



**Voting and the Administration of Elections in  
Maryland**

A report by the Schaefer Center for Public Policy for

The Maryland State Board of Elections

January 15, 2014

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## About the Schaefer Center for Public Policy

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Housed in the University of Baltimore's College of Public Affairs, the Schaefer Center is able to complement its professional staff by drawing upon the expertise of faculty and students in its three schools Criminal Justice, Health and Human Services, Public and International Affairs in its research, consulting, and professional development work.

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## EXECUTIVE SUMMARY

The administration of elections in Maryland is a large, complex enterprise. No other function of government in Maryland involves the active participation of over two million citizens on a single day. Imagine if everyone with a driver's license had to renew that license on the same day or if all taxpayers had to pay their taxes in person on a single day.

For the 2012 presidential general election, there were 3,694,658 registered voters in Maryland with another 237,969 individuals designated as "inactive" on the voter registration list.<sup>1</sup>

A total of 2,734,176 individuals endeavored to cast a ballot in the 2012 presidential general election. This was the largest number of people voting in any election in the history of Maryland and represented 74.0% of registered voters, 59.75% of the estimated voting age population in the state and 66.82% of the estimated voting eligible population.

On Election Day, November 6, 2012, 2,068,531 individuals were recorded as being issued a ballot access card for use in voting on the AccuVote TS direct recording electronic touchscreen voting units at the 1,590 polling place locations for the 1,850 precincts in the state of Maryland.

Another 430,573 individuals participated in "early voting" at forty-six (46) designated locations throughout the state. This represented 11.65% percent of total active registered voters and 15.75% of total voter turnout in the 2012 presidential general election.

Another 79,876 individuals cast provisional ballots at polling place locations and early voting locations during the 2012 presidential general election, representing 2.92% of total voter turnout, with 68,747 or 68.07% being counted in whole or in part.

Individuals made 177,726 requests for an absentee ballot with 155,098 (87.27%) of those absentee ballots returned to local boards of election for processing. Of the absentee ballots returned, 151,960 (97.98%) were accepted for counting and 3,138 (2.02%) were rejected.

Responsibility for the conduct of elections in the state is divided between the Maryland State Board of Elections and twenty-four local boards of elections. The preparation for an Election Day is a significant task for every jurisdiction but is appreciably compounded by the number of potential voters a

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<sup>1</sup> "Inactive" means that an individual has not voted in at least two consecutive federal general elections. Such an individual may vote in the election at the same precinct provided they affirm their address or by provisional ballot if their address has changed. The Maryland Court of Appeals in *Doe v Montgomery County*, found that for petition purposes, an inactive voter was to be treated the same as an "active" voter. In the 2012 presidential general election, 18,681 individuals listed as "inactive" were recorded as having cast ballots, representing 0.7% of the total voter turnout.

jurisdiction must serve. The range of registered voters among Maryland's jurisdictions is from 12,679 in Kent County to 627,566 in Montgomery County.<sup>2</sup>

Elections are administered at the local level by boards of elections and local election directors with limited staff. They recruit, train, assign and supervise 23,603 election judges (who often work a fifteen hour day, for a modest, variable stipend) to capture and collect the votes cast by individuals in 1,850 precincts in 1,590 polling locations throughout the state.

Pursuant to Chapters 157 and 158 of the 2013 Laws passed by the Maryland General Assembly, the State Board of Elections commissioned a study of the maximum wait times for Maryland voters in the 2010 and 2012 primary and general election and to determine the causes for wait times of more than thirty minutes. A research team at the Schaefer Center for Public Policy at the University of Baltimore conducted these studies and prepared the study entitled "Waiting to Vote: Incidence, Causes and Cures for Long Lines at Maryland Polling Places" which comprises Part Two of this report.

Based upon a review of all available data maintained by the State Board of Elections and the twenty-four local boards of elections, voters did not experience wait times in excess of thirty minutes during the 2010 primary election and during the 2012 primary election. Wait times did exceed thirty minutes in some polling place locations in the 2010 general election and a substantial number of polling places during the 2012 presidential general election. Based upon reported incidents from individual precinct polling places and based upon the model constructed by the research team, it was determined that some voters in a significant number of precincts had wait times in excess of thirty minutes at various times of the Election Day.

A substantial number of variables affect wait times at precinct polling locations including the allocation of voting system equipment, the physical characteristics of the polling place locations, the pattern of voter arrival at the polling place, the preparedness of the voters, the length of the ballot, and the efficacy of the election judges. These variables are not constant between elections; they are not constant among the twenty-four local election jurisdictions in the state; and they are not constant among the precincts within each of the twenty-four local jurisdictions administering the election.

For the 2012 presidential general election in Maryland, the factors identified by the research team as most likely affecting wait times were: (1) the length of the ballot in some jurisdictions; (2) the lack of sufficient voting machines in some precincts; and (3) the physical characteristics of some precinct polling place locations. Details about these findings are presented in this report.

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<sup>2</sup> Registration as of November 30, 2013; the numbers for the 2012 presidential general election were 12,594 for Kent County and 616,000 for Montgomery County.

The Center reviewed and reanalyzed the results of nationwide surveys conducted after the Election of 2012. Two large scale nationwide surveys had been conducted. Altogether 64,785 registered voters were surveyed. Of those, 885 voted in Maryland and answered questions about the length of time they spent waiting to vote. Maryland voters experienced more delays than voters from most other states. Two factors emerge from the analysis of both the national results and the results from Maryland:

- Early voters experienced more severe delays than those who voted on Election Day.
- Residents of more populous jurisdictions experienced more severe delays than those from other jurisdictions.

As part of the voting studies, the Schaefer Center conducted telephone surveys of Maryland voters in an effort to gauge their perception of the election process and to determine what might have contributed to significant wait times. Two separate pools of voters were surveyed. The Schaefer Center conducted a survey of a random sample of Maryland's early voters and asked the same questions of a sample of Maryland's Election Day voters from selected precincts. Two separate pools of voters were surveyed. The first was a random sample of early voters. The second was a random sample of voters from "problem precincts" and "control precincts." A problem precinct was identified as: (1) being one either identified by a county election official as having experienced difficulty with wait times; (2) being among those precincts with the most registered voters; (3) being among those precincts that had the most provisional ballots cast; or (4) being among those identified by the model simulator developed by the research team to estimate wait times. A further screen of voters was based upon the time of day of voting in each precinct when wait times were likely to be experienced.

Responses from 616 early voters and 542 Election Day voters were collected and analyzed. Questions about the length of the wait were asked, and the survey also asked respondents about their perceptions of some factors that were postulated as having caused these waits. The results of these surveys are compatible with the results from the national surveys and with the perception of local and national election officials. These results are:

- Early voters experienced more severe delays than those who voted on Election Day.
- Residents of more populous jurisdictions experienced more severe delays than those from other jurisdictions. In Maryland this meant that severe Election Day delays were primarily confined to the five most populous jurisdictions.
- The Election Day delays appear to be highly correlated with the average length of the ballot in the jurisdictions.
- There are likely other factors which make large jurisdictions more susceptible to voting delays but more refined measures about election procedures, including observational measures, would be needed to discover these factors.

Based upon the extensive research conducted for these studies, a series of options is presented for the Maryland General Assembly to consider along with suggestions and recommendations or possible

steps that could be taken at the state and local level, as well as the precinct polling places, to ameliorate lines that may form at early voting sites and at precinct polling places.

Among the more significant suggestions are the creation of an “Election Infrastructure Fund” that would be available for use by the Maryland State Board of Elections and the local boards of elections to upgrade facilities and technology in the ongoing effort to provide adequate service to the Maryland voter.

Second, the availability and allocation of voting system equipment needs to be enhanced when voter turnout in a precinct on Election Day is anticipated to be 60% or 65% of currently registered voters. When ballot length exceeds certain parameters these percentages may need to be modified.

Third, state and local legislative bodies should be cognizant of the impact of the length of prospective ballots on the administration of elections and resulting wait times for voters at polling place locations; the research clearly indicates that ballot length is a major contributing factor to wait times for voters.

Finally, it appears that the physical characteristics of an early voting site and a precinct polling place location (inside and outside the facility) is a major factor in the ability to manage the volume of individuals coming to a polling place to vote. Additionally, the availability to local boards of elections of suitable polling place locations impacts the conduct of the election.

During the period of this study, the research team at the Schaefer Center for Public Policy benefited from the full cooperation of the Maryland State Board of Elections in making available information and data. In addition, we contacted every local board of election office in the state to receive information and comment. Our interviews with local election directors were particularly helpful in guiding our inquiry and in offering operational perspective on the administration of elections at the precinct level. Our work has also been informed by numerous contacts with state and local election officials from throughout the country as well as a review of countless reports and studies performed by academics, advocates, election observers, media sources and other jurisdictions.

The research team at the Schaefer Center for Public Policy also conducted direct observations of the 2012 municipal elections in Annapolis, Frederick and Rockville which informed our studies of voter interaction with voting equipment and our consideration of the dynamics of queuing at the polling place.

## Study Methodology

A variety of methodologies informed this report. This section gives a brief description of each.

## INTERVIEWS WITH LOCAL ELECTION OFFICIALS AND OBSERVATION OF 2013 MUNICIPAL ELECTIONS

Interviews were conducted with the election officials from Maryland's twenty-three counties and Baltimore City. They were asked their opinions about a wide variety of issues that are addressed in this report, including extending early voting to the Sunday before Election Day, the causes of extended wait times, opening the polls at 6:30 am and their suggestions for alleviating long wait times.

The insights gleaned from those interviews inform many parts of this report and are especially reflected in the section that specifies suggestions for reducing wait times. Many county election directors felt that having large public facilities with adequate parking for Election Day and early voting would drastically improve wait times. This was specifically discussed by officials in eight jurisdictions. Many further specified that having a designated voting center in their jurisdiction that would be available for all times and that could be a place for early voting, storage, registration, and other purposes would help reduce wait times as well as facilitate election administration.

A significant number of local election officials raised the idea of the creation of a specific voting period and doing away with one designated Election Day. Many also thought that barcode scanners could be used with the electronic poll books to reduce wait times.

Many local officials also brought up resource issues including the need for more full-time and part-time staff; some suggested that the jurisdictions be mandated to provide a minimum level of support.

Most election directors adamantly opposed opening the polls at 6:30 am or extending the current system of early voting to the Sunday before Election Day because it would create additional workload and stress on the staff and election judges.

Many local election officials voiced the concern that moving to an optical scanning system might slow down the voting process and make the waiting time problem more severe as has happened in other states.

Local election officials were questioned about their opinions on many of these matters while the Schaefer Center research team observed the 2013 local municipal elections in Annapolis, Frederick and Rockville. These observations were conducted to better understand the range of possible interactions between the voters and the voting equipment and the election judges.

In these interviews one key issue that was addressed with each director was whether keeping wait times in their jurisdiction to less than 30 minutes was a realistic goal. The responses varied but nearly all said meeting such a goal would be contingent on the availability of resources.

One resource that was often mentioned was the availability of adequate polling places for Election Day and early voting. In some jurisdictions finding such venues is a continuing challenge. Some officials voiced the opinion that finding adequate facilities for early voting sites was particularly challenging.

Recruiting qualified election judges is a challenge in some jurisdictions. To adequately monitor wait times might require additional Election Day staff, which is already in short supply.

Some directors said that the main constraint in their jurisdiction was the insufficient number of touchscreen machines.

While some election directors felt that going to optical scanning machines might help, if planning was done well, others were skeptical. Some feared that an optical scanning system would present new and more challenging bottlenecks and referenced the problems that Florida faced in 2012 in dealing with lines generated by systems with optical scanning machines.

Many thought that the 2012 presidential election presented unique challenges that may never be seen again. One director stated that lines started to form in some precincts hours before the opening of the polls, and in such a situation no administrative solution would bring wait times within the hour goal.

Since the answers that election officials gave were contingent on so many factors a hard and fast goal of 40 or 60 minute waits seems to be unrealistic. In summary, with careful planning and a reasonable amount of new resources a goal of 80% of Election Day voters waiting no more than 30 minutes and 97% of Election Day voters waiting no more than 60 minutes might be attainable. Wait times for early voting depend on some factors that are not within the control of administrators, such as whether political campaigns emphasize early voting and whether adequate well-placed facilities can be obtained. Better data on wait times should be gathered before goals can be better defined.

When asked about the causes of the wait times in 2012, many local election directors said the length of the ballot created delays, and some added that the ballot language on some of the questions caused voter confusion.

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## ANALYSIS OF EXISTING DATA

Maryland is fortunate to have excellent and conveniently accessible statewide voter registration and historical turnout data. In addition, due to the acquisition and implementation of electronic poll books used statewide starting in 2006, accurate voter check-in times are available, providing the ability to produce an “hourly turnout profile” for each precinct polling place.

There is also reliable data on the number of voting machines used in each polling place, with the number of ballots cast on each voting machine available from the GEMS election results tabulation system. Each of these sources was used in this analysis and helped in developing the simulation model which is presented in this report.

Although currently there is no comprehensive data on line lengths and wait times in Maryland polling places, precinct logs, and paper forms recording the number of ballots cast on each machine per hour are available. Though these records tend to be spotty and inconsistent, some of these records were examined by the researchers to help inform the analysis. There is no direct data that measures a key component contributing to long lines and wait times in the 2010 and 2012 elections: the elapsed time a voter takes to vote on the touchscreen voting machines. This reason this data is not captured by the voting machine is to help protect the secrecy of the ballot.

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## DATA FROM NATIONWIDE SURVEYS

Two large nationwide surveys of voters were conducted in 2012, the Cooperative Congressional Election Study and the Survey of the Performance of American Elections. The data relevant to wait times from these national studies was analyzed with a focus on the information provided by the 885 Maryland residents who participated in the 2012 general election. The results of this analysis paralleled the results of the surveys conducted by the Schaefer Center for this report. Early voting was associated with longer waits both nationally and in Maryland. Residing in a populous jurisdiction was associated with longer waits both when voting early and when voting on Election Day. These associations in the national data were found to be even stronger in the subset of Maryland voters.

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## TELEPHONE SURVEY OF VOTERS

For this report the Schaefer Center for Public Policy, in collaboration with the Maryland State Board of Elections, conducted a survey of Marylanders who voted in the 2012 presidential general election – both at early voting centers and at polling places on Election Day. The records of the Maryland State Board of Elections provide the information necessary for selecting the voters who were called.

The purpose of both of these surveys was to gauge the opinions and recollections of voters about the operations and wait times that they experienced during the 2012 presidential general election. Both groups were asked specific questions about:

- The voter's general impression of the entire voting experience.
- The voter's estimate of the time spent in line waiting to check-in and the time waiting in line to cast a ballot.
- The voter's estimate of which factors caused a wait.
- The voter's perception of the wait compared to other elections.

Telephone Interviews were conducted both during the day and in the evening and 1,158 interviews were completed—616 early voters selected at random and 542 Election Day voters. The key results of

these interviews are presented in Part Two of this report. The results are consistent with the findings from the national surveys. Early voters experienced more severe delays than other voters. Severe delays on Election Day were largely confined to the most populous jurisdictions.

By combining the data from these two surveys and the national survey with the data on ballot length in each jurisdiction a relationship between ballot length and wait times was substantiated.

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## GATHERING INFORMATION FROM STATE AND LOCAL ELECTIONS OFFICIALS IN OTHER STATES

Our work has also been informed by numerous contacts with state and local election officials from throughout the country as well as a review of reports and studies performed by academics, advocates election officials, media and other jurisdictions.

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## WAIT TIME SIMULATION MODEL

An Election Day simulation model was developed, refined, and used to inform this report. The simulator takes key polling place variables as inputs and calculates estimated wait times and voters in line for each half hour period. The simulator uses the existing precinct level data on turnout percentage, the number of electronic poll books, the times of poll book check-ins, the number of touchscreens available, the number of voters, and the historical turnout patterns. The simulator model uses this data and creates estimates of the average time for an individual to vote on touchscreen and the wait times a precinct may have experienced.

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## REVIEW OF APPLICABLE RESEARCH AND STUDIES

Numerous studies about queuing theory in general and about wait times to vote were examined. Many of these studies confirmed that the patterns found in Maryland exist, usually to a lesser degree all over the country. A few of these studies are of special note.

The testimony for the Presidential Commission on Elections, by R. Doug Lewis, the Executive Director of the National Association of Election Officials<sup>3</sup> (also called “The Election Center”) affirmed this

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<sup>3</sup><https://www.supportthevoter.gov/files/2013/09/Doug-Lewis-Testimony-for-Presidential-Commission-on-Elections.pdf>



report's conclusion that ballot length was a key contributing factor to long lines in 2012. Lewis summed up the opinions of his members. Some of the key points of his testimony were:

- “We are unlikely to resolve that issue unless government officials and budget officials are willing to give us the resources to handle ‘peak period’ voting instead of anticipated day-long averages for voting.”
- “[T]here is some disagreement among election groups and individuals as to an appropriate wait time but the consensus seems to fall for most in the one hour or less category.”
- “Clearly, there will be some wait time if voters are lined up well before the polls open . . .”
- “Unless a legislature is willing to refrain in presidential election years from adding lengthy, numerous or difficult to understand ballot measures such as Constitutional amendments, referendums, or complicated bond measures, then it is unlikely that administrative solutions will work consistently.”

The work of MIT professor Charles Stewart III in analyzing the national surveys<sup>4</sup> pointed out the national issues that parallel the issues in Maryland. Some of his key findings were that:

- “Urban voters waited longer than rural voters . . .”
- “[E]arly voters waited longer than Election Day voters . . .”
- “[T]he current state of research — including the facts reviewed in this paper — provides only minimal guidance about the most effective reforms for the reduction of long lines.”

The work of Ohio State professor Theodore Allen<sup>5</sup> also was especially helpful and confirmed our findings. Allen found that, “Looking at the data, there is a direct relationship between the number of items on the ballot and the length of the wait.”

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<sup>4</sup> Charles Stewart III, “Waiting to Vote in 2012” found at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2243630](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2243630)

<sup>5</sup> for example “Delving into the reasons for long lines can bring solutions” found at [http://articles.orlandosentinel.com/2013-01-08/news/os-ed-long-lines-voting-florida-010813-20130107\\_1\\_long-lines-ballot-length-turnout](http://articles.orlandosentinel.com/2013-01-08/news/os-ed-long-lines-voting-florida-010813-20130107_1_long-lines-ballot-length-turnout)

## PART ONE: EARLY VOTING IN MARYLAND AND OTHER STATES

### Early Voting Defined

The ability of an individual to cast a ballot before an Election Day may take different forms and be labeled as "early voting." Among the fifty states, what constitutes early voting and what is called early voting varies significantly. Absentee voting (where an individual makes an application to receive a ballot prior to an Election Day) and return the ballot to the appropriate election official before a certain date, is the most common form of early voting. It should be noted that the absentee balloting process is not the same in all states. There are states in which the voter must have an authorized reason to request and cast an absentee ballot. There are other states in which the voter does not need a reason to request and cast an absentee ballot ("no-excuse absentee). There are states where a voter may appear at a local election office or another designated site to request and cast an "in-person" absentee ballot.

There is a smaller group of states (including Maryland) where a voter may appear at an "early voting center" to cast a ballot in the same manner as a ballot would be cast at a precinct polling place on an Election Day.

### Voting Early in Maryland

The Maryland history of providing individuals with alternatives to voting on an Election Day in their respective designated polling place dates to the Civil War and the passage of the 1864 Constitution of Maryland when the Maryland General Assembly provided for the ability of soldiers to cast votes wherever their units might be located.<sup>6</sup>

From 1867 until 1918, the 1867 Constitution of Maryland did not contain any provisions for absentee ballots or other early voting. During the 1918 regular session of the state legislature, a proposed constitutional amendment was passed that would authorize servicemen to cast absentee ballots. The amendment was overwhelmingly approved by the voters in the 1918 general election by 81,494 votes to 19,099.

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<sup>6</sup> See Smith & Willis, **Maryland Politics and Government**, University of Nebraska Press, 2012, pp. 142-144.

In 1954, the Maryland voters approved another constitutional amendment authorizing the general assembly to provide for absentee voting by qualified voters who are absent at the time of the election (Chap. 480, 1953 Laws). An additional constitutional amendment expanding the right to cast absentee ballots was approved by voters for persons with disabilities in 1956 (Chapter 100, 1956 Laws)

The Maryland General Assembly first authorized the opportunity for Maryland citizens to vote before an Election Day at an early vote center by legislation passed during the 2006 regular session (Chapter 61, 2006 Laws of Maryland, also known as HB 1368, *Voter Bill of Rights*). After the Maryland Court of Appeals ruled the statute unconstitutional holding that the Article I of the Maryland Constitution did not authorize such voting procedures,<sup>7</sup> the Maryland General Assembly approved a proposed amendment to the Maryland Constitution that provided that the general assembly had the power to provide “for voting by qualified voters who might otherwise choose to vote by absentee ballot” (*no-excuse absentee balloting*) and to provide “by suitable enactment a process to allow qualified voters to vote at polling places in or outside their election districts or wards or, during the two weeks immediately preceding an election, on no more than 10 other days prior to the dates specified in this Constitution” (*early voting*).

During the 2008 presidential general election, the voters approved this constitutional amendment by a wide margin, 1,755,844 in favor (72.4%) to 670,759 (27.6%) opposed. Subsequently the Maryland General Assembly again passed legislation authorizing early vote centers. (Chapter 445, 2009 Laws)

Early vote centers were first used during the 2010 gubernatorial primary election with 77,290 voters taking advantage of this new voting opportunity in six days from September 3 to 9, 2010. This represented 2.44% of eligible registered voters and 9.63% of the total voter turnout for the 2010 primary election. In the 2010 gubernatorial general election, 219,624 individuals voted early during the period October 22 to 29, 2010, representing 6.33% of registered voters and 11.72% of the total voter turnout for the 2010 general election.

During the 2012 presidential primary election, early voting was held from March 24 to April 4, 2012, with a total of 76,119 individuals utilizing the opportunity. This represented 2.40% of total eligible registered voters and 12.76% of the total voter turnout for the primary election. It should be noted that voting in Maryland as well as other states begins with absentee voting at least forty-five days prior to Election Day.

In the 2012 presidential general election 430,547 individuals took advantage of early voting representing 11.65% of registered voters and 15.75% of total voter turnout. Of these, 320,809 (74.51%)

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<sup>7</sup>*Lamone v. Capozzi*, 396 Md 53 (2006).

were individuals who voted in person at the polling place on Election Day in 2008, 33,360 (7.75%) were individuals who voted absentee in the 2008 presidential election, and 66,871 (14.36%) were voters newly registered since 2008. Voters newly registered since 2008 accounted for 17.11% of all registered voters in 2012 and 14.93% of those who voted by any method.

With limited experience in Maryland the percentage of the electorate that may utilize early voting opportunities in the future is uncertain although the experience in other states provides some guidance for the administration of elections in Maryland. Other states have different laws, rules and procedures that impact the early voting process but generally, there has been a growth in the number of individuals voting early over the past twenty years without a directly corresponding increase in voter turnout as a percentage of registered voters in those states. See Appendix A.

It can be reasonably anticipated that the number of individuals taking advantage of the convenience of early voting in Maryland will increase in future election cycles to between 20 and 30% of total voter turnout. This increase is likely to be enhanced by the potential for same day registration which was authorized by the Maryland General Assembly in 2013 (Chapters 157 and 158, 2013 Laws)

## Voting Early in the United States

Based upon a review of national surveys conducted by the National Conference of State Legislatures, the U.S. Election Assistance Commission, the National Association of Secretaries of State, the Election Center, as well as other institutions and groups and state statutes, there were thirty-two states and the District of Columbia that offered voters the opportunity to vote before the day of the election by other than a mail absentee ballot during the 2012 presidential election cycle.” See Appendix A.

As early voting is commonly referred to in Maryland (voters going to a designated early vote centers to cast ballots using the same voting system used on Election Day), there were no states that authorized early voting through the Sunday before the election during the 2012 presidential general election. There were twenty-one states and the District of Columbia that had early voting using Election Day voting equipment before the Tuesday general election.

In two states (Florida and Ohio) federal court orders extended the time for “in-person absentee balloting” through Sunday, November 4, 2012, to accommodate exceptionally long lines of voters that had accumulated in some jurisdictions in those states.

## Other States

### FLORIDA

#### EARLY VOTING PERIOD AND METHODOLOGY

In 2012, the State of Florida began the early voting period for the general election on October 27, 2012 and ended the early voting period on Saturday, November 3, 2012. Early voting in the state begins ten days before Election Day and runs until three days prior to Election Day (the Saturday before Election Day). In 2013, the Florida state legislature expanded the number of sites that could be potentially be used for early voting (*Section 101.657, F.S.*).

#### TURNOUT

In the 2012 presidential general election, Florida's early voter turnout was 2,049,097 votes cast, representing 28.1% of the total voter turnout.

#### EQUIPMENT

A diverse array of voting machines was used in the 2012 general election by Florida counties. Equipment used for early voting is the same type of machine used for Election Day voting in each jurisdiction.

#### EARLY VOTING STATUTES

The early voting statute for the state of Florida can be found in (*Section 101.657, F.S.*).

#### TRACKING EARLY VOTES

In Florida, early votes are recorded and include the name of the voter and the location in which they voted. This early voter activity information is uploaded nightly on a local level and is sent to the state. This information is uploaded to the voter records before Election Day.

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## ILLINOIS

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### EARLY VOTING PERIOD AND METHODOLOGY

In 2012, the State of Illinois began the early voting period for the general election on October 22, 2012 and the early voting period ended on Saturday, November 3, 2012. Per change to Illinois election law, early voting in the state begins 15 days before Election Day and runs until 3 days prior to Election Day (the Saturday before Election Day). Early voting in Illinois is held in the office of election authorities; however, the election authority may establish permanent or temporary early voting sites. Election authorities publish the location of all permanent and temporary early voting polling places, as well as the dates and hours in which each location will be conducting early voting. Recently, the statute was changed to mandate election authorities to offer early voting sites on some college campuses.

The statute regarding early voting is as follows:

**(10 ILCS 5/19A-10) Sec. 19A-10. Permanent polling places for early voting. (a) An election authority may establish permanent polling places for early voting by personal appearance at locations throughout the election authority's jurisdiction, including but not limited to a municipal clerk's office, a township clerk's office, a road district clerk's office, or a county or local public agency office.**

**(10 ILCS 5/19A-20) Sec. 19A-20. Temporary branch polling places. (a) In addition to permanent polling places for early voting, the election authority may establish temporary branch polling places for early voting.**

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### TURNOUT

In the 2012 presidential general election, Illinois' early voter turnout was 1,185,748 votes cast, representing 22.5% of total voter turnout.

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### EQUIPMENT

The State of Illinois used all types of equipment for early voting, as election officials are allowed to choose the equipment used in the process. Uniformity of voting machine use early voting and Election Day voting varied in Illinois as some election authorities used separate machines for early voting and other used the same type of equipment for both early voting and Election Day.

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### TRACKING EARLY VOTES

In Illinois, early voters are tracked in the election management system for their jurisdiction. This management system will print the type of early voting that was done up until local poll books are printed. After the poll books are printed, a separate list of early voters is generated and sent to the polling

locations. Poll books are not physically updated between the last day of early voting and Election Day, except for jurisdictions that use electronic poll books and have the ability to update the record prior to sending the laptops/tablets containing voter registration lists to the polling place. The following is the relevant portion of Illinois statute regarding its tracking of early votes:

**10 ILCS 5/19A-5(c) – The election authority must maintain a list for each election of the voters to whom it has issued early ballots. Before the opening of the polls on Election Day, the election authority shall deliver to the judges of election in each precinct the list of registered voters who have voted by early ballot.**

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## EARLY VOTING STATUTES

The early voting statute for the State of Illinois is Article 19A – Early Voting by Personal Appearance (10 ILCS 5/19A-5 set seq.)

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## NEW MEXICO

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### EARLY VOTING PERIOD AND METHODOLOGY

In the 2012 general election, early voting in New Mexico began on October 20, 2012, and ended Saturday, November 3, 2012. In New Mexico, early voting is conducted at early voting polling locations.

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### TURNOUT

In the 2012 presidential general election, New Mexico’s early voter turnout was 374,574 votes cast, representing 47.6% of all votes cast during the election.

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### EQUIPMENT

All votes were cast on M100 tabulators and ballot printing systems. The machines used for early voting were the same type of machines used on Election Day.

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### TRACKING EARLY VOTES

In New Mexico, early voters are flagged in the statewide voter registration system to prevent double voting. The voter registration system is used to produce Election Day rosters. For counties that used ballot printing systems in polling locations, the data is updated prior to Election Day, in order that the ballot printing system will flag early voters. Poll books are not physically updated between the last day of

early voting and Election Day. Rosters are produced after the close of early voting and data is continuously updated in the ballots printing systems.

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## EARLY VOTING STATUTES

The relevant New Mexico statutes for early voting are:

*1-6-5.6 Early Voting; alternate voting locations; procedures*

*1-6-5.7 Early Voting; use of absentee voting procedures; alternate voting locations*

*1-6-5.8 Early Voting; Native American early voting locations*

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## UTAH

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### EARLY VOTING PERIOD AND METHODOLOGY

In the Utah 2012 general election, early voting began on Tuesday, October 23rd and ended Friday, November 2<sup>nd</sup>, 2012. Early voting in Utah is conducted at early voting centers. The early voting process in Utah is identical to the process used for Election Day.

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### TURNOUT

In 2012, early voting turnout for Utah was 244,130 votes, 24.0% of the total voter turnout for the state.

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### EQUIPMENT

Equipment used for early voting is the same type of voting equipment used for Election Day voting. The state used touch screen machines to cast ballots.

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### EARLY VOTING STATUTES

The statute pertaining to Utah's early voting laws can be found in Utah Code Ann. 20A-3 Part 6 (601-605).

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### TRACKING EARLY VOTES

Early votes are tracked and recorded by a statewide voter database that tracks when a person votes. Once a voter has cast a ballot (early or otherwise), they cannot vote again. Most counties in Utah are using an electronic local version of poll books to link with the statewide database between the last day of early voting and Election Day.



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## WEST VIRGINIA

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### EARLY VOTING PERIOD AND METHODOLOGY

In the 2012 general election, West Virginia began the early voting period on October 24, 2012 and ended the early voting period on November 3, 2012 (the Saturday before Election Day). Early voting in the state is conducted by visiting a county courthouse/annex or by visiting a designated early voting community voting location.

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### TURNOUT

In the 2012 presidential general election, West Virginia's early voter turnout was 150,844 votes cast, representing 22.0% of the total voter turnout.

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### EQUIPMENT

The type of equipment used for early voting in West Virginia during the 2012 election varied by county. In West Virginia, the ES&S, iVotronic, Optical Scan and paper ballot systems were used. Two counties purchased e-poll books that were used for early voting, while other counties used poll books printed from the West Virginia voter registration system. West Virginia Code requires voting machines to be retested before use in the election; therefore, counties use voting machine systems specifically for early voting only.

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### TRACKING EARLY VOTES

In West Virginia, early votes that are cast are recorded daily throughout the early voting period. This voter history is entered into the statewide voter registration system, which prints on the poll books, marking the voter as having voted. The state does not physically update poll books between the last day of early voting and Election Day.

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### EARLY VOTING STATUTES

The early voting statute for the State of West Virginia can be found in **Chapter 3, Article 3 of West Virginia election code.**

## Impact of Extending Early Voting to the Sunday before the Election

### ADMINISTRATION

Given the current available voting system equipment and current early voting procedures, there was virtually unanimous agreement among local election directors in Maryland that early voting should not be extended to the Sunday before the election. Among the reasons cited were that it would be impossible to get poll books prepared for Election Day and that it would place extreme stress on election official staff and personnel.

