

Usability and electronic pollbooks

Project Report: Part 1

Electronic pollbooks: usability in the polling place

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Executive Summary

This is a report of a project that explored what makes electronic pollbooks (e-pollbooks) usable for election officials, poll workers, and voters. We were interested in understanding current practice for designing the interface and interactions, and in how e-pollbooks could be evaluated for usability.

During the project, we gathered information from discussions with election officials who build or use e-pollbooks, demonstrations of e-pollbook systems, poll worker manuals and training materials from several jurisdictions, and reviews of reports from election officials about pilot studies or other projects to consider the use of e-pollbooks in their jurisdiction. In all of this fact-finding, our focus was on the usability of e-pollbooks, particularly for poll workers, as well as how election staff uses them before, during, and after Election Day.

We found that there is wide interest in using e-pollbooks to improve election administration, even though election laws do not always allow their use.

The perceived benefits include:

- Faster check in times on Election Day
- Better “customer service” such as helping voters find the correct polling place
- Increased accuracy of the voter roster
- Reduced time needed to update voter records in the central database after the election.

Concerns about them include:

- Introducing more technology into the polling place
- Worries about acceptance by poll workers
- The cost of purchase and integration into election administration
- Security and election integrity issues of new technologies

This report focuses on usability and accessibility of e-pollbooks, that is, their use by poll workers and voters, rather than on technical features or costs.

The systems themselves include commercial systems, often created as an extension of the offerings to existing voting systems, voter registration databases, election management system, or poll worker support systems. Some states are building e-pollbooks that connect directly to their state-wide voter registration database.

- Most e-pollbooks have similar core features, but are differentiated by how they implement them, as well as by the additional features they offer.

- Although there is a mix of both laptops and commercial tablets, most electronic pollbooks run on standard hardware and are sold as software and service rather than dedicated self-contained systems.

One reason for undertaking this project is that information about e-pollbooks is fragmented, making it hard to get a good picture of the state of the art.

- The functions and technical architectures of e-pollbooks are highly varied: Some are tightly integrated with a voting system both authenticating voters and activating an electronic ballot. Others are a local copy of the voter registration database, used to check voters in, but with no other connection during Election Day.
- Whatever other features they include, all e-pollbooks provide the core functionality: checking in voters and recording that they voted. Almost all also support updating the voter history in the master central voter registration database.
- There many variations in how they are used, and significant differences in their design and usability. Those differences can have a significant impact on how easy it is for the poll workers, who work a very long day, to quickly and accurately complete the check-in process and other associated activities.
- There are few standards for e-pollbook usability even in the few states that have a process for certifying them.

Many election officials today focus on the ability of the e-pollbook to be integrated into their elections processes, and work seamlessly with their election systems. The usability of these systems is often not considered.

Additionally, election officials don't have an effective means for evaluating the usability of an e-pollbook or a good understanding of what makes one e-pollbook more usable for poll workers, voters, and election administrators.

This document reports on the use of e-pollbooks in the U.S.; their software, hardware, and interface design, usability, and evaluation. Also presented are the processes in which e-pollbooks are used and state laws encouraging or prohibiting their use. A companion document presents a draft test protocol for evaluating the usability of e-pollbooks.

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Introduction

Over the last half century, voter registration lists have moved from paper to centralized digital state databases. Electronic poll books (e-pollbooks) extend this technology to the polling place, providing a digital system to look up, identify, and authorize voters, rather than relying on printed poll books.

E-pollbooks also make new options for election administration possible. These new features include things as simple as making it possible for poll workers to help a voter find their correct polling place, and even print a map of the location. They also include more profound changes like real-time data updates that help reduce the number of provisional ballots and make vote centers possible¹.

This project started as an exploration of what makes e-pollbooks usable for election officials, poll workers, and voters. We were interested in understanding good practice for designing the interface and interactions, and in how e-pollbooks could be evaluated for usability.

Many new e-pollbooks have been developed since the Federal Voluntary Voting System Guidelines (VVSG) 1.0 was approved in 2005 and VVSG 1.1 was first proposed in 2009. The wider use of e-pollbooks also coincides with wide availability of mobile devices including smart phones and tablets and other new technologies. This combination of events has made e-pollbooks a natural experiment in the uses of new technologies in election systems as vendors and election officials have explored options to find the solution that works best for their needs.

There are few—if any—standards for usability written for them. They are not covered by the VVSG, and information about them is fragmented, making it hard to get a good picture of the state of the art. Standards and requirements for e-pollbooks are decentralized, managed by states and counties, with only a few states having formal standards for e-pollbooks. There is even less information available about their usability. The few formal state e-pollbook certification programs have few or no usability requirements.

This report is a first step in filling this gap, with a review of the current landscape for e-pollbooks, focused on their usability and accessibility. We

¹ Vote centers are polling places that are set up to handle voters from an entire jurisdiction rather than just those for a single precinct or district. The large number of voters makes paper lists impractical; the fact that voters can vote in more than one physical location requires synchronized updates of voter check-ins at all locations.

include accessibility as part of usability issues because both poll workers and voters who may have disabilities interact with these systems.

It focuses on:

- The role e-pollbooks play in the polling place
- Election officials' goals in adopting them
- Their usability for poll workers and voters

About this report

This report is a first step in developing a better understanding of usability for poll workers and voters using e-pollbooks. It is organized in four sections.

- An overview of the considerations for usability in the polling place including differences between e-pollbooks and voting systems.
- A proposal for how e-pollbooks might be evaluated, including a preliminary protocol for running a usability test to support design, purchase, training, or certification.
- An analysis of the design elements that make up the interface to an e-pollbook.
- A summary of our fact-finding on e-pollbooks and their practical use around the country.

The information in the report comes from discussions with people who create and use e-pollbooks and election officials who are interested in using e-pollbooks in the future, demonstrations of e-pollbook systems, poll worker manuals and training materials from several jurisdictions, and reviews of reports from election officials about pilot studies or other projects to consider the use of e-pollbooks in their jurisdiction. Specifically, we conducted fact-finding discussions and saw demonstrations with

- 20 state and local election officials
- 11 models of e-pollbooks
- 4 systems built by election departments.

The focus of the fact-finding was on the usability of e-pollbooks, particularly for poll workers, as well as how election staff uses them before, during, and after Election Day.

The largest section of this report, Using an e-pollbook: design analysis (starting on page 18) looks at the key interface features and functions of an e-

pollbook and suggests design principles for usability as well as considerations for a designer (or someone evaluating a system).

It also shows examples of patterns for each interface element to explain differences in approach visually. **This is not a review of specific products.** Instead of the usual practice of showing actual screen shots to illustrate design issues, we have created sketches and diagrams to show different approaches to interactions.

What this report is not

Although we touch on some of the legislative and policy constraints, this is not a comprehensive review of election code requirements for e-pollbooks or all variations of how e-pollbooks are used in election administration. Data from the National Conference of State Legislatures (NCSL)² report on use of e-poll books provided a helpful and thorough background to our fact-finding discussions.

This report does not include all products available. In particular, we know that there are many systems that are developed by election offices that we were not able to review.

It does not cover all of the technical functions of e-pollbooks products, except as they might affect their usability. In particular, it does not cover

- The details of how e-pollbooks interoperate with official voter registration databases
- A review of administrative functions available at the polling place
- The security of the technology
- How voter identity is verified at the polling place
- Voter registration practices such as election day registration or guidelines for what updates can be made at a polling place
- Other customizations for specific jurisdictions

This report does not make recommendations for particular e-pollbooks products or provide a feature comparison table for e-pollbooks products beyond a high-level look at the hardware and form factor differences in the **Summary of hardware in systems reviewed** section.

² Electronic Poll Books (updated 5/11/2015) <http://www.ncsl.org/research/elections-and-campaigns/electronic-pollbooks.aspx>

Overview of e-pollbooks in an election

One of the first steps in this project was to define an e-pollbook. Although there is a wide range of features packaged into different models, the core e-pollbook functionality is very consistent. We started from the definition in the report *“The American Voting Experience”* from the Presidential Commission on Election Administration (PCEA)³:

An e-pollbook is an electronic version of the paper pollbook. It is simply a list of eligible voters in the relevant jurisdiction, which traditionally has been organized alphabetically or by address of the voter.

We offer a more active definition, in keeping with our interest in the usability of e-pollbooks:

An e-pollbook is a computer-based system that allows poll workers to look up voters and either check them in to vote or identify the person as not in the list of voters permitted to vote at the polling location.

