VoTeR Center

UConn Voting Technology Research Center

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Statistical Analysis of the Post Election Audit Data
2008 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 2008 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 unacceptably high unexplained differences between hand and machine counts and also revealed substantial discrepancies in cases of cross-endorsed candidates (i.e., candidates whose names appear twice on the ballot because they are endorsed by a minor party). Follow up investigations were conducted by the Office of the Secretary of the State, resulting in several revisions to the audit data for the districts that were the subject of the follow up. This report presents the analysis of 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 investigation. The report starts with an executive summary on page 2.

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

Summary

The University of Connecticut Voting Technology Research (VoTeR) Center received the data gathered in the post-election audit performed in the State of Connecticut following the November 2008 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 VoTeR Center on December 3rd, 4th and 18th of 2008. The original audit data contained 1311 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 unacceptably high unexplained differences between hand and machine counts and also revealed substantial discrepancies in cases of cross-endorsed candidates (i.e., candidates whose names appear twice on the ballot because they are endorsed by a minor party). 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 18, 2009. Further information gathering was conducted by the SOTS Office to identify the cause of the moderately large discrepancies, and more importantly, to identify a cause of substantial discrepancies for cross-party endorsed candidates. The resulting information was conveyed to the VoTeR Center on April 3, 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 ups. The analysis does not include 43 records (3.3%) that were found to be incomplete, unusable, or obviously incorrect. In more detail, part (i) deals with 776 (63%) records that were complete and contained no obvious audit errors. Among these, 776 records (94%) show a discrepancy of 5 votes or lower, with 583 records (71%) showing discrepancy of 0 or 1 vote between the machine counts and audit hand counts. There are 49 records that have the discrepancy of more than 5 votes and the largest discrepancy is 9. Part (ii) deals with 301 records (23%) 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 240 (18%) cross-party endorsed records, and 61 (5%) records that were revised by the SOTS Office. Part (iii) deals with the revised audit returns gathered by the SOTS Office. Part (iii) discusses the records that were the subject of the last investigation by the SOTS Office. This analysis was performed on request of the Office of the Secretary of the State.

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 data where no follow up investigation was performed, the discrepancies were small, in particular, the average reported discrepancy is 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 in almost all examined problematic instances the discrepancies were a result of an incorrect hand counting. Therefore, the auditors should be better trained to follow the correct process of hand count audit.

The analysis does not include 42 records (3.2% of 1311) that were found to be incomplete, unusable, or obviously incorrect. This is an improvement relative to the November 2007 elections, where we reported 18% of the records that were unusable.

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Preface

The University of Connecticut Voting Technology Research (VoTeR) Center received the data gathered in the post-election audit performed in the State of Connecticut following the November 2008 election. The audits of the randomly selected 10% of the districts were conducted in November of 2008, and the returns were conveyed by the Office of the Secretary of the State to the VoTeR Center on December 3rd, 4th and 18th of 2008. 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. The results of those activities are attached to this report as Appendices A, B, and C. This report presents the analysis of the November 2008 post-election audit data, including revisions based on the outcomes of the SOTS investigations.

The Center is currently working 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 1311 records on December 3rd, 4th and 18th of 2008. On February 18, 2009, the Center received 105 revised records based on the first follow up, and on April 3, 2009 the Center received 37 revised records based on the second SOTS Office follow up. The purpose of the second follow up was both to identify the cause of the moderately large discrepancies and to address the substantial number of discrepancies per record for

cross-party endorsed candidates that were apparently due to the fact that auditors did not correctly assign votes to the specific party endorsement. The statistical analysis in this report deals with the 1065 records that are sufficiently complete to perform the analysis. Separately, we discuss the 203 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 data where no follow up investigation was performed, the discrepancies were small, in particular, the average reported discrepancy is lower than the number of the votes that were determined to be questionable (or ambiguous) by the auditors.

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 825 (63% of 1311) such records, and they are complete and contain no obvious audit errors. Among these, 776 records (94% of 825) show a discrepancy of 5 votes or lower, with 583 records (71%) showing discrepancy of 0 or 1 vote between the machine counts and audit hand counts. There are 49 records (6%) that have the discrepancy of more than 5 votes and the largest discrepancy is 9.

