



**MAJORITY OF TENNESSEE COUNTIES – AND CITIZENS – VOTE ON DRES... MEANING THERE ARE NO PAPER BALLOTS SEPARATE FROM MACHINES TO CLEANLY VERIFY THE VOTE AND AUDIT THE VOTE**

**Executive Summary**

Electronic voting machines, also known as Direct Recording Electronic voting machines (DREs), while in some ways an amazing help to counting the vote in an election, in many other ways have opened significant concerns about the possibility the voting process in Tennessee can be tampered with.

Unfortunately, the [majority of Tennessee counties and voters vote on DRE \(Direct Recording Electronic\) voting machines that have been proven to be able to be hacked<sup>1</sup>](#) and do not create a paper ballot separate from fallible voting machines to be reviewed by the voter and available separately to be audited. In the case of these machines, no paper lives outside these machines but, instead, remains in the machine and under the control of hackable machine software.

To ensure election integrity, DREs should be phased out quickly and replaced by a system that includes optical scanners with no ballot marking devices (BMDs) and a return to high-security, hand-marked paper ballots.

**Issue**

Seventy percent of Tennessee counties (67) have no day-of-election paper ballots, affecting 2.6 million (59%) Tennesseans. Only 1.8 million (41%) Tennesseans have greater voting security with paper ballots and no use of DREs. So almost two thirds of Tennessee voters – most in small-to-medium-sized counties – are completely exposed to possible fraud.

So, in the case of a local election issue that arises, citizens cannot truly conduct an audit since there is no voter verifiable paper audit trail to audit the situation. There are no paper ballots that have been cast and sit off to the side apart from the DRE's hackable software for use in checking the electronic count through an audit.

In a similar situation, should an election issue arise with statewide implications and needs to be addressed via a statewide audit of votes, the state of Tennessee is left with only a partial audit of a few counties and a partial audit of a few steps of the voting process in those counties that because of a partial number of ballots separate from machines can only offer a partial answer to the issue. Seventy percent of Tennessee counties can't perform a viable audit, so all Tennesseans are at risk because of these 67 counties and their DREs.

Tennessee needs to phase out the DREs and move to high-security hand-marked paper ballots on which to vote.

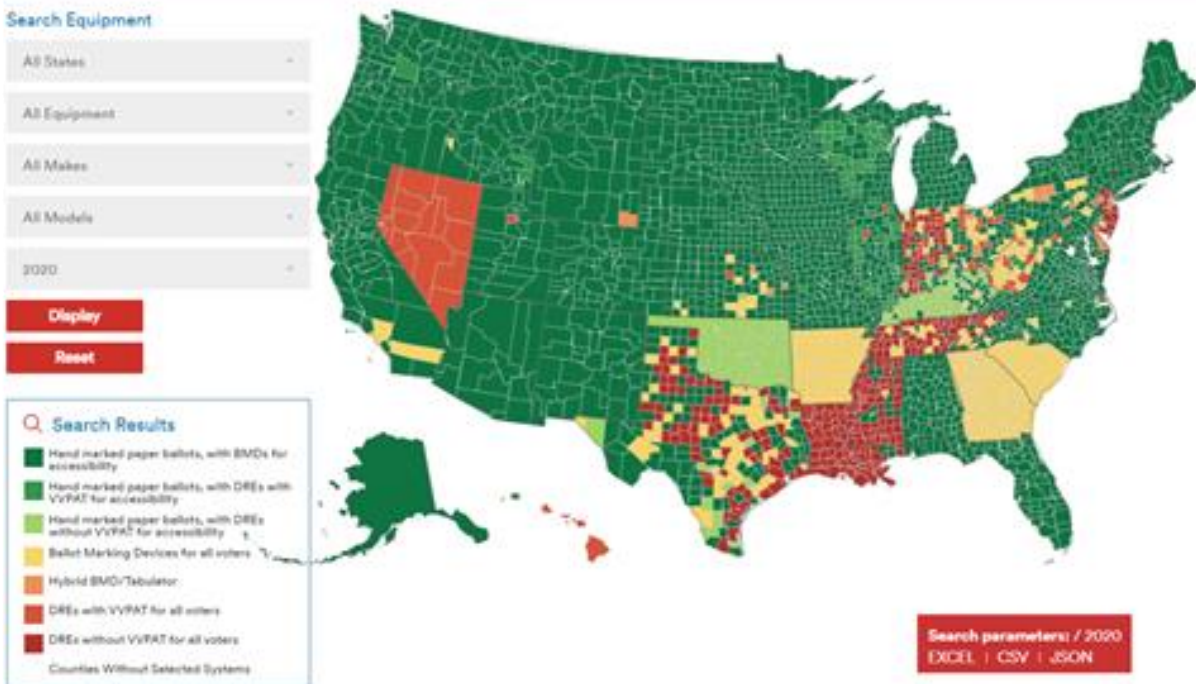
---

<sup>1</sup> <https://www.usatoday.com/story/news/investigations/2020/11/02/computer-experts-sound-warnings-safety-americas-voting-machines/6087174002/>