Using an e-pollbook in an election requires managing voter registration data throughout the entire election administration process, so adopting an e-pollbook is not just a matter of buying a system and putting it in every polling place.



³ The report is available on the PCEA website: <http://www.supportthevoter.gov/>

The data is transformed at each step. Along the way, many different groups of people interact with the system

- Election officials extract the local dataset (usually a single county or precinct) from their registration database. The master source can be either a local or state-wide database.
- Election officials (or vendors) transform the database into the correct format for the e-pollbooks so it can be loaded on the machines.
- During Election Day (or early voting days), poll workers interact with the system, updating voter records.
- Voters also interact with the system, through their signatures or by providing ID cards to scan. Ideally, they will also have the opportunity to check that the voter record found is the correct one by confirming information on the screen.

At the end of Election Day, this process is reversed to update the voters' history.

Beyond the basic functions of managing the voter registration lists, there are many variations in additional features of the existing e-pollbooks. Some are based on differences in election administration and laws, as well as the voting system used in conjunction with the e-pollbook. But, another source of differences in e-pollbooks is the background of the developers and their other election products. For example:

- Companies with voter registration systems tend to see the e-pollbook as an extension of the database, and place more emphasis on updating and managing voter records. This is particularly true for e-pollbooks created or managed by the state election offices as a front-end to the state-wide voter registration system.
- Companies whose previous work includes support tools and processes for election administration are more likely to include features to manage the polling place in the e-pollbook.
- Companies focused on poll workers and their role in the polling place often include training and support functions such as poll worker attendance or other polling place management features.
- Voting system vendors often start with an e-pollbook that creates the activation tokens for the voting system. Similarly companies with ballot-on-demand printers integrate that functionality into the e-pollbook.

- Some developers take a minimalist approach, wanting the least complex software; others want to maximize the value of the new systems in the polling place.

Despite these differences and variations, the cycle of Election Day enforces a general consistency in the work flow, shown in the following table.

The e-pollbook “journey”

When	Activities	
Pre-Election		
Prepare	Pull voters records and convert to e-pollbook format	Set up e-pollbook for polling places: ballot style or other election data
Load	Load data to the e-pollbooks (via server, network or transfer media)	Set up poll worker access and passwords
Election Day		
Opening	Set up and turn on e-pollbook Enter or download any updates to the voter records	Communicate online status to the central office
Polls Open	Check in voters and update voter history. Handle exceptions, including <ul style="list-style-type: none"> • Provisional ballots • Changes to voter records or election day registration • Redirect voters 	Communication: message and updates to and from the election office. Communicate online status and election progress updates Data updates during the day, including mid-day voter activity reports
Closing	Close election day operations Run final reports for closing and end-of-day reconciliation	Upload final data to server
Post Election		
Return	Collect data from e-pollbook and add it to elections results system	
Reports	Election checks and reports for turnout, audit, reconciliation	Communication with public and media as part of election results

When	Activities	
Voter History	Update voter history in local and state database	Voter and turnout analysis

Usability of e-pollbooks in the polling place

Usability is defined generally as a measure of the effectiveness, efficiency, and satisfaction achieved by a specified set of users with a given product in the performance of specified tasks⁴. In this case:

- The product is the e-pollbooks
- The users are the poll workers (and sometimes, the voters)
- The tasks are the different scenarios for checking in a voter and issuing them a ballot or authorizing them to vote, along with managing updates and other Election Day “housekeeping.”

The **efficiency** is a measure of how quickly poll workers can complete both routine and unusual tasks. Efficiency is important because checking in voters is one of the bottlenecks that can cause long lines at a polling place.

Effectiveness is measured by the accuracy with which poll workers can handle each voter. For example, can they:

- Find and identify the correct voter registration record including records that are easily confusable such as Jr/Sr or similar and common names
- Recognize special conditions, such as whether the voter has already voted or identification requirements
- Take appropriate action to check the voter in or deal with special requirements
- Complete administrative procedures such as logging unusual events or updating records

Finally, **satisfaction** is a measure of poll workers’ attitude towards e-pollbooks. This includes both positive attitudes and lack of negative attitudes about them. For example, do they believe that e-pollbooks:

- Help them do their job well
- Make finding voters easy
- Let them check voters in quickly

⁴ This definition is taken from ISO: 9241:11:2008. A slightly early version from 2008 is used as a reference in the Voluntary Voting System Guidelines definitions. The formal definition text is that usability is “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.”

- Help them interact with voters in a helpful way

Scenarios for use

The most basic scenario of use for poll workers is to check in a voter. This means they:

- Find a voter in the database
- Review the voter record to confirm their identity
- Collect the voter's signature or other identification, if needed
- Issue the ballot or any authorization materials
- Mark the voter as having voted

Because this scenario is repeated over and over during an election day, the most important usability attributes are the efficiency and accuracy with which poll workers can complete the interaction.

Poll workers also routinely handle a number of common problems, exceptions, and updates. For these scenarios, it is also important that the systems support the poll workers through accurately completing tasks such as:

- Collecting or confirming identification for a newly registered voter
- Checking addresses of voters
- Identifying voters who are in the wrong polling place as well as providing information about the correct polling place
- Handling voters marked as having received a mail-in ballot or having already voted
- Issuing a provisional ballot
- Collecting information about someone assisting a voter

E-Pollbooks usually include ways to handle updates to the voter registration record and Election Day Registration, where allowed. There is considerable variety in how updates are handled, based on both the capabilities of the system and legal or procedural constraints. Updates and notifications can include:

- Updates to addresses
- Name changes
- Marking a voter who may have moved out of the jurisdiction

Many e-pollbooks also include additional functions to support poll workers or election administration processes. These include:

- Communication of status and summary reports to the election office

- Chat or messaging functions between poll workers and election office
- Help and support such as poll worker training and procedure manuals

Finally, many of the e-pollbooks are software programs that run on general computers or tablets, so although not formally part of the e-pollbook functions, many systems also include, or are closely linked to, election administration functions, including:

- Poll worker rosters and attendance for payroll
- Equipment and supplies inventory
- Reporting tools and forms

Evaluating the usability of an e-pollbook

There are many ways to evaluate the usability of a system or product, from expert reviews against a checklist of best practices to a variety of methods for collecting input from people who might use the product, (demonstrations, feedback surveys, and focus groups), to analyzing statistics from the product in use (web or search results analytics or statistics about access from a server). However, the “gold standard” for evaluating usability is to observe people using the system either as they work or in an environment set up for this purpose – called usability testing.

Usability testing has several benefits:

- It can be done before a system is completely developed or deployed, to improve the design.
- It can be structured to cover both typical and less typical tasks, testing learning as well as repetitive tasks.
- People using the system can be observed without interfering in a real work environment.
- Participants can be interviewed to gain insights about their actions, especially how they solved problems in completing a task.

When combined with other evaluations methods, such as early reviews or pilot tests, usability testing is an important tool in ensuring that election systems work well in the high-stakes of an election day.

When we think about evaluating the usability of an e-pollbook, one of the challenges is that it is used in very short interactions that can be hard to observe. Since some readers may be familiar with usability and NIST’s work supporting the development of a performance test for voting systems⁵, we want to highlight that there is a difference between evaluating the usability of a voting system and an e-pollbook, shown in the table below.

⁵ Preliminary Report on the Development of a User-Based Conformance Test for the Usability of Voting Equipment - <http://www.nist.gov/itl/vote/upload/032906User-BasedConfTesting3-10-06.doc> and

Overview of Proposed Human Performance Metrics for Voting Equipment -
<http://www.nist.gov/itl/vote/upload/032906performance-metrics3-10-06.pdf>

Voting Systems	E-Pollbooks
<ul style="list-style-type: none"> • Short interaction (marking and casting a ballot) • Many users (voters) • Completed once by each user 	<ul style="list-style-type: none"> • Short interaction (finding and checking in a voter) • Few users (poll workers) • Completed many times by each user

Accuracy is critical in both interactions, but there is additional pressure for efficiency in using an e-pollbook.

In our discussions with election officials we heard that they want the e-pollbook to be intuitive, but without strong descriptions of what that means beyond a successful election and a lack of complaints from voters or poll workers. In making purchase decisions, they use events like open vendor fairs or asking a few poll workers to “try out” an e-pollbook.