### COST

Extending early voting days would increase the cost of elections because of: (1) staffing needed for extra hours; (2) security required for extra days and hours; (3) increased rental costs for facilities; (4) limitations on available locations because of extra times; and (5) the extra costs for downloading and uploading data and the shipping and delivery of data and cards for the electronic poll books. Local election officials have advised that the cost for extending early voting could range from more than \$1,000 to \$25,000 per site per day, depending upon the size of the jurisdiction and available locations.

### IMPACT ON VOTER TURNOUT

Insofar as there has only been one gubernatorial election cycle and one presidential election cycle in which Maryland voters have had the option of voting early at designated vote centers, it is speculative to project the impact on overall voting turnout on the extension of early voting hours in the state.

Measured as a percentage of total voter registration, the 2010 gubernatorial primary and general elections and the 2012 presidential primary and general elections cycles did not produce voter turnouts at the high end of the range of overall voter turnout for comparable elections in the past thirty years. See page 37.

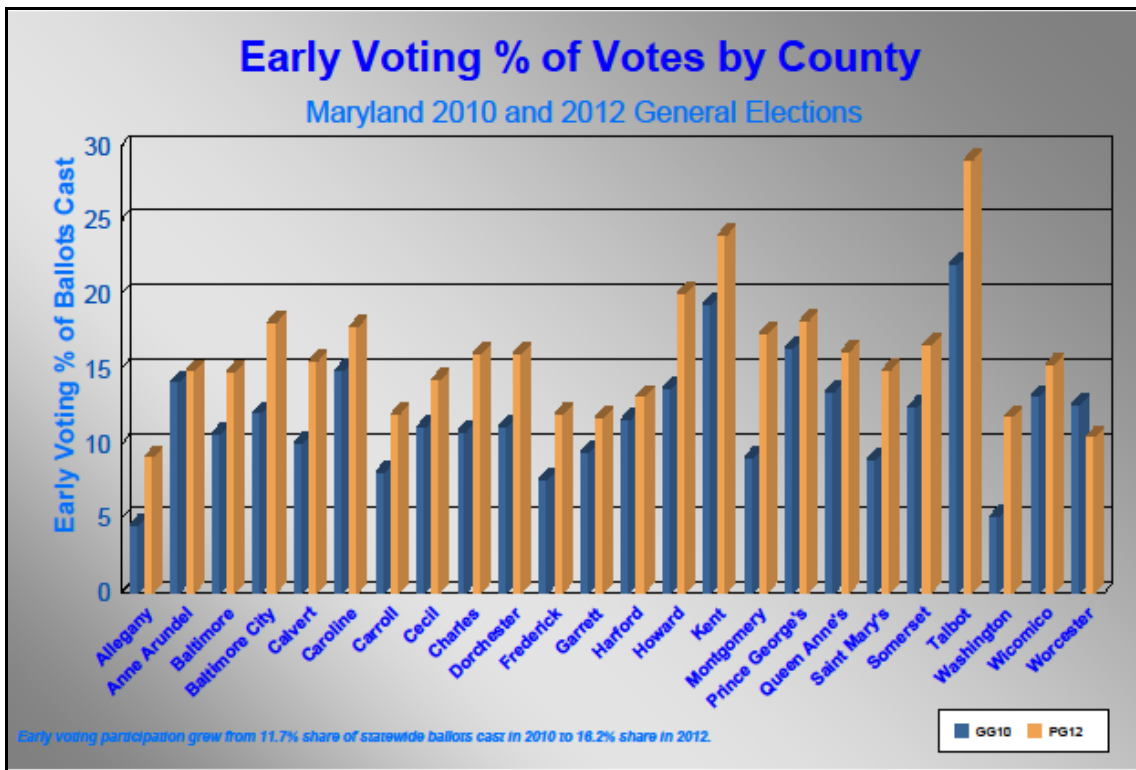
Most published reports about early voting have not found evidence of an increase in overall voter turnout as a result of early voting. The experience in other states which have different laws, rules and procedures have shown a growth in early voting over the past twenty years without a corresponding increase in voter turnout as a percentage of registered voters.

It can be reasonably anticipated that the number of individuals taking advantage of the convenience of early voting in Maryland will increase in future election cycles. This increase is likely to be

enhanced by the potential for same day registration which was authorized by the Maryland General Assembly (Chapters 157 and 158, 2013 Laws).

## EARLY VOTING

In the 2012 general election, the early voting share of the total vote ranged from a low of 9% in Allegany County to a high of 29% in Talbot County.

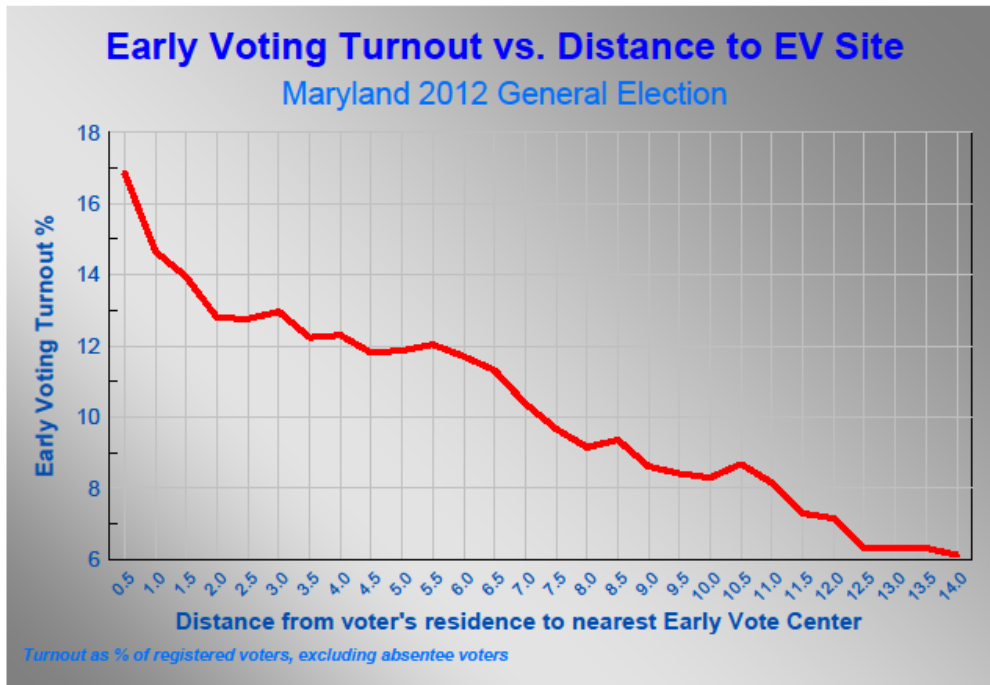


From 2010 to 2012, the early voting share of ballots cast statewide has increased from 11.7% to 16.1%, representing a 38% increase in the total statewide voter turnout. These percentages are in line with what other states have experienced with the introduction of early voting, and it is estimated that early voting in Maryland could achieve 25%-30% of total turnout by the 2016 presidential general election, assuming the addition of thirteen or more early vote centers as currently envisioned.

All but four of the current forty-six sites stayed in the same locations as in 2010, and there are probably several more that could benefit from relocation. Washington County, for example, moved their site from a bank building in downtown Hagerstown to a Red Cross office about a mile away just off Route 40, and experienced a 131% increase in early voting share of turnout.

Adjacency to a major thoroughfare, plenty of parking, and lots of square footage to provide enough voting machines to accommodate peak turnout hours are the essentials of a good early vote

center. Early voting turnout is highly correlated with a voter's proximity to an early voting center, as shown in the chart below.



And, as expected, Election Day turnout increases with voter's distance to nearest Early Vote site.

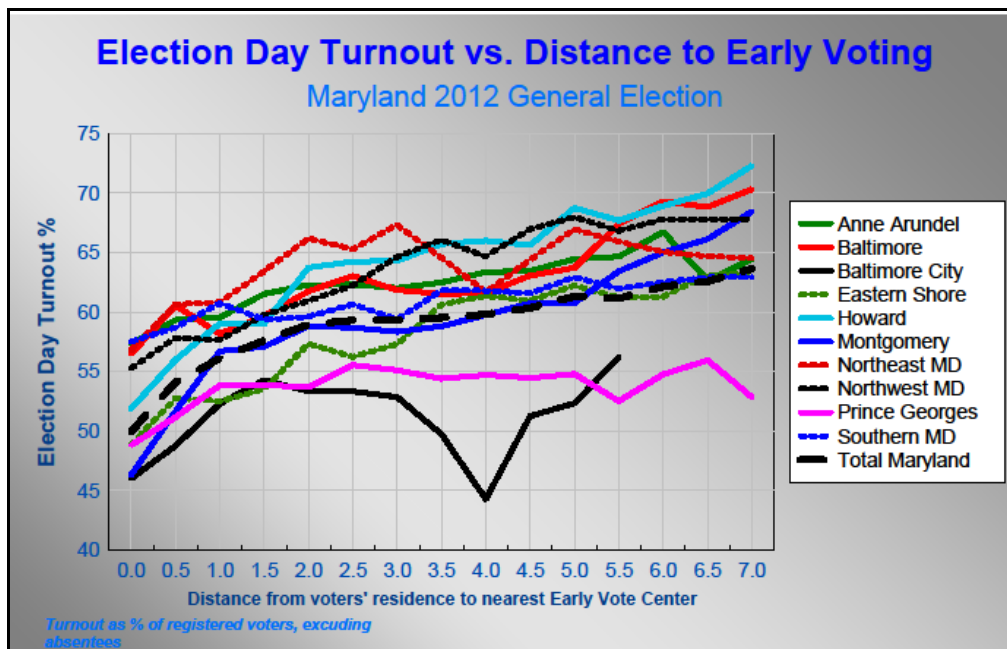


Table 1: Early Voting (EV) Turnout and Distance to the EV Site

County	% Voted Early	Early voter avg. distance (miles) from home to EV site	Lowest EV % precinct	Avg distance (miles) from home to EV site for lowest precinct	Highest EV % precinct	Avg distance (miles) from home to EV site for highest EV% precinct
Allegany	6.4%	5.7	2.1%	21.3	12.4%	0.6
Anne Arundel	10.9%	3.6	2.9%	5.6	30.7%	1.3
Baltimore City	11.6%	1.9	0.9%	2.2	30.9%	0.4
Baltimore County	10.9%	3.7	1.7%	5.4	30.2%	1.4
Calvert	12.0%	9.4	6.5%	11.6	20.6%	2.4
Caroline	13.0%	7.4	4.7%	13.7	23.1%	1.7
Carroll	9.4%	8.0	1.1%	12.5	16.5%	0.8
Cecil	9.4%	9.9	3.2%	21.1	13.4%	3.7
Charles	12.3%	7.5	5.4%	13.2	24.8%	6.7
Dorchester	12.2%	6.7	4.2%	18.5	20.7%	1.0
Frederick	9.4%	6.8	2.4%	11.1	23.9%	2.1
Garrett	8.3%	11.1	0.8%	29.9	16.1%	3.6
Harford	10.2%	5.9	3.0%	13.0	20.2%	0.9
Howard	16.1%	3.3	4.0%	15.0	31.3%	0.7
Kent	18.9%	7.0	5.1%	12.7	36.0%	1.0
Montgomery	12.7%	3.5	3.3%	4.6	31.2%	0.9
Prince George's	12.3%	4.3	1.9%	1.6	30.7%	3.1
Queen Anne's	12.4%	10.9	5.1%	19.2	28.8%	1.9
Saint Mary's	11.1%	8.5	5.7%	13.4	23.7%	2.9
Somerset	12.1%	9.0	2.5%	18.0	24.2%	3.6
Talbot	23.5%	5.0	9.1%	11.1	34.2%	1.7
Washington	8.4%	5.9	1.4%	12.2	17.8%	1.9
Wicomico	11.4%	4.5	2.1%	10.5	19.9%	1.0
Worcester	7.8%	16.1	1.4%	9.1	13.8%	8.2
State*	11.7%	4.5	2.7%	7.1	28.4%	1.7

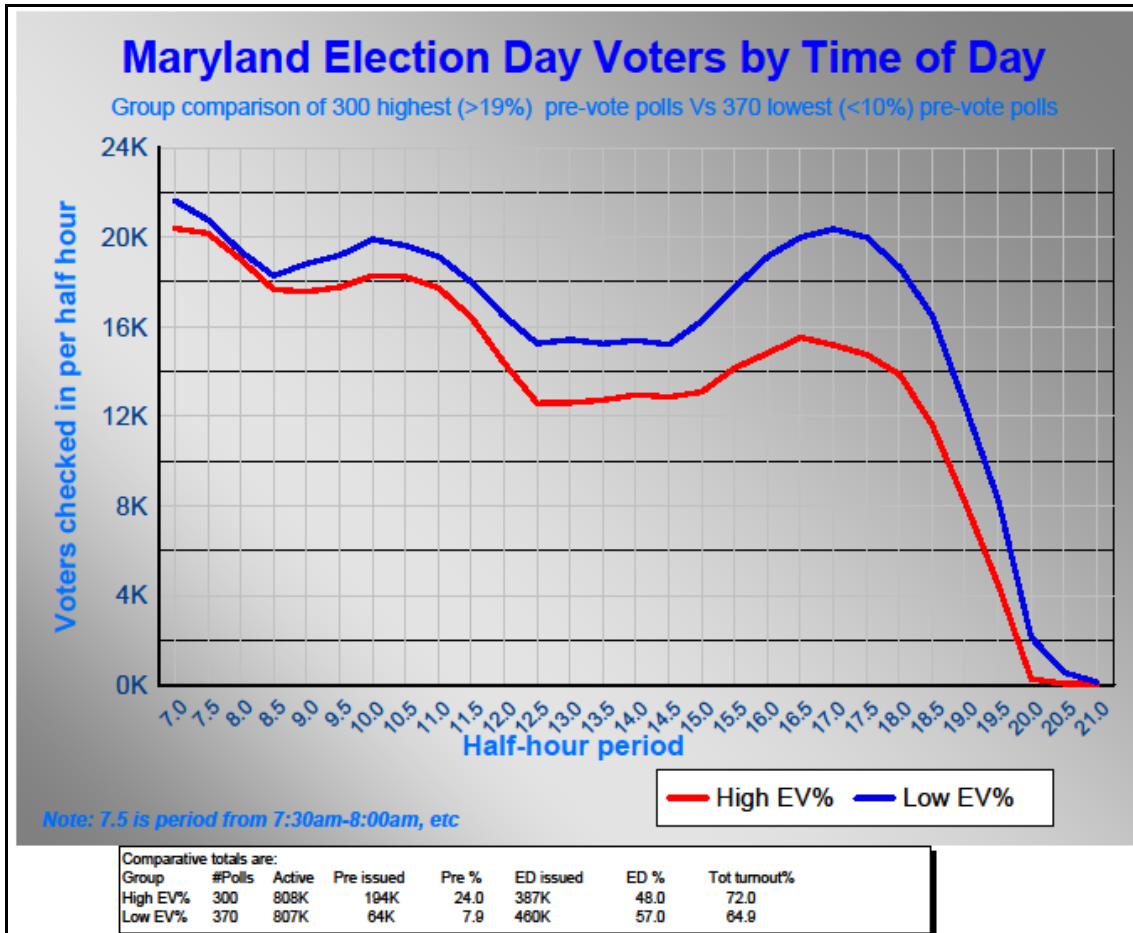
\* State averages weighted by voted early total for each county

However, it is generally not the case that total turnout (early + absentee + Election Day) for voters living close to an early vote center is higher than for voters living further away. A comparison of total turnout for the two groups in each county and Baltimore City is shown below in Table 2.

Table 2: Total Turnout by Distance to Nearest Early Voting Site

2012 General Election	Total Turnout by Distance from Voter's Residence to Nearest Early Vote Site	
	County	Inside 2 Miles
Allegany	68.7%	72.2%
Anne Arundel	74.5%	74.8%
Baltimore City	65.8%	62.9%
Baltimore	74.5%	75.3%
Calvert	74.1%	77.8%
Caroline	74.8%	73.6%
Carroll	76.6%	79.8%
Cecil	71.9%	68.0%
Charles	76.7%	77.3%
Dorchester	77.2%	77.2%
Frederick	78.6%	79.5%
Garrett	70.6%	70.5%
Harford	80.3%	78.7%
Howard	80.8%	81.5%
Kent	82.2%	77.9%
Montgomery	74.2%	74.1%
Prince George's	65.3%	69.2%
Queen Anne's	78.1%	77.2%
Saint Mary's	77.9%	74.8%
Somerset	77.3%	72.8%
Talbot	79.6%	81.8%
Washington	69.5%	73.1%
Wicomico	71.1%	76.2%
Worcester	73.0%	76.5%
<b>Maryland statewide</b>	<b>72.0%</b>	<b>74.0%</b>

As expected, Election Day polls with a high percentage of early voters have commensurately lower turnout on Election Day. However, as shown below, the reduction in turnout is not distributed equally across the voting day, and voter turnout at the start of the day is nearly as high as it would be without early voting. Since long lines and wait times are most likely to occur during the first few hours after poll opening, early voting unfortunately did not provide as much relief for Election Day lines as might have been expected.



#### THE IMPACT OF EXTENDED EARLY VOTING ON PREPARATIONS FOR ELECTION DAY

The electronic poll books to be used on Election Day and those used for Early Voting contain the same "master precinct register" database. The single master database avoids the risks associated with using multiple database versions and also allows jurisdictions enough time to perform logic and accuracy testing on the Election Day electronic poll books. The master database, about 1GB in size, is copied onto a

separate compact flash (CF) card for each poll book, then installed in the poll books as part of the L&A process.

Electronic poll book logic and accuracy testing is a time-consuming process that entails conducting more than thirty separate operations and verifications (including voter lookups for specified random voters) on each poll book. The level of effort for poll book L&A is about .6 man-hours per device. Total effort ranges from about fifty hours in smaller jurisdictions using fewer than 100 poll books, to more than 600 hours in Montgomery and Prince George's counties which each deploy more than 1,000 poll books. L&A on election-day poll books must be done concurrently with early voting, since there is not enough time to do L&A between close of early voting and Election Day.

In order to prevent early voters as well as voters who were issued absentee ballots after the date of the master database extract from voting again on Election Day, each poll book must have its central flash card (CF) updated with current voter status before it can be deployed to the election-day polling place. This process is known as the "bulk update."

Bulk update of the poll books, like L&A, is a time-consuming process, and one that cannot begin until the close of early voting statewide. The sequence of events is:

1. The State Board of Elections (SBE) reconciles the voter check-in totals on the early voting host server database with the log files uploaded from the early voting poll books at each early voting site. (approximately eight hours to complete)
2. SBE prepares a statewide "bulk update" voter database on the host server, plus a separate back-up database for each county for use in the event that poll books cannot connect to the server. (approximately two hours to complete)
3. SBE prepares customized reports for each precinct containing step-by-step instruction for the "bulk update" process along with "Voted Early" and "Absentee" test voters so that the local jurisdictions can verify that the voter status updates were applied correctly. (approximately 2 hours to complete)
4. SBE transmits databases and reports to the local jurisdictions over secure network via SFTP. (approximately one hour to complete)

The SBE processes outlined above take roughly thirteen hours from start to finish, which means that the local boards of election (LBEs) must wait until the morning following the close of early voting to begin their processes and preparations for Election Day.

The LBE bulk update steps are documented in detail in the "Conducting the Election" (CTE) Guide prepared by the SBE. The relevant section has been extracted in the attached document "EPB Bulk Update Instructions.docx". Briefly summarized, the LBE steps are:

1. Connect each electronic poll book to the SBE database server through the "Early Voting" wide area network (WAN)



2. Power up the poll book, verify the pre-assigned polling place is correct, and navigate to the "Bulk Update" function.
3. Check the "Update from Host" checkbox, tap the "Download Updates" button and wait for the automated update process to complete.
4. Navigate to the voter lookup function and look up test voters to verify that the updates have processed correctly.
5. Disconnect the device from the network and power down, re-pack in carrying case, apply and record a numbered security seal on the case.
6. Stage poll book for delivery to precinct.

The LBE level of effort for poll book "bulk update" averages about six minutes per poll book, and can vary considerably based on the quality of the connection to the SBE server. Total effort ranges from about ten hours in smaller jurisdictions to more than 200 hours in the largest jurisdictions. Due to limitations on the number of poll books that can be connected to the server at one time, the update process requires a minimum of four to six hours to complete in each jurisdiction, regardless of the manpower resources available.

It follows from the foregoing description that if the electronic poll books are to be updated with accurate voter status, they will not be available for delivery to polling places until the afternoon of the day after the close of early voting.

Due to their size and weight and the large number of units, the voting machines are typically transported by commercial delivery companies and staged at the polling places starting about ten days before Election Day. In most jurisdictions the electronic poll books are transported to the polling places by chief election judges. The election judges pick up the poll books from the LBE warehouses, starting as early as the Saturday before Election Day. Voting units and electronic poll books are set up in the polling places on Monday evening, so that any problems can be identified and fixed before the polls open the following morning at 7:00 am.

If early voting were to be extended to the last Sunday before the election, the logistics of delivering updated poll books to polling places in time for setup Monday night become very difficult for smaller jurisdictions and nearly impossible for the larger ones. There would be no safety margin for errors or for uncontrollable externalities such as weather, resulting in a significant risk that multiple precincts would not be ready to open on time.

The idea of not using updated poll books for check-in was discussed with each of the LBE directors, and was met with nearly unanimous and sometimes vehement opposition. The election directors feel strongly that this approach would needlessly compromise the integrity of the election process.

## Options for Early Voting

Based upon a review of the procedures employed in other states, a study of the early voting experience in Maryland and discussions with state and local election officials, the following options are presented for extending early voting days and times in Maryland:

1. In order to maintain the security, integrity, and accuracy of voter registration lists, the electronic poll books in Election Day polling places could be connected to the central database server at SBE, as is done with the poll books during early voting. This would require a major effort to expand the early voting wide area network to reach an additional 1,700 polling places and to upgrade the host servers at SBE. The fiscal impact would be an estimated \$2.5 million for the initial build-out, plus \$1.5 million for each election for telecommunications costs and additional technical support personnel.

2. A second option would be to provide precincts with a printed list of early voters and late absentees in lieu of updating the poll books. Compared with "bulk update" of the poll books, this option would require about the same level of effort for the Maryland State Board of Elections, but considerably less preparation effort for the local boards of elections, which would have only to print and distribute the lists to each polling place prior to poll opening. However, this option would add a significant burden at the polling place, particularly at larger precincts where the "voted early" list could well contain more than 1,000 voters. It is estimated that the pre-check would add an additional 10 to 20 seconds per voter to the check-in process. It would require an additional dedicated "pre-check" judge at each of the 1,100 polling places having more than 1,000 voters on Election Day in order to prevent the pre-check process from becoming a bottleneck. The estimated fiscal impact of this option would be \$250,000 per election.

3. A third option for implementing what other states call "early voting" is available under Maryland law. This option is called "in-person absentee voting." Such voting is currently done at the election board offices in some jurisdictions. The fact that absentee ballots are available in Maryland without the voter having to supply an excuse means that there is an option for any voter to vote in these jurisdictions on the Sunday before Election Day. Under present law, the jurisdictions have the flexibility to accommodate voters on the weekend. The Maryland State Board of Elections could adopt guidelines regarding in-person absentee voting procedures, times, and strategies to increase public awareness. The cost to small jurisdictions would be the burden such a policy might put on small staffs, both in the extra time needed to deal with the public in their job's most stress laden week and in the time it would take to deal with more absentee ballots in the canvass that follows. Still the costs to the overall system would be less than with the first two options that have been suggested. As one election director succinctly pointed out, the difference on this issue among the Maryland jurisdictions that are open to accept these ballots on that Sunday and other states is really a "branding issue." What Maryland calls "in-person absentee voting" is called in other states "early voting." This director also observed that, "As we shift to paper ballots, there is going to be much less of a distinction for voters between 'in-person absentee voting' and 'early voting.'"

4. A fourth option is to wait to adopt any changes to early voting until the 2016 election is completed and the lessons from that experience can be assessed. The changes that are already in process may also have a significant effect on implementation. Increasing the number of early voting sites from 46 to 63 in 2014 and up to 83 in 2016 and changing the number of Election Day precincts from 1850 to 2029 primarily as a result of legislative redistricting may create some additional voting dynamics, particularly in recognition that new early voting sites may decrease resources available for Election Day. It should be noted that, in Maryland and around the nation, early voting sites generate much longer wait times than does Election Day voting. Expanding to the Sunday before Election Day may result in people waiting until that day to vote and create wait times that exceed even the current early voting wait times. Many voters may prematurely get the impression that early voting will not be a convenient alternative unless the current wait time problems are solved. Concentrating on solving existing issues may be the best option now available especially considering existing limitations on equipment and the potential change of voting systems.

## PART TWO: WAITING TO VOTE

### INCIDENCE, CAUSES AND CURES FOR LONG LINES AT MARYLAND POLLING PLACES

#### Overview

A significant number of Maryland voters waited more than an hour to vote in the 2012 presidential election, both during early voting and on Election Day November 6, 2012. Disruption of early voting due to tropical storm Sandy, and unusually long ballots due to seven statewide ballot questions and, in some jurisdictions, a large number of local questions were contributing factors to wait times experienced by voters in the 2012 presidential general election. Some national surveys have reported that Maryland has fared poorly in “longest wait times” compared with other states over the past several election cycles.<sup>8</sup>

This analysis will briefly examine the factors that can lead to longer (or shorter) wait times at Maryland's precinct polling places. The analysis will attempt to quantify the likely impact of these factors on the Maryland 2012 general election, and suggest possible approaches for mitigating the negative impacts going forward.

#### Methodological Approach

Maryland is fortunate to have excellent and conveniently accessible statewide voter registration and historical turnout data. In addition, due to the acquisition and implementation of electronic poll books used statewide starting in 2006, accurate voter check-in times are available, providing the ability to produce an “hourly turnout profile” for each precinct polling place.

There is also reliable data on the number of voting machines used in each polling place, with the number of ballots cast on each voting machine available from the GEMS election results tabulation system.

Unfortunately, there is no comprehensive data on line lengths and wait times in polling places. Precinct logs and post-election interviews are the primary sources for this information, and they tend to be spotty and inconsistent. Nor is there any data captured that measures a key component contributing to long lines and wait times: the elapsed time a voter takes to vote on the touchscreen voting machines.

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<sup>8</sup> Maryland ranks below all but 5 states in The PEW Charitable Trust's “voting wait time” performance index. See <http://www.pewstates.org/research/data-visualizations/measuring-state-elections-performance-85899446194>

It may be possible to derive line lengths and wait times from the available data, but the task is made more difficult by the fact that it seems impossible to tell from the data how many voters were queued up waiting in line for a polling place to open. Also, it is hard to tell from available data if the number of voter check-ins logged on the electronic poll book in a given period actually represents the number of voters arriving during that period, since chief judges may restrict voters from checking in when all voting machines are in use by voters. This seems to have been a common occurrence in 2012, and the large majority of lines seem to have been due to backups at the voting machines as a result of unusually long ballots.

There is one small group of voters for whom wait times can be reasonably estimated-- the last voter to be checked in after poll closing time. Voters are entitled to vote in Maryland if they are in line at poll closing at 8:00 pm. Assuming these voters joined the line at or just before that time, their wait can be calculated as the amount of time between poll closing and their check-in time. There were 7,224 voters (0.35% of all Election Day voters) in 125 different precincts that checked in after 8:00 pm on Election Day, November 6, 2012.

For the large majority of voters who voted prior to poll closing, estimating wait times is less straightforward. The approach taken was to develop a Maryland Election Day simulator which uses the following input parameters:

- number of active registered voters
- percentage of Election Day turnout
- number of TS machines
- average seconds to vote on TS
- number of electronic poll books
- average seconds to check-in on electronic poll book
- polling place turnout profile

Since all of the parameters except "average seconds to vote on TS" are known for each polling place, by obtaining a reliable report of wait time or line length at a poll for a given time of day, it should be possible to determine the "average seconds to vote on TS" by testing various values for that parameter until one produces a wait time that approximates the reported wait time. The value for time to vote can then be used to simulate line lengths and wait times for other polling places in the county.

Wait time estimates for 2012 calculated on this basis will be presented later in this document.

## Key Factors in the Equation

The basic math of line formation at a precinct polling location is simple: If the number of voters arriving at a precinct polling place during a given period of time is greater than the number of voters departing, the number of voters waiting to vote will grow.

There are a number of factors that may influence the formation of lines at the precinct polling place. Summarized in Table 3 below are nine key factors that relate to the number and timing of arrivals and the rate of departures in a polling place. There are undoubtedly others, but these are believed to be the most significant. The factors are categorized as either "Known", "Predictable", "Manageable" or "Unpredictable".

As will be demonstrated herein, the "Predictable" factors can be reliably forecast from available data. Because of this predictability, it should be possible to predict the peak hourly turnout for each polling place within a small margin of error. This makes it possible to allocate the "Manageable" assets (i.e. electronic poll books and voting machines) in order that almost every polling places would have enough reserve capacity to cover the "unpredictable" eventualities (equipment breakdowns, weather-related, etc.) without suffering long lines and wait times.

Table 3: Key Factors That Relate to the Number and Timing of Arrivals and the Rate of Departures in a Polling Place

Factor	Sub-factors	Category
<b>Number of Registered Voters</b>		<b>Known</b>
	# assigned to a new polling place	Known
<b>Poll election-day turnout %</b>		<b>Predictable</b>
	# Voted absentee	Predictable
	# Voted early	Predictable
	Poll turnout history	Known
	Macro turnout trend	Predictable
<b>Poll election-day turnout hourly profile</b>		<b>Predictable</b>
<b>Polling place management</b>		<b>Manageable</b>
	Effective line management	Manageable
	Technical resources available	Manageable
<b>Average time to check-in voter on EPB</b>		<b>Predictable</b>
	Check-in judge proficiency	Manageable
	Single/Dual check-in judges	Manageable
	# of Canceled & Re-issued ballots	Unpredictable
	# of electronic poll book re-starts	Unpredictable
<b>Average time for voter to vote on TS</b>		<b>Predictable</b>
	Ballot length	Known
	Unit Judges	Manageable
	Bilingual Ballot	Known
	# Audio Ballots issued	Predictable
	# Older voters	Predictable
	# TS Timeouts	Predictable
	# Write-ins	Unpredictable
<b># of electronic poll books assigned to polling place</b>		<b>Manageable</b>
	# of poll books taken out of service	Unpredictable
<b># of TS voting machines assigned to polling place</b>		<b>Manageable</b>
	# of TS taken out of service	Unpredictable
<b>External factors affecting voter access/ ability to vote</b>		<b>Unpredictable</b>
	Weather	Unpredictable
	Traffic congestion	Unpredictable
	Power outage	Unpredictable

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## NUMBER OF REGISTERED VOTERS

The number of registered voters increased by 267,735 from the 2008 presidential general election to the 2012 election, an increase of 7.8%. This is roughly double the percent of Maryland's increase in voting age population over the same period, meaning a higher proportion of eligible citizens is being registered than in the past.

The net increase alone between comparable elections does not convey the full extent of voter registration activity over the period, as there were hundreds of thousands of voters dropped and added to the rolls making for a turnover of about a quarter of the registration lists over the four year cycle.

