Convenience Voting in Three Tennessee Counties
Final Project Report

Submitted
to

The *Make Voting Work* Initiative of the Pew Charitable Trusts

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Introduction

Voting is valued right, yet, our antiquated system of precinct-based voting is inefficient and fraught with problems of cost, efficiency, and effectiveness. Many factors contribute to problems with the current system. The sheer number of precincts alone produces tremendous difficulties and burdensome costs. In Knox County, Tennessee, for example, there are 94 voting precincts to serve 252,000 registered voters. While the countywide average voter assignment to precincts is 2,700, many local polling stations capture fewer than 100 voters. Staffing these precincts is increasingly problematic. In a Knox County election in November 2004, 915 workers were needed to staff the 94 precincts, and due to shortages of volunteers, it was necessary to recruit high school students to meet minimum requirements.

Confusion about the precinct-model also presents problems. Many voters forget their assigned polling stations, deluging election offices with inquiries each election; others show up at the wrong precincts. Limitations imposed by current election requirements for place and time of voting cause burdens on many voters, rendering them unable or less willing to participate in the election process. A study conducted by the U.S. Census Bureau found that the most commonly-cited single reason given for not voting was "no time off/too busy" (U.S. Census Bureau, *Census Brief: "Too Busy" to Vote*. July 9, 1998).

Many election officials believe that having fewer voting centers, in smarter locations, accessible to larger numbers of people, operating for several days rather than one Election Day, will deal with many of the aforementioned problems and make voting much more convenient to residents, improve voter satisfaction, decrease costs and, in turn, increase voter turnout.

The Knox County Election Commission and the Howard H. Baker, Jr. Center for Public Policy collaborated on a project to investigate this idea and to plan a *Convenience Voting* pilot program of optimally numbered and located voting centers, which would replace the existing precinct-based system in Knox, Anderson and Loudon Counties. The concept of flexible or convenience voting centers that provide citizens an opportunity to choose the time and location of voting has been tried in other communities in the United States in recent years, such as Larimer County, Colorado, and Richmond, Indiana, while several other places have begun evaluation of such programs. Studying Knox, Anderson and Loudon Counties, three contiguous counties, provided an opportunity to assess convenience voting in three unique settings with different sets of variables and circumstances in counties of varying size.

Assessing the relative financial costs of convenience voting and precinct voting is an important feature of this study. The current precinct model is conducive to excessive cost and the ineffective use of public time and financial resources. Since the counties each employ early voting it was possible to estimate costs and begin to answer questions about cost efficiency between precinct and convenience center models. Early voting in the state of Tennessee takes place at a limited number of voting locations within each county and is a *de facto* convenience voting center model. On Election Day, however, ballots are cast in precincts. Thus a comparative cost analysis model of voting center and precinct administration in the three counties was developed and applied.

Voter turnout trends for Knox, Anderson and Loudon Counties were collected to establish a baseline analysis of the precinct-voting model and convenience-voting model. These trends were compared to state, national and international trends. Because the counties have about

two decades of experience with early voting, assessing the impact of all-out convenience voting can be estimated. These trends were put into context of the election reform and best practices literature and the nationwide goal to understand and address the issue of low voter turnout rates. Issues related to voter information and needs; ballot design; security; voting system integrity; voter participation and election costs were considered.

Attitudes about convenience voting were important to evaluate and were done so in two specific ways. Focus groups were held and a telephone survey was administered in Knox, Anderson and Loudon Counties. Focus groups were designed to solicit input from public officials and active citizens on desired characteristics of a convenience voting system as well as advantages and disadvantages of such a system. Generally, responses from the focus groups were favorable towards a convenience voting mode but there were varied opinions on locations and times of actual centers. Responses in focus groups were used to design and refine questions about locations and times and other issues for the telephone survey.   From the telephone survey it was determined that preference of one model over the other was about half and half; that centers close to home would be best; and over 80% of citizens believe the best hours of operation are between 8:00 am and 7:30pm.

A vote center location analysis, based on location/site criteria identified in the literature, original survey research, focus groups, and workshops, was undertaken. The result was a list of specific places and criteria that were entered into the location-allocation GIS tool.   The location-allocation model developed by the team was used to determine optimally located vote centers suited to the unique requirements for the three counties in the study. The tool yielded a list of optimally located sites for each county that included both minimum and maximum distance models.

This project developed a model for assessing the cost of election administration, which can be employed across jurisdictions overtime. It establishes a methodology for comparing election costs within jurisdictions that shift from precinct to convenience center voting and provides a basis for assessing the advantages of a convenience-voting model relative to population and county size. It provides election officials guidance in how to design a convenience-voting system that is based on stakeholder involvement and community partnerships. Finally, this research establishes a method and a tool (a location-allocation model) that can be used for optimally locating vote centers within jurisdictions based on community driven and advanced geographic criteria.

Thus, this project contributes to future election reform in Tennessee. Enabling legislation has been secured to accommodate a Knox County pilot project in 2009, which will serve as a model for the potential diffusion of this innovation across the state of Tennessee. Subject to further Pew Foundation funding, this prospective pilot study affords a unique opportunity for the Knox County Election Commission and the Howard H. Baker, Jr. Center for Public Policy to participate in the writing of vote center law for Tennessee; indeed, could serve as a model for jurisdictions across the country (Appendix F outlines a proposed budget for this future work). Through the employment of research methods currently employed by other members of the *Pew Making Voting Work Working Group*, we now can systematically assess the impact of changing to convenience voting on the cost of election administration, voter turnout (especially on low-turnout sectors in the community), and the voter satisfaction. When extended to the gubernatorial election of 2010, we will have the basis for a three-county comparative study of convenience center implementation.

I. The Cost of Conducting Precinct Based Elections in the Three Counties

A. Overview

In an attempt to assess the cost and public finance of elections in the United States, the researchers on the Caltech-MIT Voting Technology Project concluded that:

> *Even the most basic facts about the cost and finance of elections in the United States are unavailable, and the most basic questions remain unexamined. It is not known how much we spend on election administration overall in the U.S. each year. It is not known on what funds are spent. There has been little analysis of how and how well local governments provide election services* (2001: 48).

Election expenditures are sufficiently small that they do not make the list of important governmental activities reported in the Census of Governments compiled by the U.S. Census Bureau. This makes it difficult to measure actual election administration costs nationally. Accounting practices also contribute to the difficulty of measuring election administration costs. While some counties maintain detailed budget reports, others do not (2001: 49).

The situation is no different in Tennessee. It is readily apparent that citizens in Anderson, Knox, and Loudon Counties receive relatively consistent, stable and successful election administration from the Election Commissions in these jurisdictions. To illustrate the basic cost-categories used by election administrators, Table 1 (located in Appendix A)[1] presents the cost breakdown for Loudon County for the 2004 and 2006 County and State/Federal General elections. In Table 2 the *estimated cost per vote* for these elections in all three counties is presented. These figures are calculated by taking Election Administrator's reported total cost for each election and dividing that cost by the total number of votes cast.

The Caltech-MIT study canvassed county and state governments around the country to determine annual expenditures on elections in 2000. In that presidential election year, when operating costs were lower than in other years due to the significantly higher turnout, the estimated cost per vote was $10. To arrive at this figure, researchers took the estimate of what counties spent on election administration for the year (excluding large procurements of new equipment) and divided this number by the number of votes cast in the November election. This figure was collaborated with an analysis of election administration in California. The researchers note that this is, at best a "ball park estimate." The cost per vote (CPV) figures for our "ball park estimate" of Anderson, Knox, and Loudon counties show costs considerably below the $10 per vote annual estimate. This confirms that administration costs vary widely depending on the size of the county, the type of election, and turnout rates. As the project progressed a systematic study of election processes and costs was undertaken providing more robust estimates. Additional refinement of the actual costs of election administration will be required if convenience voting is implemented in these counties.

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[1] All tables are provided in Appendix A.

Research on the cost of voting has almost exclusively been focused on the cost to the voter and not the administrative cost of elections to the state and county in which they are held. The reason is simple enough. County election commissions are interested in increasing turnout and preserving the legitimacy of the electoral process. They may certainly try to keep administrative costs associated with running elections under control, but they could not and would not recommend reducing the number of elections or cutting compliance costs as a strategy. In fact, before the emergence of alternative voting systems (mail, early voting) there was only one way to run an election (largely state-proscribed) and a cost structure largely dictated by that system.

The emergence of alternative voting systems, particularly early voting and convenience voting, now makes the cost question relevant. County election commissions are still focused on voter turnout and election quality, but now they ask if turnout and quality might be enhanced through an alternative arrangement. County councils and state legislatures want to know the costs and benefits of a potential policy change. The difficulty with offering such an assessment is that the cost and benefits are expressed in different units and there is no generally accepted formula or ratio against which to benchmark them. For example, is a 10% increase in election costs worth a 10% increase in turnout? Similarly, is a 10% reduction in turnout acceptable in order to reduce election costs by 10%?

This analysis will not answer unanswerable questions. But because we have comparative systems data (precinct voting versus early voting) and because we can make a reasonable simplifying assumption that convenience voting is basically expanded early voting, we can make some preliminary estimates of elections costs under a convenience voting system and some comparisons between elections cost and turnout.

B. Methodology

A full cost model for one election, the presidential primary of February 5, 2008, was employed for the project. Previous attempts to identify cost have often been rudimentary, generally taking the approach of dividing budgeted or actual election commission expenditures by the number of elections. This approach involved extensive interviews with election staff in all three counties to understand what kind of costs were incurred with early voting and Election Day voting and how they were incurred.

After costs directly attributable to early voting and Election Day voting had been determined, administrative overhead was estimated individually for each of five budgeted categories of expenditures and was allocated to the election costs based on an average of five elections per year. The applied overhead assumes that some fixed costs (which include direct labor) are attributable to any election, but not all costs are attributable to elections. Examples of non-attributable costs would include office furniture for the election commissioner and continuing professional education for staff. Once allocated by election, overhead was further allocated to early voting based on the proportion of early voters. The result should approximate the full cost of early voting and be the basis for an analysis of how convenience voting may affect elections costs.

The approach to operating cost specification involved dividing the election into three phases: setup, operation and takedown. A phased approach to cost was selected because it assists in the identification of all costs, and uses cost information gained from one county to

prompt questions of another. The result should be a more fully specified cost model of early voting centers that permits comparison across the three counties. Certain parts of the phased approach were further disaggregated for analysis because they constituted a significant portion of total cost.

Description of the cost model begins with a presentation of early voting statistics the three counties and the associated phased costs. The following sections compare the three counties and suggest some general conclusions with regard to how early voting costs behave relative to county size and electoral participation. Next, early voting costs are compared to Election Day voting costs using the same full cost allocation model. Some conclusions about potential cost savings under the convenience voting system conclude the section.

C. General Information

Table 3 summarizes selected features of the three counties. Knox County has almost ten times more registered voters than does Loudon County. Anderson County has about 1.5 registered voters for every Loudon County registered voter. Anderson County has 46,945 registered voters 29 precincts and two early voting centers. The election commission has 4 full time employees. The early voting centers are located in Oak Ridge Mall and Lake City Community Center. Anderson County does not pay a rental fee for these early voting sites. There are an average of 7 workers per early voting site per day of early voting. Knox County has 257,150 registered voters 92 precincts and 8 early voting centers. The election commission has 10 full time employees. The early voting centers are located in high residential or commercial densities throughout the county. Knox County does not pay a rental fee for these early voting sites. There are approximately 8 workers per early voting site per day of early voting. Loudon County has 29,165 registered voters, 14 precincts and two early voting centers. One early voting site is located in the County Election Commission Office, and the other at Roane State Community College. Loudon County does not pay Roane State a rental fee, but provides post-use carpet cleaning and janitorial services. There are approximately 5 workers for off-site early voting and additional two for on-site early voting. The election commission has 2 full time employees.

D. Early Voting Costs

The total operating cost model across the three phases of election preparation, execution, and completion are summarized in Table 4. Anderson County does not pay utilities at their two sites, but they do pay an activation fee for a T1 line. All counties in Tennessee change the locks on the early voting site before and after the election period to ensure security of the machines while the facility is closed. Other make-ready costs include moving and preparing the voting machines. The printing of paper ballots is a significant cost for Anderson County, driving their operating expenses well past Knox County's, which has an electronic system.

Knox County has significant utilities costs at their 7 sites, including heat and air conditioning. Because of the size of the county, their machine preparation costs are high, but proportional to the number of machines deployed. In additional to required security procedures, Knox County also has some janitorial and supplies expense for their 7 early voting sites. Publication costs are a significant expense for Knox County, but their use of electronic systems

reduces their printing costs to a fraction of that borne by the other two counties. However, personnel expenses are the cost driver for Knox County elections, as indicated in Table 5. Loudon County County's highest make-ready cost is the moving and preparation of the machines. Roane State furnishes the necessary T1 line and does not charge for utilities. Publication costs are a significant expense for Loudon County, given its size. As was the case in Anderson County, printing costs are very significant. Because Loudon County uses county employees for the non-technical preparation and removal of the machines, their take down costs are very low. Personnel expenses are the also the most important cost driver for Loudon County elections. The smaller counties have higher make ready and take down costs than does Knox, but most of the operating costs for all three counties is attributable to labor (poll workers and officers), which includes training.

E. Comparative Operating Cost of Early Voting and Election Day Voting

Table 6 compares operating costs for early voting and Election Day. While interesting, the operating cost per precinct is not a fair comparison for operating cost per early voting site because of the number of precincts relative to the number of early voting sites. The more useful result is the operating cost per early voter compared to the operating cost per Election Day voter.

The direct cost per Anderson County early voting site is $3,249. The direct cost per early voter for Anderson County is $1.62. The direct cost per Election Day voter is $2.19, a cost decrease of 57 cents per voter for the early voter. The direct cost per early voting site for Knox County is $21,957. The direct cost per early voter is $4.78. The direct cost per Election Day voter is $3.15, a cost increase of $1.63 per voter. The direct cost per early voting site for Loudon County is $11,164. The direct cost per early voter is $5.06. The direct cost per Election Day voter is $4.59, a cost increase of 47 cents per voter.

F. Comparative Full Cost of Early Voting

Once the cost pattern for each county had been determined, it was useful to do a comparative analysis. Table 7 presents a summary of the operating costs detailed above and adds the fixed cost component, which represents a portion of the administrative overhead of each election commission office applied proportionately to the percentage of voters who choose to vote early. The applied portion reflects the percentage of the budget category that is presumed to go to the providing of election services. Once applied, the overhead is divided by the number of elections (5) to yield a per election administrative overhead figure. That number is then multiplied by the proportion of early voters in the one election to produce the administrative overhead attributable to early voting in one election.

This model assumes that personnel costs are all attributable to elections, but contractual services, supplies and materials and other expenditures are only partially attributable to elections. Having established the full cost approach with respect to overhead, Table 8 demonstrates how differently costs are realized across the counties of differing sizes for early voting. Note that Anderson County has the lowest ratio of operating to fixed costs for early voting, indicating their costs may be less sensitive to a change to a convenience voting model. Knox County has relatively high operating costs per site, but the cost per voter drops below that of Loudon County due to the volume of voters. To the extent that convenience voting is like

early voting, we might expect the cost per voter to fall as the number of voters rise. The same is true of cost per registered voter. *While this effort is intended to advance democracy rather than economy, it does hold that to the extent that a convenience model expands participation, the cost per participant is reduced.*

G. Early Voting and Election Day Voting Cost Comparisons

In this segment, we engage the most critical question associated with cost, which is whether a convenience voting system offers some cost savings over a traditional Election Day model. Again, using early voting as a proxy for convenience voting, and applying the same cost model to Election Day voting, we can see in Table 9 that costs are realized differently under the two systems. In this specification, absentee votes are combined with Election Day votes and take a share of the operating and fixed costs. The operating cost per vote is lower in Anderson County, but that is because most of their election costs are fixed. Comparing the total cost per voter shows a significant economy in Knox County relative to the other two counties driven by the volume of voters.

Comparing Election Day and early voting costs side-by-side yields useful information. Table 10 provides the breakdown for the February 2008 presidential primary. One conclusion that attaches to the preceding analysis is that election costs behave differently in different settings. It was noted earlier that costs have different "drivers" in the three counties, and changes in the drivers permitted by system changes would affect the total cost structure. That is, if printing costs could be reduced in the smaller counties, and personnel costs in the larger county, the cost structure would be fundamentally changed. So even in Knox County, where Election Day has lower total cost per voter, a change in the way elections are staffed in a convenience voting model could lower the total cost per voter enough to make the switch to a convenience system an economic benefit. As always, the economic benefit is not the primary value of such a policy change.

H. State Cost Reimbursement

The Tennessee Department of State, Division of Elections, reimburses county election commissions for certain costs associated with elections. These costs include printing, labor (poll workers), publication costs, rental costs and election supplies. Certain other costs are also allowable if fully documented. While the reimbursement changes the operating cost of each county election commission, it does not fundamentally change the cost of the election in terms of public monies spent to conduct an election.

The reimbursed cost of the election studied for this project, the February 5, 2008 presidential primary are presented in Table 11 as a percent of the operating cost of the election and as a percent of the full cost of the election. Both Knox and Loudon Counties recovered approximately half of their operating costs from the state, while Anderson County recovered a quarter of their cost. It would be unwise to generalize the reimbursed percentages from this election. It appears that Anderson may have faced considerable cost associated with applications for ballots that was not reimbursed for this election, but should be reimbursable for other elections.