## Discussion

While many Tennessee county officials have told state officials to “keep your hands off our election machines” because they’re comfortable with them, it appears they may not understand how truly vulnerable their county is to today’s more nefarious bad actors who now can abuse weakly protected technology to change votes... nullifying the voice of county citizens.

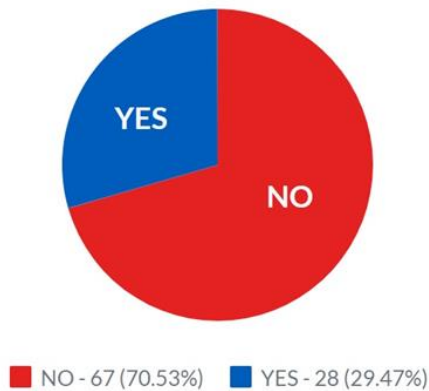
That’s because **Tennessee is one of the few remaining states that have a large number of DREs in use and all without creating a paper ballot that is separate from the software-laden voting machines which have been proven to be easy to hack.** Here is a map of the nation showing Tennessee and a few states who are woefully behind the eight ball on election equipment, paper ballots and other election process components that are anything but secure.



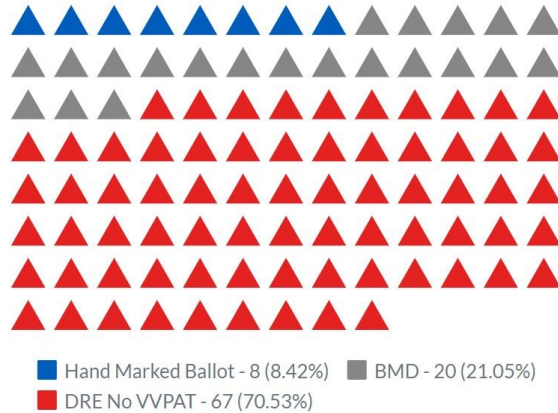
Seventy percent of Tennessee counties (67) have no day-of-election paper ballots, affecting 2.6 million (59%) Tennesseans. Only 1.8 million (41%) of Tennesseans have greater voting security with paper and no use of DREs. So almost two thirds of Tennessee voters – most all in small-to-medium-sized counties – are completely exposed to possible fraud.

These charts below break down this huge liability. The chart on the right offers a county count and the chart at the left shows the conglomerate picture.

## COUNTIES WITH DAY-OF PAPER BALLOTS



## COUNTIES BY SYSTEM TYPE



### No doubt about it... DREs are an exceptionally high risk.

The DRE is a completely contained machine unit that helps cast and store people's vote. The machine has a touch screen on which the voter makes his candidate selections before pressing the button for the vote to be stored in the machine. Yes, some machines have something like a voter verified paper audit trail (VVPAT) but not the DRE machines in Tennessee. There are no ballots that are spit out for the voter to hold in his hands, examine to ensure he's about to cast the vote he wants to cast and no ballot that sits completely apart from the machine off to the side to be audited after the election.

Yes, a button can be pushed on the machine to reveal the electronic vote count and to produce a total tally of votes on the machine via a grocery store-like roll of paper. But everything – all the data -- is under the sole control of the machine's software. Software which has proven to be able to be hacked.

[And many are just simply aging out since manufacturers mostly no longer support them.](#)<sup>2</sup>

A research study in April 2021 gave a pretty good indication about how citizens across the United States feel about DREs when the Pew Research Center reported (after interviewing 5,000+ adults) that [82% of adults strongly or somewhat strongly favored requiring electronic voting machines to print a paper backup of the ballot.](#)<sup>3</sup>

Interestingly, in Tennessee in 2018 a Democratic senator, Jeff Yarbrow from Nashville, sponsored a bill that would provide greater vote security by requiring before January 1, 2020 that all [electronic voting machines have the capability to create a voter verifiable paper audit trail \(VVPAT\) for each ballot cast](#)

<sup>2</sup> <https://www.brennancenter.org/our-work/research-reports/voting-machines-risk-where-we-stand-today>

<sup>3</sup> [https://www.pewresearch.org/politics/wp-content/uploads/sites/4/2021/04/PP\\_2021.04.22\\_voting-access\\_REPORT.pdf](https://www.pewresearch.org/politics/wp-content/uploads/sites/4/2021/04/PP_2021.04.22_voting-access_REPORT.pdf)

[and that the VVPATs be preserved as paper ballots.](#)<sup>4</sup> But the bill failed to advance because no Republican on the committee seconded the sponsor's motion on the proposed legislation.

