



VoTeR Center

UConn Voting Technology Research Center

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Statistical Analysis of the Post Election Audit Data 2009 November Elections

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Abstract

This report presents the analysis of the post-election audit returns performed in the State of Connecticut following the November 2009 election. The audits involved the randomly selected 10% of the districts. The initial review of audit reports prepared by the towns revealed a number of returns with substantially high unexplained differences between hand and machine counts. Additionally discrepancies were originally reported in the cases of cross-party endorsed candidates, i.e., candidates whose names appear twice on the ballot because they are endorsed by two parties. However, improvements were noted in the accuracy of hand counting the votes of cross-party endorsed candidates. (The analysis of the data for cross-party endorsed candidates is presented separately.) Follow up investigations were conducted by the Office of the Secretary of the State (SOTS) to determine the cause of discrepancies. This resulted in a revision of the audit data for the districts that were the subject of the follow up. This report presents the analysis of the audit returns in three parts: (i) the analysis of the original audit records that did not involve cross-party endorsed candidates, (ii) the analysis of the audit records for cross-party endorsed candidates, including the returns that were revised based on the SOTS Office follow up, and (iii) the analysis of the non-cross party endorsed records that were revised based on the SOTS Office follow up. We note that in no case discrepancies could be attributed to inaccurate machine counts. The summary of the report is found on page 2 of this report.

This analysis was performed on request of the Office of the Secretary of the State.

Summary

The University of Connecticut Center for Voting Technology Research (VoTeR) received the data gathered in the post-election audit in the State of Connecticut following the November 2009 election. The audits involved the randomly selected 10% of the districts and the audit returns were conveyed by the Office of the Secretary of the State (SOTS) to the Center on December 8th and 18th of 2009. The original audit data contained 776 records, where each record represents information about a given candidate: date, district, machine seal number, office, candidate, machine counted total, hand counted total of the votes considered unquestionable by the auditors, hand counted total of the votes considered questionable by the auditors, and the hand counted total, that is, the sum of undisputed and questionable ballots.

The VoTeR Center's initial review of audit reports prepared by the towns revealed a number of returns with unexplained differences between hand and machine counts and also revealed discrepancies in cases of cross-party endorsed candidates (i.e., candidates whose names appear twice on the ballot because they are endorsed by two parties). As a result, the SOTS Office performed additional information-gathering and investigation and, in some cases, conducted independent hand-counting of ballots. The resulting information was conveyed to the VoTeR Center on February 9th and 24th of 2010. Further information gathering was conducted by the SOTS Office to identify the cause of the moderately large discrepancies, and to identify the cause of discrepancies for cross-party endorsed candidates. The resulting information was conveyed to the VoTeR Center on March 19, 2009.

This report presents the results in three parts: (i) the analysis of the original audit records that did not involve cross-party endorsed candidates, (ii) the analysis of the audit records for cross-party endorsed candidates, and (iii) the analysis of the records that were revised based on the SOTS Office follow up. The analysis does not include 6 records (0.8%) that were found to be incomplete. In more detail, part (i) deals with 447 (57.6%) records that were complete and contained no obvious audit errors. All of these 447 records (100%) show a discrepancy of 3 votes or lower, with 431 records (96.4%) showing discrepancy of 0 or 1 vote between the machine counts and audit hand counts. The largest discrepancy is a single case of 3. Part (ii) deals with 52 records (6.7%) involving cross-party endorsed candidates. As a result of the second SOTS Office follow up, it was confirmed that large discrepancies reported for the cross-party endorsed candidates were due to the fact that the auditors did not correctly assign hand counted votes to the specific party endorsements. We present the analysis of the original 32 (4.1%) cross-party endorsed records, and 20 (2.6%) records that were revised by the SOTS Office. Part (iii) deals with the revised audit returns gathered by the SOTS Office.

The main conclusion in this report is that for all cases where non-trivial discrepancies were originally reported, it was determined that hand counting errors or vote misallocation were the causes. No discrepancies in these cases were reported to be attributable to incorrect machine tabulation. For the original data where no follow up investigation was performed, the discrepancies were small; in particular, the average reported discrepancy is much lower than the number of the votes that were determined to be questionable.