I. Summary and Conclusions

The limitations of employing the early voting model as a proxy for a convenience voting system are considerable. Probably the greatest limitation is that early voting is offered in addition to traditional Election Day voting, not as a substitute. A convenience voting system would substitute for an Election Day model, treating Election Day as the last day for convenience voting. Early voting ceases in advance for Election Day. Decisions that election officials make regarding early voting expenses are profoundly affected by the prospect of Election Day.

That said, early voting provides the best proxy for convenience voting costs. Moreover, a fully specified cost model could be employed to help these and other counties predict what would happen to their costs if they adopted a convenience voting system. As we have seen, cost drivers change cost results. Using best estimates and a wealth of practical experience, county election commissions could use such a model to predict their costs under a convenience voting model. In fact, each of the three counties has described how they predict their costs will change and how a convenience voting system will affect their operations.

Anderson County noted the difficulty associated with recruiting and training poll workers and retaining their services consistent through the election year. They predict that a set of voting locations that remains constant over time will be more attractive to poll workers and will make scheduling poll workers easier. They noted that experienced poll workers make fewer mistakes, and that a substantial portion of staff time is spent trying to explain and reconcile mistakes. One mistake an inexperienced poll worker may make is to improperly issue a failsafe, or provisional ballot issued when the voter's registration information does not match his/her current address. These ballots are expensive to handle, because they must be reconciled before they can be counted. Convenience voting eliminates the problem of voters showing up at the wrong precinct.

In Knox County, officials estimated that they could reduce their workforce of 800 election workers by half. Moreover they believed that the stability associated with a trained elections workforce would improve poll efficiency and reduce errors. They noted that considerable staff time was devoted to recruiting and training poll workers, and that office workflow would improve with a stable group of reliable poll workers. They also pointed to other reductions in administrative expenses as reporting deadlines could be met without overtime costs, and that paperwork volume would be reduced as better trained workers made fewer errors that require staff attention.

Loudon County correctly identified printing as their cost driver, and noted that a switch to a convenience voting system would permit them to print one ballot per person, not order a batch of preprinted ballots based on their estimation of turnout and party preference. In a presidential primary year as was tracked in this model, election officials do not know which party the voter will choose and must over purchase for safety's sake. Then unused ballots must be destroyed, an expensive process in itself. Loudon County officials also noted some considerable expense associated with installation of secure T1 lines in convenience voting centers, but expressed confidence that savings from printing and improvements in turnout would offset this cost.

In conclusion, Loudon County election officials made a particularly insightful observation on the whole endeavor of costing elections. While it might be possible to calculate the cost of process one a failsafe ballot, the more compelling cost is one of participation. Election officials in Loudon County believe 50% of potential voters who are issued a failsafe never actually vote – and may never try to vote again.

There are many ways to regard cost. This model has used a moderately sophisticated approach to cost allocation for different elections systems. However, most policy analyst knows that the way cost information is presented "frames" the policy questions. The selection of cost per voter was not arbitrary in this case. It frames the issue of cost through the prism of participation, and embodies the value that greater participation in elections not only improves democracy but reduces unit costs.

II. Precinct-Based Voter Turnout Trends in the Three Counties

The County Elections Commissions in Anderson, Knox, and Loudon counties are responsible for administering primary and general elections for municipal, school district, county, state, and federal offices, as well as referenda. This research focuses on the state-wide elections from 1994 to 2006 in which the same county, state, and federal offices were contested. These are elections in which all county precincts are used on Election Day. In each of the recent presidential election years (1996, 2000, and 2006) three comparable elections occur: the *February Presidential Preference Primary*; the *August County General*; and the *November State/Federal General*. In non-presidential election years the comparable elections are the *August County General* (when county offices are filled and candidates for state-wide office are nominated) and the *November State/Federal General*.

In a very real sense the three counties already have more than 20-years experience with convenience voting; early voting has been in practice in Tennessee since 1994. Non-precinct early voting begins fifteen days before Election Day. It ends five days before the election and voters then must cast ballots at polls located in their precincts. Table 12 presents the election statistics for the three counties since the implementation of early voting.[2] The growing popularity of early voting is readily apparent in the trend lines offered in Figure 1. Experience with early voting away from the precinct polls affords administrators and voters alike a foundation for extending convenience voting through Election Day.

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[2] The very low turnout numbers reported for Loudon County for the 2000 Presidential Preference Primary is an anomaly and seems unlikely—but these are the numbers reported on the Tennessee Division of Elections website.

Figure 1. Percent of Early Voting Votes: 1994 to 2006
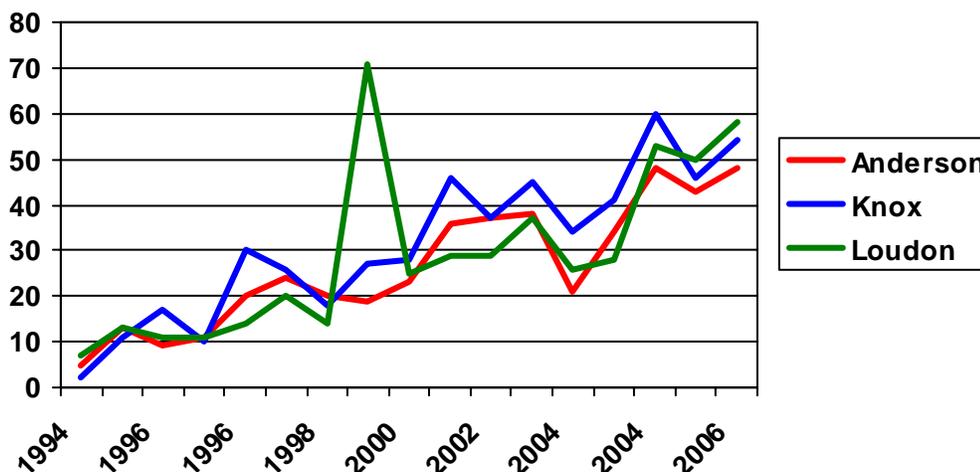
For the last three November general elections, voter turnout in Anderson, Knox, and Loudon counties has lagged behind the state and national rates, as can be seen in Table 13. These figures can be compared for each county if Voting Convenience Centers are implemented in future elections and hopefully this innovation will promote closing the gap between county, state, and federal turnout rates. Certainly, it is something carefully to be measured and compared if convenience voting becomes a reality.

III. Voter Turnout Trends in the U.S. and Other Established Democracies

A. Measuring Voter Turnout

The traditional measure of the number of people voting in an election is the votes cast for the highest office on the ballot. In the U.S., for example, the total vote for *national* elections for President, Senate, or House is used. In local American elections, the number of votes cast for county or municipal executives is employed. In other established democracies, the measure depends on whether the executive system is *parliamentary* or *presidential*. In systems where the head of government (prime minister, premier, or chancellor) is selected by the legislature and can be dismissed with a legislative vote of no confidence, the measure is votes cast for the parliament. In systems where the head of government is directly elected by a popular vote, the measure is votes cast for the chief executive. It has been found that voter turnout in presidential elections produce significantly greater turnout than legislative elections.

Regardless of the office being contested, there is the issue of how best to measure relative voter turnout among systems and, within polities, across elections over time. There are three common measures used to measure turnout:

1. Percentage of voting *age* population casting ballots (VAP), which is calculated as the number of ballots cast divided by the number of individuals of voting age.

2. Percentage of voting *eligible* population casting ballots (VEP), which is calculated as the number of ballots cast by voting age *citizens* who have the right to vote. In the U.S., for example, many individuals who are part of the voting age population are not eligible to

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vote, such as non-citizens, felons, and the mentally incapacitated. The VAP does not take into account members of the military or civilians living overseas.

3. Percentage of registered voters casting ballots (VRP), which is calculated as the number of ballots cast by those who are registered to vote on election day.

Using the VAP to measure turnout works well for those nations in which reliable and timely census data are available and aggregated at the level of government (national, regional, local) under study. It provides a reasonable but limited estimate of the proportion of non-voters. And, it can be tracked over time for turnout trends. The problem is that the VAP is sensitive to the changes in the size of the electorate that occur with demographic shifts or with expansions in the franchise, such as occurred with the lowering of the voting age from 21 to 18 in the United States. In such cases, changes in turnout do not necessarily signal significant political trends in citizen participation as is usually assumed, but are simply inevitable by-products of changing election rules and/or increasing the denominator (the population base) by which the numerator (votes cast) is calculated. (Franklin 2004: 86-89)

The VEP corrects for the fact that not everyone included in the population census meeting the age requirement to vote is eligible to vote on election day. Various restrictions on eligibility, as are common in the U.S. and which vary from state-to-state, such as residency requirements, disenfranchisement of felons, and registration laws, render the simple use of the voting age population potentially misleading as eligibility varies across time and jurisdiction. A more precise estimate of turnout is produced when the number of individuals who are ineligible to vote on election day is deducted from the voting age population. The problem, of course, is obtaining reliable, time appropriate data on eligible and ineligible populations. Nevertheless, the choice of using VAP or VEP measures can make an important difference in studying turnout trends. Studies using the VAP measure report a significant decline in U.S. voter turnout since 1971. It has been found, however, that by employing the VEP measure, found in contrast that declining turnout rates after 1971 can be explained by the increase in the ineligible population. (McDonald and Popkin 2001, McDonald 2002 and 2004)

Using the VRP to measure turnout is common but problematic. It only captures that proportion of the non-voting population that is registered to vote when ballots are cast. Those individuals who do not or cannot register are left out of the calculation. Further, comparing turnout rates over time using the VRP becomes difficult as registration rules differ or change within and among jurisdictions. Also, voter registration rolls inevitably contain people who are no longer eligible to vote on any given election day. In addition to having distinctive voter registration laws among the states, jurisdictions in the U.S. vary on how well registration records are maintained. Still, given the difficulty of obtaining population data that are synchronized accurately and reliably with the occurrence of each election—or even within a given election year, the VRP remains useful. Because this study focuses on *county elections in Tennessee*, thereby controlling for registration restrictions which are set in state law, the VRP is appropriate for measuring turnout over time—especially in the pre and post convenience center situation for each county.

B. Turnout Trends

The proportion of citizens who cast votes in elections varies considerably across countries as is apparent in Table 14. The explanations for this variation in turnout are numerous. They include factors related to *individual voter characteristics* (e.g., socioeconomic class, psychological

orientation to politics, education, access to transportation and technology, group affiliations, levels of community engagement), *characteristics of the political system* (e.g., legal requirements pertaining to registration and voting, election administration, voter mobilization activities by political parties and interest groups, degree of competitiveness for elective offices, frequency and nature of elections), and the *political culture* within which citizens, groups, and institutions are embedded.

Comparative research on electoral behavior tends to focus on the *institutional* or *cultural* context to explain why electoral turnout varies among countries.   Studies have commonly found that:

- The type of electoral system shapes participation, with proportional representation systems generating higher voter participation than majoritarian or plurality elections;

- The type of executive system (presidential versus parliamentary) affects turnout, with presidential contests producing higher turnout than legislative;

- The frequency of elections is related to turnout because more frequent voting may produce "voter fatigue" and depress participation over time. (Verba, Nie, and Kim 1978; Reif and Schmitt 1980; Powell 1986; Jackman 1987; Jackman and Miller 1995; Franklin, van der Eijk, and Oppenhuis 1996; Franklin 1996 and 2002; Blais and Dobrzynska 1998; Ladner and Milner 1999; Norris 2002, 2004a, and 2004b; Franklin 2007; Gunther, Montero, and Puhle 2007).

Complicating efforts to study election turnout trends and explain variation among European nations is the emergence of a new type of *second-order national elections*; i.e., elections to the European Parliament, which are distinctive from traditional elections for national executive and legislative offices (van der Brug and van der Eijk 2007; Gunther, Montero, and Puhle 2007). For Europe this raises the issue of the relationship between the size of the election district and voter behavior in which voter turnout declines as the size of the constituency increases. (Cain, Ferejohn, and Fiorina 1987; Reif and Schmitt 1997; Dahl 1998; Katz 1999; Norris 1997 and 2004a)

In recent decades there has been a general decline in voter turnout worldwide as presented in Figure 2. The recent downturn in established democracies has raised concern among governments, non-governmental organizations, and citizens (Gratschew 2007). Whether this decline should be a matter of alarm, however, is a matter of some dispute. For example, although voter turnout in national elections in Europe has declined since the late 1970s, Franklin (2004) found the decline to be slight in most European Union countries and basically attributable to changes in institutional arrangements and party competitiveness. Moreover, the higher decline in the Netherlands and in Italy in recent years, is likely due to the progressive replacement of electoral cohorts (socialized to high turnout due to compulsory voting laws) with voters who came of age after compulsory voting was abolished in these countries (Franklin 2007: 30-31). The lowering of the voting age has been an especially important change affecting turnout in most established democracies. It is among the youngest age cohort that voting turnout rates are the lowest (Wattenberg 2008). It is important to note, however, that a lively debate is emerging over whether registration and turnout rates in fact are declining in the United States. McDonald, for example, argues that studies showing recent declines is flawed because researchers are not properly measuring eligible voters. (2004)

Figure 2. Voter Turnout in Established and Other Democracies Since 1945
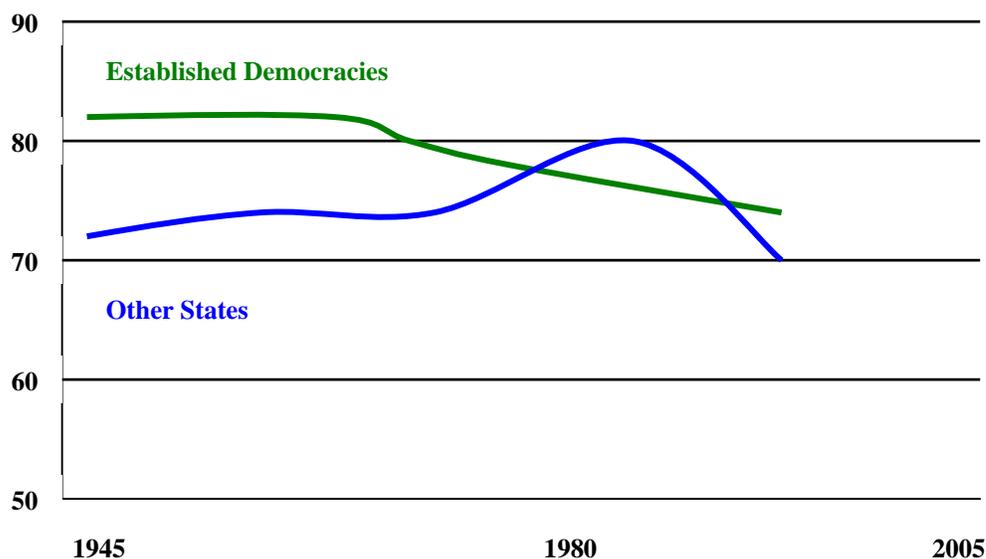
Adapted from Marcus E. Ethridge and Howard Handelman, *Politics in a Changing World*, 4th edition (Belmont, California: Thompson Wadsworth, 2008): 106.

International efforts to deepen and strengthen democracy and good governance through reforms in electoral systems have focused on issues of electoral administration, voter education, election observing, and party capacity-building (Norris 2004a: 4). Relatively low, stagnant, or declining levels of voter turnout have often been taken as a sign of political alienation and the loss of vital social capital (Piven and Cloward 1989; Putnam, Leonardi, and Nanetti 1993; Hirschbein 1999; Putnam 2000). Still, voter turnout is increasingly recognized as a limited indicator of the health of established democracies; it remains important but the dynamics of generational transformation may well compel a rethinking of its relative importance.

Traditionally, voter turnout has been considered a measure of how engaged citizens are in the political process at any given time. High turnout is considered a sign of vitality in a democratic system. It is taken to indicate that people are engaged in political issues, willing to invest time and resources in their governance, and willing to accept responsibility for holding leaders accountable. Lower turnout is often considered the result of alienation, mistrust, and lack of confidence in the political system. Therefore, the extensively researched and well-documented trend of declining voter turnout in the United States has produced concern for the health of the American polity for well over a decade (Texiera 1992; Patterson 2002).

As is clear from Table 14, voter turnout rates are lower in the U.S. than in most other democracies. Various explanations of this phenomenon have been offered including:

- *Frequency and number of elections.* The U.S. federal system with its layers of government produces far more numerous and frequent elections than most other nations. Elections become commonplace events—Europeans may vote only two or three times in a span of four years while Americans may have ten or more elections during the same period. Switzerland, which is even lower in turnout than the U.S. also has frequent and numerous elections.

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- *Registration Requirements.* European voters are registered to vote by the state—voter registration is automatic; i.e., citizens of legal age are automatically registered to vote. In the U.S. registration in most states is a separate process from voting, which creates inconvenience, additional administrative costs, and confusion on Election Day.

- *Election scheduling.* In Europe elections are generally not scheduled on workdays, whereas in the U.S., most elections are held on Tuesdays. Americans report having less and less free time, which could partially account for declining voter turnout. Elections on workdays and constrained free time increases voting inconvenience.

- *Compulsory voting.* Some democracies, such as Australia and Belgium, have compulsory voting laws, but in the U.S. voting is not compulsory. When compulsory voting was eliminated in the Netherlands and Italy, turnout dropped significantly, which suggests in the highly improbably event that voting became compulsory in the U.S., turnout would indeed increase.