Although the informal methods mentioned above can provide a general sense of the intuitiveness of an e-pollbook, a usability test will provide richer and more comprehensive data. A good usability test has the following features:

- Simulates “real world” conditions, such as room similar to a polling place and a mock election in which “voters” are checked-in (but don’t vote).
- Covers a broad range of scenarios both common and uncommon. The “voters” present pre-selected scenarios. The scenarios represent the situations the poll workers will encounter.
- Includes a range of poll workers using the system (first timers, inexperienced, experienced) with each being presented with the full set of scenarios
- Focuses on observing and taking notes on the poll worker experience (what was easy, what was difficult, how was the overall experience, etc.)
- Includes enough sessions (typically 8 – 12) to ensure that a variety of experiences using the e-pollbook are included in the test.

Usability testing can be used in this context to provide information on the intuitiveness of an e-pollbook. The results can be used for several different purposes:

- Evaluating an e-pollbook being developed or customized to improve the system’s overall design
- Identifying tasks or procedures that need emphasis during poll worker training or voter education

- Testing a system for state certification or approval.
- Comparing different e-pollbooks to help make a purchase decision.

If the usability test is run with a single e-pollbook product, the results can be analyzed to determine:

- What scenarios did all poll workers complete successfully?
- What scenarios did most or all poll workers have problems with?
- How consistent are the types of problems poll workers had?
- How similar are the number of different problems each poll worker had?
- Are there differences in success rates for experienced, inexperienced, or first-time poll workers?

If the usability test is run on e-pollbooks from more than one manufacturer, the results can also be analyzed to determine:

- What differences were seen in the completion rates for common/uncommon scenarios between the e-pollbooks?
- What differences were seen in the completion rates for experienced/inexperienced/first-time poll workers between the e-pollbooks?
- If your poll workers participated twice, once on each e-pollbook, what is their subjective reaction to the e-pollbooks? Do they have a preference and why?

Note that roughly equivalent acceptable results between e-pollbooks from different manufacturers means the purchase decision can focus on other factors.

The “**Usability Testing for e-Pollbooks**” is in Part 2 of this report. It contains a complete description of the usability test protocol. It can be found with this report at civicdesign.org/projects/epollbooks/

Using an e-pollbook: design analysis

For a first analysis of the interfaces of e-pollbooks, we started from the basic ‘Scenarios for use’. We saw demos of many of the commercial e-pollbooks as well as some built by election departments. We also conducted fact-finding discussions with many election officials about how they integrated e-pollbooks into their election administration processes (see Sources for a list).

The goal of this work is to provide a starting point for a better understanding of the usability of e-pollbooks to help both people developing these systems, and people using these systems, make good decisions about how to design, select, and deploy them.

This project did not include investigation or observations of the process of setting up the e-pollbooks in the polling place. The ease of setup is also important for a complete picture of the usability of e-pollbooks. For example, setting up local networks (or “daisy chains” of e-pollbooks or systems that have complicated peripherals can be a challenge for poll workers.

We looked at the ways that different e-pollbooks support some of the most common tasks and interactions. This analysis does not draw any conclusions about which designs are best. In fact, there are often several ways to design an interaction with good usability.

The interactions we examine in detail are:

- Basic voter check in
- Find a voter by scanning an ID
- Finding a voter by searching
- Reviewing the list of voters found
- Checking voter status
- Checking voter details
- Handling updates and exceptions
- Collecting signatures
- Helping voters in line
- Entering text with an on-screen keyboard
- Supporting poll workers
- Accessibility

Each task/interaction includes the following information:

Section	What it contains
What	A brief description of the interaction and task it supports
Why	How this is important for usability
Usability Guidelines	Design principles that apply to this interaction
Considerations	Questions to ask about the design of this task that affect usability
Variations	Different approaches to the interaction in current e-pollbooks

Basic voter check in

What

The core task: checking in a voter, starting from the home base. This task assumes a voter who is registered to vote, eligible to vote in the election, in the correct polling place, with all necessary identification and no status warnings.

This section is focused on the beginning and end of the basic voter check in. Steps and activities within the process are discussed as a part of other tasks/interactions.

Why it is important

It's the repetitive path through the interface that will be used most often. The poll worker needs to be able to do this quickly and accurately.

Usability Guidelines

- Efficient: Can poll workers complete this task quickly?
- Effective: Can poll workers complete this task accurately?

Design considerations

- How complex is the opening screen for the check-in process, the screen used as “home base”?
- How easy is it for the poll worker to start over after checking-in a voter?
- How obvious is the starting point for finding a voter record?
- How easy is it for a poll worker to return to the search results (list of voters, for example when checking in members of the same family in succession or when the first voter selected is not correct?)
- How many different actions or screens does the poll worker have to navigate to complete this task?

Common variations

- The “home base” may be dedicated to the core function as a voter roster, or may be shared with other election or polling place administration functions.
- The poll worker may have to decide between searching or scanning to find a voter as the first step.
- The interaction to find a voter may take place on several screens or in a single screen that changes through a task.

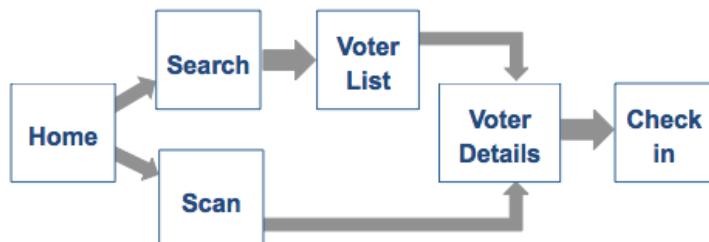
- At the end of checking in a voter, the system may reset to a variety of screens.

Variation in the path

The task starts from a choice to search or scan, leading to separate paths.

This variation makes it easy to see that there are two ways to find a voter, but adds a screen.

Diagram



The home base screen includes both search and scan options on the same page

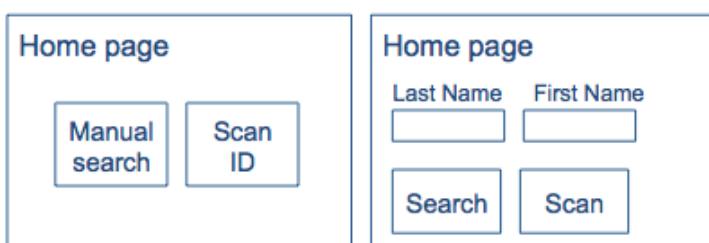
This variation has fewer screens, but the home screen is often more complicated.

Variations in page layout

The Election Day home page may have minimal controls in the main part of the screen.

Poll workers choose between manual search for a voter and scanning an ID, either on a dedicated screen, or with an additional button on the search screen.

Diagram



The Election Day home page may include access to additional election or polling place administration features, which may be presented as subordinate to the voter check in features.



Find a voter by scanning an ID

What

Using a QR or barcode on an ID card to look up the voter record. This ID is most often a driver's license, but can also be a voter registration card, a sample ballot mailed to the individual, or any other legally accepted ID.

Why it is important

Part of core task. Fast accurate lookup can help reduce lines. Using an ID card can make the process both faster and more accurate.

Usability Guidelines

- Efficient: Can poll workers and voters easily position the ID card for scanning?
- Effective: Can poll workers accurately identify the voter found by the scanning process? Does the system support this by highlighting distinguishing elements in the voter record such as gender and age?
Example: A voter might use a sample ballot as ID, coded as belonging to a different voter in the same household, or from the wrong district not knowing that they are personalized.
- Satisfaction: Are voters and poll workers comfortable using the scanning feature?

Design considerations

- Voters are part of this interaction. In states where the ID is used as a convenience (rather than a legal requirement) do they accept using it to sign in?
- Are voters comfortable with how their ID is handled? There is less opportunity for the ID to get lost if only the voter handles it.
- Do the poll workers see the ID card, and can they use it to compare the details to the voter record found?
- What does the system display if there is a problem with the scan?

Common variations

- Different scanning methods, such as built-in cameras, external devices that add visual scan or swipe mechanisms.
- Whether the poll worker or the voter handles the ID card
- Whether or not the poll worker sees an image of the ID on-screen.
- Number of steps required to read the card and find the voter.

