



Boone County Clerk's Office Risk-Limiting Audit Report  
November 2, 2021 Special Election  
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Boone County Clerk

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## Purpose and Scope

As the 2022 election cycle approaches, our office is acutely aware of the national conversation about public confidence and trust in our democracy. It is our mission to help educate voters about safeguards already in place in Boone County that ensure accurate and secure elections. However, it is also important to provide voters with the opportunity to learn about other successful methods for checking election results, including risk-limiting audits, which are used in fifteen other states.<sup>1</sup> In furtherance of that goal, the Boone County Clerk's Office chose to pilot a risk-limiting audit of the November 2, 2021 Special Election for the city of Columbia. This pilot served as a supplemental process to the post-election audit that is required by Missouri law.

In Missouri, post-election audits are already an integral part of elections.<sup>2</sup> For every election in Missouri, election night results are unofficial until a bipartisan team of election judges conducts a hand recount of all ballots cast from a randomly selected 5% of the county's precincts. This is an open and transparent process that the public is welcome to observe at our office after the election. The election judges compare the hand recount of the paper ballots against the election night results tabulated by the voting equipment to check the accuracy of the results and the integrity of the voting equipment. The bipartisan nature of the audit and the additional verification helps provide confidence and trust in Missouri's electoral system. The goal of this audit is an exact match of the hand recount to the tabulated results.

A risk-limiting audit, on the other hand, is a type of post-election audit that provides statistical evidence that the outcome of the election is correct.<sup>3</sup> The risk-limiting audit uses independent statistical software to select a random sample of voted ballots from the election to be hand-counted. Bipartisan teams check the votes on the ballots and record the results in the software. The audit is complete when the results provide sufficiently strong evidence that a full hand count would confirm the outcome of the unofficial election night results. The goal of this audit is statistical confidence that the electoral outcome reported on election night was correct.

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<sup>1</sup> "Risk-Limiting Audits," *National Conference of State Legislatures*, September 16, 2021 at <https://www.ncsl.org/research/elections-and-campaigns/risk-limiting-audits.aspx>.

<sup>2</sup> 15 CSR 30-10.110, Rules of Elected Officials – Secretary of State – Voting Machines, "Manual Recount," at <https://www.sos.mo.gov/cmsimages/adrules/csr/current/15csr/15c30-10.pdf>.

<sup>3</sup> For more information about the mathematics of risk-limiting audits, see Lindeman, Mark and Philip B. Stark, A Gentle Introduction to Risk-limiting Audits, *IEEE Security and Privacy, Special Issue on Electronic Voting*, March 16, 2012 at <https://www.stat.berkeley.edu/~stark/Preprints/gentle12.pdf>.

The size of the random sample of ballots is determined by the margin of victory (how close the race was). The wider the margin, the lower the number of ballots that need to be checked. Since the margin of victory for the November 2, 2021 election was so wide (7,203 ‘yes’ votes to 1,761 ‘no’ votes), the sample size required to have a confidence level of 95% that the results of the election were correct was 38 ballots.

## **Audit Process**

With transparency and education in mind, we wanted the public to be able to view, participate in, and ask questions of the process. The office invited the chairs of the Democratic and Republican central committees to provide names of those who would be interested in serving on the bipartisan audit teams. We also worked with the Associated Students of the University of Missouri and Missouri Students Association at the University of Missouri to host the audit at a central location on the University of Missouri campus to provide greater space and access.

To prepare for the audit, our office reviewed all chain-of-custody procedures and safeguards in the months leading up to the election. For every election in Boone County, election judges utilize a series of checklists and forms to document voting equipment and supplies, including ballots. As part of the election night poll closing process, the bipartisan team of election judge supervisors seal the voted ballots in a bag with a tamper-evident zip-tie seal at the polling place and deliver them, together in one vehicle, to the Government Center. The ballot bags are then checked in with office staff, organized by polling place, and stored in the County Clerk’s Office secure vault until the post-certification process begins. A certificate of ballots, which includes details about the number of used and unused ballots, accompanies the ballots. These certificates became the foundation of our ballot manifest (Appendix A), which documented the number of ballots contained in each of the sealed ballot bags. This is our standard method of ballot storage and chain-of-custody in Boone County, so no changes to the ballot organization process were needed to prepare for the risk-limiting audit.

The audit was conducted the week following the election on Monday, November 8, 2021. On that morning, the ballots were transported in the sealed bags from the Boone County Clerk’s Office vault to the University of Missouri campus by our staff in our office vehicle. We used a chain-of-custody log to document every movement of the ballots, from our office to the campus and back to our office at the conclusion of the audit. Doors opened at 10:00 am and we first conducted a brief training and presentation at 10:30 am to provide background and context for the audit (Appendix B). The entire process concluded just before 2:00 pm.

