machine and hand count and differences cluster tightly around 0. Absentee batches, for example, show a larger number of ballots deviating from 0 compared to Election Day ballots in Figure 1 with only 52% of batches having a perfect match, but the deviations cluster much more tightly around 0 with deviations not exceeding -3 or 3. Thus, for absentee ballots about 17% of counts had a difference of -1 or 1, another 5% had a difference of -2 or 2 and a small 2% of batches had a difference of -3 or 3. The symmetry around 0 shows that there was no bias for or against a particular party or candidate.

Because early voting machines were slightly more likely to tabulate in a way that resulted in an over count of ballots, perhaps because of larger batch sizes and a larger number of ballot styles, we see a higher percentage of differences on the positive side of our graph in Figures 1a and 1b. Nevertheless, the differences between counts are small and substantively insignificant. For early voting about 61% of batches produced identical results, another 13% produced a difference of 1, another 11% produced a difference of 2, another 4% produced a difference of 3, and another 2% produced a difference of 4,6, 8 and 11. A difference of -1 was produced 4% of the time and a difference of -2 was produced 2% of the time.

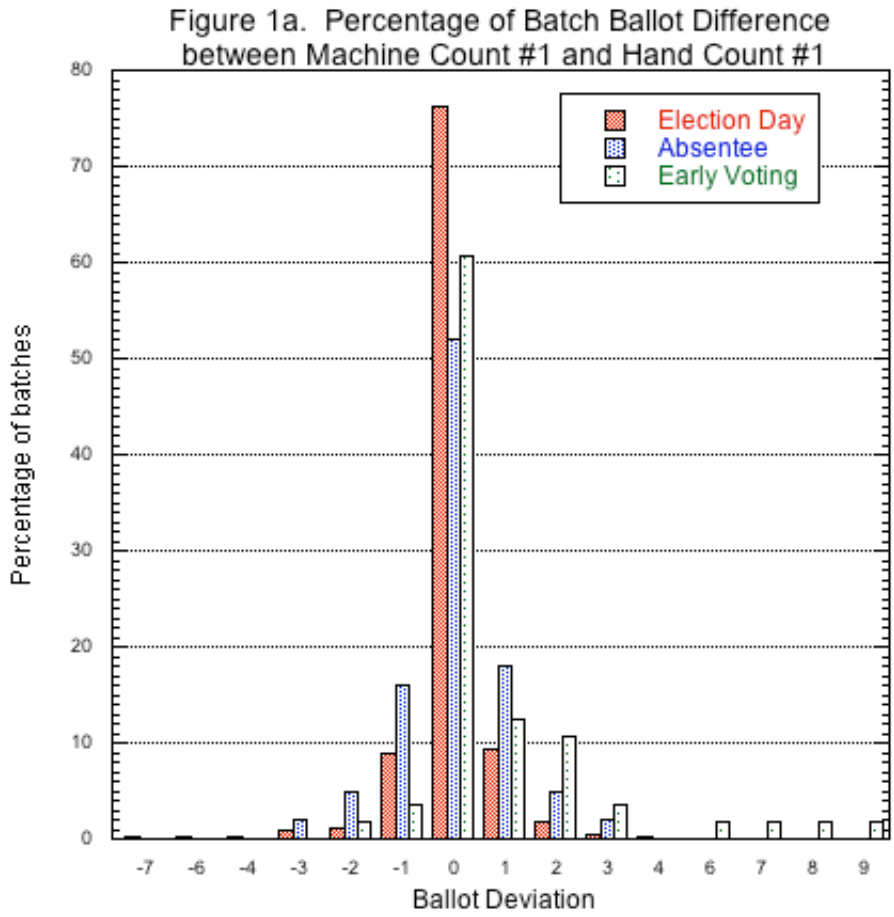
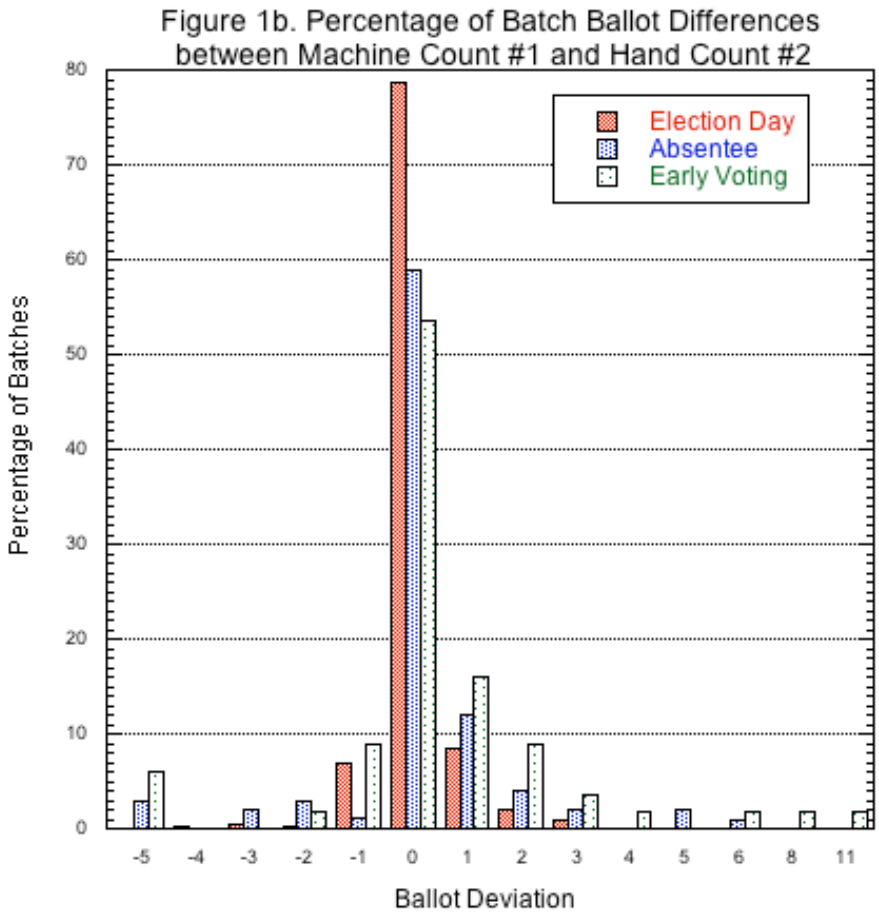


Figure 1b shows the same information only comparing the first machine count to the second hand count. The results are very similar and generally show that comparisons between a machine and hand count using 2 or 3 persons is about the same.



Because we aggregated across all candidates in Figures 1a and 1b, we break down the data further in Table 3.4 to examine the possibility of candidate or party bias when deviations exist between the machine and hand counts. Each column shows a specific factor in the counting process.

1. Column 1 defines the ballot question under examination and whether those ballots were cast on Election Day, by mail-in absentee or at early voting locations.
2. Column 2 shows the total number of boxes or batches examined for each candidate.
3. Column 3 shows the total number of batches where there was a difference in candidate totals between the first machine and hand count. For example, the number 23 is in the first row of data in column 3 and indicates that 23 batches showed differences between the Democratic gubernatorial hand and machine count.

4. Column 4 examines whether there was a net gain or loss for that candidate between the machine and first hand count. Thus, the number 15, in the first data row, shows that across all those batches, the Democratic candidate lost 15 votes between the machine and hand count.
5. Column 5 shows the total percentage difference between the machine and hand count. Thus, .08% of votes, in the first row of data, represent the total difference between the machine and hand count.
6. Column 6 shows the average deviation in terms of the number of ballots per batch for each candidate.
7. Column 7 shows the same information as column 3, only for the difference between the first machine count and second hand count, counter number 1.
8. Column 8 is identical to column 4, only it shows the net gain or loss for that candidate between the first machine and second hand count, counter number 1.
9. Column 9 is identical to column 5; only it shows the total percentage difference between the machine and second hand counts.
10. Column 10 is identical to column 6; only it shows the average deviation in terms of the number of ballots per batch for each candidate.

Differences across counts should be random and not favor any particular party or candidate. The presence of systematic bias would suggest potential election problems that should be examined in greater depth. We were able to examine the degree of differences between our machine and hand counts by comparing the difference between each candidate's votes. Table 3.4 displays the number of batches by voting mode where differences occurred and the total number of votes gained or lost for each candidate. As can been seen in this table, the number of votes gained or lost by a particular candidate is very small. Over all voting modes, the Democratic candidate for Governor gained 8 votes if we look at the differences between the machine and hand count #1. If we look at hand count #2 instead, the Democratic gubernatorial candidate only gained 7 votes over all modes of voting. The Republican candidate for Governor also gained a slightly larger number of votes across all three voting modes. Compared to the machine count, in hand count #1 the Republican gubernatorial candidate gained 15 votes, and in hand count #2 gained 23 votes.

The average deviation across all batches is also very small. In most cases, the average deviation is less than half of one ballot per batch. In early voting, we find a slightly higher deviation, especially in the case of the Republican candidate for land commissioner where we see an average deviation of about 1 ballot per batch. This larger deviation is due, in part, to the greater number of machine errors in the early voting machines. If we look at the potential bias towards a particular candidate as a percentage of total ballots, it becomes clearer that the deviations between machine and hand counts are insignificant. In short, the evidence in Table 3.4 suggests that the differences between machine and hand counts are small, and that there is no bias either for or against a particular candidate or party.

Table 3.4. Differences across Machine and Hand Counts for or against each candidate

	Total Number of Batches	Total Number of batches where there was a difference, MC1 v HC1	Net Gain or Loss	Net Gain or Loss as Percentage of Total Votes (MC1)	Average Deviation, MC1 v HC1	Total Number of batches where there was a difference, MC1 v HC2	Net Gain or Loss	Net Gain or Loss as Percentage of Total Votes (MC1)	Average Deviation, MC1 v HC2
Election Day									
Dem Gov	107	23	-15	0.08	-0.14	23	-7	0.04	-0.07
Rep Gov	107	20	15	0.19	0.14	21	14	0.17	0.13
Dem LC	107	32	-11	0.09	-0.10	25	-1	0.01	-0.01
Rep LC	107	27	5	0.03	0.05	22	9	0.06	0.08
Absentee									
Dem Gov	25	16	9	0.13	0.36	9	0	0.00	0.00
Rep Gov	25	14	-11	0.28	-0.44	12	1	0.03	0.04
Dem LC	25	7	5	0.11	0.20	9	-14	0.30	-0.56
Rep LC	25	11	-1	0.02	-0.04	11	16	0.26	0.64
Early Voting									
Dem Gov	14	8	14	0.27	0.00	5	14	0.27	0.00
Rep Gov	14	6	11	0.39	0.79	4	8	0.28	0.57
Dem LC	14	3	11	0.29	0.79	8	9	0.23	0.64
Rep LC	14	5	15	0.36	1.07	9	16	0.38	1.14

Explaining Differences Between Machine and Hand Counts

We have shown above that small differences exist between machine and hand counts, but that these differences are generally very small, occur randomly, and are not the result of potentially fraudulent activities that could bias the election outcome. However, it remains to be explained why these differences across counts occur. There are a number of potential explanations for why ballot counts differ between humans and machines. First, it is possible that certain characteristics of the counters themselves lead to differences, such as a person's age or level of education. More educated counters for example may feel more comfortable with the counting process, leading to fewer differences between the counting modes. Second, since we used both two- and three-person hand counting teams to tally ballots, it is possible that using a three-person team provides an extra check on potentially miscounting a ballot, leading to fewer differences between machine and three-person counts. Finally, it is possible that the number or type of ballots (e.g. Election Day, early, and absentee) being counted has an impact on the number of deviations between machine and hand counts. For example, we saw above descriptively that absentee ballots had the lowest identical matches, but that variation across counts clustered very tightly around 0. These larger differences across early and absentee ballots could be the result of the greater number of ballots in many of these batches. Hand and machine counts may be more likely to count a ballot incorrectly when the number of ballots they are counting at any one time is fairly large. It is also possible that the greater number of ballot styles in any given batch of early voting or absentee ballots caused some confusion among the hand counters, although this seems unlikely in our case because the races we counted were in the same position on every ballot.

Fortunately, we have enough data to test all of these potential explanations for why differences occur across machine and hand counts. To test these explanations, we need to use regression analysis. The data set consists of 298 observations. Since we counted all 149 batches by hand twice, we include each count in the data set as a separate observation. However, since three of the absentee batches were never counted by machine, these drop out of the final analysis for a total sample of 292 batches.[33] Demographic data was collected from the audit team members in pre- and post-audit questionnaires delivered by the research team. See Appendix K for more on the survey data collected during the pilot audit study.

Table 3.5 provides some descriptive statistics on the variables that we use in the regression analyses below. The main dependent variable, Deviation Rate, requires some explanation. This variable captures all the differences between the totals for all four candidates within a particular hand count compared to machine count #1. Deviation Rate does not consider the direction of the difference, only the deviation between counts. For

[33] The negative binomial indicated that the data were over-dispersed. In the robust regression in table 6, the results are only based on 289 observations, because of a few missing observations in the time to count variable.

example, if the machine count tallied 10 votes for each of the four candidates, but the hand count gave 11 votes to the Democratic gubernatorial candidate and 9 votes to his opponent, and 9 votes to the Democratic candidate for land commissioner and 11 votes to his opponent, the total deviation rate for this count would equal 4. Since the difference between each candidate across the two counts is 1 vote, all these differences are summed to produce the dependent variable, Deviation Rate.[34] As shown in Table 3.5, the range of deviation across all the counts is from 0 to 30, but the mean number of deviations across observations is less than 2. Over half of our observations have deviation rates of 0, which demonstrates that for a majority of batches across all modes of voting, there was no difference between machine and hand counts (as shown above). The other dependent variable that we use, Percentage Deviation Rate, is simply Deviation Rate divided by the total number of ballots in a batch. This second dependent variable will allow us to control for batch size in order to determine if any additional variables might be important for explaining deviations across counts.

Table 3.5. Descriptive Statistics on all variables

	N	**Mean**	**Median**	**S.D.**	**Minimum**	**Maximum**
Deviation Rate	292	1.86	0	3.49	0	30
Percentage Deviation Rate	292	0.005	0	0.008	0	0.046
Ballot N	292	315.7	263.5	224.4	4	1972
Time to Count (in minutes)	294	63.2	46.5	52.3	5	521
Average Age	298	48.7	45.7	12.1	31.5	71.5
Average Education	298	1.8	2	0.35	1	3
Single Ethnicity Count Teams	147	-	-	-	0	1
Absentee	56	-	-	-	0	1
Early	28	-	-	-	0	1
All Female	71	-	-	-	0	1
All Male	92	-	-	-	0	1

The other variables listed in Table 3.5 are a little more self-explanatory. All of the remaining variables are the independent variables that will be used to explain Deviation Rate in the regression analyses. Ballot N is simply the number of ballots within a particular batch. On average, hand counters had to count about 316 ballots at a time, although the range in size is very large. Nearly all the absentee batches had 455 ballots, and a number of the early voting sites had anywhere from 62 to nearly 2000 ballots. Time to Count is the number of minutes it took a hand-counting team to finish counting the ballots in a batch. Average Age is the average age of all the counters within a hand tallying team. Average Education is the average level of education within a hand tallying team. The education variable is on a three-point scale, with 1 meaning that a team had on average, a high school education or less, 2 meaning that the team had some college or technical school education, and 3 meaning that the team had a college-level education or higher. The Absentee and Early variables are dummy variables taking on a value of 1 when the batch of ballots was cast in an early voting site or absentee, respectively, and 0

[34] We chose to count the error rate with both candidates because there was a 3rd option of undervote that could have been counted for a particular ballot office. Thus, the deviation count is not necessarily a mirror image of what happened in one race.

otherwise. We also included standard demographic predictors in our model including whether the counters were all male, all female or a mixed gender team and whether counters were all the same ethnicity or a mixed ethnicity team. These variables are also dummies coded 1 for all male, all female and all the same ethnicity and 0 otherwise.