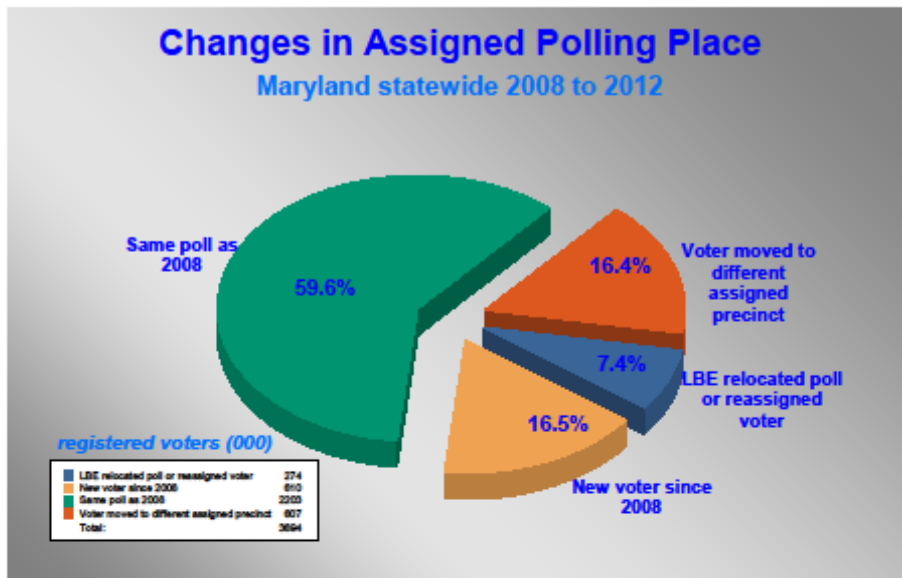
A continually expanding voter registration list will certainly strain the resources that local boards of elections have to conduct an election, especially a high turnout presidential election. The voting system currently used in Maryland is no longer being manufactured and, especially with more voting equipment being necessary for early voting sites, steps will have to be taken to minimize the impact on voters.

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## VOTERS ASSIGNED TO A NEW POLLING PLACE

Despite the best efforts of local boards of elections (LBEs) to inform voters of polling place moves and reassignments, there were some voters who don't get the word. In the worst-case scenario (as happened to at least one Queen Anne's County voter in the past election) the voter waits in line for 45 minutes only to be told at the check-in table that he is at the wrong polling place. The voter is then faced with either voting a provisional ballot, or waiting in line again at his correct polling place. In the 2012 general election there were 49,500 provisional ballots issued with reason #1 ("not in precinct register")—62% of all provisional ballots. There may have been some voters who went to their correct poll to cast a regular ballot, but decided not to vote. As seen in the pie chart below, in 2012 well over one million Maryland voters were confronted with voting at an unfamiliar polling place.





## Factors Affecting Election Day Turnout

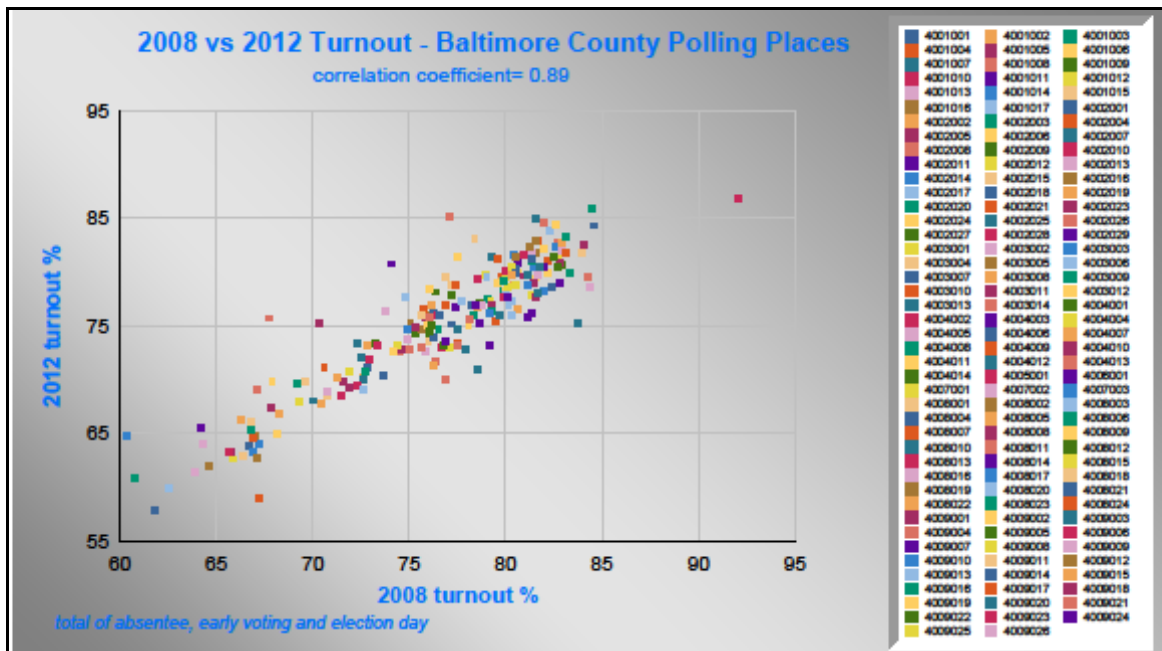
### ABSENTEE VOTING

Since voters issued absentee ballots are not entitled to vote (other than provisional) at a polling place, higher numbers of absentee voters will lower turnout at polling places and should reduce the voting lines. However, since absentee ballots come with their own set of complications and costs associated with printing, mailing and tabulating the ballots, they are not a panacea. In the 2012 election absentee participation (as percent of all ballots cast) ranged from a low of 3.9% of ballots cast (Caroline County) to a high of 8.8% (Worcester County, with Montgomery County close behind at 8.5%).

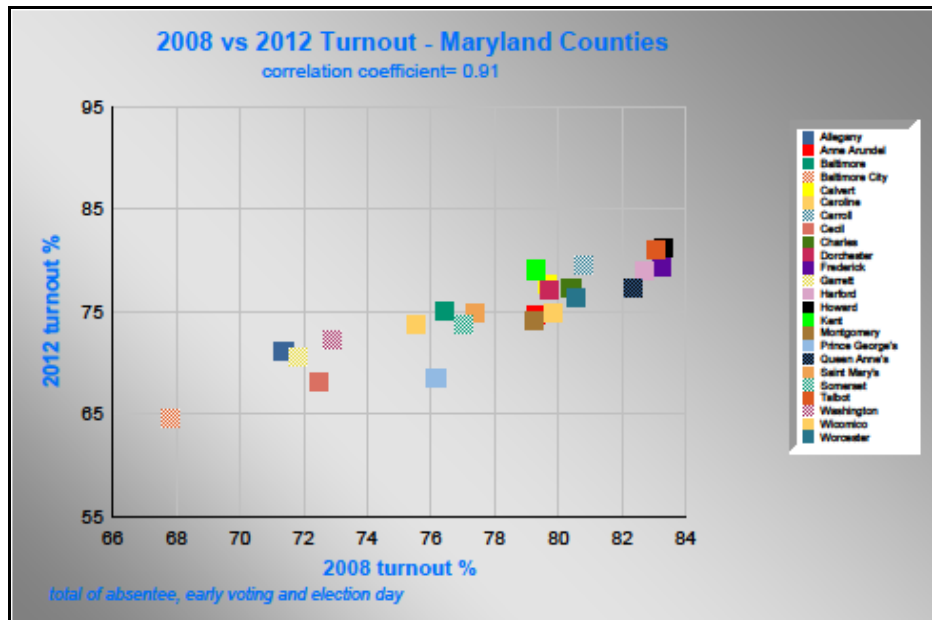
Given the substantial drop (over 25%) in the number of absentees from 2008 to 2012, it is reasonable to suppose that a large number of 2008 absentee voters switched to early voting in 2012. In fact, 24% of the absentee voters in 2008 became early voters in 2012, as compared with 16% of the non-absentee voters. However, the difference in switch rates represents fewer than 10,000 of the 2008 absentee voters. This difference can largely be explained by the fact that many counties encouraged their election judges to vote early rather than vote by absentee ballot in 2012. There were 23,603 election judges in 2012.

## POLLING PLACE TURNOUT HISTORY

Although, as noted earlier, there is roughly 25% turnover of the individual voters comprising Maryland's electorate over a four-year election cycle, the demographic profile of the voters assigned to a given polling place—age, party affiliation, and socioeconomic—tends to be quite stable or changes slowly over time. These demographic factors are highly correlated with voter turnout. Therefore, it is not surprising that past turnout for a polling place is a very good predictor of future turnout. The following chart plots turnout percentage for 2012 against 2008 turnout for each polling place in Baltimore County. It can be seen there is a strong correlation ( $r=.89$ ) with relatively few outliers.



There is also a strong ( $r=.91$ ) correlation in county turnout from one election to the next as shown in the following graph.

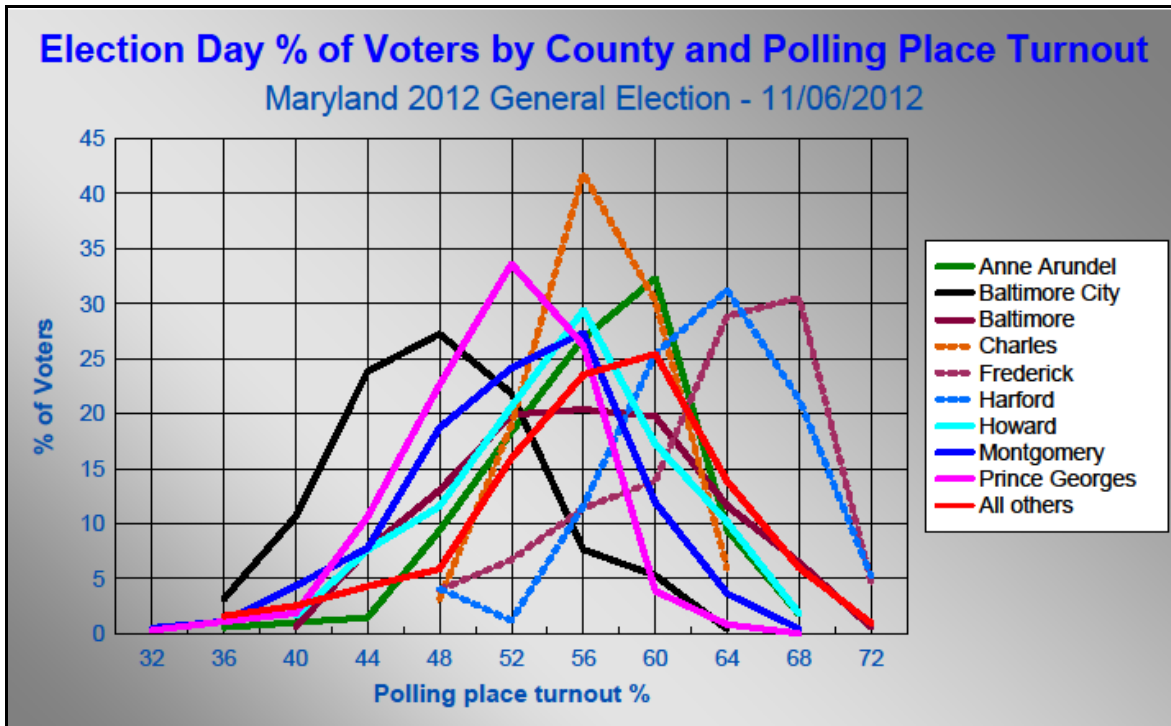


It also holds true that percentage voting absentee ( $r=.88$ ) and percentage voting early ( $r=.78$ ) for a polling place are highly correlated from one election to the next.

A reasonable starting point for estimating the Election Day turnout for each polling place is to take the Election Day turnout percentage for the polling place from the previous similar election (e.g., presidential general to presidential general) and apply that turnout percentage to the current count of registered voters.

As can be seen from the following chart for 2012, there is a wide range of polling place turnouts, not only across counties but within counties. The average spread for all counties between lowest polling place turnout in the county and highest polling place turnout is 26 percentage points.

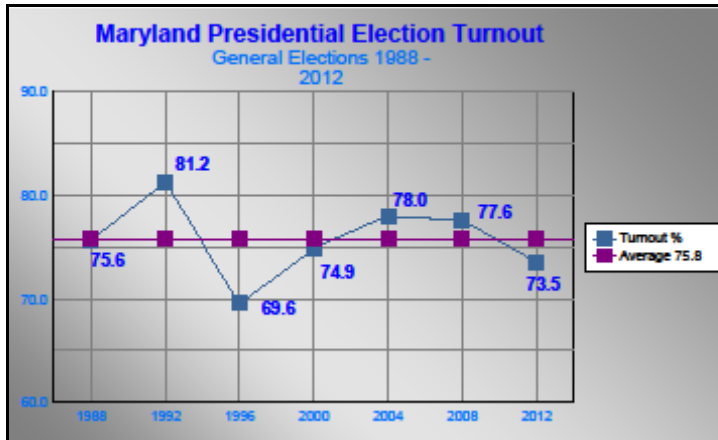
These spreads are likely to grow even wider as the early voting share of total turnout grows, since as we have seen, the early voting impact on Election Day turnout varies greatly depending on distance to the nearest early voting center. One of the conclusions that can be drawn from this data is that equipment allocation guidelines based only on the number of registered voters should be avoided.



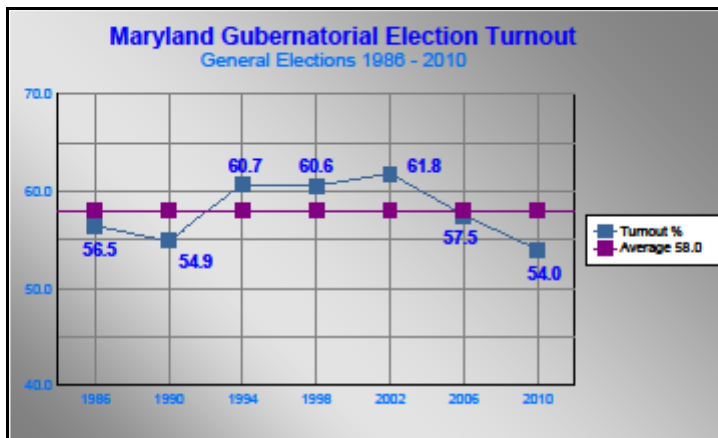
#### BASELINE TURNOUT TRENDS

Imagine the individual poll turnout estimates described above as waves on the water, and statewide turnout as the tide that lifts or lowers them all. Note in the chart below that turnouts in the two most recent presidential elections bracket the long term average of 75.8%, similar to the pattern in 1992-1996 (Bush I versus Clinton - Clinton versus Dole). If the pattern remains the same, 2016 turnout will be in the 75%-77% range.

At the high water mark in 1992, low-turnout non-partisan voters represented less than 10% of registered voters and they now account for nearly 19%.



In gubernatorial elections, the long term average turnout is 58% in the seven elections since 1986 - about 18 percentage points below the presidential election average. This turnout difference provides enough of a safety cushion so that long lines and excessive wait times are unlikely to be a serious problem in gubernatorial elections.

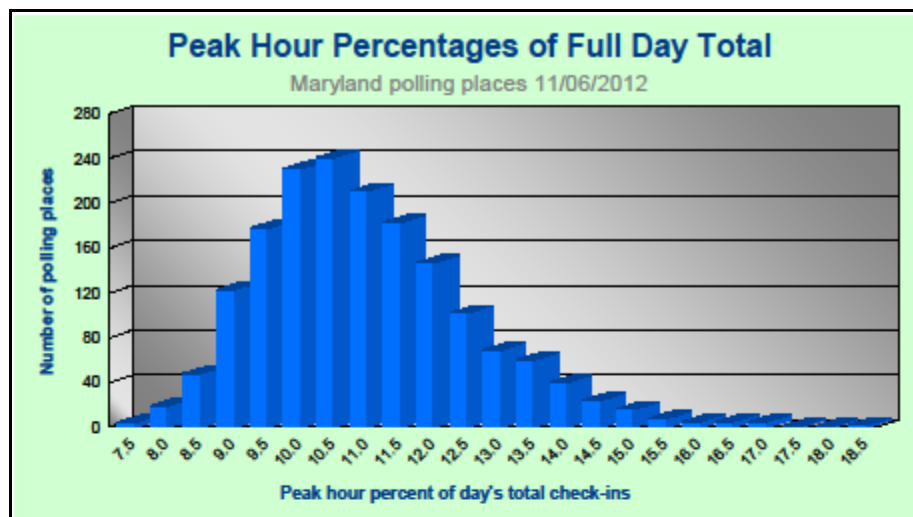


## Polling Place Hourly Turnout Profiles

### PEAK HOURS

If, in the 2012 election, voter arrivals had been distributed equally throughout the day in every polling place, 7.7% of the day's voters would have arrived during each of the thirteen hours the polls were open. Long lines and wait times of more than a few minutes would have been virtually non-existent.

Unfortunately, the rate of arrivals throughout the day is anything but constant. As seen in this chart, peak hour check-ins represented 11.5% or more of the full day total in about 40% of all polling places.



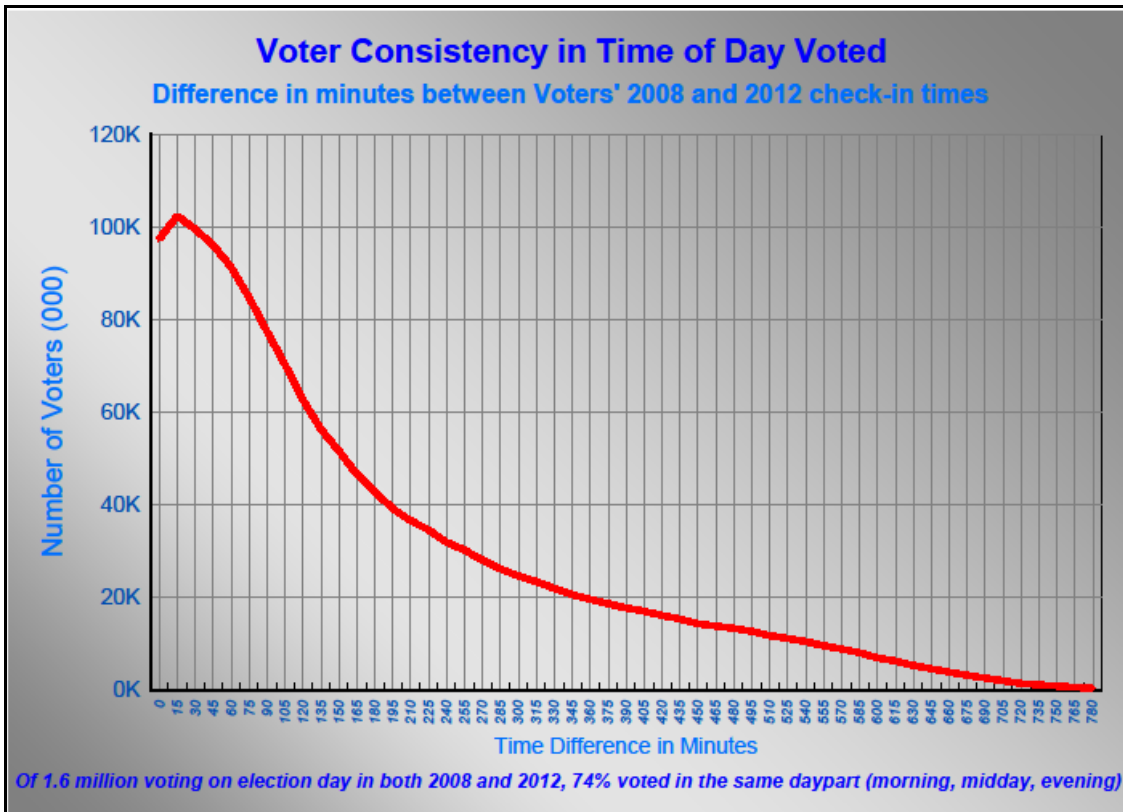
To illustrate the importance of peak turnout, it is useful to consider a “typical” Maryland polling place having 2,400 active voters, three electronic poll books, ten touchscreens and 1,300 in-poll voters on Election Day. Assume it takes an average of 60 seconds to check-in a voter on an electronic poll book, and that voters will spend an average of five minutes on the touchscreen.

With arrivals evenly distributed throughout the day, the polling place can easily accommodate the 100 voters arriving each hour—even with one of the poll books *and* one of the voting machines out of service.

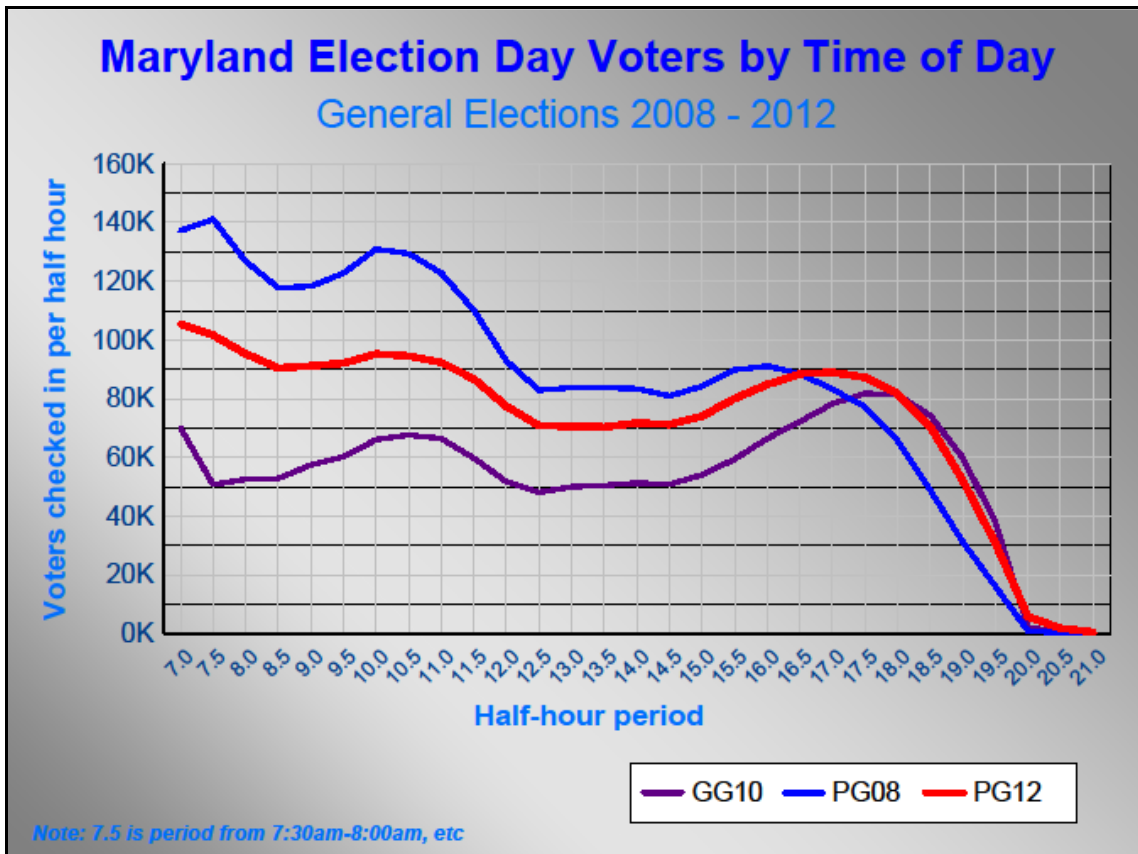
On the other hand, in the far more common “peak hour” scenario, 150 voters arrive during the peak hour. The three check-in judges must work as fast as they can to check them in as quickly as they arrive, and the ten touchscreens can accommodate only 120 of the 150 voters arriving during the hour, leaving thirty voters still waiting to vote at the end of the hour. The polling place is now just one equipment failure away from an unacceptably long line.

#### CONSISTENCY OF TURNOUT PROFILES

Just as total turnout for a polling place tends to be consistent from election to election, so does the hourly turnout pattern. The underlying reason for this is that voters, not surprisingly, have a strong tendency to vote at about the same time of day from one election to the next. As can be seen on this chart, of the 1.8 million voters in 2012 who also voted in 2008, the majority voted within two hours of the same time of day in both elections.



At the statewide level, the shape of the hourly turnout curves for the past three elections is quite similar, with a slight shift in the PM peak from 4:00 pm to 5:00 pm over the period. In each of the elections there was a significant drop off in turnout between 12:30 and 3:00 pm. This is the window when voters would be least likely to encounter a line.



Charts for each polling place in Maryland showing actual hourly turnout for 2008 and 2012 were examined by the research team. The plots are nowhere near as smooth as the statewide totals, but it can be seen that the plots for most polling places are quite congruent for the two elections.

#### TYPICAL TURNOUT PATTERNS

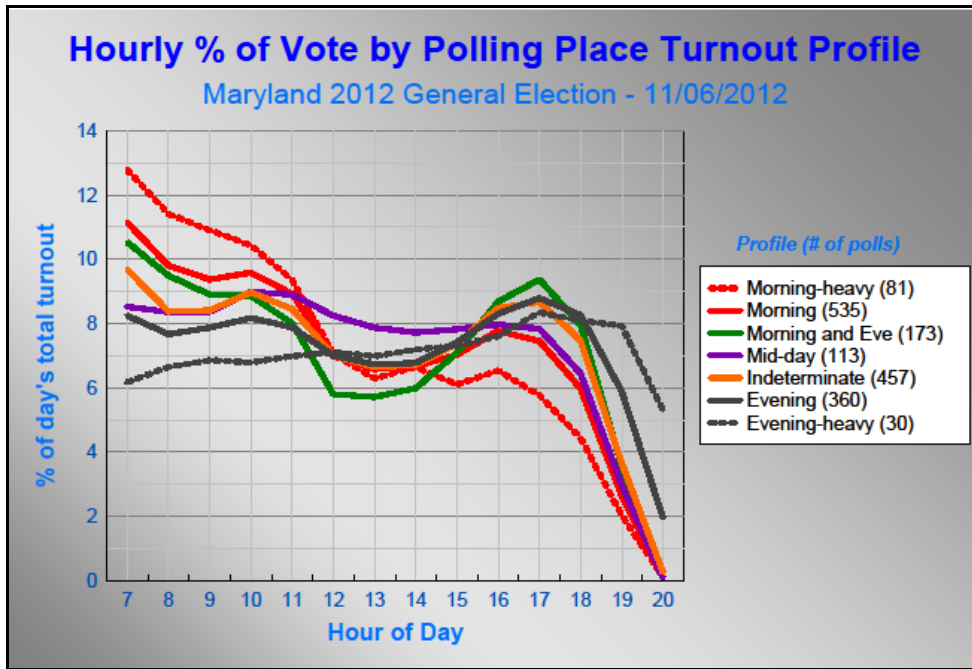
About three quarters of polling places fall into a particular turnout pattern as defined in Table 4 below.



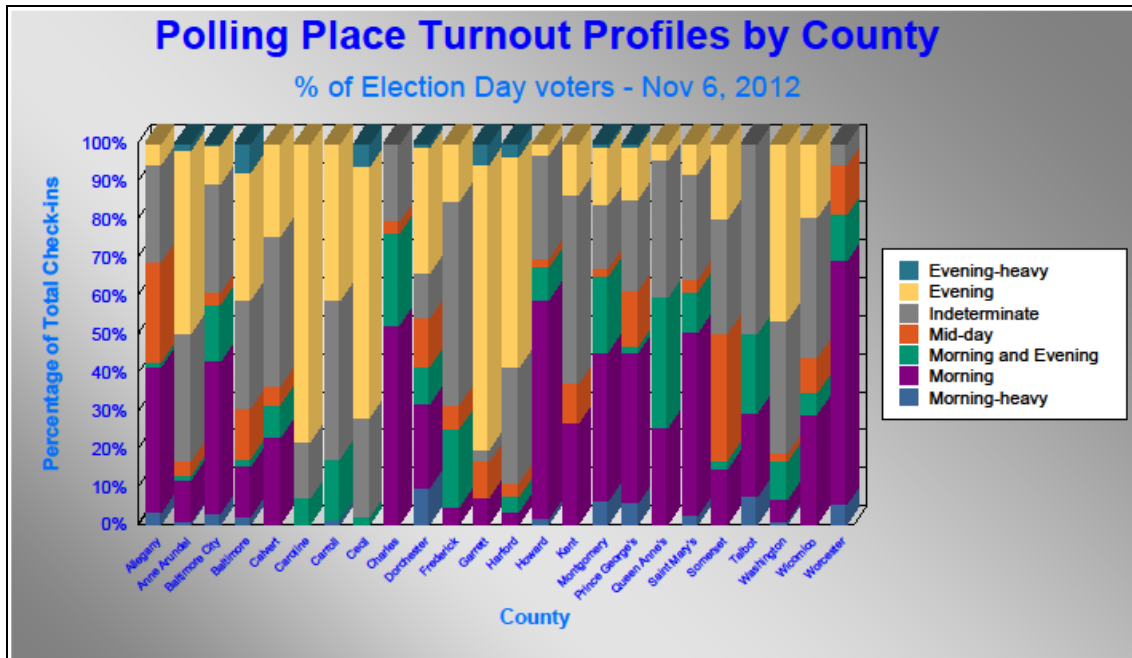
Table 4: Turnout Patterns

Profile	Criteria	# of Polls	% of Polls	% of votes
Morning-heavy	7am-10am vote total exceeds 5pm-8pm vote total by more than 20%	81	4.6%	2.9%
Morning	7am-10am vote total exceeds 5pm-8pm vote total by 11%-20%	535	30.6%	27.0%
Morning & Evening	7-10am vote total and 4-8pm vote total each exceed 27.5% of full day total	173	9.9%	9.5%
Mid-day	10am - 4pm vote total exceeds 48% of full day total	113	6.5%	6.7%
Indeterminate	Pattern does not meet any of the defined criteria	457	26.1%	27.9%
Evening	5pm-8pm vote total exceeds 7am-9am vote total by 5%-15%	360	20.6%	24.1%
Evening-heavy	5pm-8pm vote total exceeds 7am-9am vote total by more than 15%	30	1.7%	1.9%

Presented next are plots of hourly turnout for the defined profiles. Recall that long lines are more likely to be associated with *peak hour* turnout rather than overall turnout, so all other things being equal we would expect a higher chance of long lines in polling places with profiles having peak hours above 9% than in those that stay below 9%.



The following chart shows the breakdown of turnout profiles by county.



## Polling Place Management

### EFFECTIVE LINE MANAGEMENT

A line process can be conceptualized as a set of discrete and dependent steps. Each step has a finite capacity. Constraints or bottlenecks are those steps that have less capacity than the others in the process. By definition they are found in any such system. The key is recognizing and then managing the constraint.

Pete Abilla, a consultant who specializes in Operations Research, summarizes his view of bottlenecks this way:<sup>9</sup>

1. Bottlenecks determine the throughput of a system.
2. An increase in the bottleneck rates is the only way to increase throughput.

<sup>9</sup> <http://www.shmula.com/recognizing-constraints-bottlenecks/247/>

3. All other process steps should be slaves to the bottleneck.
4. It's okay to take resources from a non-bottleneck if it will help the bottleneck.

And he goes on to make these recommendations:

1. Bottlenecks should never be idle; to lose time on a bottleneck is to lose throughput.
2. Never let a bottleneck run out of work. It's okay to build inventory in front of a bottleneck.
3. Increase productivity rates (offline and online processes) by reducing down-time, change-over time, and off-task time.
4. Reduce defects by having Quality Assurance and Quality Control in front of a bottleneck, not after.
5. Focus all improvements on the bottleneck.

