

0 Connecticut Citizen Election Audit

We must do better: Citizen Post-Election Audit Report

Independent Observation and Analysis
of Connecticut's Audit of the 2018 General Election

February 22, 2019

We conclude, based on citizen observations and analysis of official municipal audit reports, Post-election vote audits of the November 2018 elections failed to meet basic audit standards. Audit should provide voters with justified confidence in elections. Instead, these audits reduce our confidence in election officials:

- ▼ The audits were not conducted and reported as required by law. The Secretary of the State's Office continues to fail to take responsibility for that failure by local officials.
- ▼ 39% of official audit reports provided by registrars were incomplete.
- ▼ Human error was still considered an acceptable explanation of differences between machine and manual counts. This defeats the purpose of the audits.
- ▼ Weaknesses in ballot chain-of-custody and security procedures necessary for confidence that ballots were not tampered with between the election and the municipal audit counting sessions.
- ▼ Continued use of flawed electronic audit procedures that are not publicly verifiable.

We are pleased with the following developments;

- ▲ Fewer instances of write-in ballots not properly separated into separate envelopes for storage.
- ▲ Fewer instances of write-in ballots read into scanners multiple times on election night.
- ▲ Electronic Audit equipment had few if any problems reading creased, folded, or mutilated ballots

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Executive Summary

Introduction

Connecticut statutes require the Secretary of the State and registrars of voters to conduct audits after every election and primary.

After the November 2018 Election, Connecticut conducted its 20th large-scale post-election audit.¹ This was also the 20th large-scale audit observation for the Connecticut Citizen Election Audit (“Citizen Audit”).

The purposes of our observations are to create election integrity, demonstrate citizen interest in the process, increase citizen involvement in elections, provide feedback to the Secretary of the State and the Connecticut General Assembly on the audit process, and provide the public with the information necessary to determine its confidence in Connecticut's elections.

Citizen Audit volunteer observers invested 22 days observing 21 audit counting sessions. Without the service of these volunteers, Connecticut’s post-election audits would take place without public observation, and the insights in this report would not be possible.

¹ In this document we will frequently use the term “audit” when we mean “post-election audit,” “post-election audit counting session,” or other parts of the process, from the random selection of districts to be audited to the official report of each post-election audit produced by the University of Connecticut Voter Center (UConn).

Findings

We conclude, based on citizen observations and analysis of official municipal audit reports, Post-election vote audits of the November 2018 elections failed to meet basic audit standards. Audit should provide voters with justified confidence in elections. Instead, these audits reduce our confidence in election officials:

- ▼ The audits were not conducted and reported as required by law. The Secretary of the State's Office continues to fail to take responsibility for that failure by local officials.
- ▼ 39% of official audit reports provided by registrars were incomplete.
- ▼ Human error was still considered an acceptable explanation of differences between machine and manual counts. This defeats the purpose of the audits.
- ▼ Weaknesses in ballot chain-of-custody and security procedures necessary for confidence that ballots were not tampered with between the election and the municipal audit counting sessions.
- ▼ Continued use of flawed electronic audit procedures that are not publicly verifiable.

The public, candidates, and the Secretary of the State should expect local election officials to be able to organize audits and produce accurate, complete audit reports. The public should expect the Secretary of the State's Office to take the lead in ensuring that the audit is complete and publicly verifiable.

We are pleased with the following developments:

- ▲ Fewer instances of write-in ballots not properly separated into separate envelopes for storage.
- ▲ Fewer instances of write-in ballots read into scanners multiple times on election night.
- ▲ Electronic Audit equipment had few if any problems reading creased, folded, or mutilated ballots

We emphasize that this report does not question any election official's integrity. Most election officials are well motivated and of high integrity, as are other public officials. However, unquestioned trust and lack of knowledge can lead to a lack of vigilance that allows errors to be overlooked and opportunity for the occasional bad actor to manipulate elections and audits.

Connecticut Continues Flawed Electronic Audits

Summary

For the third year in a row, several municipalities, the Secretary of the State's Office, and the UConn Voter Center² conducted electronic audits. In 2016, Connecticut became the first and remains the only state in the United States to replace publicly verifiable audits with unverifiable electronic audits.

These audits represent several steps backward from the traditional manual, hand-count audits:

- Unlike hand-count audits, the electronic audits were not publicly verifiable.³ The public and the Citizen Audit cannot determine the accuracy of such audits.
- The audits were conducted without written procedures approved by the Secretary of the State.

The Citizen Audit strongly recommends *Electronically-Assisted Manual Post-Election Audits*:

- The sound science of *Evidence Based Elections* provides the basis for manually checking and transparently verifying the results of an electronic audit. If efficiently conducted, such audits would take approximately the same effort for election officials as the unverifiable electronic audits used for this election.
- Electronically-Assisted Post-Election Audits could provide confidence with less tedious work, with high accuracy and greater confidence.

For complete details on the shortcomings of Connecticut's electronic audits and the alternative of Electronically-Assisted Post-Election Audits, see Appendix B.

² <https://voter.engr.uconn.edu/voter/>

³ Unlike most government agency and business audits, post-election audits are traditionally not conducted independently. They are conducted by the same organizations and individuals responsible for conducting the elections and specifying election equipment. Elections are also highly political. The solution is publicly verifiable audits – audits that can be independently verified by candidates and the public.

Audit Background

After the November 2018 Election, Connecticut conducted its 20th large-scale post-election audit.^{4,5} This was also the 20th large-scale audit observation by the Connecticut Citizen Election Audit (Citizen Audit).

The purposes of our observations are to create election integrity, to demonstrate citizen interest in the process, increase citizen involvement in elections, provide feedback to the Secretary of the State (SOTS) and the Connecticut General Assembly on the audit process, and provide the public with the information necessary to determine its confidence in Connecticut's elections.

By law, the Secretary of the State is required, after each election, to select at random 5%⁶ of Connecticut's voting districts to participate in post-election audits. The audit counting sessions were required to be conducted between November 21, 2018 and November 28, 2018. In the random drawing 38 voting districts were selected for audit from the list of districts. The districts audited were located in 28 municipalities.⁷

Citizen Audit volunteer observers invested 22 days observing 21 local counting sessions⁸ during this period. Observers frequently attended audits on short notice, observed multiple audits, and accommodated last minute changes to the audit schedule. **Without the service of these volunteers, Connecticut's post-election audits would take place without public observation, and the insights in this report would not be possible.**

⁴ In this document we will frequently use the term "audit" when we mean "post-election audit" or "post-election audit counting session." Technically, we believe that the whole process encompassing everything from the preservation of records, random drawings, counting in municipalities, the report by the University of Connecticut, and the evaluation of that report by the Secretary of the State would be the "audit." However, for readability we will usually follow the common practice of using "audit" to refer to parts of the whole.

⁵ Connecticut statutes require the Secretary of the State and registrars of voters to conduct audits after every election and primary.

⁶ Effective July 1, 2016 the post-election audits were reduced by the General Assembly from 10% to 5% of districts.

⁷ SOTS press release after the random drawing:

<https://portal.ct.gov/SOTS/Press-Releases/2018-Press-Releases/Election-Results-to-be-Audited-from-Selected-Polling-Locations>

⁸ We were unable to send observers to every audit and we were unable to match some who volunteered with audits on dates they were available, in their areas of the State.