Following the training and presentation, the audit began. The ballot manifest, which listed the number of ballots in each sealed ballot bag (“the batch”), was uploaded into the independent audit software and we then needed to create a random number seed so that the software could identify 38 ballots in the batches to review. The audience was invited to roll ten-sided dice to create a random number seed, which was typed into the software to generate a list of 38 ballots, identified by batch and ballot position (i.e. position 24 would be the 24<sup>th</sup> ballot in that batch).

The audit of the 38 ballots was performed by three bipartisan teams of one Democrat and one Republican. Ultimately, eight individuals volunteered to help on the bipartisan teams due to participants' time availability. The teams were seated at tables facing the audience so that attendees could easily view the process.



The three bipartisan teams sitting at tables in front of the ballot bags. Two staff from the Boone County Clerk's Office facilitated the checkout of the ballot bags so that the teams could cut the seals on the bags, check the seal verification sheet in the bag, and reseal the ballots at the conclusion of the process.

The three audit teams received a list of which ballots they needed to examine from the batches. After checking out their ballot bag, the teams counted through their assigned batch to find the randomly selected ballot and record on a tally sheet whether the ballot was a "yes" or "no" vote. The data from the tally sheets was entered into the audit software by the bipartisan teams once each team had examined all the ballots on their list.

### **Audit Results**

The teams recorded the results for all 38 ballots with final totals of 30 "yes" and 8 "no." These totals not only mirrored the wide margin of the election night results, but they were statistically significant and met the risk limit so that we only needed one round of counting to complete the audit. The risk-limiting audit was successful, validating the election results! (Appendix C)

## Conclusions

Since this election was small with a wide margin of victory (only one issue on the ballot, total of 8,964 ballots cast, 80% margin of victory), this risk-limiting audit was straightforward to organize and execute. The three audit teams were able to easily understand and perform the audit even with no preparation before that day. For any potential future audits, we are now prepared to train and provide context to bipartisan teams in advance so, while we would likely need more teams to process a higher number of ballots for larger and closer elections, we would still be able to accomplish a successful audit quickly and accurately.

We were pleased to confirm that our existing methods for organizing and storing ballots post-election are highly secure and worked well with the recommendations for a risk-limiting audit. The audit requires that ballots be divided into batches and our offices already does this by storing ballots in separate bags by polling place. This made it easy for us to prepare for the audit, as we did not have to change our existing procedures.

Overall, we felt that our risk-limiting audit pilot of the November 2, 2021 Special Election was a valuable addition to our existing post-election audit procedures and helped us show Boone County voters that we are committed to upholding and improving the safeguards in place to ensure accurate and trustworthy elections.

## Recommendations

One limitation to a county independently conducting a risk-limiting audit is that the county is only able to audit election races that are wholly contained within its jurisdiction (for example, a state representative district fully within Boone County, a county-wide ballot question, etc.) because the county would need access to every voted ballot in the race. However, these audits can be scaled up for races like Governor or U.S. Senate if they are conducted at a state-wide level. We found the risk-limiting audit to be a valuable tool to provide statistical evidence of the accuracy of our election results and statewide adoption would further instill voter confidence in the results of statewide races, as those typically have greater prominence and national attention.

*We'd like to extend our heartfelt thanks to local election authorities, election judges, and policy makers for their attendance and participation, including the Missouri Secretary of State's Office, state representatives Hon. Wayne Wallingford, Hon. Cheri Toalson Reisch, Hon. Adam Schwadron, Hon. Ann Kelley, Hon. David Tyson Smith, and Hon. Kevin Windham, and local election authorities Hon. Kara Clark Summers, Hon. Kurt Bahr, Hon. Diane Thompson, and Hon. Shane Schoeller, and to VotingWorks for their assistance in preparing for and conducting the risk-limiting audit.*