Research on queuing has shown that, on average, people overestimate how long they've waited in a line by about 36 percent<sup>10</sup>. The impact of line management on actual wait times is difficult to quantify, but academic research and anecdotal evidence from Maryland polling places suggest that there are some simple steps that can minimize the voter's perceived wait time.

- Polling places should have a single line leading to the check-in table (i.e. do not have separate lines leading to each check-in judge.) This will eliminate a major cause of frustration with lines in general—the unfairness of ending up in the “slow line” through no fault of your own.
- Voters waiting in line should be given something to do—a sample ballot, pencil and League of Women Voters literature on the state ballot questions would have been ideal for the past election. As David Maister notes in his article *The Psychology of Waiting Lines*, “Occupied Time Feels Shorter than Unoccupied Time.”<sup>11</sup>
- When there were lines at polling places in 2012, it was typically due to a backup at the voting machines rather than the electronic poll books. In this situation, it would be preferable to form another line for the voting machines rather than hold up check-ins waiting for the voting machines to catch up. This is because, as noted by Maister in the paper cited above, “preprocess waits are perceived as longer than in-process waits.” Note that this approach might require polling places to have a higher number of voter access cards than the current guidelines (5 per touchscreen).

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<sup>10</sup> “Why Waiting is Torture” New York Times, August 18, 2012. See <http://www.nytimes.com/2012/08/19/opinion/sunday/why-waiting-in-line-is-torture.html?pagewanted=all>

<sup>11</sup> <http://davidmaister.com/wp-content/themes/davidmaister/pdf/PsychologyofWaitingLines751.pdf>

- Election judges should regularly update voters standing in line with expected wait times and explanations for delays. Maister again: “Uncertainty magnifies the stress of waiting.”
- Where possible set up a serpentine queue rather than a stretched out line. This puts voters in closer proximity to others waiting in line and can lead to more interaction between voters, making the wait less boring. It also makes it more convenient for an election judge to communicate with those in line (see previous bullet). Special needs voters can be handled off-line.

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#### TECHNICAL RESOURCES AVAILABLE

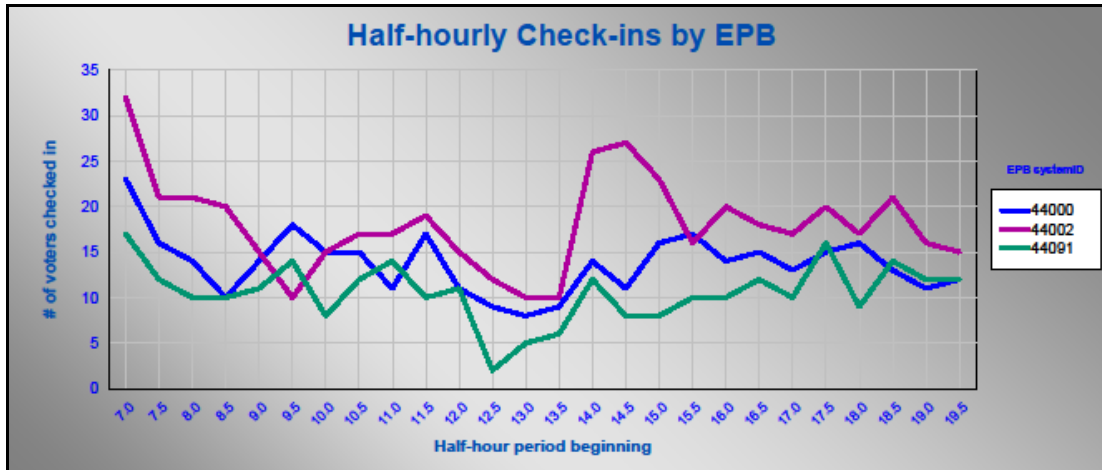
As will be seen in the wait time simulations presented in later section, long lines are most likely to form at the beginning of the day. If there is a delay in opening the poll, or if not all electronic poll books and voting machines are ready at the time the poll is opened, lines can snowball and potentially take hours to subside. It is important that each polling place have election judges who are familiar with the equipment and technical resources either on-site or available on short notice if equipment malfunctions.

#### Factors Affecting the Speed of Voter Check-in

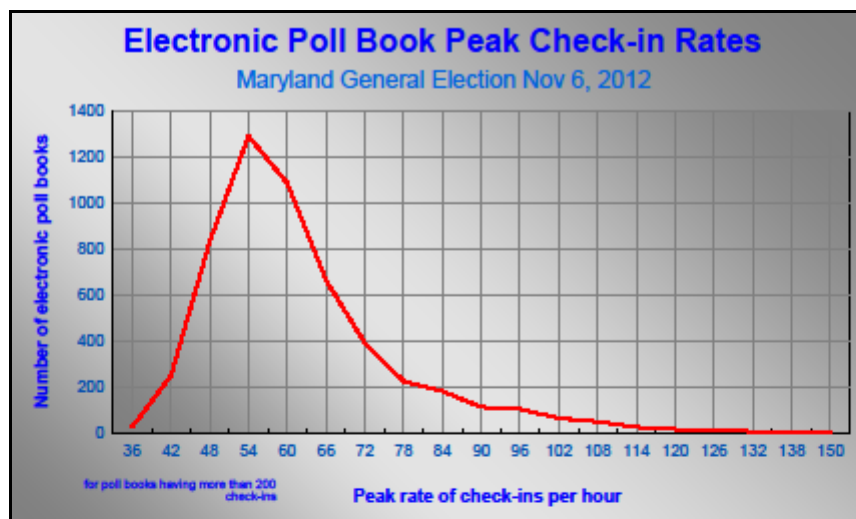
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#### CHECK-IN JUDGE PROFICIENCY

It is problematic to measure check-in judge proficiency using check-in rates over an entire day, because some slowdowns (such as halting check-ins due to a backup at the voting machines) are beyond the control of the check-in judges. However, the first half hour is probably a pretty good indicator, because in most polling places all check-in judges were working at peak capacity to clear the voters who were in line waiting for the poll to open. Here is a plot of check-ins by poll book for Oakwood Elementary in Anne Arundel County. You can see that poll book #44002 checked in about twice as many voters as #44091 in the first half hour.



Depicted below is a plot showing the number of poll books by peak check-in rate. There were 97 poll books in the state that actually hit rates of 100 voters per hour (a check-in every 36 seconds), but the median number was 60 per hour (one check-in per minute), and 60 per hour is a good rule of thumb for planning purposes.



## SINGLE/DUAL CHECK-IN JUDGES

Some local boards of elections use a single check-in judge on each electronic poll book, while others use two judges (one to look up the voter and another to tear off the VAC and obtain the voter’s signature). The dual-judge approach is more conducive to maximum check-in rates. In fact, the counties that tended to have the highest peak rates (Baltimore County, Charles, Harford and Saint Mary’s) use the “dual judge” system.

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## CANCELED BALLOTS AND RE-ISSUED BALLOTS

Ballot exceptions do slow down the check-in process, because each canceled or re-issued ballot amounts to checking in the voter twice (and in some cases more than twice.) Out of roughly 2.5 million ballots issued on the poll books, there were 8,137 re-issued ballots and 2,658 cancelled ballots, representing 0.43% of Election Day and early voters. Due to the low incidence of cancels and re-issues, they were not a significant contributor to long lines in the 2012 election.

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## ELECTRONIC POLL BOOK RE-STARTS

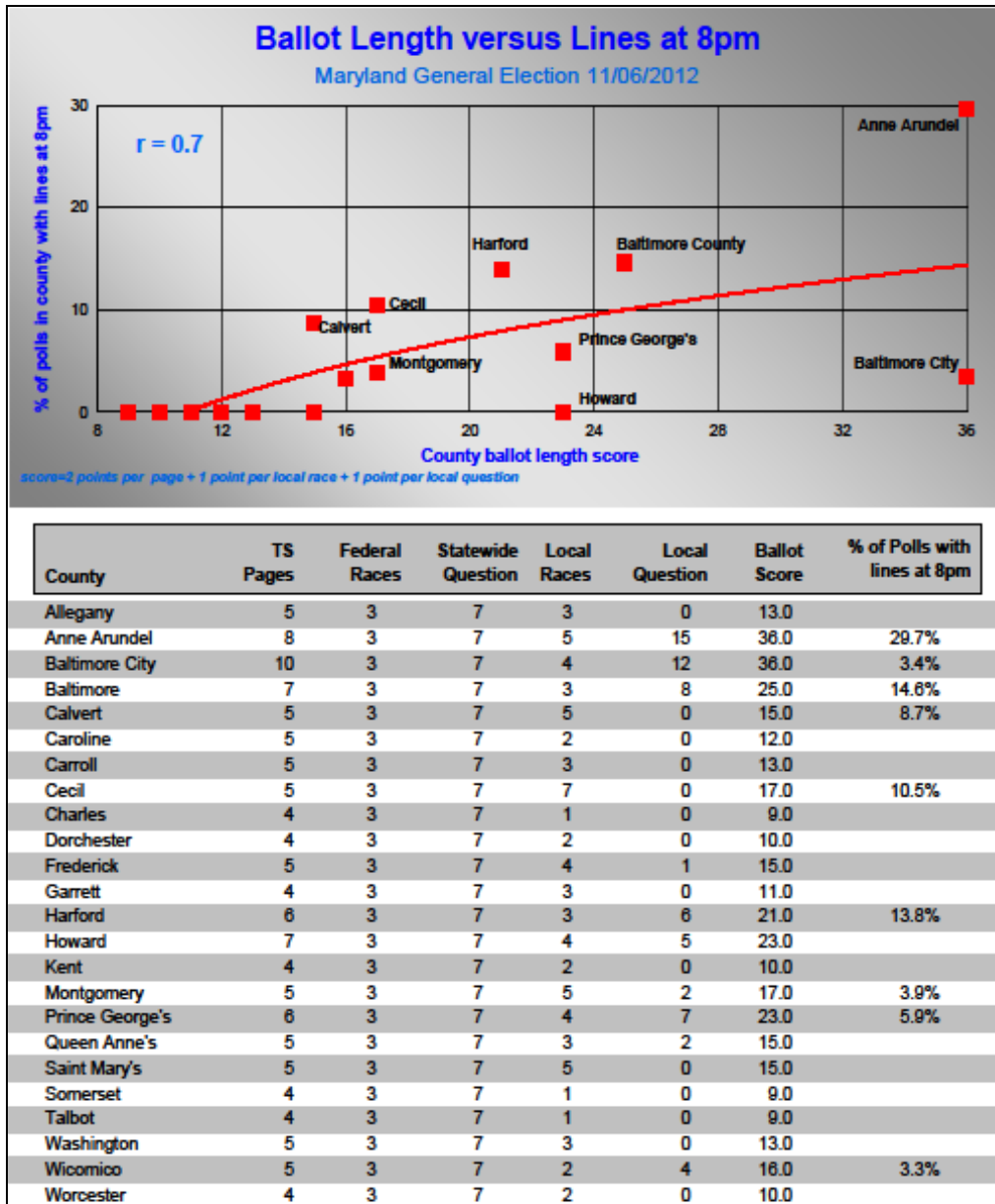
In 2012 as in past elections since the advent of the electronic poll books in Maryland, there were 5,953 electronic poll book “re-boots” on Election Day 2012. Due to the low incidence of re-boots, they were not a significant contributor to long lines in the 2012 election.

## Factors Affecting Time Taken To Vote on Touchscreen

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### BALLOT LENGTH

Longer ballots in some Maryland jurisdictions were undoubtedly the root cause of the lines experienced at a number of early voting sites and Election Day polling places in the November 2012 election. There were three federal election contests and seven statewide questions on the ballot in all counties. In addition, there were anywhere from one to twenty local contests and questions depending on the jurisdiction. Ballot length on the voting units ranged from four touchscreen pages in seven counties up to eight pages in Anne Arundel and ten pages in Baltimore City. Here is a plot of the “ballot length score” for each county versus the percentage of polling places in that county that had lines when the polls closed at 8:00 pm. Note that in the data from the chart below, none of the seven counties with four touchscreen ballot pages had any lines at 8:00 pm. Only three of the eleven counties with five touchscreen ballot pages had lines at 8:00 pm.

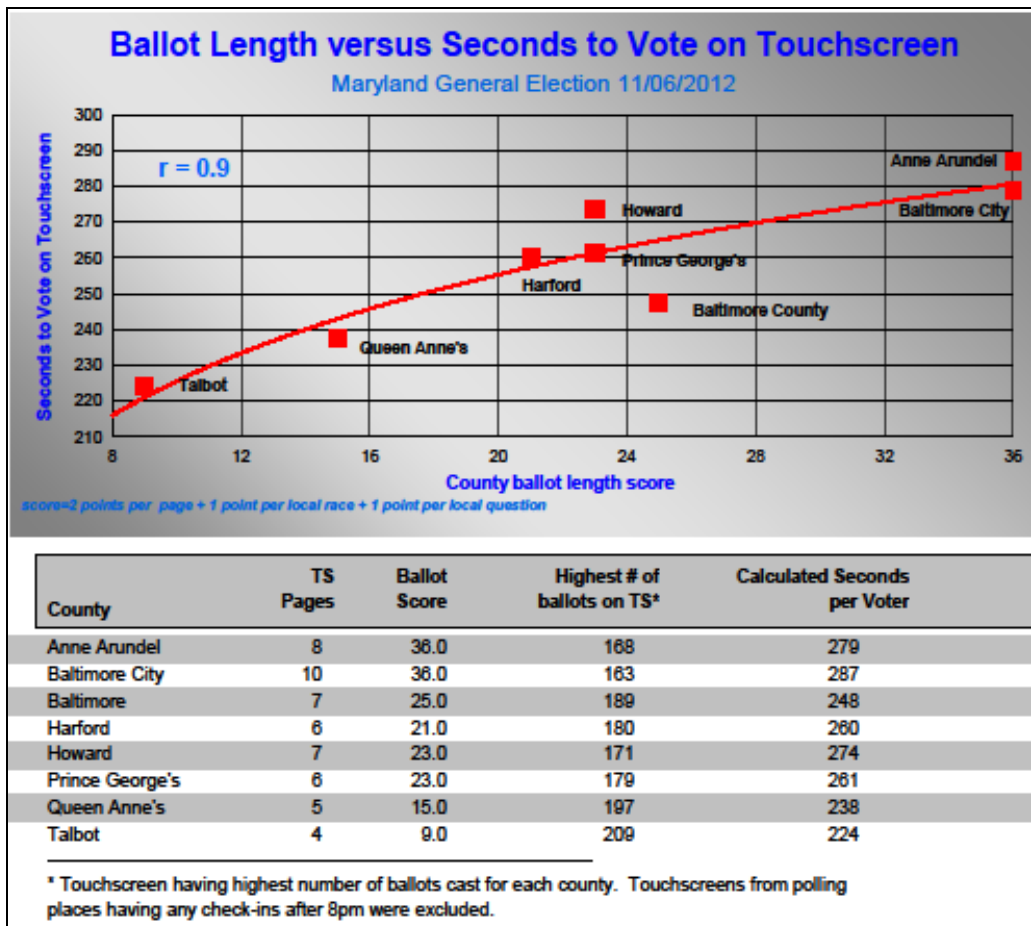


Baltimore City and Howard County might have been expected to have more end-of-day lines than they actually did, but as shown in the turnout profile chart on page 42, a heavy majority of polls in those jurisdictions were skewed toward morning turnout.

Despite Baltimore City's long ballot, a Baltimore City voter who was familiar with the candidates and issues, and had made up his or her mind in advance, should have been able to comfortably complete the touchscreen ballot in less than four minutes. A well-prepared Talbot County voter, with a four page touchscreen ballot and only one local race, should be done in two minutes or less.

Nonetheless, there were anecdotal reports from many jurisdictions of some voters spending ten to twenty minutes on the touchscreens. Therefore, it is not surprising that average times on touchscreen were significantly longer than the “best case” times described above.

The voting system used in the studied election does not provide specific data on the amount of time each voter takes to vote on the touchscreen. However, it does provide the total number of ballots cast on each unit, so it is possible to compare the highest number of ballots cast on a touchscreen for each jurisdiction. By dividing that number into the total number of seconds the polls were open (46,800) we can come up with a reasonable estimate of the best-case average “seconds to vote” in a jurisdiction. Here is the plot:



Note that the chart does not have data points for all counties. For this analysis the touchscreen ballot counts are useful only if the touchscreen was at maximum utilization throughout the day. In many counties (such as Montgomery), there were enough touchscreens allocated to each polling place so that none were actually “maxed out” at any of the polling places. Due to the absence of historical data about early voting in presidential election years, it was hard for administrators to account for the potential impact of key factors, including the “Election Day turnout relief” from early voting. This “relief” was widely



variable from precinct to precinct, with the majority of counties having a swing of more than 20 points in early voting participation from the lowest to the highest precinct.

Across the state, ballot length averaged 67% longer in 2012 general election than in 2008 general election. (See Table 5) No jurisdiction except Baltimore City had used a ballot of comparable length in a presidential election since the advent of the touchscreens. The 2012 Anne Arundel County ballot was actually three times as long (based on word count) as the 2008 ballot, with an estimated average time of 5.3 minutes for a voter to complete the ballot, compared with 2 minutes in 2008. This is the functional equivalent of cutting the capacity of each touchscreen machine by 60%. With fewer touchscreens available to deploy in 2012 because of early voting, it is not surprising that waits of more than 30 minutes were common in Anne Arundel County. On pages 109-110 in Appendix C an example of the impact of touchscreen variables for a precinct polling place with 2,200 registered voters in Anne Arundel County is explained in detail.

Table 5: Average Number of Words on the Ballot

County	Average Number of Words on the Ballot: General Election 2008	Average Number of Words on the Ballot: General Election 2010	Average Number of Words on the Ballot: General Election 2012	Percentage increase from 2008 to 2012
Allegany	569	922	1,005	76.6%
Anne Arundel	682	1,245	2,018	195.9%
Baltimore City	2,250	1,794	2,245	-0.2%
Baltimore	1,186	1,543	1,535	29.4%
Calvert	577	960	1,019	76.6%
Caroline	553	1,040	973	75.9%
Carroll	551	895	1,002	81.9%
Cecil	614	1,035	1,052	71.3%
Charles	532	1,016	962	80.8%
Dorchester	566	884	970	71.4%
Frederick	559	956	1,057	89.1%
Garrett	643	943	1,002	55.8%
Harford	569	857	1,364	139.7%
Howard	569	943	1,576	177.0%
Kent	583	972	977	67.6%
Montgomery	770	1,095	1,312	70.4%
Prince George's	1,125	1,325	1,634	45.2%
Queen Anne's	630	986	1,125	78.6%
Saint Mary's	571	945	1,023	79.2%
Somerset	568	916	968	70.4%
Talbot	952	1,027	968	1.7%
Washington	568	955	1,083	90.7%
Wicomico	655	1,193	1,273	94.4%
Worcester	566	903	985	74.0%
<b>Total</b>	17,408	25,350	29,128	67.3%

Another key factor is that ballot length may not have been as important in past elections because of the “drop off” rate from the top of the ballot to the bottom of the ballot. But, there was little “drop off” in the 2012 presidential general election. For example, in Anne Arundel County the last county question listed was voted on by 85.5% of the voters and the state question number 7 concerning casino gambling was voted on by 98.6% of the voters. It should be noted that unprecedented amounts of money were spent by proponents and opponents of the state ballot questions in 2012, far exceeding the amount of money spent by candidates in Maryland.

For a more in-depth analysis of the impact of ballot length on voter interface with the voting system, see Appendix C which details our observations of the 2013 municipal elections in Annapolis, Frederick, and Rockville and discusses touchscreen ballot metrics for the 2008, 2010, and 2012 general elections.

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## UNIT JUDGES

According to the chart above it appears that the average time taken to vote on Maryland’s touchscreens ranged from about 3 minutes 45 seconds in the “short ballot” counties up to about 4 minutes 40 seconds in the “long ballot” counties. It is important to note that these durations include not just the time the voters actually spent using the touchscreens, but also the “transition time” needed to make the turnover from a voter who has finished voting to the next voter who will be using that touchscreen. This process is managed by the Unit Judges, who typically escort the voter to the next available touchscreen and instruct the voter on how to insert the voter access card to bring up the ballot display, and return voter access cards to the check-in station to be re-used. The turnover time can be affected by a number of factors, including how quickly the available touchscreens are identified, and how quickly the Unit Judge can have the next voter “up and running.” Unit judges are also responsible for returning voter access cards to the check-in station to be re-used.

As a case in point, a Chief Judge at Broadneck Elementary (Anne Arundel County) reported in a post-election interview that the Unit Judges had been trained to deliver a “long spiel” to each voter on how to operate the touchscreen. The 30 seconds or so of extra delay for each voter was enough to create a backup at the voting machines, so that wait times had grown to over one hour by 9:00 am. The Unit Judges were instructed to shorten the explanation and the line cleared quickly. As we’ll see in the simulation section, when a polling place has barely enough touchscreens to handle the voter load, a difference of only a few seconds in average time taken to vote can have a significant impact on wait times.

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## BILINGUAL BALLOT

In the two bilingual ballot jurisdictions (Montgomery County and Prince George's County) there is an extra screen for the voter to select preferred ballot language, which adds an estimated ten seconds to "average time on touchscreen." This seems inconsequential, but as observed in the simulations, under some circumstances seemingly trivial increases in average time to vote can make a big difference in wait times for voters.

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## AUDIO BALLOTS

If audio ballots (VIBS) were widely used, they would cause an increase in average time to vote since the audio ballot takes an estimated six times as long to complete as a regular ballot. However, there is little overall effect. In 2012 there were 105 audio ballots issued during early voting (1 out of every 4,200 ballots) and 392 issued on Election Day (1 out of every 5,300 ballots). More than 80 percent of Maryland's precinct polling places did not issue any audio ballots.

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## OLDER VOTERS

Anecdotal evidence suggests that those few voters who take an exceptionally long time at the touchscreen (ten minutes or more) tend to be elderly. However, there is scant evidence from the available data that older voters on average take significantly longer to vote than other voters. There were seven polling places in the past election (including Charlestown in Baltimore and Leisure World I and II in Montgomery) with more than 70% of those voting were age 70 or over. Only one of the seven (Leisure World I) reported unusual lines, due to a busload of voters from the nursing home and "poor line management."

Another occurrence associated with older voters is the "touchscreen timeout," which happens after two minutes of the voter doing nothing on the touchscreen. After a timeout, the procedure is for an election judge to "cancel" the ballot, and the "cancelled" status is written to the voter access card before it is ejected by the voting system. The voter is then re-issued another voter access card and tries again.

The electronic poll books record the status (blank, unvoted, cast or cancelled) of the smart cards as they are inserted into the poll book's card reader/writer, so there is good data on number of canceled ballots and unvoted cards in each polling place. There were a total of 2,161 canceled cards and 3,647 unvoted cards recorded on November 6, 2012.

Unvoted cards result from so-called "fleeing voters" who are checked-in and issued a voter access card, and then depart the polling place without voting, presumably because of too long a wait for an available touchscreen. A significant number of unvoted access cards in a polling place is likely a good

indicator of backups at the touchscreens. Of the 1,749 Election Day polling places, there were 700 without an unvoted card and 244 with five or more unvoted access cards.

The number of canceled cards as a percentage of total ballots issued in a polling place has a very weak positive correlation with average voter age of the polling place ( $r=0.07$ ). The number of unvoted cards as a percent of total ballots has a very weak *negative* correlation with average voter age ( $r=-0.13$ ). The impact of the number of cancelled cards on wait times was minimal.

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## WRITE-INS

In all but the First Congressional District counties on the eastern shore, the percentage of ballots with write-in selections was under 1%. The Eastern Shore counties ranged from 5% in Dorchester to a 20% in Kent because of unusual circumstances that prompted write-in campaigns in the contest for Congress which garnered 17, 887 votes.

Overall the impact of write-ins was minimal, accounting for only 0.2% of the total time voters spent casting their ballots on the touchscreens statewide. Write-ins were, however, a significant factor in most of the Eastern Shore counties, adding an estimated 3% to the overall voter time on touchscreen in Talbot and nearly 5% in Kent. Fortunately, both of these counties had relatively short ballots, so the impact on wait times was minimized.

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## PROVISIONAL BALLOTS

During the 2012 presidential general election there were 79,876 individuals that cast provisional ballots at polling place locations and early voting locations. On Election Day, the range of provisional ballots cast was zero in twenty-three precincts to 626 in the College Park precinct (Prince George's County, District 21, Precinct 17). On early voting days the range of provisional ballots issued at the forty-six early vote centers was zero on seven occasions to 207 at the Silver Spring Bain Center site on November 2, 2012. On only nine occasions at seven different early vote centers out of 230 possible occasions were a 100 or more provisional ballots cast during the early voting period.

Over 75% of the precincts issued less than forty provisional ballots on Election Day, November 6, 2012. Only twenty out of the 1,850 precincts issued more than 100 provisional ballots with only 185 issuing more than fifty. Except for polling places with large numbers of college students (University of Maryland College Park, Towson University, University of Maryland-Eastern Shore, Bowie State University) and a few selected precincts, the use of provisional ballots did not appear to be a significant cause of wait times whenever there were an adequate number of election judges to properly handle the provisional ballot process.

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## PRECINCT VOTER REGISTRATION AND TOTAL ELECTION DAY TURNOUT

Often, there is tendency to equate the number of registered voters assigned to a precinct and the number of total voters at any given precinct as the key factor in producing wait times. While there may be instances when these numbers may become problematic for the operation of a precinct polling place, size alone is not determinative of a wait time and may, in some instances produce economies of scale.

During the 2012 presidential elections, many precincts with the largest total number of registered voters and the largest number of Election Day voters did not experience chronic wait times in excess of thirty minutes or an hour. For example, the precinct with the largest number of registered voters (6,806) and the largest number of Election Day voters (4,819) was Carrolltowne Elementary School (District 5, Precinct 4) in Carroll County. However, because of the physical characteristics of the polling place, the modest length of the ballot (1,002 words on four touchscreen pages), an adequate supply of voting machines (30), and effective polling place management, wait times at the precinct were not reported, and were not found by available data, to be extraordinary.

It is also noteworthy that ten out of the twelve precincts with the most number of total voters (all in excess of 3,000) on November 6, 2012, in the state were in Carroll County where precinct consolidation has been used as a strategy to efficiently allocate voting system equipment and operate polling place locations.

## The Nationwide Surveys and the Opinions of Maryland Voters Found by Those Surveys

The Schaefer Center analysis was also informed by two large scale surveys that were conducted nationwide in both 2008 and 2012 and by the work of Charles Stewart III in analyzing the nationwide data.<sup>12</sup>

The Cooperative Congressional Election Study (CCES)<sup>13</sup> is designed to help study a wide range of questions. It uses a stratified national sample. In 2008,<sup>14</sup> 32,800 people were interviewed. Of those, 19,446 were voters who answered questions about waiting to vote on Election Day and 353 were Maryland voters who answered questions about waiting to vote. In 2012, 54,535 people were interviewed. Of those, 22,495 answered questions about waiting to vote on Election Day and 7,584 answered questions about waiting to vote during early voting periods for a total of 30,079 relevant respondents. Of these, 529 were Marylanders who voted on Election Day and 183 were Marylanders who voted early for a total of 712 relevant respondents.

The other nationwide survey which was relevant to this study was the Survey of the Performance of American Elections (SPAЕ).<sup>15</sup> This survey is specifically designed to probe into the perceptions of voters about the voting experience. This survey uses statewide samples of 200 registered voters. Of the 10,000 registered voters interviewed in 2008, 7,211 voted and answered questions about waiting to vote. Of the 200 Marylanders interviewed for the survey in 2008, 176 voted and answered questions about waiting to vote. Of the 10,200 registered voters surveyed in 2012 (including the District of Columbia), 5,958 voted on

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<sup>12</sup> Charles Stewart III, "Waiting to Vote in 2012" found at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2243630](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2243630) as of January 9, 2014.

<sup>13</sup> The CCES survey results can be found at <http://projects.ig.harvard.edu/cces/book/study-design>. The 2012 CCES data were provided to us by the Center for American Politics and Citizenship and the Department of Government and Politics at UMD, College Park

<sup>14</sup> Stephen Ansolabehere, 2011, "CCES, Common Content, 2008", <http://hdl.handle.net/1902.1/14003> UNF:5:7eeaUMPVCcKDNxK6/kd37w== V6 [Version]

<sup>15</sup> Stewart, Charles, 2013, "2012 Survey of the Performance of American Elections", <http://hdl.handle.net/1902.1/21624> UNF:5:nMKNqnHfGzpAilhPJPvE8g== V2 [Version] found at [http://thedata.harvard.edu/dvn/dv/measuringelections/faces/study/StudyPage.xhtml;jsessionid=40f46f192322b969f2788c87f80f?globalId=hdl:1902.1/21624&studyListingIndex=0\\_40f46f192322b969f2788c87f80f](http://thedata.harvard.edu/dvn/dv/measuringelections/faces/study/StudyPage.xhtml;jsessionid=40f46f192322b969f2788c87f80f?globalId=hdl:1902.1/21624&studyListingIndex=0_40f46f192322b969f2788c87f80f)

Election Day and answered questions about the wait and 1,651 voted early and answered such questions. Of these, 134 were Marylanders who voted on Election Day and thirty-nine were Marylanders who voted early.

Combining these surveys we have 529 Maryland voters who answered national survey question about waiting to vote in 2008 and 885 Maryland voters who answered national survey questions about waiting to vote in 2012.

These numbers are high enough to give us some confidence in the results. Specifically, with the 529 responses from 2008 we can be 95% confident that the results of a “yes or no” question are within 4.3 percentage points of the answer that would be found in the entire population of interest. With the 885 responses from 2012 we can be 95% confident that the sample responses from such questions are within 3.3 percentage points of the answer that would be found in the entire population of interest. (Many of the tables below use subgroups and the results cannot be said to be asserted with as high a confidence level.)

The results from these nationwide surveys parallel the results found in the Schaefer Center surveys.

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#### WAIT TIMES IN GENERAL

Table 6 below compares the national sample to the Maryland subsample on the key measure of waiting times found in both national surveys. Respondents on the CCES 2012 and the SPAE 2012 were asked “Approximately how long did you wait in line to vote?” Table 6 below shows the results for both the early voters and the voters on Election Day who responded nationwide and also for those voters who were Maryland voters. Maryland voters reported more delays. For example putting together those who reported delays of 31 minutes to 60 minutes and those who reported delays of more than an hour, 36.2% of Maryland voters reported a delay of more than a half hour compared with only 11.6% of voters nationwide.

**Table 6: National and Maryland Voters (Early and Election Day): Answers to the Question “Approximately how long did you wait in line to vote?” 2012**

<b>Reported Wait</b>	<b>Nationwide 2012</b>		<b>Maryland 2012</b>	
Not at all	14,579	38.7%	131	14.8%
Less than 10 minutes	11,906	31.6%	195	22.0%
10 to 30 minutes	6,841	18.2%	239	27.0%
31 minutes to 60 minutes	3,009	8.0%	185	20.9%
More than 1 hour	1,353	3.6%	135	15.3%
Totals	37,688	100.0%	885	100.0%

Charles Stewart takes this data and combines it with the respondents' estimate of how much more time was spent waiting after one hour to create an indicator of the average waiting time. By his calculation Maryland had the second longest waiting times in the nation in 2012.<sup>16</sup>

Data from 2008 show the some of the same pattern. In the 2008 survey, 25.3% of Maryland respondents reported a delay of more than 30 minutes and 14.1% of voters nationwide reported such a delay. Table 7 shows the responses in 2008.