Purpose of Connecticut's Random, Post-Election Audits

As stated in the Office of the Secretary of the State's Post-Election Audit Procedures:⁹

The primary purpose of the hand count¹⁰ audit is to assess how well the optical scan voting machines functioned in an actual election and to ensure that votes cast using these machines are counted properly and accurately.

Good government groups support the "Principles and Best Practices for Post-Election Audits,"¹¹ which includes the following definition and benefits:

Well-designed and properly performed post-election audits can significantly mitigate the threat of error, and should be considered integral to any vote counting system. A post-election audit in this document refers to hand counting votes on paper records and comparing those counts to the corresponding vote counts originally reported, as a check on the accuracy of election results, and resolving discrepancies using accurate hand counts of the paper records as the benchmark. Such audits are arguably the most economical component of a quality voting system, adding a very small cost for a large set of benefits.

The benefits of such audits include:

- *Revealing when recounts are necessary to verify election outcomes*
- *Finding error whether accidental or intentional*
- *Deterring fraud*
- *Providing for continuous improvement in the conduct of elections*
- *Promoting public confidence*

⁹ Official Procedures: <http://ctelectionaudit.org/2016/AuditProcedure201605.pdf>

¹⁰ Hand count means the manual counting of ballots and votes without relying on voting machines such as optical scanners.

¹¹ <http://www.electionaudits.org/principles>

Citizen Observation: Challenges and Limitations

Through past experience in observing audits, we have continuously improved our forms, training materials, conference call and video training sessions for observers. In 2018 we completely revised our observation report forms, replaced the SurveyMonkey tool with LimeSurvey, and completely replaced our observer training videos.

We recognize that there may be occasional errors in our raw data derived from observations. However, when taken as a whole, the observations tell a collective story that is quite consistent and provides valuable feedback to the public and for the continuing education of elections officials.

Without our volunteer observers willing to invest a day of their time, being available for short-notice scheduling, and observing to the best of their ability, no one except local election officials would know how post-election audits are conducted in Connecticut. Our observers care about democracy and ensuring that measures are in place to protect the integrity of our elections.¹²

¹² Upon request of any registrar of voters participating in the audit, we would be pleased to discuss volunteer observation reports and provide feedback applicable to his or her municipality.

Analysis

We Do Not Question Any Election Official's Integrity

This report does not question any election official's integrity. Most elections officials are well motivated and of high integrity, as are other public officials. However, unquestioned trust and lack of knowledge can lead to a lack of vigilance that allow errors to be overlooked and the opportunity for the occasional bad actor to manipulate elections and audits.

At a minimum, lack of attention to detail and opportunities for error and fraud leave voters without justified confidence in our election system and election officials.

Citizen Observation Analysis

Volunteer citizen observers observed local counting sessions and reported their observations on Observation Report Forms.¹³ Analysis in this section is based on those reports. Appendix A is a table showing the percentage of "yes" responses on all yes/no questions on Observation Report Forms for this audit and several previous audits. Appendix C describes in detail our methodology of observation and analysis.

Even-Year Elections vs. Odd-Year Elections vs. Primary Elections

In several aspects, it is more appropriate to compare even-year elections with even-year elections, odd-year elections with odd-year elections, and primary elections with primary elections. Even-year elections include statewide races and involve more ballots, yet generally are easier to count manually than municipal elections. Odd-year elections are municipal elections. They involve fewer ballots due to lower turnout, yet present more challenging counts of vote-for-multiple races (for example, "Vote for 6 of the 12 candidates"). Primary election audits require counting only a single race, have far fewer ballots, do not involve cross-endorsements or write-ins, and seldom have vote-for-multiple contests.

A. Procedures Are Unenforceable, Current Laws Are Insufficient

As noted in previous reports, discussions with representatives of the Secretary of the State's Office and the State Elections Enforcement Commission (SEEC) indicated that many, if not all, of the post-election audit procedures, including those covering chain-of-custody, are unenforceable. There has been disagreement between past SEEC Directors and some members of the General Assembly regarding the enforceability of regulations, but there is agreement that current post-election audit procedures are not enforceable.¹⁴

¹³ Our latest forms used for this observation is available at: <http://ctelectionaudit.org/Forms/ObservationReportM.pdf> and <http://ctelectionaudit.org/Forms/ObservationReportE.pdf> for the manual and electronic audits, respectively.

¹⁴ In 2015, Public Act 15-224 authorized the Secretary of the State to designate enforceable procedures, yet the audit procedures have not been so designated.

A.1 Ballot Security Laws Are Insufficient for Credible Audits

Laws that govern the post-election sealing of ballots, memory cards, and tabulators are unclear and insufficient. After over a decade of optical scanner use, the laws have not been updated to recognize that polling place voting with optical scanners involves paper ballots. Most officials interpret the law to imply that polling place ballots are required only to be sealed only until the 14th day after the election, yet the audits do not start until the 15th day after the election, while the Secretary of the State interprets the law such that ballots must be sealed until they are destroyed after 22 or 6 months. We note that the adherence to prescribed chain-of-custody and ballot security procedures varies widely among audited districts.

Ballots are not uniformly maintained in secure facilities, and access to these storage facilities is not reliably logged or recorded, even though the law requires two individuals to be present when these facilities are accessed. In many towns, each registrar could have undetected lone access to the sealed ballots¹⁵ for extended periods. In many towns, several other individuals also have such access. The lack of uniform security of the ballots diminishes confidence in the integrity of the ballots. This diminishes confidence in the integrity of election results.

Ballots are the basis for the data reported in audits and the foundation for the integrity of elections. Secure, credible chain-of-custody procedures should preclude the opportunity for a single individual to have any unobserved extended access to ballots, providing the opportunity for an individual to substitute or modify ballots.

B. Laws and Procedures Are Not Followed or Understood

Problems uncovered in this year's observation include: incorrectly completed forms, chain-of-custody concerns, inconsistent counting methods, error-prone, confusing totaling processes, and problems with totaling results.

The Official Audit Procedures¹⁶ were frequently not followed, were not enforced, and, as noted previously, may not be enforceable. Additionally, the procedures still lack detailed guidance in efficient counting methods that would provide accurate and observable results. See Section C below.

Our observations indicate that some towns do a good job of using the procedures in the audit, following each step, in order, and enhancing them with effective detailed counting methods. However, in other towns it was clear that election officials were not referencing or following the procedures. Some who attempt to follow the steps do not seem to understand them and appear to be reading the procedures for the first time at the start of the counting session. Frequently, effective counting procedures are coupled with *ad-hoc*, disorganized totaling procedures. This causes inaccuracies and frustration for officials,

¹⁵ While useful, ballot bag seals, which are small plastic or plastic and metal numbered devices, supposed to not be reusable, offer little protection, especially when used to protect ballots from those who are responsible for applying and checking seal integrity: *Security Theater: Scary! Expert Outlines Physical Security Limitations*

<http://ctvoterscount.org/security-theater-expert-outlines-physical-security-limitations/> See a video demonstration of how to compromise such seals here: https://www.youtube.com/watch?time_continue=2&v=ZtzLlfULnbI

¹⁶ The latest SOTS procedures: <http://ctelectionaudit.org/2016/AuditProcedure201605.pdf>

which makes it difficult to observe the accumulating vote totals from teams and their batches to reach the final totals.

