



**NINETEEN REPORTS, NINETEEN REASONS AND ONE HUNDRED SEVENTY-EIGHT FOOTNOTES WHY  
BALLOT MARKING DEVICES (BMDs) ARE A BAD TECHNOLOGY IF YOU'RE CONCERNED  
WITH ELECTION INTEGRITY**

**FALLACY #1: BMDs ARE PREFERABLE TO HAND-MARKED PAPER BALLOTS.**

"There is no realistic mechanism to fully secure vote casting and tabulation voting systems from cyber threats."

*National Academies of Sciences, Engineering, and Medicine; Securing the Vote: Protecting American Democracy (2018)*

<https://www.nap.edu/catalog/25120/securing-the-vote-protecting-american-democracy><sup>1</sup>

*Curling v. Raffensperger lawsuit demanding, among other steps, that Georgia cease using BMDs and move to hand-marked paper ballots (October 2020)*

<https://georgiarecorder.com/wp-content/uploads/2021/08/CurlingVRaffensperger.pdf><sup>2</sup>

*J. Alex Halderman Declaration in Curling vs Raffensperger Georgia lawsuit affirming the vulnerabilities of BMDs vs. hand-marked paper ballots (August 2021)*

<https://tennesseeelectionintegrity.com/wp-content/uploads/2022/05/Halderman-Rebuttal-080221.pdf><sup>3</sup>

*The Only Safe Means of Voting is Hand-Marked Paper Ballots (June 2020)*

<https://www.nccivitas.org/2020/safe-means-voting-hand-marked-paper-ballots/><sup>4</sup>

*Expert Opinions on Electronic Ballot Marking Devices (BMD) Security (VoterGA)(2023)*

<https://voterga.files.wordpress.com/2019/03/expert-security-opinions.pdf><sup>5</sup>

*Security Analysis of the Dominion ImageCast X BMD (Alex Halderman report unsealed in Georgia)(2023)*

<https://freedom-to-tinker.com/2023/06/14/security-analysis-of-the-dominion-imagecast-x/><sup>6</sup>

**— BMDs can be hacked, mis-programmed, misconfigured, or contain malware which alters the ballot or tallies.**

*Can Voters Detect Malicious Manipulation of Ballot Marking Devices? (May 2020)*

<https://jhalderm.com/pub/papers/bmd-verifiability-sp20.pdf><sup>7</sup>

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<sup>1</sup> <https://www.nap.edu/catalog/25120/securing-the-vote-protecting-american-democracy>

<sup>2</sup> <https://georgiarecorder.com/wp-content/uploads/2021/08/CurlingVRaffensperger.pdf>

<sup>3</sup> <https://tennesseeelectionintegrity.com/wp-content/uploads/2022/05/Halderman-Rebuttal-080221.pdf>

<sup>4</sup> <https://www.nccivitas.org/2020/safe-means-voting-hand-marked-paper-ballots/>

<sup>5</sup> <https://voterga.files.wordpress.com/2019/03/expert-security-opinions.pdf>

<sup>6</sup> <https://freedom-to-tinker.com/2023/06/14/security-analysis-of-the-dominion-imagecast-x/>

<sup>7</sup> <https://jhalderm.com/pub/papers/bmd-verifiability-sp20.pdf>

*Ballot Marking Devices Cannot Assure the Will of the Voters (April 2019)*

[https://www.researchgate.net/publication/333245177\\_Ballot-marking\\_devices\\_BMDs\\_cannot\\_assure\\_the\\_will\\_of\\_the\\_voters](https://www.researchgate.net/publication/333245177_Ballot-marking_devices_BMDs_cannot_assure_the_will_of_the_voters)<sup>8</sup>

*There is No Reliable Way to Detect Hacked Ballot-Marking Devices (August 2019)*

<https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf><sup>9</sup>

*It's Still Practically Impossible to Secure Your Computer or Voting Machine Against Attackers Who Have 30 Minutes of Access (August 2021)*

<https://freedom-to-tinker.com/2021/08/13/its-still-practically-impossible-to-secure-your-computer-or-voting-machine-against-attackers-who-have-30-minutes-of-access/><sup>10</sup>

*Magical thinking about Ballot-Marking-Device contingency plans*

<https://freedom-to-tinker.com/2022/07/21/magical-thinking-about-ballot-marking-device-contingency-plans/><sup>11</sup>