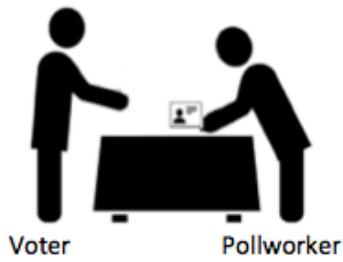
Variations in the interaction**Diagram**

Some systems include a stand with a location for voters to place their card for accurate scanning.

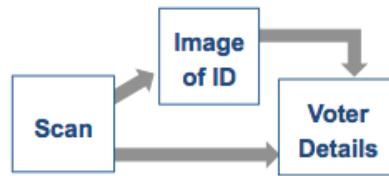
This also means the voter holds on to the card, instead of handing it to the poll worker.



Other systems have the poll worker take the ID from the voter to scan it.



The system may show the poll worker an image of the ID card, or simply read the QR or barcode and go directly to the voter details page



Finding a voter by searching

What

Finding a voter by entering name, address, or other details.

Why is it important

Part of core task. Fast lookup can help reduce lines. Accurate lookup and handling of potential issues with items such as confusable names, status indicators, and similar addresses is critical.

Usability guidelines

- Efficient: Can poll workers find voters with a minimum of typing?
- Efficient: Does the system respond quickly with the results list?
- Effective: Can poll workers accurately identify the voter in a list?

Design considerations

- How many fields have to be filled in before launching a search?
- Are the fields arranged for easy entry, including access to additional fields?
- Does the search only look for matches in specified fields, or anywhere in record?
- How does the system prompt poll workers to refine the search when the result is a long list of potential voters?
- Can poll workers easily see how many voters are found in a search?
- How is the search initiated? Do results automatically display and start to narrow as criteria are entered or not until the search is launched?
- Does the poll worker have to choose the scope of the search (precinct, county, state, inactive)

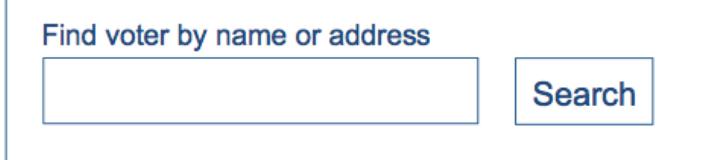
Common variations

- The initial search form includes a wide variety of fields, from just name to all possible fields. Additional fields may be shown with a tab or radio button control to change the search form.
- The search may be initiated with a simple search button, selection of a search scope, or be automatically initiated by the program.

Typical search options include

- Name or First Name, Last Name, Middle Name/Initial, Suffix
- Address or Street Number, Street Name, City, Zip Code
- Date of Birth or Age
- Voter Registration number or other ID number

- A single field for all search criteria

Variations in the search form	Diagram
Some systems have separate search forms for finding a voter in different ways, and use tabs or buttons to allow poll workers to switch between them	
A few systems include all of the fields at once, allowing poll workers to use any of them to find a voter, balancing clutter with efficiency.	
One system has a single search box which will search anywhere in the voter record, including name, address, or other details.	
Even systems that automatically filter the list of voters usually have a search button. Some systems have separate search buttons or other controls to set the scope of the search, while others allow this filtering on the search results screen	

Reviewing the list of voters (search results)

What

Identifying a voter correctly in a list of voters

Why is it important

Part of core task. Poll workers need to be able to quickly identify the right voter in a list, among other voters who may have similar names or addresses, knowing if they are in the wrong place, and determining if they have already voted or have any other special situations.

Usability guidelines

- Efficient and Effective: Does the interface help poll workers accurately identify the voter in the list, separating names “ready to vote” from those who need special attention?

Design considerations

What information is available in the list, and what information requires clicking into the voter record. Can a poll worker tell at a glance if the voter:

- Is ready to vote
- Has already voted
- Is in the wrong precinct
- Has any special status
- Might be easily mistaken for another voter (for example, Jr. vs Sr.)

If the voter is not in the list, can, and how, does the poll worker:

- Expand the search to include the county or state, or inactive voters
- Refine the search by adding additional information, or editing the search criteria?

How easy is it to scan the list?

- Is the typography helpful in showing the most important information?
- Is there enough space between lines?
- Are the most important elements visually differentiated?
- Is the information arranged for quick comprehension?

Common variations

- The search results list may be displayed on the same screen as the search form, or on a new screen.
- There are many variations in the columns in the results list, and how names and other information are displayed.

- There are many variations in icons or other indicators for voter status. (see Checking voter status)
- Some systems mix all voters in a single results list, but at least one separates the list into voters for the current precinct, followed by others in the county.

Variations in the layout	Diagram																																				
If the entire county is searched, voters in the correct precinct are sometimes differentiated through how they are displayed, or by separating them into two lists.	<table border="1"> <thead> <tr> <th>Name</th><th>Address</th></tr> </thead> <tbody> <tr> <td>Drinker, Jean</td><td>57 Main Street, Bewyn</td></tr> <tr> <td>Driver, John L</td><td>1545 Tates Drive, Berwyn</td></tr> <tr> <td>Driver, Melinda K</td><td>1545 Tates Drive, Berwyn</td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Name</th><th>Address</th></tr> </thead> <tbody> <tr> <td>Doughtery, Jordan</td><td>23 Chestnut Street, Maple</td></tr> <tr> <td>Drough, Mary J</td><td>5774 River Road, Easton</td></tr> <tr> <td>Dribner, Robert L</td><td>54 Range Road, Franklin</td></tr> </tbody> </table>	Name	Address	Drinker, Jean	57 Main Street, Bewyn	Driver, John L	1545 Tates Drive, Berwyn	Driver, Melinda K	1545 Tates Drive, Berwyn	Name	Address	Doughtery, Jordan	23 Chestnut Street, Maple	Drough, Mary J	5774 River Road, Easton	Dribner, Robert L	54 Range Road, Franklin																				
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Checking voter status

What

Identifying any special status for a voter including that they have received a vote-by-mail/absentee ballot, are inactive, need to show ID or update their address, require assistance, or other indicators used in a jurisdiction.

Why

Part of core task. Critical to accurate handling of each voter.

Usability guidelines

- Efficient: Are status indicators shown at the earliest point in the work flow, so poll workers can act quickly to handle a voter correctly?
- Effective: Are status indicators easily visible, clearly distinct, and stand out on the screen?
- Effective: Do status indicators use colors in a way that match conventional use, such as using red for problems and green or blue for normal conditions?
- Consistent: Are status indicators used consistently on all screens, and are not easily confused with any other icons or indicators?

Design considerations

- Does every voter have a status indicator, or only voters with a special status, or those who have already voted?
- What status indicators are shown in the results list versus situations that require going to the individual voter record?
- How many icons are there? Are they easy to understand, or hard to learn or easily confused. (Example: does a check mean active and ready to vote, or has voted?)

Common variations

- There are many different styles of icons and choice of indicators.
- Although red-amber-green or blue is often used for color coding status indicators for voted-problems-ready, there is not a lot of consistency across e-pollbooks.
- The status indicator is often shown in the results list, but may also only be shown on the voter detail screen.

Variation in the indicators	Diagram
Some e-pollbooks use a small number of icons and colors, for example, ready, voted, problems.	
Some e-pollbooks use words for the different status indicators.	ACTIVE VOTED ABSENTEE
Some e-pollbooks use abbreviations for the different status indicators.	ACT VOT ABS

Checking voter details

What

Display of information about the voter, allowing poll workers to check their identity and address issues before issuing a ballot.

Why it is important

Part of core task. Critical to accurate handling of each voter.

Usability guidelines

- Efficient: Do poll workers have access to the information and actions they need for each voter?
- Effective: Is information about the voter presented in a way that makes it easy to read, making key details easily visible?

Design considerations

Note: the design considerations listed here apply to all screens, but are especially important on the voter details screen

Is the screen designed so the most important information stands out and in a way that makes it easy for poll workers to scan the screen quickly?

- Is the most important information on the screen the most visible?
- Is there high contrast between text and background color so the information stands out well?
- Is the text large enough, with good spacing between lines or elements?
- Is color used effectively? Does it match conventional use (such as green for positive)?

Common variations

- Voter details may be shown as a form, or in a display format.
- There was a wide variation in how the actions from the voter information screen were displayed.

Variations in the layout

The e-pollbooks were roughly split between those that used a “database” or form-style layout and those that formatted voter information for display.