B.1 Write-in Problems Reduced

Unlike the last three years, this year produced no reports of significant numbers of write-in ballots read through scanners twice on Election Day.

We are pleased with this development. Perhaps officials paid attention to our previous reports. Perhaps the surfacing of such problems at last year's electronic audits at the Secretary of the State's offices led to more emphasis of the problem in the annual training of registrars.

As we said last year:

Over time, we have noted increasing instances of write-ins being read twice. Initially, we and officials may not have noticed the problem, especially in manual audits, with officials attributing those instances to "Human Error" in counting. In this audit, officials noticed three districts in the electronic audit where this occurred or was suspected of occurring. It is likely that this problem is more frequently detected in electronic audits.

This problem should normally be noticed and corrected shortly after the election, based on discrepancies between the number of voters signed in and the number of ballots counted. When discovered or suspected, the solution is a *discrepancy recanvass*, designed specifically to recount in order to remedy a suspected election night counting error.

This could be considered a benefit of the audit, if the Secretary of the State's Office takes action to correctly instruct moderators how to handle write-ins; instructs moderators, head moderators, registrars, and municipal clerks how to correctly check results; and to then have head moderators call for discrepancy recanvasses.

We have begun to track instances of compliance with the requirement that hand-counted and write-in ballots are sealed in separate envelopes on election night.

B.2 In the Past, Official Audit Reports Were Not Sent or Not Tracked by the SOTS Office

For this audit, as of the date of publication, despite numerous promises, we have not received copies of the official audit report forms from the Secretary of the State's Office. Instead we are using the completed, signed forms collected by observers or obtained by Citizen Audit Freedom of Information requests to individual registrars. We have no reason to believe this has changed.

B.4 Fifteen Incorrectly Completed Forms, and Incomplete Audit Counting

Several registrars' reports were incomplete due to insufficient data to determine the actual results of the local audits, and if and how they were performed. As in the past, for some reports we can make assumptions and fill in missing data. In this audit some reports are so incomplete that we cannot make reasonable assumptions and *have no reason to assume that the audits were actually performed*.

We are equally concerned that such reports in the past were accepted by the Secretary of the State's Office and UConn as representing the actual results of the audit. Voters should expect that the SOTS

review such reports and return them to local officials to be completed and, where necessary, require the audit be repeated.

Without complete reports we cannot analyze or verify the results of the audit. So we cannot provide any level of confidence in the optical scanners in those districts, nor in the officials charged with supervising and performing the audits. This, after all, is the statutory purpose of the audits.

Audit Report

Town Name: _____ Voting District (and polling place name): _____

District Numbers:(Cong _____) (State Senate _____) (Assembly _____)

Ballot Carrying Case Seal Number: _____ Audit Date: _____

Total of tabulator-counted ballots - hand counted at the audit:

Totals ballots counted by tabulator as shown on tabulator tape produced on election night:

Ballot Carrying Case Seal Number (When Rescaled After Audit): _____

A	B	C	D	E	F
Office	Candidate	Machine Totals (Tape)	Undisputed Vote Totals	Questionable Vote Totals	Overall Hand Count Totals (D + E)

Explanation of Differences:

Submit completed forms within 48 hours by fax to 1-866-392-4023

Registrar of Voters: _____ (Signed) _____ (Printed)

Registrar of Voters: _____ (Signed) _____ (Printed)

Official Audit Report Form - Figure 1

	2018	2016	2014 ¹⁷
Number of ballots counted by hand or machine not filled in or filled in incorrectly	11 ¹⁸	1	2
Some columns not completed and/or incorrectly completed	2	2	6
Minor arithmetic/transcription errors	5	0	6
Reports with negative counts of questionable ballots	0	0	0
Fewer races or candidates counted than required by law	0	0	4
Missing reports from SOTS	N/A	0	1
Differences attributed to questionable votes, but not reported in Col. E. Or not enough reported.	2	1	0
Cross-endorsed candidates not counted as such	1	5	12
Total incorrect or missing reports	15 ¹⁹	9	25
Districts selected	38	38	77
Rate of incomplete reports	39%	24%	32%

Errors in Official Report Forms - Table 1

Incomplete data should be taken seriously. The Secretary of the State should not accept incomplete forms. She should insist that forms be filled out correctly and that enough races are counted. Where necessary, SOTS should perform investigations, including recounting ballots or votes. These investigations should be announced publicly in advance to allow public observation. Every significant difference is an opportunity for an election error or malfeasance to remain undetected. Images of the actual official Audit Report Forms and our data compiled from those reports can be viewed at: <http://www.CTElectionAudit.org>.

In recent years, we noted a continuing trend of improvement. Obviously that trend headed in the wrong direction this year as it also did in 2017 when it was 41%. We speculate that it is just human nature that when reports are not checked, over time there is less and less motivation and attention to accurately complete the audits and audit forms.

¹⁷ We present several tables in this report from the 2016, and 2014 audits. Even-year, State and Federal elections are more comparable than odd-year elections and the elections for Governor every four years are even more comparable.

¹⁸ Seven of these were in just one municipality, in the electronic audit completed at the Secretary of the State’s Office.

¹⁹ Some district reports had more than one error, counted only once in this total.

B.5 “Human Error” Should Not Be Accepted as an Explanation of Differences

	2018	2016	2014
Reports attributing differences in counts to “Human Error”	5 ²⁰	9	16
Rate of “Human Error” excuse in official reports	13%	24%	21%

Official Forms Listing “Human Error” as Cause of Differences - Table 2

Officials routinely attribute differences in counts to “Human Error.” Accepting that as the reason or excuse completely negates the purpose of the audit. Without reliable, accurate counting in the audit it is impossible to attribute errors to either machines or humans. Hand counts which are inaccurate do not imply that machine counts were accurate.

Registrars submitting and the SOTS Office accepting reports with “Human Error” as explanations are also contradictory to the published procedures, which state:

Small differences of one or two unexplained votes can often occur, but such differences should be verified by at least two counts. It is your responsibility to be thorough and comfortable that your counts of the ballots are accurate. If you are not confident in your counts then you should continue counting and recounting until you are satisfied that your hand count result is accurate.

Differences excused by “Human Error” should not be accepted by the SOTS Office nor by the University of Connecticut in their reporting of scanner accuracy. They should be investigated, determined, and reported accurately.

There were also illogical explanations of differences in the official audit report forms completed by officials:

²¹Chance of human error. Some ballots had check marks that we thought [were]counted, [but] maybe machine didn't count [But no questionables were reported on the form?]

Voter errors, bubbles not filled in properly. [But no questionables were reported on the form.]

Jams, [and] counted ballots read through again. [Data does not support that as a cause of more ballots counted by the scanner than in the audit, since vote counts match tape exactly and would be about four less if jammed ballots were read twice]

²⁰ Counts are significantly reduced, because the audit was reduced to 5% of districts from 10% of districts prior to 2016. Also, “Human Error” is not a reasonable explanation for electronic audits.

²¹ All observer and official comments in this report are edited for grammar and clarity. Our editorial comments are in brackets “[]”.