  The average number of votes recorded for the candidates is 543. The overall average number of questionable votes per district is over 6. The ballots are determined to be "questionable" by the human auditors: 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 under 2 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. Thus on the average reported discrepancy is less than the average number of reported questionable votes. Overall this is a good indication that suggests that, on average, despite the presence of questionably marked ballots, the machine count 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 301 records (23% of 1311). 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 301 records into two parts. Section 4.1 presents the analysis of 240 (18%) original (not revised) cross-party endorsed records. Section 4.2 presents the analysis of 61 records (5%) revised by the SOTS office. These records were combined on the candidate/district basis, representing the data for 22 candidates.

  Among the 240 cross-party endorsed records, 140 records (58%) show discrepancy of 0 or 1 votes between the machine counts and audit hand counts, and 198 records (82.5%) show discrepancy of 5 votes or lower. There are 42 records that have the discrepancy of more than 5 votes and the largest discrepancy is 9. We note that the original data contained high discrepancies that are clearly the result of misallocation of votes. For example, in the particular case of 110 discrepancies recorded in the original record, it was determined that the "unknowns" (explained in more details in Section 4) were counted twice and the correct discrepancy is 4 votes. (More

precisely, the discrepancy here is -4 votes: the negative discrepancy means that the machine count is an overcount relative to the hand count.)

The conclusion is that, while no discrepancies were found to be caused by the machine counts, future audits will need to pay special attention to counting cross-party endorsed votes. More training is needed to ensure proper handling of cross-endorsed candidates and this issue should be the focus of future audit analysis to ensure it is properly addressed and understood.

- The analysis of the (non cross-party endorsed records that were revised based on the SOTS Office follow up involves 142 records (11% of 1311). Among these 105 records pertain to the seven towns for which additional data was gathered by the SOTS Office during the first follow up, while the rest of the records is the result of the second follow up, dealing with about twenty towns. 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 the case with the cross-party endorsements.

On the other hand we note that only 43 records (3.2% of 1311) were found to be incomplete, unusable, or obviously incorrect. 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 elections, where we reported 18% 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 825 (65% of 1311) 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 854 records. We then analyze the absolute value of discrepancy, the pattern of undercounts and overcounts, and the percentage of the votes reported as questionable.

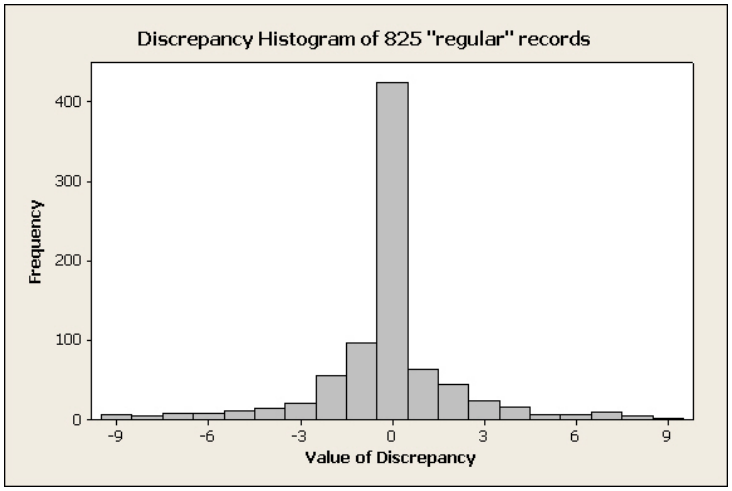

Figure 1

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 825 records considered here, the average absolute discrepancy is 1.28, and the standard deviation is 1.95, suggesting that the occurrences of discrepancies are 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	424	51.39%
Records with discrepancy |D| of 1-3	303	36.73%
Records with discrepancy |D| of 4-6	64	7.76%
Records with discrepancy |D| of 7-9	34	4.12%
Totals:	**825**	**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%	650	78.79%
Records with discrepancy 0.5% to 1%	69	8.36%
Records with discrepancy 1% to 2%	38	4.61%
Records with discrepancy 2% to 5%	37	4.48%
Records with discrepancy 5% to 10%	11	1.33%
Records with discrepancy 10% to 20%	13	1.58%
Records with discrepancy over 20%	7	0.85%
Totals:	**825**	**100%**

3.2 Undercount and Overcount Discrepancies

When considering negative discrepancies (overcounts) and positive discrepancies (undercounts) for the 825 records, the average discrepancy is –0.13, and the standard deviation is 2.33, 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: 225 (27.27% of 825) records with negative values of discrepancy.

Description	Counts	% of Counts
Records with discrepancy D from -1 to –3	172	76.44%
Records with discrepancy D from -4 to –6	34	15.11%
Records with discrepancy D from -7 to –9	19	8.45%
Totals:	**225**	**100%**

Table 4 presents discrepancies for the records that indicate undercounts.