Diagram

Voter ID	00000000001
Last Name	Doughtery
First Name	Jordan
Middle Name	
Sex	M
DOB	08/01/1963
Address	123 Chestnut
City	Maple Grove
Zip	08888

Jordan Doughtery
August 1, 1963 - Male
23 Chestnut, Maple Grove 08888

Handling updates and exceptions

What

The situations outside the basic check-in, such as provisional voting, election day registration, updates to the voter record, and other features such as entering notes.

Why it is important

When updates and exceptions are handled smoothly the voter is reassured that the system is working well. If the poll worker seems to be having difficulty or taking a long time it can affect the voter's perceptions, and create a bottleneck during the check-in process, leading to long lines.

Usability guidelines

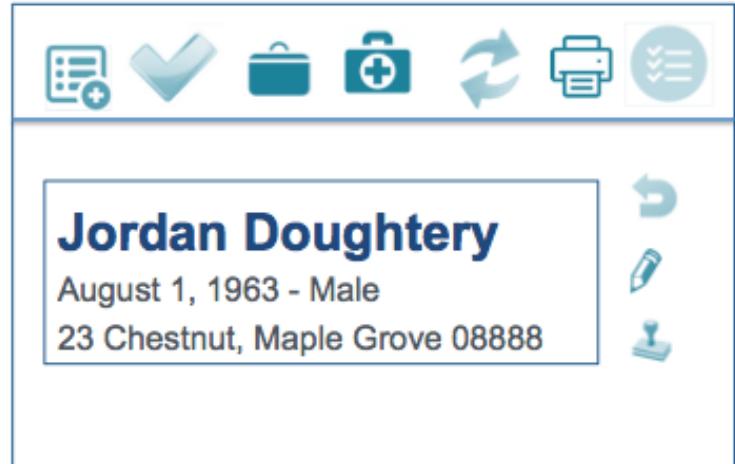
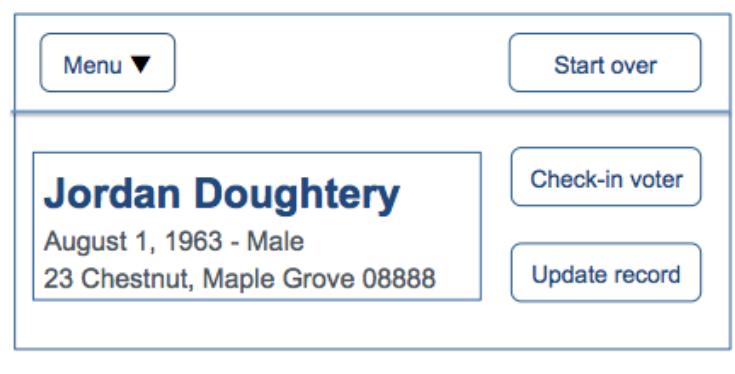
- Efficient: Can poll workers complete tasks, especially those requiring data entry, in a reasonable length of time?
- Effective: Can poll workers complete all steps needed to address the exceptions?

Design considerations

- Are the controls to start or continue an exception process clearly labeled and obvious?
- How easy are the screens to perform updates or other actions to locate and complete?
- How easy is it to collect information from the voters and complete any necessary actions?

Common variations

- The placement of controls to make changes varies widely, including edit buttons placed near each section of data and single buttons for each possible action.
- Entry forms are displayed in a series of screens, or in an overlay window.

Variations in the interaction	Diagram
<p>Some screens have immediate access to many potential actions but at the cost of screen clutter. In this example, there is a busy row of icons at the top of the screen. In addition, the use of unlabeled icons can be confusing.</p>	 <p>The diagram shows a user interface with a row of eight unlabeled icons at the top. Below this is a central card containing the following information:</p> <p>Jordan Doughtery August 1, 1963 - Male 23 Chestnut, Maple Grove 08888</p> <p>To the right of the card are three small icons: a circular arrow, a pencil, and a hand holding a document.</p>
<p>Some screens provide a single access point to less frequently used actions, such as the menu button on the left. The use of simple labels makes the function of each button clear.</p>	 <p>The diagram shows a user interface with a "Menu ▼" button on the left and a "Start over" button on the right. Below this is a central card with contact information and two labeled buttons on the right:</p> <p>Jordan Doughtery August 1, 1963 - Male 23 Chestnut, Maple Grove 08888</p> <p>Buttons on the right:</p> <ul style="list-style-type: none"> Check-in voter Update record

Collecting signatures

What

Voters often have to sign the poll roster. In an e-pollbook they can often sign electronically or sign on a printed slip of paper from an attached label printer.

Why it is important

There are often legal requirements around signature collection. The poll worker may have to compare the voter's signature with the signature on file.

Usability guidelines

- Effective: Can voters easily identify where to sign and fit their signature into the space?
- Effective: Can voters confirm their identity on the signature screen to reduce errors?
- Effective: Can poll workers confirm the signature as required?

Design considerations

For digital signatures

- Does the voter sign on the screen or on a separate signature pad.
- For signing on-screen, how is the screen presented to the voter? (For example, tipped on a stand, rotated, or other.)
- Is the angle optimized to help voters produce a legible signature?
- Can voters use a stylus, or do voters have to sign with their finger. (Signing with a finger is more difficult than using a stylus on many types of signature pads.)
- Can the voter see easily where to sign and are they able to clear the signature, and sign again?

For signatures on paper

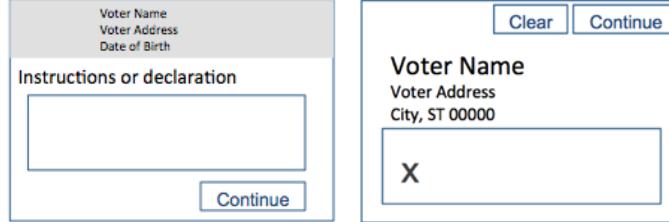
- How easy is it to print the signature collection label or paper?

For all signatures

- What information does the voter confirm that the poll worker has presented the form for the correct voter (name, DOB, address, etc.)
- If the poll worker is required to compare signatures how is this done?

Common variations:

- Devices used to capture signatures vary.
- The signature screen has a wide variety of information, from the full voter record to no identifying information

Variation in the interaction	Diagram
<p>The signature screen may include information about the voter, instructions, or an oath or declaration</p>	

Helping voters in line

What

Providing directions and other guidance to get a voter to the correct voting place helps them vote whether it is direction to another location or the correct line in a multiple-precinct polling place.

Why it is important

Guiding voters to the correct polling place or line reduces provisional ballots and provides a more positive experience for voters and poll workers

Usability guidelines

- Efficient: Can poll workers quickly and easily identify the correct polling place without taking too much extra time?
- Effective: Can poll workers easily provide instructions to the voter in a useful form?

Design considerations

- Does the system include an option for a phone or small tablet to “work the line”
- Is the “mobile” version of the e-pollbook easy to use with one hand, while standing?
- What features and information is included in the mobile version?
- Can the poll worker print directions or a map to give the voter?

Common variations

- Most e-pollbooks can provide the name and address of the correct polling place for a voter. Many can print this information, often with a map or directions.
- E-pollbooks with hand-held or small tablet systems to allow someone to look up voters standing in line can often display this information to share with the voter.
- Some e-pollbooks have a limited set of look-up functions in an app that can work on any phone, others have a dedicated companion app.

Entering text with an on-screen keyboard

What

Typing text using an on-screen keyboard rather than a standard keyboard

Why it is important

Typing on an on-screen keyboard is a different experience. Numerical, non-alphabetical characters, and accents are accessed differently. An on-screen keyboard also claims a large amount of screen space.

Usability guidelines

- Effective: Does the e-pollbook present the keyboard when needed, and hide it appropriately?
- Satisfaction: Does the appearance and hiding of the keyboard avoid intruding on the task or related information?

Design considerations

- How is the appearance and hiding of the keyboard managed?
- Can a user hide the keyboard manually? Does the mechanism to do this assume that the user knows the conventions of the platform?
- Does the keyboard hide information poll workers need or reduce the space for information on the screen?
- Is the keyboard customized for special characters poll workers might need?

Common variations

- The keyboard handling is related to the sequence of screens in search, especially the transition from entering a search to seeing the search results: some systems manage showing and hiding the keyboard automatically. Others jump to a new screen where the keyboard is hidden.

Supporting poll workers

What:

Features to allow election offices to monitor and support poll workers:

- Scripts (words for the poll workers to say) and prompts (reminders and instructions) to help poll workers follow the correct sequence, or use consistent language where required in the flow.
- Messaging systems that allow election officials to broadcast updates or to answer questions without a phone call.
- Monitoring systems that allow election officials to see whether e-pollbooks are online, how many people have voted, and other data.