B.6 Multiple Chain-of-Custody Concerns

In several municipalities,²² observers expressed concerns with chain-of-custody and ballot security.

Question	% Yes:	2018	2016	2014
Do you have any concerns with the chain of custody?		22%	33%	35%
A single individual can access ballot containers in storage.		63% ²³	27%	46%

Municipalities Where Observers Noted Chain of Custody Concerns - Table 3

Single officials deliver ballots, single individuals were left with ballots, and ballots were left alone with observers. In other cases, numbered seals were improperly applied, were open, or were not used.

A larger concern is that, in many towns, single individuals may access the ballots undetected for extended periods of time. In 63% of towns surveyed in this audit, a single individual can access the ballot storage. In other towns, even though policies require more than one person to access ballots, there are few or no protections in place to prevent a single person from accessing the ballots.²⁴ This is a serious problem, since single individuals could change the ballots and be undetected. **At minimum it destroys the credibility of audits and elections.**

This year we changed/clarified our ‘individual access’ question such that we no longer accept an *honor system* as sufficient to prevent a single official from accessing ballots.

From observers:

Electronic Audit: Room 220 left with nobody with the ballots when I walked in. 3rd Floor left with one person from UConn. Later one UConn staffer walked off alone with one ballot to show others downstairs.

Electronic Audit: By the time ballots were resealed there was only one official in the room.

Only one supervisor was present during some of the breaks.

a) I was left alone with ballots. b) Ballots were put in boxes and left in blue bin [AKA Election on Wheel]s c) The bags were not used. The blue bin seal was recorded.

Ballot bag seems to be ordinary pink suitcase. Is it secure as a specially designated bag?

Regular duffel suitcases - how safe are the zippers from being compromised?

²² We did not observe every characteristic of every audit counting session that we attended. Some questions did not apply; in some audits observers could not fully observe audits that continued beyond one day, etc.

²³ Rates cannot be compared year to year, as the question was changed in 2018 to more accurately reflect physical security. Previous questions accepted two person security based only upon an *honor system*.

²⁴ Numbered tamper-evident seals are a useful protection, but without extensive procedures for their verification and other strong ballot protections, at best they provide a few seconds of protection from possible compromise. For examples, see:

<http://www.cs.princeton.edu/~appel/voting/SealsOnVotingMachines.pdf> and <http://www.cs.princeton.edu/~appel/voting/Johnston-AnalysisOfNJSeals.pdf>

C. Training and Attention to Counting Procedures Are Inadequate and Inconsistently Followed

C.1 Audit Organization and Counting Procedures:

Observers expressed concerns that many of the audits were not well organized. Observers noted the following concerns, which frequently occurred within the same municipalities:

Question	Manual Audit	%Yes:	2018	2016	2014
Do you have any concerns that the auditing was not well-organized?			33%	38%	31%
Do you have any concerns that the manual count was inaccurate?			21%	33%	41%
Do you have any concerns that the officially reported information is inaccurate?			14%	13%	26%
Do you have any concerns with the transparency/observability of the process?			0%	6%	6%

Municipalities Where Observers Noted Procedural Concerns Manual Audit - Table 4

We note that over time, concerns with the manual audit have been decreasing.

From observers:

There were no detailed instructions on how to count, record, and check the ballots.

Electronic Audit: The only training was by UConn staff about the technical aspects of using projector and scanner.

Instructions to the counters were minimal at best; therefore problems eventually arose.

Each team member was given a printout of the SOTS official audit procedures prior to beginning of counting, but they were not reviewed orally.

C.2 Need for Dual Verification

Observers noted that audit counting procedures requiring “two eyes,” i.e., dual verification of the count of each individual ballot, were frequently ignored. When a large number of ballots are counted by a single individual, miscounts can require tiring recounts and unnecessary investigation. When single individuals count hundreds of ballots or votes, errors are almost inevitable.

Question	Manual Audit	%Yes:	2018	2016	2014
Were the ballots counted by each team such that a second election official verified each count? [Two eyes]			60%	60%	65%
IF HASHMARKING USED: Did a second official observe that each vote was read accurately? [Two eyes]			64%	42%	56%
IF HASHMARKING USED: Did a second official make duplicate hashmarks observe that each hashmark was recorded accurately?			50%	36%	59%
IF STACKING/PILES USED: Was the vote counting process such that two election officials verified that each vote was stacked as marked? [Two eyes]			50%	83%	58%
IF STACKING/PILES USED: Were the stacks of ballots counted such that two election officials verified that each stack was counted accurately? [Two eyes]			50%	100%	56%

Municipalities Audited Manually Where Observers Noted Dual Verification Concerns - Table 5

Comparing only the manual count statistics over time, the use of double checking continues to vary.

From observers:

The teams counted slowly such that there was time for each person to observe the vote read or the hashmark recorded. However, with one particular team, frequently the person reading the vote did not observe the recording of the hashmark.

Three teams of four double-checked hashmaking, but the fourth team of two supervisors did not.

Question	Electronic Audit	%Yes:	2018	2017
	While you were observing, in your judgment, did two local election officials focus their attention on each ballot?		50%	88%
	While you were observing, in your judgment, did local officials have enough time to confirm that the Audit Station correctly classified each bubble on a ballot for 90% of the ballots?		50%	13%
	While you were observing, in your judgment, did local officials have enough time to confirm that the Audit Station correctly counted each vote on each ballot, in the columns on the right for 90% of the ballots?		0 ²⁵ %	0%

Electronic Audit Concerns - Table 6

Electronic Audit: The system prevented the observation of actual ballots being counted. Observers judged that in about half the audits, most ballot images displayed were observed by two officials. Yet where two individuals observed ballot images, they could not actually have verified the counts on the right in the one to three seconds the ballot images were displayed - especially since, as in 2017, all count results were not displayed on the screen because of Audit Station limitations and the large number of candidates and races.

For complete details on the shortcomings of Connecticut’s electronic audits and the alternative of Electronically-Assisted Post-Election Audits, see Appendix B.

From observers:

One district had many crumpled ballots. Did not have significant problems reading them. Great improvement over last year!

²⁵ In both 2018 and 2017 several of the contest results did not fit on the screen.

C.3 The Importance of Blind Counting

Blind counting is a method of counting without pre-conceived knowledge of the expected outcome. When counting teams know the machine totals or know the differences between their counts and the machine totals, there is a natural human tendency to make the hand count match the machine count. This risks taking shortcuts and seeking unjustified explanations for discrepancies which, in turn, lower the credibility of the process and undermines confidence in the audit results.

Question	Manual Audit	%Yes:	2018	2016	2014
Were counters kept unaware of the election totals for the ballots or races they were counting until counting and recounting each race was finally complete?			73%	65%	72%
If initial counts were off, were counters kept unaware of the exact and approximate level of difference?			38%	38%	49%

Municipalities Where Observers Noted Blind Counting Concerns - Table 7

In November 2018 when manual counts were off, 62% of the time counters were informed of the exact or approximate number of discrepancies. 27% percent of the time the scanner counts available. This wide-spread lack of blind counting greatly reduces the credibility of the audit.

From observers:

The counters in teams A and B were not aware of the tabulator totals however, they were all let go before the batches were totaled and the race totals compared to those on the machine tape. That left the registrars to finish the job and resolve any discrepancies so from that point on it was not blind counted.