How disappointing that we passed up the chance to offer citizens more security [because paper ballots are a far better and safer solution on which to vote.](#)<sup>5</sup>

**So, without printed ballots in these 67 counties you can't truly, effectively and fairly audit the vote.** Should there be an issue locally or even state-wide which a post-election audit could clear up, it can't clearly and cleanly be done in these counties. And that affects the other 28 counties where audits can be done because any audit the state performs is only partial. So, an issue could crop up where all 4.45 million registered Tennessee voters could be denied an effective resolution.

[Those county officials that want the Tennessee state government to keep away from updating their voting machines need to realize the harm that their personal desires impart to the citizens of their own county, as well as the citizens of Tennessee.](#)<sup>6</sup>

**What is the answer? Phase out the DREs as soon as possible, replace them with optical scanners (with no ballot marking devices (BMDs) and return the state to hand-marked paper ballots.**

[Since the 2020 election, citizens have certainly been loud and clear concerning diminishing the amount of technology in the voting process.](#)<sup>7</sup> The fact that voting machines have been proven to be hackable by bad actors and election results can be changed has added great impetus to taking this security step. But some technology may be required simply to speed up the process of counting ballots.

The cleanest solution to the problem is to do away with the counting scanners completely and hand count the ballots. But, in the meantime, **optical scanners can serve as a technology that counts the vote**, as long as the equipment is inspected periodically for any questionable software or hardware that can be inserted into these machines and the [guardrails of enhanced audits and high-security paper ballots](#) on either side of the scanners are added to further ensure against any weaknesses. [Optical scanners can help determine a winner quickly in an election because these machines can quickly scan and count ballots.](#)<sup>8</sup> (Of course, no contest is truly final until the audit is performed to verify the winner.)

[A number of organizations nationwide highly recommend the combination of optical scanners with paper ballots.](#)<sup>9</sup>

In other documents, we have recommended a [security risk evaluation for all machinery](#) that remains in the voting process which will help ensure the remaining equipment is clean. Only one scanner is needed

---

<sup>4</sup> <https://tennesseestar.com/2018/08/22/republicans-in-state-senate-did-not-support-bill-to-secure-tennessee-voting-machines-with-paper-ballot-audit-trail/>

<sup>5</sup> <https://www.theatlantic.com/magazine/archive/2017/12/guardian-of-the-vote/544155/>

<sup>6</sup> <https://www.govtech.com/elections/despite-risks-some-states-still-use-paperless-voting-machines.html>

<sup>7</sup> <https://www.theatlantic.com/magazine/archive/2017/12/guardian-of-the-vote/544155/>

<sup>8</sup> <https://www.cleveland.com/election/2020/10/how-do-optical-scanners-collect-votes-and-why-are-they-so-secure-election-truth.html>

<sup>9</sup> [https://www.citizensforbetterelections.org/?page\\_id=211](https://www.citizensforbetterelections.org/?page_id=211)

in a precinct (with one backup scanner) to cast and count the ballots. And many scanners, like the Dominion optical scanner currently in use in Williamson County, have the ability for self-adjudication in real time. That means any mis-marked ballot is spit back out to the voter immediately before it is counted and the voter is allowed to step to another location to change, correct or re-do their own ballot. So, no third party will have to figure out the voter's intent... there's no adjudication by an unknown person who has simply no clue about the voter's intent.

Part of our recommendation for lessening the technology in voting is **the removal of the Ballot Marking Devices (BMDs)** that are proving to be equally risky in the voting process.

The studies coming out concerning the risks of BMDs is stunning. We have a separate document about the fallacies of BMDs, but here are a few of the issues our research has uncovered:

- [BMDs can be hacked, misconfigured or contain malware that alters the ballots or tallies](#);<sup>10</sup>
- [BMD touchscreens can be mis-calibrated causing "vote flipping"](#);<sup>11</sup>
- [Studies prove only a small percentage of voters check BMD-generated ballots for errors](#);<sup>12</sup>
- [BMD accuracy cannot be confirmed by audit](#);<sup>13</sup> and
- [BMDs have a lack of transparency, auditability and produce longer voting wait times](#).<sup>14</sup>

There are other issues, but these confirm the risks of using BMDs and with citizens calling for less technology in their voting process, election officials and legislators need to heed what they – and the research – are saying. Both the [National Election Defense Coalition](#)<sup>15</sup> and [Verified Voting](#)<sup>16</sup> have strongly opposed the purchase and deployment of BMDs.