Table 4: Records indicating undercounting: 179 (20.96% of 854) records with positive values of discrepancy.

Description	Counts	% of Counts
Records with Discrepancy D of 1-3	131	74.43%
Records with Discrepancy D of 4-6	30	17.05%
Records with Discrepancy D of 7-9	15	8.52%
Totals:	**176**	**100%**

3.3 Statistics for Questionable Ballot Counts

The average number of questionable votes per record is 6.1.

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	388	47.03%
Records with questionable count Q > 0 to 2%	269	32.60%
Records with questionable count Q > 2% to 5%	106	12.85%
Records with questionable count Q > 5% to 10%	39	4.73%
Records with questionable count Q > 10%	23	2.79%
Totals:	**825**	**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 301 records (23% of 1311) 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. In our preliminary communication to the SOTS Office, it was noted that in some cases large discrepancies were reported for the cross-party endorsed candidates (as high as 110), possibly due to the fact that 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.

The second follow up by the SOTS office confirmed that the large number of discrepancies is indeed the result of a misallocation error made by auditors and that the highest discrepancy among cross-party endorsed candidates is 10 (cf. 110 contained in one audit record).

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 301 cross-party records. One can observe that large discrepancies are present.

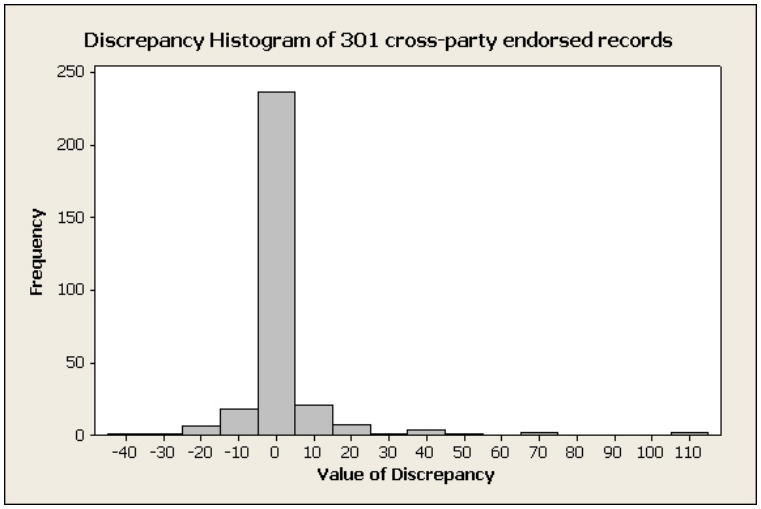

Figure 2: Original (uncorrected) frequency of discrepancies for cross-party records.

The SOTS Office examined and/or followed up on 61 of the original 301 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 240 (unrevised) records as received in December of 2008. Section 4.2 presents the discussion of the data from the 61 records that served as the basis for SOTS Office revision conveyed on April 3rd, 2009.

4.1 Analysis of 240 original Cross-Party Endorsement Records

This section presents the analysis of 240 cross-party endorsement records. Figure 3 is the graphical representation of the data distribution for discrepancies found in the originally reported 240 “cross-party endorsement” records.

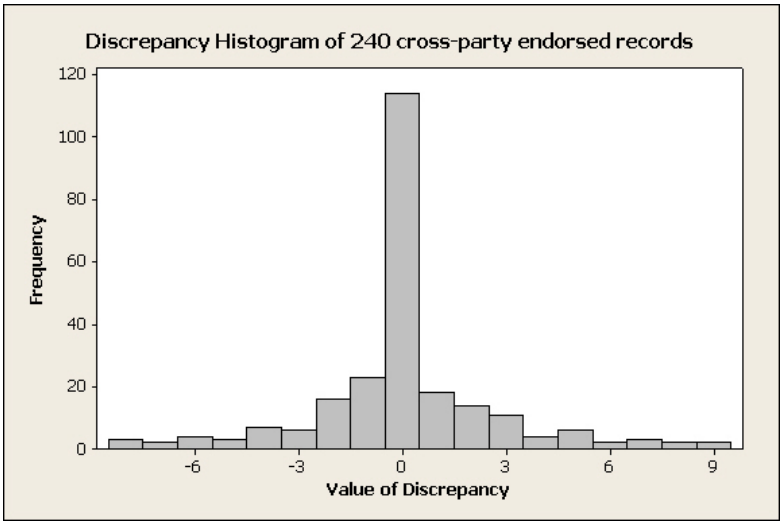

Figure 3: Frequency of discrepancies for the 240 records that were not subject to revision.