Counters were kept unaware of the tabulator total throughout the initial counting; however, they were informed of the level of difference on occasions that the first count did not match the tabulator.

Once the vote count batches were tallied, the moderator looked at the machine tape and said how many they were off. But did not change the count. Simply added the questionables and called it a day.

After the initial count they discussed which counts were off and by how much.

Electronic Audit: One advantage of the Electronic Audit is that knowledge of results by local election officials cannot change the machine results. Yet we note that without a manual audit of actual ballots against the Audit Station results, there is no way to confirm that the reported electronic audit results accurately reflect the cast ballot and vote totals.

C.4 Lack of Written Electronic Auditing Procedures

Electronic Audit: There were no written procedures for the Electronic Audit. There was some training by University of Connecticut staff, who also assisted the election officials and answered their questions.

The law passed in 2015 authorized Electronic Audits:

...provided (1) the Secretary of the State prescribes specifications for (A) the testing, set-up and operation of such equipment, and (B) the training of election officials in the use of such equipment...

Without written procedures, it is difficult to determine if the Secretary of the State in fact authorized the procedures employed and impossible to assess if authorized procedures, if any, were uniformly followed.

Official Audit Report Data Analysis

After the local counting sessions, officials complete and submit the Official Audit Report Forms to the SOTS. Where possible, observers collect copies of the forms at the counting session. The Citizen Audit obtained the rest of the official forms by Freedom of Information Act request of registrars.

The statistics in this section were produced from the official forms. The images of those forms and our detailed data compiled from those forms are available at <http://CTElectionAudit.org>.

As stated earlier: Without complete reports we cannot analyze and verify the results of the audit, or provide any level of confidence in the optical scanners in those districts, nor in the officials charged with supervising and performing the audits.

Ballot Count Accuracy

Any unexplained difference greater than or approaching the automatic canvass trigger of 0.5% should be a concern.²⁶

Unlike vote counts (discussed later) there can be no “questionable” ballot counts. Any difference in ballot counts must be due to optical scanner or human error, or both. Human errors²⁷ are not limited to audit hand counts. Scanners or ballots could have been mishandled and incorrectly counted on Election Day, read through the scanner twice, misplaced on Election Day, or subsequently misplaced.

²⁶ In state-wide contests the margin is much less. The canvass trigger is 2000 votes, which in a presidential election is approximately 0.12%.

²⁷ Ultimately, almost all errors are human errors in counting, software programming, election setup, or failing to follow procedures. Exceptions would include hardware errors or fraud.

Machine Totals (Tape)	Audit Count	Difference	Percent Difference
2424	2420	4	0.2 %
2704	2703	1	0.0 %
2614	2615	-1	0.0 %
1901	1902	-1	-0.1 %

All Ballot Count Differences in the Audit - Table 8

This table does not include the 11 districts for which reports did not include ballot count reports for both columns.

In these districts it is unlikely that a significant number, if any, of write-in ballots were fed twice into the scanner. This aspect of the elections are likely being conducted better, perhaps because of our efforts in identifying the problem in earlier audits. We note that such continuous improvement is one of the benefits of conducting audits.

We conclude that the scanners in the election and manual counters in the audit were both at least generally accurate in counting ballots in those municipalities which provided complete reports.

Most likely some of those incomplete reports are due to lack of attention to detail and a lack of motivation by officials, yet we have no basis to conclude that some of them do not hide errors or intentional fraud. The integrity and value of the audit depends on complete, accurate work and oversight.

Vote Count Accuracy

Col C Machine Totals (Tape)	Col D Undisputed Vote Totals	Col E Questionable	Col F Total Hand Count (D + E)	Difference (F - D or E - D)	Percent Difference
1440	1493	8	1501	-53	-3.7 %
721	769	4	773	-48	-6.7 %
1211	1253	10	1263	-42	-3.5 %
728	750	6	756	-22	-3.0 %
1212	1228	8	1236	-16	-1.3 %
1361	1332	13	1345	16	1.2 %
1318	1330	1	1331	-12	-0.9 %
1639	1612	17	1629	10	0.6 %
1064	1074	0	1074	-10	-0.9 %
2059	2039	13	2052	7	0.3 %
1150	1143	2	1145	5	0.4 %
1087	1092	0	1092	-5	-0.5 %
1332	1316	11	1327	5	0.4 %
1263	1267	0	1267	-4	-0.3 %
2499	2440	55	2495	4	0.2 %
1219	1203	12	1215	4	0.3 %
818	814	0	814	4	0.5 %
1193	1179	10	1189	4	0.3 %

Candidate Count Differences Greater than 3 in the Audit- Table 9

The table above presents, by number and percentage, vote differences greater than three between hand-counted votes and machine-counted votes, after all ballots with questionable votes are considered and all votes for cross-endorsed candidates are totaled.

Based on observer reports, **we do not believe that all of the hand counts of votes are accurate. Yet there is no way to judge the accuracy of the optical scanners in these districts, leaving little to provide trust in the election results and confidence in officials' abilities to perform their duties.**

We note that the highest five count differences, from -53 to -16, were all from one district in one town.. The registrars from that district provided the following with their audit report which gives some insights into the challenges faced by a number of registrars in smaller towns:

11-26-18

There have been a few issues in this office; I have completed 6 elections this year and one completely on my own. Two extra budget referendums that the selectman are blaming me that the budget is out of whack, when we usually have four a year elections a year.

Since the two controlling Republican Registrars have resigned, we have a new registrar in the mix and now I get a chance to learn the whole job.

This election the selectmen only allowed enough money \$3,500 and told me I can hire five workers. I hired nine and I could have used more workers to handle the volume. I told the selectmen that I was splitting the checkers book because we have 2000 ballots. They told me the voters will wait in line. We split the book, anyways. Out of the nine, two people were trained in the past. The selectmen will not pay for the training in the CT general Statues, or allow me to implement the training.

That leaves me to believe the reason why the numbers are not correct We had spoiled ballots and handwritten test ballots that ended getting mixed up together with machine counted ballots. There were 25 spoiled ballots taken off of the moderator's returns, with no envelopes to separate them, that is why we believe they are mixed in.

The selectmen are also complaining about the 5:15am start in the morning, I have showed them the General Statues, but they seem oblivious.

November 6th 2018, the internet was intermitting since the day before; we had the State IT man, Frontier and the American disability for election violation. The ballot box jammed a few times, had to open and the ballot box was full. 127 paper ballots were not counted in this audit. We also found "over voted ballots were in the bag from tabulator. The polling day, Election Day moderator says there were no over votes. Either this is the test ballots or the machine?

The following tables show the number of candidate counts, with varying count differences between the optical scanners and the hand counts, after considering that so called questionable votes may or may not have been counted by the scanners:²⁸

Candidate Vote Count Difference Range	Number of Differences in Range	% of All Candidate Counts 2018	2016	2014
0	135	64.6%	90.1%	66.2%
1-3	28	15.5%	8.5%	26.3%
4-6	8	4.4%	1.2%	4.1%
7-9	1	0.6%	0.1	1.2%
>9	9	5.0%	0.1	2.2%
Average Difference in Votes:		1.76	0.23	1.86

Summary of Vote Count Differences-Table 10

Once again, without credible audit reports, the data in this table are of little use in evaluating accuracy of the scanners or comparing results to earlier elections and primaries.