Key to better election integrity and a critical part of our recommended new, comprehensive, more secure voting model is the **use of high security voter-/hand-marked paper ballots that feature the same security standards as that used by U.S. Treasury to prevent counterfeiting**. This move is supported by J. Alex Halderman, a University of Michigan professor of computer science and engineering and director for the Center for Computer Security & Society Election Integrity, who in a 2018 Defcon presentation [pointed out the extensive vulnerabilities in voting machines and recommended states return to paper ballots and enhanced audits](#).<sup>17</sup>

Our team has worked with current Arizona Representative Mark Finchem, [who is developing a high security ballot for Arizona voters](#)<sup>18</sup> following their 2020 election audit which revealed breathtaking issues. His proposed high security ballot will use the same security standards used by the U.S. Treasury to protect our money and prevent counterfeiting. Components include:

- Randomized ID, watermark UV light-reactive paper;

<sup>10</sup> <https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf>

<sup>11</sup> <https://apnews.com/article/ae388fb69d14e5d3619128a591cdc0c4>

<sup>12</sup> <https://jhalderm.com/pub/papers/bmd-verifiability-sp20.pdf>

<sup>13</sup> <https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf>

<sup>14</sup> <https://www.electiondefense.org/ballot-marking-devices>

<sup>15</sup> <https://www.electiondefense.org/ballot-marking-devices>

<sup>16</sup> <https://verifiedvoting.org/statement-on-ballot-marking-devices-and-risk-limiting-audits/>

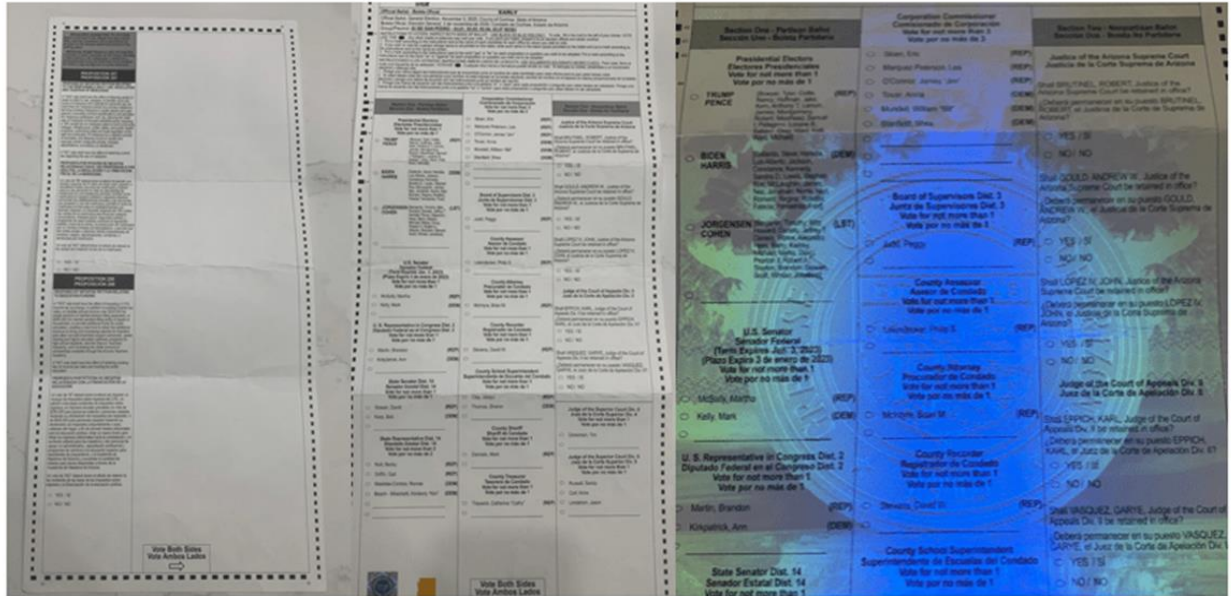
<sup>17</sup> <https://www.youtube.com/watch?v=4K0YZcbbzhc>

<sup>18</sup> <https://votefinchem.com/finchems-arizona-ballot-integrity-project-seeks-to-prevent-voter-fraud/>



- Embedded ballot holograms of translucent mylar;
- Microprinting of words, images in the hologram;
- A randomized ID only the voter knows... that will help him/her track his/her vote throughout its progression... helping the voter ensure his/her vote was counted as he/she intended.