**Table 7: National and Maryland Voters (Early and Election Day): Answers to the Question "Approximately how long did you wait in line to vote?" 2008**

Reported Wait	Nationwide 2008		Maryland 2008	
Not at all	10,804	40.5%	171	32.3%
Less than 10 minutes	7,470	28.0%	128	24.2%
10 to 30 minutes	4,631	17.4%	96	18.1%
31 minutes to 60 minutes	2,377	8.9%	72	13.6%
More than 1 hour	1,375	5.2%	62	11.7%
Totals	26,657	100.0%	529	100.0%

## EARLY VOTING AND DELAYS

Just as the Schaefer Center survey found that early voters were more likely to experience waits greater than an hour or greater than an half hour than were other voters the national surveys show the same pattern both nationally and in Maryland.

**Table 8: National and Maryland Early Voters: Answers to the Question "Approximately how long did you wait in line to vote?" 2012**

Reported Wait	Nation 2012 Early		Maryland 2012 Early	
Not at all	3195	34.6%	20	9.0%
Less than 10 minutes	2708	29.3%	31	14.0%
10 to 30 minutes	1898	20.6%	58	26.1%
31 minutes to 60 minutes	933	10.1%	53	23.9%
More than 1 hour	501	5.4%	60	27.0%
Totals	9235	100.0%	222	100.0%

<sup>16</sup> Stewart p.25



Table 8 above shows that 50.9% of the early voters who were respondents in the national surveys reported a delay of more than 30 minutes. The Schaefer Center survey of early voters found nearly the same percentage—51.7%. But the Schaefer Center survey found only 16.3% of early voters in Maryland indicated they waited more than an hour, which is lower than the 27% found in the national surveys. The difference may be due to the smaller sample size of relevant early voters from Maryland in the national samples (222) compared to the Schaefer Center sample (590).

Early voting is a key indicator of longer wait times both in Maryland and nationally. Stewart, using his system for estimating exact wait times from this data, explains the relationship this way: “One administrative feature of elections seems robustly related to wait times, early voting. . . . Early voters averaged wait times of 17 minutes, 54 seconds ( $\pm 24$  seconds), compared to the average wait time of 12 minutes ( $\pm 12$  seconds) for Election Day voters.”<sup>17</sup>

This was especially the case in Maryland. If we look only at Election Day voters the contrast with early voters is clear.

Table 9: National and Maryland Election Day Voters: Answers to the Question “Approximately how long did you wait in line to vote?” 2012

Reported Wait	Nation 2012 Election Day		Maryland 2012 Election Day	
	Count	Percentage	Count	Percentage
Not at all	11384	40.0%	111	16.7%
Less than 10 minutes	9198	32.3%	164	24.7%
10 to 30 minutes	4943	17.4%	181	27.3%
31 minutes to 60 minutes	2076	7.3%	132	19.9%
More than 1 hour	852	3.0%	75	11.3%
Totals	28453	100.0%	663	100.0%

Table 9 shows that 31.2% of Election Day voters who responded to the national sample indicated a wait of more than 30 minutes this was a steep reduction from the 50.9% of early voters who indicated such a wait. And the 11.3% who indicated a wait of more than an hour is much less than the 27% or early voters who indicated such a wait.

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<sup>17</sup> Stewart p. 21

## THE SIZE OF THE JURISDICTION AND DELAYS

The national surveys also confirm the Schaefer Center survey results that show that the problem of delays was largely confined to the five most populous jurisdictions in Maryland. On the questions relating to the waiting times of the Election Day voters the nationwide surveys are more reliable since they have more respondents and since the Schaefer Center survey of Election Day voters was designed to identify the nature of the problem and not the extent of the problem. On the questions of the waiting times of early voters the Schaefer Center survey is more reliable since it has more respondents and it was a random sample designed to capture both the extent and the nature of the problem.

Table 10 below compares each of the five most populous jurisdictions and the other jurisdictions on the percentage of the total number of Maryland Election Day voters who were respondents on the CCES 2012 and the SPAE 2012 surveys combined who indicated they spent more than one half hour in line to vote.

**Table 10: Maryland Election Day Voters: Responses in 2012 National Surveys to the Question “Approximately how long did you wait in line to vote?” that Indicated that They Waited More than One Half Hour, by Jurisdiction**

<b>Election Day Voters 2012</b>	<b>Waited Less than One Half Hour</b>	<b>Waited More than One Half Hour</b>	<b>Percent Who Waited More than One Half Hour</b>
Anne Arundel MD	20	31	60.8%
Baltimore City MD	35	23	39.7%
Baltimore County MD	60	46	43.4%
Montgomery MD	67	35	34.3%
Prince George's MD	39	58	59.8%
Other MD Jurisdictions	235	14	5.6%
<b>Totals</b>	<b>456</b>	<b>207</b>	<b>31.2%</b>

The vast majority (94.4%) of these voters were from the five most populous jurisdictions in Maryland.

This pattern was still there in the responses of the early voters from Maryland, though here the national surveys showed that significant problems with waiting were also found in the early voting sites in other jurisdictions (Table 11).

**Table 11: Maryland Early Voters: Responses in 2012 National Surveys to the Question “Approximately how long did you wait in line to vote?” that Indicated that They Waited More than One Half Hour, by Jurisdiction**

<b>Early Voters 2012</b>	<b>Waited Less than One Half Hour</b>	<b>Waited More than One Half Hour</b>	<b>Percent Who Waited More than One Half Hour</b>
Anne Arundel MD	7	17	70.8%
Baltimore City MD	8	12	60.0%
Baltimore County MD	7	25	78.1%
Montgomery MD	19	11	36.7%
Prince George's MD	6	14	70.0%
Other MD Jurisdictions	62	34	35.4%
<b>Totals</b>	<b>109</b>	<b>113</b>	<b>50.9%</b>

These results were also computed for those respondents on the CCES 2012 or the SPAE 2012 surveys who responded “more than one hour” to the question “Approximately how long did you wait in line to vote?” Table 12 shows Election Day voters and all the responses to the question with the percentage indicated of those who waited more than an hour.

**Table 12: Maryland Election Day Voters: Responses in 2012 National Surveys to the Question “Approximately how long did you wait in line to vote?” that Indicated that They Waited More than One Hour, by Jurisdiction**

<b>Election Day Voters 2012</b>	<b>Not at All</b>	<b>Less than 10 Minutes</b>	<b>10-30 Minutes</b>	<b>31 Minutes - 1 Hour</b>	<b>More than 1 Hour</b>	<b>Totals</b>	<b>Percent Who Waited More than an Hour</b>
Anne Arundel MD	0	4	16	21	10	51	19.6%
Baltimore City MD	4	11	20	17	6	58	10.3%
Baltimore County MD	11	10	39	34	12	106	11.3%
Montgomery MD	13	21	33	25	10	102	9.8%
Prince George's MD	3	11	25	22	36	97	37.1%
Other MD Jurisdictions	80	107	48	13	1	249	0.4%
<b>Totals</b>	<b>111</b>	<b>164</b>	<b>181</b>	<b>132</b>	<b>75</b>	<b>663</b>	<b>11.3%</b>
	16.7%	24.7%	27.3%	19.9%	11.3%	100.0%	

Table 13 shows the same results for those who 2012 early voters who responded to the national surveys.

**Table 13: Maryland Early Voters: Responses in 2012 National Surveys to the Question “Approximately how long did you wait in line to vote?” that Indicated that They Waited More than One Hour, by Jurisdiction**

Early Voters 2012	Not at All	Less than 10 Minutes	10-30 Minutes	31 Minutes - 1 Hour	More than 1 Hour	Totals	Percent Who Waited More than an Hour
Anne Arundel MD	1	3	3	4	13	24	54.2%
Baltimore City MD	3	2	3	8	4	20	20.0%
Baltimore County MD	0	0	7	12	13	32	40.6%
Montgomery MD	1	6	12	5	6	30	20.0%
Prince George's MD	1	2	3	2	12	20	60.0%
Other MD Jurisdictions	14	18	30	22	12	96	12.5%
Totals	20	31	58	53	60	222	27.0%

These tables also show that the most severe problems occurred among early voters in the largest jurisdictions, although again early voting problems were found in other jurisdictions as well.

#### RACE AND WAITING TO VOTE

Charles Stewart in his analysis of the national surveys points out that race initially appears to be a factor. This appearance is true of Maryland as well. Using the CCES 2012 survey and the self-reported “race” variable we compare the perceptions of wait times of Black and White respondents. The national numbers are shown in Table 14 below.

**Table 14: National Voters (Early and Election Day): Answers to the Question “Approximately how long did you wait in line to vote?” 2012 by Race**

	U.S. White		U.S. Black	
Not at all	9,869	40.6%	656	24.2%
Less than 10 minutes	7,751	31.9%	799	29.5%
10 to 30 minutes	4,195	17.3%	654	24.2%
31 minutes to 60 minutes	1,747	7.2%	375	13.9%
More than 1 hour	756	3.1%	223	8.2%
Totals	24,318	100.0%	2707	100.0%

The Maryland numbers from the CCES 2012 survey tell a similar story (Table 15).

**Table 15: Maryland Voters (Early and Election Day): Responses in 2012 National Surveys to the Question “Approximately how long did you wait in line to vote?”, by Race**

	MD White		MD Black	
Not at all	85	16.7%	3	2.1%
Less than 10 minutes	135	26.5%	16	11.3%
10 to 30 minutes	132	25.9%	41	29.1%
31 minutes to 60 minutes	97	19.1%	38	27.0%
More than 1 hour	60	11.8%	43	30.5%
Totals	509	100.0%	141	100.0%

But Stewart found that when “we control for the state the respondents live in, this difference falls to 7.7 minutes; controlling for county and then ZIP code reduces these differences to 4.7 and 0.8 minutes, respectively.”<sup>18</sup> The last difference is not statistically significant. When one controls for precinct and for early voting (an analysis that cannot be done given the current data set available) the difference would diminish still further.

It is likely then that this difference is explained by geography and not by race. Still the result that African-Americans pay a higher “wait tax” to vote is disturbing and calls for redoubled efforts to get needed resources to those populous jurisdictions and those early voting centers that are having the significant problems with wait times both nationally and in Maryland.

## Schaefer Center Surveys Conducted for This Study

The Schaefer Center for Public Policy in collaboration with the Maryland State Board of Elections, conducted a survey of Marylanders who voted in the 2012 presidential general election – both at early voting centers and at polling places on Election Day. The records of the Maryland State Board of Elections provide the information necessary for selecting the voters who were called.

A random sample of all early voters for whom a telephone number was available in the records was drawn. The random selection led to interviews being conducted with respondents from all the early voting sites except the site in Garrett County and the site in Somerset County. The selection of voters who voted on Election Day 2012 was more complex.

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<sup>18</sup> Stewart p. 20

One object of this survey was to gather the voters' perceptions of the problems that led to long lines. To do this the Schaefer Center used a variety of methods to try to contact voters who would be more likely to have experienced lines on Election Day. These precincts were identified by a set of indicators. Precincts were included if:

- They were identified by a county election official as having experienced difficulty.
- They were identified by the simulation (described above) as having significant lines.
- They were among the most populous precincts.
- They were among those precincts that had the most provisional ballots cast.

Given these criteria a set of 234 possible problem precincts were identified. Interviews were completed with respondents from 188 of these precincts. In addition, a set of 250 precincts in which problems were not identified were chosen. Interviews were conducted with respondents from 62 of these precincts.

Among the voters from the precincts so identified, those voters who voted at traditional peak times were identified to increase the likelihood that they would have experienced lines.

The purpose of both these telephone survey was to gauge the opinions and recollections of voters about the operations and wait times that they experienced during the 2012 presidential general election. Both groups were asked specific questions about:

- The voter's general impression of the whole voting experience.
- The voter's estimate of the time each spent in line waiting to check-in and the time waiting in line to cast a ballot.
- The voter's estimate of which factors caused a wait.
- The voter's perception of the wait compared to other elections.

Interviews were conducted between November 18, 2013 and December 16, 2013 both during the day and in the evening, resulting in 1,158 completed surveys - 616 early voters selected at random and 542 Election Day voters selected from precincts identified as potentially problematic or from control precincts. Each telephone number was tried up to six times at various times of the day and evening and on days both during the week and on weekends. Of the 10,176 phone numbers that were called, 1,504 refused to participate in the survey.

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## GENERAL IMPRESSIONS OF THE ELECTION EXPERIENCE

In order to ascertain the perspective of voters in the 2012 presidential general election, the Schaefer Center research team designed two telephone surveys. The first survey was randomly selected from all Maryland voters that participated in early voting in 2012.

Respondents were asked, “Overall, how would you rate your experience voting at in the November 2012 general election? Please rate your experience?” The respondents were asked to respond with a number from 1 to 10 where 1 was “poor” and 10 was “excellent.”

Those respondents from the random sample of early voters were generally pleased with their experience. The most common answer was “excellent.” Of the 611 early voters who answered that question, 209 (34.2%) responded that their experience had been excellent. Only 135 (22.1%) gave the experience a grade less than 7. The average score these early voters gave the experience was a 7.8.

The respondents selected from the list of selected Election Day precincts were even more positive about their voting experience. Of the 542 respondents from these selected Election Day precincts, 241 (44.5%) responded that their experience had been excellent. Only 78 (14.4%) gave the experience a grade less than 7. The average score these voters from selected Election Day precincts gave the experience was an 8.4

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#### OVERALL WAITING TIMES

This survey did not ask directly about the overall time it took to vote but instead asked about two components of that time: The time waiting to check-in and the time waiting to be directed to a touch screen. Both the random sample of early voters and the voters from selected Election Day precincts were asked “About how long did you have to wait between the time that you arrived and the time when you were checked in?” and then were given the same five alternatives from which to choose that the national samples used in there. The results for early voters are shown in Table 16:

**Table 16: Maryland Early Voters: Responses in the Schaefer Center Surveys to the Question “About how long did you have to wait between the time that you arrived and the time when you were checked in?”**

Wait To Check In	Number of Early Voters	Percent
No wait at all	61	10.0%
Less than 10 min	84	13.8%
10 to 30 min	171	28.1%
31 min to 1 hour	99	16.3%
More than 1 hour	193	31.7%
Totals	608	100.0%

The results for the voters from selected Election Day precincts are shown in Table 17:

**Table 17: Maryland Election Day Voters: Responses in the Schaefer Center Surveys to the Question “About how long did you have to wait between the time that you arrived and the time when you were checked?”**

Wait To Check In	Number of Election Day Voters	Percent
No wait at all	82	15.4%
Less than 10 min	118	22.1%
10 to 30 min	166	31.1%
31 min to 1 hour	91	17.0%
More than 1 hour	77	14.4%
Totals	534	100.0%

The random sample of early voters and the voters from selected Election Day precincts were also asked “After you were checked in, about how long did you have to wait before being assigned to a touch screen voting machine?” The results for early voters are shown below:

**Table 18: Maryland Early Voters: Responses in the Schaefer Center Surveys to the Question “After you were checked in, about how long did you have to wait before being assigned to a touch screen voting machine?”**

Wait To Be Assigned a Touchscreen after Check In	Number of Early Voters	Percent
No wait at all	235	39.6%
Less than 10 min	235	39.6%
10 to 30 min	95	16.0%
31 min to 1 hour	21	3.5%
More than 1 hour	8	1.3%
Totals	594	100.0%

And the results for voters from selected Election Day precincts are shown below:

**Table 19: Maryland Election Day Voters: Responses in the Schaefer Center Surveys to the Question “After you were checked in, about how long did you have to wait before being assigned to a touch screen voting machine?”**

Wait To Be Assigned a Touchscreen after Check In	Number of Election Day Voters	Percent
No wait at all	204	38.8%
Less than 10 min	189	35.9%
10 to 30 min	106	20.2%
31 min to 1 hour	19	3.6%
More than 1 hour	8	1.5%
Totals	526	100.0%



The waits were preponderantly reported to be in the check-in line. But interviews with local election officials explain that in many facilities, although the real bottleneck is at the touchscreens it is more convenient to have voters wait in the check-in line rather than in the relatively more cramped space between the poll book and the voting machines.

Combining the results of the two questions about wait time, we can make some inferences about how long these respondents waited in line in total. If we assume that those who answered “10 to 30 minutes” in response to both questions about waiting times waited more than 30 minutes altogether we have the following results: Of the 590 respondents from the random sample of early voters for whom we have complete data, 305 (51.7%) likely waited a half-hour or more. Of the 520 voters from selected Election Day precincts, 202 (37.3%) likely waited a half hour or more.

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#### FACTORS CONTRIBUTING TO WAITING TIMES

Respondents gave a range of answers to the question “Can you estimate how many minutes it took you to cast your ballot at the touch screen voting machine?” But the most common answer for both groups was 5 minutes. The average for both groups did differ with the early voters saying it took them just a bit above four and a half minutes (4.58 minutes) to complete and cast the ballot and the voters from selected Election Day precincts saying it took more than five minutes (5.08 minutes).

The respondents were asked “Before you got to the touch screen voting machine, had you read or reviewed a sample ballot before you voted?” More than 91% (1012) of those who answered the question said they had reviewed a sample ballot. Only 94 (8.5%) said they did not. Reviewing a sample ballot had a statistically significant relationship with the respondents’ perceptions of how long it took them to cast a ballot at the touchscreen machine. The mean number of minutes reported taken by those who said they had read or reviewed the sample ballot was 4.7 minutes and the mean number of minutes reported by those who had not read or reviewed a sample ballot was 5.4.

Respondents from both samples were asked whether they had made up their minds on the candidates and on the ballot issues before they got to the touchscreen voting machine. Of the 1078 respondents from both samples who answered and who had indicated that they could remember how long it took to vote at the machine, 702 (65.1%) said they had made up their mind on both the candidates and the ballot questions. These respondents did average about a minute less on the machines than did the other voters (4.47 minutes versus 5.48 minutes).

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## DISCOURAGED VOTERS

Of particular interest are those voters who were so discouraged by the lines that they left and had to come back again. Estimating the numbers of these voters could inform an estimate of how many potential voters were discouraged from voting in the 2012 election and might be discouraged from voting in future elections. Respondents were asked, “When you went to vote, did you have to leave before you were able to check-in?” Of the 614 early voters who answered this question, 24 (3.9%) said “yes.” Of the 542 selected Election Day precinct voters, five (0.9%) said “yes.”

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## WAIT TIMES COMPARED TO PAST ELECTIONS

The time it took to vote was not perceived to be an increasing problem by these respondents. They were asked, “Compared to other times that you have voted in a presidential general election in Maryland, did you spend more time, less time, or about the same amount of time?”

The random sample of early voters generally indicated it took the same amount of time or less than in the past. Of the 571 who had voted before and who answered the question, 166 (29.1%) said it took more time, 154 (27.0%) said it took less time, and 251 (44.0%) said it took about the same amount of time.

The results from the sample of voters from selected Election Day precincts provide even stronger evidence that voters do not perceive waiting times to be a growing problem. Of the 505 who had voted before and who answered the question, 106 (21.0%) said it took more time, 127 (25.1%) said it took less time, and 272 (53.9%) said it took about the same amount of time.

Those respondents who indicated that it took more time than in the past were asked a set of questions to try to ascertain the respondents’ perceptions of the causes of any delays they may have experienced. Respondents were asked “How important would you say each of the following factors was in how long it took you to cast your ballot at the touchscreen voting machine in the 2012 presidential general election?” They were then told “Please rate each on a scale of 1 to 10 where 1 means that it wasn’t a factor at all, and 10 means that it was a very important factor.” They were then given this list of factors:

- Using the touch screen voting machine
- The wording used in the ballot
- The number of candidates and issues on the ballot
- The number of candidates for office
- The number of ballot questions

When asked to rate using the touch screen voting machines as a factor, respondents who were early voters and who thought that 2012 had taken more time rated the "wording used in the ballot" as the most significant factor. Respondents from the selected Election Day precincts rated "the number of ballot questions" as the most significant factor. But the number of respondents who had perceived an increasing problem was few and the differences between their ratings were very small.

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#### QUESTIONS ABOUT POTENTIAL BOTTLENECKS

In order to help identify potential problems or bottlenecks in the system respondents were asked "When you were checked in, did the poll worker have any trouble looking up your name in the electronic poll book?" Of the 615 early voters who responded, 15 (2.4%) said that there was such trouble. Of the 541 voters in selected Election Day precincts who responded, 18 (3.3%) indicated such trouble. The small difference between these groups is rather surprising since the early voting sites are often staffed by more experienced election judges and officials. If the bottleneck in a particular election site was at the touch screen, the frequency of these electronic poll book troubles can be considered low. But if the bottleneck was at the poll book station, remedial actions, including better training, supplemental materials, and testing of check-in judges, should be considered.

Another potential problem may be inefficient use of touch screen machines. Respondents were asked "While you were waiting for a touch screen voting machine, do you remember if any of the other voting machines were NOT being used?" Of the 479 early voters who could recall, 45 (9.4%) said "yes." Of the 443 voters from selected Election Day precincts, 58 (13.1%) said "yes."

Another potential inefficiency was explored by asking respondents "Did a poll worker explain how to use the touch screen voting machine to you as you were escorted to the machine?" If the bottleneck was at the touch screen machine, moving the explanation to a different part of the process may be indicated. However, there was little or no difference in their answers to this question between those who experienced delays of more than a half hour and those that did not.

Of the 304 early voters who are estimated to have experienced delays of more than 30 minutes, 241 (79.3%) indicated that "yes" a poll worker did explain how to use the touch screen machine as they were escorted to the machine while of the 279 who did not experience a delay of more than 30 minutes, 235 (84.2%) said "yes."

The results were similar among the voters from selected Election Day precincts. Of the 200 voters from these precincts who appear to have experienced a delay of more than 30 minutes, 151 (75.5%) indicated that "yes" a poll worker did explain how to use the touch screen machine as they were escorted to the machine while of the 313 who did not experience a delay of more than 30 minutes, 393 (81.2%) said "yes."

Respondents were also asked to rate on a scale from 1 to 5 their impression of whether the instructions given were easy or difficult to understand. Nearly 90% of those who heard such instructions found them easy to understand as presented below in Table 20.

**Table 20: Maryland Election Day and Early Voters: Responses in the Schaefer Center Surveys to the Question “Could rate how easy or difficult it was to understand the poll worker’s explanation on a scale of 1 to 5, where 1 is Very Difficult to Understand and 5 is Very Easy to Understand?”**

<b>Rating of Difficulty Understanding Touchscreen Instructions</b>	<b>Number Giving That Rating</b>	<b>Percent</b>
1. Very Difficult to Understand	2	0.2%
2	4	0.5%
3	16	1.8%
4	82	9.3%
5. Very Easy to Understand	782	88.3%
Totals	886	100.0%

## DEMOGRAPHIC FACTORS AND WAITING TIMES

The average age of those who waited a half hour or an hour to vote in 2012 was significantly less than the average age of those who did not wait. The average age of those early voting respondents who had to wait more than a half hour was 55.4 compared to 61.7 for early voters who did have to wait. Among the respondents from selected Election Day precincts the average age of respondents who had to wait more than a half hour was 49.8 and the average age of those who did not have to wait was 55.6. A similar pattern emerged for those who had to wait more than an hour. All these differences were statistically significant.

This age difference might be because the average age of voters in urban areas is lower or it might be because the self-reports are biased by age. Young people who may have more pressing constraints on their time may perceive the same time spent as being longer than people who are not under such constraints.

Other studies have shown that self-reports may also be biased by sex with males perceiving longer wait times than females. The Schaefer Center surveys did not show a statistically significant relationship between sex and perceived waiting times and the CCES 2012 survey did not either.

The national surveys also show a relationship between race and time waiting to vote in the 2012 general election both in the nation and in the state of Maryland. But the literature points out that it is possible that this relationship is the result of a more powerful relationship between large jurisdictions and lines. Some possible reasons for this relationship are discussed above.

## POPULOUS JURISDICTIONS AND WAIT TIMES

The Schaefer Center surveys provide support for the assertion that there is a strong relationship between voting in populous urban jurisdictions and having to wait in longer lines. This is true for Early Voters as shown in Table 21 below.

**Table 21: Maryland Early Voters: Responses in the Schaefer Center Surveys that Indicate the Voter Waited More than One Hour to Vote, by Size of Jurisdiction**

SCPP Random Survey of Early Voters	No	Yes	Percent Indicating They Waited More than One Hour
The Five Most Populous Jurisdictions	235	179	43.2%
Other Jurisdictions	162	14	8.0%
Totals	397	193	32.7%

As the table shows only 8% of the early voters surveyed indicated that they had to wait more than one hour. The larger jurisdictions that had significant numbers of early voters represented in the sample showed a much higher percentage. Table 22 shows a similar pattern for those early voters who indicated they waited more than one half hour.

**Table 22: Maryland Early Voters: Responses in the Schaefer Center Surveys that Indicate the Voter Waited More than One Half Hour to Vote, by Size of Jurisdiction**

SCPP Random Survey of Early Voters	No	Yes	Percent Indicating They Waited More than One Half Hour
The Five Most Populous Jurisdictions	158	256	61.8%
Other Jurisdictions	127	49	27.8%
Totals	285	305	51.7%

The percentage of Election Day voters who had to wait an hour or a half hour was much smaller than the percentage of early voters who had to wait, but the two tables below show that here, too the problem was most pronounced in the five largest jurisdictions. Table 23 shows the statewide average of those voters from selected Election Day precinct who had to wait an hour or more on Election Day was 16.3% but only 2 of the 47 voters from selected Election Day precincts outside the five largest jurisdictions indicated they waited that long.

**Table 23: Maryland Early Voters: Responses in the Schaefer Center Surveys that Indicate the Voter Waited More than One Hour to Vote, by Size of Jurisdiction**

<b>SCPP Survey of Selected Election Day Precinct Voters</b>	<b>No</b>	<b>Yes</b>	<b>Percent Indicating They Waited More than One Hour</b>
The Five Most Populous Jurisdictions	390	83	17.5%
Other Jurisdictions	45	2	4.3%
Totals	435	85	16.3%

And Table 24 shows that 38.8% of all these voters from selected Election Day precincts indicated that they waited one half hour or more but only 17% of the 47 voters that were not from the five largest jurisdictions so indicated.

**Table 24: Maryland Early Voters: Responses in the Schaefer Center Surveys that Indicate the Voter Waited More than One Half Hour to Vote, by Size of Jurisdiction**

<b>SCPP Survey of Selected Election Day Precinct Voters</b>	<b>No</b>	<b>Yes</b>	<b>Percent Indicating They Waited More than One Half Hour</b>
The Five Most Populous Jurisdictions	279	194	41.0%
Other Jurisdictions	39	8	17.0%
Totals	318	202	38.8%

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**POSSIBLE REASONS FOR THE RELATIONSHIP BETWEEN POPULOUS JURISDICTIONS AND WAITING TIMES: BALLOT LENGTH**

In the context of Maryland’s 2012 general election it appears that the bottleneck was the step in the process which began when a voter was ready to use the touchscreen machine and ended when next voter was ready to use the machine. The voters’ interaction with the touchscreen machines appears to have been the important constraint in the system. This appears to have been the case in other states as well. Evidence supporting this view is presented in Table 25.

Table 25: Average Number of Words in a Jurisdiction's Ballot Styles

Jurisdiction	Average Number of Words in the Jurisdiction's Ballot Styles
Baltimore City	2,245
Anne Arundel	2,018
Prince George's	1,634
Howard	1,576
Baltimore County	1,535
Harford	1,364
Montgomery	1,312
Wicomico	1,273
Queen Anne's	1,125
Washington	1,083
Frederick	1,057
Cecil	1,052
St. Mary's	1,023
Calvert	1,019
Allegany	1,005
Garrett	1,002
Carroll	1,002
Worcester	985
Kent	977
Caroline	973
Dorchester	970
Somerset	968
Talbot	968
Charles	962

The list above can be compared with Table 26 which shows the percent of respondents from each jurisdiction who indicated on a national survey that they had waited more than 30 minutes on Election Day.

Table 26: Percent of Maryland Respondents in the 2012 National Surveys Who Indicated a Wait of More than 30 Minutes

Jurisdiction	Percent Respondents Who Indicated a Wait of More than 30 Minutes to Vote on Election Day 2012
Anne Arundel	61%
Prince George's	60%
Baltimore County	43%
Baltimore City	40%
Montgomery	34%
Charles	14%
Cecil	13%
Harford	12%
Calvert	8%
St. Marys	7%
Howard	6%
Carroll	3%
Frederick	3%
Allegany	0%
Caroline	0%
Dorchester	0%
Garrett	0%
Kent	0%
Queen Anne's	0%
Somerset	0%
Talbot	0%
Washington	0%
Wicomico	0%
Worcester	0%

The average number of words in the ballots for those jurisdictions with more than 15% of the respondents saying they waited more than 30 minutes was 1,749 words. The average number of words for the other jurisdictions was 1,073 words. Ballot length clearly contributed to the problem of lines in 2012.

Ballot length has been identified as a problem by investigators in other states. One report of Florida's problems in 2012 concludes that:

The cause was the same as in the 2004 central Ohio election. Ballot length drove the line-length differences. Some locations had more races, issues and referendums than others, but resources were provisioned by eligible voters in the precinct, or head count, only. Looking at the data, there is a direct relationship between the number of items on the



ballot and the length of the wait. Many voters read the detailed information about the issues and referendums while in the voting booth.<sup>19</sup>

Many of the recommendations submitted for further consideration in this report are informed by the desirability of identifying steps in the processes of future elections that may be bottlenecks and of facilitating the application of more resources to those bottlenecks.

#### OTHER POSSIBLE REASONS FOR THE RELATIONSHIP BETWEEN POPULOUS JURISDICTIONS AND WAITING TIMES

There is some indication that another factor might be identified as relevant to the allocation of resources in future elections. If a polling place experiences “waves” of voters that are more intense than the “waves” at other polling places, it will require more resources if it is to limit extent of voter queues.

For example, imagine two precincts with the same turnout, but in the first the voters arrive at regular intervals throughout the day and in the second the voters arrive in two bunches, say at 8:00 am and 1:00 pm. Voters at the second will experience long lines while those at the first will not. There is only a little evidence that this was the case in 2012. Table 27 shows coefficient of variation for the number of check-in per hour in each of the jurisdictions for Election Day 2012. The coefficient of variation would be higher for those places that experienced “wave” phenomena.

There is some indication that the jurisdictions where voters indicated waits of over 30 minutes were also those that might have waves, but the data used here is not strong enough to let us infer that. Check-in data is a poor substitute for arrival data since potential voters might arrive well in advance of being checked-in. Better data about arrivals would allow more efficient use of resources. Data that could be used for simulations to model the election of 2016 could be collected in 2014.