The bottom line is that despite many factors that motivate people to vote, many citizens in America and around the world do not vote. Downs (1957) explained nonvoting as a rational choice in which individuals decided not to vote because the costs of voting were perceived to outweigh the benefits of participation. Scholars have long recognized, and policy makers now appear, at least implicitly, to recognize the role that voter choice plays in the decision to cast a ballot. Thus, we see the growing popularity of policy reforms designed to alter the formal rules, referred to as *electoral engineering* (Franklin 2004; Norris 2004a).

In the United States especially, electoral engineering to simplify registration and make voting more efficient, effective, and convenient has increased tremendously over the past decade (Posner 2006). Since passage of the Help America Vote Act of 2002 (HAVA), states have fostered a variety of innovations to shift voter cost-benefit calculations that will be reviewed in a later section of this report.

Election reform needs to adjust to new patterns of civic engagement especially among the youngest cohort of potential voters. For example, in Europe and the United States there is a growing recognition that civic activism and community involvement, rather than voting, is the preferred form of citizen participation among the young. Thus, other forms of engagement are better indicators of the vitality of democracy (Norris 2002; Zukin et al. 2006; Gratschew 2007; Wattenberg 2008).

IV. A Review of Election Reform Literature

Declining voter turnout rates, the rise of potentially transformational voting technologies, the dynamics of electoral competition, and the rise of a new, potentially distinctive, electoral generation is driving widespread electoral engineering efforts. Enhanced accessibility, cost-savings, and convenience have produced a variety of election process innovations that include the goal of increasing voter turnout:

- *Easier voter registration* by reducing the number of days prior to an election in which voters can register to vote, *Motor Voter* registration (allowing individuals to register to vote when renewing their driver's licenses), or Election Day registration.

- *Vote-by-mail* has become increasingly popular in Western states and localities; for example, most of the voters in the state of Washington vote-by-mail rather than at polling-places. Several larger cities in Montana have moved to vote-by-mail for local elections as well.

- *Early voting*, which allows voters to cast in-person ballots at centralized polling places and "no-excuse" absentee voting, has increased in the past five years. Nationally, 35 states allow all voters some option to cast ballots before Election Day.

- *Convenience voting at vote centers*, or super precincts, whereby local precincts are closed in favor of a smaller number of polling places where any voter in the jurisdiction can vote regardless of home address.

Easing registration restrictions appears to increase voter registration (Wolfinger and Rosenstone 1980; Squire, Wolfinger and Glass, 1987), but do such innovations affect voter turnout? Studies of the direct effect of voter registration and election process reforms show that innovations such as motor voter registration, relaxed absentee voting, mail-in voting, and early voting, produce limited or marginal impact on voter turnout (Knack 1995; Oliver 1996; Rhine 1996; Stein and Garcia-Monet 1997; Stein 1998; Karp and Banducci 2000; Berinsky, Burns and Traugott 2001; Traugott, 2004.) Most studies essentially have found that electoral reforms have only been used by those who otherwise would have been most likely to vote anyway. That is to say, most previous research on election engineering has found that the changes tended to make voting easier and more convenient for those who vote frequently (Southwell and Burchett 1997 and 2000; Traugott 2004; Berinsky 2005). It should be noted that, although overall turnout rates may not appear directly to be affected by electoral reforms, the characteristics and behavior of voters who avail themselves of changes may shift. For example, because individuals who use absentee ballots vote differently than those who vote at precincts on election day, liberalized absentee voting might affect election results. (Dubin and Kalsow 1996a and 1996b)

Election administration innovations do not appear to have significantly changed the behavior of infrequent or non-voters. Initial research on early voting, which in most jurisdictions includes the use of voting centers, followed this pattern. Nevertheless, recent research demonstrates that the use of convenience voting centers, in addition to other benefits, does have a *positive* impact on voter turnout and may well shift voter cost-benefit calculations (Dyck and Gimple 2005; Stein and Vonnahme 2006 and 2008).

V. Election Administration Reform and Emerging Best Practices

In most nations the central government manages elections, but in the United States separate state systems operate within the broad scope of federal policies. (Massicotte, Blais, and Yoshinaka 2004) The administration of elections in the United States is deeply embedded within the structure and process of the highly decentralized constitutional system, a complex political history, and a tremendously diverse political culture. (Avaliktos 2004; Montjoy 2008; Nicosia 2003) The American electoral system "comprises a complex array of Federal and State constitutional provisions, statutes and regulations, political party rules, enduring political traditions, and contemporary practices (Coleman, Thomas, and Cantor 2003: 1)." Thus, the federal government provides a "general framework for elections but elections are primarily the responsibility of state and local governments," while great "variability exists in the ways various local elections are conducted (Walker 2003: 158-9)."

The controversial 2000 presidential election produced deep and abiding concerns for election administration in the United States. In response, the Congress produced the *Help America Vote Act* (HAVA) of 2002, which emphasized voting technology by setting voting equipment standards and providing states with funding for purchasing new equipment. The HAVA also established the U.S. Elections Assistance Commission (EAC) as a clearinghouse for disseminating information to improve election administration throughout the nation. To be sure, as Lewis has observed, "election reform prompted by the Help America Vote Act is perhaps the single most important election legislation since the Voting Rights Act of 1965 (2005)."

In recent times two waves of election reform have dominated election administration reform, implementation of the HAVA and a backlash to HAVA focusing on concerns with electronic voting technologies. (Moynihan and Silva 2008: 818-823)   Moreover, states have varied widely in the extent to which they have engaged in election reform. A study of election reform after the 2000 election determined that a few states moved quickly to enact comprehensive reforms. Most states, however, gradually enacted modest but noteworthy improvements in election laws, and many failed to adopted significant reforms until forced by the requirements of the HAVA.. In this comparative study of state reform, Tennessee was found to be one of the "incremental change" states. (Palazzolo, 2005: 4)[3]

A byproduct of the concerns produced by the 2000 election, which were exacerbated by problems encountered in the election of 2004, is a growing body of studies on election reform designed to improve the quality and effectiveness of the conduct of elections (Palazzolo and Ceaser, 2005). As one scholar has recently noted, "exactly what it is about the system that needs fixing actually continues to elude everyone (Miller 2005a: 1)." Unfortunately, as Miller further has observed, "differing perspectives, both among researchers and among state election administrators, make the task of understanding the dynamics of our electoral system a complex and difficult one (2005b: 25)." Frustration with the pace and depth of election administration reform is common. While some consider the incremental progress in election reform as a failure to achieve intended goals, what remains clear is that "the reform process is so complex—with so many different actors, stakeholders, and contributing factors—that delays or lack of progress is not only unsurprising but completely understandable (Chapin and Palazzolo 2005: 237-8)." A basic consensus concerning election reforms seems to have emerged; that is to say, beyond the technological fixes that occurred early in the process (such as eliminating punch cards), "the issues and the solutions needed are more complex and often involve trade-offs among diverse goals (Coleman and Fischer 2004: 1).

At the very center of electoral administration reform is the international trend toward voting supported by electronic devices—electronic or *e-voting* (Kersting and Baldersheim 2004). E-voting includes a range of procedures from on-site and remote voting machines to internet voting. Following the Florida recount fiasco in the 2000 U.S. presidential election, and the legal morass it produced, American states moved toward the large-scale adoption of direct recording electronic (DRE) machines—which has produced a large set of controversial technological, administrative, legal, and political issues (Caltech-MIT 2001; Miller 2004; Moynihan 2004; Miller 2005; Moynihan and Silva 2005; Alvarez, Ansolabehere, and Stewart III 2005; Alvarez, Hall, and Llewellyn. 2006; Ansolabehere and Stewart III 2006). This in turn is driving the trend toward e-voting technology that employs voting machines with *voter-verified paper audit trails* (VPATS). (Seelye 2004). There is now a strong national effort to persuade state legislatures to adopt VPAT technology (VerifiedVoting.org 2008a). On Super Tuesday 2008, VPATS were employed

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[3] For an excellent overview of HAVA and the states see Montjoy (2005)

in to some extent in five states (VerifiedVoting.org 2008b). Arguably, the further along the path of election engineering the more complicated and difficult it becomes.

Beyond a large range of security, cost-benefit, reliability, accounting, and social equity issues, rests the question of the impact of e-voting on electoral participation (Gritzalis 2003; Celeste, Thornburgh, and Lin 2006; Alvarez and Hall 2004). Research on the impact of e-voting on voter turnout is in its infancy and empirical studies are few. Based on local government experiments with e-voting in the UK, however, there is preliminary evidence e-voting modestly increases participation among the younger generation. It was found, however, that using low-technology automated postal ballots was more effective in stimulating turnout, especially among the older generation—as well as being cheaper and easier to administer (Norris 2004b and 2004c).

The literature also reveals significant cognitive distance among *election officials*, who have endeavored to use electronic technology to make elections more efficient, and many *information technologists* and *computer scientists*, as well as political activists who are skeptical regarding the security of such systems (Moynihan 2004; National Research Council 2006; Alvarez and Hall 2004; Gritzalis 2003; CALTECH VTP 2001; Alvarez, Hall, and Llewellyn. 2006). Further, there is controversy as to the costs and benefits of process reforms such as Internet voting, mail-in balloting, and in-person early voting (Fortier 2006; Alvarez and Hall 2004; Celeste, Thornburgh, and Lin 2006). Further, it is increasingly apparent that the systematic study of election administration abounds with methodological and substantive problems (Moynihan and Silva 2005; Alvarez, Ansolabehere, and Stewart 2005; Miller 2005a; Miller 2005b). That is to say, despite the central importance of elections in the political process—precious little is firmly known as to the impact of election administration upon the vote. We have anxieties, complaints, uncertainties, questions, and arguments in abundance, but no hard and fast answers.

Election administrators in the United States are the gatekeepers of the nation's political system. They are, in essence, "the administrators of democracy" (Moyniham and Silva 2008: 816). How well they perform the functions associated with running elections directly affects voters' level of *trust* and *confidence* in the reliability and accuracy of election results. Consequently, the performance of the people, processes and technologies involved in election administration are critical to efforts to count every vote and to help assure citizens that every vote counts.

Election administrators are expected to run elections in ways that successfully balance and advance competing values such as *access* versus *security*, *privacy* versus *verifiability* and *expense* versus *accuracy*. Identifying the best practices that have potential for improving the quality and performance of the various aspects of election administration are important for increasing voter participation in elections and boosting the level of public confidence in election results. It is also vital to keeping election administration consistent, cost-effective, and affordable.

As noted previously, the *Help America Vote Act* of 2002 (HAVA) established the U.S. Election Assistance Commission (EAC), in part, to establish minimum election administration standards for States and units of local government with responsibility for the administration of Federal elections. In addition, the EAC is to serve as a national clearinghouse and resource for the compilation of information and review of procedures with respect to the administration of

elections by adopting voluntary voting systems guidelines and conducting research and activities that promote the effective administration of elections (U.S. EAC 2007e).

In 2005, the EAC adopted *Voluntary Voting System Guidelines* (VVSG) that significantly increased security requirements for voting systems and expanded access including opportunities to vote privately and independently for individuals with disabilities. The VVSG provides a set of specifications and requirements against which voting systems can be tested to determine if the systems provide all the basic functionality, accessibility, and security capabilities required of these systems.

A. Voter Information

The EAC has identified several best practices for the various functions of election administration. These encompass voter information materials, effective designs for optical scan, and full-face and rolling DRE (direct record electronic) ballots, and several aspects of voting system security.

Best practices for voter information literature include the following:

- Emphasize voter needs over administrative and vendor requirements.
- Use simple language for all content. Studies show that clear and concise writing is beneficial to voters of all literacy levels. Rewriting ballot instructions and voter information materials using simple language increases usability and, on the voter's behalf, accuracy.
- Use one language per item. To meet usability standards, display no more than two languages simultaneously.
- Use upper- and lowercase *sans serif* type, set left aligned at the sizes outlined in the specifications, for readability. Avoid setting text in a centered alignment and setting text in all capital letters. Minimize the number of fonts used.
- Use color functionally to emphasize important information and processes. The use of color cannot be the sole means of conveying information or making distinctions.
- When clarifying instructions and processes, use accurate diagrams to describe voting technology and equipment.
- Use instructional icons only. Universally recognized icons such as arrows are acceptable and encouraged (EAC 2007a).

B. Ballot Design

The Election Assistance Administration (EAC) also has identified several best practices for the design of optical ballots. Like the recommendations for voter information, these include:

- Emphasize voter needs over administrative and vendor requirements.
- Use simple language for all content. Studies show that clear and concise writing is beneficial to voters of all literacy levels.
- Rewriting instructions, ballot instructions, and voter information materials using simple language increases usability and, on the voter's behalf, accuracy.
- Use one language per ballot, which is recommended practice. To meet usability standards, display no more than two languages simultaneously.

- Use upper- and lowercase sans serif type, set left aligned at the sizes outlined in the specifications, for readability. Avoid setting text in a centered alignment. Avoid setting text in all capital letters. Minimize the number of fonts used.
- Set at a minimum of 12 points all ballot content voters will read. Given a choice between 12-point type size and fewer pages, ballots with 12-point type and more pages were found to be more usable than those with fewer pages and smaller type.
- Use color functionally and consistently. Color can draw the reader's attention and emphasize important information. The use of color cannot be the sole means of conveying information or making distinctions. Another non-color mode must complement color use, such as contrast, icon, text style, etc.
- When clarifying instructions and processes, use accurate diagrams to describe voting technology and equipment.
- Use instructional icons only. Universally recognized icons such as arrows are acceptable and encouraged (EAC 2007b)

C. *Full-face DRE ballots*

The best practices identified by the Election Assistance Administration (EAC) for the design of full-face DRE ballots and rolling DRE ballots, respectively, include:

- Emphasize voter needs over administrative and vendor requirements.
- Use simple language for all content. Studies show that clear and concise writing is beneficial to voters at all literacy levels. Rewriting instructions ballot instructions and voter information materials using simple language increases usability and, on the voter's behalf, accuracy.
- Use one language per ballot, which is recommended practice. To meet usability standards, display no more than two languages simultaneously.
- Use upper- and lowercase *sans serif* type, set left aligned at the sizes outlined in the specifications, for readability. Avoid setting text in a centered alignment. Avoid setting text in all capital letters. Minimize the number of fonts used.
- Use color functionally and consistently. Color can draw the reader's attention and emphasize important information. The use of color cannot be the sole means of conveying information or making distinctions. Another non-color mode must complement color use, such as contrast, icon, text style, etc.
- When clarifying instructions and processes, use accurate diagrams to describe voting technology and equipment.
- Use instructional icons only. Universally recognized icons such as arrows are acceptable and encouraged (EAC 2007c).

D. *Rolling DRE ballots*

- Emphasize voter needs over administrative and vendor requirements. Ensure that default screen settings (type size, color use, contrast levels) are usable for the broadest range of voters as is reasonably possible.
- The process should be clear. Voters should always know where they are in the process. At the contest level, voters should know how to vote in a particular contest or question and know how many votes they have remaining in multi-selection contests.
- Ensure that screen settings for language choices, text size, contrast, and audio support are readily available and easy to change.

- Use simple language for all content. Studies show that clear and concise writing is beneficial to voters of all literacy levels. Rewriting ballot instructions and voter information materials using simple language increases usability and, on the voter's behalf, accuracy.
- Use color functionally to emphasize important information, highlight processes, and support usability needs. However, the use of color cannot be the sole means of conveying information or making distinctions. Some other noncolor mode such as contrast, icon, text style, etc., must complement the color. This is a mandatory VVSG requirement to address color blindness.
- Ensure that voters can review their voting record and change their votes from any point in the ballot.
- Ensure that voters can easily compare their on-screen voting record with their printed record. Provide redundant confirmations before a ballot is cast.
- Use upper- and lowercase *sans serif* type, set at a minimum of 25 points, for all ballot content voters will read. Given a choice between adequate type size and reducing the need to scroll lengthy referenda text, ballots with larger type were found to be more usable, even if voters needed to scroll. Avoid setting text in a centered alignment. Avoid setting text in all capital letters. Minimize the number of fonts used.
- Consideration should be given to candidate name order being rotated from precinct to precinct, so that all candidates will be listed first in roughly an equal number of precincts.
- Use instructional icons only. Universally recognized icons such as arrows are acceptable and encouraged (EAC 2007d)

E. Security

Voting system security has been the focus of considerable research. The EAC for example recommends that specific policies and procedures exist for monitoring each person with access to the voting system should exist. Examples of criteria to apply to voters who have access to the voting system include a clear definition exists of who exactly qualifies as a voter, a system in-place for maintaining a record of each voter (i.e., the registration system) and a record is maintained of each time the voter uses the voting system (EAC 2007e). Obviously, voters use the voting system only at a specified, well-defined time (i.e., in-person absentee voting, in-precinct voting, early voting, etc.). However, each voter must follow a well-defined and rigorously enforced procedure before he or she can use the voting system to cast a ballot (EAC 2007e).

Equally specific procedures should be developed for each person that has access to the voting system. This includes elections office staff, vendor personnel, and visitors. Moreover, positive identification of each person that requests access to the voting system should be required and a log of everyone that accesses the voting system should be maintained that includes the person's name, the date and time the access begins, the purpose of the access, and the time the access ends (2007e).

Securing the voting devices during in-person absentee and/or early voting is another aspect of voting system security. The EAC recommends, for instance that election agencies use the same procedures to prepare, test, deliver, and set up in-person absentee and/or early voting devices as those used to prepare, test, deliver, and set up voting devices that are used in the polling places on Election Day. Voting storage media should be placed in the same voting devices each morning and remove the media each night. These devices should be closed, sealed, and secured at the end of each day and placed in a tamper-proof location, preferably

within the election office. Numbers on all protective seals and public counters should be verified before the voting devices are used for voting the next morning (EAC 2006).