Below is a photo on the left of the back and front of a regular ballot. On the right is what is seen when UV light is shown on the high security paper... a number of watermarks and holograms.



Then, below you can see the secure micro printing that appears in certain places on the ballot, as well as a better photo of the translucent ballot holograms. Finally at the bottom left is the QR Code that citizens can use to be transported to a secure website where their unique ballot ID number is revealed for them to follow the ballot's path through counting.

An additional benefit of the unique ID is that it will ensure a ballot is not counted more than once and it will be exceedingly helpful in the enhanced risk limiting audit we are proposing.

**Secure MICRO PRINT** UV Magnification 3



- Translucent Ballot Hologram
- Lower left-hand corner
- Special Wavelength Responsive

UV Light

Regular Light



- **QR Code** is UNIQUE to every ballot. Only the VOTER knows their ballot ID #
- You TRACK YOUR ballot through the entire system to insure YOUR ballot is counted
- Election officials cannot connect the ballot with the voter



Official Ballot - Boleta Oficial

Official Ballot, General Election, November 3, 2015  
Boleta Oficial, Elección General, 3 de noviembre de 2015  
Group/Precinct: 03 BE SAN PEDRO - 03.01.1

INSTRUCTIONS TO VOTERS: INSPECT BOTH SIDES OF THE BALLOT LIKE THIS



Cost Effective  
Ballot Security  
Voter Privacy Protected  
Public Record Protection

Trust...But Verify  
Support BALLOT INTEGRITY  
Support VOTER INTEGRITY  
Support ELECTION INTEGRITY

Your unique ballot ID is: Y4SKN6G

How much will this cost?  
That's right, 25¢ per ballot



By making every ballot image available to everybody, all the time, we come close to making the forensic audit obsolete...



This is the type ballot we are strongly recommending for use in Tennessee in every ballot... early voting, absentee and election day voting.

Some legislators are concerned about the cost of going to other technologies, however the option that the Tennessee Voters for Election Integrity is proposing – moving to hand-marked paper ballots that are read by optical scanners – is actually much cheaper than other more elaborate voting systems. [The National Election Defense Coalition agrees.](#)<sup>19</sup>

[According to Pew, optical scanners that read paper ballots cost around \\$5,000, but only one -two scanners are needed per polling location in addition to the cost of the paper ballot at an estimated \\$0.35 to \\$0.65 each.](#)<sup>20</sup> Finchem's ballot has been estimated to cost \$0.25.

Same with the cost of optical scanners versus the BMDs.

### **Recommendation**

The evidence is clear that the use of DREs that create no verifiable voter paper audit trail are highly risky and should be phased out as quickly as possible. With 70% of Tennessee counties (67) having no day-of-election paper ballots, affecting 2.6 million (59%) Tennesseans, DREs are an exceptionally high risk.

[Phase out the DREs as soon as possible, replace them with optical scanners \(with no ballot marking devices \[BMDs\]\) and return the state to hand-marked paper ballots.](#)<sup>21</sup>

<sup>19</sup> <https://www.electiondefense.org/ballot-marking-devices>

<sup>20</sup> <https://tennesseestar.com/2018/08/22/republicans-in-state-senate-did-not-support-bill-to-secure-tennessee-voting-machines-with-paper-ballot-audit-trail/>

<sup>21</sup> [https://www.citizensforbetterelections.org/?page\\_id=211](https://www.citizensforbetterelections.org/?page_id=211)

[Use high-security, hand-marked paper ballots on which to vote.](#)<sup>22</sup>

Ultimately, a more long-term solution: Remove the scanners and count the ballots by hand by precinct.

### **Conclusion**

The risks are too great to depend upon old technology that is both aged and vulnerable. DREs need to go. The sanctity of the American citizen's vote is too precious not to address the vulnerabilities in these voting machines and processes that have proven to dash the confidence citizens may have in the voting process.

Remove DREs and use high-security, hand-marked paper ballots on which to vote. No BMDs. Ultimately, count the vote by hand, but in the interim, use optical scanners that have been checked for nefarious technology and are surrounded by guardrails to keep them honest.

In reality, voting machine companies sell "trust," not just a way to vote. And at this point, no voting machine company, election commission or government official in Tennessee has that. Our recommendation represents the voice of citizens and is the best course of action that can ensure the validity of an election and help launch a return of consumer confidence and trust in Tennessee elections.

###

---

<sup>22</sup> <https://www.brookings.edu/blog/techtank/2019/08/14/why-paper-is-considered-state-of-the-art-voting-technology>