We decided to present the results from two different models, but these results are robust across a number of different specifications and techniques. Table 3.6 shows the results from two regressions.[35] In Model 1, we find that the strongest effect on deviation rates between machine and hand counts is the number of ballots being counted. The more ballots a team of hand counters or machine (we know that some of these are because of the machine) has to tally, the more likely they are to deviate from each other, or end up with different results than the machine. This result is our strongest and most significant finding and is very robust holding up over a number of different model specifications not shown here. Moreover, the number of ballots is still a significant predictor after accounting for early and absentee batches that were previously shown to be more prone to differences between machine and hand counts. Although the number of ballots is the most significant predictor of deviation across counts, the impact is still relatively small. Holding all the other variables at their mean, the marginal effect of batch size ranges from virtually no impact on the smallest batches, to an increase of about 1.5 in the deviation rate on the largest batches.[36] The only other significant predictor of deviation is the average age of the counting team. We find that younger teams are more likely to deviate from the machine count than older teams. However, the marginal effect of age on the deviation rate is very close to zero.

Because the number of ballots is such a strong predictor of the deviation rate, we decided to control for batch size by using a dependent variable that represents deviation rate as a percentage of batch size. These results are presented in Model 2 of Table 3.6. In Model 2 we find statistical evidence that supports earlier findings after accounting for batch size. Early voting and absentee batches are more prone to deviations across counts, and we again find that younger hand-tallying teams are significantly more likely to deviate from the machine counts. We also find some suggestive evidence that 3-person hand counts were more likely to lead to deviations across counts, and that single ethnicity hand counting teams were somewhat less likely to deviate from the machine count results. However, the statistical evidence is only marginally significant (at $p<.10$), and unlike our other variables, the significance of these two variables is highly dependent on model specification.

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[35] We use a negative binomial regression in Model 1 because our dependent variable is a count variable making OLS inappropriate. Also, because the dependent variable has a large number of zeros, poisson regression is inappropriate. We also tested the model by clustering the observations by batch because each batch is counted as two observations creating an independence issue across these batches. However, the use of clustering has virtually no impact on the results so we present the model without clustering here. In Model 2, we use robust regression to account for heteroskedasticity in our data, and a small number of influential outliers. We also used a variety of other model specifications, and those models produce results that are qualitatively similar to what we report in Table 3.6.

[36] The marginal effect of ballot N was also calculated holding all other variables at their median. Using the median instead of the mean had very little impact on the results. To calculate the marginal effect of ballot N, we used 62 as the minimum batch size (instead of 4), and 1972 as the maximum batch size.

In Model 2 we also include the time it took to count the ballots.[37] These results suggest the longer it takes to count a batch of ballots, the more likely there is to be a deviation across machine and hand counts. However, the time it takes to count ballots is highly correlated with ballot N.[38] Substantively, the time to count variable functions much like ballot N, and suggests that even though we have controlled for the number of ballots in the dependent variable, larger batches are still more likely to have deviations across counts. If we remove the time variable from the model, the results are not substantively different.[39]

Table 3.6 Regressions of Counter and Ballot Characteristics on Deviations Between Machine and Hand Counts

	Model 1: Negative Binomial Regression Deviation Rate		Model 2: Robust Regression Deviation as % of Batch Size	
	Coefficient	Standard Error	Coefficient	Standard error
Ballot N	.0035****	.0007		
Counting Time (min.)			.00002****	.000004
Absentee (dummy)	.2546	.2381	.0016***	.0005
Early (dummy)	-.4549	.2946	.0018**	.0007
First Hand Count	-.0754	.1960	-.0008*	.0004
Average Age	-.0247***	.0084	-.00009****	.00002
Average Education	.3822	.2868	.0003	.0006
Single Ethnicity Team	.3161	.2006	-.0008*	.0004
All Female	.0481	.2286	-.00056	.00053
All Male	.1677	.2438	-.0001	.0005
Constant	-.4954	.6941	.0045***	.0014
F			8.22	
Log Pseudo likelihood	-470.86			
Wald Chi-square	58.40			
N	292		289	

*****p<.001, ***p<.01, **p<.05, *p<.10*

Through the regression models presented above, we are also able to reject some of the possible explanations for deviation across counts. Although the First Hand Count variable is marginally significant in Model 2, it is not significant in Model 1. These results suggest that the use of two- or three-person hand counting teams has very little effect on the number of deviations between machine and hand counts. We also found the average level

[37] We could not include time to count in Model 1 because of multicollinearity issues between time to count and ballot n.
[38] The correlation rate between ballot n and time to count is .73.
[39] The count dummy variable, and the single ethnicity count team variables become insignificant when the time to count variable is removed. This change is unsurprising considering that in a number of other models not shown here, these two variables were rarely, if ever, significant.

of education within a hand counting team has little impact on their ability to successfully count ballots.

The number of ballots within a batch is our most significant predictor of deviation rates, whether this is measured by the actual number of ballots in a batch or by the time it takes to count a batch. We also find some evidence that early and absentee batches are more likely to have deviations across counts, confirming evidence presented above in Figures 1a and 1b. We also found consistent results that younger teams, on average, were more likely to deviate from the machine count when hand-tallying ballots.

Differences Across Hand Counts

In addition to explaining the differences that arise when we compare machine counts to hand counts, it is also important to discuss the differences across hand counts. Since we counted each batch of ballots twice, once with a two-person team, and once with a three-person team, we can analyze the accuracy of hand counting ballots and describe how consistent human counters are across two separate counts. If we find that differences across hand counts display similar patterns, as is suggested by data in Table 3.6 and Figures 1a and 1b, to differences between machine and hand counts, it would provide further evidence that not only are the differences between machine and human counters random, but also likely due to human error in many cases. Also, it allows us to test whether a 2-person or 3-person team provides better accuracy. If the hand counts are not statistically different from one another, these results would suggest that using an additional person to hand count ballots has little impact on reducing the deviations across machine and hand counts.

Table 3.7 provides a comparison of the aggregate vote totals for each candidate by voting mode.

1. Column 1 defines the ballot question under examination and whether those ballots were cast on Election Day, by mail-in absentee or at early voting locations.
2. Column 2 is the total for each candidate by voting mode for the first hand count.
3. Column 3 is the total for each candidate by voting mode for the second hand count, counter 1.
4. Column 4 is the total for each candidate by voting mode for the second hand count, counter 2. In nearly all cases, the second counter is not an independent count from the first counter, so the results across the two counts are largely the same.[40]
5. Column 5 is the difference between the first hand count tally and the second hand count tally for counter one.

[40] As can be seen in Table 7 there is a discrepancy in the Land Commissioner vote totals among the absentee ballots within hand count #2. This discrepancy is the result of one batch where the two counters did not agree on the final vote totals. In nearly all cases, these counts were voided and recounted, but the discrepancy was not caught in this one case.

6. Column 6 is the percentage difference between the first and second hand count.

In general, the differences across both hand counts are very small, ranging from no difference for the Democratic gubernatorial candidate in early voting, to a difference of 18 ballots for the Republican candidate for Land Commissioner. Just like evidence presented above that looked at differences between hand and machine counts, we do not find a difference greater than 0.5% for any candidate or across any mode of voting. The largest percentage difference across the two hand counts was a mere 0.3% for the Democratic candidate for Land Commissioner among absentee ballots. There is some slight evidence that there are greater differences across hand counts in absentee voting, but even here, the differences are very small.

Table 3.7. Aggregate Comparison of Hand Count #1 to Hand Count #2 by Contest and Voting Mode

1	2	3	4	5	6
	Total Hand Count #1	Total Hand Count #2, Counter 1	Total Hand Count #2, Counter 2	Difference HC1-HC2*	Percentage Difference
Election Day					
Dem Gov.	18448	18440	18440	8	0.043
Rep Gov.	7993	7994	7994	1	0.013
Dem LC	11769	11759	11759	10	0.085
Rep LC	14541	14539	14539	2	0.014
Absentee					
Dem Gov.	7928	7938	7938	10	0.130
Rep Gov.	4277	4267	4267	10	0.230
Dem LC	5388	5404	5398	16	0.300
Rep LC	6831	6813	6818	18	0.260
Early Voting					
Dem Gov.	5114	5114	5114	0	0.000
Rep Gov.	2813	2816	2816	3	0.110
Dem LC	3831	3833	3833	2	0.052
Rep LC	4144	4143	4143	1	0.024

**To calculate the differences between HC1 and HC2 where differences exist between the two counters in HC2, I used the totals from counter #1.*

Note: Percentage difference = 1 - (Count A/Count B), where Count A is always smaller than Count B.

Figure 2 compares the data as we did in Figures 1a and 1b by summing the differences across candidate by voting mode and then subtracting hand count 2 from hand count 1. The results show that both Election Day and early batches had the highest rate of similarity with over 70% of batches returning identical counts. Absentee batches, which are not processed by the voter, show a somewhat lower level of identical matches (45%), but in all cases the deviations are all clustered closely around 0 and the ballot batch sizes for absentee were rather large (almost all of them had a ballot size of 455). All voting modes show the same pattern, the largest percentage of batches are identical across

counts with deviations of 1 or -1 between 9% and 14%, deviations of -2 or 2 between 2% and 11%, and at each successive point we see a lower proportion of differences. The highest differences are a mere 6 ballots off any one count.

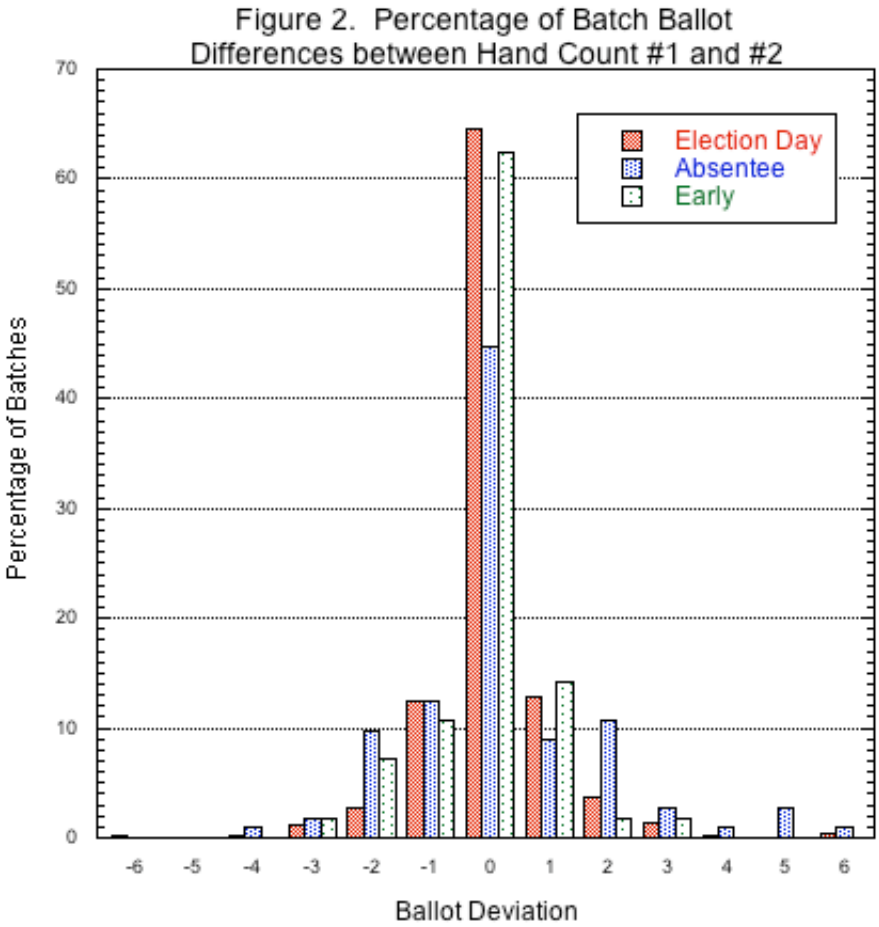


Table 3.8 extends the analysis of differences between hand counts to account for potential bias in the hand counting process towards a particular party or candidate.

1. Column 1 defines the ballot question under examination and whether those ballots were cast on Election Day, by mail-in absentee or at early voting locations.
2. Column 2 defines the total number of batches.
3. Column 3 is the total net gain or loss between hand counts across batches.
4. Column 4 is the percentage difference between the two hand counts.
5. Column 5 is the average deviation between the two hand counts per batch.

Similar to the evidence shown above for potential bias between machine and hand counts, we find that the deviations for or against a particular candidate or party are very small, appear to be random, and tend to cancel each other out. In Table 3.8 we can see that over all voting modes, the Democratic gubernatorial candidate loses 2 votes, while the Republican gubernatorial candidate has a net gain of 6 votes. As a percentage of total votes for each candidate, the deviations are very small, ranging from 0% to 0.3%.

Table 3.8. Differences across Hand Counts For or Against Each Candidate

1	2	3	4	5	6
	Total Number of Batches	Total Number of batches where there was a difference, HC1 v HC2	Net Gain/Loss	Net Gain/Loss as Percentage of Total Votes (HC1)	Average Deviation, HC1 v HC2
Election Day					
Dem Gov	107	38	8	0.04	0.08
Rep Gov	107	35	-1	0.01	-0.01
Dem LC	107	41	10	0.08	0.09
Rep LC	107	38	2	0.01	0.02
Average				**0.04**	**0.05**
Absentee					
Dem Gov	28	17	-10	0.13	-0.36
Rep Gov	28	16	10	0.23	0.36
Dem LC	28	14	-16	0.30	-0.57
Rep LC	28	15	18	0.26	0.64
Average					**.48**
Early Voting					
Dem Gov	14	4	0	0.00	0.00
Rep Gov	14	5	-3	0.11	-0.21
Dem LC	14	6	-2	0.05	-0.14
Rep LC	14	6	1	0.02	0.07
Average					**.10**
Total Average					**.21**

The last column of Table 3.8 shows the average deviation across all batch counts. The average difference across any particular count for any particular candidate are all quite small ranging from -0.57, as seen for the Democratic candidate for land commissioner in the absentee batches, to 0.64, as seen for the Republican candidate for land commissioner in absentee batches. An average difference of less than 1 ballot per batch is very small and insignificant, suggesting strongly that there is no significant difference between a 2 and 3-person hand count. We tested this hypothesis explicitly in Table 3.9, which shows the result from a paired t-test, and found that statistically speaking 2 and 3 person hand counts produce the same results. Therefore, employing more counters is an unnecessary

check on the process. A two-person counting team will count the ballots just as well as a three-person counting team.

Table 3.9. Comparison of 2 and 3-person Hand Counts, Paired Difference of Means Test

	Mean difference	*t*-value Significance	Pearson Correlation
Gubernatorial Race			
Richardson	-.01	.25	1.0
Dendahl	.04	.32	1.0
Governor Under votes	-.03	.32	.98
Land Commissioner Race			
Baca	-.05	.32	1.0
Lyons	.14	.86	1.0
Land Commissioner Under votes	.05	.36	.98

Note: N=149

Voided Hand Counts

Part of the process of counting ballots by hand involves recounting certain batches or precincts due to human error.[41] Here, we examine the voided tally sheets to learn what their impact on the audit outcome would have been if these voided counts had been included instead of being removed from the analysis. On numerous occasions throughout our study, hand counters made some type of mistake while hand tallying ballots. Commonly, counters would get to the end of a count and find they had too few or too many total ballots counted. When these mistakes occurred a supervisor voided the tally sheets, new tally sheets were provided to the counters, and the ballots were counted again.

Many other times, voided counts were never finished as the counters realized early on in the count that they had made a mistake and requested a restart. In these instances, a voided count may have been the result of miscommunication between the two counters; or in the case of the three-person teams, a voided count might have resulted from a discrepancy between the two hand counters at check points in their processing. In other cases, batches were voided due to mistakes in marking the tally sheets, such as tallying votes in the wrong space on the tally sheet. Unfortunately, when a hand count was voided before the count was finished, we were unable to capture the frequency of these occurrences.