For the cross party endorsement, it is important for the auditors to perform hand counting of the votes that precisely documents for which party endorsement the votes were cast, and to note all cases where more than one bubble was marked for the same candidate. The SOTS follow up confirmed that large discrepancies were the result of mistakes in hand counting. Therefore, the auditors should be better trained to follow the correct process of hand count audit.

The analysis does not include 6 records (0.8% of 776) that were found to be incomplete, unusable, or obviously incorrect. This is an improvement relative to the November 2007 and November 2008 elections, where we reported 18% and 3.2% of the records that were unusable.

This analysis was performed on request of the Office of the Secretary of the State.

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Preface

The University of Connecticut Center for Voting Technology Research (VoTeR) received the data gathered in the post-election audit in the State of Connecticut following the November 2009 election. The audits of the randomly selected 10% of the districts were conducted in November of 2009, and the returns were conveyed by the Office of the Secretary of the State to the Center on December 8th and 18th of 2009. For the definition of the audit see Connecticut Public Act 07-194 AN ACT CONCERNING THE INTEGRITY AND SECURITY OF THE VOTING PROCESS, approved July 5, 2007. For the instructions on conducting the audit, see Audit Procedures Optical Scan Voting Equipment, Office of the Secretary of the State, November 2007.

In accordance with the Act, the SOTS office conveys the report documenting hand audit returns to the VoTeR Center, and the Center is in turn required to report on its analysis to the SOTS Office:

“(d)...Such report shall be filed with the Secretary of the State who shall immediately forward such report to The University of Connecticut for analysis. The University of Connecticut shall file a written report with the Secretary of the State regarding such analysis that describes any discrepancies identified. After receipt of such report, the Secretary of the State shall file such report with the State Elections Enforcement Commission.”

The following subsections of the audit law are also highly relevant:

“(i) If the audit officials are unable to reconcile the manual count with the electronic vote tabulation and discrepancies, the Secretary of the State shall conduct such further investigation of the voting machine or tabulator malfunction as may be necessary for the purpose of reviewing whether or not to decertify the voting machine or machines in question or to order the voting machine to be examined and recertified....”

(o) As used in this section, “discrepancy” means any difference in vote totals between machine and manual counts in a voting district that exceeds one-half of one percent of the lesser amount of the vote totals between machine and manual counts where such differences cannot be resolved through an accounting of ballots...”

After a preliminary review of the audit reports, the VoTeR Center identified a number of towns with what appeared to be unacceptably high and unexplained difference between hand-counted and machine-counted totals and the VoTeR Center identified similar discrepancies connected to cross-endorsed candidates. The SOTS Office conducted follow-up investigations, including sending teams to independently hand-count ballots. This report presents the analysis of the November 2009 post-election audit data, including revisions based on the outcomes of the SOTS investigations.

The Center is continuing to work with the Office of the Secretary of the State in order to refine the criteria that will be used in the future elections audits to identify audit returns that will cause additional audits and/or examination of equipment to be requested.

This analysis was performed on request of the Office of the Secretary of the State.

1 Overview of the Analysis

This report contains several statistical analyses of the audit returns. The VoTeR Center received 776 records on December 8th and 18th of 2009. On February 9th and 24th of 2010 VoTeR Center received revised records for four towns which showed the highest discrepancies. Further information gathering was conducted by the SOTS Office to identify the cause of the moderately large discrepancies. The resulting information was conveyed to the VoTeR Center on March 19, 2009.

The statistical analysis in this report deals with the 499 records that are sufficiently complete to perform the analysis based on the original audit returns. Separately, we discuss the 271 records that were the subject of the follow up SOTS Office investigations.

The main conclusion in this report is that for all cases where non-trivial discrepancies were originally reported, it was determined that hand counting errors or vote misallocation were the causes. No discrepancies in these cases were reported to be attributable to machine tabulation. For the original audit returns for which no follow up investigation was performed by the SOTS Office, the discrepancies were small.

The analyses of the audit returns are presented in three parts.

- The analysis of the original audit records that do not involve cross-party endorsed candidates. There are 447 (57.6% of 776) such records, and they are complete and contain no obvious audit errors. Among these, 447 records (100%) show a discrepancy of 3 votes or lower, with 431 records (96.4%) showing discrepancy of 0 or 1 vote between the machine counts and audit hand counts. The largest discrepancy is a single case of 3.