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<sup>19</sup> [http://articles.orlandosentinel.com/2013-01-08/news/os-ed-long-lines-voting-florida-010813-20130107\\_1\\_long-lines-ballot-length-turnout](http://articles.orlandosentinel.com/2013-01-08/news/os-ed-long-lines-voting-florida-010813-20130107_1_long-lines-ballot-length-turnout)

Table 27: Coefficient of Variation for the Variable “Check Ins per Hour” in the 2012 Election, by Jurisdiction

Jurisdiction	Coefficient of Variation for the Hourly Total in the Election of 2012
Prince George's	0.611
Baltimore County	0.570
Baltimore City	0.546
Saint Mary's	0.531
Washington	0.500
Howard	0.496
Queen Anne's	0.495
Frederick	0.482
Anne Arundel	0.481
Wicomico	0.478
Calvert	0.471
Cecil	0.467
Montgomery	0.466
Worcester	0.436
Harford	0.421
Charles	0.419
Allegany	0.417
Caroline	0.408
Garrett	0.408
Dorchester	0.406
Somerset	0.396
Carroll	0.369
Talbot	0.270
Kent	0.254

#### VOTERS ARRIVING BEFORE 9:00 AM

Another relationship emerged from the Schaefer Center survey data. Those voters who arrived to vote before 9:00 am were more likely to experience wait times in lines. The two tables (28 and 29) below show a statistically significant relationship between arriving before 9:00 am and experiencing a wait of more than an hour for early voters and for voters from the selected precincts.

**Table 28: Maryland Early Voters: Responses in the Schaefer Center Surveys that Indicate the Voter Waited More than One Hour to Vote, by Whether or Not They Arrived before 9:00 am**

<b>Early Voters</b>	<b>Less than 1 Hour Wait</b>	<b>More than 1 Hour</b>	<b>Percent Indicating They Waited More than One Hour</b>
Arrived before 9:00	27	30	52.6%
Arrived after 9:00	363	160	30.6%
All voters	390	190	32.8%

**Table 29: Maryland Election Day Voters: Responses in the Schaefer Center Surveys that Indicate the Voter Waited More than One Hour to Vote, by Whether or Not They Arrived before 9:00 am**

<b>Election Day Voters</b>	<b>Less than 1 Hour Wait</b>	<b>More than 1 Hour</b>	<b>Percent Indicating They Waited More than One Hour</b>
Arrived before 9:00	109	32	22.7%
Arrived after 9:00	309	53	14.6%
All voters	418	85	16.9%

There was also a statistically significant relationship between arriving early and waiting more than half an hour for early voters as shown in Table 30 below. For voters from selected precincts the relationship between arriving before 9:00 and waiting more than half an hour was not statistically significant.

**Table 30: Maryland Early Voters: Responses in the Schaefer Center Surveys that Indicate the Voter Waited More than One Half Hour to Vote, by Whether or Not They Arrived before 9:00 am**

<b>Early Voters</b>	<b>Less than One Half Hour</b>	<b>More than One Half Hour</b>	<b>Percent Indicating They Waited More than One Half Hour</b>
Arrived before 9:00	18	39	68.4%
Arrived after 9:00	262	261	49.9%
All voters	280	300	51.7%

## THE SURVEY RESULTS AND THE PROVISION OF EQUIPMENT TO STRESSED PRECINCTS ON ELECTION DAY

An analysis was conducted of the number of electronic poll books and touch screens that were provided to the precincts. Precincts were divided into those in which at least one respondent who voted on Election Day reported experiencing a wait of one-half hour or more and those in which they did not.

There was no statistically significant relationship between this classification of the precincts and the number of touch screens or poll books deployed per Election Day voter.

A similar analysis was conducted by dividing the precincts between those in which at least one respondent reported experiencing a wait of one hour or more and those precincts in which there was no such respondent. Again there was no statistically significant relationship that would allow us to infer that the precincts where such delays were experienced had fewer machines deployed per Election Day voter.

## PART THREE: WAIT TIME SIMULATOR

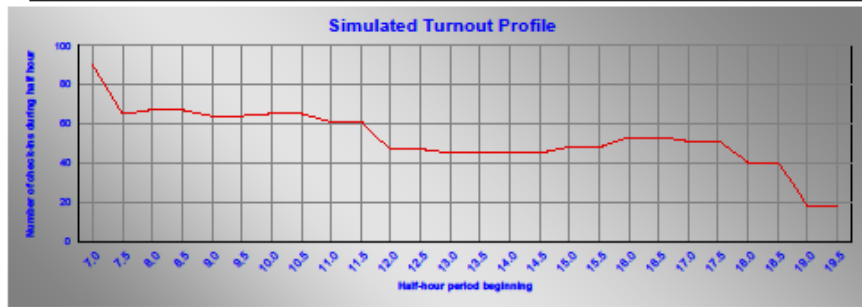
An Election Day simulator has been developed which takes key polling place variables as inputs and calculates estimated wait times and voters in line for each half hour period. Here is the baseline simulation for a “statistically average” Maryland polling place having 2,400 active voters, three electronic poll books, ten touchscreens, 57% Election Day turnout and a “Morning” turnout profile. Baseline simulation uses average times of 60 seconds for check-in and 260 seconds (4 minutes, 20 seconds) to vote on touchscreen. The model assumes that the number of voters waiting at 7:00 am equals 25% of the first hour total arrivals.

### Maryland Polling Place Wait-time Simulator

Turnout Profile: Morning

# Active voters:	2,400	# EPB:	3	EPB avg. time to check in (secs)	60	EPB .5hr cpty:	90
ED turnout %:	57%	# TS:	10	TS avg. time to vote (minutes)	4.3	TS .5hr cpty:	69

Half Hour	Starting # Waiting for			Processed in period		# of voters in line		Wait time in minutes	
	EPB	TS	New Arrivals	EPB	TS	Avg.	Max.	Avg.	Max.
7:00 am	39	39	58	90	69	33	39	14.3	16.9
7:30 am	7	28	58	65	69	22	28	9.5	12.1
8:00 am	0	17	67	67	69	16	17	6.9	7.4
8:30 am	0	15	67	67	69	14	15	6.1	6.5
9:00 am	0	13	64	64	69	10	13	4.3	5.6
9:30 am	0	8	64	64	69	5	8	2.2	3.5
10:00 am	0	3	65	65	68	1	3	0.4	1.3
10:30 am	0	0	65	65	65	0	0	0.0	0.0
11:00 am	0	0	61	61	61	0	0	0.0	0.0
11:30 am	0	0	61	61	61	0	0	0.0	0.0
12:00 pm	0	0	47	47	47	0	0	0.0	0.0
12:30 pm	0	0	47	47	47	0	0	0.0	0.0
1:00 pm	0	0	45	45	45	0	0	0.0	0.0
1:30 pm	0	0	45	45	45	0	0	0.0	0.0
2:00 pm	0	0	45	45	45	0	0	0.0	0.0
2:30 pm	0	0	45	45	45	0	0	0.0	0.0
3:00 pm	0	0	48	48	48	0	0	0.0	0.0
3:30 pm	0	0	48	48	48	0	0	0.0	0.0
4:00 pm	0	0	53	53	53	0	0	0.0	0.0
4:30 pm	0	0	53	53	53	0	0	0.0	0.0
5:00 pm	0	0	51	51	51	0	0	0.0	0.0
5:30 pm	0	0	51	51	51	0	0	0.0	0.0
6:00 pm	0	0	40	40	40	0	0	0.0	0.0
6:30 pm	0	0	40	40	40	0	0	0.0	0.0
7:00 pm	0	0	18	18	18	0	0	0.0	0.0
7:30 pm	0	0	18	18	18	0	0	0.0	0.0
<b>Day Totals</b>				<b>1,363</b>	<b>1,363</b>	<b>3.9</b>	<b>39</b>	<b>1.7</b>	<b>16.9</b>



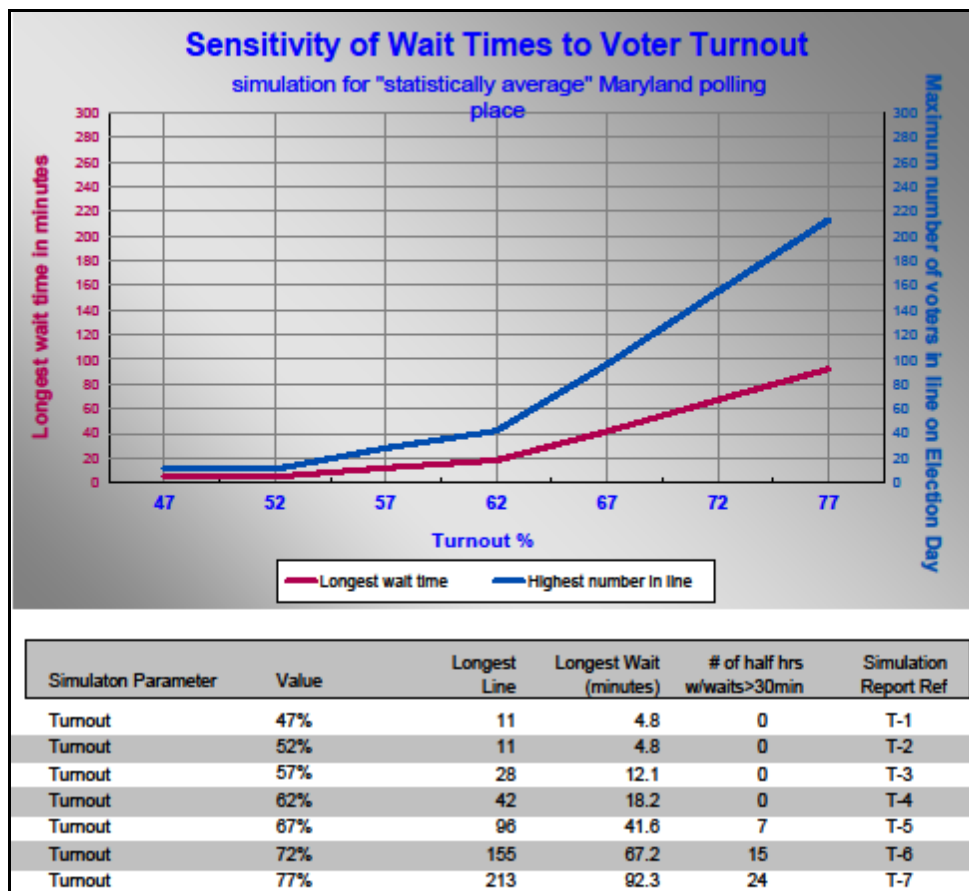
In the baseline simulation, note that the limiting factor is the touchscreens (with capacity to handle 69 voters per half hour) and not the electronic poll books (with capacity to handle 90 voters per hour.) This disparity was typical of most polling places in the 2012 election. Obviously, under these circumstances adding additional poll books or reducing the check-in times on the poll books would do nothing to reduce wait times—only additional touchscreens or voters casting their ballots on the touchscreens more quickly would help, since the touchscreens and not the poll books are the immediate constraint on the number of voters that can be processed.

## Sensitivity Analysis

This section shows the effect on our “statistically average” polling place, with parameters set to the “baseline” values described in the example above, of changes in a single parameter. In these analyses “wait time” is the elapsed time from when a voter joins the line waiting for check-in until he or she is escorted to a voting machine. The simulation outputs used to generate these reports are referenced in the last column of the data chart below.

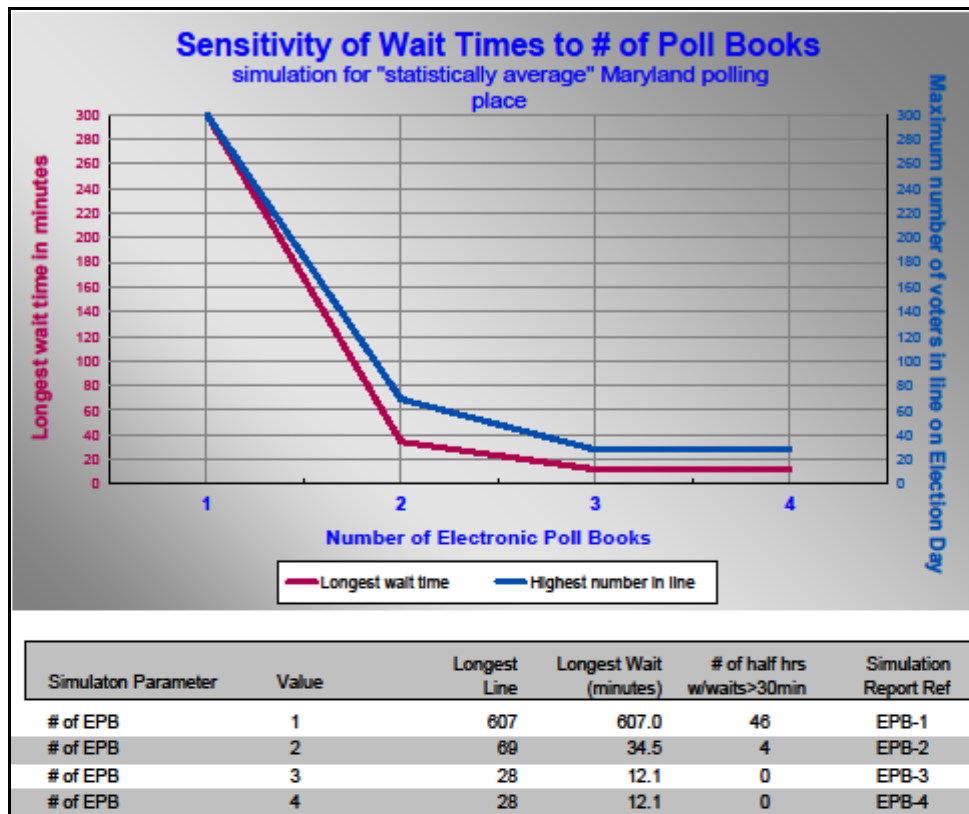
### TURNOUT PERCENTAGE

Wait times begin to exceed thirty minutes when turnout hits 65%. Only 7% of polling places had Election Day turnout of 65% or more. The highest Election Day turnout percentage for a poll having more than 250 registered voters was Jarrettsville Fire Hall in Harford County (election district 4, precinct 6) at 72.7%.



## NUMBER OF ELECTRONIC POLL BOOKS

Our average polling place could not function with only one poll book, but could muddle through with only two if necessary, particularly if the check-in judges were proficient. There is no benefit (other than additional safety factor) from adding a fourth poll book.

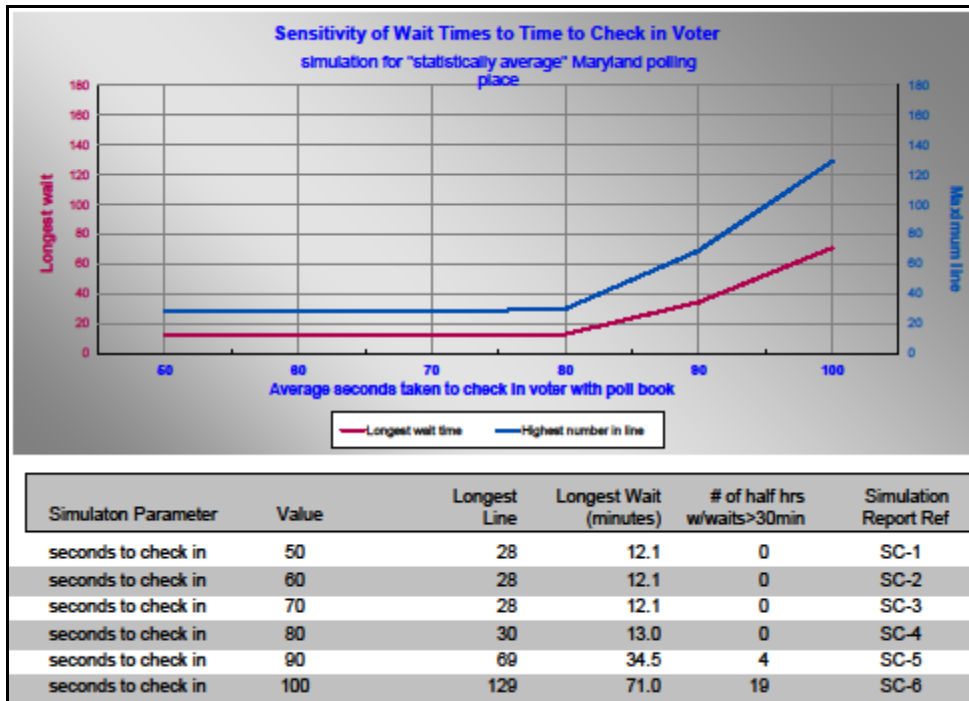


The electronic poll book transaction logs indicate that about 40 (less than 1%) of the 5,454 poll books deployed on Election Day were taken out of service due to equipment malfunctions. From the data it does not appear that any of these contributed to longer lines.

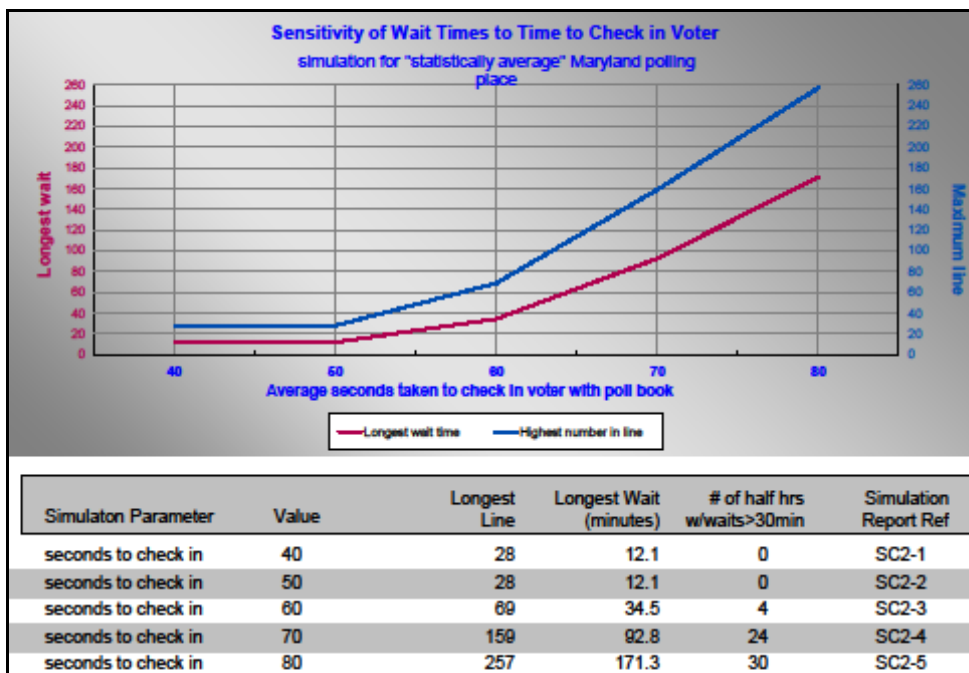
## AVERAGE TIME TAKEN TO CHECK IN A VOTER ON AN ELECTRONIC POLL BOOK

The first chart shows effect of check-in times on wait times assuming the polling place uses three electronic poll books. There is no effect on wait times until the check-in judges are taking more than 80 seconds on average to check in a voter.





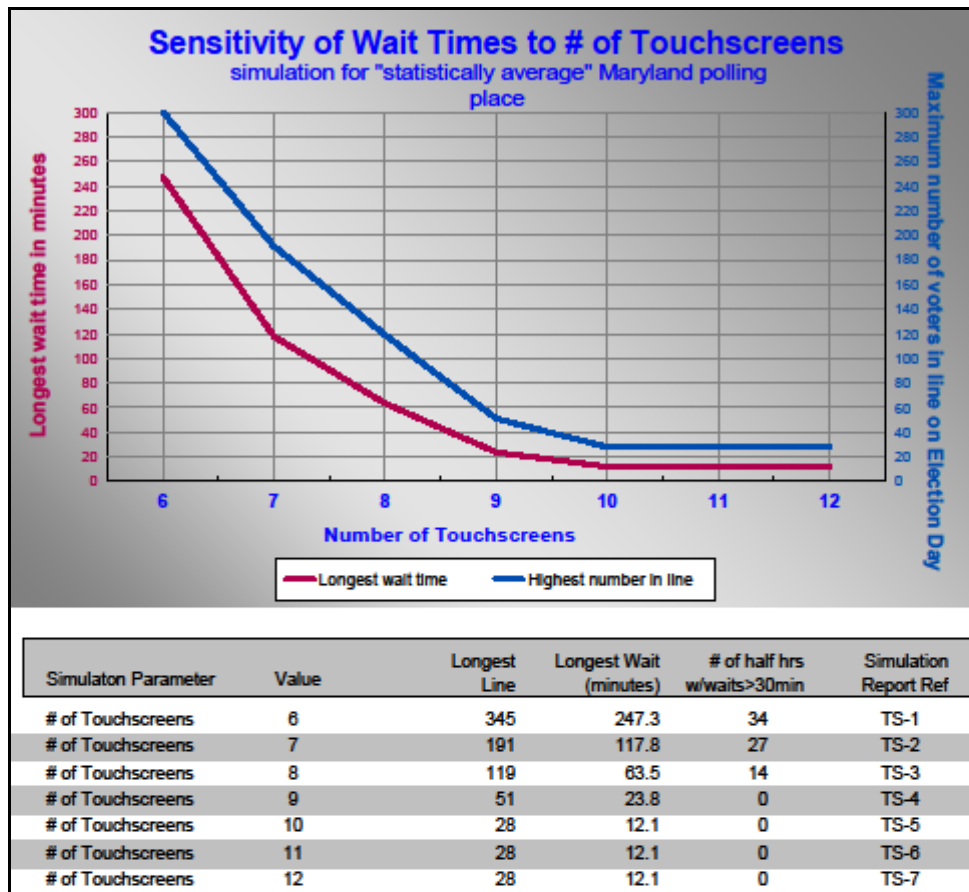
The next chart is for the same polling place having only two poll books. In this case wait times grow significantly longer as soon as average check-in times exceed 55 seconds.



## NUMBER OF TOUCHSCREENS

With ten touchscreens wait times are minimal, and there is no further reduction in wait times from using more than ten. Lines and wait times begin to increase when the number of touchscreens is reduced to nine, and when reduced to eight there is an average of 119 voters in line and 34 minutes wait time for the entire day. In the 2012 presidential election, 786 touchscreens were used at the early voting centers and were not available to be used on Election Day, November 6, 2012.

Assuming enough available touchscreens, the optimal number of touchscreens for our “statistically average” polling place would be eleven. This would allow a comfortable margin of error in turnout estimates, and also provide a cushion in event of equipment failure.

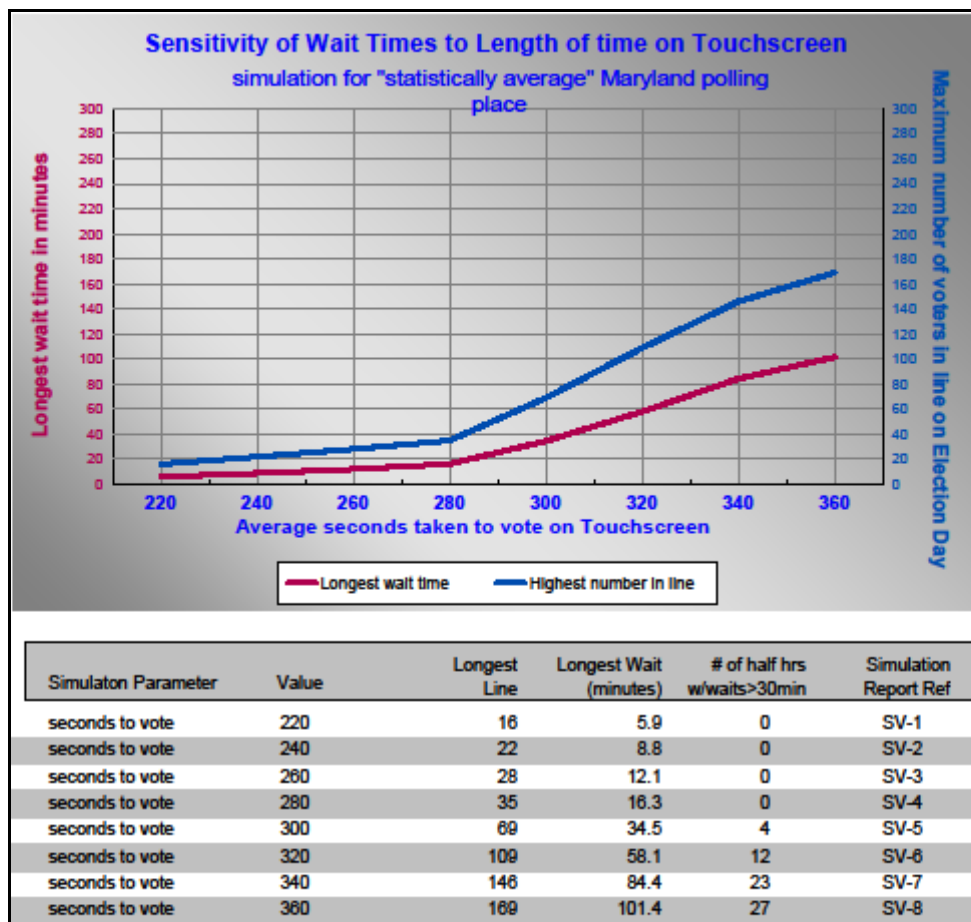


## AVERAGE TIME TO VOTE ON TOUCHSCREENS

Lines and wait times go from being minimal if voters are spending an average of four minutes to vote on the touchscreens to being completely unacceptable if they are spending six minutes. Ballot length

is the underlying cause of longer times, but voter preparation (or lack thereof) is an equally important factor. Though it is tempting to suggest express voting lines for voters with pre-marked sample ballots in hand, that idea is probably a non-starter. Many polling places did supply sample ballots and this should be standard practice in general elections with lengthy ballots.

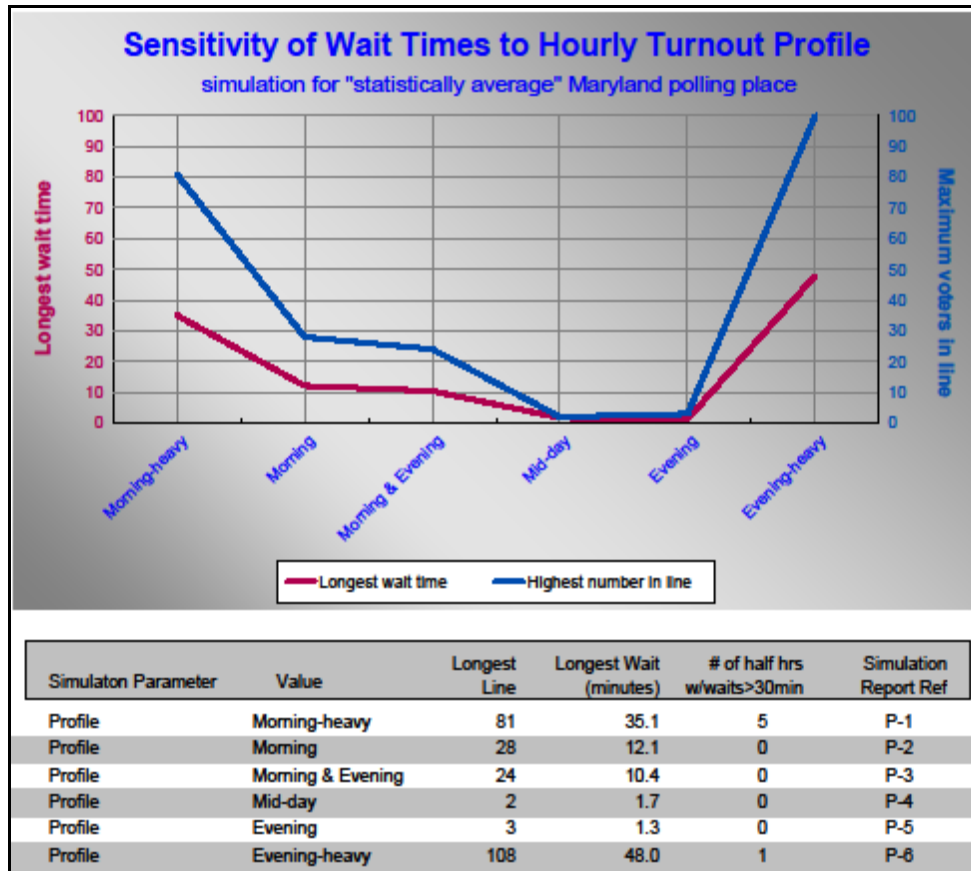
The plot shown below is for our “statistically average” polling place having ten touchscreens. The effect of reducing the number of touchscreens to nine would essentially be to shift the lines on the graph two vertical divisions to the left, so that lines and wait times would increase appreciably at 260 seconds (4 minutes, 20 seconds) instead of 300 seconds (5 minutes). Likewise, increasing the number of touchscreens to eleven would shift the curve to the right, so that increases would start at 340 seconds (5 minutes, 40 seconds).



## TURNOUT PATTERN

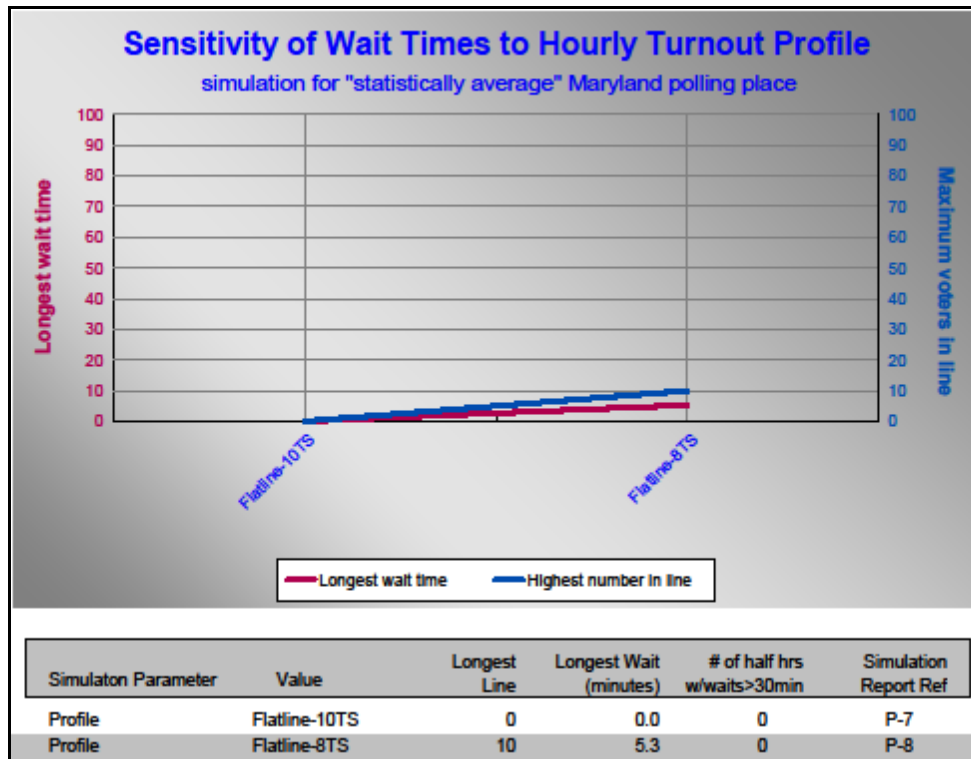
Since it is the peak arrival periods that tend to induce lines, it is not surprising that, all other things being equal, polling places having voter arrivals more evenly distributed throughout the day will have

fewer lines and shorter wait times. This chart shows the longest lines and wait times for common turnout profiles applied to our “statistically average” polling place.