The EAC also has addressed several aspects of the security of a computer-based voting system and conclude that security is enhanced by a combination of four factors working in concert together. These include:

- Use of software should be limited to the very basic functions required to perform in the voting system's processes. In addition, the software should provide audit scripting to track sequence of events that occur on the system and, to the extent possible, identify person(s) that initiated the events. The software should also employ a sufficient level of encryption or validation protocol to limit changes made without proper authorization.

- Use well-defined, strictly enforced policies and procedures to control access to the voting system, the circumstances under which users can access the system, and functions users are allowed to perform on the system. Maintain strong custody control of all equipment, software, and key or control materials at all times.

- Use physical security and access logs. Physical security, including fences, walls, doors, locks, seals, and so forth, control and limit access to the system.

- Use a two-person accountability and control system. Access, control, and custody should always involve two or more personnel. This accountability independently verifies the honesty and integrity of the election procedures under any scrutiny (EAC 2007e)

F. Integrity of Voting Systems

According to the Tennessee Advisory Commission on Intergovernmental Relations (TACIR 2007), there is a possibility that the Help America Vote Act (HAVA) will be amended to implement voter verified paper audit trails (VVPAT) for the 2008 or 2012 presidential elections. Tennessee, for example, is one of twenty states that require; neither a voter verified paper audit trail (VVPAT), nor a routine post-election audit. Eight of those twenty states have VVPAT statewide, though it is not specifically required. Despite the concerns expressed by voters, only fifteen states require both, and fifteen more require some form of VVPAT, but no audit (TACIR 2007).

Both optical scan machines and DRE machines supplemented by DRE printers can produce a VVPAT. For both types of paper record balloting, the massive amount of paper that must be handled by poll workers raises security issues. For example, paper can be damaged, lost, mishandled, or stolen increasing the opportunity for legal challenges. Furthermore, both kinds of machines are subject to hacking and software tampering to change vote totals. But even so, paper trails reassure voters that their vote is being counted accurately and can be audited or recounted (TACIR 2007).

After reviewing what is known about voting machines, as well as practices in Tennessee and other states, TACIR (2007) suggests that election commission consider the following possible changes:

- Implement voter-verified paper audit trails statewide within a reasonable time frame. Studies have repeatedly shown that optical scan systems have lower up-front costs than DREs, but that ballot printing costs may make DREs the less expensive option if they remain in use beyond about twenty years.

- Adopt VVPAT that can be counted by hand, as well as by machine—machine tallies to support prompt reporting of results with hand counting for audit and recount purposes. Experience thus far with attaching printers to DREs has been unsatisfactory, mainly because of readability. Vendors are working on better systems, but they are still in the planning and experimental stages. If DRE printers are adopted, care should be taken to ensure that they will support hand counting.

- Adopt a standard for VVPAT that would meet federal guidelines under consideration.

- Request a review by the Election Assistance Commission to find out how much of Tennessee's remaining HAVA funds would be available to purchase new voting machines.

- Require voting machine vendors to escrow all of their proprietary software so that it can be reviewed by experts as recommended by the U.S. Election Assistance Commission and secured for further analysis if vote-counting problems should arise.

- Strengthen audit requirements to ensure that a random sample of machines is routinely tested by comparing hand counts to machine totals, and when results vary by more than a small percentage, that a broader recount process follows.

- Consider making early voting and voting by mail more accessible. Broadening the availability of both would reduce the pressure on polling places on Election Day, addressing one of the concerns of recent elections—long lines and long waits.

- Consider a Vote by Mail pilot program that would allow the state to assess the advantages and disadvantages of this type of voting in Tennessee

- Strengthen security and pre-test requirements and make them consistent for all voting systems.

- Consider Election Day parallel voting machine tests to detect hidden programs that are triggered by Election Day conditions and are erased so that they cannot be detected later.

G. Increasing Voter Participation & Controlling Election Costs

Several strategies have been employed to make the act of voting easier and more convenient for voters. Vote by Mail (VBM) elections can increase turnout by four to five percentage points in general elections and significantly more in local or off-year elections (Gronke and Miller 2007). Rather than sparking participation among citizens who never vote, it appears that the added convenience of voting by mail serves primarily to retain higher participation among those voters who tend to vote in general elections by making it easier for them to vote in traditionally lower-interest local, special, or nonpartisan elections (Common Cause 2008).

The purported benefits of mail balloting include a reduction in logistical problems associated with in-person voting on Election Day, a reduction in poll-worker requirements, increased opportunities to conduct voter mobilization, minimizing the appeal of last-minute attack ads, providing more time for voters to fill out their ballots, and the potential to save both time and money (Common Cause 2008).

Still another strategy that has the potential for increasing voter participation and reducing election costs involves replacing precinct-based voting with strategically located Vote Centers. A Vote Center is a polling place where any voter in a jurisdiction may go to vote; there is no wrong place to vote. Since the *Commission on Federal Election Reform* (also known as *The Carter-Baker Commission*) studied and supported the Vote Centers concept, the Vote Centers concept has gained popularity among election administrators nationwide (Rokita 2005).

As first developed in Larimer County, Colorado, Vote Centers utilize technology to allow counties to decrease the number of polling places and to allow voters greater flexibility in casting ballots on Election Day. A county, similar to Larimer County, Colorado with a population of 200,000 voters, for instance, likely would create one vote center per 7,500-10,000 active registered voters (Rokita 2005). The 20-30 Vote Center locations would be chosen based on accessibility and convenience for voters countywide. Churches, Shopping Centers, Hotels, and Government Buildings are locations commonly selected to house Vote Centers in Larimer County. In pioneering the use of vote centers, Larimer County has found that, "while the system has worked well . . . new rules for voting equipment have interacted with old, and seemingly unrelated, reporting requirements to cause continuing implementation issues (Doyle 2008: 800)."

The Vote Centers are wired (often temporarily) and connected by a secure T-1 line to the county election board office. The connections provide real-time access to the electronic poll book, thereby enabling election officials to ensure each person votes only once (Rokita 2005).

The obvious feature of Vote Centers that distinguishes them from traditional concepts of polling places is that voters may vote at any of the county's Vote Centers at any time while the polls are open. This is a benefit for many voters that live in one area of the county, but commute to another. A voter, for example, dropping children off at school could vote at the Center nearest the school. A voter working downtown could vote at the Courthouse on a lunch break. Voters are able to vote according to their schedules and lifestyles (Rokita 2005).

According to the *Center for Democracy and Election Management* (2007), Larimer County found that ninety-five percent of its 165,000 registered voters cast ballots in the 2004 election after the county switched to vote centers in 2003. As noted earlier, recent scholarly research on voter centers has concluded that they have a positive and significant effect on the individual's electoral participation (Stein and Greg Vonnahme 2006 and 2008).

Larimer County's operation also appears to have significantly reduced the number of workers required to man its polling places and reduce the average age of poll workers (Rokita 2005). Vote Centers help to reduce the cost of administering an election by reducing the number of polling places and the number of voting systems needed to run an election (particularly for those counties that use optical scan ballot card voting as their principal method of voting) (Rokita 2005). Presumably, the need to print and store large poll books is largely eliminated and time is saved following an election in terms of updating voter registration

records. These data would already have been entered at the polls and reliance on poll books would be unnecessary.

With fewer election workers, it is assumed, the cost of their services and meals (for the counties that provide them) will be decreased. Finally, the cost of making significant structural changes or buying additional accessible machines to comply with HAVA accessibility requirements will be less (Rokita 2005). In 2006, legislative proposals pertaining to vote centers were introduced in four states (California, Colorado, Indiana and Utah) and in 2007, legislative proposals dealing with vote centers were introduced in South Carolina, Tennessee, and Texas (Center for Democracy and Election Management 2007).

To help plan and implement a Vote Center concept, the Election Assistance Commission Administration has published several suggested best practices. In terms of the locating, inspecting and determining Vote Center sites, the EAC (2007f) recommends the following:

- Collect information about available locations by contacting area city halls and county building/ planning departments. Work to obtain access to existing GIS data base information to determine location, building capacity, parking availability and building contact information.
- Contact area city planning departments to review future use and zoning maps to determine where and what type of future growth is expected within the next election cycle. Periodically review new occupancy permits to assist with population density projections. For example, it is important to know when and where large apartment complexes are scheduled to be constructed as it may require additional polling places to efficiently serve the voters.
- Develop checklists and tool kits to facilitate the inspection of all possible locations and ensure compliance with the requirements of the *American with Disabilities Act* (ADA). Partner with your county building/planning department staff to assist with inspection responsibilities.
- Develop a working data base of all available locations within your jurisdiction in order to easily manage last minute polling place cancellations.
- Reach out to disabled community organizations and ask for their assistance in finding and securing accessible polling locations.
- Develop a written contract for the use of each building on Election Day. Be sure to provide the building manager a copy of the county's insurance policy information, and ask for a copy of theirs.
- Develop and distribute a uniform fee structure for use of the building. Some jurisdictions may provide the use of public buildings at no cost.
- Vote center and early voting locations are polling places where any voter in the jurisdiction can vote, and should be located close to major traffic arteries for easy access. Consider using places that have large parking areas and that people frequent
on a regular basis, i.e. libraries, recreational centers, malls, municipal/county buildings. Remember that these locations must also meet all applicable ADA requirements.
- Conduct a public hearing to gain input and approval of the vote center/early voting locations. Be sure to invite members of the major political parties.
- Consider merging the data collected on all possible locations with the county's Geographic Information System (GIS) computer system. By merging voter registration and "expected to vote" numbers by precinct with the GIS data, you are

able to visually locate buildings that are within close proximity to precincts/voters and with sufficient capacity to serve the number of voters expected on Election

In terms of polling place supplies preparation and distribution, the EAC (2007f) recommends that the jurisdiction:

- Partner with other county departments to support the delivery and pickup of voting equipment and supplies. When using delivery companies for equipment/supply distribution, be sure to include details about specific delivery requirements within your contract document. Examples include equipment packing needs and delivery deadlines. Consider awarding the contract to a company that has its own ability to develop a delivery routing plan based on information provided by the county office.
- Develop asset control procedures for all equipment and supplies. Utilize bar code technology to track distribution and return of equipment.
- Place laminated reminder cards throughout the poll worker supply kits to call attention to important tasks and/or responsibilities.
- Develop easy to follow checklists for use in opening and closing voting equipment.
- Train poll workers to operate in teams of two when opening and closing the equipment. One person should read the instructions and the other perform the task.
- Encourage poll workers to balance the number of voters checked in to number of voted ballots cast periodically throughout the day.

Further, the EAC (2007f) recommendations for staffing, training, and Election Day support of vote centers include:

- Develop a working knowledge of the telephone system and its capacity level. Utilize phone banks to distribute calls on Election Day, and make sure to have procedures and policies in place to protect the privacy of confidential information. Provide a separate phone number that is dedicated to polling place opening/closing calls from poll workers. A different phone number should handle all regular calls from the general public.
- Partner with area community college instructors to assist with development of a poll worker training course. Provide incentives to poll workers who complete the course. Ideas include: additional compensation and/or issue certificates of completion and lapel pins. Incorporate training on customer service and problem solving techniques in the poll worker training program.
- Assign field coordinators to regions containing 8-12 polling places on Election Day. The coordinators should receive additional training/certification. They should be trained to respond to trouble shooting calls in their region, and also to periodically visit their assigned polling places to assure that all locations are set up correctly and processing voters according to established procedures.
- Utilize early voting poll workers as Election Day supervising poll workers in the largest polling places or as regional field coordinators. They may bring knowledge and experience from working longer periods of time at the vote center/early voting locations.

The EAC (2007f) recommends the following facility management strategies:

- Consider coordinating the polling place setup process on Monday evening, prior to election morning. By completing some of the setup process the night before, poll

workers are relieved of some of the anxiety that they experience on Election morning. Request that poll workers call in and confirm the completion of their polling place setup the night before. This assures the Election Office that some of the procedures have been completed prior to Election morning.

- Develop a polling place layout design for each polling place. Train poll workers to use the approved layout when setting up their location on Election Day.
- Conduct a mock election utilizing the maximum number of check-in computers at all early voting and/or voter center locations. Utilize poll workers to staff the locations and as "mock voters".
- Monitor the computer server for capacity issues; determine how many voters can be processed within a certain period of time; and evaluate other line control and crowd management issues. Debrief the results of your mock election to determine the need for additional space, staff, and check-in computers.
- Determine how the county can implement a "Plan B" to divert voters to a different area for processing when the line extends beyond a defined point. For example, poll workers can provide a 3x5 card to the voter who is 100 feet back in the line. Place the time on the card and ask the voter to provide it to the computer check-in clerk who will also note the time. Collect these cards to evaluate customer wait time.

Finally, the EAC (2007f) suggests that election commissions consider the following voter education strategies in establishing Vote Centers:

- Implement a visible public relations campaign to inform voters of the various voting opportunities available to them. Incorporate information about early voting/vote center locations and hours of operations on all mailing pieces distributed.
- Recognize that voters are creatures of habit and keep the early voting/vote center locations and hours of operation consistent.
- Post informational signs at vote center/early voting locations to inform voters of how long their expected "wait time" will be at certain points in the line. Also provide information on alternative vote center/ early voting locations in the event that voters choose to leave and return at another time or place.
- Inform voters of when the peak voting times are and encourage them to avoid that day and/or time of day.
- Post a "polling place lookup and review the sample ballot" feature on the jurisdiction's Web site and publicize the commission's Web site address on all mailing pieces distributed.

VI. Stakeholder Involvement

A. Focus Groups

We conducted three focus groups (one in Knox County; one in Anderson County, one in Loudon County) to solicit input from public officials and active citizens on desired characteristics of a Convenience Voting system. The focus groups also helped us design and refine questions for the three-county telephone survey that followed. The focus groups were not recorded on audio or videotape. Project Director Amy Gibson attended all three sessions and took extensive notes. For each of the sessions, we have presented the questions posed by the moderator and have summarized the responses as a series of bullet points.

A1. Knox County. The Knox County focus group was held on October 15, 2007 on the University of Tennessee Campus. The meeting began at noon and concluded at 1:30 p.m. The Knox County focus group was led by Dr. John Scheb of the Howard H. Baker Center for Public Policy. Attending the meeting were research team members Dr. Amy Gibson, Project Director, and Dr. David Folz of the Howard H. Baker Center for Public Policy. The fifteen participants included five Election Commission officials or employees, three other city or county officials, a representative from the League of Women Voters, and six other highly active and attentive citizens. On a questionnaire distributed prior to the commencement of the discussion, all fifteen participants indicated that they vote "all the time." Thirteen of the fifteen indicated that they regularly participate in early voting. Ten indicated that they favor the concept of convenience voting; five were not sure.

 "Let's begin talking about the advantages and disadvantages of Convenience Voting Centers."
- There is a familiarity. People know where to go will vote.

- Some people already have concerns about early voting.

- The current system preserves a sense of community.

- What are the numbers as they relate to early voting and precinct voting?

- I sometimes will not vote in early voting and instead save my vote for the precinct so that someone shows up.

- If I did not work the election then my preference would be to vote in my precinct.

- I need a deadline, so having Election Day voting is important to me because I forget to go during early voting.

- Seems that what is positive for some is negative to others. Where my precinct is it is inconvenient. Something to think about is the transitory nature of our community. People move a round a lot and it take s while for people to know and learn where there precinct is, so I think it is best to have a convenience model.

- For a lot of people they can walk to vote and we should think about this in relation to developing a pedestrian friendly community.

- Seems like the status quo could be best for all.

- It could be harder for candidates in districts because they will then have to travel all over the community to meet with constituents.

- Except for candidates that are county wide.

- (How many people have actually walked and stopped and talked to people on the way to the polls?). 3 of 20ish

"What about turnout. What would be the impact?"

- Will probably be negligible.   What makes people vote are issues and candidates and not whether voting is convenient. The impact could be negative if it keeps people from voting. Other factors in turnout are greater.

- Well, sure, but it will help if people are not being turned away from a precinct. It could not hurt.

- Could it change the demographic, e.g. more republican or democrat?

- Are people that are less mobile taking advantage of early voting?

- Maybe, but it is still best for a transitory community.

"How would this be accomplished?"

- Currently there are 6 early voting centers. The idea would be 9 convenience voting centers (1 per commission district). Maybe 15-18 max.

- How does this impact state representatives?

"Think about types of locations and centers."

- Needs to be a public space where lots of people gather.

- Where people are going for other reasons.

- Seems that in the short run the people that are affluent will gain more but the long term it will even out.

- Needs to be accessible. Maybe churches, but is there is not an issue of separation of church and state?

- What about a mobile voter unit?

- That is a great idea. You could go to nursing homes and other places.

How many people think a mobile unit is s good idea?

- A large majority raised their hands.

- If you had one of those you would need to be careful where you went so that it was not going into more republican or more democrat areas. And be careful in churches because some preachers will sit in the pulpit and advocate certain ideas and candidates.

- No kidding. A preacher says to vote this way and then says by the way the mobile unit is outside.

"What is your ideal location? Let's go around the room."