— **BMD touchscreens can be mis-calibrated causing “vote flipping.”**

*Reliability of Pricy New Voting Machines Questioned (February 2020)*

<https://apnews.com/article/ae388fb69d14e5d3619128a591cdc0c4><sup>12</sup>

*Ballot Marking Devices Cannot Assure the Will of the Voters (April 2019)*

[https://www.researchgate.net/publication/333245177\\_Ballot-marking\\_devices\\_BMDs\\_cannot\\_assure\\_the\\_will\\_of\\_the\\_voters](https://www.researchgate.net/publication/333245177_Ballot-marking_devices_BMDs_cannot_assure_the_will_of_the_voters)<sup>13</sup>

*There is No Reliable Way to Detect Hacked Ballot-Marking Devices (August 2019)*

<https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf><sup>14</sup>

— **BMDs are less auditable and less secure than paper ballots.**

*Guess Which Ballot Costs Less and is More Secure Paper or Electronic? (August 2019)*

<https://www.pennlive.com/opinion/2019/08/guess-which-ballot-costs-less-and-is-more-secure-paper-or-electronic-opinion.html><sup>15</sup>

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<sup>8</sup> [https://www.researchgate.net/publication/333245177\\_Ballot-marking\\_devices\\_BMDs\\_cannot\\_assure\\_the\\_will\\_of\\_the\\_voters](https://www.researchgate.net/publication/333245177_Ballot-marking_devices_BMDs_cannot_assure_the_will_of_the_voters)

<sup>9</sup> <https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf>

<sup>10</sup> <https://freedom-to-tinker.com/2021/08/13/its-still-practically-impossible-to-secure-your-computer-or-voting-machine-against-attackers-who-have-30-minutes-of-access/>

<sup>11</sup> <https://freedom-to-tinker.com/2022/07/21/magical-thinking-about-ballot-marking-device-contingency-plans/>

<sup>12</sup> <https://apnews.com/article/ae388fb69d14e5d3619128a591cdc0c4>

<sup>13</sup> [https://www.researchgate.net/publication/333245177\\_Ballot-marking\\_devices\\_BMDs\\_cannot\\_assure\\_the\\_will\\_of\\_the\\_voters](https://www.researchgate.net/publication/333245177_Ballot-marking_devices_BMDs_cannot_assure_the_will_of_the_voters)

<sup>14</sup> <https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf>

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*There is No Reliable Way to Detect Hacked Ballot-Marking Devices (August 2019)*

<https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf><sup>17</sup>

*It's Still Practically Impossible to Secure Your Computer or Voting Machine Against Attackers Who Have 30 Minutes of Access (August 2021)*

<https://freedom-to-tinker.com/2021/08/13/its-still-practically-impossible-to-secure-your-computer-or-voting-machine-against-attackers-who-have-30-minutes-of-access/><sup>18</sup>

**— Reliability of BMDs relies on voters detecting error on their ballot, yet only 5%-7% of voters find and report errors.**

*Can Voters Detect Malicious Manipulation of Ballot Marking Devices? (May 2020)*

<https://jhalderm.com/pub/papers/bmd-verifiability-sp20.pdf><sup>19</sup>

*What Voters Are Asked to Verify Affects Ballot Verification: A Quantitative Analysis of Voters' Memories of Their Ballots (December 2018)*

[https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3292208](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3292208)<sup>20</sup>

*J. Alex Halderman Declaration in Curling vs Raffensperger Georgia lawsuit affirming the vulnerabilities of BMDs vs. hand-marked paper ballots (August 2021)*

<https://tennesseeelectionintegrity.com/wp-content/uploads/2022/05/Halderman-Rebuttal-080221.pdf><sup>21</sup>

*Today's Electronic Voting Machines*

<https://freespeechforpeople.org/todays-electronic-voting-machines/><sup>22</sup>

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<sup>15</sup> <https://www.pennlive.com/opinion/2019/08/guess-which-ballot-costs-less-and-is-more-secure-paper-or-electronic-opinion.html>

<sup>16</sup> [https://www.researchgate.net/publication/333245177\\_Ballot-marking\\_devices\\_BMDs\\_cannot\\_assure\\_the\\_will\\_of\\_the\\_voters](https://www.researchgate.net/publication/333245177_Ballot-marking_devices_BMDs_cannot_assure_the_will_of_the_voters)