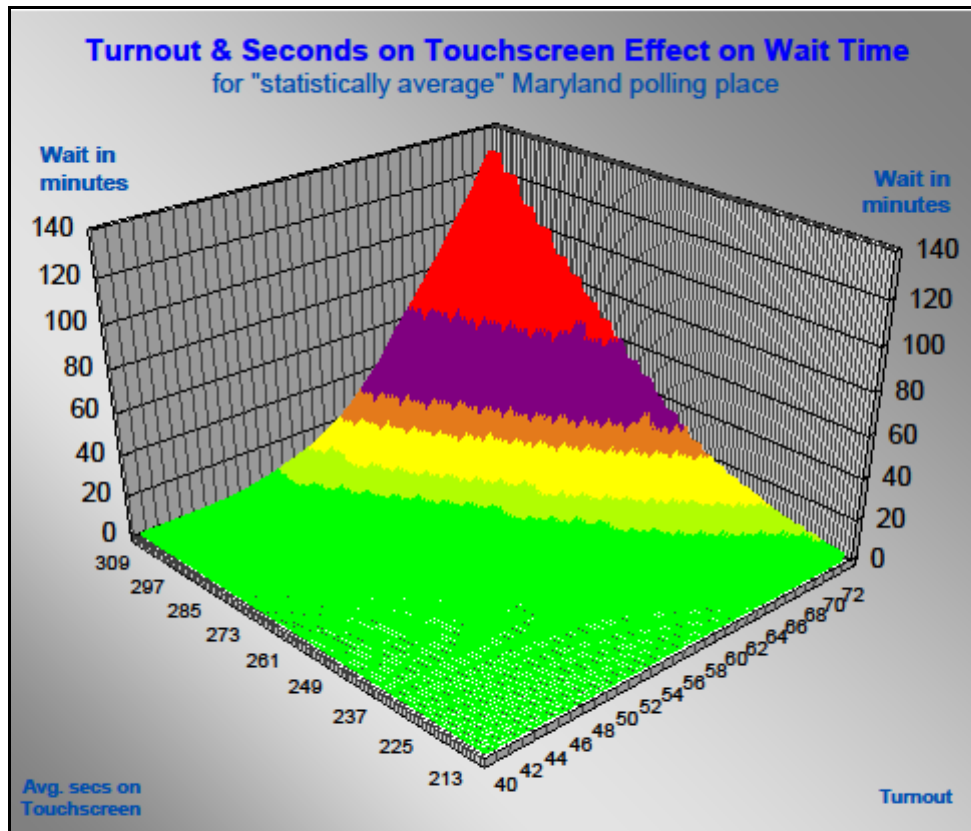
It is clear that shifting voters out of peak morning and evening times into the noon-3:00 pm period would be an effective low-cost way of minimizing lines. There was some public outreach with this suggestion in 2008, and there seems to be a fair amount of awareness among voters that noon to 3:00 pm is the best time to vote, but for many voters mid-day voting is not an option.

A “Flatline” profile having exactly the same number of voters arriving in each period was created for simulation purposes. As can be seen in the following chart, this profile has no lines and zero wait time for the entire day in a ten-touchscreen simulation. Even when the number of touchscreens is reduced to eight (which produces wait times of more than 60 minutes in our “baseline” simulation using the “Morning” turnout profile) the longest wait is only five minutes with the “Flatline” turnout profile.



## MULTIPLE FACTORS

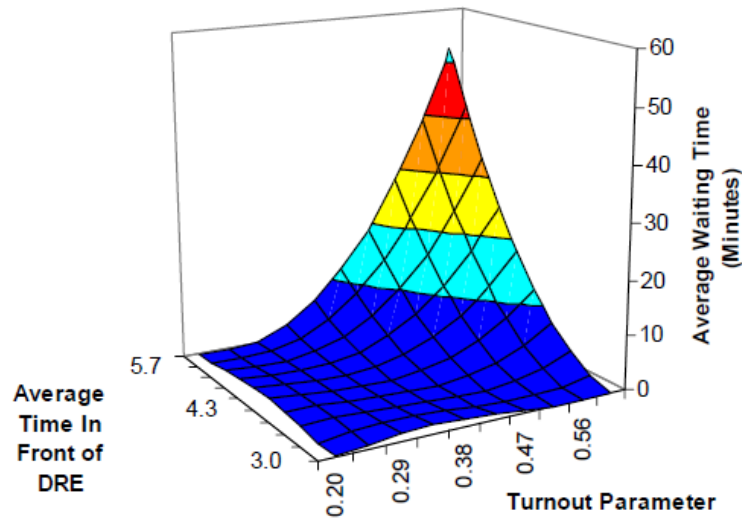
This chart shows how voter turnout and time to vote on the touchscreen interact to affect average wait time. As long as polling place turnout does not exceed 58% *and* average time to vote on the touchscreen does not exceed 240 seconds (4 minutes), the average wait times remain under 20 minutes (the three lower zones in the chart). On the other hand, the simulation predicts that there will be wait times of more than 30 minutes throughout the day whenever turnout exceeds 65% *and* average time to vote on the touchscreen is 280 seconds (4 minutes 40 seconds) or more. There were actually only four polling places (all in Anne Arundel County) in 2012 that met these criteria. In fact, three of these four precinct polling places did have a significant number of voters checked in after 8:00 pm, which is a reliable indicator that there were long lines.



For comparison, presented below is a similar chart supplied by Dr. Theodore T. Allen, a professor of industrial and systems engineering at Ohio State University in Columbus. Dr. Allen has done considerable research on Election Day lines in Franklin and Cuyahoga counties in central Ohio. It was his estimate that 203,000 Florida voters in the 2012 election “gave up in frustration” and did not vote due to long lines that was widely reported in the press. This chart is from *DRE Analysis for May 2006 Primary Cuyahoga County, Ohio*, study by Election Science Institute (ESI). Dr. Allen was a key member of the team that conducted the research.

The range used for average times on the voting machines for Cuyahoga County is quite similar (when converted to seconds) to that used in the Maryland simulation. The Cuyahoga County turnout range is lower, because the study was conducted for a primary election.

Figure 4 shows the simulation predictions for the average waiting times for all voters. The plot shows the strong interaction between high turnout and long average times in front of DRE equipment, i.e., long ballot lengths. Both Figure 3 and Figure 4 indicate that ballot lengths play a comparable role to turnout issues in long waiting times. Yet, unlike turnout the average times in front of the DRE can be predicted fairly accurately before the election by testing people on the DREs.



## Using the Simulator and 2012 Data to Estimate Wait Times and Line Lengths in 2012

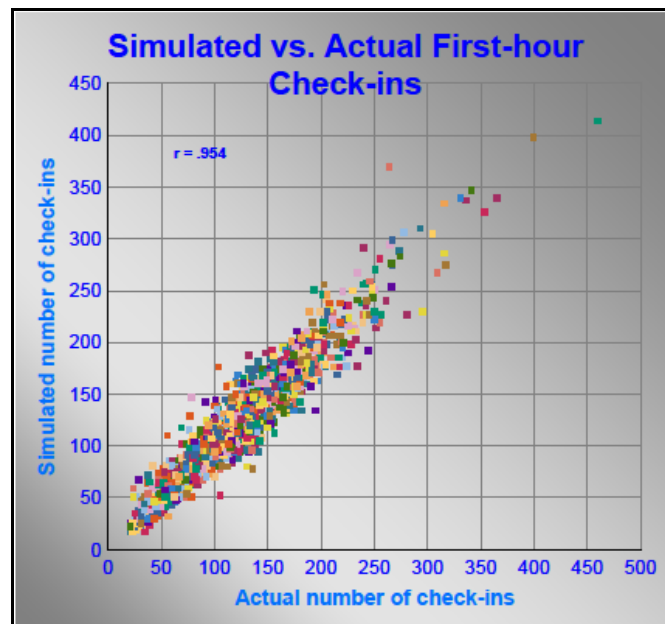
### POLLING PLACE REVIEWS

Using data from the 2012 general election, individual “Polling Place Review” reports have been produced for each of the forty-six early voting centers and 1,850 Election Day precincts. The reports include the following sections for each polling place:

- a summary of the polling place’s voter registration and Election Day activity
- a plot of the polling place’s half-hourly turnout compared with county and state patterns
- a plot of half-hourly check-ins for each electronic poll book used in the polling place
- number of ballots cast on each touchscreen in the polling place
- earliest, latest and number of voters checked in for each electronic poll book
- simulation showing estimated line length and wait times for each half hour period

Some of the simulation parameters (total number and hourly pattern of check-ins, number of electronic poll books, number of touchscreens and average seconds for check-in on electronic poll books) are reliably supplied from available data while others (average time to vote on touchscreen, and touchscreens or poll books added or taken out of service during the course of the day) can be deduced with some educated guesswork as explained below.

Using reports from the local boards of elections and interviews with a small number of voters and election judges, the simulations were “tuned” to actual observations, primarily by adjusting the “average seconds to vote on TS” parameter. The simulations were also reviewed to ensure that polling places having check-ins after 8:00 pm were correctly modeled in the simulation. It is of course impossible for any simulations to be totally consistent with the reality of Election Day, but there is good agreement between the simulations and reality. Here is a plot of the simulated check-ins versus the actual counts for the 7:00 am - 8:00 am first hour of voting:



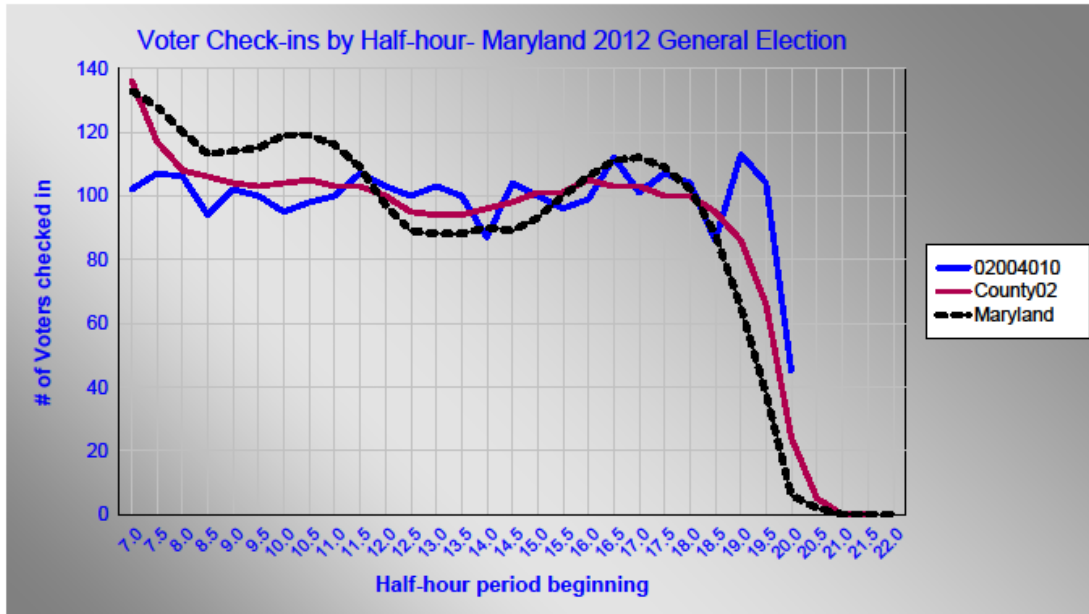
The next several pages show the report for Crofton Elementary in Anne Arundel County as an example. This polling place had some of the longest Election Day wait times in the state. The difference in the check-in pattern for each precinct from the Anne Arundel County and state average patterns indicates a strong likelihood that a significant number of voters were discouraged from voting in the morning due to long lines and returned later to vote.

Note from the detail below that there were six “unvoted” cards. This suggests that voters had an additional wait for the touchscreens after they had been checked in, and that six voters left without voting.

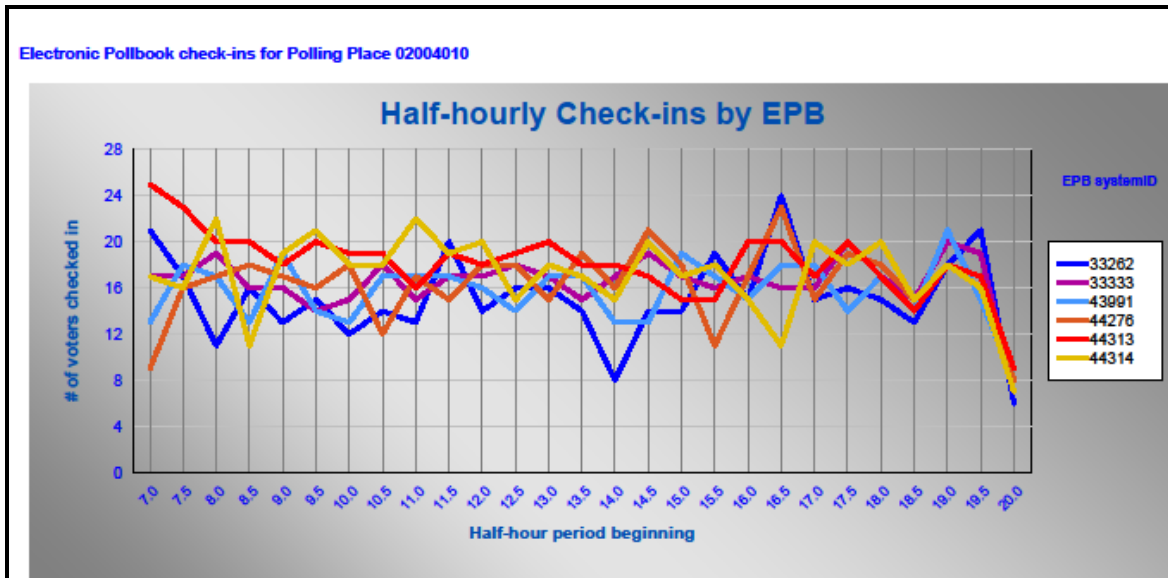


Voted Absentee (% of active)	158	3.9%	Peak half hour	7:00pm	# of Touchscreens/added/(hr)	18
Voted Early (% of active)	333	8.1%	Est peak hourly arrivals	226	Est avg tme on TS	5.5minutes
Provisional (% of checkins)	51	1.9%	# of electronic pollbooks	6	Est hourly TS capacity	196
Elec Day voters%/Tot turnout	2,875	85.3%	Calc min. seconds/checkin	85	Blank/canceled/unvoted cards	94 / 2 / 6
Voters aged 70+	299	11.2%	Est hourly EPB capacity	332	# ballots re-issued	15

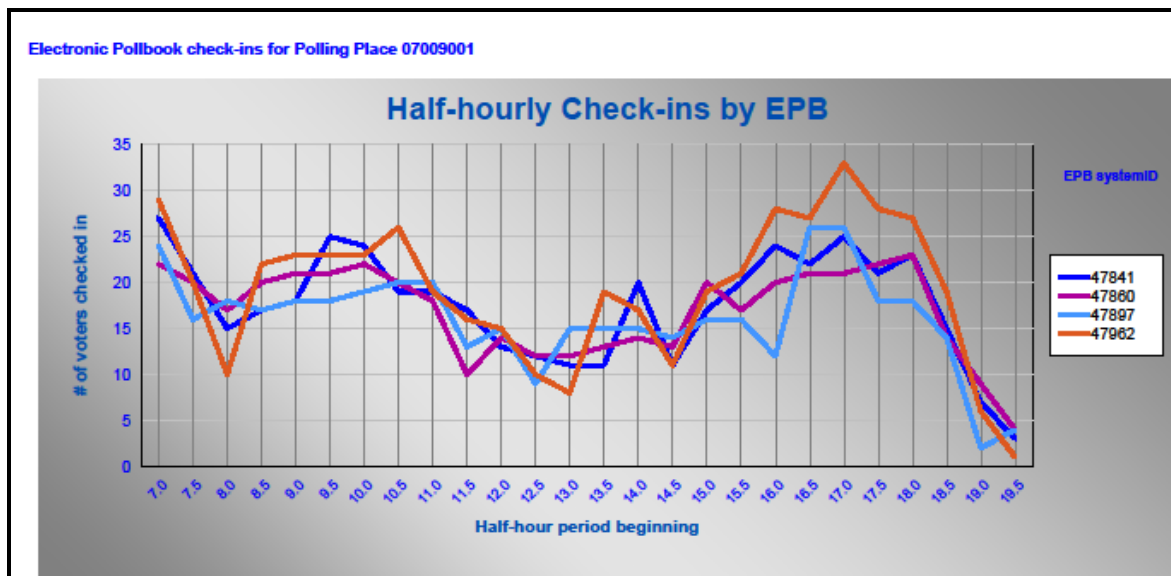
Notes: SCPP survey >60mins: M1013, M1233, M1244, / AfterHrs: 46/ EJ log/line/ LBE note- \*Email from voter indicating two hour wait to vote/SBE note- another voter arrived before 7am, waited more than 1 hour to check in. Said that "everyone was in a pleasant mood." Her husband arrived about 11am. Waited at least 1 hour to check in. No contact with poll worker until inside lobby. No sample ballots available until inside. Said there were never more than 10 people waiting in prior elections./ SCPP survey UNDER 60mins: M1001,M1020



Presented below is the chart showing the number of check-ins on each of the electronic poll books throughout the day at Crofton Elementary. The activity of the individual poll books appears to fluctuate somewhat randomly, with no overall pattern as a group. This indicates that check-ins were being deliberately delayed due to backlogs at the voting machines, and not occurring naturally as the voters arrived at the polling place.



By comparison, the pattern for Winfield Elementary in Carroll County is depicted below. In this case voters were being checked in immediately when they arrived at the polling place, and the overall pattern conforms to the actual voter turnout pattern.



Next are the detail reports for the voting machines and electronic poll books at Crofton Elementary. It appears that all eighteen touchscreens and six electronic poll books were working normally throughout the day. Note that touchscreen machine "0" has lower ballot totals than the others. This is not unusual, since machine "0" is often configured for accessible voting and reserved for that purpose when possible.

Touch-screen Detail for Polling Place 02004010		Electronic Poll Book Detail for Polling Place 02004010				
Average ballots per TS	145.9	<u>System ID</u>	<u># of check-ins</u>	<u>Earliest</u>	<u>Latest</u>	<u># of restarts</u>
Standard deviation	12.2					
<u>machineid</u>	<u>ballots cast</u>					
0	119	33262	410	7:01:45 am	8:14:46 pm	0
1	153	33333	447	7:00:41 am	8:14:55 pm	0
2	154	43991	424	7:01:42 am	8:15:56 pm	0
3	145	44276	440	7:01:17 am	8:14:58 pm	0
4	162	44313	491	7:01:12 am	8:22:57 pm	0
5	146	44314	463	7:01:18 am	8:14:57 pm	0
6	155					
7	150					
8	158					
9	152					
10	160					
11	150					
12	147					
13	120					
14	141					
15	136					
16	144					
17	134					

Here is an example of the equipment detail report for another polling place. From the data it seems likely that #14 was taken out of service in early afternoon, and that machine #s 19 and 20 were brought in as replacements from the LBE prior to the evening rush. Electronic poll book #43963 was having problems and was taken out of service.

Touch-screen Detail for Polling Place 02003004		Electronic Poll Book Detail for Polling Place 02003004				
Average ballots per TS	124.2	<u>System ID</u>	<u># of check-ins</u>	<u>Earliest</u>	<u>Latest</u>	<u># of restarts</u>
Standard deviation	28.8					
<u>machineid</u>	<u>ballots cast</u>					
0	104	33316	426	7:01:14 am	7:47:18 pm	0
1	144	43963	51	7:02:14 am	8:42:37 am	12
2	144	44032	528	7:01:15 am	8:01:05 pm	0
3	151	44092	416	7:03:28 am	7:50:59 pm	0
4	130	44100	500	7:01:06 am	7:53:07 pm	0
5	132	44113	283	1:50:26 pm	8:02:53 pm	0
6	140	44338	451	7:01:11 am	8:01:56 pm	0
7	134					
8	137					
9	137					
10	132					
11	142					
12	132					
13	139					
14	86					
15	145					
16	136					
17	134					
18	109					
19	51					
20	50					

The wait-time simulation for Crofton Elementary is presented below. All election-day simulations assume that the number of voters waiting in line at poll opening is equal to 25% of total first hour turnout. For this polling place the half-hour voter capacity is calculated at 112 for the electronic poll books and at 98

for the touchscreens, making the touchscreens the limiting factor. Wait times and line lengths are calculated on the basis of either the number waiting for the poll book (EPB) or the TS, whichever is larger. If the “number waiting for TS” is higher than the “number waiting for EPB”, the difference could either be checked in and waiting for an available TS or not checked in until a TS becomes available. The simulation treats both cases as the same for purposes of calculating wait times. The number of available voter access cards (94 in the case of Crofton Elementary) is essentially a cap on the number of voters who can be in line waiting for a TS after checking in.

**Wait-time Estimates - Tuesday, 11/06/2012**

Turnout pattern: Morning

02004010- Crofton Elementary School

1405 Duke of Kent Drive, Crofton MD 21114

Hours: 7am-8pm TS cards:94 Last check-in: 20:22  
Day total:2,675 Model minutes on TS: 6.0 #After hours:45

# Active voters:	4,096	# EPB:	6.0	EPB avg. time to check in (secs)	96	EPB .5hr cpcy:	112
ED turnout %:	65.3%	# TS:	18.0	TS avg. time to vote (minutes)	5.5	TS .5hr cpcy:	98

Notes: SCPP survey >60mins: M1013, M1233, M1244, / AfterHrs: 45/EJ logline/LBE note- "Email from voter indicating two hour wait to vote/SBE note- another voter arrived before 7am, waited more than 1 hour to check in. Said that "everyone was in a pleasant mood." Her husband arrived about 11am. Waited at least 1 hour to check in. No contact with poll worker until inside lobby. No sample ballots available until inside. Said there were never more than 10 people waiting in prior elections./ SCPP survey UNDER 60mins: M1001,M1020

Half Hour	Starting # Waiting for		Processed in period		# of voters in line		Wait time in minutes		
	EPB	TS	New Arrivals	EPB	TS	Avg.	Max.	Avg.	Max.
7:00 am	73	73	111	112	98	80	86	24.1	26.0
7:30 am	72	86	111	112	98	93	99	28.0	29.9
8:00 am	71	99	130	112	98	115	131	34.7	39.5
8:30 am	88	131	130	112	98	147	163	44.3	49.1
9:00 am	106	163	124	112	98	177	190	53.1	57.1
9:30 am	118	190	124	112	98	203	216	61.1	65.0
10:00 am	130	216	127	112	98	231	245	69.4	73.8
10:30 am	145	245	127	112	98	260	275	78.2	82.5
11:00 am	160	275	118	112	98	285	295	85.6	88.7
11:30 am	166	295	118	112	98	305	316	91.8	94.9
12:00 pm	173	316	93	112	98	314	316	94.2	94.9
12:30 pm	154	311	93	112	98	309	311	93.0	93.6
1:00 pm	135	307	88	112	98	302	307	90.9	92.3
1:30 pm	111	298	88	112	98	293	298	88.0	89.4
2:00 pm	87	288	89	112	98	284	288	85.3	86.5
2:30 pm	65	280	89	112	98	275	280	82.8	84.0
3:00 pm	42	271	94	112	98	269	271	80.9	81.5
3:30 pm	24	267	94	112	98	265	267	79.7	80.3
4:00 pm	6	263	104	110	98	266	269	80.0	80.9
4:30 pm	0	269	104	104	98	272	275	81.8	82.7
5:00 pm	0	275	100	100	98	276	277	83.0	83.3
5:30 pm	0	277	100	100	98	278	279	83.6	83.9
6:00 pm	0	279	81	81	98	271	279	81.5	83.9
6:30 pm	0	263	81	81	98	254	263	76.5	79.0
7:00 pm	0	246	36	36	98	216	246	64.8	74.0
7:30 pm	0	185	36	36	98	154	185	46.4	55.6
8:00 pm	0	124	0	0	98	75	124	22.5	37.2
8:30 pm	0	25	0	0	25	12	25	3.9	7.8
<b>Day Totals</b>			<b>2,664</b>	<b>2,671</b>	<b>184.7</b>	<b>316</b>		<b>55.6</b>	<b>94.9</b>



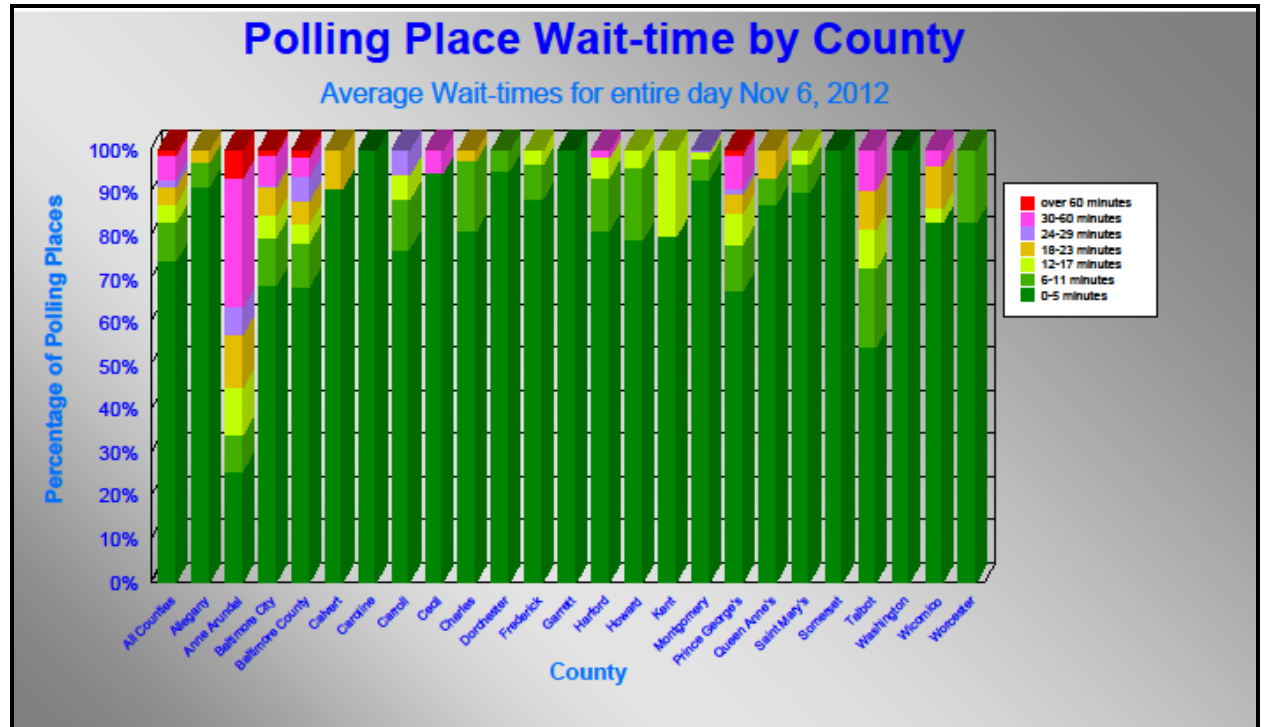
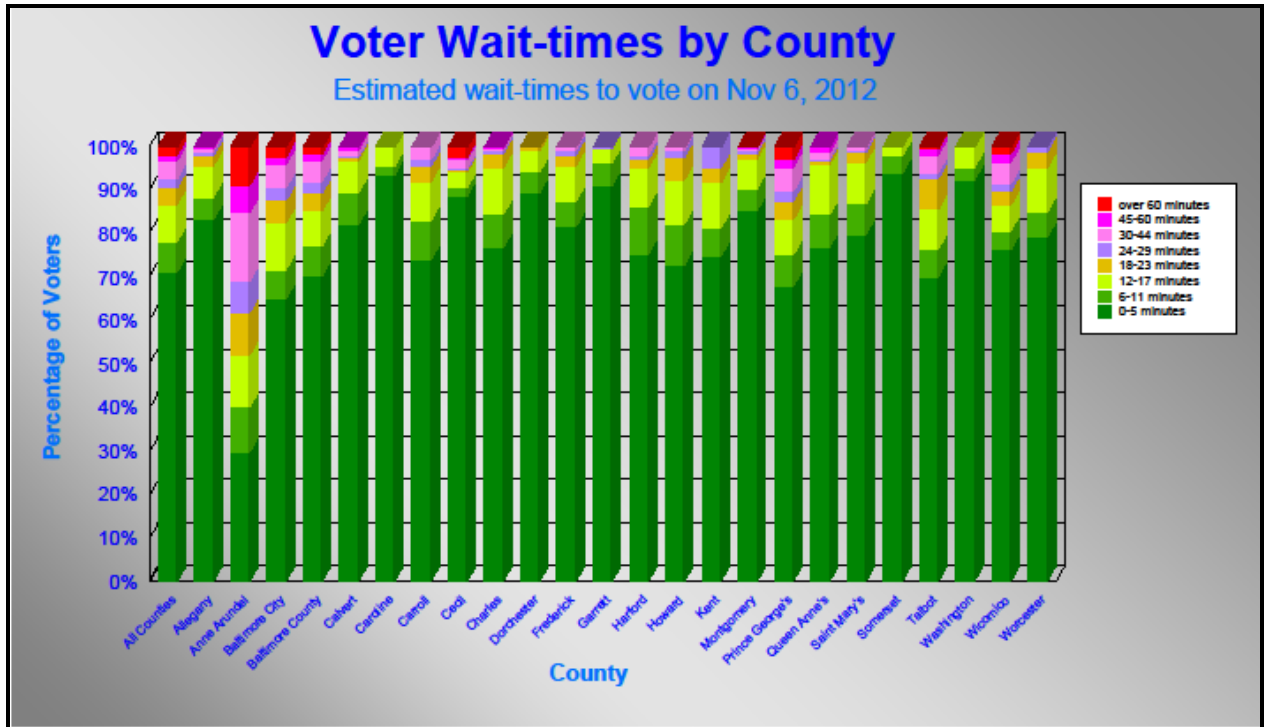
## Wait Time Estimates for 2012

A summary of the wait time estimates derived from the individual election-day simulations for each polling place in Maryland's local election jurisdictions is shown below.