However, we do have data on those voided hand counts that were finished and voided by a supervisor. In 17% of our batches, there was a least one completed hand count that was voided by a supervisor. Hand counts were voided for a couple of reasons. Many times,

[41] Voided counts can also happen with a machine, and we did have one instance in our study where ballots had to be re-counted by a machine due to machine failure. Voided hand counts were much more frequent.

after a count had been finished, the counters realized that their vote totals did not match the total number of ballots. They had either missed a few ballots, or had counted a ballot twice. If the counters did not catch this problem themselves, the supervisors were able to catch this error after reviewing the tally sheets when the ballots were returned.[42] This potential problem highlights the importance of a good supervisory team that can quickly review the hand counts after they have been completed to ensure any simple errors can be corrected during the audit. The other problem that led to a hand count being voided was disagreement between the two tally sheets in the three-person counts. In a few cases, a count was finished only for the counters to realize they had differing totals for one or more of the candidates. For one batch, this problem was not caught, as can be seen in the Land Commissioner results in Table 3.7 above.

While in almost all cases, these counting errors were caught by either the counters themselves or by the supervisors, it is important to study the extent of the error, and its potential impact should these errors not be caught during an audit. Table 3.10 shows the aggregate results for each candidate by voting mode if the voided counts were used instead of the actual counts. In many cases, the use of the voided counts increases the percentage difference in the Election Day and absentee batches between the machine and hand counts, although in some cases the difference actually decreases.[43] In all cases, however, the impact of these voided counts is very small and would likely not trigger a full recount.

Table 3.10 presents only the aggregate results if the voided counts had been used instead of the actual counts used in our study and compares that to our findings in Table 3.3 with the actual counts.

1. Column 1 defines the ballot question under examination and whether those ballots were cast on Election Day, by mail-in absentee or at early voting locations.
2. Column 2 contains the total number of ballots counted in the first machine count.
3. Column 3 reports the total from the first hand count of ballots.
4. Column 4 reports the total from the second hand count of ballots.
5. Column 5 reports the difference between the first machine count and the first hand count. A positive number indicates that more ballots were counted in the machine count than in the hand count. A negative number indicates that fewer ballots were counted in the machine count than in the hand count.
6. Column 6 reports the absolute percentage difference between the first machine count and the first hand count.
7. Column 7 presents the results on the absolute percentage difference between the first machine and first hand count from Table 3, where no voided counts were used.
8. Column 8 reports the difference between the first machine count and the second hand count. A positive number indicates that more ballots were counted in the

[42] In the three absentee batches that were only hand tallied, the vote totals do not match the total number of ballots.
[43] There were no voided hand counts in early voting.

machine count than in the hand count. A negative number indicates that fewer ballots were counted in the machine count than in the hand count.

9. Column 9 reports the absolute percentage difference between the first machine count and the second hand count.
10. Column 10 reports the results on the absolute percentage difference between the first machine and second hand count from Table 3.3, where no voided counts were used.

However, these results are only based on the first voided count for the 26 batches where a hand count was voided. In results not shown here, the use of the second voided hand counts makes little difference except in one case. In absentee batch A050, there was a voided hand count where the difference between machine count #1 and the hand count for the Republican gubernatorial candidate was 27 votes.[44] In all other voided hand counts, the differences were only a few ballots but this case demonstrates that it is possible for a large discrepancy to occur. In the aggregate, if this batch was included, it created a percentage difference among absentee votes for the Republican gubernatorial candidate of 0.95%. If the number of absentee batches counted in our study had been smaller, this single count could have potentially triggered a full recount of all absentee ballots. Fortunately, this error was caught during the pilot audit, but it does highlight the importance of supervising the hand counters and checking completed hand counts by the supervisory team.

[44] For A050, machine count #1 counted 99 ballots for John Dendahl, while in the second voided hand count, the counters tallied 126 votes for John Dendahl.

Table 3.10. Aggregate Comparison of Machine Counts to Hand Counts, Using Voided Hand Counts instead of Actual Hand Counts

1	2	3	4	5	6	7	8	9	10
	Total Machine Count	Total Hand Count #1	Total Hand Count #2	Difference MC1-HC1	Percentage Difference, with Voided Counts	Percentage Difference, Actual Count	Difference MC1-HC2	Percentage Difference, with Voided Counts	Percentage Difference, Actual Count
Election Day									
Dem Gov.	18433	18442	18438	-9	0.05	0.08	-5	0.03	0.04
Rep Gov.	8008	7992	7996	16	0.20	0.19	12	0.15	0.17
Dem LC	11758	11764	11758	-6	0.05	0.09	0	0.00	0.01
Rep LC	14548	14535	14538	13	0.09	0.05	10	0.07	0.06
*Absentee**									
Dem Gov.	6990	6980	6991	-10	0.14	0.13	-1	0.01	0.00
Rep Gov.	3868	3880	3867	12	0.31	0.28	1	0.03	0.03
Dem LC	4739	4727	4753	-12	0.25	0.11	-14	0.29	0.11
Rep LC	6120	6121	6105	1	0.02	0.02	15	0.25	0.00
Early Voting									
Dem Gov.	5128	5114	5114	14	0.27	0.27	14	0.27	0.27
Rep Gov.	2824	2813	2816	11	0.39	0.39	8	0.28	0.28
Dem LC	3842	3831	3833	11	0.29	0.29	9	0.23	0.23
Rep LC	4159	4144	4143	15	0.36	0.36	16	0.38	0.38

*3 of the absentee batches were unable to be counted by machine and are excluded from this table. There were no voided hand counts among these three batches.

Note 1:19 Election Day precincts and 7 absentee batches had voided hand counts. This table only reflects the counts from the 1st voided count for each of these 26 batches. 6 out of these 26 batches had a 2nd voided count.

Note: Percentage difference = 1 - (Count A/Count B), where Count A is always smaller than Count B.

Differences Across Machine Counts

We inserted the ballots into the same machine twice. Once at the beginning of our process simulating the election and a second time at the end of our process so that we could explicitly compare machine count to machine count. In the second machine count problem ballots that were not read by the machine the first time were processed separately the second time so that the overall N comparisons would be the same. In some cases, new problem, machine rejected, ballots were encountered the second time. Table 3.11 shows the aggregate total number of ballots counted in each machine count.

Table 3.11. Aggregate Comparison of First (t1) to Second (t2) Machine Count

	Total Number of Ballots Counted by Machine at t1	Total Number of Ballots Counted by Machine at t2	Difference t1-t2
Election Day	26737	26732	5
Early Voting	8093	8060	33
Absentee	11009	11027	-18
Total	45839	45819	20

Note: these totals reflect all 146 batches counted by machine.

The ballots rejected by the machine pose a particular problem in comparing the accuracy of machine counts because the number of ballots rejected in machine count #1 did not always equal the number of ballots rejected in machine count #2. Moreover, even if the number of rejected ballots is equal across the two counts, we cannot be completely certain that the exact same ballots were rejected in both instances. During an election, and during our study, all rejected ballots were tallied by hand separately from the totals used to compare machine counts to hand counts. To assess the accuracy of voting machines, it is therefore necessary that we add the hand-tallied totals to the machine-read totals to make comparisons across machine counts. In the analysis that follows, the actual ballot totals used in the previous sections will not be the same for machine count #1, precisely because these new totals reflect the addition of all those ballots rejected by the machine.[45]

In most cases, the machines were much more accurate in counting ballots than humans. Table 3.12 shows the differences between the two machine counts by the number of batches.

1. Column 1 defines the voting mode for the batch: Election Day, absentee and early.

[45] We also had to drop 5 batches from the comparison of MC1 to MC2 because of problems in counting the rejected ballots for these batches in MC2. These errors were due to human error during our study and cannot be avoided. In these five batches the total ballot N was off by 1 ballot in machine count #2, making any conclusions about the accuracy of the voting machine in these cases unreliable.

2. Column 2 reports the total number of batches counted by machine used for this analysis.
3. Column 3 reports the total number of batches with no differences across machine count.
4. Column 4 reports the total number of batches where the machine over or under counted the number of ballots.
5. Column 5 reports the total number of batches where the machine counts differ when the numbers of ballots were equal across counts.

Ninety-five percent of Election Day precincts showed no deviation in vote totals across both machine counts. Of the remaining 5%, the machine either under or over-counted the number of ballots in that precinct. For absentee ballots, 86% of these batches had identical counts across each machine count. In early voting, the machines were much less accurate, with less than 50% of the machines having identical counts across machine count #1 and machine count #2. While these figures might suggest a high degree of error by machines, this is not the case. As described in further detail below, much of the deviations across machine counts can be explained by rare cases where the machines either counted a ballot twice or accepted a ballot without counting it, or by likely errors in the hand tallying of rejected ballots. These are shown in Table 3.12.

Table 3.12. Differences Between Machine Count #1 and Machine Count #2 by Number

1	2	3	4	5
	Total Number of Batches Counted by Machine*	Total Number of Batches with No Differences Across Machine Counts	Total Number of Batches Where the Machine Over or Under Counted the Number of Ballots	Total Number of Batches Where Machine Counts Differ When Number of Ballots are Equal Across Counts
Election Day	106	101	5	0
Absentee	22	19	0	3
Early Voting	13	6	6	1
Total	*141*	*126*	*11*	*4*

**1 Election day precinct, 3 absentee batches, and 1 early voting machine were dropped from the analysis because of problems in reconciling vote totals with the total number of ballots in Machine Count #2. These problems were due to human error during the audit process, and not due to machine error.*

Despite the potential problem of machines over or under counting ballots, the aggregate affect on a candidate's vote totals is very small. Table 3.13 reports the aggregate count of each candidate by voting mode. In Election Day precincts and absentee batches the highest difference across machine counts is two votes. In early voting, we see a much higher difference across machine counts, which can be explained by the greater likelihood of these machines for over-counting ballots. Nevertheless, the actual

percentage difference across machine counts for early voting is still less than 0.5%, similar to what we found when comparing machine to hand counts.

1. Column 1 defines the voting mode for the batch: Election Day, absentee and early.
2. Column 2 reports the total ballots in the first machine count.
3. Column 3 reports the total ballots in the second machine count.
4. Column 4 reports the difference between the first and second machine count.
5. Column 5 reports the percentage difference between the first and second machine count.

Table 3.13. Aggregate Comparison of Machine Count #1 to Machine Count #2 by Contest and Voting Mode

1	2	3	4	5
	Total Ballots, Machine Count #1	Total Ballots, Machine Count #2	Difference MC1-MC2	Percentage Difference
Election Day				
Dem Gov.	18154	18156	-2	0.011
Rep Gov.	7794	7793	1	0.013
Dem LC	11626	11628	-2	0.017
Rep LC	14189	14189	0	0.000
Average				**0.028**
Absentee				
Dem Gov.	6271	6270	1	0.016
Rep Gov.	3433	3435	-2	0.058
Dem LC	4236	4234	2	0.047
Rep LC	5472	5473	-1	0.018
Average				**0.035**
Early Voting				
Dem Gov.	5041	5028	13	0.260
Rep Gov.	2795	2784	11	0.390
Dem LC	3768	3767	1	0.027
Rep LC	4117	4103	14	0.340
Average				**0.254**
Total Average				**0.106**

Note: Totals are based on machine read ballots plus hand tallied rejected ballots for 106 Election Day batches, 22 absentee batches, and 13 early voting batches. 5 batches had to dropped from the analysis because of problems of reconciling the rejected ballots from machine count #2.
Note 2: Percentage difference = 1 - (Count A/Count B), where Count A is always smaller than Count B.

As seen above in Table 3.12, there are also a few cases where differences exist across machine counts that cannot be explained by the machine over or under counting ballots. In four batches there is a deviation in vote totals across machine counts, even though the total number of ballots across each count is the same. Table 3.14 compares the vote totals

for each candidate across machine count #1 and machine count #2 for these four batches. In all cases, the counts only differ by no more than 1 vote.

1. Column 1 defines the batch identification.
2. Column 2 reports the total number of vote for the Democratic gubernatorial candidate in the first machine count.
3. Column 3 reports the total number of votes for the Democratic gubernatorial candidate in the second machine count.
4. Column 4 reports the total number of votes for the GOP gubernatorial candidate in the first machine count.
5. Column 5 reports the total number of votes for the GOP gubernatorial candidate in the first machine count in the second machine count.
6. Column 6 reports the total number of voters for the Democratic land commissioner candidate in the first machine count.
7. Column 7 reports the total number of voters for the Democratic land commissioner candidate in the second machine count.
8. Column 8 reports the total number of voters for the GOP land commissioner candidate in the first machine count.
9. Column 9 reports the total number of voters for the GOP land commissioner candidate in the second machine count.

A likely explanation for these deviations is error in hand-tallying rejected ballots. In all four of these cases, the total number of ballots read by the machine does not match across machine counts, making it impossible to compare across counts without using the rejected ballots. In the case of the early voting machine in Table 3.14, even though there was only a single rejected ballot in machine count #1, the counters in hand count #1 and hand count #2 differed on how to count that ballot. The other batches where the machine counts differ come from the absentee batches. The M650 machine, while it did not over or under count ballots, did reject a much larger number of ballots than the M100. This higher rate of rejection did cause some small problems, as the rejected ballots had to be counted by hand. In batch A051, the M650 rejected over 40 ballots in both machine counts. The counters in hand count #1 and #2 differed on how to count these ballots, leading to the deviation in vote totals seen in Table 3.14. It is possible that the M650 counted a ballot differently across both machine counts, but the more likely reason is error in hand counting rejected ballots because we see a clear discrepancy there.

Table 3.14. Examination of All Machine Count Differences Where Total Number of Ballots is Equal Across Counts

1	2	3	4	5	6	7	8	9
	Total Number of Votes for Democratic Governor, MC1	Total Number of Votes for Democratic Governor, MC2	Total Number of Votes for Republican Governor, MC1	Total Number of Votes for Republican Governor, MC2	Total Number of Votes for Democratic Land Commissioner, MC1	Total Number of Votes for Democratic Land Commissioner, MC2	Total Number of Votes for Republican Land Commissioner, MC1	Total Number of Votes for Republican Land Commissioner, MC2
Absentee								
A009	333	333	116	116	219	218	231	232
A013	322	322	124	125	222	222	229	229
A051	282	281	166	167	173	172	273	273
Early Voting								
E220603	206	207	71	70	162	163	113	112

Note: All totals include machine read ballots plus hand-tallied rejected ballots

While machines do make mistakes, these results suggest that the M100 and M650 voting machines are more accurate in counting ballots, and replicating results across counts, than tallying ballots by hand. Table 3.15 presents data already used in previous tables to compare the percentage differences between two hand counts to the differences between two machine counts.

1. Column 1 defines the ballot question under examination and whether those ballots were cast on Election Day, by mail-in absentee or at early voting locations.
2. Column 2 is the overall difference between the first and second hand count.
3. Column 3 is the percentage difference between the first and second hand count.
4. Column 4 is the overall differences between the first and second machine count.
5. Column 5 is the percentage difference between the first and second machine counts.

For Election Day precincts and absentee batches, the differences across the two machine counts are much less than those found across two hand counts. However, for three of the four candidates in early voting, we find that hand counting ballots was more accurate and less likely to produce differences across two counts. Again, this difference in the early voting machines can be explained by the greater tendency to over or under count ballots.

Table 3.15. Comparison of Deviations Between Hand Counts and Machine Counts, by Candidate and Voting Mode

1	2	3	4	5
	Difference HC1-HC2	Percentage Difference	Difference MC1-MC2	Percentage Difference
Election Day				
Democratic Gov.	8	0.043	2	0.011
Republican Gov.	1	0.013	1	0.013
Democratic LC	10	0.085	2	0.017
Republican LC	2	0.014	0	0.000
Absentee				
Democratic Gov.	10	0.130	1	0.016
Republican Gov.	10	0.230	2	0.058
Democratic LC	16	0.300	2	0.047
Rep LC	18	0.260	1	0.018
Early Voting				
Democratic Gov.	0	0.000	13	0.260
Republican Gov.	3	0.110	11	0.390
Democratic LC	2	0.052	1	0.027
Republican LC	1	0.024	14	0.340

Note: Source of information available in Tables 3.7 and 3.13.

Counting Efficiency and Counting Times

Each counter was responsible for noting the time they picked up the ballots from a supervisor and noted when they returned them. Compliant with chain of custody procedures, there was also a login form at the checkout desk on which check out and check in time were recorded. Having this information recorded twice allowed us to verify batch times. From this information, we are able to calculate average times for the machine counts and the hand counts. Table 3.16 shows the results by batch and by ballot. The data indicate that the early voting machines with large numbers of ballot styles took substantially longer ($p < .05$) to count ballots than machines used on Election Day which had only 1 ballot style associated with its electronic reader. The differences are substantial with the machine reader taking only about 18 seconds per ballot for Election Day machines, averaging across the two machine counts, compared with about 27 seconds per ballot for early voting machines.