<sup>17</sup> <https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf>

<sup>18</sup> <https://freedom-to-tinker.com/2021/08/13/its-still-practically-impossible-to-secure-your-computer-or-voting-machine-against-attackers-who-have-30-minutes-of-access/>

<sup>19</sup> <https://jhalderm.com/pub/papers/bmd-verifiability-sp20.pdf>

<sup>20</sup> [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3292208](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3292208)

<sup>21</sup> <https://tennesseeelectionintegrity.com/wp-content/uploads/2022/05/Halderman-Rebuttal-080221.pdf>

<sup>22</sup> <https://freespeechforpeople.org/todays-electronic-voting-machines/>

**—Only hand marked ballots are software-independent, contestable, and defensible.**

*Ballot Marking Devices Cannot Assure the Will of the Voters (April 2019)*

[https://www.researchgate.net/publication/333245177\\_Ballot-marking\\_devices\\_BMDs\\_cannot\\_assure\\_the\\_will\\_of\\_the\\_voters](https://www.researchgate.net/publication/333245177_Ballot-marking_devices_BMDs_cannot_assure_the_will_of_the_voters)<sup>23</sup>

*There is No Reliable Way to Detect Hacked Ballot-Marking Devices (August 2019)*

<https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf><sup>24</sup>

*It's Still Practically Impossible to Secure Your Computer or Voting Machine Against Attackers Who Have 30 Minutes of Access (August 2021)*

<https://freedom-to-tinker.com/2021/08/13/its-still-practically-impossible-to-secure-your-computer-or-voting-machine-against-attackers-who-have-30-minutes-of-access/><sup>25</sup>

**—BMDs can show one thing on the screen, but print something different on paper (votes can be changed or deleted).**

*There is No Reliable Way to Detect Hacked Ballot-Marking Devices (August 2019)*

<https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf><sup>26</sup>

*Ballot Marking Devices Cannot Assure the Will of the Voters (April 2019)*

[https://www.researchgate.net/publication/333245177\\_Ballot-marking\\_devices\\_BMDs\\_cannot\\_assure\\_the\\_will\\_of\\_the\\_voters](https://www.researchgate.net/publication/333245177_Ballot-marking_devices_BMDs_cannot_assure_the_will_of_the_voters)<sup>27</sup>

*Testing Cannot Tell Whether Ballot Marking Devices Alter Elections (August 2020)*

<https://www.stat.berkeley.edu/~stark/Seminars/bmd-p-talk-20.slides.pdf><sup>28</sup>

**— BMD accuracy cannot be confirmed by testing or audit.**

*They may look and look, yet not see: BMDs cannot be tested adequately (July 2022)*

<https://tennesseeelectionintegrity.com/bmd-research-report-phillip-stark-072522/><sup>29</sup>

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<sup>23</sup> [https://www.researchgate.net/publication/333245177\\_Ballot-marking\\_devices\\_BMDs\\_cannot\\_assure\\_the\\_will\\_of\\_the\\_voters](https://www.researchgate.net/publication/333245177_Ballot-marking_devices_BMDs_cannot_assure_the_will_of_the_voters)

<sup>24</sup> <https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf>

<sup>25</sup> <https://freedom-to-tinker.com/2021/08/13/its-still-practically-impossible-to-secure-your-computer-or-voting-machine-against-attackers-who-have-30-minutes-of-access/>

<sup>26</sup> <https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf>

<sup>27</sup> [https://www.researchgate.net/publication/333245177\\_Ballot-marking\\_devices\\_BMDs\\_cannot\\_assure\\_the\\_will\\_of\\_the\\_voters](https://www.researchgate.net/publication/333245177_Ballot-marking_devices_BMDs_cannot_assure_the_will_of_the_voters)

<sup>28</sup> <https://www.stat.berkeley.edu/~stark/Seminars/bmd-p-talk-20.slides.pdf>

<sup>29</sup> <https://tennesseeelectionintegrity.com/bmd-research-report-phillip-stark-072522/>

*Ballot Marking Devices Cannot Assure the Will of the Voters (April 2019)*

[https://www.researchgate.net/publication/333245177\\_Ballot-marking\\_devices\\_BMDs\\_cannot\\_assure\\_the\\_will\\_of\\_the\\_voters](https://www.researchgate.net/publication/333245177_Ballot-marking_devices_BMDs_cannot_assure_the_will_of_the_voters)<sup>30</sup>