## Appendix A

Batch Name	Number of Ballots
CENTRALBatch1	196
1B&1E&1I&1MBatch2	44
1C&1GBatch3	292
1DBatch4	64
1F&1J&1K&1L&2KBatch5	348
2A&2GBatch6	248
2B&2JBatch7	151
2C&2H&3A&3G&3LBatch8	352
2D&2LBatch9	194
2F&2IBatch10	235
3B&3DBatch11	191
3C&3I&3NBatch12	82
3E&3H&3MBatch13	219
3F&3JBatch14	187
4A&4JBatch15	328
4B&4GBatch16	419
4C&4DBatch17	421
4EBatch18	299
4F&4I&5ABatch19	401
4H&4NBatch20	324
4K&4MBatch21	379
4LBatch22	192
5B&5KBatch23	307
5C&5HBatch24	333
5D&5I&5JBatch25	315
5E&5N&5PBatch26	380
5F&6GBatch27	296
5G&5MBatch28	130
6A&6B&6F&6LBatch29	100
6C&6HBatch30	286
6D&6E&6I&6K&6MBatch31	348
6JBatch32	203
ABSENTEEMAILBatch33	474
ABSENTEEINPERSONBatch34	226



# Risk-Limiting Audit of the Nov. 2, 2021 Special Election

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BRIANNA L. LENNON  
BOONE COUNTY CLERK

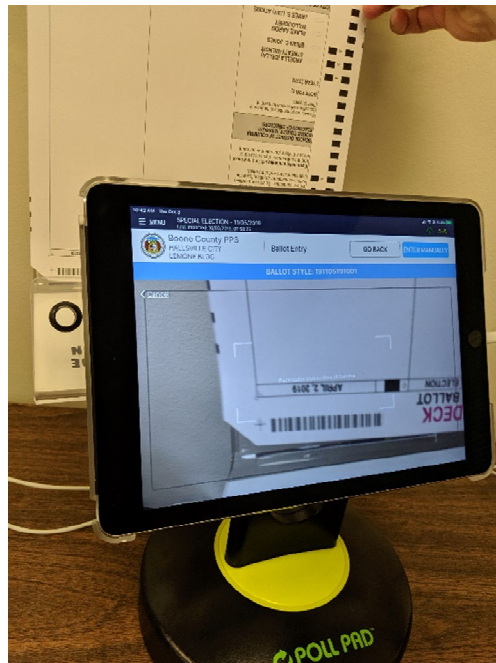
## *Why are we here?*

- In Missouri, audits are already an integral part of the election process.
- Before certifying any election, a bipartisan team of election judges must hand count the ballots from a randomly-selected 5% of our precincts.
- We also know that, nationally, public confidence in our election process has been shaken over the last year and it's important to us that we do everything we can to educate voters about safeguards already in place.



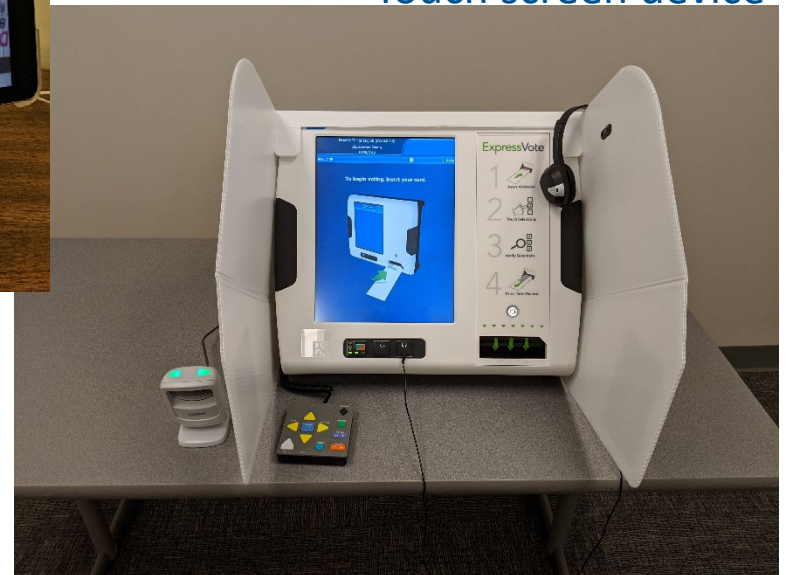
## *Voting in Boone County*

You have the choice of a paper ballot you mark with a pen or a paper ballot you mark with a touch screen.



iPad issuing a voter a ballot  
to mark with a pen

Touch screen device





## *Voting in Boone County*

Voters place their ballot into the top of the voting machine. The screen let's them know if they made any mistakes and confirms that the ballot has been received.



*RLA:  
What is it?*

- Post-election audit that provides statistical evidence that the outcome is correct.
- The number of ballots that need to be examined is based on the margin of victory – the greater the margin the lower the number of ballots that need to be examined.
- This type of audit also checks the accuracy of the voting system.
- Simply put, it's a quality control measure!