Surprisingly, hand counts were very quick, although it's important to keep in mind that only 2 ballot questions were tallied. Hand count averages were largely the same across voting mode ($p > .05$), suggesting that ballot style differences in early and absentee batches did not affect counting times. The average time for hand counting was about 12 seconds per ballot. Overall, the M100 machine counts in our audit averaged slightly longer than the hand counts.

Absentee ballots processed by the M650 had substantially shorter tabulating times, as they should be since these machines are used for high-throughput. Average times for processing absentee ballots was about 1.5 seconds per ballot and about 11 minutes per batch of roughly 455 ballots.

Table 3.16. Average Time to Count Batches in Minutes and Average Time to Count Ballots in Seconds by Voting Mode and Type of Count

	Election Day	Early	Absentee	Average Across All Ballot Styles
Average Time to Count Batch (in minutes)				
Machine Count 1	75.75	245.57	9.68	80.72
Machine Count 2	75.96	271.15	12.60	82.54
Hand Count 1	60.63	92.08	90.52	68.96
Hand Count 2	48.10	93.71	76.26	57.55
Average Time to Count per Ballot (in seconds)				
Machine Count 1	18.11	25.49	1.29	15.33
Machine Count 2	18.16	28.15	1.69	15.67
Hand Count 1	14.55	9.56	12.10	13.01
Hand Count 2	11.50	9.72	10.21	10.82

From the numbers presented in Table 3.16 it is clear that the type of machine (M100 Election Day, M100 Early or M650 absentee) being used to count the ballots and the batch size play a role in how long it takes to count ballots, but we examined this more systematically by controlling for batch and counter characteristics that may make a difference in overall speed, such as the age and education of the employee.[46] The results, presented in Table 3.17, show that as expected, batch size increases the amount of time to finish a batch count by .18 minutes for every ballot counted. The average batch size is about 314 ballots, thus a batch of this size would take about 56 minutes to count holding all else constant. The number of rejected ballots contained in a batch had no effect on overall counting time. Since these ballots were overall few in number and were either counted separately in the case of a hand count or put into a separate folder after the machine count their presence was unlikely to increase or decrease overall counting times.

Table 3.17. OLS Regression of Batch and Counter Characteristics on Time to Count Ballots in Minutes

	Coefficient (Standard Error)
Batch Size (ballot N)	.18***
	(.011)
Number of Rejected Ballots	.39
	(.547)
Machine Count 1	9.28
	(5.59)
Machine Count 2	12.95*
	(5.589)
Hand Count 2	-26.48**
	(6.79)
Early Batch	58.01***
Absentee Batch	-52.23***
Age of Counters (average)	.78***
	(.169)
Education Level of Counters (teams averaged)	-12.72*
	(4.26)
Constant	-2.97
	(9.10)
R^2	.53
N	581

*p<.05, **p<.01, ***p<.001

Using hand count one as the base count to compare against, it is clear that machine counts take longer, but remember that the machines counted the entire ballot whereas the hand counters only counted two ballot items. The results show that both the machine counts took longer especially if we note that machine count 1 just misses statistical

[46] Demographic characteristics of our team members were collected through pre- and post-audit questionnaires. See Appendix K for more information collected during these surveys.

significance (p =.06). However, moving from the first to the second hand count significantly decreases the amount of time it took to count a batch, decreasing counting time by about 25 minutes. We suspect that counting teams developed greater efficiency in counting over time, and processing with the supervisor also likely decreased as time passed in the process. Additionally, in many cases the ballots were already sorted into three straight party groups for the second hand count, which helped decrease the amount of time spent on the front end of the hand count. The results suggest that when counters are familiar with the process and the paperwork involved, their efficiency improves.

In addition to examining batch characteristics, we looked at some counter demographic variables that may have an impact on counting speed, particularly age and education. Based on observations during the counting process, age appeared to play a role in the speed a team could count. Some older team members reported having poor hearing. They were also more likely to comment on becoming uncomfortable throughout the day and suffering from tired or strained vision. Given these observations, we decided to include age as a variable of interest. Average team or counter age did prove to be negative and statistically significant. For every additional unit increase in the average counting team's age, it will take approximately three-quarter's of a minute longer to complete the task. Thus, if we were to compare a younger team of say 25 to an older team of 65, the older team would take on average 32 minutes longer, holding all other factors constant in our model

The results also show that the higher the average team's or individual's education level, the less time it took to count a batch. The decrease in time was fairly large, with college-educated teams cutting counting time by approximately 39 minutes. Education was averaged for the team and was measured using a three point scale where 1 represented high school degree or less, 2 represented some college/post-high school education/career training and 3 represented a college degree or higher. The majority of the team members in our audit had some college or post-high school education. These results suggest that having counters with higher levels of education or at least a group with varying levels of education may increase counting efficiency.

Overall, counting time appears to be highly dependent on the number of ballots included in the batch as well as familiarity with the process. As counters became more familiar with the ballots, their counting speed increases. This would suggest that election officials may want to place extra emphasis on training their employees, getting them familiar with the tallying process, the tally sheet layout, ballot layout, and chain of custody procedures before the audit process begins to save time and meet audit deadlines once the audit clock starts ticking.

Problem or Rejected Ballots

As part of the pilot audit study, we identified problem ballots. Problem ballots were mostly defined as ballots not machine readable. But, problem ballots could also be

identified by hand counters who encountered a ballot where they found it difficult to identify voter intent (this was rare). When a problem ballot was encountered team members were required to fill out individual ballot logs (See Appendix H, Forms H.5, H.6, and H.7) for any ballot that was a problem in the machine count or in the hand count. In addition, we created scans of each individual ballot for further study after the end of the audit. In total, we identified 364 "problem ballots," or 0.8% of the total number of ballots sampled for the audit study.[47]

Table 3.18 describes the type of problems encountered throughout the audit study and their relative frequency. The most frequent problem we encountered was related to the structure of the ballot. Ballot structure largely refers to a problem with the voting machine sensors ability to read the black boxes on either side of the ballot. These black boxes signal to the machine the orientation of the ballot, which is necessary for the machine to be able to read the ballot correctly. We found that if even one box was worn, the voting machine was likely to reject the ballot. This problem was most common with the M650 voting machine, as can be seen in Table 3.19. Two hundred and sixteen of the 221 ballots that were rejected at least once because of some ballot structure issue were absentee ballots. After studying these ballots, the most likely reason for this problem among absentee ballots is the folding of the ballot. So that they can be mailed, absentee ballots must be folded, and along the folds for many of these ballots there was some type of wear in the black boxes. Torn ballots created similar problems, because the tears usually affected the ability of the machine to read the black boxes. On rare occasions, ballots became jammed in the voting machine and were damaged.

In some cases, voters marked their ballots using check marks or X's, rather than filling in the ovals. Depending on the position of the mark and how much of the mark filled the oval, the voting machines had problems reading the voter intent and rejected the ballots. Only 18 ballots had this problem. There were only a few cases in which the hand counters had problems interpreting voter intent. These cases usually involved erased marks for the straight party option, or incomplete ovals where it appeared the voter began to choose and option but then decided they did not want to vote for that particular ballot question.

Table 3.18. Description of Problem Ballots

Problem	*Number of Ballots*	*% of Problem Ballots*
Over vote	89	24.5
Ballot Structure	221	60.7
Torn Ballot	24	6.6
Machine unreadable marks	18	5.0
Voter Intent unclear, Hand Count	12	3.3
Total	364	

[47] Images of some of the problem ballots can be found at http://electionupdates.caltech.edu/NM_Audit_Project_sound.mov

Table 3.19. Type of Problem by Voting Mode

Voting Mode	*Over vote*	*Ballot Structure*	*Torn Ballot*	*Machine Unreadable Marks*	*Voter Intent Unclear, Hand Count*
Election Day	61	4	6	12	6
Absentee	10	216	15	4	6
Early Voting	18	1	3	2	0
Total	89	221	24	18	12

The next most common problem that we encountered was over voted ballots. As shown in Table 3.18, about 25% of problem ballots had some type of marking that signaled either to the voting machine or to the hand counters that the voter marked more than one option for a single ballot question. Although in some cases voters completely filled in two ovals for a particular race or ballot question, the most common problem seems to be confusion by the voter where they began to mark one oval, but then completely filled in the other oval, or vice versa. For example this is seen on one ballot where the voter voted "yes" to retain Judge Edward Chavez, but also marked "no" for the same question. In fact, this type of problem was exceedingly common among the judge retention questions. As shown in Table 3.20, nearly 70% of over voted ballots were among judge retentions.

Table 3.20. Position of Over votes on Problem Ballots

Ballot Question	*Number of Ballots*	*% of Over voted Ballots*
Judge Retentions	62	69.7
Straight Party	5	5.6
Bonds & Amendments	10	11.2
Other Races	12	13.5
Total	89	

The high rate of over voting among the judge retention questions within our subset of problem ballots raises some potential problems of ballot design. Studies of ballot design problems have suggested that inconsistent formatting can lead to higher residual vote rates and create confusion and frustration among voters.[48] In Bernalillo County, the ballots used in 2006 used a different format for the judge retention questions than had been used in previous elections. Every other ballot question had a bold title followed by the voting options (See Appendix I for a sample ballot). For the judge

[48] Lawrence Norden, David Kimball, Whitney Quesenbery, and Margaret Chen, "Better Ballots," Brennan Center for Justice, New York University School of Law, July 2008. See especially pages 36-39.

retentions, the ballot question was moved to the right side of the two voting options in much smaller text. Without careful study of the ballot, voters might think each line of the judge retentions was a separate ballot question. The requirement of using bilingual ballots in New Mexico makes the judge retention questions especially confusing, as the format makes the use of English and Spanish look like two ballot questions rather than one. For example, in one such case a voter marked every single option for the judge retentions, and then attempted to correct his vote by altering his mark. And, in another example, a voter marked the Spanish for each judge retention option, rather than the oval.

In addition to the problem of ballot design in the judge retention ballot questions, there are other inconsistencies on the ballot that may have confused some voters. For example, there is inconsistent use of all uppercase or mixed case text in the instructions for judge retentions. Studies of ballot design suggest that ballots should be consistent, and that the use of mixed case is easier to read for voters.[49]

Conclusion

The audit project we completed was unprecedented and provided useful substantive information about optical scan machine counts, hand counts and performance audits. Our audit project also gave us the opportunity to research, develop and study procedures for a post-election ballot audit in a state like New Mexico. We hope that our substantive and procedural research is useful to all stakeholders in the process as election reform continues to play an important role in improving the election process and ultimately enhancing voter confidence.

Our research as reported in this section revealed a number of important conclusions, here we only summarize some of the more important ones. First, we found that the optical scan vote tabulators infrequently either over or under counted ballots. But, when over counting or undercounting occurred it did not favor one candidate or party over another, and thus we do not see evidence that this over or under counting is likely to influence election outcomes. Third, deviations between machine and hand counts are usually small, centered on 0 (no deviation), and tapering off rapidly as the number of differences increases. As to the factors that seem to influence the differences we observe between hand and machine counts, we found that the observed differences between machine counts and hand counts are more likely to occur when batch sizes are large then when they are small. Finally, we found that our counters averaged about 13 seconds to count 2 ballot questions, Election Day machines with 1 ballot style averaged about 23 seconds to count an entire ballot, early voting machines with 420 ballots styles over 78 unique combinations averaged about 35 seconds to count an entire ballot, and absentee voting machines averaged about 2.4 seconds to count a ballot (these calculated times include the costs of checking out and in a ballot box).

[49] Lawrence Norden, David Kimball, Whitney Quesenbery, and Margaret Chen, "Better Ballots," Brennan Center for Justice, New York University School of Law, July 2008. See pages 16-17.

We also found ballot design has a significant influence on when voters under or over vote. Special consideration of ballot design is important to a smooth and successful election.

APPENDIX A: RECOMMENDED BALLOT RECONCILIATION AND AUDIT LOG FORMS

Form A.1. Precinct Ballot Reconciliation Form

A. # of voter signatures	
B. # of ballots read by machine	
C. Subtract Row B from Row A (A-B)	
D. # of Provisional ballots	
E. # of in-lieu of ballots	
F. Total number of uncounted ballots by machine	
G. Insert total of Row A	
H. Total Number of ballots cast/Add row F to Row G (F+G)	

Form A.2. Total number of Ballots Reconciliation

A. # of ballot received	
B. # of ballots cast by machine	
C. # of in-lieu of ballots	
D. # of Provisional ballots	
E. # of spoiled ballots	
F. # of other ballots cast (e.g. emergency ballots)	
G. # of ballots destroyed at the end of the day	
H. Sum Row B thru F	
I. Subtract Row H from Row A (A-H)	

Form A.3. Early Voting Ballot Reconciliation Form

A. # of voter signatures	
B.1. # of ballots read by machine 1 (SN_____)	
B.2 # of ballots read by machine 2 (SN_____)	
B.3 # of ballots read by machine 3 (SN_____)	
B.4 # of ballots read by machine 4 (SN_____)	
B.5 # of ballots read by machine 5 (SN_____)	
C. Total number of ballots read by machine (B.1 +B.2+B.3+B.4+B.5)	
D. Subtract row C from Row A (A-C)	

Form A.4. Election Day Machine Count Log

Date:_____

Precinct/Batch#_____

Machine ID#_____

Total # of ballots read by machine:_____

***Machine Count Results*:**

President/Governor

Party/Candidate	Total Votes
A. Democrat	
B. Republican	
C. Undervotes –	
D. Write-in candidate (only included in form when write-in candidate is an option)	
Sum A+B+C (total should match "Total # of ballots read by machine" see above)	

Form A.5. Hand-Manual Counter Audit Batch Log (please fill out in addition to the tally sheet)

Precinct/Batch#_____

Seal # (on open):_____

Date:_____

Reader Name: _____

Counter #1 Name:_____

Counter #2 Name:
_____

Part 1.

A. Total # of machine counted ballots claimed to be in ballot box	
B. Total # of machine counted ballots inside ballot container	
A minus B (A – B)	

Part 2.

President/Governor

Party/Candidate	Total Votes
A. Democrat	
B. Republican	
C. Undervotes	
D. Write-in (only included in form when write-in candidate is an option)	
Sum A+B+C (total should match "Total # of ballots read by machine" see above)	

Seal # (on close): _____

Form A. 6

AUDIT

Hand Counted Ballot Tally Sheet

Counters (please print names):

Precinct/Batch

Election

Poll Location

County

Date

Race	*Each square is designed for five tally marks*										TOTALS
Candidate/Party											Candidate/ Party
SUB-TOTAL											
Undervotes											Undervotes
Overvotes											Overvotes

											TOTALS
Candidate/Party											Candidate/ Party
SUB-TOTAL											
Undervotes											Undervotes
Overvotes											Overvotes

1. Receipt of Ballots

Total Ballots Received

Supervisor Signature

Seal# Upon Receipt

2. Counting of Ballots

Total Ballots Counted

Supervisor Signature

Reader Signature

Counter Signature

3. Return of Ballots

Total Ballots Returned

Seal# Upon Return

Supervisor Signature

APPENDIX B: CHAIN OF CUSTODY PROCEDURES

MEMORANDUM

To: New Mexico Team

From: Michael Alvarez, Thad Hall, and Lonna Atkeson

Subject: Chain of Custody Procedures for Ballots

There are two issues with chains of custody to consider with the New Mexico project.

- First, there is the short-term question of establishing the chain of custody procedures for this pilot project.
- Second, there is the larger question of developing the chain of custody procedures generally in an election, from start to finish.

Chain of Custody for University of New Mexico Project

For the auditing project, there should be clear procedures for the maintenance of the chain of custody of all ballots. Every step of this process should be witnessed by at least two workers in the team. This process should include:

1. Formal transfer of ballots to audit team. The audit team will accept the ballots from the elections office in sealed containers and this transaction will be logged. This log should include the batch/precinct codes, the number of ballots, the date and time, the names of the workers giving the ballots, the workers accepting the ballots, and their signatures.