The average number of votes recorded for the candidates is 344. The overall average number of questionable votes per district is under 6. The ballots are determined to be “questionable” by the human auditors as follows: a ballot is questionable if the auditors believe that it is marked in such a way that the machine will likely not be able to read it properly. Note that this does not mean that the machine absolutely would not read it. Given this assessment based on human judgment call, it is predictable that in many cases hand counts would not match machine counts.

The average absolute discrepancy between the machine count and the hand count performed in the audit is 0.5 votes. This number is computed by taking the sum of the absolute (positive) values of the discrepancies in all records and dividing this sum by the number of records. We note that the average reported discrepancy is less than the average number of reported questionable votes per audit record. That is, the average absolute discrepancy is 0.5, while the average number of questionable votes is almost 6. Overall this is a good indication that suggests that, on average, despite the presence of questionably marked ballots, the machine counts are very close to the hand count.

The detailed analysis is in Section 3.

- The analysis of the original audit records for cross-party endorsed candidates involves 52 records (6.7% of 776). For such candidates the name of the candidate appears more than once per race on the ballot, based on the party endorsement. The second follow up conducted by the SOTS office confirmed that large discrepancies reported for the cross-party endorsed candidates were due to the fact that the auditors did not correctly assign hand counted votes to the specific party endorsements. The detailed analysis is in Section 4. We separate the presentation of the analysis for these 52 records into two parts. Section 4.1 presents the analysis of 32 (4.1%) original (not revised) cross-party endorsed records. Section 4.2 presents the analysis of 20 records (2.6%) revised by the SOTS office. These records were combined on the candidate/district basis, representing the data for 8 candidates.

Among the 32 cross-party endorsed records, all 32 records (100%) show discrepancy of 0 or 1 votes between the machine counts and audit hand counts.

We note that there is a substantial improvement since the last hand count audit of cross-party endorsed candidates (November 2008 elections). In most of the cases the votes were counted correctly. In the original data (before SOTS investigation) the maximum discrepancy of 11 was found. The investigation showed that this was the result of an improper counting of the votes cast for cross-party endorsed candidates.

The conclusion is that, while no discrepancies were found to be caused by the machine counts, future audits will need to continue to pay attention to counting cross-party endorsed votes. Continued training is needed to ensure proper handling of cross-endorsed candidates.

- The analysis of the (non cross-party endorsed) records that were revised based on the SOTS Office follow up involves 271 records (34.9% of 776). Among these 53 records pertain to the four towns for which additional data was gathered by the SOTS Office during the first follow up, while the rest of the records reflect the result of the second follow up. The analysis is in Section 5. As with the cross party endorsed records, the precision of hand counting needs to be improved to enable a better overall analysis.

Our overall conclusion is that hand counting of the ballots during the audit is an error-prone process. In all cases where large discrepancies were investigated, it was reported that hand counting was not performed correctly, or that the correctly counted votes were misallocated as is common with the cross-party endorsements.

On the other hand we note that only 6 records (0.8% of 776) were found to be incomplete. The statistical analysis does not include these records. While some problematic records are clearly due to human error (e.g., errors in addition), in other cases it appears that auditors either did not follow the audit instructions precisely, or found the instructions to be unclear. However, this is a substantial improvement relative to the November 2007 and November 2008 elections, where we reported correspondingly 18% and 3.2% of the records that were unusable.

2 Introduction and Notation

Throughout this document we use the following notation:

- M is used to denote the machine counted ballots
- U is used to denote the number of undisputed hand counted ballots
- Q is used to denote the number of questionable hand counted ballots
- H is the sum of undisputed and questionable ballots, that is, $H = U + Q$
- D is the discrepancy between the hand counted total and machine total, that is, $D = H - M$

Thus for a given candidate, we define discrepancy D as the difference between H (the sum of the undisputed ballots U and the questionable ballots Q) and M (the machine count).

If the discrepancy D is positive then we say that we observe a machine undercount relative to the hand count H , i.e., the machine counted fewer ballots than the auditors.