We note that although the discrepancies here are substantially lower then in the original 301 records, it is very likely that some errors due to misallocation of votes are still present.

4.1.1 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 **240** records, the average absolute discrepancy is **1.54**, and the standard deviation is **2.13**, 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	114	47.50%
Records with discrepancy |D| of 1-3	88	36.67%
Records with discrepancy |D| of 4-6	26	10.83%
Records with discrepancy |D| of 7-9	12	5.00%
Totals:	240	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%	159	66.25%
Records with discrepancy 0.5% to 1%	13	5.42%
Records with discrepancy 1% to 2%	12	5.00%
Records with discrepancy 2% to 5%	31	12.92%
Records with discrepancy 5% to 10%	17	7.08%
Records with discrepancy 10% to 20%	5	2.08%
Records with discrepancy over 20%	3	1.25%
Totals:	**240**	**100%**

4.1.2 Undercount and Overcount Discrepancies

When considering negative discrepancies (overcounts) and positive discrepancies (undercounts) over the **240** records, the average discrepancy is **0.06**, and the standard deviation is **2.62**, again suggesting that there **is a clustering** of discrepancies about the average.

Table 8 presents discrepancies for the records that indicate overcounts.

Table 8: Records indicating overcounting: 64 (26.67% of 240) records with negative values of discrepancy.

Description	Counts	% of Counts
Records with discrepancy D from -1 to –3	45	70.31%
Records with discrepancy D from -4 to –6	14	21.88%
Records with discrepancy D from -7 to –9	5	7.81%
Totals:	**64**	**100%**

Table 9 presents discrepancies for the records that indicate undercounts.

Table 9: Records indicating undercounting: 62 (25.83% of 240) records with positive values of discrepancy.

Description	Counts	% of Counts
Records with Discrepancy D of 1-3	43	69.35%
Records with Discrepancy D of 4-6	12	19.36%
Records with Discrepancy D of 7-9	7	11.29%
Totals:	**62**	**100%**

4.1.3 Statistics for Questionable Ballot Counts

The average number of questionable votes per record is **4.95**.

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	115	47.92%
Records with questionable count Q > 0 to 2%	73	30.42%
Records with questionable count Q > 2% to 5%	24	10.00%
Records with questionable count Q > 5% to 10%	11	4.58%
Records with questionable count Q > 10%	17	7.08%
Totals:	**240**	**100%**

4.2 Analysis of 61 Revised Cross-Party Endorsement Records

The SOTS Office was able to affirmatively eliminate the large discrepancies contained in the original 61 record. 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 61 records not on the basis of individual audit records, but rather on the totals for each candidate in question. When the 61 records combined on a candidate basis, this results in 21 candidate totals. Below we present the results for these 21 computed totals. The average discrepancy here is -3.76 and the standard deviation is 2.58. Note that all discrepancies are negative, hence we have only overcounting discrepancies. Table 11 presents discrepancies for 20 combined totals.

Table 11: Discrepancy table for 21 combined totals

Description	Counts	% of Counts
Records with discrepancy D of 0	1	4.8%
Records with discrepancy D of -1	3	14.3%
Records with discrepancy D of -2	2	9.5%
Records with discrepancy D of -3	4	19.0%
Records with discrepancy D of -4	8	38.1%
Records with discrepancy D of -8	1	4.8%
Records with discrepancy D of -10	2	9.5%
Totals:	**21**	**100%**

The list of 15 polling locations corresponding to the 61 records is found in Appendix A.

5 Analysis for the Revised Records

This section deals with the records that were revised based on the SOTS Office follow ups that were prompted by the preliminary analysis of the audit records. On February 18, 2009 VoTeR Center received the first batch of revised records, 105 (8% of 1311) 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 seven towns (8 polling places). 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 April 3, 2009 VoTeR Center received the second batch of revised records, 37 (2.8% of 1311) in total, not counting the records that pertain to cross-party endorsed candidates. For all those 37 records the discrepancy reported in the original audit records was between 10 and 30. We discuss the result of the SOTS Office follow up in Section 5.2.

5.1 Discussion of 105 revised records (February 18, 2009 revision)

The first set of revised records contains 105 records (8% of 1311). These records pertained to the following towns: Danbury, East Haven, Greenwich, Harwinton, Middletown, Milford and Preston. There were two problematic districts in the town of Greenwich. 14 of 105 records had substantial discrepancies (greater than 30).