*There is No Reliable Way to Detect Hacked Ballot-Marking Devices (August 2019)*

<https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf><sup>31</sup>

— **BMD pretests are not reliable because the BMDs can be hacked with target time set for voting hours only.**

*There is No Reliable Way to Detect Hacked Ballot-Marking Devices (August 2019)*

<https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf><sup>32</sup>

**FALLACY #2: BMDs REDUCE POLLING PLACE LINES, MAKE THE VOTE PROCESS MORE EFFICIENT.**

— **BMDs actually produce longer lines.**

*Guess Which Ballot Costs Less and is More Secure Paper or Electronic? (August 2019)*

<https://www.pennlive.com/opinion/2019/08/guess-which-ballot-costs-less-and-is-more-secure-paper-or-electronic-opinion.html><sup>33</sup>

— **Using BMDs takes voters 3x longer than using paper ballots.**

*Reliability of Pricy New Voting Machines Questioned (February 2020)*

<https://apnews.com/article/ae388fb69d14e5d3619128a591cdc0c4><sup>34</sup>

— **BMDs can fail**

*Reliability of Pricy New Voting Machines Questioned (February 2020)*

<https://apnews.com/article/ae388fb69d14e5d3619128a591cdc0c4><sup>35</sup>

*J. Alex Halderman Declaration in Curling vs Raffensperger Georgia lawsuit affirming the vulnerabilities of BMDs vs. hand-marked paper ballots (August 2021)*

<https://tennesseeelectionintegrity.com/wp-content/uploads/2022/05/Halderman-Rebuttal-080221.pdf><sup>36</sup>

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<sup>30</sup> [https://www.researchgate.net/publication/333245177\\_Ballot-marking\\_devices\\_BMDs\\_cannot\\_assure\\_the\\_will\\_of\\_the\\_voters](https://www.researchgate.net/publication/333245177_Ballot-marking_devices_BMDs_cannot_assure_the_will_of_the_voters)

<sup>31</sup> <https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf>

<sup>32</sup> <https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf>

<sup>33</sup> <https://www.pennlive.com/opinion/2019/08/guess-which-ballot-costs-less-and-is-more-secure-paper-or-electronic-opinion.html>

<sup>34</sup> <https://apnews.com/article/ae388fb69d14e5d3619128a591cdc0c4>

<sup>35</sup> <https://apnews.com/article/ae388fb69d14e5d3619128a591cdc0c4>

<sup>36</sup> <https://tennesseeelectionintegrity.com/wp-content/uploads/2022/05/Halderman-Rebuttal-080221.pdf>

— **BMDs have a history of not functioning correctly, for example, in Northampton, PA, Los Angeles, CA, and in GA.**

*Testing Cannot Tell Whether Ballot Marking Devices Alter Elections (August 2020)*  
<https://www.stat.berkeley.edu/~stark/Seminars/bmd-p-talk-20.slides.pdf><sup>37</sup>

*A Pennsylvania County's Election Day Nightmare Underscores Voting Machine Concerns (November 2019)*  
<https://www.nytimes.com/2019/11/30/us/politics/pennsylvania-voting-machines.html><sup>38</sup>

### **FALLACY #3: BMDs ARE LESS EXPENSIVE THAN PAPER BALLOTS.**

— **BMDs cost 2x the amount per voter as Hand Marked Paper Ballots.**

*Guess Which Ballot Costs Less and is More Secure Paper or Electronic? (August 2019)*  
<https://www.pennlive.com/opinion/2019/08/guess-which-ballot-costs-less-and-is-more-secure-paper-or-electronic-opinion.html><sup>39</sup>

— **More money spent on IT staff at local level when BMDs are used.**

*Voting Machines at Risk: Where We Stand Today (March 2019)*  
<https://www.brennancenter.org/our-work/research-reports/voting-machines-risk-where-we-stand-today><sup>40</sup>

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<sup>37</sup> <https://www.stat.berkeley.edu/~stark/Seminars/bmd-p-talk-20.slides.pdf>

<sup>38</sup> <https://www.nytimes.com/2019/11/30/us/politics/pennsylvania-voting-machines.html>

<sup>39</sup> <https://www.pennlive.com/opinion/2019/08/guess-which-ballot-costs-less-and-is-more-secure-paper-or-electronic-opinion.html>

<sup>40</sup> <https://www.brennancenter.org/our-work/research-reports/voting-machines-risk-where-we-stand-today>