If the discrepancy D is negative then we say that we observe a machine overcount relative to the hand count H , i.e., the machine counted more ballots than the auditors.

- $|D|$ is the absolute value of the discrepancy (or the positive value of D)

This means that if D is positive, then $|D| = D$, and if D is negative, then $|D| = -D$.

Note that this presupposes that the hand count does not contain (human counting) errors. This is not necessarily so in actuality. However, since in general it is not possible to ascertain whether the hand counted data contain errors, we assume that the hand counted data is reported correctly, unless a follow up investigation determined otherwise.

3 Analysis of Single-Party Endorsed Records

This section deals with the original audit records that are complete, contain no obvious audit errors, and that do not involve cross-party endorsed candidates. There are 447 (57.6% of 776) such records. This analysis does not include the records that were subject to the two follow-up investigations performed by the SOTS Office.

Figure 1 is the graphical representation of the data distribution for discrepancies found in these 447 records. We then analyze the absolute value of discrepancy, the pattern of undercounts and overcounts, and the percentage of the votes reported as questionable.

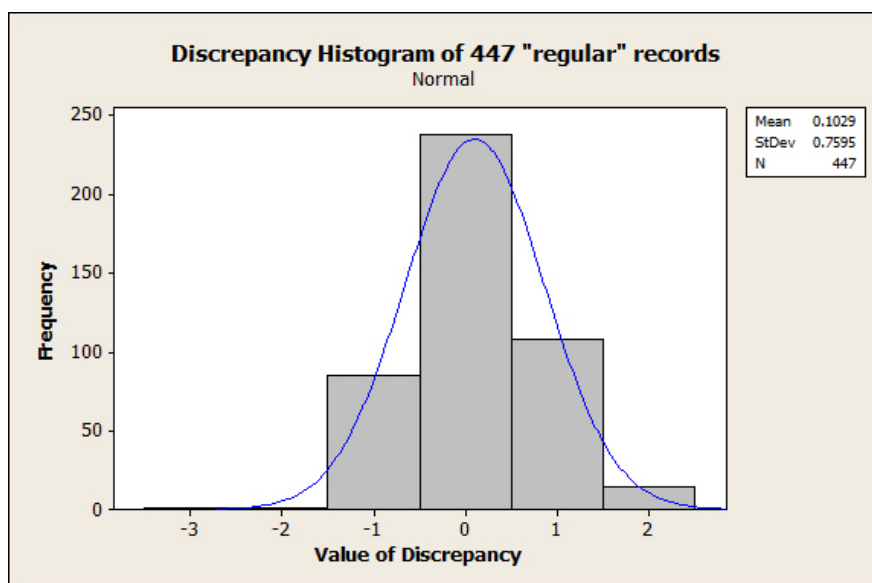


Figure 1

3.1 Absolute Value of Discrepancy

Here we give the analysis considering the absolute number of discrepancies, $|D|$. We include discrepancies for all records for which both the machine count M and the total hand count H is given. For the 447 records considered here, the average absolute discrepancy is 0.51, and the standard deviation is 0.57, suggesting that the occurrences of discrepancies are tightly clustered in the vicinity of the average. Table 1 presents tiered view of the absolute discrepancies.

Table 1: Absolute value of discrepancy.

Description	Counts	% of Counts
Records with discrepancy $ D $ of 0	238	53.24%
Records with discrepancy $ D $ of 1	193	43.18%
Records with discrepancy $ D $ of 2	15	3.36%

Records with discrepancy D of 3	1	0.22%
Totals:	447	100%

Table 2 presents tiered view of the absolute discrepancies by the percentage of discrepancy.

Table 2: By Percentage of Discrepancy

Description	Counts	% of Counts
Records with discrepancy less than 0.5%	374	83.67%
Records with discrepancy 0.5% to 1%	32	7.16%
Records with discrepancy 1% to 2%	22	4.92%
Records with discrepancy 2% to 5%	15	3.36%
Records with discrepancy 5% to 10%	3	0.67%
Records with discrepancy 10% to 20%	1	0.22%
Totals:	447	100%

3.2 Undercount and Overcount Discrepancies

When considering negative discrepancies (overcounts) and positive discrepancies (undercounts) for the 447 records, the average discrepancy is 0.1, and the standard deviation is 0.76, again suggesting that the occurrences of discrepancies are clustered in the vicinity of the average.