Why it is important

Helps central office stay in touch with the elections staff in the field. Reduces the amount of information poll workers have to remember. Also helpful for poll worker troubleshooting.

Usability guidelines

- Efficient: Can poll workers get answers to questions quickly?
- Efficient: Can election offices monitor the election remotely, from a central location?
- Effective: Are poll workers prompted to ask the right questions and handle voters accurately?
- Effective: Can poll workers ask questions or look up information from their training manuals easily?

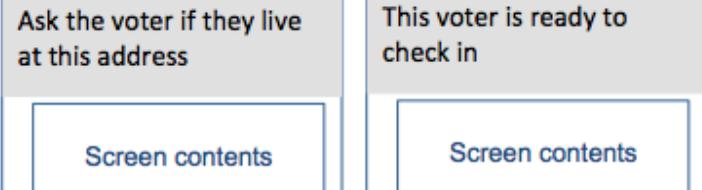
Design considerations:

- Are poll worker prompts or scripts customizable by the election administration staff or only by the vendor's staff?
- Is access to the poll worker training materials built-into the interface?
- Are messages or documentation easy to find without disrupting the flow of voters at the check-in table?
- If poll workers can enter notes about a voter, is this free-form text, or a selection of pre-written notes, or a combination?

Common variations

- Many of the systems have on-screen prompts and scripts.
- Some of the systems include complete poll worker operations manuals or support systems.
- A few of the systems include two-way chat/messaging capabilities.

- Some systems allow poll workers to enter notes about a voter to be reviewed by the elections office.

Variations	Diagram
Many of the systems dedicate a portion of the screen to customizable prompts. They may be in the form of a script.	

Accessibility

What

Systems can be designed to enable customization for accessibility, and may have custom controls that change display features or interactions. E-pollbooks on standard laptops or tablets can use the features of the platform to provide accessibility for poll workers.

Why it is important

Accessible pollbooks can enable people with disabilities to work as poll workers – which is also a good way to support voters with disabilities better.

Usability guidelines

- Effectiveness and Satisfaction: Does the system use platform capabilities for customizing the size of text, color and contrast, and supporting assistive technology where it does not interfere with election administration or security?

Design considerations

Does the system meet accessibility guidelines such as Section 508 or WCAG 2.0

- Can the poll worker change the text size, set colors or change the background from light to dark?
- Does the system work with any built-in accessibility tools such as those that zoom the screen or read information out loud?
- Does the system work with a built-in or add-on screen reader so people who rely on this assistive technology can use the e-pollbook?

Common variations

Very few of the vendors or election office designers mentioned accessibility. We saw:

- One system aiming for Section 508 certification
- One system with a control to allow poll workers to change the text size
- Most systems do not allow the text to be resized or contrast changed
- Many systems use bright red and green colors on buttons, however they also have meaningful text labels.

E-pollbooks in election administration

Although this report is focused on the usability and accessibility of e-pollbooks as they are used at the polling place, it is helpful to consider how they fit into the overall administration of an election and what goals they can support.

To understand why e-pollbooks are being adopted so rapidly, we wanted to know what benefits local election officials see in adding another piece of technology to the polling place. Feedback from election officials on the use of e-poll books in their election processes included:

- Making current procedures easier or more accurate
- Improving election administration
- Enabling new ways of conducting elections
- Monitoring activity at polling places more effectively
- Drawbacks and roadblocks to practical use
- Impact on people in the election process, including election staff, poll workers, and voters.

Making current procedures easier or more accurate

Many election officials mentioned that updating voter history in the state or county database after an election is much easier from e-pollbooks than from paper poll books. In some cases, they also found that the records were more accurate because there are fewer errors in transcribing hand-written records from paper poll books to the database.

Reconciling Election Day records and crediting voters for participation now takes 10 days and 24 people. Using electronic poll books would reduce the time to 1 or 2 days for a single person.

- Election staff member

Improving election administration

Election officials were interested in the capabilities for analysis of activity at the polling place, including:

- Numbers of voters checking in at the polling place during the day. These patterns could help them manage lines better in the future
- Data on updates such as address changes made during the day
- Capturing notes from poll workers on problems they encountered when interacting with voters
- Reducing instances where voters are issued the wrong ballot

Enable new ways of conducting elections

It is not possible to run an election where votes are cast at the polling place⁶ in which voters have a choice of polling place without a way to have immediate updates to the voter history. Vote centers in county offices can use an official network within their building to connect to the voter registration database, but extending vote centers to additional locations in order to have sufficient vote centers to support an entire election requires *connected e-pollbooks*

Even in states where legislation does not allow vote centers, election officials are aware of this trend in elections and thinking about how to build their election administration procedures so that they are ready if laws change.

Monitoring activity at polling places more effectively

Many of the e-pollbooks have the capability of maintaining an Internet connection to a central portal that the election office can monitor. Election officials mentioned many ways they can use this capability:

- It makes it possible for them to see all of the polling places “come online” in the morning, so they get a positive indication that they are set up and ready for voters.
- They can communicate with poll workers during the day to solve problems or push updates in the voter registration database to them.
- They can see how busy each polling place is, gauging turnout during the day and being prepared for supplies shortages.

Drawbacks and roadblocks.

The single biggest negative aspect of e-pollbooks was simply that they are another piece of technology that must be purchased and maintained in a time

⁶ Some jurisdictions with unconnected vote centers or early voting locations place ballots in envelopes like a vote-by-mail ballot and only check whether the ballots are eligible to count at a central location.

of tight budgets not only within the election office, but in county budgets where elections compete with many other priorities.

We conducted an extensive evaluation of electronic poll books and selected one to purchase, but had the budget request rejected by the county administration.

- Election Director

Impact on the people

Adding a new technology or procedures affects election officials, poll workers, and voters. Election officials had several concerns about the changes that come with any change in election administration, even if they were enthusiastic about this particular technology.

Elections offices are already working with voter registration databases, but adding new technology in the polling place to interface with those databases requires purchasing and managing the devices, new procedures, and new training needed for the elections staff.

Poll workers, of course, have to learn new technology. There are some concerns about whether older workers will find the systems easy enough to use, especially if they have not used computers or tablets. However, there were few reports of problems, and more about how poll workers liked the e-poll books. One vendor told us that a series of unfortunate events led to a new e-pollbook being put into operation at some polling places with virtually no training – there were minimal problems.

Voters also seem to accept the change from paper rosters to the new devices with little concern. This may be in part because election officials said they worked hard to minimize the impact on voters.

Our system was already using a laptop to look up voters and print authority slips, so the move to a fully electronic pollbook has no impact on the voters. - Election Director

E-pollbooks in state election codes

State legislation on e-pollbooks is a rapidly changing landscape. Not only is there wide variety in current rules, but there are also efforts to update state laws in many states.

State election codes address e-pollbooks in three main ways, from explicitly allowing them, having language that prohibits their use, or being neutral, written in a way that offers flexibility for both paper and e-pollbooks.

How e-pollbooks are addressed state election codes

Status	Language in the election code
Prohibited	Language explicitly prohibits the use of e-pollbooks, or includes language that effectively disallows them.
Neutral	There is no language or procedures in the code that cannot be done with e-pollbooks.
Allowed	Explicit language allowing e-pollbooks or specifying procedures for their use.

The states included in the fact-finding for this report illustrate the range of current legislative landscape:

- In Connecticut, recent changes to state law allowed the use of e-pollbooks by making minor changes to the existing language to allow functions to be done manually on paper or electronically.
- In Minnesota, the Electronic Roster Pilot Project (201.225) authorized the use of e-pollbooks with specific requirements, such as the degree of network access allowed, and authorized pilot tests of systems.
- In Colorado, HB1303 made sweeping changes in 2013, mandating a Uniform Voting System that includes the use of vote centers, which require the use of e-pollbooks.
- In Wisconsin, investigations into the use of e-pollbooks were suspended after an initial phase because of concerns about cost, usefulness, and the use of networks in polling places, but in September 2015, work began on the development of standards for testing and approval of e-pollbooks.

Election requirements affecting e-pollbooks

Election codes have a wide range of specificity in requirements that affect e-pollbooks. For example, a requirement for voter signatures might simply require that they be collected, or specifically require that they be on paper. Similarly they might be written in a way that is broad enough to encompass both paper and digital signatures, explicitly allow digital signatures, or explicitly disallow them.