²⁸ The maximum benefit of any doubt is given to the scanners, recognizing a difference only when a scanner counted more votes than the sum of questionable votes and undisputed votes, or when a scanner counted less than the number of undisputed votes.

“Questionable” Votes

Observations and comments from election officials indicate confusion about classifying “undisputed ballots” and about counting “questionable votes.” An undisputed ballot is a ballot with no apparent problem or questionable votes on it. A questionable vote is a mark on a ballot that may not have been read properly by the optical scanner. Based on observations, counting teams and registrars demonstrated a variety of interpretations of what constitutes “undisputed” and “ballots with questionable votes.” Audit statistics confirm these observations.

Col C Machine Totals (Tape)	Col D Undisputed Vote Totals	Col E Questionable	Col F Total Hand Count (D + E)	Difference (F-D or E-D)	Percent Questionable
2499	2440	55	2495	4	2.2 %
2204	2153	49	2202	2	2.2 %
2006	1958	48	2006	0	2.4 %
891	853	39	892	0	4.4 %
1140	1106	34	1140	0	3.0 %
756	723	33	756	0	4.4 %
802	770	32	802	0	4.0 %
869	840	29	869	0	3.3 %
1041	1014	27	1041	0	2.6 %
2077	2053	26	2079	0	1.3 %
1886	1866	25	1891	0	1.3 %
1070	1053	20	1073	0	1.9 %
1563	1542	20	1562	1	1.3 %
963	950	18	968	0	1.9 %
1639	1612	17	1629	10	1.0 %
791	778	15	793	0	1.9 %
1523	1508	15	1523	0	1.0 %
396	384	14	398	0	3.5 %
1361	1332	13	1345	16	1.0 %
1600	1591	13	1604	0	0.8 %
1093	1079	13	1092	1	1.2 %
2059	2039	13	2052	7	0.6 %
772	760	12	772	0	1.6 %
1550	1536	12	1548	2	0.8 %

Col C Machine Totals (Tape)	Col D Undisputed Vote Totals	Col E Questionable	Col F Total Hand Count (D + E)	Difference (F-D or E-D)	Percent Questionable
1219	1203	12	1215	4	1.0 %
508	496	12	508	0	2.4 %
530	518	12	530	0	2.3 %
1332	1316	11	1327	5	0.8 %
311	300	11	311	0	3.5 %
983	971	11	982	1	1.1 %
494	492	11	503	0	2.2 %
1912	1909	10	1919	0	0.5 %
1193	1179	10	1189	4	0.8 %
1211	1253	10	1263	-42	0.8 %
466	459	10	469	0	2.1 %
1037	1027	10	1037	0	1.0 %
525	517	9	526	0	1.7 %
545	542	9	551	0	1.7 %
374	365	9	374	0	2.4 %
1765	1765	8	1773	0	0.5 %
1440	1493	8	1501	-53	0.6 %
1212	1228	8	1236	-16	0.7 %
1896	1890	8	1898	0	0.4 %
728	750	6	756	-22	0.8 %
1926	1923	6	1929	0	0.3 %
1213	1210	5	1215	0	0.4 %
11	6	5	11	0	45.5 %
1397	1394	5	1399	0	0.4 %
1371	1366	5	1371	0	0.4 %
678	674	5	679	0	0.7 %
1214	1211	5	1216	0	0.4 %
434	432	4	436	0	0.9 %
1226	1224	4	1228	0	0.3 %
217	214	4	218	0	1.8 %
1203	1203	4	1207	0	0.3 %

Col C Machine Totals (Tape)	Col D Undisputed Vote Totals	Col E Questionable	Col F Total Hand Count (D + E)	Difference (F-D or E-D)	Percent Questionable
1123	1119	4	1123	0	0.4 %
1401	1397	4	1401	0	0.3 %
985	981	4	985	0	0.4 %
632	631	4	635	0	0.6 %
721	769	4	773	-48	0.6 %
1549	1546	4	1550	0	0.3 %
418	414	4	418	0	1.0 %

Questionable Votes Over 3 - Table 12

	2018	2016	2014
Overall % Questionables	0.59%	0.31%	1.37%
Counts over 12 Questionables	23 ²⁹	11	45

Trend in Questionable Votes -Table 13

²⁹ Starting in 2016 the audit was 5% of districts, so compared to 10% audits in previous years, such as 2014, the count would likely have been about 46.

About the Citizen Audit

The Connecticut Citizen Election Audit ("Citizen Audit")

Our purpose is to increase integrity and confidence in elections, for the benefit of the voters of Connecticut. We provide independent audit observations, independent audits, and independent reports focusing on the integrity of elections and election administration. We are non-partisan and strive for objectivity and integrity in our work. The Citizen Audit has observed and reported on every general primary and election since the statewide implementation of optical scan voting in Connecticut in 2007.

EXECUTIVE DIRECTOR/BOARD

Significant decisions and reports are approved by majority vote of the Board. Members of the Board are experienced volunteer observers, with diverse skills, political affiliation, and geographic representation. Current members of the Board are:

- Luther Weeks, Executive Director
- Kathleen Burgweger, Jean de Smet, Aaron Goode, Julie Lewin, Tessa Marquis, Mary Rydingsward, Jan-Maya Schold, Douglas Sutherland, and Victoria Usher

CITIZEN-POWERED

The Citizen Audit is an entirely volunteer, citizen-powered organization. We appreciate every Citizen Audit volunteer. Without dozens of volunteers spending days and hours on each election objectively observing, auditing, and reporting, the promise of publicly verifiable elections could not be pursued and will never be attained.

Acknowledgments

Coordination for this project by Luther Weeks with report editing by Julie Lewin.

We appreciate the responsive and cordial replies to our requests for information from registrars of voters across Connecticut.

Contact/Additional Information

Luther Weeks, Executive Director, [Luther 'at' CTElectionAudit.org](mailto:Luther@CTElectionAudit.org), 860-918-2115. All reports and additional supporting data are available at <http://www.CTElectionAudit.org>.