Table 3 presents discrepancies for the records that indicate overcounts.

Table 3: Records indicating overcounting: 87 (19.46% of 447) records with negative values of discrepancy.

Description	Counts	% of Counts
Records with discrepancy D of -1	85	97.7%
Records with discrepancy D of -2	1	1.15%
Records with discrepancy D of -3	1	1.15%
Totals:	87	100%

Table 4 presents discrepancies for the records that indicate undercounts.

Table 4: Records indicating undercounting: 122 (27.29% of 447) records with positive values of discrepancy.

Description	Counts	% of Counts
Records with Discrepancy D of 1	108	88.52%
Records with Discrepancy D of 2	14	11.48%
Totals:	122	100%

3.3 Statistics for Questionable Ballot Counts

The average number of questionable votes, as determined by the auditors, per record is 5.98.

Table 5 presents statistics with respect to the questionable ballots per candidate.

Table 5: Questionable Ballot Counts.

Description	Counts	% of Counts
Records with questionable count Q of 0	136	30.43%
Records with questionable count Q > 0 to 2%	183	40.94%
Records with questionable count Q > 2% to 5%	90	20.13%
Records with questionable count Q > 5% to 10%	32	7.16%
Records with questionable count Q > 10%	6	1.34%
Totals:	447	100%

4 Analysis of the Cross-Party Endorsement Records

In this part we discuss the original audit records for cross-party endorsed candidates and report on the follow up performed by the SOTS Office and reported to the VoTeR Center. There are 52 records (6.7% of 776) involving cross-party endorsed candidates, where the name of the candidate appears more than once per race on the ballot, based on the party endorsement. We note that there is a substantial improvement in counting votes for cross-party endorsed candidates in comparison to November 2008 elections. For November 2008 elections the highest discrepancy reported for cross-party endorsed candidates was 110 versus 11 for November 2009 elections.

The reason we analyze the records for cross-party endorsed candidates separately in this report is to bring attention to the counting issue the auditors have with such records. In many cases in the past, and in some current cases, the auditors did not correctly assign hand counted votes to the specific party endorsements and how the optical scan (OS) tabulators report multiple votes cast for the same candidate on the same ballot.

To explain the situation with the cross party endorsed records we present an example. Assume that there is a race denoted by Race R, where there is a candidate denoted by Candidate C that is endorsed by “Orange Party” and “Cyan Party”. Thus Candidate C will appear on the ballot for Race R twice.

Office \ Party	Presidential	Race R	Other Races
Party 1	Candidate P1	Candidate R1	Candidate O1
Party 2	Candidate P2	Candidate R2	Candidate O2
...
Orange Party	...	Candidate C	...
.....
Cyan Party	...	Candidate C	...
...
Party n	Candidate Pn	Candidate Rn	Candidate On

Let us assume that Race R is a “vote for one” race and that we have 3 voters denoted by V1, V2, and V3, whose votes are as follows.

- Voter V1 for Race R has voted only for Candidate C endorsed by Orange Party
- Voter V2 for Race R has voted only for Candidate C endorsed by Cyan Party
- Voter V3 for Race R has voted for Candidate C endorsed by both Orange Party and Cyan Party, i.e., the voter filled in the two ovals on the ballot for Race R for Candidate C.

In this scenario, in the case of Voter V1, the OS machine will increment the counter for Candidate C endorsed by Orange Party by 1 (one).

In the case of Voter V2, the OS machine will increment the counter for Candidate C endorsed by Cyan Party by 1 (one).

In the case of Voter V3, the OS machine will increment the counter for Candidate C endorsed by “UNKNOWN” party by 1 (one)

If we print a machine report after these 3 voters have cast their ballots, it will have a section like this:

```

.....
Race R
Candidate R1 ----- 0
Candidate R2 ----- 0
...
Candidate C (Orange Party) -- 1
Candidate C (Cyan Party) ---- 1
Candidate C (UNKNOWN) ----- 1

```

```

...
Candidate Rn ----- 0
.....