- Wal-Mart

- School, Bearden middle

- Rocky Hill Elementary

- South Knox community center

- East Town Mall

- Court house

- Market Square

- East Port school

- Five Points area

- Kroger on Broadway

- Court house

- Farragut middle

- Market Square

"What do you think are the best days and hours of operation?"

- Early voting through Election Day.

- A 10 day voting center that ends on Election Day and assuming 20 voting centers.

- Begin at 7:30 in the morning and have a couple of days with extended hours that go until midnight.

- Depends on the type of election. Might be different for a presidential election than a local election.

- Retail places are discovering the benefit of 24 hour shopping and that there are real advantages, so perhaps voting would follow.

- What about election by mail? And no-excuse absentee. That is a real issue and would help with voter turnout.

- They have same day registration in New Hampshire.

- Well, have to be careful. What if I say, here is $5, fill out the ballot and I will mail it for you.

- The fraud potential seems more likely. But I guess there is fraud in all systems.

- The long-term vision will be the unmanned kiosk and you use your thumbprint to access and vote.

- There needs to be an explanation tool. How does it physically happen and how do you prevent fraud.

- Convenience voting does not get at voter apathy, so I am not sure we are really addressing the bigger issue.

- Yes, exactly.

- Convenience voting decreases costs and increases security. Keeping elections safe and sound you will increase retention of workers. They will retain knowledge and that is a big deal in securing elections.

- You probably need to segment the surveys into likely and non-likely voters.

- For new people to the community, the precinct voting system matches your neighborhood and the people that represent you. So, when you are creating convenience voting you need to address this.

- Seems the goal of convenience model is threefold: higher voter turnout; decreasing costs of elections; increasing security of elections.

- We need to think about the relationship between convenient voting and the transitory nature of our community.

- Four of five election commissioners must approve sites in order to become a site to ensure that convenience voting does not become a political football.

- No matter where you live you can already go to early voting.

- Are we throwing away a good system, we have both. We have early voting which is convenience voting and precinct voting. That satisfies everyone. Are we decreasing choice and voter turnout by replacing precincts?

- How do you cater to the people who like precinct voting?

- Would people be less likely to vote if you change the location?

- People are creatures of habit and need consistency in hours and place.

- How does the actual change happen? Who votes the change?

- Changes by the people—the legislature and then the people vote.

- And counties can opt in or opt out. Just because passes the legislature does not mean that counties are forced to participate.

A2. Anderson County. The Anderson County focus group was held on October 16, 2007 at noon at the UT outreach building in Oak Ridge. The session was moderated by Dr. Michael Fitzgerald of the Howard H. Baker, Jr. Center for Public Policy. Project Director Amy Gibson also attended and took notes. Sixteen active citizens participated in the focus group, including three election officials or employees, three other local officials, and two local party chairs. All sixteen participants indicated that they vote "all the time." Twelve indicated that they regularly participate in early voting. Eleven indicated support for the concept of convenience voting; five were not sure.

"Let's begin with the advantages and disadvantages of the current system of precinct-based voting."

- People are used to going down the street to vote. They know where to go.

- In spite of great PR, people will still show up at precincts to vote and will wonder why they can't vote there.

- Early voting closes and then there is a gap between that and Election Day. Convenience voting fixes that and will help people decide how to vote and who to vote for. So many people make up their mind when they are standing in line and when you have a gap then it allows people more time to think about who to vote for.

- Precinct voting is confusing. Convenience makes it easier to vote.

- It is not confusing. Actually people are accustomed to going, especially older people as they know where to go and if you change it then you could reduce voter turnout.

- It may decrease initially, but people will learn and overall it is good because it decreases costs.

- Parking is always an issue. Make sure and address that.

- There are a huge number of retirees in this community. What do you perceive to be the impact on them?

- You have a lot of seniors who want to go to a physical and known place and then you have younger people who want mail or internet voting. As you think about this you need to account for different kinds of voters.

- How to you verify signatures if you vote via internet?

- My initial though was put voting in a convenience store, like a convenience market, so make sure you define what you mean.

- The challenge is finding locations.

"OK, so where?"

- Bank

- Grocery Store

- Where people gather.

- Schools, although one issue with the schools increasingly is security, i.e. who is coming in to them.

- Churches

- No, you have separation of church and state issues.

- Malls

- Model it after early voting

- Wal-Mart

- Somewhere where you would not have crowd

- You will likely always have crowds. The last 4 days, lines are very long.

- Sometimes they make it hard to vote. Winter elections are bad. Why go outside?

- If you have to stand in line for 10 minutes or more then no matter what the location, it is not convenient.

- Why aren't we voting on Sunday? It is the "deadest" day of the week.

- Best hours would be before and after work.

- I think 11-8. People vote either at lunch or after work.

- What does before work mean? To some, before work is at 6.

- Are there stats that say that convenience voting actually increases turnout?

- We have about 1 voting center for every 20,000 people.

- I think the whole thing will change the way people vote not the number of votes.

- Older people don't want change. So, changing the location could decrease voting and it is the older people that vote.

- If you change the precinct you ill decrease turnout and people will be afraid of going to the wrong place and not knowing what to do.

- But if we anticipate that people will be afraid and then target the message to them…

- Certain groups because of uncertainty will still not go.

- People won't wait in line and if the candidate is bad then people won't cote and convenience won't matter.

- You have both already. You have precinct and you have early voting. That is convenience voting.

- If published the right way, it is an advantage. On Saturday people sleep in. We should not be open on Saturday morning. Change the hours.

- Good idea, but it is not going to increase votes.

- I agree.

- If make it easier then better for the people and that is what it is all about.

- But for some, it is already easy.

- Would it matter if the issue was marketed as a cost savings thing?

- Yes, maybe.

- Just think that change will create trouble. Look at direct mail as a marketing tool in general. It does not work. People throw it in the garbage.

"What about mobile voting?"

- Great idea and in that case you might actually increase voting.

- Yes, but parties get involved and will say that you tracked more miles in the Democratic area than the Republican area.

- But it will increase votes.

- Bottom line, any change will be open to criticism.

- No advantage either way. I like the idea if it saves money but it won't increase votes.

- You may see a drop in votes initially, but over time it will balance out.

- It is less confusing.

- People don't vote because of apathy or they don't think voting matters.

- It is not an issue of increasing votes; rather it is about preserving tradition and pride. You see friends at precincts and it is just the way it should be.

- But all those people are voting early now. About 51% or more vote early so that reaction is not as entrenched as you think.

- Votes on wheels is great. It is high visibility. You could drive to Wal-Mart with a big sign that says vote here. It would be great. You very well may increase votes. But that should be in addition to the system and not instead of precinct voting as a whole. Don't get rid of it all. Maybe just target some precincts.

- Mobile unit would make me more apt to vote.

- If could vote at Wal-Mart then that would help and it would be huge. People already go there. The foot traffics would be great.

"How long are you willing to stand in line?"

- Six to ten minutes.

"Is it important to vote in the same place?" {Majority says no.}

"Would it be good to use existing buildings and make sure that once convenience centers are selected that they stay the same year after year."

- It is more than convenience; I want to make sure that my vote is secure. Does convenience mean security?

- How can I make sure that my vote is counted? Where is the paper trail?

- If convenience center then you max the number of machines available, so there are shorter lines and fewer poll workers- select the best workers.

- Is it that hard to get poll workers?

- Yes.

- Do you have to have an equal number of machines at each center? If there were different numbers of machines at different places then would it be biased or perceived as biased?

- And what about same day registration?

- What about every 8 years when the state judges are on the ballot- that will cause a time problem.

- How does the disabilities act affect location and the number of machines at each place?

- What about the boundary restriction around a mobile unit. You might end up seeing a caravan of candidates following the mobile unit. Candidates would be running people off the road.

A3. Loudon County. The Loudon County focus group was held on October 17, 2007 at noon at the Loudon County government building. Te session was led by Dr. John Scheb of the Howard H. Baker, Jr. Center for Public Policy. Project Director Amy Gibson also attended and took notes. Ten active citizens participated in the focus group, including three local officials. Nine indicated that they vote "all the time" while one said "most of the time." Nine also indicated that they participated regularly in early voting. Eight indicated initial support for convenience voting; one was not sure.

 "Let's begin by talking about the advantages and disadvantages of the current system of precinct-based voting in Loudon County."

- Fourteen precincts at $25,000 a year is a lot. That is ¼ of our budget and if we have a 3 election cycle then that is a major part of our budget.

- Ninety percent of the problems we have with elections are people going to the wrong precinct.

- I work at a small precinct- you have to have a cell phone. During a presidential election we still had 200 people in a tiny room. It is a neighborhood precinct- everyone knows each other.

- Problems in elections in Loudon are different than on Knoxville because we are different and smaller community.

- Voting precincts preserves that community. It is like a family reunion.

- No, we got funerals for that.

- Right, voting is different. You have die hard voters that will vote period no matter where they have to go.

- Loudon is among highest in the state for early voting. In excess of 51% in presidential election voted and of that 70% voted early.   In Knox it was 60%.

- Are there statistics on early voting and whether there is higher turnout?

- Not so much. Research suggests that convenience centers make it easier for people who will vote anyway. There may be a slight up-take but not much.

- Are people who are early voting newer to the community, younger or more affluent?

- In Loudon you have the anomaly- the "geezer ghetto" of Tellico village. They vote early and they will wait. 85% vote in Tellico village.

- If you do the convenience thing you need to have the personnel- the horses to drive it. Can you offer multiple days and times?

"In general what is your attitude toward getting rid of precinct voting and doing convenience voting only? Let's begin with a show of hands. How many people would favor going to some form of convenience voting?" {Eleven of thirteen participants raised their hands to indicate a positive response.}

- Use the heavily used places in the precincts as centers and you are not really getting rid of precinct voting.

- Is this cafeteria style a nightmare of record keeping?

- No, it is all connected by computer it is all networked.

- Isn't precinct voting already convenient voting as in you took the voting close to the people only now you can go to "any precinct."

- Heaviest day is the last day of voting. The last three days you may need to have more than 1 center per commission district.

- The model would be that they would have a rolling opening of convenience centers, some would be open for a few days and as it gets later then more open.

"What about a mobile voting unit?"

- They had one at Tellico Village-88% voted and 75% of them voted early.

- I think we need flex voting. See when the heavy times are that people vote and then you just go to different places during the day.

- There are different needs for different types of elections.

"If it were totally up to you, where would you vote? What is the most convenient location for you personally?"

- Wal-Mart- has good parking and is handicapped accessible.

- Some sort of food center- people will eventually go there within 2 weeks.

- Current precinct- community center

- Wal-Mart

- School

- Tellico Village church

- Current early voting center

- Roane state Community College

- Roane state

"What about days and times?"

- Two weeks and all day Saturday.

- Early voting is 15 days and closer 3 days then opens on Election Day. Saturday is the lowest day for turnout.

- Actually it is busy in the morning and then slow.

- When it is open later, people line up.

- 4:00 is way too early to close.

- If anything, 2 weeks is too much. I say 10 days.

- If I have to make a tri to vote then it is not convenient. Convenience voting is when I am already out or already here and look I can vote. 2 weeks is good. Everyone within 2 weeks will go to a voting center.

- In Glendale 34 % of them voted early meaning that they had to drive into to town to vote. That is huge and had a huge impact on the election.

- Early voting impacts younger voters.

- Yep, kids will go to Wal-Mart and buy a CD and will vote.

- Kids are less community minded- their community boundaries are bigger. It is their phone list. Who is on their My-Space page.

- So kids will probably vote in convenience centers

- The mail box is the biggest possibility for fraud.

- What about people who pick up folks and take them to vote?

- Biggest thing is that you can go anywhere.

- My wife did not vote because she did not get off of work at 5:00.

- Needs to be open until 9:00; 7-9 because you have shifts of people- the morning before work folks, and the lunch people and the work people.

- Eight is late enough. Others agree.

"How many think 8 p.m. is late enough?" {Majority gave affirmative response.}

"How about 7:00?" {Again, majority gave affirmative response.}

- If you can vote late then you don't need the early shift. Even Wal-Mart is closed until 10 or so. So, you could have 10 to 7 or 8.

- I think 8 to 8. And if so then it reduces the number of days to be open because people are on a schedule and they don't need 2 weeks of 8 to 8 to go vote.

- Last three days have extended hours.

"What about Sunday?"

- Maybe Knoxville but not Loudon. You are too far in the Bible belt. Unless you set up at the cracker barrel and then you'd have folks asking the preacher to go early so you could vote and eat before other folks got out of church.

- Saturday is busy for folks, but you have to make voting important. You have to want to vote.

- Do you think businesses will be miffed because you are setting up at Wal-Mart? That you are taking a voting center to a business that will benefit and profit from the foot traffic? You have mom and pop stores that are already being squeezed out and then

you add in that Wal-Mart gets a voting center… maybe setting up at a business is an issue. The mobile center does not have that issue.

- Maybe not set it up in the store but near it. Near a Wal-Mart.

- And think about parking, rest rooms and weather. And you have to have internet at all the sites.

- Wireless is not an issue.

- Ultimate convenience is on-line voting.

- Seniors are not going to vote on-line.

- Think about the last 15 minutes of voting and think about the number of people who are at the wrong precinct. It is more than you think and if they are there during the last 15 minutes, then they have no option to vote.

A4. Impressions from Focus Groups.

Participants in the focus groups manifested a high level of receptivity towards the concept abolishing precinct-based voting in favor of convenience voting. However, for the most part they did not appear personally concerned about the problem of voter inconvenience, whether associated with the current system or a revamped system. Perhaps this was due to the fact that the focus group participants were not typical voters; they were officials, leaders and highly active citizens. These individuals are likely to vote regardless of inconvenience. However, most did recognize the need to make voting more convenient for the average voter. There were few concerns that convenience voting might marginalize certain groups. There was some expression of concern about security and the potential for voter fraud, but election officials in attendance allayed these fears by explaining security procedures and the technology that would be employed under convenience voting. There were varied opinions and suggestions with respect to the locations of voting centers and the days and times that they should operate. Clearly, such questions are better addressed via general population surveys.

B. Public Opinion Survey Findings: Pre-election Survey Results of Registered Voters in Anderson, Knox and Loudon Counties

The purpose of the pre-election survey of registered voters is to ascertain what voters in Anderson, Knox and Loudon counties think about the idea of establishing voting centers to replace precinct-based voting and to determine what voters' preferences are with respect to the various attributes, features and characteristics of county Convenience Voting Centers, the voting experience itself and various ideas for changing how voters may exercise the franchise. The sections of this report summarize findings related to: what voters in each county think is important about the location the Voting Centers, the features of a Voting Center, voting preferences and behaviors, early voting behavior and opinions about that experience, opinions on various ideas that involve changes in voting regulations, intended and actual voting behavior, and respondents' attributes and background characteristics.

B1. Survey Methodology

Trained personnel using a Ci3 Computer-Assisted Telephone Interviewing (CATI) system at the University of Tennessee Social Science Research Institute (SSRI) and samples of working residential telephone numbers obtained from Genesys employed Random Digit Dialing to reach a sample of registered voters in Anderson, Knox and Loudon counties. The goal was to complete at least 400 interviews with registered voters in each county.

During the period November 11–30, 2007, a total of 401 interviews were completed with registered voters in Anderson County; 400 interviews were completed with registered voters in Knox County; and 404 interviews were completed with registered voters in Loudon County. Based on county election commission figures for 2007, Anderson, Knox and Loudon counties had approximately 44,000, 219,000 and 25,000 registered voters, respectively. At the 95% confidence interval, the margin of error for the Anderson County random sample is ± 4.99, for Knox County it is ± 5.0 and for Loudon County it is ± 4.97.

B2. Opinion on Establishing Voting Centers

To determine whether registered voters opposed, neither opposed or favored, or favored the idea of replacing polling places in each precinct with Voting Centers that would be more centrally located in each area of a county, an introductory statement was read to each respondent that explained the proposal in the following way:

> *Today, if a person chooses to vote on Election Day, they can vote only at the designated polling place in the precinct where they live. Some say that this precinct system is expensive to operate and sometimes confusing to voters who do not know in which precinct they are supposed to cast their ballots. Some people have suggested that this precinct voting system should be eliminated and replaced by Voting Centers in each area of a county that would operate during the twenty days prior to and through Election Day. Like Early Voting, registered voters could vote at any county Voting Center. All Voting Centers would be connected by computer that would instantly update voter activity and prevent anyone from voting more than once in an election. In general, what do you think of this idea of replacing polling places in each precinct with Voting Centers that are more centrally located in each area of a county? Would you say that you: oppose, neither oppose nor favor, or favor this idea?*

As indicated in Figure 3, the largest proportion of respondents in each county favored the idea of replacing polling places in each precinct with Voting Centers more centrally located in each area of a county. Almost half of registered voters in Anderson and Loudon counties favored this proposal while over half (53%) of registered voters in Knox County indicated that they favored this idea (also see Table B1 in Appendix B).[4] This level of support is uniform across all attribute characteristics of respondents with the exception of females who are somewhat more likely than males to favor voting centers.

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[4] All tables showing survey results are compiled in Appendix B.