Appendix A. Observation Report Statistics

Percentage answer Yes:	Manual Nov 2018	Manual Nov 2016	Elec Nov 2018	Elec Nov ³⁰ 2016
Did the supervisor review the audit procedures with the counting team?	77%	71%	50%	17%
Did the supervisor clarify procedures for everyone before beginning to count ballots?	86%	86%	0%	67%
Did the supervisor explain that two individuals should observe each ballot on the screen and verify that bubbles are correctly classified by the Audit Station?			43%	
Did the supervisor explain that two individuals should verify the counts on the right of the screen match the bubbles on each ballot?			0%	
Did the supervisor explain the ballot and vote counting procedures in detail with the counting teams?	77%	71%		
Were the ballots delivered to the site by at least two individuals?	100%	100%	100%	100%
Were you permitted to observe that the ballot seals were not tampered with?	100%	93%	100%	100%
Were the ballot seals intact?	100%	100%	100%	100%
Was there a separate envelope for hand counted ballots in the ballot container?	50%		100%	

³⁰ The questions asked for the Electronic audit have evolved since the first electronic audit in 2016 so there are many differences between 2018 and 2016. why above below some columns or parts and questions ital--not consistent other places

Was there a separate envelope for write-in ballots in the ballot container?	33%		75%	
Was the total number of ballots counted before the votes were counted for races?	80%	97%		
Were the ballots counted by each team such that a 2nd official verified each count?	60%	60%		
If multiple teams ballots, was the totaling independently verified by a 2nd official?	73%	79%		
If you concentrated could you confirm that the Audit Station correctly classified each bubble on each ballot?			25%	
If you concentrated could you confirm that the Audit Station correctly counted each vote on each ballot, in the columns on the right of the screen?			0%	
While you were observing, in your judgement, did two local election officials focus their attention on each ballot?			50%	
While you were observing, did one of the officials ask to slow down or to go back to review previous ballots?			88%	
While you were observing, in your judgment, did local officials have enough time to confirm that the Audit Station correctly classified each bubble on a ballot for 90% of the ballots?			50%	
While you were observing, in your judgment, did local officials have enough time to confirm that the Audit Station correctly counted each vote on each ballot, in the columns on the right for 90% of the ballots?			0%	
If hashmarking was used: Did a 2nd official observe that each vote was read accurately?	64%	42%		
If hashmarking was used: Did a 2nd official make duplicate hashmarks OR observe that each hashmark was recorded accurately	50%	36%		

If sorting and stacking was used: Was the vote counting such that a 2nd official verified that each vote was stacked as marked?	50%	83%		
If sorting and stacking was used: Were the stacks of ballots counted such that a 2nd official verified that each stack was counted accurately?	50%	100%		
Did the Audit Station have problems reading ballots on colored/tinted stock?			0%	
Did the Audit Station have problems reading folded or creased ballots?			33%	
Did the Audit Station have problems reading absentee or Election Day Registration ballots?			0%	
Did the Audit Station have equipment/hardware problems with the scanner, computer, or projector?			33%	
Did the Audit Station have problems that required reprogramming/relearning the Audit Station district ballot format?			17%	
Did the Audit Station have other software problems with the scanner or computer?			17%	
If hashmarking was used: Were you permitted to observe that each vote was read Accurately?	100%	100%		
If hashmarking was used: Were you permitted to observe that each hashmark was recorded accurately?	100%	100%		
If sorting and stacking was used: Were you permitted to observe that each vote was placed in the correct stack?	100%	100%		

If sorting and stacking was used: Were you permitted to see that the count of ballots in piles for each race was accurate?	100%	100%		
Were counters kept unaware of the tabulator totals for the ballots or races they were counting until counting and recounting each race was finally complete?	73%	65%		100%
If initial counts were off, were counters kept unaware of the exact and approximate level of differences? I.e. No indication was given of the amount a count was off.	38%	38%		100%
Were questionable votes on ballots ruled upon separately, vote by vote, rather than all votes on such ballots all classified as questionable, when some were not questionable?	86%	82%		86%
Were questionable votes ruled on prior to the tallying of votes for each race AND counts not adjusted based on knowledge of the results of the differences in counts for each race?	92%	82%		100%
Did officials find a match between machine counts and manual counts at the end of the initial count of each race?	21%	13%		71%
Did officials try to resolve mismatched counts by counting again?	58%	88%		50%
Did officials try to resolve mismatched counts by changing counting teams?	8%	60%		
Did officials resolve mismatched counts by the end of the audit?	55%	31%		
Were you able to observe that hashmarks and totals of batches for each team were tallied accurately?	100%	67%		
Were you able to observe that the number of ballots from multiple teams and batches were totaled accurately?	85%	80%		

Were you able to observe that the number of votes from multiple teams and batches were totaled accurately?	100%	71%		
Did elections officials record counts, including unresolved discrepancies, if any, on the Official Audit Report Form by the end of the audit?	92%	81%	75%	
Were you given an opportunity to have/make a copy of the Audit Report Form?	92%	75%	100%	0%
Did the ballot counts on the optical scanner tape(s) printed on election night match the tabulator tape ballot count transcribed on the official audit report form(s)?	91%	64%	80%	67%
Did the race counts on the optical scanner tape(s) printed on election night match the tabulator tape counts transcribed to Column 'C' on the official audit report form(s)?	90%	50%	100%	67%
Were the ballots under the observation of at least two officials at all times?	62%	88%	57%	71%
Could you confirm that the ballots were returned to their proper containers?	92%	94%	100%	100%
Were the ballot containers resealed?	92%	100%	100%	43%
Were seal numbers recorded correctly on the official report forms?	100%	100%	100%	75%
Do you have concerns with the way the room was laid out?	7%	24%		
Do you have concerns with the way the room was laid out?			0%	14%

Do you have concerns that the audit was not well-organized?	33%	29%		
Do you have any concerns that the audit was not well-organized?			57%	0%
Do you have concerns with the counting and totaling process?	67%	12%		
Do you have any concerns with the counting and totaling process?			0%	100%
Do you have any concerns that the counts were inaccurate?	21%	41%		
Do you have any concerns that the counts were inaccurate?			0%	0%
Do you have any concerns that the officially reported information is inaccurate?	15%	13%		
Do you have any concerns that the officially reported information is inaccurate?			0%	14%
Do you have any concerns with the transparency/observability of the process?	0%	6%		
Do you have any concerns with the transparency/observability of the process?			0%	100%
Do you have any concerns with the chain-of-custody?	20%	18%		
Do you have any concerns with the chain-of-custody?			25%	71%
How many people are required to access ballot storage? Answer: One	42%	31%	100%	17%

<p>Were there any memory card problems in pre-election testing or on Election Day?</p>	<p>7%</p>	<p>29%</p>	<p>0%</p>	<p>17%</p>
<p>Were there any problems with the IVS voting system?</p>	<p>0%</p>	<p>13%</p>	<p>0%</p>	<p>0%</p>
<p>Were there any other significant events, such as ballot problems, scanner problems, or occurrences before, during, or after Election Day?</p>	<p>47%</p>	<p>27%</p>	<p>29%</p>	<p>17%</p>

Observation Report Statistics -Table 14

Appendix B. Electronic Audit Details

This appendix presents in detail the electronic audit methods employed by election officials and a better alternative. It is adapted from the November 2016 Post-Election Audit Report.

The Unverifiable Methods Used for the Electronic Audits

The electronic audits were conducted using the UConn Audit Station. UConn developed the Audit Station over that last few years by the UConn Voter Center.³¹ The audits generally followed the methods and claims made in a 2013 paper authored by UConn and the SOTS Office:³²

- Ballots are rescanned, analyzed, and recounted by the Audit Station in batches.
- Simultaneously projected on a screen are the scanner ballot images, the system's interpretation of marks on the image, and how the votes were counted for each image are
- Two local election officials view each image, check the interpretation, and check the votes counted. They may override the system's interpretation of each image. On the projected ballot images, bubbles interpreted and counted by the system as votes or as possible (questionable) votes are over-marked by shades of light green and light red.
- At the end of counting a voting district, a summary report of the totals of the counts for the district for each contest is printed by the Audit Station, this report is used to create the Official Audit Report.