```

In examining the audit reports we noticed that in some cases the hand count shows 0 (zero) total in the UNKNOWN line for a cross endorsed candidate ($H = 0$), while the machine counted number of votes is positive ($M > 0$). Thus it appears that the auditors assigned votes to candidates using one of the parties, whereas the votes should have been assigned to UNKNOWN as in the example above. In other cases it is possible that the auditors recorded the votes to candidates without duly noting the appropriate party endorsement. All such situations may lead to large discrepancies.

Figure 2 is the graphical representation of the data distribution for discrepancies found in the original 52 cross-party records. One can observe that relatively large discrepancies are present.

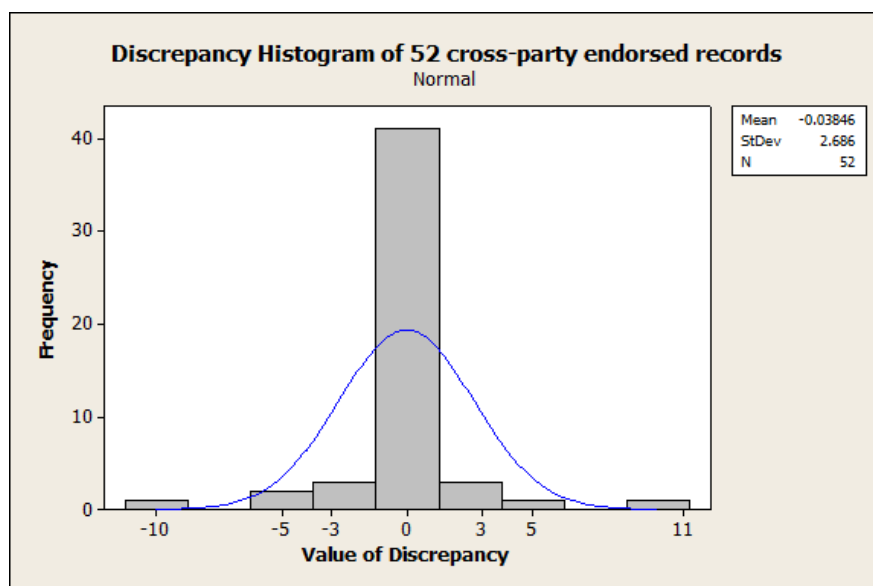


Figure 2: Original (uncorrected) frequency of discrepancies for cross-party records.

The SOTS Office examined and/or followed up on 20 of the original 52 records and confirmed that the large discrepancies are due to misallocation. The correction resulted in combining counts for a specific candidate, thus the corrected counts are reported separately from the information in rest of the original records.

Section 4.1 gives the analysis of 32 (unrevised) records. Section 4.2 presents the discussion of the data from the 20 records that served as the basis for SOTS Office revision conveyed on March 19th, 2009.

4.1 Analysis of 32 original Cross-Party Endorsement Records

This section presents the analysis of 32 cross-party endorsement records. Figure 3 is the graphical representation of the data distribution for discrepancies found in the originally reported 32 “cross-party endorsement” records.

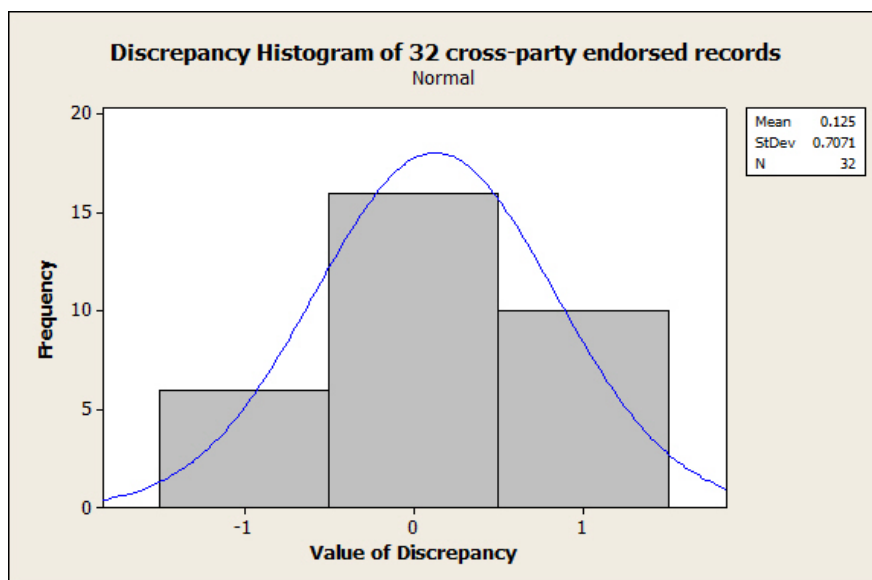


Figure 3: Frequency of discrepancies for the 32 records that were not subject to revision.