Personnel of the SOTS Office conducted a hand count in towns of Danbury, East Haven, Middletown and Preston. Additionally, town of Greenwich submitted a revised audit report showing no discrepancies for both districts in question. The second review of the original documentation submitted by town of Harwinton revealed no discrepancies.

Appendix B presents the initial number of hand counted votes and the corresponding discrepancies versus the recount results.

The result of the second hand count showed that 99 out of 105 revised records had no discrepancies (zero), and the largest discrepancy for the remaining 6 records is 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 37 revised records (April 3, 2009 revision)

We now discuss the small batch of records containing 37 (2.8% of 1311) records for the districts from 22 towns where originally the discrepancies between 10 and 30 votes were reported (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 relatively small data set, the different type of data in this set, and the very small discrepancies, we do not present a detailed analysis. In Appendix C we present the list of these 22 districts.

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 one case the auditors explicitly noted in their audit returns that some batches of 50 ballots were accidentally not counted. Submitting incomplete audit returns has very 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 follow up performed to identify any confusion made by cross-party endorsed candidates confirmed that in almost all problematic instances a high number of discrepancies was a result of an incorrect hand counting. Therefore, the auditors should be better trained to follow the correct process of hand count audit.

The analysis does not include 42 records (3.2% of 1311) that were found to be incomplete, unusable, or obviously incorrect. This is an improvement relative to the November 2007 elections, where we reported 18% 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. 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).

Appendix A

15 Town and Polling Names for 20 cross-party endorsed candidate records that were revised based on the second follow-up by the Office of the Secretary of the State.

Town	Polling Name
Berlin	**Senior Center**
Fairfield	**Fairfield Ludlowe High School**
Manchester	**Waddell School**
Mansfield	**Eagleville Fire Department**
Marlborough	**Elmer Thienes Elementary**
Middletown	**Moody School Gym-District 5**
Middletown	**Snow School-Gym-District 7**
Middletown	**Wesley School-District 9**

Town	Polling Name
Milford	**Joseph A Foran High School**
Orange	**Mary L Tracy School**
Plainville	**Our Lady Of Mercy Parish Hall**
Rocky Hill	**Griswold Middle School**
Stamford	**Stamford High School (Rear)**
Westport	**Saugatuck Elementary School**
West Haven	**Mackrille School Voting District 8**

Appendix B

Results of the first follow-up performed by the Office of the Secretary of the State (105 records).

Record #	Machine Total	Initial Hand Count Audit Totals	Initial Discrepancy	Second Hand Count Audit Totals	Follow-Up Discrepancy
1	1868	1856	-12	1867	-1
2	2133	2040	-93	2133	0
3	1016	995	-21	1016	0
4	1193	1132	-61	1193	0
5	885	867	-18	885	0
6	1171	1047	-124	1172	1
7	794	769	-25	794	0
8	1080	1001	-79	1080	0
9	119	65	-54	119	0
10	942	904	-38	938	-4
11	278	226	-52	278	0
12	815	467	-348	515	0
13	280	224	-56	280	0
14	829	501	-328	831	2
15	1168	1224	56	1168	0
16	1194	1316	122	1192	-2
17	803	794	-9	803	0
18	1368	1465	97	1368	0
19	1723	2089	366	1723	0

Appendix C

22 Town and Polling Names for 37 records that were revised based on the second follow-up by the Office of the Secretary of the State.

Town	Polling Name
East Haven	Momauguin School 2
Fairfield	Fairfield Ludlowe High School Dist. 9
Farmington	Irving Robbins Middle School - Dist 1, Precinct 12
Hamden	Shepherd Glen School
Manchester	Martin School
Mansfield	Eagleville Fire Department
Marlborough	Elmer Thienes Elementary School
Middletown	Moody School Gym-District 5
Middletown	Wesley School-District 9
Naugatuck	Western School - A
New Haven	Main Library Ward 1-02

Town	Polling Name
North Branford	Jerome Harrison Elementary School
N. Stonington	New Town Hall
Orange	Mary L Tracy School
Plainville	Our Lady Of Mercy Parish Hall
Redding	Redding Community Center
Shelton	Shelton Intermediate School
Stamford	Stamford High School (Rear)
West Haven	Ann V. Molloy School Voting District 7
West Haven	Mackrille School Voting District 8
Westport	Saugatuck Elementary School 136-1
Wethersfield	Wethersfield Ambulance Facility

[end]