Requirements in election codes that affect e-pollbooks include:

- Compatibility with the file format of state registration databases
- Internet access and peer-to-peer networking within the polling place or between the polling place and elections office
- Whether (and how) voter signatures are collected, including paper and digital signatures.
- Voter identification requirements, or types of identification that voters might present at the polling place.
- Requirements for reconciliation and audit procedures, which might mandate reconciliation with the poll book records
- Voting system certification requirements and constraints on purchase decisions

Certification or approval of e-pollbooks

Where state election codes allow e-pollbooks, states may set constraints on which models may be used within the state.

State requirements for approval of e-pollbooks

State requirements	Description and examples
No requirements	No requirements in the state election code. Counties may choose to use e-pollbooks or not.
Data compatibility only	Requires only compatibility with the state voter registration format
Certification	E-pollbooks must be approved through a state certification process. Examples: <ul style="list-style-type: none">• Indiana has a full certification process conducted by the

State requirements	Description and examples
	<p>state with an advisory Voting System Technical Oversight Program (VSTOP) at Ball State University</p> <ul style="list-style-type: none"> • Ohio has an approval process conducted by a state board
Approval	<p>The state approves vendors and products from which counties may select, or approves products on a case-by-case basis, but without a formal certification process.</p>
Single system	<p>The entire state uses a single product. Local elections offices are either required to use it, or must use it if they use an EPB</p> <ul style="list-style-type: none"> • Michigan and Utah have a system managed by the state Department of Elections • Colorado's Uniform Voting System will include an e-pollbook
EPB as part of a voting system	<p>The EPB is a component in a state-wide voting system.</p> <ul style="list-style-type: none"> • Some voting systems create a voter access card (or similar technology) that activates the voting session, and which updates an electronic voter list. • Maryland and Georgia have a single voting system for the entire state which includes an e-pollbook

For more information

For a more complete national view of the legislative landscape, the National Conference for State Legislatures (NCSL) has extensive research on state campaign and election code which covers a wide range of topics including an analysis of e-pollbook adoption⁷.

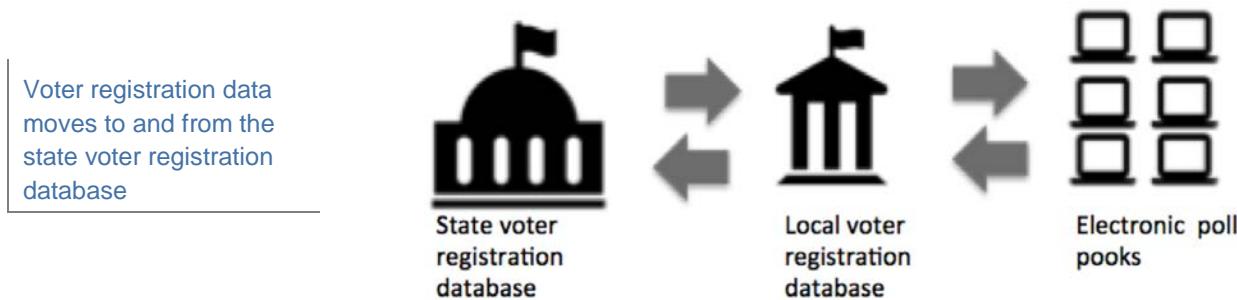
⁷ <http://www.ncsl.org/research/elections-and-campaigns/electronic-pollbooks.aspx>

E-pollbooks and the voter registration database

Any pollbook is a temporary extension of the voter registration database. Whether the pollbook is paper or electronic, voter records are extracted from the master database and made available in the polling place to identify voters and record their voting history for the current election.

The ability to update the state voter registration database easily, using records from the polling place directly (rather than through a manual process) is one of the primary benefits of e-pollbooks.

Typically, records for the county are downloaded from the state database and the data transformed in any way needed, before loading onto the e-pollbooks. At the end of an election, the flow is reversed to update the state database.



Loading voter records on the e-pollbooks

Loading the voter registration database on the e-pollbooks is the core pre-election task, paired with receiving the voter records from them at the end of Election Day.

In an indication of the importance of this task, when multiplied by the number of pollbooks needed in an entire county, almost all of the vendors we spoke with could easily cite the load times required to copy the database.

Technical options for data transfers

For all transfer methods requiring a network connection, both speed and reliability depend on the type of connection. There are also security considerations, which are beyond the scope of this report.

- Wired or wireless LAN are faster and more reliable.
- Mobile hotspots or cell phone connections are slower and less reliable.

All e-pollbook vendors offered more than one option to meet local election administration requirements.

Methods of loading data onto the EPB

Method	Examples	Considerations
Hardware	USB drive, SD card	Direct and fast, but requires manual action at each pollbook.
Peer-to-peer	Master device at each polling place	Local synchronization of pollbook data by loading the data on a single device which is used to synchronize the other local devices
Portal	Device management system such as Apple MDM	Cloud-based system that manages synchronization across all devices
Server	Internet connection to a server or directly to the central database	Device connects to a server to download or upload data.

Timing and administrative procedures

Several related factors influenced administrative procedures for how and when voter records are moved between the central database and the e-pollbooks.

The scope of the voter registration database on a single e-pollbook may be:

- A single precinct or polling place
- An entire county or local jurisdiction
- The entire state

We heard one example for how e-pollbooks could support increased turnout. Election officials in a county that included a large state university wanted poll workers to be able to tell students if they were registered elsewhere in the state. This was especially important for early voting, because

voters not registered in the county might have time to make arrangements to vote.

Issues in deciding procedures for loading voter records

Decision factor	Issues and variations
Relationship between the local and state database	<p>Does the county maintain its own VRDB, or is it a local extension of the state records?</p> <p>Does the e-pollbook communicate with a local VRDB or work directly from the state VRDB?</p>
Size and scope of the data loaded on the e-pollbooks	<p>How large is the data file for each EPB? The size of the data file affects speed and reliability of the transfer, and the network connection required.</p>
Passwords and access at the polling place	<p>How do poll workers access the system?</p> <ul style="list-style-type: none">• Individual passwords• Passwords for each polling place <p>How does the system identify the jurisdiction for which it can check in voters?</p> <ul style="list-style-type: none">• Through the poll worker password?• Something poll workers enter?
Internet connection at the polling place	Are e-pollbooks required, allowed, or permitted to communicate with the election office?
Network connection	<p>The type and bandwidth of the network connection may include:</p> <ul style="list-style-type: none">• A hard-wired connection to an official government network (for example, a vote center in a clerk's office).• A wired or wireless network at the polling place.• A mobile hotspot or modem.
Requirements for updates during the Election Day	<p>Election procedures may require:</p> <ul style="list-style-type: none">• No updates during the day – all records are transferred after polls close.• Periodic updates for status checks or mid-day reporting requirements.

Decision factor	Issues and variations
	<ul style="list-style-type: none"> Constant updates (for example, in a vote center environment where voters can vote at any polling place).

Most of the time, the voter records are loaded onto the e-pollbooks at the elections office, before the election. If the election system is fully (and reliably) connected, it is also possible to load the data records onto the EPB on the morning of the election.

At least one company suggests that the entire database can be downloaded from their cloud-based portal on election morning, so there is no pre-loading of the EPB required at all.

Updating voter records during Election Day

The scope and process for data updates depends on the type of network connections available to the e-pollbooks.

When e-pollbooks have a network connection, voter records can be constantly updated during the day, so that all e-pollbooks have up-to-date information at all times.

Even if there is no external network connection, e-pollbooks may have a local network within the polling place, allowing multiple stations to serve a single polling place, whether a single voting district or a small collection of them. All of the commercial products we reviewed offered this option for jurisdictions where external network connections are not allowed.

Data connection between e-pollbooks

Connection type	Data exchanged during Election Day	Impact of ED admin
No connection	None	Updates entered manually

Connection type	Data exchanged during Election Day	Impact of ED admin
Local network only	Local EPBs synchronized	Polling place voter history updates shared locally Manual updates can be entered on one EPB per polling place
Periodic connection	Periodic updates from the polling place (EPBs → central)	EPB updates (voter history, voter registration changes) sent to the central database
Periodic connection	Periodic updates to the polling place (central → EPBs)	Updates are sent to the EPB, including missing records or updated voter information for specific voters
Internet or VPN connection	EPBs synchronized to central database	The entire voter database is synchronized between the EPB and central database

If Internet connectivity is allowed, the bandwidth of the connection can be an important consideration in how voter records are synchronized.