The Audit Station is creative in its method of displaying images for verification and adjudication by officials. Unfortunately, that creativity adds nothing to the public verifiability of the audit, while requiring unnecessary, tedious, and challenging work for local officials. Leading scientists in the field of post-election auditing have explained why such audits fall short:³³

- **Like all electronic and computer equipment, the scanner is subject to error and fraud via hacking:**
 - **There is no guarantee that the images displayed represent an accurate rendition of the actual ballots.**
 - **There is no guarantee that counts displayed for each image are faithfully added to the totals printed at the end of the district audit.**

³¹ University of Connecticut, School of Engineering, Center for Voting Technology Research: <https://voter.engr.uconn.edu/voter/>

³² <https://voter.engr.uconn.edu/voter/2013/06/computer-assisted-post-election-audits/>

³³ statistics.berkeley.edu/~stark/Preprints/retabNotAudit13.pdf

- It has not been established that individual officials can and will faithfully review hundreds or thousands of individual images, the system's interpretation, and the system's associated vote counts.

Note: Such claims need to be verified in theory and in practice. The officials reviewing images and counts for hours are likely to believe in the accuracy of the AccuVoteOS and the Audit Station. At minimum, it should be proven that individuals with such beliefs could and would reliably detect differences less than 0.5% (the legal recount threshold) affecting a single candidate in an election with many races, while reviewing thousands of ballots for a voting district.

- Our observation indicated that faithful evaluation of images was not possible in the November audit. Under the control of officials, images and counts were displayed for one to three seconds.
 - In six of seven teams of officials, two officials did not faithfully watch the projected display of all ballots. As ballots were displayed under the control of one official, the other official at times looked away, stood and turned away to prepare the next batch of ballots for scanning, or were reading and typing on their cell phones.
 - At the rate of one to three seconds, we believe it would be difficult for officials to determine if the Audit Station had marked a bubble that was not filled in.
 - At the rate of one to three seconds, we believe it would be difficult for officials to notice if the Audit Station missed a mark that was filled in elsewhere on the ballot.
 - At the rate of one to three seconds, we believe it was not possible to verify that all bubbles highlighted were correctly counted and that those not highlighted were not counted.

In 2016, at about three seconds, observers found it barely possible to verify that the race for President was accurately marked and counted. Doing that for even a handful of votes in succession took extreme concentration – it is not reasonable to think that officials could maintain the necessary concentration for dozens of ballots, let alone thousands!

- The November 2016 election ballot, like every even year election, was a relatively simple 8.5" x 11" single-sided ballot, with five vote-for-one races. November Municipal election ballots range from 11 columns with a couple of vote-for-multiple races, to back-to-back 8.5" x 17" pages with many large vote-for-multiple races. The UConn researchers explained that in those cases both sides of the ballots and all the candidate counts would appear on a single projected screen.
- In November 2017 and November 2018 there were larger, multi-page ballots. The results on the right hand of the display did not show results of all the races and candidates being audited. Thus those counts could not have been verified by the officials, even if the ballot were displayed for an extended period.

A Simpler Way, a Better Way, a Publicly Verifiable Way

Electronically-Assisted Manual Post-Election Audits

There is a way to get the efficiency and accuracy benefits of electronic auditing with the confidence of public verifiability. It is to manually audit the electronic counting and to verify both the interpretations of ballots and the totaling of results. The sound science of Evidence Based Elections³⁴ points the way to performing such a manual audit of an electronic audit:

- As each ballot is interpreted by the system, a "Cast Vote Record" (CVR) is created that is associated with the ballot. The Cast Vote Record is a database record that lists the interpretation of each bubble as voted, possibly voted, or not voted.
- At the completion of the scanning and interpretation of a district, all the CVRs are exported in a standard computer readable format (such as .csv) and made available to a reasonable number of observers on a standard media (such as CDs or thumb drives). The file of CVRs can then be independently counted by observers to assure that the sum of the CVRs equals the totals printed by the Audit Station³⁵. Such counting could use software trusted by observers and, if necessary, verified by a hand count of each CVR.
- A relatively small number of CVRs are randomly selected and compared to the associated ballots. Any differences between the CVRs and the actual ballots as interpreted by officials must be recorded.
- Since ballots are in order and in batches, it is relatively easy to locate each randomly selected ballot. If the system printed out an easily read page for each randomly selected ballot with the batch number, ballot number in the batch, and the bubble interpretations for the CVRs, it would be relatively easy for officials to locate ballots and compare them to the printed CVRs. It could be done openly such that observers could verify that the printed CVRs matched the exported CVRs, and that the officials correctly compared the CVRs to the ballots and correctly recorded any differences.
- Any differences between the CVRs and the selected ballots are a cause for concern with the accuracy of the Audit Station and may be cause to question the accuracy of the audit. With a well-designed and functioning system, differences, if any, should be rare.

³⁴ <http://www.stat.berkeley.edu/~stark/Preprints/evidenceVote12.pdf>

³⁵ A quick survey of election officials and advocates indicates that CVRs for entire elections or audits are regularly provided to requesters in the states of AZ, NY, CO and SC. In SC, they are published online.

Appendix C. Methodology

The following activities were performed in the course of the project to organize observers and collect and analyze data for the report. They are in approximate time sequence.

- Just prior to the election, we emailed past observers an invitation to sign up on the web to observe local counting sessions specifying the dates they were available to observe and the distance they were willing to travel to an observation. Observers were encouraged to provide at least three availability dates and volunteer to travel at least 35 miles. Observers were also instructed to sign up for a conference call training session and were emailed training materials, including access to video training.
- Our observers attended and participated in the random drawing of districts to be audited. After the drawing, the SOTS Office issued a press release with the list of selected districts and selected alternate districts.
- Municipalities and districts in the drawing were recorded in our Audit Database. We sent emails, made calls, and left voice mails with registrars of voters of the selected municipalities, to learn the dates and times of their local audit counting sessions.
- Observers participated in conference call and web video trainings in the days prior to the start date of the local audit counting sessions, which began 15 days after the election.
- Starting shortly after the drawing and extending through the audit period, as the audit dates were obtained from local officials, observers were matched and tentatively scheduled for upcoming local audit counting sessions. Some audit dates were forwarded to us from the SOTS Office as that office was informed of dates by local officials. Often schedule changes were made when observers were unable to observe a tentatively scheduled audit. Some observers signed up for additional dates. Others volunteered to observe additional audits.
- Observers attended audits, completed paper Observation Report Forms,³⁶ and, where possible, collected draft or final copies of the official SOTS Audit Report. Copies of Audit Report Forms were mailed or scanned by observers to us for early data entry. Observers submitted most Observation Report Forms, using the LimeSurvey tool, while some mailed or emailed paper forms for data entry by the Citizen Audit.
- Three Citizen Audit volunteers observed and reported on the electronic audits which were held in the at the Secretary's offices at 30 Trinity Street, Harford. A newly revised Electronic Observation Report Form was used.
- Observation Report Forms for counting sessions not observed or those not obtained from observed counting sessions, the Citizen Audit obtained the from through FOI requests to the registrars.
- We completed data entry of all Official Audit Report Forms based on the official data.
- Data and Observation Reports were analyzed and compared with past results, and this report was created.

³⁶ <http://ctelectionaudit.org/ObservationReportForm.pdf>