Estimated Wait-times for Voter Check-in on November 6, 2012

Wait-time range in minutes→	0 - 5	6 - 11	12 - 17	18 - 23	24 - 29	30 - 45	46 - 60	60 - 90	90 - 120	over 120
<b>Total</b>	1,486,600 69.9%	149,200 7.0%	187,800 8.8%	83,700 3.9%	49,800 2.3%	95,100 4.5%	30,700 1.4%	32,400 1.5%	8,100 0.4%	2,400 0.1%
<b>Allegany</b>	21,600 83.3%	1,300 5.2%	1,900 7.2%	600 2.3%	300 1.0%	200 0.6%	100 0.4%	0 0.0%	0 0.0%	0 0.0%
<b>Anne Arundel</b>	52,100 24.9%	18,500 8.9%	25,700 12.3%	21,300 10.2%	16,300 7.8%	38,700 18.5%	14,400 6.9%	14,500 6.9%	5,700 2.7%	1,800 0.9%
<b>Baltimore</b>	207,900 67.2%	21,800 7.1%	26,800 8.7%	14,100 4.6%	10,700 3.5%	16,800 5.4%	5,500 1.8%	4,100 1.3%	1,200 0.4%	500 0.2%
<b>Baltimore City</b>	126,600 64.3%	13,300 6.7%	21,600 10.9%	10,200 5.2%	5,700 2.9%	11,400 5.8%	3,600 1.8%	4,200 2.1%	400 0.2%	0 0.0%
<b>Calvert</b>	27,600 76.4%	3,300 9.2%	3,300 9.1%	700 1.9%	200 0.5%	900 2.4%	200 0.5%	0 0.0%	0 0.0%	0 0.0%
<b>Caroline</b>	9,900 93.8%	200 1.9%	500 4.3%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
<b>Carroll</b>	54,400 74.1%	6,700 9.1%	6,500 8.9%	2,500 3.4%	1,200 1.6%	2,100 2.9%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
<b>Cecil</b>	30,900 88.8%	700 1.9%	1,300 3.6%	100 0.4%	200 0.5%	700 2.0%	200 0.5%	800 2.3%	0 0.0%	0 0.0%
<b>Charles</b>	46,200 77.0%	4,500 7.6%	6,400 10.7%	2,000 3.3%	400 0.7%	300 0.5%	100 0.2%	0 0.0%	0 0.0%	0 0.0%
<b>Dorchester</b>	10,800 89.6%	600 4.7%	600 4.9%	100 0.8%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
<b>Frederick</b>	79,800 81.8%	5,700 5.8%	8,100 8.3%	2,400 2.4%	1,200 1.3%	400 0.5%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
<b>Garrett</b>	9,900 91.3%	600 5.2%	400 3.3%	0 0.0%	0 0.2%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
<b>Harford</b>	77,600 74.2%	12,000 11.5%	9,900 9.5%	2,200 2.1%	1,300 1.2%	1,500 1.5%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
<b>Howard</b>	83,400 73.0%	10,700 9.4%	11,700 10.2%	5,900 5.2%	1,900 1.7%	600 0.5%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
<b>Kent</b>	5,200 74.9%	400 6.5%	700 10.4%	200 3.4%	300 4.8%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
<b>Montgomery</b>	289,000 85.4%	17,400 5.1%	23,500 7.0%	4,200 1.2%	1,500 0.4%	2,200 0.6%	300 0.1%	100 0.0%	0 0.0%	0 0.0%
<b>Prince George's</b>	199,700 67.0%	21,800 7.3%	25,000 8.4%	13,300 4.5%	7,300 2.4%	16,800 5.6%	5,200 1.7%	8,300 2.8%	500 0.2%	100 0.0%
<b>Queen Anne's</b>	15,200 77.0%	1,500 7.5%	2,300 11.6%	200 0.9%	100 0.5%	300 1.3%	200 1.2%	0 0.0%	0 0.0%	0 0.0%
<b>Saint Mary's</b>	30,500 79.9%	2,700 7.0%	3,700 9.7%	800 2.2%	300 0.7%	200 0.5%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
<b>Somerset</b>	7,700 94.0%	300 4.0%	200 2.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
<b>Talbot</b>	9,200 70.3%	800 6.3%	1,200 9.2%	900 7.0%	200 1.4%	500 4.1%	200 1.3%	100 0.4%	0 0.0%	0 0.0%
<b>Washington</b>	48,700 92.5%	1,500 2.9%	2,400 4.6%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
<b>Wicomico</b>	25,200 76.4%	1,500 4.4%	1,900 5.8%	1,000 3.1%	600 1.9%	1,600 5.0%	600 1.9%	300 0.9%	200 0.6%	0 0.0%
<b>Worcester</b>	17,600 79.3%	1,300 5.8%	2,300 10.2%	800 3.7%	200 1.1%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%

The following charts show county comparisons of the percentage of voters experiencing various wait times and a breakdown of the percentage of polling places having various average wait times.



## PART FOUR: SUGGESTIONS FOR REDUCING WAIT TIMES AT MARYLAND POLLING PLACES

The analyses reported above suggest some ideas for improving the system. Information was also gathered from the local election officials, from the national literature, and from election officials from across the nation.

### Suggestions for Legislative or Administrative Action

#### PROVIDING ADEQUATE NUMBERS OF MACHINES, PERSONNEL, AND SUITABLE FACILITIES

Local election officials have been constrained in providing services by budget pressures from the state and local governments even though there is an increasing demand for services by voters and increasing federal and state legal requirements on the administration of elections. An “Election Infrastructure Fund” that would be available for use by the Maryland State Board of Elections and the local boards of elections to upgrade facilities and technology in the ongoing effort to provide adequate service to the Maryland voter could be created. The Election Infrastructure Fund could be a revolving fund up to \$50 million.

The availability and allocation of voting system equipment needs to be enhanced when voter turnout in a precinct on Election Day is anticipated to be above 60% or 65% of currently registered voters. When ballot length exceeds certain parameters these percentages may need to be modified.

The impact of the length of prospective ballots on the administration of elections and resulting wait times for voters at polling place locations should be taken into account by state and local legislative bodies and administrative agencies. Research and expert opinion agree that ballot length is a major contributing factor to wait times for voters. Limiting ballot length and allocating more resources to deal with ballot length are two strategies that should be implemented. This will require a more detailed examination of local government charter provisions. In many elections, ballot length is a significant variable that should be taken into account. Ballot length is a key variable in a DRE system because it adds to the time that a voter can be expected to take at the bottleneck phase of the voting process. In a voting system with scanners, key constraints could be: (1) ballot length; (2) the number of privacy booths; (3) the number of undervotes or overvotes. Strategies designed to reduce ballot length should be considered, including efforts to permit or place local ballot questions on ballots in elections other than high turnout presidential elections.

Strategies to deal with the availability of acceptable voting sites should be explored. It appears that the physical characteristics of an early voting site and a polling place location (inside and outside the facility) are a major factor in the ability to manage the volume of individuals coming to a polling place to vote.

Machines, personnel, and materials should be budgeted for and allocated based on anticipated turnout in the most popular hour for that precinct, not just for its anticipated turnout for the day or for the jurisdiction. Simulation models informed by enhanced data collection might be used to guide these allocations. Allocation estimates should be made using those variables that data show may be related to key constraints or bottlenecks in the voting process.

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#### POLLING PLACE CONSOLIDATION

Of the 1,850 Election Day precinct polling places in Maryland, about 30% are either located at the same address as another polling place or within close proximity (less than ½ mile radius) to another polling place. A number of local boards of elections (particularly Anne Arundel, Carroll, Frederick, Harford, Howard and Wicomico) have consolidated more than 100 precincts since 2006, with generally favorable results. Further consolidation might make sense in order to free up resources for adding and upgrading early vote centers. A table summarizing the potential opportunities for local boards of elections may be found in Appendix B, with the understanding that many of these opportunities will not be practical for a variety of reasons. Another concept supported by some local election officials is the creation of “vote centers” for Election Day voting. These vote centers would be large facilities centrally located in a jurisdiction capable of handling multiple precincts.

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#### PLANNING FOR THE FUTURE

Trained observers could be used during elections to gather more precise data on the factors that affect the flow of voters and the wait times. This data could then be used to improve future simulation. Election judges or other staff assigned to inform the voters of wait times and the causes of delays and to verify that voters that they are in the correct line could also be assigned to gather data about those who leave the line (“renege”) and those who do not enter the line because it is too long (“balk”). This would be of assistance in gathering data on wait times (perhaps by distributing and collecting cards).

Procedures that allow electronic scanning at the check-in stations may be efficient and should be authorized. This would require a modification of Section 10-302 to permit the use of new technologies in the check-in process.



The implementation of some of these suggestions will create extra public costs. Some of that cost will be obvious to the public as polling places will be over-resourced much of the time. One way to better explain such costs could be to institute internet reporting of election budget items and also reporting the benefits of such expenditures (including, for example, the time saved by voters and increases in voter participation).

Once a new voting system has been initiated and data (including wait times) from an election using that system can be analyzed, studies could be conducted that would examine the potential effects of adjusting the size of the precincts on wait times and initiate that adjustment if it is indicated. Simulations informed by existing and new data sources could be used to make recommendations about precinct consolidation and ideal precinct size. Performing empirical tests to help estimate the time it take take voters to complete a ballot may help inform these estimates. With such data election officials would have better tools with which to design facility configurations.

## Suggestions for Improving the Voting Experience

The survey conducted for this report shows that, despite the wait times, most voters have a very positive attitude about the voting experience. Suggestions for improving that experience did emerge in the course of gathering data for this report.

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### RECRUITING AND TRAINING HIGHLY QUALIFIED STAFF AND ELECTION JUDGES

Recruiting qualified staff to assist in election preparation and on Election Day—as well as recruiting election judges—is a challenge in many jurisdictions. Some jurisdictions allow county personnel to be compensated for working in the elections. Such policies could be implemented in other jurisdictions to assist the local board of elections.

Chief judges and other election officials should be trained to think of the voting process as a queuing system and identify the possible key constraints (bottlenecks) in the process. In recent elections, the time it takes from the casting of one ballot on a touchscreen to the casting of the next ballot by another voter has been a key constraint. Election judges should be trained to move resources, if possible, to the bottleneck in the process as it may develop on an Election Day. In 2012, this would have meant moving additional election judges to the touchscreens. In the future, it may mean putting resources around scanners so that no seconds are lost in moving people to and from the machines. In addition to this training, staff could be “cross-trained” to perform multiple jobs so that resources can be re-deployed to address bottlenecks. Cross-training is currently done by some local boards of elections.

It is possible that the new bottleneck will be at the scanners. For example, some election directors indicated that they believed many ballots would need to be rescanned. If the scanners do prove to be the bottleneck, special training and procedures should be developed to reduce the time required between one scan and another. National surveys showed Florida to be the state with the longest wait times in 2012. Florida used scanners, but some reports indicate that an increase in ballot length was a significant problem.<sup>20</sup>

Election judges, as well as local and state boards of elections, should inform those waiting in line about anticipated wait times. One maxim in the psychological theory surrounding queues is that “Uncertain waits seem longer than known, finite waits.” The gathered data could also inform web-based dissemination of information about wait times.

Testing of election judges on the time each takes to complete critical tasks is conducted in some jurisdictions and could be extended to other jurisdictions. Queuing theory indicates this testing might be an effective strategy if the training and subsequent testing is designed to ameliorate the key constraints or bottlenecks in the voting process.

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#### IMPROVING VOTER PREPARATION

The survey of Maryland voters conducted for this study demonstrated that those voters who have reviewed sample ballots take significantly less time to vote than do those who have not. Continued or improved emphasis on getting sample ballots to voters is indicated.

Special outreach to voters whose polling place has changed or who are close to early voting centers should be made. Anecdotal evidence indicates that voters whose polling places had changed or who were unfamiliar with the difference between early voting and Election Day voting were inconvenienced and contributed to line delays.

As part of the outreach to voters, publicity about the Maryland State Board of Election’s mobile friendly web based information services could be enhanced. Some local jurisdictions have also started to implement such services and collaboration between state and local services can be envisioned. Such services allow a voter to better plan for voting and to confirm that they are at the right place at the right time. Such services might be enhanced by also informing voters about historical patterns of wait times at voting locations or about the current wait times during an election period. Other measures to encourage voting in off-peak periods could be implemented such as using sample ballot mailings to help set expectations for wait times based on time of day.

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<sup>20</sup> [http://law.wm.edu/news/stories/2013/documents/2012\\_election\\_delays\\_report.authcheckdam.pdf](http://law.wm.edu/news/stories/2013/documents/2012_election_delays_report.authcheckdam.pdf)

## IMPROVING THE VOTERS' PERCEPTIONS

To help improve the voter experience while waiting while waiting:

- Polling places should have a single line leading to the check-in table (i.e. do not have separate lines leading to each check-in judge.) This will eliminate a major cause of frustration with lines in general—the unfairness of ending up in the “slow line” through no fault of your own.
- Voters waiting in line should be given something to do—the opportunity to review a sample ballot or read literature on the state and local ballot questions would have helped voters be more prepared for the 2012 general election.
- When, as was often the case in 2012, there are backups at the voting machines but not at the poll books, it can be preferable to form another line for at the voting machines (if the available space permits) rather than hold up check-ins waiting for the voting machines to clear. Such a strategy might require issuing more voter access cards to a precinct.
- Election judges should regularly update voters standing in line with expected wait times and explanations for delays.

Individuals assigned to the job of informing voters about the line status could also make sure people are in the right line, and explain where the bottleneck is and ask people to be ready to vote in an informed way (without creating any pressures).

At high volume precinct polling places, greeters and signs could advise voters that a seemingly long line does not necessarily mean a long wait (and specify, to the extent possible, the expected wait times). For example, a line of 150 voters waiting to vote could easily be more than 300 feet long and wrap halfway around the outside of the polling place. Seeing such a line might discourage many voters from getting in line.

If more than one scanner is deployed in a voting place, queuing theory also recommends that there be only one line feeding into all the stations and not one line for each station.

Policies on the use of cell phone and electronic devices in polling places need further study as the capacity of these devices continues to evolve. The psychological theories related to queuing problems indicate that people engaged in an activity perceive their waits as shorter than do others. Perhaps the latest proposed federal regulations on cell phone use on airplane flights could be a model. In those proposals, conversational use of phones is limited, but other uses are not. A regulation might be developed that would allow use of such devices until a certain point in the voting process when they could then be prohibited. Also, election jurisdictions around the country are considering expanded use of these technologies in the voting process.

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## SUMMARY STATEMENT

Most Marylanders who voted in the 2012 general election were pleased with the experience. But, it is not known how many potential voters were discouraged or how many future voters will be dissuaded from voting by the wait times. This burden of waiting to vote falls disproportionately on certain Marylanders because of their location in populous jurisdictions accompanied by the variable factors such as ballot length, available resources and the characteristics of their precinct polling location. These facts indicate that action needs to be taken. Some actions that might be taken have been included in this report.

Resources needed to conduct an election should be allocated in manner which reduces the overall wait times and which reduces the disparate impact of those wait times. Early voting was statistically related to wait times, both nationally and in Maryland, during the 2012 general election. Residing in populous jurisdictions was related to wait times, both nationally and in Maryland, in 2012. Ballot length was related to wait times in Maryland in the 2012 general elections. There are likely other relationships which could be discovered if data collection systems were adjusted to focus on wait times and resources appropriately allocated for that purpose.

## APPENDICES

### Appendix A: Early Voting in Other States

STATE	In-Person Early Voting	In-Person Absentee	No-Excuse Absentee	Absentee Excuse Required	All-Mail Voting	Permanent Absentee
Alabama				X		
Alaska	X	X	X		Limited	
Arizona	X	X	X		Limited	X
Arkansas	X	X		X	Limited	
California	X	X	X		Limited	X
Colorado		X	X		Limited	X
Connecticut				X		
Delaware				X		
D.C.	X	X	X			X
Florida	X	X	X		Limited	
Georgia	X	X	X			
Hawaii	X	X	X		Limited	X
Idaho	X	X	X		Limited	
Illinois	X	X	X			
Indiana		X		X		
Iowa		X	X			
Kansas	X	X	X		Limited	
Kentucky				X		
Louisiana	X			X		
Maine		X	X			
Maryland	X	X	X		Limited	
Massachusetts				X		
Michigan				X		
Minnesota				X	Limited	
Mississippi				X		
Missouri				X	Limited	
Montana		X	X		Limited	X
Nebraska		X	X		Limited	

<b>Nevada</b>	X	X		X	Limited	
<b>New Hampshire</b>				X		
<b>New Jersey</b>			X		Limited	X
<b>New Mexico</b>	X	X	X		Limited	
<b>New York</b>				X		
<b>North Carolina</b>		X	X			
<b>North Dakota</b>	X		X		Limited	
<b>Ohio</b>		X	X			
<b>Oklahoma</b>	X		X			
<b>Oregon</b>					X	
<b>Pennsylvania</b>				X		
<b>Rhode Island</b>				X		
<b>South Carolina</b>				X		
<b>South Dakota</b>		X	X			
<b>Tennessee</b>	X	X		X		
<b>Texas</b>	X			X		
<b>Utah</b>	X		X			X
<b>Vermont</b>		X	X			
<b>Virginia</b>				X		
<b>Washington</b>					X	
<b>West Virginia</b>	X	X		X		
<b>Wisconsin</b>		X				
<b>Wyoming</b>	X		X			
<b>TOTALS</b>	21 states + DC	26 states + DC	27 states + DC	21 states	2 states	7 states + DC

Source: ncls.org and contacts with state election officials

## Appendix B: Consolidations

County	# consols having same street address	# consols in close proximity	Combined avg size (active)	Combined Avg # voted	# EPB reduced	# TS reduced	# Elec Judges reduced	Elec Judge savings
Allegany	0	5	1,881	1,045	2	2	8	\$1,174
Anne Arundel	2	37	3,103	1,830	3	4	74	\$10,715
Baltimore City	152	43	2,756	1,358	114	109	512	\$94,654
Baltimore County	72	9	3,955	2,340	-3	3	70	\$15,240
Calvert	0	0						
Caroline	0	0						
Carroll	6	0	3,883	2,594	1	0	16	\$3,040
Cecil	4	0	3,693	2,162	0	0	9	\$1,710
Charles	0	8	3,461	2,054	2	0	16	\$2,418
Dorchester	2	0	3,420	2,175	0	0	2	\$440
Frederick	4	2	3,327	2,147	1	0	14	\$2,380
Garrett	2	2	2,019	1,060	2	4	8	\$1,760
Harford	6	2	4,720	3,118	0	0	25	\$5,625
Howard	51	15	3,512	2,110	12	24	182	\$38,220
Kent	2	0	3,146	1,237	2	3	9	\$1,800
Montgomery	6	30	4,221	2,260	13	30	78	\$14,790
Prince George's	12	32	3,657	1,914	13	12	100	\$25,000
Queen Anne's	0	0						
Saint Mary's	4	8	3,303	1,884	4	1	25	\$4,125
Somerset	15	0	2,103	1,231				
Talbot	0	0						
Washington	2	8	3,031	1,620	26	24	106	\$24,910
Wicomico	0	4	2,717	1,451	4	2	15	\$3,375
Worcester	0	0						
<b>State Total</b>	342	205	3,299	1,825	196	218	1,269	\$251,376

## Appendix C: Ballot Length

The Schaefer Center research team has developed a preliminary model for estimating the amount of time a voter takes from the moment of being issued their voter access card (VAC) at the end of the check-in process until they return the VAC upon completion of voting, including the time it takes them to mark, review and cast their ballot on the touchscreen voting machine.

Some of the assumptions in the model were informed by observing the November 5, 2013 municipal elections in Rockville (touchscreen ballots), Annapolis (touchscreen ballots) and Frederick Maryland (optical scan paper ballots). Members of the research team observed the polling place operations and timed individual components of the voting process for more than 300 voters. As shown in the table below, there was a notable difference between Annapolis and Rockville voters in the amount of time they spent on the voting machine. The time difference is seemingly due almost entirely to the ballot length, since the average age of the Annapolis and Rockville voters (57) was the same, and no other explanatory factors have been identified. It is also relevant that both Annapolis races were “vote for one,” whereas one of the Rockville contests was “vote for no more than four” with six candidates listed.

Election	Average Seconds To Vote on Touchscreen	Ballot Word Count (Excluding Instructions)	Ballot Pages (Excluding Language Selection, Instructions, and Review Pages)	Number of Races	Questions	Language selection Screen
Annapolis City 2013	49	38	1	2	0	No
Rockville City 2013	109	256	2	2	3	Yes

One of the Schaefer Center observers at an Annapolis polling place also noted "elderly voters" (those estimated as being age 70 or more) as part of the data gathering. Although there was only a small number of observations, the results confirm the widespread anecdotal evidence (and commonsense supposition) that elderly voters on average take longer to vote.

	Number Observed	Average Time Taken To Vote on Touchscreen	Standard Deviation (in Seconds)
Age 70 and up	17	114 seconds	134
Under 70	90	36 seconds	18

The "voter time on touchscreen" model uses variables related to ballot length and content, voter preparedness, and certain polling place attributes.

Ballot length and content variables include the number of ballot pages, the number of words in the ballot, the number of races and the number of ballot questions, with values assigned according to these assumptions:



- Voters will on average take 15 seconds to situate themselves at the voting machine and read the 137 words on the touchscreen "Instructions to Voters" page.
- A "Prepared" voter (one who has read the sample ballot and decided how to vote before entering the voting booth) will on average take 1.5 seconds per race and 2.5 seconds per issue to complete the ballot marking process.
- An "Unprepared" voter reads the ballot at an average rate of 350 words per minute, and averages an additional 4 seconds per race or issue to decide how to vote.
- Voters will on average take 2 seconds per ballot page (including instructions and review pages) to check the "Next" button and wait for the screen to refresh and display the next page.
- Voters will on average take 2 seconds per race or issue to review the ballot summary page(s) prior to pressing the "Cast Ballot" button. Note that this may be a generous estimate for most voters. The estimate is set somewhat high to allow for the small percentage of voters who will need to make a correction to their ballot after noticing a mistake during their review. Also, for ballots exceeding a certain length (usually about 4 pages) the ballot summary does not fit on a single screen, which requires the voter to scroll down in order to review all contests. Many voters have found the scrolling to be confusing, due to the scroll bar being on the left and the lack of any page delineation in the ballot review section.

The following table compares the touchscreen ballot metrics for the 2012 presidential election for each county.

Touchscreen Ballot Metrics - 2012 Presidential General Election								
County	Ballot Words	Ballot Pages	Federal Races	State & Local Races	State Questions	County Questions	Estimated Minutes on Touchscreen (Prepared)	Estimated Minutes on Touchscreen (Unprepared)
Allegany	1,005	5	3	3	7	0	1.4	4.7
Anne Arundel	2,018	8	3	5	7	15	2.7	9.3
Baltimore City	2,245	11	3	4	7	12	2.5	9.7
Baltimore	1,535	7	3	3	7	8	2	7
Calvert	1,019	5	3	5	7	0	1.5	4.9
Caroline	973	5	3	2	7	0	1.3	4.5
Carroll	1,002	5	3	3	7	0	1.4	4.6
Cecil	1,052	5	3	7	7	0	1.6	5.2
Charles	962	4	3	1	7	0	1.2	4.3
Dorchester	970	4	3	2	7	0	1.3	4.4
Frederick	1,057	5	3	4	7	1	1.5	5
Garrett	1,002	4	3	3	7	0	1.3	4.6
Harford	1,364	6	3	3	7	6	1.8	6.3
Howard	1,576	7	3	4	7	5	1.9	7
Kent	977	4	3	2	7	0	1.3	4.4
Montgomery	1,312	5	3	5	7	2	1.6	5.9
Prince George's	1,634	7	3	4	7	7	2	7.3
Queen Anne's	1,125	5	3	3	7	2	1.5	5.2
Saint Mary's	1,023	5	3	5	7	0	1.5	4.9
Somerset	968	4	3	1	7	0	1.2	4.3
Talbot	968	4	3	1	7	0	1.2	4.3
Washington	1,083	5	3	3	7	0	1.4	4.9
Wicomico	1,273	5	3	2	7	4	1.6	5.7
Worcester	985	4	3	2	7	0	1.3	4.5

*Note: Ballot word and page counts exclude instructions and review screens in all counties and the language selection screen*

The “time on touchscreen” model incorporates a “voter preparedness” factor which specifies the ratio of "prepared" to "unprepared" voters. In the SCPP telephone survey, 65% of respondents said they had made up their mind on both the candidates and the ballot questions before they voted, so the model currently assumes a statewide prepared/unprepared ratio of 65/35. It is reasonable to suppose that this ratio might differ considerably from one polling place to another, but there are no data available as yet on what those differences might be.

This table shows estimated time to vote the touchscreen for prepared and unprepared voters, and the blended times based on 65/35 and 80/20 ratios of prepared to unprepared voters.

County	Ballot Words	Ballot Pages	Estimated Minutes To Vote on Touchscreen (Prepared)	Est. Minutes To Vote on Touchscreen (Unprepared)	Blended Minutes To Vote on Touchscreen (65/35)	Blended Minutes To Vote on Touchscreen (80/20)
Allegany	1,005	5	1.4	4.7	2.5	2
Anne Arundel	2,018	8	2.7	9.3	5	4
Baltimore City	2,245	11	2.5	9.7	5	3.9
Baltimore	1,535	7	2	7	3.8	3
Calvert	1,019	5	1.5	4.9	2.7	2.1
Caroline	973	5	1.3	4.5	2.4	1.9
Carroll	1,002	5	1.4	4.6	2.5	2
Cecil	1,052	5	1.6	5.2	2.8	2.3
Charles	962	4	1.2	4.3	2.3	1.8
Dorchester	970	4	1.3	4.4	2.4	1.9
Frederick	1,057	5	1.5	5	2.7	2.2
Garrett	1,002	4	1.3	4.6	2.5	2
Harford	1,364	6	1.8	6.3	3.4	2.7
Howard	1,576	7	1.9	7	3.6	2.9
Kent	977	4	1.3	4.4	2.4	1.9
Montgomery	1,312	5	1.6	5.9	3.1	2.5
Prince George's	1,634	7	2	7.3	3.9	3.1
Queen Anne's	1,125	5	1.5	5.2	2.8	2.2
Saint Mary's	1,023	5	1.5	4.9	2.7	2.2
Somerset	968	4	1.2	4.3	2.3	1.8
Talbot	968	4	1.2	4.3	2.3	1.8
Washington	1,083	5	1.4	4.9	2.6	2.1
Wicomico	1,273	5	1.6	5.7	3	2.4
Worcester	985	4	1.3	4.5	2.4	1.9

As can be seen from the above table, the level of voter preparedness has a significant impact on average time taken to vote, and, by extension, on touchscreen capacity. Using the example of a typical Anne Arundel County polling place with 10 voting machines, the total hourly capacity of the machines at a 65/35 voter preparedness ratio is 120 voters. At an 80/20 voter preparedness ratio the hourly capacity of those same 10 machines increases to 150 voters. This 25% increase in capacity is the functional equivalent of having an added two voting machines at the polling place.

Finally, the “time on touchscreen” model uses some variables based on attributes of the individual polling places. The values for these variables are assigned according to these assumptions:

- Voters at polling places having bi-lingual ballots (at present all polling places in Montgomery and Prince George's counties) will on average take an additional 5 seconds to review and confirm their language choice on the language selection screen.

- For purposes of the model, the time it takes for the voter to proceed from the check-in table to the ballot station, and, after voting, to proceed from the ballot station to the VAC collection point (which completes the voting process) is added to the time the voter spends actually voting on the touchscreen. This “overhead” time is assumed to be a function of the total distance traveled, and distance traveled is related to the physical size of the polling place, which is assumed to be proportional to the number of voting units in the polling place. An overhead time factor has been calculated for each polling place using a formula that accounts for a fixed minimum time and distances between stations at the polling place.
- Voters age 70 and up are assumed to take on average 50 percent longer to vote. The model calculates an estimated “time on touchscreen” value for each polling place based on the variables described above, then adjusts that value upward based on the actual turnout of voters aged 70 and up in that polling place.

The table below shows a comparison by county of the estimated touchscreen daily capacity for the 2008, 2010 and 2012 general elections based on the “time on touchscreen” model described above. The “Daily Max voters per TS” columns in the table show the calculated daily capacity of a county’s individual touchscreens based on the voter average time on TS and maximum utilization of the touchscreen for all 13 hours of Election Day. The State summary averages are weighted using the actual Election Day turnout for each county.

County	2012 General Election				2010 General Election				2008 General Election			
	Touchscreen Ballot Pages	Touchscreen Ballot Words	Voter Average Time on Touchscreen in Minutes	Daily Max Voters per Touchscreen	Touchscreen Ballot Pages	Touchscreen Ballot words	Voter average Time on Touchscreen in Minutes	Daily Max Voters per Touchscreen	Touchscreen Ballot Pages	Touchscreen Ballot words	Voter Average Time on Touchscreen in Minutes	Daily Max Voters per Touchscreen
Allegany	5	1,005	2.7	287	4	922	3.2	247	4	569	1.5	514
Anne Arundel	8	2,018	5.3	147	5	1,245	3.5	220	4	682	2	386
Baltimore City	11	2,245	5.3	148	8	1,794	4.5	173	8	2,250	5.4	144
Baltimore	7	1,535	4	195	7	1,543	4.5	172	5	1,186	3.6	215
Calvert	5	1,019	2.8	281	4	960	2.9	272	4	577	1.6	482
Caroline	5	973	2.5	307	5	1,040	2.7	292	4	553	1.5	537
Carroll	5	1,002	2.6	298	4	895	2.8	280	4	551	1.5	537
Cecil	5	1,052	3	262	5	1,035	3.4	229	4	614	1.9	421
Charles	4	962	2.3	334	5	1,016	3.1	254	4	532	1.3	592
Dorchester	4	970	2.6	305	4	884	2.7	292	4	566	1.6	487
Frederick	5	1,057	2.8	276	4	956	2.9	272	4	559	1.5	537
Garrett	4	1,002	2.6	298	4	943	3.2	247	4	643	1.7	458
Harford	6	1,364	3.6	219	4	857	2.6	303	4	569	1.6	503
Howard	7	1,576	3.8	206	4	943	2.7	290	4	569	1.5	508
Kent	4	977	2.6	300	4	972	2.8	280	4	583	1.7	454
Montgomery	5	1,312	3.3	237	5	1,095	3.5	223	4	770	2.1	371
Prince George's	7	1,634	4	195	6	1,325	3.6	214	5	1,125	3	260
Queen Anne's	5	1,125	3	264	4	986	3.1	252	4	630	2	396
Saint Mary's	5	1,023	2.8	281	4	945	3.2	245	4	571	1.6	477
Somerset	4	968	2.4	320	4	916	2.8	276	4	568	1.6	492
Talbot	4	968	2.5	309	5	1,027	2.6	296	4	952	2.4	331
Washington	5	1,083	2.7	287	4	955	3.2	243	4	568	1.5	525
Wicomico	5	1,273	3.2	242	5	1,193	3.4	227	4	655	1.8	429
Worcester	4	985	2.6	298	4	903	2.7	288	4	566	1.5	508
<b>State (wtd.)</b>	<b>6.5</b>	<b>1,488</b>	<b>3.8</b>	<b>219</b>	<b>5.4</b>	<b>1,215</b>	<b>3.5</b>	<b>227</b>	<b>4.6</b>	<b>945</b>	<b>2.6</b>	<b>359</b>

It can be seen from this table that changes in ballot length can have a tremendous impact on the number of voting units required, and can completely dwarf the relatively small changes in voter registration or anticipated voter turnout that have traditionally received the most attention in equipment allocation decisions.

As an example, consider an Anne Arundel county polling place with 2,200 registered voters.

- In 2008 the polling place was assigned 10 touchscreens and had Election Day turnout of about 1,600 voters. With those voters taking an average of 2 minutes on the touchscreen, the 10 touchscreens assigned had a capacity of more than 3,800 voters for the day. There was plenty of excess capacity to handle peak hour turnout and any unusual bursts of voter arrivals during the day, with few voters except for those in line at 7:00 am waiting more than 5 minutes to vote.
- In 2010, due to the advent of early voting and lower expected turnout, the number of touchscreens assigned is reduced to 9. Election day turnout does in fact drop to 1,100 voters, but since each takes an average of 3.2 minutes to vote the 10 touchscreens assigned had a capacity of only 2,200 for the day—a 16% decrease in excess capacity and greater likelihood of lines forming during peak periods with some waits of 10 to 15 minutes.

- In 2012 the number of registered voters assigned to the polling place has increased by about 4% from 2008 to 2,300 voters, not enough to justify another touchscreen. Due to increased early voting Election Day turnout declines 1,500 voters, actually fewer than in 2008. However, with voters now taking an average of 5.3 minutes to vote due to the long ballot, the capacity of the 10 machines is only 1,470. Capacity is less than turnout, leading to wait times of over 30 minutes throughout the day and 30 voters still waiting to vote at 8:00 pm.

It is clear that ballot length should be a major consideration in making equipment allocation decisions for any election. Otherwise there is likely to be under-capacity and long wait times in jurisdictions with long ballots, and wasteful over-capacity in jurisdictions with short ballots.