- E-pollbooks accessing the Internet wirelessly via a mobile hotspot will be restricted to mobile network data speeds.
- E-pollbooks using the building's wireless connection may be sharing that wireless connection with other computers and wireless devices in the building.

EPB's don't usually come with any special connectivity hardware, so local jurisdictions can make their own decision about the connection method best for them.

Election Day morning supplemental updates

Once at the polling place, pollbooks (both paper and electronic) are normally updated before voting begins. These supplemental updates collect last-minute changes to the voter history, such as whether someone has already

voted or received a mail-in ballot and is not allowed to vote in the polling place. As with the initial loading of the data, the morning updates can be done in several ways.

Methods of loading morning updates data onto the EPB

Method	Description
Manual entry	In a procedure similar to paper, poll workers work from a list, manually updating the records
USB drive, SD card	The updates are provided on a local drive delivered to the polling place
Peer-to-peer	Local synchronization of pollbook data by from one of the pollbooks across a peer-to-peer network
Download	Internet connection to a server or directly to the central database. Each device connects to a server to download or upload data.

Reports and monitoring during the day

With the ability to transfer information about voter turnout during the day, the election office can monitor the election more closely and provide updates to the public, press or campaigns.

Ohio requires mid-day reporting of the lists of people who have voted so far. With connected pollbooks, this information can be gathered and distributed from the election office instead of at each polling place.

Some EPB products include operational dashboards as well, allowing election offices to check that:

- The EPB is online and even its battery status
- Number of voters checked in
- Number of provisional ballots issued

End of day reporting

End of day closing and reporting typically reverses the loading process, usually using the same data transfer methods. Generated reports can be used for analysis and to improve election administration.

Although some commercial products come with a library of reports, others simply make the data available for use in standard data analysis programs.

Cases and form factor

Election officials mentioned several considerations about the form factor of the e-pollbook

- Many liked having a physical keyboard, feeling that it was easier to type. This might be an integrated laptop keyboard, but could also be a keyboard case added to a tablet (at additional cost).
- Officials often wanted to use laptops running Windows because they have them available in the county offices, because IT staff are familiar with the Windows operating system, or because they believe they would be more flexible.
- They liked tablet-based systems because they did not require separate devices such as mouse, signature pad or scanners, but used built-in functions instead.

Voters don't like laptop systems as much because all those wires face them and look messy draped across the table. There's the power cord and mouse, but also connections to the scanner, signature pad and printer.

Election Director

Many of the e-pollbooks reviewed come with custom cases designed to be an integral part of how they are used in an election.

- Some cases are also part of the system in use, for example, set up to act like a docking station, so poll workers only have to plug in a single power cord, with all other connections hidden in the case.
- Many have bright colors – green, red or yellow – so they are easily visible and not as likely to be lost in a corner or walk out the door.

- One system had a case that enclosed a small tablet that also served as both a stand or handle to hold the tablet while working the line

Tablets often came with custom stands that served several purposes:

- Adjusted the angle of the screen to one that is easier to read, especially in a room with bright overhead lights.
- Provided a stylus holder (and attachment)
- Provided a location for voters to place an ID to be scanned
- Assisted the poll workers in turning the tablet to the voter for a signature

Controlled access to EPBs and functionality

The e-pollbooks use a variety of mechanisms for controlling access to the voter records and specific functions. The table lists examples but is not exhaustive.

Functionality	Examples of how handled
Login / connect	<ul style="list-style-type: none"> • Individual poll workers identify themselves via password or other identity confirmation method such as an assigned string of numbers or grid cards • The chief poll worker logs into all of the e-pollbooks • There is a login for the polling place, rather than for an individual
Access restrictions	<ul style="list-style-type: none"> • Login/connection method activates correct precinct • Admin password required for certain functions such as ballot re-issue, override clock to change closing time

Election day monitoring

All e-pollbooks provide some high-level views of polling place activity. Some examples are listed in the table below:

Functionality	Examples
Show polling place statistics	<ul style="list-style-type: none"> • Number of voters handled per hour • Number of voters checked in • List of checked-in voters

	<ul style="list-style-type: none">• List of not checked-in voters
Hardware status	<ul style="list-style-type: none">• Battery level• Loss of power• Internet connection
Visibility to election department	<ul style="list-style-type: none">• Central office can see polling places come online

Sources

We are enormously grateful to all the election officials and people from e-pollbook companies who took time to talk to us and show us their systems.

The report of the Presidential Commission on Election Administration (PCEA), *The American Voting Experience*⁸, helped put this work in a larger context.

To understand the legal landscape for e-pollbooks and where they were in use, we drew heavily on the National Conference of State Legislatures and research by Katy Owens Hubler on the use of e-pollbooks in states⁹.

We conducted short fact-finding discussions with election officials from state and county offices in:

- California (Nevada County)
- Colorado
- Connecticut
- District of Columbia
- Florida (Orange County)
- Georgia
- Illinois (Cook County)
- Indiana and Ball State VSTOP program
- Maryland
- Michigan
- Minnesota
- Missouri (St. Louis County)
- New Jersey
- Ohio
- Pennsylvania (Fulton County)
- Texas (Travis County)
- Wisconsin
- Virginia (Fairfax County)
- Wyoming

⁸ The report is available on the PCEA website: <http://www.supportthevoter.gov/>

⁹ Electronic Poll Books | E-Poll Books, updated 5/11/2015 <http://www.ncsl.org/research/elections-and-campaigns/electronic-pollbooks.aspx>

We also got to see demonstrations of 11 commercially available e-pollbooks at a “Demo Day” in Fairfax County and the 2015 NASED meeting in Washington DC.

- ES&S Express Pollbook
- EasyVote EasyPollbook
- Election Administrators Tablet
- EveryoneCounts eLect
- DemTech Plexus
- KnowINK PollPad
- Robis AskED Pollbook
- Scytl/SOE Clarity ePollBook
- Tenex Pollbook
- VR Systems EVid
- Votec VoteSafe

Finally, we were able to read reports on investigations into adopting e-pollbooks or pilots using them, as well as certification requirements from several states:

- Indiana Electronic PollBook Certification Test Protocol for the Voting System Technical Oversight Program
- Ohio Electronic Pollbook Requirements Matrix
- Pennsylvania EPB Test Protocol
- Virginia State Board of Elections, Electronic Pollbook Certification
- Minnesota Electronic Roster Task Force: Legislative Report and Evaluation (2014) Findings and Recommendations (2015)
- St. Louis, Missouri Biennial Report
- Wisconsin Government Accountability Board Electronic PollBook Research Final Report
- Trading in the Paper: Nevada County’s Electronic PollBook Journey

Summary of hardware in systems reviewed

E-pollbook	Hardware platform	Scanner for ID Capture ⁽¹⁾	Signature Capture	Case or stand	Other ⁽²⁾
Robis AskED Pollbook	Windows 8 Laptop or Tablet	External	Onscreen or External	Custom case with docking station	On-demand ballot printing
VR Systems EVid	Windows Laptop or Tablet	External	External		Mobile app for line management
ES&S ExpressPoll	Windows 8 Toshiba Tablet	Camera	Onscreen	Custom Stand Keyboard	Interfaces to on-demand ballot printing
Votec VoteSafe	Windows 7, XP Laptop	External	External		
Scytl/SOE Clarity ePollBook	Windows Laptop Android Tablet	External Camera	External Onscreen		508 certified iOS in process
Election Administrators EA Tablet System	Android Asus Tablet	Camera	Onscreen	Custom case Stylus holder	Mobile app for line management
EasyVote EasyPollbook	Windows Laptop	External	External		
DemTech Voting Soutions Advocate	Windows iOS Tablet	External	External	Keyboard	Admin. on Windows laptop
KnowINK PollPad	iOS Tablet (iPad)	Camera	Onscreen	Custom stand ID holder	
Tenex Pollbook	iOS Tablet (iPad or iPad Mini)	Camera	Onscreen	Custom stand	
EveryoneCounts eLect	Custom Tablet	Camera	Onscreen	Custom stand	

Note 1: Most systems can provide a scanner for any drivers license, as needed in each state

Note 2: All of the systems have an option for a small label printer