4.1.1 Absolute Value of Discrepancy

Here we give the analysis considering the absolute number of discrepancies, $|D|$, that is the positive value of the discrepancy. We include discrepancies for all records for which both the machine count M and the total hand count H is given. For the 32 records, the average absolute discrepancy is 0.5, and the standard deviation is 0.51, suggesting that the occurrences of discrepancies are clustered in the vicinity of the average. Table 6 presents tiered view of the absolute discrepancies.

Table 6: Absolute value of discrepancy.

Description	Counts	% of Counts
Records with discrepancy $ D $ of 0	16	50%
Records with discrepancy $ D $ of 1	16	50%
Totals:	32	100%

Table 7 presents tiered view of the absolute discrepancies by the percentage of discrepancy.

Table 7: By Percentage of Discrepancy

Description	Counts	% of Counts
Records with discrepancy less than 0.5%	21	65.63%

Records with discrepancy 0.5% to 1%	3	9.38%
Records with discrepancy 1% to 2%	1	3.12%
Records with discrepancy 2% to 5%	4	12.5%
Records with discrepancy 5% to 10%	1	3.12%
Records with discrepancy 10% to 20%	0	0%
Records with discrepancy over 20%	2	6.25%
Totals:	32	100%

4.1.2 Undercount and Overcount Discrepancies

When considering negative discrepancies (overcounts) and positive discrepancies (undercounts) over the 32 records, the average discrepancy is 0.13, and the standard deviation is 0.7, again suggesting that discrepancies are clustered about the average.

Table 8 presents discrepancies for the records that indicate overcounts.

Table 8: Records indicating overcounting: 6 (18.75% of 32) records with negative values of discrepancy.

Description	Counts	% of Counts
Records with discrepancy D of -1	6	100%
Totals:	6	100%

Table 9 presents discrepancies for the records that indicate undercounts.

Table 9: Records indicating undercounting: 10 (31.25% of 32) records with positive values of discrepancy.

Description	Counts	% of Counts
Records with Discrepancy D of 1	10	100%
Totals:	10	100%

4.1.3 Statistics for Questionable Ballot Counts

The average number of questionable votes per record is 1.5.

Table 10 presents statistics with respect to the questionable ballots per candidate.

Table 10: Questionable Ballot Counts.

Description	Counts	% of Counts
Records with questionable count Q of 0	24	75%
Records with questionable count Q > 2% to 4%	8	25%
Totals:	32	100%

4.2 Analysis of 20 Revised Cross-Party Endorsement Records

The SOTS Office was able to affirmatively eliminate the large discrepancies contained in the original 20 records. It was determined that in all instances the audit workers misallocated the vote totals for the cross endorsed candidate to the wrong candidate/party category. However, when the total votes recorded by the machine are compared to the total votes from the hand count, the reported discrepancies are substantially diminished.

Based on these findings we present the analysis of 20 records not on the basis of individual audit records, but rather on the totals for each candidate in question. When the 20 records combined on a candidate basis, this results in 8 candidate totals. Below we present the results for these 8 computed totals. The average discrepancy here is -0.25 and the standard deviation is 0.46. Note that all discrepancies are negative, hence we have only overcounting discrepancies. Table 11 presents discrepancies for 8 combined totals.