2. The AES team will be given the ballot containers with absentee ballots. The AES team will create batches of ballots with each batch containing 455 ballots (and a remainder batch). This process will be supervised and each batch will be sealed into its own container. Two audit team members will supervise and batch, with each batch logged with the batch/precinct codes, the number of ballots if different from the 455, the date and time, the names of the workers giving the ballots, the workers accepting the ballots, and their signatures.

3. Whenever a ballot container is opened, that action will be witnessed and a log should be kept. In the audit, the container should be opened by the counters/scanners in front of the manager/supervisor. This log should include the batch/precinct codes, the number of ballots, the date and time, the names of the workers giving the ballots, the workers accepting the ballots, and their signatures.

4. The opened ballots will be run though the tabulator so that an initial count is noted, including total ballots counted, total ballots rejected by the machine, a total number of ballots, and totals for the races we are auditing. This process will be logged.

5. The audit/counting team will, once they have completed work and audited or scanned a set of ballots, reseal the ballot container, witness and logging that activity.

6. The audit team will create a final entry in the log, noting that the final count matched the initial count, that the box was sealed, and will also check that there are no gaps in the chain of custody forms.

7. At the end of the process, the audit teams will transfer the ballots in sealed ballot boxes back to the local election officials and this transition will be logged. The log should include the batch/precinct codes, the number of ballots, the date and time, the names of all workers, and their signatures.

8. All log files generated during this process will be collected and retained.

The goal of this procedure would be to ensure that no ballots are lost and that the providence of all ballots involved in the process is maintained.

APPENDIX C: DETAILED INFORMATION ON WEB VISITORS AND NETWORK LOCATIONS

newmedia.unm.edu

Visits for all visitors

Feb 22, 2008 - Mar 23, 2008
Comparing to: Site

593 Visits **19.77** Visits / Day

Friday, February 22, 2008	0.00% (0)
Saturday, February 23, 2008	0.00% (0)
Sunday, February 24, 2008	0.34% (2)
Monday, February 25, 2008	10.96% (65)
Tuesday, February 26, 2008	20.91% (124)
Wednesday, February 27, 2008	12.14% (72)
Thursday, February 28, 2008	7.93% (47)
Friday, February 29, 2008	5.73% (34)
Saturday, March 1, 2008	1.18% (7)
Sunday, March 2, 2008	0.34% (2)
Monday, March 3, 2008	4.72% (28)
Tuesday, March 4, 2008	4.05% (24)
Wednesday, March 5, 2008	4.05% (24)
Thursday, March 6, 2008	4.05% (24)
Friday, March 7, 2008	3.54% (21)
Saturday, March 8, 2008	0.00% (0)
Sunday, March 9, 2008	0.34% (2)
Monday, March 10, 2008	2.87% (17)
Tuesday, March 11, 2008	3.37% (20)
Wednesday, March 12, 2008	1.85% (11)
Thursday, March 13, 2008	3.20% (19)
Friday, March 14, 2008	1.85% (11)
Saturday, March 15, 2008	0.34% (2)
Sunday, March 16, 2008	0.17% (1)
Monday, March 17, 2008	2.87% (17)
Tuesday, March 18, 2008	2.36% (14)
Wednesday, March 19, 2008	0.51% (3)

1 Google Analytics

Thursday, March 20, 2008	0.34% (2)
Friday, March 21, 2008	0.00% (0)
Saturday, March 22, 2008	0.00% (0)
Sunday, March 23, 2008	0.00% (0)

newmedia.unm.edu

Network Location

Feb 22, 2008 - Mar 23, 2008

Comparing to: Site

593 visits came from 69 network locations

Site Usage

Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
593 % of Site Total: 100.00%	2.42 Site Avg: 2.42 (0.00%)	00:03:31 Site Avg: 00:03:31 (0.00%)	44.86% Site Avg: 44.86% (0.00%)	45.87% Site Avg: 45.87% (0.00%)

Network Location	Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
university of new mexico	137	3.03	00:06:13	45.99%	37.96%
bernalillo county	126	2.08	00:04:00	43.65%	56.35%
qwest communications corporation	58	2.50	00:02:07	43.10%	41.38%
comcast cable communications inc.	39	1.87	00:00:46	58.97%	48.72%
california institute of technology	32	2.25	00:03:20	15.62%	43.75%
automated election services	27	2.07	00:01:57	14.81%	48.15%
city of albuquerque	16	3.00	00:03:50	25.00%	25.00%
u.s. dept. of health and human services	14	2.29	00:02:44	14.29%	50.00%
university of new mexico healthsciences center	11	3.82	00:09:55	9.09%	27.27%
covad communications co.	10	2.00	00:01:39	40.00%	50.00%
comcast cable communications inc	6	1.67	00:00:42	50.00%	50.00%
county of placer	6	1.83	00:01:18	66.67%	50.00%
southwest cyberport	6	2.67	00:03:16	83.33%	33.33%
cellco partnership dba verizon wireless	5	2.60	00:02:53	40.00%	40.00%
comcast business communications inc.	5	1.60	00:00:13	20.00%	60.00%
moore tool company inc-061005011207	5	2.80	00:04:02	20.00%	40.00%
kamazar productions	4	1.75	00:00:16	75.00%	50.00%
national institute of standards and technology	4	2.25	00:00:53	50.00%	75.00%
university of utah	4	1.25	00:00:03	75.00%	75.00%
verizon internet services inc.	4	3.25	00:01:51	50.00%	50.00%
cablevision of kingman	3	2.33	00:00:37	33.33%	33.33%

1

Google Analytics

massachusetts institute of technology	3	1.33	00:00:03	33.33%	66.67%
netscape communications corp.	3	2.33	00:00:17	66.67%	66.67%
new york university	3	1.67	00:00:33	33.33%	66.67%
pppox pool - rback13.pltn13-1152551162	3	1.00	00:00:00	100.00%	100.00%
voicenet	3	1.67	00:03:55	33.33%	66.67%
windstream communications inc	3	3.67	00:08:07	66.67%	0.00%
comcast cable communications	2	2.00	00:00:19	100.00%	0.00%
county of los angeles	2	2.00	00:00:12	100.00%	0.00%
juno online services inc.	2	4.00	00:03:30	100.00%	0.00%
los alamos national laboratory	2	2.00	00:00:16	50.00%	0.00%
pppox pool - rback6.tpkaks 051906-1309	2	1.00	00:00:00	50.00%	100.00%
road runner holdco llc	2	2.00	00:02:32	0.00%	50.00%
state of new mexico	2	1.00	00:00:00	50.00%	100.00%
tds telecom	2	2.00	00:00:14	50.00%	50.00%
time warner telecom inc.	2	8.50	00:01:03	50.00%	50.00%
vsnl kanpur	2	1.00	00:00:00	100.00%	100.00%
xspedius communications co.	2	4.50	00:01:11	100.00%	0.00%
60cs/scsnm	1	2.00	00:00:33	100.00%	0.00%
america online inc	1	3.00	00:00:21	100.00%	0.00%
apple computer	1	2.00	00:00:11	100.00%	0.00%
at&t global network services	1	2.00	00:00:08	100.00%	0.00%
at&t worldnet services	1	1.00	00:00:00	100.00%	100.00%
bellsouth.net inc.	1	1.00	00:00:00	100.00%	100.00%
central new mexico community college	1	2.00	00:00:10	100.00%	0.00%
charles river associates inc./washington dc	1	5.00	00:01:32	100.00%	0.00%
charter communications	1	4.00	00:20:26	100.00%	0.00%
chinanet guangdong province network	1	1.00	00:00:00	100.00%	100.00%
comcast cable communications ip services	1	3.00	00:00:50	100.00%	0.00%
cruzio	1	3.00	00:01:03	100.00%	0.00%
direction generale de l informatique	1	2.00	00:00:36	100.00%	0.00%
doubletree hotel	1	1.00	00:00:00	0.00%	100.00%
embarq corporation	1	2.00	00:00:31	100.00%	0.00%
genesys computers	1	2.00	00:18:54	100.00%	0.00%
level 3 communications inc.	1	1.00	00:00:00	100.00%	100.00%
millenium digital media	1	1.00	00:00:00	100.00%	100.00%
pppox pool - rback2 klmzmi.382521	1	1.00	00:00:00	100.00%	100.00%

private customer - wave broadband	1	3.00	00:04:34	100.00%	0.00%
rcn corporation	1	3.00	00:00:35	100.00%	0.00%
sandia national laboratories	1	3.00	00:01:13	100.00%	0.00%
santa fe county	1	1.00	00:00:00	100.00%	100.00%
service provider corporation	1	1.00	00:00:00	0.00%	100.00%
sprint pcs	1	1.00	00:00:00	0.00%	100.00%
state of colorado general government computer	1	1.00	00:00:00	100.00%	100.00%
tubitak - uekae	1	1.00	00:00:00	100.00%	100.00%
university of arizona	1	2.00	00:00:12	100.00%	0.00%
us distributors inc	1	1.00	00:00:00	100.00%	100.00%
verizon internet services	1	1.00	00:00:00	100.00%	100.00%
xo communications	1	3.00	00:00:55	100.00%	0.00%
					1 - 69 of 69

APPENDIX D. AUDIT TEAM MEMBERS POSITION SUMMARY

Election Audit Support/Temporary

Position Description

Department: **County Clerk**
Reports to: **Assigned Supervisor**
Grade: **5**
Pay Status: **FLSA Non-Exempt**
EEOC Code: **6**

POSITION SUMMARY
Under general supervision, perform election related activities within the designated area and assist in other functions as required.

MAJOR DUTIES AND RESPONSIBILITIES SUMMARY

1. Responsible for performing hand counts of ballots in an election audit environment.
2. Responsible for documenting results of hand counts on department specified forms.
3. Responsible for verifying and documenting machine totals from tape printouts.
4. Receive, analyze, process and maintain a variety of information relevant to assigned section and ensure proper record keeping, follow up and scheduling.
5. Interact with the public on election activities relevant to assigned area and with election officials as necessary.
6. Function as a role model in the areas of customer services, public relations and quality of work.
7. Maintain activity log and prepare reports as needed.
8. Communicate daily with supervisors on section activities.
9. Train other personnel assigned to area as needed.

The above information on this job description has been designed to indicate the general nature and level of the work performed by employees within this classification. It is not designed to contain or be interpreted as a comprehensive inventory of all duties and responsibilities required of all employees assigned to this job.

MINIMUM QUALIFICATIONS

1. High school diploma or GED, plus a combination of post-secondary and experience totaling three (3) years of progressively responsible office experience which includes working with the general public.

2. Ability to interpret and apply State and Federal Election Law.
3. Ability to communicate effectively in both oral and written English.
4. Ability to interact professionally with the public, co-workers and other County employees.
5. Skilled in computer use for word processing, data entry and retrieval.

SCREENING AND COMPLIANCE

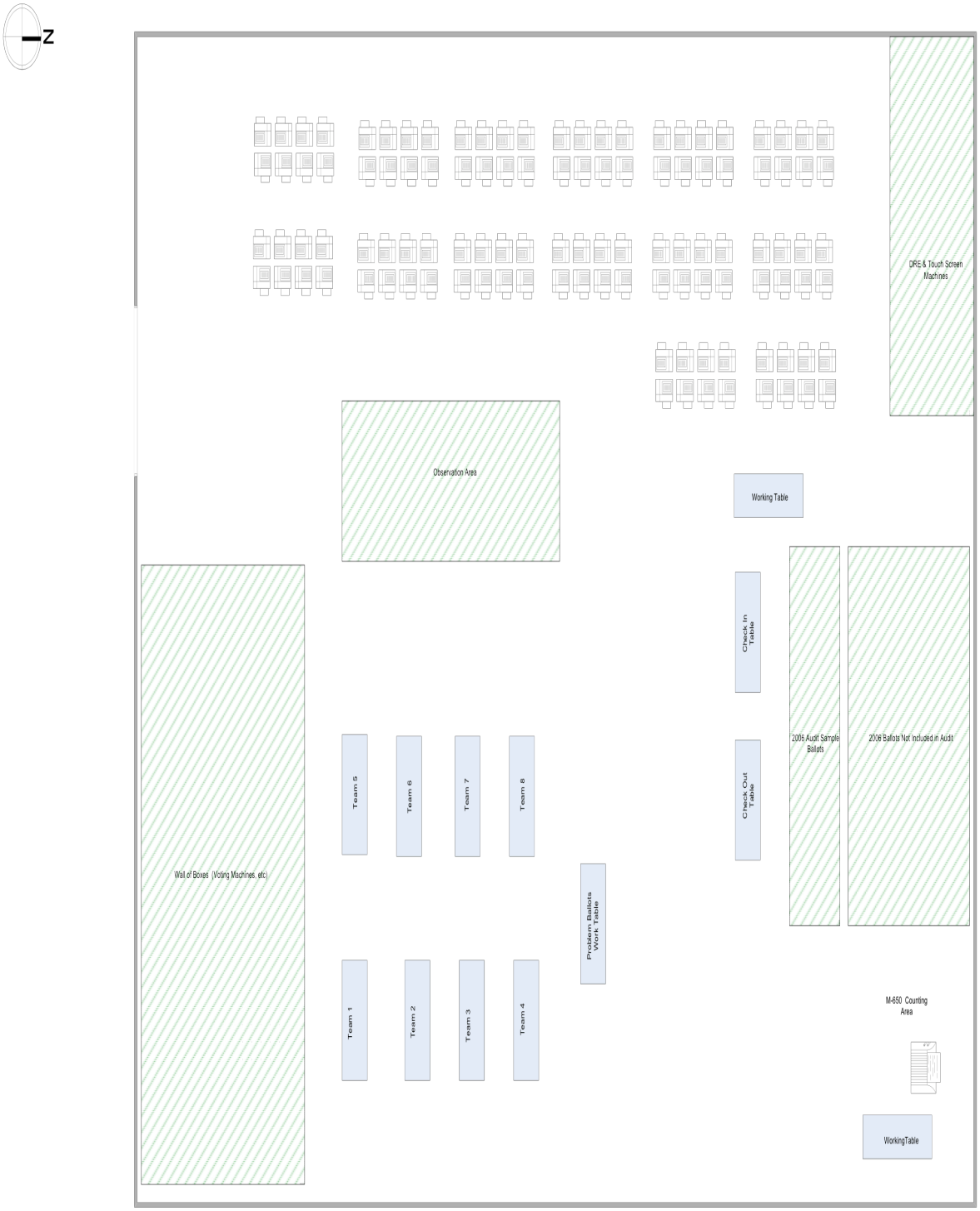
The offer of this Bernalillo County position requires compliance with the following:

1. Employee must successfully complete the post-offer employment medical examination and background investigation.
2. Employee must comply with the safety guidelines of the County.

WORKING CONDITIONS

1. All essential duties are performed indoors.
2. Duties are performed in a temperature-controlled environment.
3. Duties are performed on an even surface, which may be carpet, tile or concrete. Working surface is typically dry.
4. Worker works with direction from supervisor with a team of individuals.
5. Work shifts will vary in length and schedule.