*RLA:  
How does it  
work?*

- Independent RLA software will tell us a random selection of ballots to check from the entire election.
- Bipartisan teams of audit judges will look at the selected ballots.
- The audit teams' results will be entered into the software until we reach the desired risk-limit.

## *Goals for the day*

- Answer questions about how elections are currently certified
- Provide an example of another audit technique used in other states
- Use this as an opportunity to foster discussion about our elections processes

Reach us online, by phone, or in person at:

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Organization	Election Name	State			
Missouri - Boone County	November 2, 2021 Special Election	MO			
CONTESTS					
Contest Name	Number of Winners	Votes Allowed	Total Ballots Cast	Tabulated Votes	
Columbia Proposition 1	1	1	8964	Yes: 7202; No: 1760	
Audit Name	Audit Type	Audit Math Type	Risk Limit	Random Seed	Online Data Entry?
November 2, 2021 Special Election	BALLOT_POLLING	BRAVO	5%	303925253143717	Yes
Jurisdiction Name	Audit Board Name	Member 1 Name	Member 1 Affiliation	Member 2 Name	Member 2 Affiliation
Boone County	Audit Board #1	David Mallory	Democrat	James C. Meyer	Republican
Boone County	Audit Board #2	Susan Taylor	Republican	Preston Williams	Democrat
Boone County	Audit Board #3	Cheri Toalson-Reisch; Anthony Lupo; Kurt Bahr	Republican	Michael Barnes	Democrat
ROUNDS					
Round Number	Contest Name	Sample Size	Risk Limit Met?	P-Value	Audited Votes
1	Columbia Proposition 1	38	Yes	0.001160254	Yes: 30; No: 8
SAMPLED BALLOTS					
Jurisdiction Name	Batch Name	Ballot Position	Audited?	Audit Result: Columbia Proposition 1	
Boone County	1C&1GBatch3	24	AUDITED	Yes	
Boone County	1C&1GBatch3	161	AUDITED	Yes	
Boone County	1C&1GBatch3	236	AUDITED	No	
Boone County	2A&2GBatch6	29	AUDITED	Yes	
Boone County	2A&2GBatch6	118	AUDITED	Yes	

Boone County	2B&2JBatch7	100	AUDITED	No	
Boone County	2C&2H&3A&3G&3LBatch8	140	AUDITED	No	
Boone County	2C&2H&3A&3G&3LBatch8	164	AUDITED	Yes	
Boone County	2C&2H&3A&3G&3LBatch8	236	AUDITED	Yes	
Boone County	2C&2H&3A&3G&3LBatch8	328	AUDITED	Yes	
Boone County	2F&2IBatch10	13	AUDITED	Yes	
Boone County	2F&2IBatch10	153	AUDITED	Yes	
Boone County	3B&3DBatch11	115	AUDITED	Yes	
Boone County	3E&3H&3MBatch13	218	AUDITED	Yes	
Boone County	4A&4JBatch15	39	AUDITED	Yes	
Boone County	4C&4DBatch17	175	AUDITED	Yes	
Boone County	4C&4DBatch17	398	AUDITED	Yes	
Boone County	4EBatch18	173	AUDITED	Yes	
Boone County	4EBatch18	236	AUDITED	Yes	
Boone County	4F&4I&5ABatch19	396	AUDITED	Yes	
Boone County	4H&4NBatch20	310	AUDITED	Yes	
Boone County	4K&4MBatch21	92	AUDITED	No	
Boone County	4K&4MBatch21	167	AUDITED	Yes	
Boone County	4K&4MBatch21	274	AUDITED	No	
Boone County	4LBatch22	130	AUDITED	No	
Boone County	4LBatch22	159	AUDITED	Yes	
Boone County	5B&5KBatch23	173	AUDITED	Yes	
Boone County	5C&5HBatch24	261	AUDITED	Yes	
Boone County	5D&5I&5JBatch25	2	AUDITED	No	
Boone County	5E&5N&5PBatch26	117	AUDITED	Yes	
Boone County	5F&6GBatch27	69	AUDITED	No	
Boone County	6A&6B&6F&6LBatch29	19	AUDITED	Yes	
Boone County	6C&6HBatch30	66	AUDITED	Yes	
Boone County	6D&6E&6I&6K&6MBatch31	127	AUDITED	Yes	
Boone County	ABSENTEEINPERSONBatch34	200	AUDITED	Yes	
Boone County	ABSENTEEMAILBatch33	154	AUDITED	Yes	
Boone County	ABSENTEEMAILBatch33	258	AUDITED	Yes	
Boone County	CENTRALBatch1	150	AUDITED	Yes	