Figure 3. Opinion on Replacing Precinct Polling with Voting Centers (in percents)
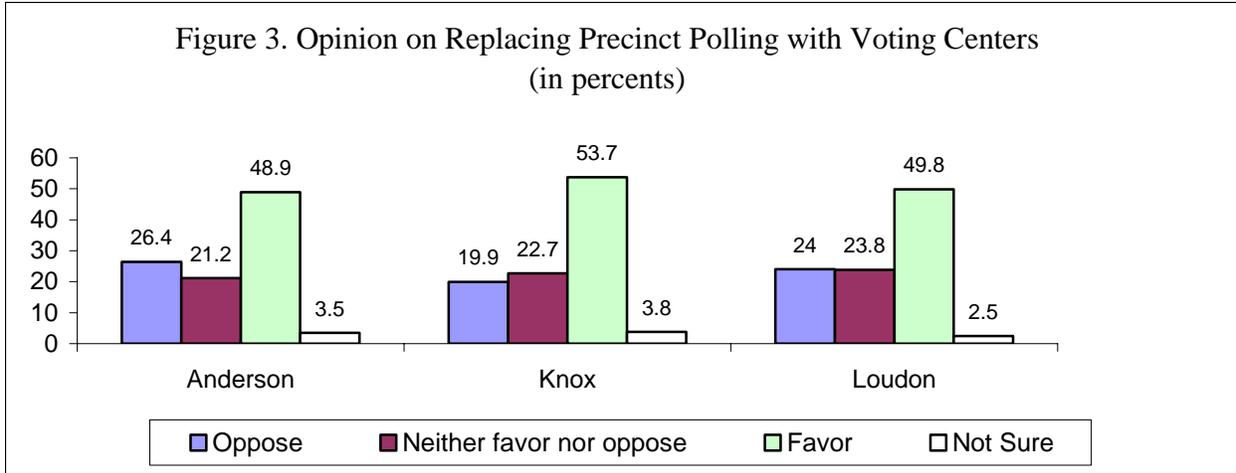
A partially closed-ended question explored the reasons why about 23.8% of registered voters, on average, opposed the Voting Center idea. Among the choices offered for why a respondent might oppose this idea, the one selected most frequently related to the prospect that it might cause confusion among voters. However, the largest proportion of those who opposed the Voting Center idea had in mind an "other" unspecified reason for opposing it (see Table B2).

Likewise, a partially closed-ended question explored the reasons why about half of registered voters favored the idea of establishing County Voting Centers. The most frequently cited reason (by 40.8% of registered voters) was that they thought Voting Centers would be more convenient for voters. The reason cited next most frequently (by 24.1% of all respondents) was that they thought that it would increase voter participation (see Table B3).

B3. Location Preferences for Convenience Voting Centers

As indicated in Figure 4, about three-fourths of voters in each county thought that the most convenient location for a Voting Center would be "closer to home." This was the top choice among 72.6% of voters in Anderson County, 75.3% in Knox County and 73.9% in Loudon County. The next most frequently cited location (a distance second) was "closer to work." This choice was selected by just 10.1% of voters in Knox County, 8.8% in Anderson County and 7.0% in Loudon County. Smaller proportions of voters in each county thought that other locations would be most convenient for a Voting Center.

Figure 4. Most Convenient Location for a Voting Center
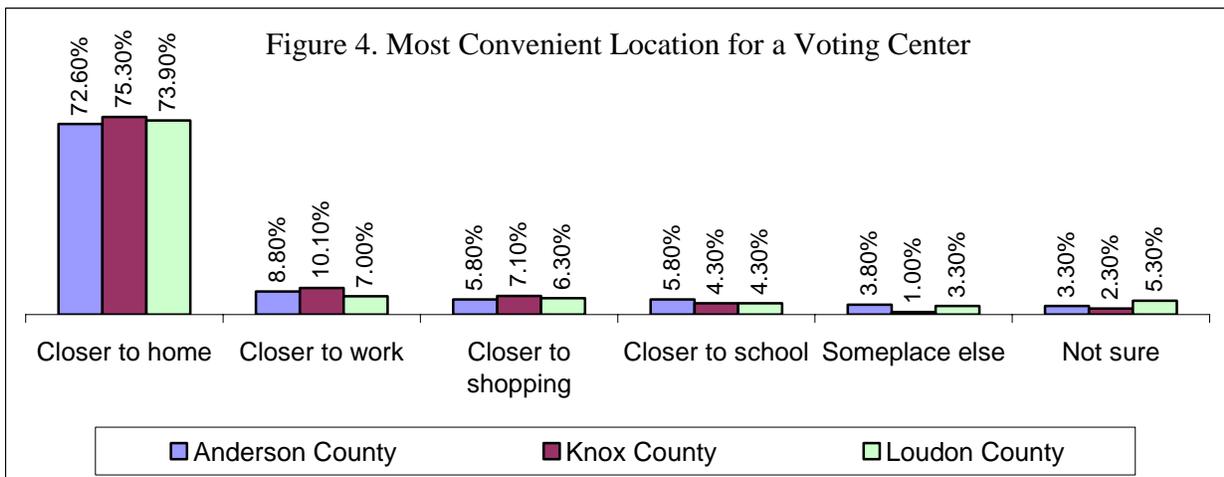
Registered voters were asked in an open-ended question how far, in miles, they would be willing to travel (from the respondent's answer in Table B4) to vote at a Voting Center if their county established these facilities. Figure 5 shows the median maximum distance, in miles, that voters in each county are willing to travel to vote at a Voting Center. Voters in Anderson and Knox counties are willing to travel a median distance of 5.0 miles while voters in Loudon County are willing to travel a median distance of 6.5 miles to vote in a Voting Center. The mean distance voters are willing to travel to a Voting Center is 7.93 miles in Anderson County, 7.92 miles in Knox County and 10.09 miles in Loudon County (see Table B5).

Figure 5. Maximum Median Miles Willing to Travel to a Voting Center
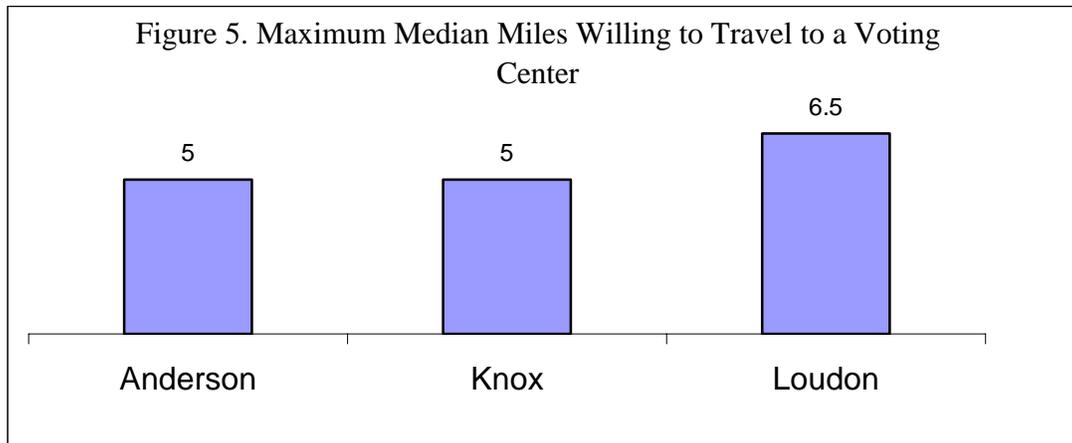
Similarly, voters were asked in an open-ended question to indicate "what would be the maximum amount of time, in minutes, that you would be willing to travel (from the respondent's answer in Table B4) to vote at a Voting Center if their county established these facilities. Figure 6 shows that the maximum median number of minutes of travel time for voters in each county is 15 minutes. The means for the number of minutes that voters in each county are willing to travel to a Voting Center are also similar. For Anderson County, the mean is 20.04 minutes, for Knox County it is 20.10 minutes and for Loudon County it is 22.83 minutes (also see Table B6).

Figure 6. Maximum Median Minutes Voters are Willing to Travel to Vote at Voting Center
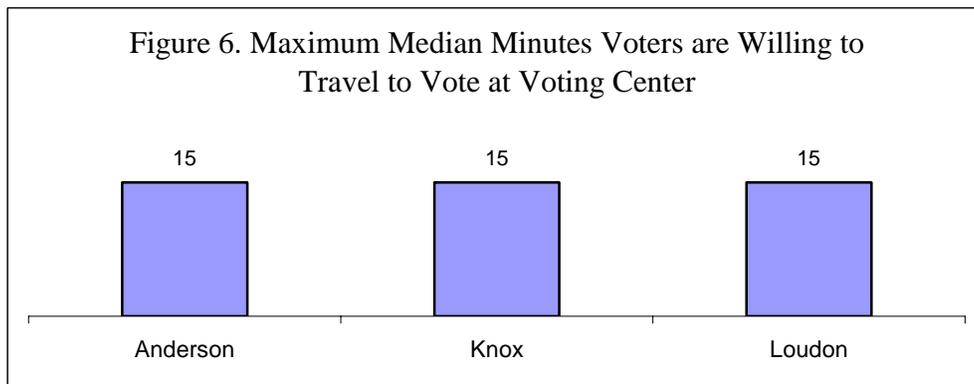
Another indicator of voters' willingness to travel to vote at a Voting Center is how far they are willing to deviate from their regular travel routes to vote at a Voting Center if these facilities were established in their respective counties. Voters in each county were asked to specify the

maximum distance, in miles, that they would be willing to deviate from their regular travel routes to vote at a Voting Center. Although the mean difference among counties is not statistically significant, Figure 7 shows that voters in Anderson and Knox County are willing to deviate shorter distances than are voters in Loudon County. The median and modal value for each county is 5.0 miles (also see Table B7).

Figure 7. Maximum Distance, in Miles, Willing to Deviate From Regular Travel Routes to Vote at Voting Center

7.84	7.55	9.02
Anderson	Knox	Loudon
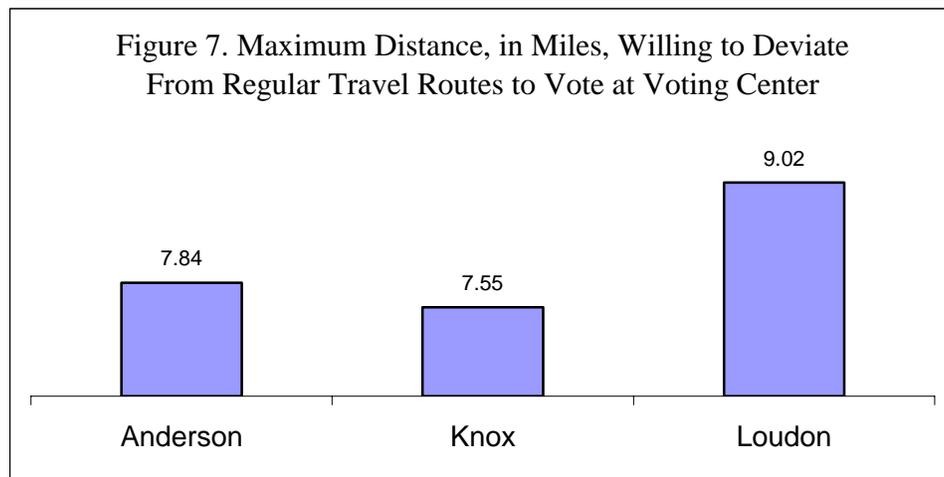
B4. The Importance of Various Voting Center Features

Respondents were asked a series of questions about the importance of various features of a Voting Center that they may use in the future. These concerned having a Voting Center within walking distance, the ease of finding a parking place close to the Voting Center's entrance, the ease of vehicle ingress and egress to the Voting Center parking lot, the Voting Center's hours of operation, the amount of time one would have to stand in line to cast a ballot at a Voting Center, and the location of the Voting Center near the respondent's work, home or school. Tables B8 through B13 report the distribution of responses to questions about the importance of each of these features.

The findings indicate that having a Voting Center within walking distance is very important or important for only about a fourth of respondents in each county and that this feature is not important at all for more than three-fifths of registered voters in each county (see Table B8).

Conversely, more than three-fifths of registered voters think that it is very important or important to be able to find a parking place close to the entrance of a Voting Center. This feature is not important at all for less than one-fifth of respondents (see Table B9).

Similarly, more than two-thirds of respondents, on average, think that the ease of ingress and egress from the parking lot of a Voting Center onto a highway is a very important or important feature for a prospective Voting Center. This feature is not important at all for less than one-fifth of voters (see Table B10).

The feature that garnered the highest frequency of very important or important responses concerned the hours of operation of a Voting Center. In each county, about three-fourths of respondents rated this feature as either very important or important (see Table B11).

The Voting Center attribute that garnered the second highest frequency of very important or important responses from registered voters concerned the amount of time that a voter has to stand in line at a Voting Center to cast a ballot. About 70% of voters in each county considered this to be a very important or important consideration in a Voting Center that they might want to use (see Table B12).

Finally, the location of a Voting Center near the respondent's work, home or school was considered to be very important or important for just under two-thirds of voters, on average in each county. In fact, more than 85% of respondents in the three counties considered this feature to be at least somewhat important (see Table B13).

B5. Voting Preferences and Behavior

Registered voters in the three counties were asked which time of the day is most convenient for them to vote. The findings, summarized in Figure 8, show that the time considered to be most convenient for the majority of respondents (about 83%) is sometime between 8:00am to 7:30pm. However, among all three counties, 11% of voters consider early morning (before 8:00a.m.) to be the most convenient to vote while for another six percent, on average, evenings after 7:30pm are the most convenient (also see Table B14).

Figure 8. Most Convenient Time of Day to Vote
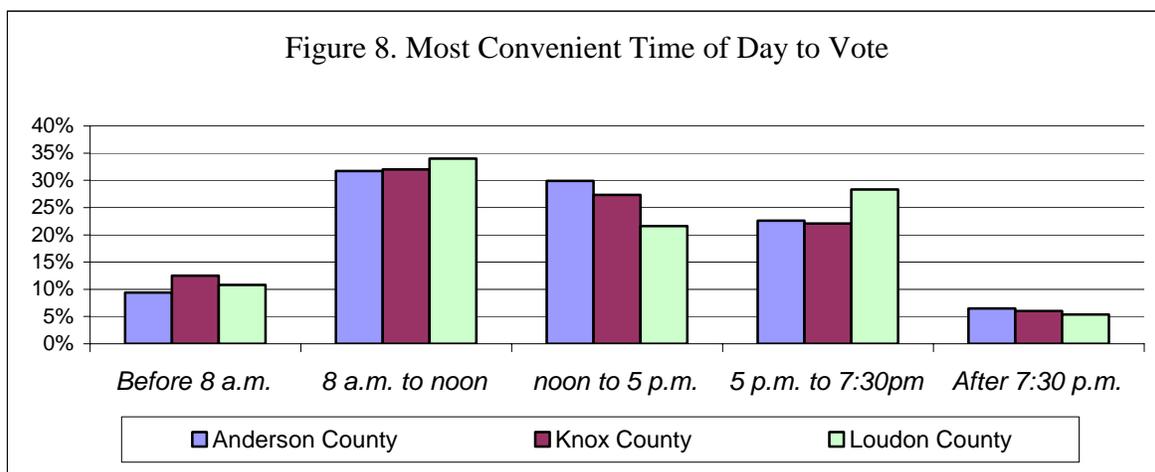
The maximum amount of time that respondents indicate that they are willing to stand in line to wait to vote, after which they might turn around and leave the polling place is 30 minutes, the modal response by voters in each county (see Table B15). On the other hand, when asked how long the respondent usually has to stand in line to vote where the individual usually casts their ballot, the median and modal responses were ten minutes, except in Loudon County where the modal response was five minutes (see Table B16). The average amount of time that voters in all three counties report as the usual amount of time that they have to stand in line to vote where they case their ballot is just over 14 minutes.

When voters leave work, home, school or some other place to go to vote, the average number of miles that they report having to travel to the place where they cast their ballot is less than four miles. As indicated in Figure 9, voters in Anderson County have the shortest trip while voters in Loudon County average the longest trip to the place where they usually cast their ballot (also see Table B17).

Figure 9. Average Miles Traveled to Polling Place
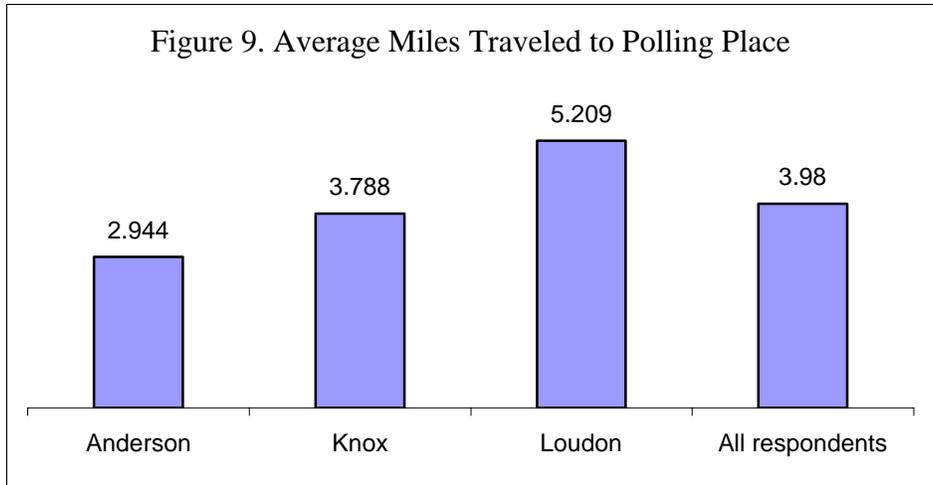
In terms of the actual travel time from work, home, school or some other place to the location where the respondent usually votes, the mean reported time it takes for this trip is 8.70 minutes. The modal time for all counties is five minutes and the median travel time for voters in Anderson County also is five minutes. For voters in Knox County, the median travel time is 5.5 minutes and for voters in Loudon County, the median travel time is 10 minutes. (See Table B18).