APPENDIX E: AUDIT FACILITY LAYOUT



APPENDIX F: DETAILED INFORMATION ON SAMPLED ELECTION DAY, EARLY AND ABSENTEE BALLOTS

Table F.1. Ballot Totals by Precincts Sampled in Election Audit

Batch Number	Total Number of ballots	Batch Number	Total Number of Ballots	Batch Number	Total Number of Ballots	Batch Number	Total Number of Ballots
P004	158	P104	56	P300	145	P462	157
P005	206	P108	79	P313	129	P463	190
P012	224	P114	568	P324	394	P466	236
P013	187	P116	705	P329	149	P489	288
P014	238	P122	108	P330	125	P491	179
P016	155	P132	94	P344	294	P492	181
P024	473	P150	262	P345	364	P493	207
P028	155	P162	189	P347	166	P504	163
P029	192	P164	186	P355	234	P505	197
P041	310	P183	286	P358	259	P512	305
P043	301	P184	154	P382	157	P519	140
P045	205	P186	352	P385	166	P526	285
P049	196	P214	170	P401	224	P527	117
P052	313	P215	107	P406	135	P536	164
P055	476	P217	84	P411	184	P538	306
P056	333	P226	88	P420	360	P541	605
P057	867	P246	89	P421	286	P543	160
P075	123	P251	167	P422	540	P547	221
P080	456	P252	172	P427	574	P549	255
P085	579	P253	250	P429	403	P554 A	65
P087	384	P255	261	P431	175	P562	301
P088	202	P258	58	P433	183	P565	197
P092	256	P284	181	P435	265	P566	342
P093 A	4	P286	216	P440	129	P569	447
P097	347	P290	146	P443	128	P573	336
P102	143	P293	278	P449	254	P603	713
P103	183	P297	322	P454	334		

Table F.2 Ballot Totals by Early Voting Machines Sampled in Election Audit

Location	Machine #	Total votes
Parkland Plaza	220703	288
Parkland Plaza	220690	717
Integrity Plaza	220678	945
Academy Office Park	227276	935
Griego Center	220603	277
Griego Center	220617	706
Griego Center	220628	137
Los Ranchos Villa	219458	1972
Los Ranchos Villa	227281	62
Los Vecinos	220766	587
Los Vecinos	220832	428
Los Vecinos	220869	246
Clerks	219476	439
Clerks	215801	346

Table F.3. Ballot totals by Absentee Batches Sampled in Election Audit

Batch Number	Total Number of Ballots
4	455
9	455
11	455
13	455
16	455
18	455
20	455
21	455
23	455
27	455
30	455
32	455
35	455
37	455
38	455
39	455
40	455
44	455
45	455
50	298
51	455
55	441
56	455
57	455
60	455
63	455
65	467
66	463

APPENDIX G: CHECK OUT LOG

Form G.1 Counting Team Check out Log

Name	Team #	Date	Batch ID	Mach #1		Hand #1		Hand #2		Machine #2		Super-visor – Check out	Super-visor-Check-in	Total Ballots on check-in
				Out	In	Out	In	Out	In	Out	In			

Note: The columns in this form were actually much larger than presented here.

Form G.2. Audit Log, Early Voting

Machine Number	Machine Count #1 Initial	Serial #	Hand Count #1 –initial	Serial #	Hand Count #2 initial	Serial #	Machine Count #2 - initial	Serial #
E220703								
E220690								
E220678								
E227276								
E220603								
E220617								
E220628								
E219458								
E227281								
E220766								
E220832								
E220869								
E219476								
E215801								

APPENDIX H. COUNTER AND READER AUDIT FORMS

Form H.1. Manual/Machine Counter Daily Log
(Each team should keep this with them throughout the day and turn it in before leaving)

Date:_____ *Start of Day*:_____ *End of Day*:_____

*Team#*_____ *Counter 1* ID#_____ *Counter* 2 ID#_____

Please record all activities conducted throughout the day. Activities might include any breaks taken, which precincts or batches were counted, or lunch. If a tally sheet is spoiled during the hand count, please record this information in the comments section.

Activity:_____ Start Time:_____ End Time:_____ Comments:_____

Activity:_____ Start Time:_____ End Time:_____ Comments:_____

Activity:_____ Start Time:_____ End Time:_____ Comments:_____

Activity:_____ Start Time:_____ End Time:_____ Comments:_____

Activity:_____ Start Time:_____ End Time:_____ Comments:_____

Activity:_____ Start Time:_____ End Time:_____ Comments:_____

Activity:_____ Start Time:_____ End Time:_____ Comments:_____

Activity:_____ Start Time:_____ End Time:_____ Comments:_____

Activity:_____ Start Time:_____ End Time:_____ Comments:_____

Activity:_____ Start Time:_____ End Time:_____ Comments:_____

Activity:_____ Start Time:_____ End Time:_____ Comments:_____

Form H.2. 1st Machine Count Machine Counter Batch Log

Date:_____ Start Time:_____ End Time:_____

Team#_____ Counter 1 ID#_____ Counter 2 ID#_____

Precinct/Batch#_____ Machine ID#_____

Seal Number _____

Total # of ballots read by machine:_____

Total # of counted ballot inside ballot container: _____

*Total # of rejected ballots:*_____

Total # of actual ballots
*(rejected ballots plus ballot total of machine-read ballots):*_____

***Machine Count Results*:**

Governor

Richardson/Denish:_____ *Dendahl/Wilson Beffort*:_____ Undervotes:_____

Land Commissioner

Baca:_____ *Lyons*:_____ Undervotes:_____

If there are any rejected ballots, please fill out and attach a problem ballot log to this log for each ballot. Please paperclip together all rejected ballots and place them in a separate folder (available from the supervisor) inside the ballot container before being returned.

Please turn this log in to the supervisor when you are finished counting.

Form H.3. 1st Hand-Manual Counter Batch Log (please fill out in addition to the tally sheet)

Precinct/Batch#_____ Seal # (on open):_____

Date:_____ Start Time:_____ End Time:_____

Team#_____ Reader ID#_____ Counter ID#_____

Total # of ballots claimed to be inside the ballot container:_____

Total # of counted ballots inside ballot container:_____

Problem Ballots (please fill out and attach a problem ballot log for each flagged ballot):

Total # of problem ballots:_____ *Total # of counted problem ballots*:_____

Total # of uncounted problem ballots (i.e. unable to determine voter intent):_____

Problem Ballot Results:

Governor
Richardson/Denish:_____ *Dendahl/Wilson Beffort*:_____ Undervotes:_____

Land Commissioner
Baca:_____ *Lyons*:_____ Undervotes:_____

---

*Manual Count Results (Total, **including** results from problem ballots, but not rejected ballots)*:

Governor
Richardson/Denish:_____ *Dendahl/Wilson Beffort*:_____ Undervotes:_____

Land Commissioner
Baca:_____ *Lyons*:_____ Undervotes:_____

Machine Rejected Ballot Results (please keep this ballots separated from any additional problem ballots):

Governor
Richardson/Denish:_____ *Dendahl/Wilson Beffort*:_____ Undervotes:_____

Land Commissioner
Baca:_____ *Lyons*:_____ Undervotes:_____

Total # of machine rejected ballots:_____

Please turn this log in to the supervisor when you are finished counting. Any problem ballots should be placed in a separate folder (available from the supervisor) inside the container before being returned. If you took any breaks during the count of ballots, please write the start and end time of each break on the back of the log.

Form H.4. 2nd Machine Count-Machine Counter Batch Log

Date:_____ Start Time:_____ End Time:_____

Team#_____ Counter 1 ID#_____ Counter 2 ID#_____

Precinct/Batch#_____ Machine ID#_____

Seal Number _____

Total # of ballots claimed to be inside the ballot container:_____

Total # of counted ballot read by machine: _____

*Total # of rejected ballots:*_____

Total # of actual ballots
*(rejected ballots plus ballot total of machine-read ballots):*_____

Machine Count Results (including results of previously identified problem ballots):

Governor

Richardson/Denish:_____ *Dendahl/Wilson Beffort*:_____ Undervotes:_____

Land Commissioner

Baca:_____ *Lyons*:_____ Undervotes:_____

Problem Ballots:

Total # of problem ballots received from manual counters: _____

Total # of problem ballots rejected by voting machine: _____

For ALL problem ballots, please fill out and attach a problem ballot log for each ballot. If there are any additional ballots that are rejected by the machine that have not been previously identified, please also fill out and attach a problem ballot log for each of those ballots.

Please turn this log in to the supervisor when you are finished counting.

Ballot ID Number:_____
(internal purposes only)

Form H.5. Problem Ballot Log for Manual Counts (one log per ballot)

Team#:_____ *Counter 1 ID#*:_____ *Counter 2 ID#*:_____

Precinct/Batch #:_____ *Sticky Color*:_____

Ballot Information: (Please record the result of each ballot and identify one or more problems)

Assign ballot# (see instructions below) _____

*Vote Choice: Governor*_____ *Land Commissioner*_____

Describe Problem:_____

Or describe problem _____

_____

Difficulty of Determining Vote Choice (on scale of 1 to 4, see below):_____

Possible Problems:
1. Overvote – voted for more than one candidate for the same office
2. Voter used some other type of marking to indicate vote choice, rather than fill in the bubble. Voter intent is unambiguous.
3. There are other extra markings on the ballot
4. There is some type of marking near the candidates but voter intent is ambiguous.
5. Other, please explain in space provided or on the back of this log.

Determining Vote Choice:
How difficult was it for you to determine the intent of the voter on this ballot?
1. Not at all difficult 2. Not too difficult 3. Somewhat difficult 4. Very difficult

Instructions for assigning a ballot number to the problem ballot:
Each problem ballot log should correspond to one ballot in a precinct or batch of ballots. Within that group of ballots, assign #1 for the first problem ballot that is encountered, #2 for the second ballot, and so on. The colored sticky that is attached to the ballot should have a number written on the sticky that corresponds to the assigned ballot number from this log. Please ask a supervisor if you have any questions about this process.

Ballot ID Number:_____
(internal purposes only)

Form H.6. Problem Ballot Log for Machine Counts (one log per ballot)

Team#:_____ *Counter 1 ID#*:_____ *Counter 2 ID#*:_____

Precinct/Batch#:_____ *Sticky Color*:_____

Assign ballot# (see instructions below) _____

Rejected Ballots (please record the voting machine message explaining why the ballot was rejectd

_____

_____

_____

_____

_____

Ballot Information (This applies only to ballots that are flagged by the manual counters and not rejected by the machine):

*Vote Choice: Governor*_____ *Land Commissioner*_____

Instructions for assigning a ballot number to the problem ballot:
Each problem ballot log should correspond to one ballot in a precinct or batch of ballots. Within that group of ballots, assign #1 for the first problem ballot that is encountered, #2 for the second ballot, and so on. The colored sticky that is attached to the ballot should have a number written on the sticky that corresponds to the assigned ballot number from this log. Please ask a supervisor if you have any questions about this process.

Ballot ID Number:_____
(internal purposes only)

Form H.7. Problem Ballot Log for Machine Counts - M650 (one log per ballot)

Team#:_____ *Counter 1 ID#*:_____ *Counter 2 ID#*:_____

Batch#:_____ *Sticky Color*:_____

Assign ballot# (see instructions below) _____

Rejected Ballots (please record the voting machine message explaining why the ballot was rejected):

_____

Ballot Information (This applies only to ballots that are flagged by the manual counters and not rejected by the machine):

*Vote Choice: Governor*_____ *Land Commissioner*_____

Possible Machine Error Messages (For M650s/Absentee Ballots only):
1. Invalid Row Count! Found (number of rows) Rows (ballot may be torn)
2. Missing Start Bar, Channel 'X'! (ballot may be torn)
3. Missing Stop Bar, Channel 'X'! (ballot may be torn)
4. BLANK BALLOT
5. Possible Counterfeit Ballot
6. Indeterminate Sensor Reading(s) on Channel(s) (list of channels)! (questionable mark on ballot)
7. Sort OVERVOTE
8. Sort WRITE-IN

Instructions for assigning a ballot number to the problem ballot:
Each problem ballot log should correspond to one ballot in a precinct or batch of ballots. Within that group of ballots, assign #1 for the first problem ballot that is encountered, #2 for the second ballot, and so on. The colored sticky that is attached to the ballot should have a number written on the sticky that corresponds to the assigned ballot number from this log. Please ask a supervisor if you have any questions about this process.

Form H.8. 2nd Hand Count Manual Counter Batch Log Counter #1 (please fill out in addition to the tally sheet)

Precinct/Batch#_____ Total# of ballots:_____

Date:_____ Start Time:_____ End Time:_____

Team#_____ Reader ID#_____ Counter ID#_____

Seal #:_____

Problem Ballots *(please fill out and attach a problem ballot log for each flagged ballot)*:

Total # of problem ballots:_____ *Total # of counted problem ballots*:_____

Total # of uncounted problem ballots (i.e. unable to determine voter intent):_____

Problem Ballot Results:

Governor
Richardson/Denish:_____ *Dendahl/Wilson Beffort*:_____ Undervotes:_____

Land Commissioner
Baca:_____ *Lyons*:_____ Undervotes:_____

Manual Count Results *(Total,* ***including*** *results from problem ballots, but not rejected ballots)*:

Governor
Richardson/Denish:_____ *Dendahl/Wilson Beffort*:_____ Undervotes:_____

Land Commissioner
Baca:_____ *Lyons*:_____ Undervotes:_____

Machine Rejected Ballot Results *(please keep this ballots separated from any additional problem ballots)*:

Governor
Richardson/Denish:_____ *Dendahl/Wilson Beffort*:_____ Undervotes:_____

Land Commissioner
Baca:_____ *Lyons*:_____ Undervotes:_____

Total # of machine rejected ballots:_____

Please turn this log in to the supervisor when you are finished counting. Any problem ballots should be placed in a separate folder (available from the supervisor) inside the container before being returned. If you took any breaks during the count of ballots, please write the start and end time of each break on the back of the log.

Form H.9. **2nd Hand Count Manual Counter Batch Log Counter #2** (please fill out in addition to the tally sheet)

Precinct/Batch#_____ Total# of ballots:_____

Date:_____ Start Time:_____ End Time:_____

Team#_____ Reader ID#_____ Counter ID#_____

Seal #:_____

Problem Ballots *(please fill out and attach a problem ballot log for each flagged ballot)*:

Total # of problem ballots:_____ *Total # of counted problem ballots*:_____

Total # of uncounted problem ballots (i.e. unable to determine voter intent):_____

Problem Ballot Results:

Governor
Richardson/Denish:_____ *Dendahl/Wilson Beffort*:_____ Undervotes:_____

Land Commissioner
Baca:_____ *Lyons*:_____ Undervotes:_____

Manual Count Results *(Total, **including** results from problem ballots, but not rejected ballots)*:

Governor
Richardson/Denish:_____ *Dendahl/Wilson Beffort*:_____ Undervotes:_____

Land Commissioner
Baca:_____ *Lyons*:_____ Undervotes:_____

Machine Rejected Ballot *Results (please keep this ballots separated from any additional problem ballots)*:

Governor
Richardson/Denish:_____ *Dendahl/Wilson Beffort*:_____ Undervotes:_____

Land Commissioner
Baca:_____ *Lyons*:_____ Undervotes:_____

Total # of machine rejected ballots:_____

Please turn this log in to the supervisor when you are finished counting. Any problem ballots should be placed in a separate folder (available from the supervisor) inside the container before being returned. If you took any breaks during the count of ballots, please write the start and end time of each break on the back of the log.