Table 11: Discrepancy table for 8 combined totals

Description	Counts	% of Counts
Records with discrepancy D of 0	6	75%
Records with discrepancy D of -1	2	25%
Totals:	8	100%

5 Analysis for the Revised Records

This section deals with the records that were revised based on the SOTS Office follow up that were prompted by the preliminary review of the audit records. On February 9th and 24th of 2010 VoTeR Center received the first batch of revised records, 53 (6.8% of 776) in total. The first follow up was performed to address substantial number of discrepancies in some precincts (discrepancies over 30 votes). All those

unusual discrepancies were concentrated in four towns. As a result in those towns a second hand count of the actual ballots was performed by the SOTS Office personnel. The discussion of results is presented in Section 5.1. On March 19th, 2010 VoTeR Center received the second batch of revised records, 218 (28.1% of 776) in total, not counting the records that pertain to cross-party endorsed candidates. For all those 218 records the discrepancy reported in the original audit records were under 30. We discuss the result of the SOTS Office follow up in Section 5.2.

5.1 Discussion of 53 revised records (February 9th and 24th, 2010 revision)

The first set of revised records contains 53 records (6.8% of 776). Personnel of the SOTS Office conducted a hand count in the towns for which these records pertained: New Fairfield, Norwich, Portland and Preston.

The investigation showed that in Norwich the discrepancies arose as a result of inaccurate counting. The recount showed that the machine totals and hand count audit totals agree.

The second town, Portland, reported overcounts for every record in the report. The investigation showed, that even though, the hand count was done accurately, they auditors accidentally missed a bundle of twenty five ballots, which resulted in having high discrepancies. Recount results were consistent with the machine totals.

The recount performed in New Fairfield showed that all inconsistencies were due to absentee ballots. Hand count audit results did not include absentee ballots, while the machine totals included these ballots. After recounting all the ballots, including absentee ballots, the hand count audit and machine totals agreed.

Lastly, in Preston they discovered that the largest discrepancy (-60) was due to the confusion made by the candidate running for two different races. The recount showed that the machine totals agree with the hand count.

The result of the second hand count showed that 52 out of 53 revised records had no discrepancies (zero), and remaining 1 record has a discrepancy of -2.

Given the relatively small data set, the different type of data in this set, and the very small discrepancies, we do not present a detailed analysis.

5.2 Discussion of 218 revised records (March 19th, 2010 revision)

We now discuss a batch of records containing 218 (28.1% of 776) records where originally the reported discrepancies were under 30 (these do not include cross-party endorsed candidates).

In this case the SOTS Office personnel contacted each registrar of voters and questioned their hand count audit procedures. In all instances, the registrars of voters were able to attribute the discrepancies to hand counting errors. Thus no discrepancies (zero) are reported for these districts.

Given the fact that no discrepancies were reported for those records we do not present a detailed analysis.

6 Conclusions and Recommendations

The main conclusion of this analysis is that the hand counting remains an error prone activity. In order to enable a more precise analysis, it is recommended that the hand counting precision is substantially improved in future audits. The completeness of the audit reports also need to be addressed. For example, in two of the towns when the second hand count was performed it was determined that the auditors did not count a batch of 25 ballots in one case and the absentee ballots in the second. This initially resulted in

apparently unexplained discrepancies. Submitting incomplete audit returns has little value for the auditing process.

For the cross party endorsement, it is important for the auditors to perform hand counting of the votes that precisely documents for which party endorsement the votes were cast, and to note all cases where more than one bubble was marked for the same candidate. The auditors should be better trained to follow the correct process of hand count audit.

The analysis does not include only 6 records (0.8% of 776) that were found to be incomplete. This is an improvement relative to the November 2007 and November 2008 elections, where we reported correspondingly 18% and 3.2% of the records that were unusable. While some problematic records are clearly due to human error (e.g., errors in addition), this suggests that auditors either did not follow the audit instructions precisely, or found the instructions to be unclear.

One important additional observation is that on the average the absolute number of reported discrepancies (for complete, unrevised, original audit records) is substantially smaller than the average of the reported questionable votes. This is consistent with prior audits. Here one may conclude that the machines are still able to correctly tabulate most questionable ballots, resulting in small differences between the machine reported totals and the hand counted totals.

We also believe that our reporting of the analysis, and the analysis itself needs to be improved. A major change planned for future analysis is to assess the impact of the perceived discrepancies on the election outcomes (in addition to analyzing individual audit return records). This is going to be exceedingly important for the cases where a race may be very close, but where the difference between candidates is over 0.5% (thus not triggering an automatic recount).

[end]