B6. Early Voting Behavior and Experience

On average, about 54% of voters in all three counties report that they voted during the early voting period in the last election in which they participated. Just over half of voters (50.3%) in Anderson County participated in early voting while 55.5% of Knox County voters and 55.9% of Loudon County voters report that they participated in early voting (see Table B19).

Respondents were asked to think about the early voting place where they last voted and to rate its convenience in terms of the features most important to the respondent. The findings in Figure 10 indicate that more than two-thirds (68.1%) of voters in each county who voted early in the last election in which they participate, thought that the early voting polling place that they used was Very Convenient. Only very small proportions reported that the early voting polling place that they used was somewhat or very inconvenient with the largest proportion (9.5%) of these responses from voters in Knox County (also see Table B20).

Figure 10. Rating of the Convenience of the
Early Voting Polling Place Last Used (N=648)
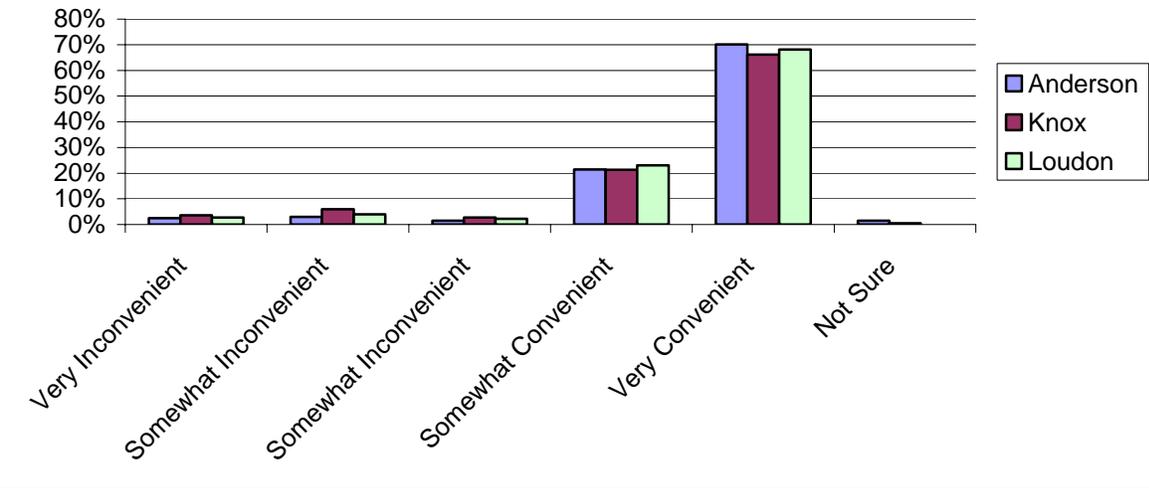
B7. Opinions on Ideas for Possible Changes in Voting Regulations

Respondents were asked their opinions about several ideas involving changes to the conditions or circumstances under which voters may participate in elections. Voters were asked what they thought about the idea of having a mobile voting unit that would visit different locations around a voter's county with advance publicity of its schedule. As Figure 11 shows, respondents' opinions about whether this was a bad or good idea or whether they had any opinion at all were split. Just a slim plurality of voters in each county thought that his was a good idea (also see Table B21).

Figure 11. Opinion on Mobile Voting Units
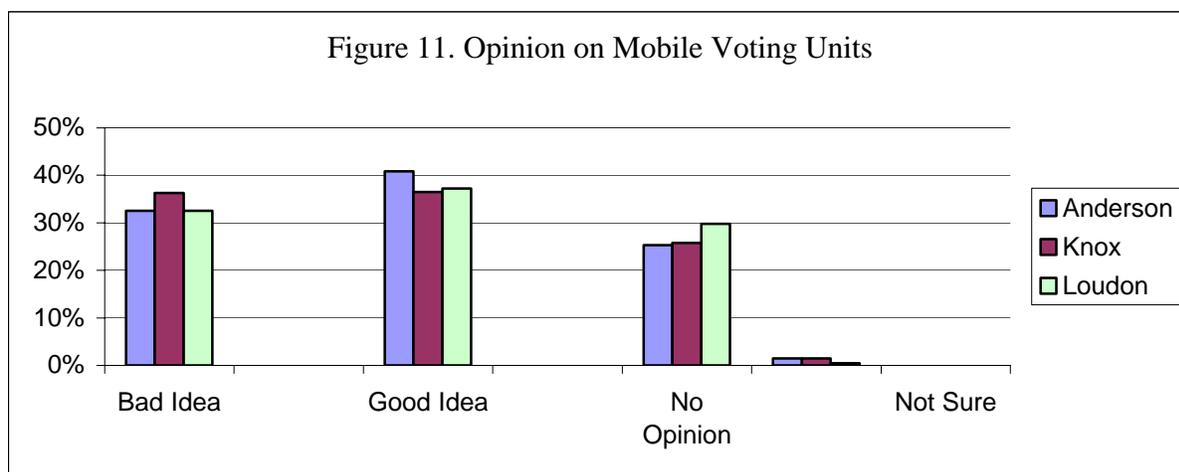
Analyses indicates that among those respondents who have an opinion on this idea, those who have lower incomes and are liberal, Democrat, and female are statistically more likely to think that mobile voting units are a good idea. Conversely, those with higher incomes and who are conservative, republican and male are statistically more likely to think that mobile voting units are a bad idea.

Respondents were also asked what their opinion was about the idea of having polling places open on Sundays. As Figure 12 indicates, large majorities of voters in each county thought that this was a bad idea. Those who identified themselves as conservative and republican were statistically most likely to think having polling places open on Sundays was a bad idea (also see Table B22).

Figure 12. Having Polling Places Open on Sundays
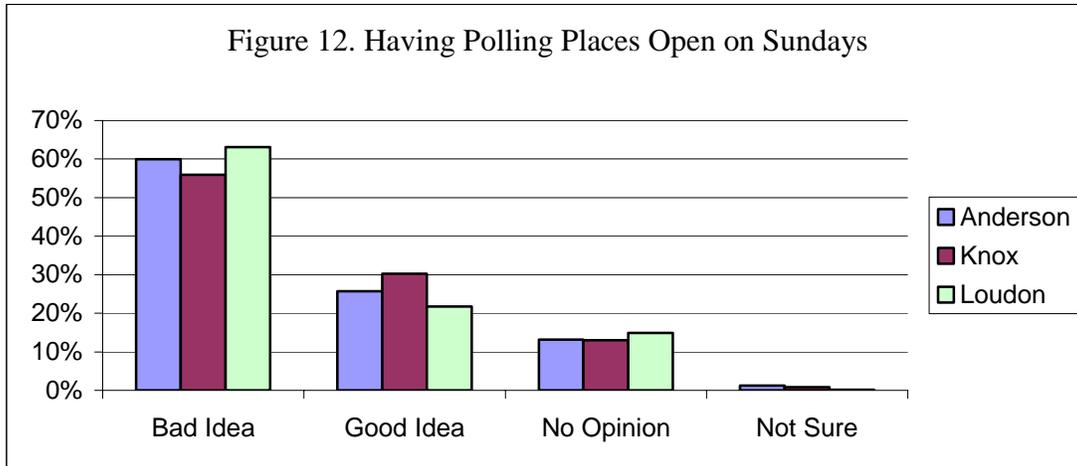
Another idea implemented in some states to enhance the convenience of voting is "no-excuse" absentee voting. This process allows registered voters to request an absentee ballot for any reason but requires that the voter's signature on the mailed-in ballots be compared with the voter's signature on file with the election commission. The signatures must match before vote is counted in an election. As shown in Figure 13, a plurality of voters in each county thinks that this is a good idea (also see Table B23).

Figure 13. Opinions on "No Excuse" Absentee Voting in Tennessee
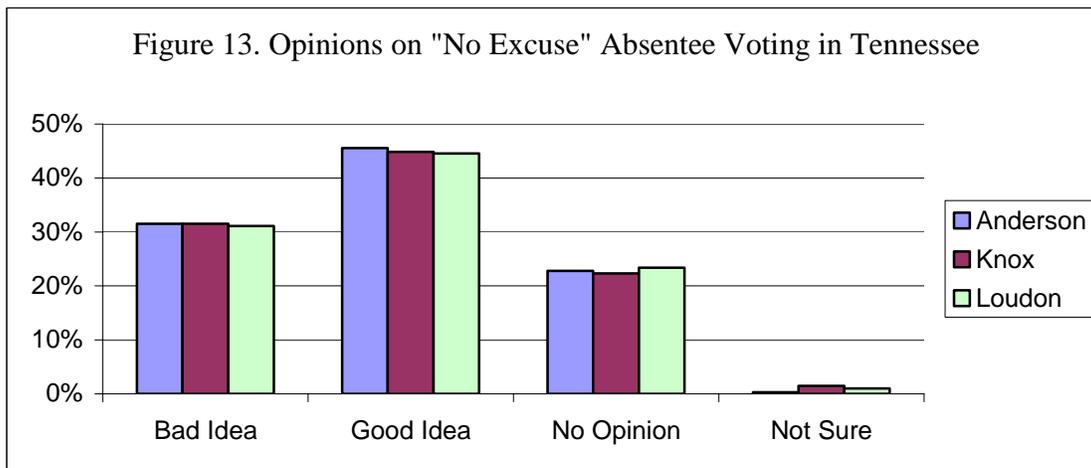
Analyses of the response to this question and respondent attributes indicates that conservatives, males and those with higher incomes are more likely to think that no excuse absentee balloting is a bad idea while liberals, females and those with lower incomes are more likely to think that no excuse absentee balloting is a good idea.

Finally, respondents were asked how important it was to them that they have access to public transit in order to get to a polling place. While large majorities of respondents in each county (about three-quarters) indicated that having public transit was not very important for getting to a polling place, 26.3% of respondents in Anderson County, 21.8% in Knox County and 18.4% of respondents in Loudon County thought that access to public transit to get to their polling place was somewhat or very important (see Table B24). Analyses indicate the respondents who are most likely to consider public transit to be somewhat or very important for

access to their polling place are more likely to be females with lower income and educational levels.

B8. Intended and Actual Voting Behavior

Respondents were asked about the likelihood that they would vote in the election for county officers to be held in their counties in August 2008. As Figure 14 shows, large majorities of registered voters in each county (about 80% in each) indicate that it is very likely that they will vote in the next election in which their county officers are chosen (also see Table B25).

Figure 14. Liklihood of Voting in County Elections in August 2008
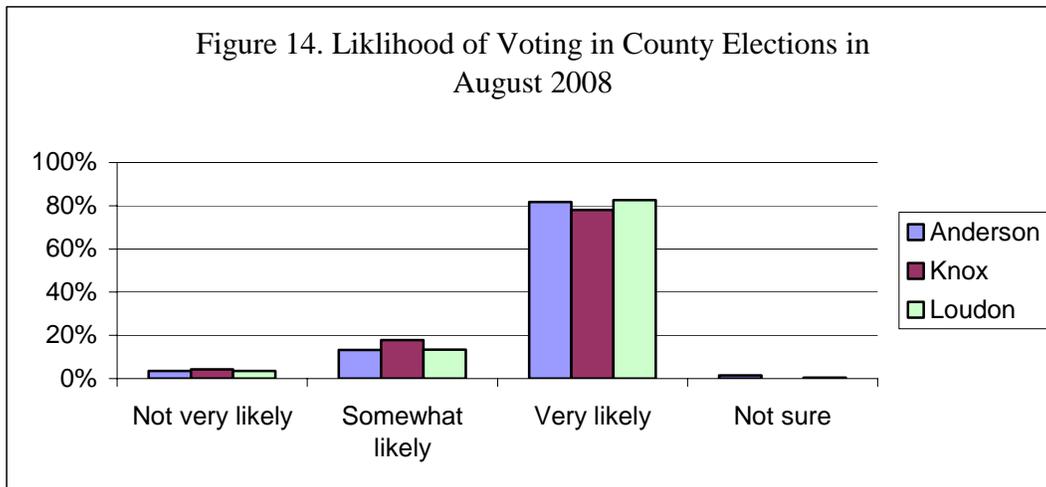
Respondents also were asked if they voted in the last election in which their county's officials such as the County Mayor, Sheriff, or Property Assessor were elected. In Anderson County, 84% indicated that they did vote in their county's last election while 75.3% of respondents in Knox County answered this question in the affirmative. In Loudon County, 85.9% of respondents say that they voted in their county's last election in which county officers were selected (see Table B26).

For the 195 individuals in the three counties who indicated that they did not vote in that election, the frequency with which various reasons were reported in Table B27. The largest proportion of the respondents who did not vote in the last county election indicated that the reason was "other" than the factors suggested by the question.

For the remaining 969 respondents in the three counties who said that they did vote in their county's last election in which county officials were elected, majorities in each county indicated that the reason they voted was because they "considered the election to be important" (see Table B28).

B9. Respondent Attributes

Tables B29 through B38 in Appendix B report the socioeconomic and background attributes of the respondents to this survey in each county. In terms of the respondents' length of residence in the state of Tennessee, 38.41 years is the survey average but modal length of residence among respondents in each county varies considerably. Anderson County

respondents' most frequently reported length of residence is 40 years. For Knox County voters, the modal length of residence is 20 years and for Loudon County it is just 6 years.

The length of time respondents have lived in their current county of residence also varies. While the average for all respondents is 29.81 years, the modal figures for Anderson, Knox and Loudon counties is 30, 20, and 3 years, respectively.

The average age of all respondents to the survey is 59.38 years. The modal responses by residents of each county are not far apart with 60, 58 and 65 years of age being the most frequent responses by residents of Anderson, Knox and Loudon counties, respectively.

The level of education of the registered voters reported by respondents in each county is shown in Figure 15. Large majorities of respondents in each county have at least a high school diploma or its equivalent.

Figure 15. Educational Attainment of Registered Voters
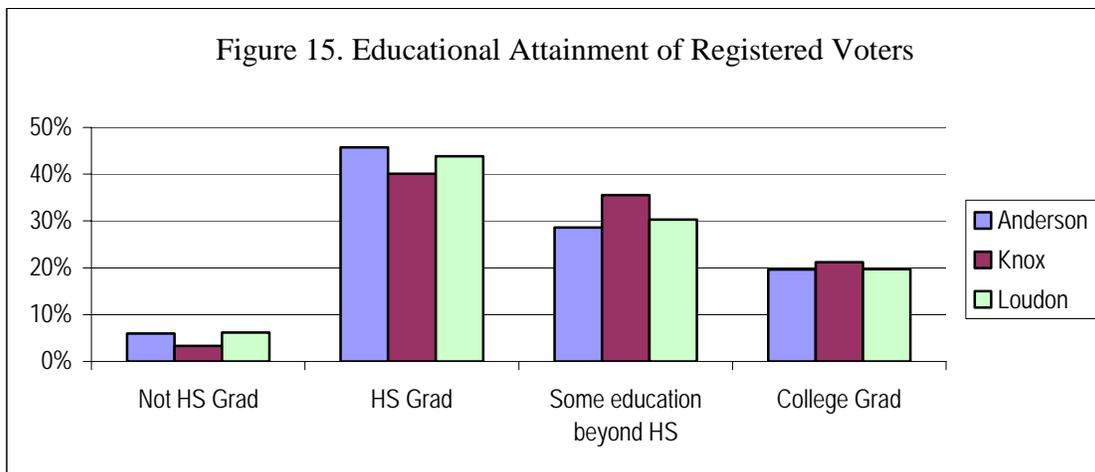
The self-described ideological orientation of the respondents in each county is show in Figure 16. The largest proportion of registered voters who responded to the survey are self-described conservatives but about another third of respondents describe themselves as moderates. Only about 17% of respondents describe themselves as liberals.

Figure 16. Ideological Orientation of Registered Voters
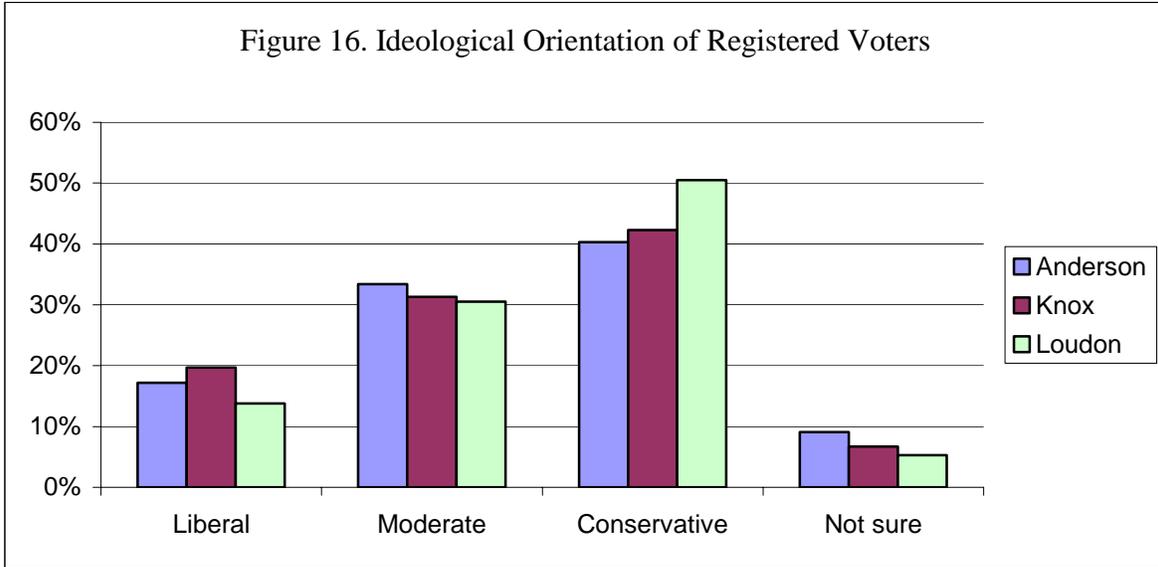
The party identification of the survey respondents is shown in Figure 17. Democrats and Independents comprise the largest proportions in Anderson County while Republicans and Independents comprise the largest proportions in Knox and Loudon counties.