APPENDIX I. SAMPLE BALLOT

OFFICIAL GENERAL ELECTION BALLOT - BALOTA OFICIAL DE ELECCION GENERAL
November 7, 2006 - 7 de noviembre, 2006

BERNALILLO COUNTY | CONDADO DE BERNALILLO | PRECINCT 102

INSTRUCTIONS: To vote complete the oval to the LEFT of your choice, like this (●)
INSTRUCCIONES: Para votar complete el óvalo a la IZQUIERDA de su selección, como esto (●)

STRAIGHT PARTY

- DEMOCRATIC
- REPUBLICAN
- GREEN

UNITED STATES SENATOR
SENADOR DE LOS ESTADOS UNIDOS
VOTE FOR ONE - VOTE POR UNO

- JEFF BINGAMAN
- ALLEN M. MCCULLOCH, M.D.
- _____

UNITED STATES REPRESENTATIVE
REPRESENTANTE DE LOS ESTADOS UNIDOS
DISTRICT 1 - DISTRITO 1
VOTE FOR ONE - VOTE POR UNO

- PATRICIA A. MADRID
- HEATHER A. WILSON

GOVERNOR and LIEUTENANT GOVERNOR
GOBERNADOR y TENIENTE GOBERNADOR
VOTE FOR ONE - VOTE POR UNO

- BILL RICHARDSON and DIANE D. DENISH
- JOHN DENDAHL and SUE WILSON BEFFORT

SECRETARY OF STATE
SECRETARIO DE ESTADO
VOTE FOR ONE - VOTE POR UNO

- MARY HERRERA
- KEDDY S. PEREA

STATE AUDITOR
AUDITOR DE ESTADO
VOTE FOR ONE - VOTE POR UNO

- HECTOR H. BALDERAS
- LORENZO GARCIA

STATE TREASURER
TESORERO DE ESTADO
VOTE FOR ONE - VOTE POR UNO

- JAMES B. LEWIS
- DEMESIA PADILLA

ATTORNEY GENERAL
PROCURADOR GENERAL
VOTE FOR ONE - VOTE POR UNO

- GARY K. KING
- JIM BOSE

COMMISSIONER OF PUBLIC LANDS
COMISIONADO DE TIERRAS DE DOMINIO PUBLICO
VOTE FOR ONE - VOTE POR UNO

- JIM BACA
- PATRICK H. LYONS

STATE REPRESENTATIVE
REPRESENTANTE DE ESTADO
DISTRICT 8 - DISTRITO 8
VOTE FOR ONE - VOTE POR UNO

- GAIL CHASEY
- LANCE KLAFETA

PUBLIC REGULATION COMMISSIONER
COMISIONADO DE LA COMISIÓN REGULATORIA
DISTRICT 4 - DISTRITO 4
VOTE FOR ONE - VOTE POR UNO

- CAROL K. SLOAN
- DAVID E. BACON

DISTRICT JUDGE - JUEZ DE DISTRITO
2nd JUDICIAL DISTRICT - 2º DISTRITO JUDICIAL
DIVISION 2 - DIVISIÓN 2
VOTE FOR ONE - VOTE POR UNO

- STAN WHITAKER

DISTRICT JUDGE - JUEZ DE DISTRITO
2nd JUDICIAL DISTRICT - 2º DISTRITO JUDICIAL
DIVISION 3 - DIVISIÓN 3
VOTE FOR ONE - VOTE POR UNO

- MARIA MONTOYA ZAMORA

DISTRICT JUDGE - JUEZ DE DISTRITO
2nd JUDICIAL DISTRICT - 2º DISTRITO JUDICIAL
DIVISION 12 - DIVISIÓN 12
VOTE FOR ONE - VOTE POR UNO

- CLAY PACE CAMPBELL
- SANFORD K. SIEGEL

DISTRICT JUDGE - JUEZ DE DISTRITO
2nd JUDICIAL DISTRICT - 2º DISTRITO JUDICIAL
DIVISION 16 - DIVISIÓN 16
VOTE FOR ONE - VOTE POR UNO

- CARL J. BUTKUS
- DAWN PENN ADRIAN

DISTRICT JUDGE - JUEZ DE DISTRITO
2nd JUDICIAL DISTRICT - 2º DISTRITO JUDICIAL
DIVISION 24 - DIVISIÓN 24
VOTE FOR ONE - VOTE POR UNO

- KENNETH H. MARTINEZ

PUBLIC EDUCATION COMMISSION
COMISIÓN DE EDUCACIÓN
DISTRICT 13 - DISTRITO 13
VOTE FOR ONE - VOTE POR UNO

- _____

JUDGE OF THE METROPOLITAN COURT
JUEZ DE LA CORTE METROPOLITANA
DIVISION 4 - DIVISIÓN 4
VOTE FOR ONE - VOTE POR UNO

- JULIE A. ALTAMIRE

JUDGE OF THE METROPOLITAN COURT
JUEZ DE LA CORTE METROPOLITANA
DIVISION 11 - DIVISIÓN 11
VOTE FOR ONE - VOTE POR UNO

- SANDRA M. ENGEL

JUDGE OF THE METROPOLITAN COURT
JUEZ DE LA CORTE METROPOLITANA
DIVISION 19 - DIVISIÓN 19
VOTE FOR ONE - VOTE POR UNO

- BENJAMIN CHAVEZ

JUDGE OF THE METROPOLITAN COURT
JUEZ DE LA CORTE METROPOLITANA
DIVISION 17 - DIVISIÓN 17
VOTE FOR ONE - VOTE POR UNO

- RACHEL FENE ZWILLER ALVAR

- CLYDE M. DEMERSSEMAN

JUDGE OF THE METROPOLITAN COURT
JUEZ DE LA CORTE METROPOLITANA
DIVISION 18 - DIVISIÓN 18
VOTE FOR ONE - VOTE POR UNO

- ROSIE LAZCANO ALURED

JUDGE OF THE METROPOLITAN COURT
JUEZ DE LA CORTE METROPOLITANA
DIVISION 15 - DIVISIÓN 15
VOTE FOR ONE - VOTE POR UNO

- LINDA S. ROGERS

COUNTY ASSESSOR
ASESOR DE CONDADO
VOTE FOR ONE - VOTE POR UNO

- KAREN LOUISE MONTOYA
- HAROLD DAVIS

COUNTY SHERIFF
ALGUACIL DE CONDADO
VOTE FOR ONE - VOTE POR UNO

- JOSE E. CHAVEZ
- DARREN WHITE

PROBATE JUDGE
JUEZ DE SUCESIONES Y TESTAMENTOS
VOTE FOR ONE - VOTE POR UNO

- DERRI RUDD

ELECTION OF NON PARTISAN JUDGES
ELECCIÓN DE JUECES NO PARTIDARIOS
VOTE YES OR NO FOR EACH JUDGE
VOTE (SI) O (NO) POR CADA JUEZ

- YES / (SI)
- NO / (NO)

- YES / (SI)
- NO / (NO)

- YES / (SI)
- NO / (NO)

- YES / (SI)
- NO / (NO)

Election of Metropolitan Court Judges
Elección de Jueces de la Corte Metropolitana
Vote YES or NO for each judge
Vote (SI) o (NO) por cada juez

- YES / (SI)
- NO / (NO)

- YES / (SI)
- NO / (NO)

- YES / (SI)
- NO / (NO)

- YES / (SI)
- NO / (NO)

- YES / (SI)
- NO / (NO)

- YES / (SI)
- NO / (NO)

- YES / (SI)
- NO / (NO)

- YES / (SI)
- NO / (NO)

- YES / (SI)
- NO / (NO)

- YES / (SI)
- NO / (NO)

Typed Sample Ballot

VOTE BOTH SIDES
VOTE AMBOS LADOS

YES / (SÍ)

NO / (NO)

YES / (SÍ)

NO / (NO)

General Obligation Flood Control Bonds

FOR / (A FAVOR)

AGAINST / (EN CONTRA)

County Library, Books and Materials

FOR / (A FAVOR)

AGAINST / (EN CONTRA)

County Public Safety

FOR / (A FAVOR)

AGAINST / (EN CONTRA)

County Parks and Recreation Facilities

FOR / (A FAVOR)

AGAINST / (EN CONTRA)

La Construcción De Facilidades Y Mejoras De ADA

FOR / (A FAVOR)

AGAINST / (EN CONTRA)

County Roads, Bike Paths and Trails

FOR / (A FAVOR)

AGAINST / (EN CONTRA)

County Sheriff's Life Gross Receipts Tax

FOR / (A FAVOR)

AGAINST / (EN CONTRA)

CONSTITUTIONAL AMENDMENT NO. 1

ENMIENDA DE LA CONSTITUCIÓN NO. 1

FOR / (A FAVOR)

AGAINST / (EN CONTRA)

CONSTITUTIONAL AMENDMENT NO. 2

ENMIENDA DE LA CONSTITUCIÓN NO. 2

FOR / (A FAVOR)

AGAINST / (EN CONTRA)

CONSTITUTIONAL AMENDMENT NO. 3

ENMIENDA DE LA CONSTITUCIÓN NO. 3

FOR / (A FAVOR)

AGAINST / (EN CONTRA)

CONSTITUTIONAL AMENDMENT NO. 4

ENMIENDA DE LA CONSTITUCIÓN NO. 4

FOR / (A FAVOR)

AGAINST / (EN CONTRA)

BOND QUESTION A

PROPUESTA DEL BONO A

FOR / (A FAVOR)

AGAINST / (EN CONTRA)

BOND QUESTION B

PROPUESTA DEL BONO B

FOR / (A FAVOR)

AGAINST / (EN CONTRA)

BOND QUESTION C

PROPUESTA DEL BONO C

FOR / (A FAVOR)

AGAINST / (EN CONTRA)

VOTE BOTH SIDES
VOTE AMBOS LADOS

s

APPENDIX J. DETAILED INFORMATION ON CANDIDATE COUNTS BY BATCH

Appendix J.1 Detailed Account of First Machine and First and Second Hand Counts, Election Day

	Machine Count #1				Hand Count #1				Hand Count #2–Counter #1				Hand Count #2-Counter #2			
Batch	DG	RG	DLC	RLC	DG	RG	DLC	RLC	DG	RG	DLC	RLC	DG	RG	DLC	RLC
4	110	47	72	84	110	47	72	84	110	47	71	85	110	47	71	85
5	145	53	107	93	145	53	107	93	145	53	108	92	145	53	108	92
12	163	55	113	102	163	55	112	103	163	55	113	102	163	55	113	102
13	133	50	79	104	133	50	79	104	133	50	79	104	133	50	79	104
14	181	57	130	107	181	57	130	107	181	57	130	107	181	57	130	107
16	109	45	78	74	109	45	78	74	109	45	78	74	109	45	78	74
24	308	163	193	273	308	163	193	273	307	163	193	272	307	163	193	272
28	120	34	69	86	120	34	69	86	121	34	69	86	121	34	69	86
29	146	45	83	104	146	45	83	104	146	45	83	104	146	45	83	104
41	229	79	149	159	229	79	149	159	229	79	151	157	229	79	151	157
43	245	51	175	122	246	50	175	122	245	51	175	122	245	51	175	122
45	177	26	120	81	177	26	120	81	177	26	121	80	177	26	121	80
49	163	32	115	78	163	32	115	78	164	31	115	78	164	31	115	78
52	218	91	138	166	218	91	138	166	218	90	136	167	218	90	136	167
55	373	101	228	243	371	102	229	242	373	100	231	239	373	100	231	239
56	250	82	164	166	251	81	163	165	250	82	164	166	250	82	164	166
57	625	234	342	513	625	234	342	513	627	234	342	513	627	234	342	513
75	98	24	71	50	98	24	71	50	98	24	71	50	98	24	71	50
80	262	190	147	304	262	190	147	304	262	188	146	303	262	188	146	303
85	321	251	146	428	320	252	146	428	319	253	145	429	319	253	145	429
87	264	117	164	212	264	117	163	213	262	117	161	213	262	117	161	213
88	152	49	101	96	152	49	101	96	153	48	100	96	153	48	100	96
92	181	70	101	154	179	71	101	153	181	70	101	154	181	70	101	154
97	267	76	166	174	267	76	166	174	267	76	166	174	267	76	166	174
102	120	17	98	34	120	17	98	34	120	17	98	34	120	17	98	34
103	164	15	121	59	164	15	122	58	164	15	121	59	164	15	121	59
104	52	4	38	18	52	4	38	18	52	4	38	18	52	4	38	18

108	46	32	35	40	47	32	36	40	46	32	35	40	46	32	35	40
114	332	228	168	389	333	228	169	390	331	227	166	389	331	227	166	389
116	431	271	235	461	438	264	236	460	432	270	237	459	432	270	237	459
122	89	18	71	34	89	18	71	34	89	18	71	34	89	18	71	34
132	87	7	65	28	87	7	65	28	86	8	65	28	86	8	65	28
150	197	62	141	117	197	62	141	117	197	62	141	117	197	62	141	117
162	160	28	117	69	160	28	117	69	160	28	117	69	160	28	117	69
164	157	27	124	60	157	27	125	59	157	27	123	61	157	27	123	61
183	223	57	168	113	223	57	170	111	224	57	170	112	224	57	170	112
184	125	28	81	73	125	28	80	73	125	28	81	73	125	28	81	73
186	296	54	227	120	296	54	227	120	296	54	227	120	296	54	227	120
214	148	18	129	36	148	18	129	36	148	18	129	36	148	18	129	36
215	90	14	92	13	90	14	92	13	90	14	92	13	90	14	92	13
217	64	20	52	31	64	20	52	31	64	20	52	31	64	20	52	31
226	82	5	59	28	82	5	59	28	82	5	57	30	82	5	57	30
246	68	17	57	26	68	17	57	26	68	17	57	26	68	17	57	26
251	149	16	118	44	149	16	118	44	149	16	118	44	149	16	118	44
252	147	21	118	51	147	21	118	51	147	21	118	51	147	21	118	51
253	208	40	158	87	206	42	161	84	208	40	158	87	208	40	158	87
255	202	48	174	78	202	48	174	78	202	48	174	78	202	48	174	78
258	34	24	13	43	34	24	13	43	34	24	13	43	34	24	13	43
284	119	53	85	87	119	53	85	87	119	53	85	87	119	53	85	87
286	168	47	129	84	169	47	130	84	168	48	130	84	168	48	130	84
290	72	69	39	104	72	69	38	105	72	68	40	103	72	68	40	103
293	194	82	129	142	195	81	130	141	197	79	130	141	197	79	130	141
297	204	110	113	202	204	110	113	202	204	110	113	202	204	110	113	202
300	91	52	56	87	91	52	53	90	92	51	56	87	92	51	56	87
313	102	25	76	49	102	25	74	51	102	25	76	49	102	25	76	49
324	273	115	163	224	272	115	162	224	273	115	163	224	273	115	163	224
329	104	45	70	79	104	44	69	79	103	45	69	79	103	45	69	79
330	85	40	54	68	86	39	54	68	85	40	54	68	85	40	54	68
344	212	77	152	139	212	77	151	140	212	77	152	139	212	77	152	139
345	279	76	223	132	280	75	224	131	283	72	223	132	283	72	223	132
347	119	46	96	68	119	46	96	68	119	46	96	68	119	46	96	68

355	194	35	172	59	194	35	178	58	194	35	172	59	194	35	172	59
358	220	34	172	71	220	34	173	70	220	34	172	71	220	34	172	71
382	121	34	96	56	121	34	96	56	121	34	96	56	121	34	96	56
385	127	36	89	75	127	36	89	75	127	36	89	75	127	36	89	75
401	154	67	94	123	154	67	94	123	153	68	94	123	153	68	94	123
406	102	33	65	70	102	33	65	70	102	33	65	70	102	33	65	70
411	121	53	87	91	122	53	90	90	122	53	88	93	122	53	88	93
420	247	112	156	198	247	112	156	198	247	112	156	198	247	112	156	198
421	179	105	100	182	179	105	100	182	179	105	100	182	179	105	100	182
422	317	220	171	360	320	218	170	362	319	217	171	360	319	217	171	360
427	340	231	166	396	341	230	167	395	340	231	166	396	340	231	166	396
429	254	143	131	265	254	143	129	267	253	144	132	264	253	144	132	264
431	124	51	80	94	123	52	81	93	124	51	80	94	124	51	80	94
433	141	40	89	92	141	40	90	91	141	40	89	92	141	40	89	92
435	172	90	104	156	172	90	104	156	172	90	104	156	172	90	104	156
440	81	47	45	81	82	46	46	80	81	47	45	81	81	47	45	81
443	94	34	67	61	94	34	67	61	94	34	67	61	94	34	67	61
449	180	70	119	126	181	69	119	126	180	70	119	126	180	70	119	126
454	200	125	114	212	204	121	115	211	200	125	114	212	200	125	114	212
462	97	57	55	95	97	57	55	95	97	57	55	95	97	57	55	95
463	115	75	68	120	115	75	68	120	115	75	68	120	115	75	68	120
466	154	80	92	142	154	80	92	142	154	80	92	142	154	80	92	142
489	175	108	111	172	175	108	111	172	175	108	111	172	175	108	111	172
491	107	65	65	111	107	65	65	111	107	65	65	111	107	65	65	111
492	117	63	68	112	117	63	68	112	117	63	68	112	117	63	68	112
493	121	81	69	135	121	81	69	135	121	81	69	135	121	81	69	135
504	119	42	65	93	118	43	63	93	119	42	65	93	119	42	65	93
505	137	59	83	112	137	59	83	112	137	59	83	112	137	59	83	112
512	170	133	79	225	170	133	79	225	169	134	80	224	169	134	80	224
519	84	54	49	86	84	54	49	86	84	54	49	86	84	54	49	86
526	158	116	83	197	158	116	83	197	158	116	82	198	158	116	82	198
527	60	52	29	84	60	52	29	84	60	52	29	84	60	52	29	84
536	105	57	66	96	105	57	66	96	105	57	66	96	105	57	66	96
538	210	89	133	161	210	89	133	161	211	89	133	161	211	89	133	161

541	292	302	120	479	292	302	120	479	292	301	120	478	292	301	120	478
543	115	44	68	90	114	45	68	90	115	44	68	90	115	44	68	90
547	140	79	80	137	140	79	80	137	140	79	80	137	140	79	80	137
549	160	94	89	160	160	94	89	160	160	94	89	160	160	94	89	160
562	202	94	122	174	202	94	122	174	200	95	121	174	200	95	121	174
565	98	96	53	141	98	96	53	141	98	96	53	141	98	96	53	141
566	213	123	118	213	213	123	118	213	213	123	118	213	213	123	118	213
569	258	180	162	282	258	180	162	282	258	180	163	281	258	180	163	281
573	198	133	131	201	198	133	131	201	199	132	131	201	199	132	131	201
603	474	227	260	434	474	226	260	434	474	227	260	434	474	227	260	434
554A	50	15	26	37	50	15	26	37	50	15	26	37	50	15	26	37
93A	3	0	2	1	3	0	2	1	3	0	2	1	3	0	2	1

Appendix J.2. Detailed Information about Machine and Hand Counts by Candidate, Absentee Ballots

Batch	Machine Count #1				Hand Count #1				Hand Count #2-Counter #1				Hand Count #2-Counter #2			
	Dem Gov	GOP Gov	Dem LC	GOP LC	Dem Gov	GOP Gov	Dem LC	GOP LC	Dem Gov	GOP Gov	Dem LC	GOP LC	Dem Gov	GOP Gov	Dem LC	GOP LC
A004	318	127	216	226	318	127	215	227	316	128	216	225	316	128	216	225
A009	324	116	215	226	325	116	215	226	323	117	215	226	323	117	215	226
A011	328	111	210	228	328	111	210	228	328	111	209	229	328	111	209	229
A013	317	121	219	223	317	122	217	225	317	122	222	220	317	122	222	220
A016	306	135	190	248	305	136	190	248	305	136	188	250	305	136	188	250
A018	254	187	178	267	251	190	177	267	255	186	177	267	255	186	177	267
A020	291	153	203	240	290	154	205	238	291	153	203	240	291	153	203	240
A021	259	186	171	274	259	186	171	273	259	186	176	268	259	186	176	268
A023	287	162	220	226	287	162	220	226	287	162	220	226	287	162	220	226
A027	288	153	194	246	287	154	191	249	288	153	194	246	288	153	194	246
A030	268	169	179	263	268	169	179	263	268	169	180	263	268	169	174	268
A032	282	161	206	234	280	163	205	235	280	162	206	234	280	162	206	234
A035	260	180	181	264	260	180	181	264	260	179	181	264	260	179	181	264
A037	268	167	179	258	267	168	179	258	270	165	184	253	270	165	184	253
A038	268	174	190	250	267	175	191	249	267	175	189	251	267	175	189	251
A039	279	161	200	237	280	160	200	237	279	162	200	239	279	162	200	239
A040	287	157	204	241	286	158	204	241	288	156	204	241	288	156	204	241
A044	284	163	188	254	286	161	188	254	284	163	188	254	284	163	188	254
A045	268	171	168	275	268	171	168	274	268	171	168	274	268	171	168	274
A050	194	99	125	166	195	98	125	166	194	99	125	166	194	99	125	166
A051	254	149	155	245	254	149	155	245	254	149	155	245	254	149	155	245
A055	282	152	207	230	281	152	207	229	282	152	207	230	282	152	207	230
A056	264	177	164	283	263	178	164	283	264	177	164	283	264	177	164	283
A057	272	175	182	263	270	177	182	262	272	175	182	262	272	175	182	262
A060	288	162	195	253	289	162	195	254	291	159	200	248	291	159	200	248
A063					326	117	242	205	324	119	241	206	324	119	241	206
A065					327	129	217	244	328	129	215	242	328	129	215	242
A066					294	152	195	261	296	152	195	261	296	152	195	261

Appendix J.3. Detailed Information about Machine and Hand Counts by Candidate, Early Ballots

	Machine Count #1				Hand Count #1				Hand Count #2-Counter #1				Hand Counter #2-Counter #2			
	Dem Gov	GOP Gov	Dem LC	GOP LC	Dem Gov	GOP Gov	Dem LC	GOP LC	Dem Gov	GOP Gov	Dem LC	GOP LC	Dem Gov	GOP Gov	Dem LC	GOP LC
E215801	244	92	182	160	244	92	182	160	244	92	182	160	244	92	182	160
E219458	1257	697	871	1087	1251	688	864	1079	1251	689	867	1076	1251	689	867	1076
E219476	298	131	238	195	297	131	238	194	297	131	238	194	297	131	238	194
E220603	205	71	162	112	206	70	162	112	205	72	161	114	205	72	161	114
E220617	504	183	395	304	501	183	393	303	501	183	393	303	501	183	393	303
E220628	101	32	84	50	101	32	84	50	101	32	84	50	101	32	84	50
E220678	525	402	384	546	523	404	384	546	525	403	383	547	525	403	383	547
E220690	561	147	452	262	560	145	450	260	558	147	450	260	558	147	450	260
E220703	209	71	180	106	209	71	180	106	209	71	180	106	209	71	180	106
E220766	305	272	225	357	304	270	225	354	304	270	224	355	304	270	224	355
E220832	240	186	176	247	240	186	176	247	240	186	177	246	240	186	177	246
E220869	147	95	97	145	147	95	97	145	147	95	97	145	147	95	97	145
E227276	492	423	357	565	491	424	357	565	492	423	358	564	492	423	358	564
E227281	40	22	39	23	40	22	39	23	40	22	39	23	40	22	39	23

Pre-Audit Questions:

1. Have you ever been a poll worker or poll judge?

Yes	32.0
No	68.0

1a. If yes, have you been a poll worker?

Yes	75.0
No	25.0

1b. If yes, have you been a poll judge?

Yes	50.0
No	50.0

2. Was that in New Mexico or some other state?

New Mexico	100.0
Some other state	0.0

3. Do you have any prior experience counting ballots after an election?

Yes	80.0
No	20.0

4. If you are affiliated with a political party on your voter registration, which party?

Democrat	61.5
Independent	0.0
Republican	11.5
Other	7.7
None	3.8
Don't Know	3.8
Refuse to answer	11.5

5. Do you consider yourself a :

Strong Democrat	20.0
Democrat	40.0
Independent, Leaning towards Democrat	0.0
Independent	8.0
Independent, Leaning towards Republican	0.0
Republican	12.0
Strong Republican	0.0

Libertarian	4.0
Green	4.0
Don't Know/Not Sure	12.0

6. Would you characterize yourself as someone who:

Works for the party year after year, win or lose, regardless of candidates or issues.	65.0
Works for the party when there is a specific candidate or issue that interests you.	30.0
Neither of these	5.0

7. How would you describe your own political philosophy?

Strongly liberal	11.5
Liberal	19.2
Moderate leaning liberal	3.8
Moderate	19.2
Moderate leaning conservative	0.0
Conservative	19.2
Strongly conservative	0.0
Libertarian	3.8
Radical	3.8
Don't know/Not sure	19.2

8. How confident are you that votes are counted as the voter intended by counting machines such as the paper ballot scanner ?

Very confident	59.3
Somewhat confident	33.3
Not too confident	0.0
Not at all confident	3.7
Don't know/Not sure	3.7

9. How confident are you that votes are counted as the voter intended by hand counters ?

Very confident	37.0
Somewhat confident	48.1
Not too confident	11.1
Not at all confident	0.0
Don't know/Not sure	3.7

10. Do you know which party currently has the most members in the House of Representatives?

Democrat	48.1
Republican	3.7
Don't know/Not sure	48.1

11. How much of a majority is required for the House and Senate to override a

Presidential Veto?

A bare majority (50% plus one)	8.0
A two-thirds majority	40.0
A three-fourths majority	4.0
Don't know/Not sure	48.0

12. Some people don't pay much attention to politics. Would you say that you have been Very Interested, Somewhat Interested or Not Much Interested in political campaigns so far this year?

Very Interested	33.3
Somewhat Interested	44.4
Not Much Interested	22.2

13. How many days in the past week did you watch national network news on TV?

None	22.2
One Day	7.4
Two Days	3.7
Three Days	11.1
Four Days	7.4
Five Days	18.5
Six Days	11.1
Every Day	18.5
Don't know	0.0

14. How many days in the past week did you read a daily newspaper?

None	18.5
One Day	22.2
Two Days	11.1
Three Days	11.1
Four Days	0.0
Five Days	14.8
Six Days	0.0
Every Day	18.5
Don't know	3.7

15. In what year were you born? (Ages calculated)

18-25	18.5
26-35	7.4
36-45	14.8
46-55	11.1
56-65	22.2
66-75	25.9

16. Which racial or ethnic group best describes you?

Hispanic/Latino	66.7

Caucasian	14.8
Black	7.4
Other	7.4
Refuse to answer	3.7

17. What is your gender?

Male	40.7
Female	59.3

18. What is the highest level of education you have completed?

Less than HS diploma	3.8
HS diploma	23.1
Some college	26.9
Vocational/Technical School	26.9
Associates Degree	3.8
College degree (BA/BS)	11.5
Graduate/Professional degree	3.8

19. Please indicate, to the best of your knowledge, your annual household income:

Less than 10,000	8.3
10,001 – 20,000	4.2
20,001 – 30,000	25.0
30,001 – 40,000	20.8
40,001 – 50,000	20.8
50,001 – 60,000	8.3
60,001 – 70,000	0.0
70,001 – 80,000	4.2
80,001 – 90,000	0.0
90,001- 100,000	0.0
Over 100,000	8.3

Post Audit Questions:

20. Based on your experience working in the past few weeks on the auditing project, how confident are you that votes are counted correctly by the machines?

Very confident	66.7
Somewhat confident	29.2
Not too confident	0.0
Not at all confident	4.2
Don't know/Not sure	0.0

21. Again, based on your experience working the past few weeks on the auditing project, how confident are you that votes are counted as the voter intended by hand counting with 2 person teams?

Very confident	54.2

Somewhat confident	37.5
Not too confident	4.2
Not at all confident	4.2
Don't know/Not sure	0.0

22. Again, based on your experience working the past few weeks on the auditing project, how confident are you that votes are counted as the voter intended by hand counting with 3 person teams?

Very confident	62.5
Somewhat confident	25.0
Not too confident	4.2
Not at all confident	4.2
Don't know/Not sure	4.2

23. Did you find the "Hand Count Manual Counter Batch Log" easy to use?

Yes	100.0
No	0.0
Don't know/Not sure	0.0

24. Did you find the "Machine Count Machine Counter Batch Log" easy to use?

Yes	100.0
No	0.0
Don't know/Not sure	0.0

25. Did you find the "Hand Counted Batch Tally Sheet" easy to use?

Yes	100.0
No	0.0
Don't know/Not Sure	0.0

26. Did you find the M-100 ballot scanning machine easy to use?

Yes	91.7
No	0.0
Don't know/Not sure	8.3

27. While conducting hand counts, did you ever sort your ballots into three groups depending upon whether the ballot had a mark indicating a straight party preference before beginning a tally (straight party Democrat, straight party Republican and no straight party preference)?

Yes	100.0
No	0.0
Don't know/Not sure	0.0

28. If you answered yes to question 27, did you find that sorting the ballots by straight party made the hand tallying process:

Much easier	79.2

Somewhat easier	16.7
Somewhat harder	4.2
Much harder	0.0
Don't know	0.0

29. You dealt with a variety of precincts, which often contained a different number of ballots. Please indicate with a number next to each category below how many ballots are in each of the following categories. (Averages calculated)

Small precinct	104
Medium precinct	335
Large precinct	999

30. Did you and your group change the process you used to hand count ballots based upon the size of the precinct?

Yes	33.3
No	62.5
Don't know/Not sure	4.2

31. Did you and your group change the process you used to hand count ballots based on whether there were two or three people in your group?

Yes	25.0
No	66.7
Don't know/Not sure	8.3

32. Did you find that a two-person or three-person team was more productive for doing hand counting of ballots?

The two-person team was better	58.3
Neither, the number did not matter	4.2
The three-person team was better	29.2

33. Which describes how you followed procedures for the first machine count?

Followed the procedures provided completely	87.5
Followed some of the procedures	4.2
Developed our own procedures	8.3
Don't know	0.0?

34. Which describes how you followed procedures for the second machine count?

Followed the procedures provided completely	87.5
Followed some of the procedures	4.2
Developed our own procedures	8.3
Don't know	0.0

35. Which describes how you followed procedures for hand counts with 2 people?

Followed the procedures provided completely	33.3
Followed some of the procedures	25.0
Developed our own procedures	37.5

Don’t know	4.2

36. Which describes how you followed procedures for hand counts with 3 people?

Followed the procedures provided completely	41.7
Followed some of the procedures	12.5
Developed our own procedures	37.5
Don’t know	8.3

37. How much did you enjoy working with the other members of your team?

Enjoyed it a lot	87.0
Enjoyed it a little	13.0
Did not enjoy it much	0.0
Did not enjoy it at all	0.0

APPENDIX L. PROBLEM OR REJECTED BALLOTS

APPENDIX L. PROJECT TEAM MEMBERS BIOGRAPHIES

Lonna Rae Atkeson is Professor of Political Science and Regents' Lecturer at the University of New Mexico. Her research expertise is in elections, public opinion, campaigns and political behavior and she is widely published. Her research has been supported by the National Science Foundation and the Pew Charitable Trusts. She holds a BA in political science from the University of California, Riverside and a Ph.D. in political science from the University of Colorado, Boulder.

R. Michael Alvarez is Professor of Political Science at the California Institute of Technology. An internationally-renown expert on elections and election procedures, he has written scores of articles and books on election administration, voting technologies, and electoral behavior. He is the Co-Director of the Caltech/MIT Voting Technology Project, and he has taught at Caltech since 1992. He holds a BA in political science from Carleton College, and MA and Ph.D. in political science from Duke University.

Thad E. Hall is Assistant Professor of Political Science and a research fellow at the Institute of Public and International Affairs at the University of Utah. Also an internationally recognized expert on election reform and administration, he has written several books and articles on election participation, voting technology, and public policy and administration. He has conducted research for the Department of Defense, the Election Assistance Commission, and is currently part of a research team (including Alvarez) studying Internet voting in Estonia for the Council of Europe. His BA is from Oglethorpe University, and he holds and MPA from Georgia State University and a Ph.D. in political science from the University of Georgia.

Bernalillo County Clerk Maggie Toulouse Oliver brings a wealth of practical and academic experience to her job. Oliver was appointed by the County Commission in 2007 to fill the unexpired term of former Clerk, and now Secretary of State, Mary Herrera. Prior to her appointment, Ms. Toulouse Oliver worked for 13 years as a campaign consultant and political activist. She also earned a Bachelor's degree in Political Science and Spanish and Master's Degree in Political Science from UNM. During graduate school, Maggie focused on voting behavior and election systems as her area of interest. In 2004, Maggie was named New Mexico State Director and then Southwest Region Campaign Manager for the League of Conservation Voters (LCV), the Independent Political Voice for the Environment. Maggie worked at LCV for 3 years until her appointment as Clerk.

Robert Adams is the Deputy County Clerk for Bernalillo County New Mexico. He was appointed by County Clerk Maggie Toulouse Oliver in January 2007. Mr. Adams oversees the

Bureau of Elections. Prior to his current position, Mr. Adams served in State Government, at the New Mexico Human Services Department, Division of Information Technology for four years, a position appointed by Governor Bill Richardson. He has managed and worked for political campaigns at the local, state and federal levels. Mr. Adams is a lifelong New Mexico resident, born and raised in Farmington, New Mexico. He attended New Mexico State University where he received a degree in Government.

Lisa Bryant is a graduate student at the University of New Mexico. Focusing on American politics, her research interests include political behavior, campaigns and elections, public opinion and race, ethnicity and gender. She holds a BA in political science from the University of New Mexico.

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Jessica Taverna is a PhD candidate at the University of Utah where her research interests focus on the intersection between public policy and democratic theory. She received her BA in history and Environmental Studies from Bowdoin College.

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