Figure 17. Partisan Idenfication
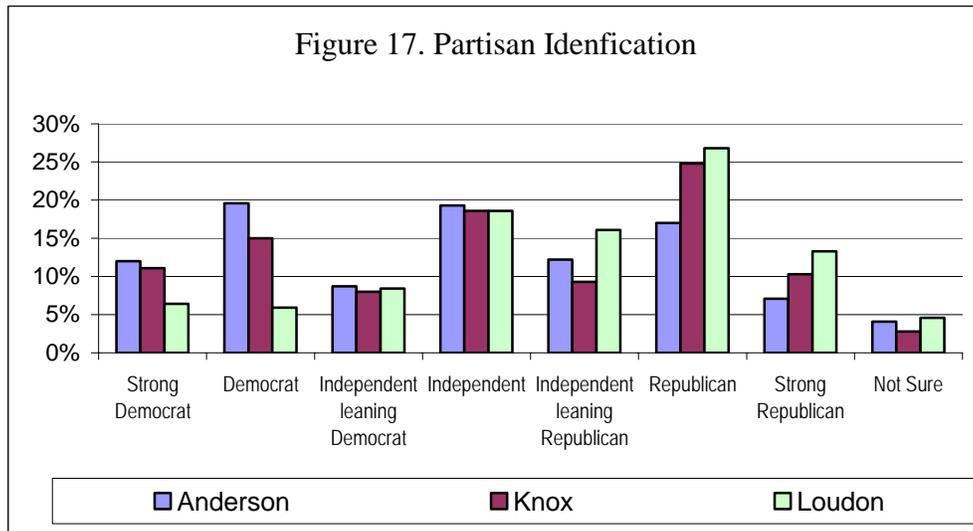
In terms of the gender of the registered voters in this survey, 63.1% are female while 36.9% are male. Almost three-fourth's (73.5%) of respondents are married and 96.6% of the respondents to the survey are white.

The ranges for the respondents' total 2006 household income from all sources "including earnings from all jobs, unemployment insurance, pensions, welfare, and so on, and counting income for everyone living in your home" is indicated in Figure 18.

Figure 18. Respondents' 2006 Total Household Income
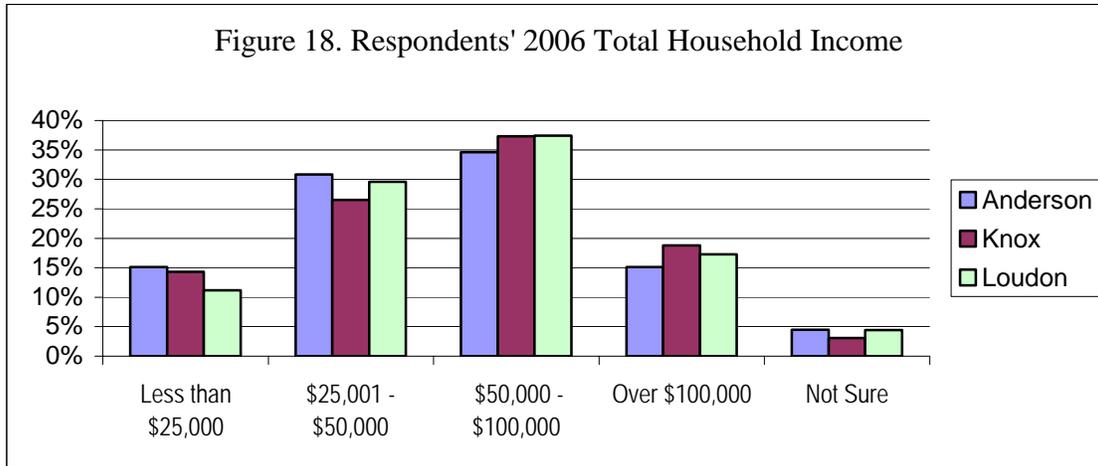
B10. Conclusions for Pre-election Survey Results

- About half of all survey respondents (50.7%) favor the idea of replacing polling places in each precinct with Voting Centers located more centrally in the county in which they reside. About another one-fifth of citizens (22.5%) neither favor, nor oppose this idea, indicating that they have no strong opinions on this matter. The level of support for the Vote Center concept is uniform among citizens despite differences in party identification, ideology, education, age, race, and marital status. Only gender is statistically linked with this opinion with women somewhat more likely than men to favor the Vote Center idea.

- Large majorities of citizens in each county think that the most convenient location for Vote Centers, if established, would be closer to their place of residence compared to other locations. Citizens are willing to travel 5 to 6 miles in distance or a maximum travel time of 15 minutes to vote at a Vote Center from their place of residence.

- Large majorities of citizens think that it is important or very important for the convenience and usability of Vote Centers to have on-site parking readily available near the center entrance, ease of ingress and egress to the parking lot, convenient hours of operation, and fast-moving voter lines.

- More than four-fifths of citizens (83%) think the most convenient hours for a Vote Center are between 8:00am to 7:30pm. However, 11% of voters consider early morning (before 8:00a.m.) to be the most convenient to vote while for another six percent, on average, think that evenings after 7:30pm are the most convenient.

- On average, more than half of citizens (54%) vote during the early voting period.

- Opinions are divided about equally divided on the desirability of having mobile voting units. A plurality of citizens (45%) think that allowing "no excuse" absentee voting would be a good idea but a majority of citizens (60%) think that opening polling places on Sundays would be a bad idea.

VII. Vote Center Location Analysis

A. Introduction

The Knox County Election Commission operates 94 precincts on Election Day, as mandated by state law, serving an average of 2,700 potential voters per station. However, voter turnout counts reveal that many precincts accommodate much smaller numbers, indicating that fewer centers might be justified. The challenge, not just to Knox but to all counties, is to determine optimal numbers and locations of voting centers to adequately serve the local population, while ensuring all eligible voters have equal and fair access to voting centers. The concept of flexible vote centers that provide citizens an opportunity to choose the time and location of voting has been tried in other communities in the United States in recent years, including several in Colorado and Indiana.

A1. Contributions of the Tennessee Convenience Voting Project

A pilot program to operate in Knox County, Tennessee, recently approved by state legislation, offers similar flexibility as the Colorado and Indiana models, and it includes a few innovations. The Knox County program takes the concept from an Election Day structure and extends it throughout the entirety of a 20-day early voting period, ending with Election Day. Also, the Knox County project includes geographic modeling to identify the locations of vote centers. An optimal-location algorithm and choice-making model (location-allocation model) using geographic information systems provide advanced site-selection capabilities to place election centers that best serve the voting public. Location-allocation models are powerful tools used to select locations for multiple-site facilities that serve geographically distributed demand. In an election system application, a location-allocation model will determine the optimal configuration of vote centers and inform decisions on the best number of centers needed. The model will be driven by population size, distribution, and travel distances.

Our research will contribute to future election reform in Tennessee. Current Tennessee enabling legislation is written to specifically accommodate a Knox area pilot project, so our program will be a model for other communities across the state. This gives us a unique opportunity to participate in the writing of vote center law for Tennessee, which, in turn, could serve as a model for jurisdictions across the country.

A2. Project Components

The Howard H. Baker, Jr. Center for Public Policy and its research partners have completed research comprising a planning phase for a *Convenience Voting* program in Tennessee, supported by grants from the Pew Charitable Trusts and the Tennessee state legislature. The planning work included several components: review of literature and best practices, assessment of costs of voting, measurement of voter impressions and requirements for vote centers, and development of methodology to identify optimal numbers and locations of vote centers.

This latter component, vote center location analysis, comprises the focus of this report, which is the result of several work items:

1. A comprehensive list of location/site criteria identified in academic and other publications.

2. A workshop for researchers and election practitioners to examine the inventory of location/site criteria. Attendees evaluated the published factors and added to the list other criteria deemed important. The comparative importance of the criteria was discussed, and the group produced a final list of vote center location/site factors.

3. Categories of potential vote center locations/sites.

4. Location-allocation models within a geographic information system to identify numbers and locations of vote centers from an inventory of candidates.

5. A workshop of location-allocation modelers and election commission officials to review a preliminary set of vote center locations/sites.

6. An evaluation of locations/sites for actual suitability by conducting field inspections.

B. Vote Center Research

Vote centers are a recent innovation in election administration, first adopted in Larimer County, Colorado in 2003 (Scheele, Losco, Crawley, and Vasicko, 2008). Communities offering vote centers typically have eliminated their traditional precincts, replacing them with a system of sites fewer in number but more centrally located within residential, work, and other activity cores. In addition to geographic accessibility, a vote center system allows voters to cast ballots at any center of their choosing, affording flexibility not available in a precinct system.

Research has demonstrated that the placement of polling locations has significant impact on voter turnout and satisfaction (Stein and Garcia-Monet, 1997; Gimpel and Schuknecht, 2003; Brady and McNulty, 2004; Leonetti, Gimpel, Shaw, and Dyck, 2004; Haspel and Knotts, 2005; Stein and Vonnahme, 2008; Stein, Vonnahme, Bighash, Moti, and Phan, 2008). With the elimination of precinct-based polling locations in favor of vote centers, it is critical that vote centers are optimally located to ensure equal and fair access to the election process, while minimizing impacts that contribute to decreased voter participation and satisfaction.

Vote center location criteria have received some treatment in election reform research, as well as in informational materials and legislation published by the states and counties that have adopted convenience voting systems (see *References*). However, published research and other sources treat only a selection of location criteria, often in a generalized manner, rather than attempting a complete list of variables that should be considered when establishing vote centers. An inventory of vote center location criteria is an important input for the modeling work conducted in this project, the intended purpose of which is to devise a methodology for optimal vote center location selection that can be replicated in any community. Admittedly, the relative newness of the vote center concept might preclude the notion of identifying any such list as *complete*, but aggregating the many pieces into one collection is a start and is conducted in the following section.

C. Vote Center Location and Site Criteria

C1. Site and Location Criteria Workshop

        On April 28, 2008, the Howard H. Baker, Jr. Center for Public Policy invited election officials, poll workers, representatives from political parties, and members of the voting public to a *Site and Location Criteria Workshop* to identify and evaluate factors considered important in selecting vote centers. Participants were chosen to represent Knox, Anderson, and Loudon counties, areas targeted for a *Convenience Voting* program in this research project.

        At the workshop, participants were given a brief review of election reform research pertaining to vote centers, assessment of best practices followed in other communities, and findings of focus group work aimed at soliciting opinion on the *Convenience Voting* concept and its mechanics. Workshop invitees also were given a brief overview of Tennessee state-mandated requirements for polling places.

        As explained in the introductory comments at the workshop, it is necessary to distinguish between *location* and *site* criteria for vote center selections. *Location* factors, as treated here, pertain to the larger-scale, geographic characteristics, that is, the "where" factors of a voting place. *Site* criteria, as defined in this study, pertain to smaller-scale, facility-level factors, namely, the functional and physical characteristics of a facility. Both types of selection criteria appear in academic literature and in publications from states and counties employing vote center systems, although not necessarily categorized as plainly as here.

        Participants were put to work in a brainstorming session, asked to compile a list of criteria necessary for a good vote center location and a list of features that would contribute to an effective center. A preliminary set of factors compiled from literature review provided talking points, and members suggested several additional items for consideration.

        After lists of location and site criteria were assembled, workshop participants separated into county-specific groups to evaluate the identified factors. Members worked in county-specific groups to distinguish location and site needs by community size: small (Loudon), medium (Anderson), and large (Knox). They were asked to assign each location and site criterion to one of five categories: a) mandatory (required by state law), b) essential (not required by law, but considered absolutely necessary), c) important, d) useful, and, e) not important.

        State-mandated requirements, as applied here, occur in two forms: a) existing state law, at the time of the workshop, that governs the operation of polling places, and b) new legislation pending before the Tennessee Senate and House, at the time the workshop was held. (Though not yet approved at the time of the workshop, criteria identified in the pending legislation were treated as mandatory by some participants. Vote center legislation was subsequently passed by the state Senate and House, and signed by the Governor on June 3, 2008. A summary of the recently-approved legislation is presented in Appendix C.)

C2. Workshop Product A: Location Criteria

Summarized in Table 15 are location criteria for selecting vote centers. Criteria were rated by level of importance, and results were compiled separately for different-sized counties. Based on average ratings from all workshop participants, the criterion, 'minimum number of sites based on population served,' emerged as the top-rated location determinant for vote center selection. This was driven by vote center bills pending before the Tennessee House and Senate (at the time the workshop was held) that states at least one vote center will be provided for every 25,000 registered voters. Of the 12 location criteria evaluated by invitees, this was the only one bound by state mandate.

Among the remaining location factors, those related to voter travel were rated most important. The criterion, 'along major thoroughfares/high traffic areas,' achieved a second-place ranking, followed by characteristics dealing with distance/travel time from home to vote centers, proximity to activity centers, and distance/travel time from work to vote centers. Locations along public transit routes were rated lower because two of the three counties represented at the workshop do not have public transit service. Also, locating vote centers to specifically accommodate selected demographic groups (based on age, income, and other characteristics) was a low priority for workshop members.

C3. Participant Discussion about Location Criteria

Knox County participants saw centralized placement of vote centers in residential population clusters as only somewhat important. That was not intended to discount the importance of residential proximity to vote centers, however. Members rated 'distance/travel time from home to vote center' as 'essential.'

Workshop invitees from Anderson County stated that a travel time of 15 to 20 minutes should be a maximum for home-based trips to vote. Large portions of Anderson County are rural, with residents living far from dense residential areas or employment centers. Excessive travel time or distance would be burdensome and discourage voter participation in more remote areas.

It was noted by Loudon County representatives that elderly voters will participate less if forced to drive greater distances. They are willing to drive, but distance constraints are present. The Tellico community in Loudon County is home to more than 6,000 voters, many of whom are elderly, so travel distance is a particularly important consideration.

Loudon County participants felt travel distance/time from home or work to vote centers was an 'either/or' criterion. If vote centers could not be situated close to residential clusters, then it would be essential that they be located close to employment centers. At least one of the conditions had to be met.

Participants from the small- and medium-sized counties acknowledged that desired travel time and distance maximums would require additional vote centers placed in outlying, rural, low-density areas. However, such centers would not serve many voters (compared to centrally-located stations) and would not be efficient if left to operate over the full 20-day voting period. As an alternative, members suggested a 'hybrid vote center model,' offering a small number of outlying vote centers that operate for a much shorter time. Two-day vote centers could provide polling service to outlying voters one day before election day and on election day

itself. The larger, optimally-located and optimally-numbered vote centers would still operate throughout the entirety of the 20-day election period.

When discussing minimum numbers of polling centers based on voters served, workshop coordinators pointed out that (pending) state legislation requires at least one center for every 25,000 registered voters. It was also noted that other states used tighter standards, requiring one center for every 10,000 voters. Workshop invitees discussed the matter, but there was no consensus on a narrower threshold universally suited for all three local counties because of the varying degrees of urban and rural populations from county to county. Instead, adherence to the state mandate would suffice for now.   As highlighted during the workshop's introduction, a computer model will be built to determine optimal numbers of vote centers in each of the three member counties, and the model will comply with the state standards.

Knox County workshop representatives cited the importance of placing vote centers along public transit routes, however, they felt that criterion was not necessary for every center, as long as some of the centers complied. In contrast to the Knox County situation, Loudon County has no public transit service. Accordingly, participants graded the transit criterion as 'not important.' Anderson County members acknowledged the value of placing centers on transit routes, giving the criterion a 'useful' rating, but, similar to Loudon County, public transit service is unavailable.

Regarding location familiarity and stability from election to election, Loudon County participants stated this was of particular importance to its elderly voters, asserting that with location changes, participation rates drop among older voters.

C4. Workshop Product B: Site/Facility Criteria

Site/facility criteria for effective vote centers were identified by workshop participants (Table 16). Criteria were rated by level of importance, and results were compiled separately for different-sized counties. The six highest-rated site/facility criteria included those held in accordance with existing and proposed state mandates for polling places. Some workshop members did not assign a value of 1.0, representative of the 'mandatory (state law)' rating because the vote center bill was still pending before the Tennessee legislature, however, they did rate those criteria with a 2.0 value ('essential'), keeping them among the highest rated factors. The criterion, 'number of days available,' tied for seventh in importance and is included in the list of mandated factors.

Highest-rated among factors not required by state law (existing or pending) was 'adequate parking, vehicle accessibility, walking distance.' Providing facilities that best accommodate vehicle and pedestrian access was considered essential to voter turnout and satisfaction. Also receiving 'essential' ratings were two factors pertaining to vote center worker accommodations. 'Restrooms' and 'break room/kitchen' facilities were assigned scores of 2.0, however, only the representatives from one county considered these items. Further discussion on these factors is provided in the next section.

'Adequate number of trained workers, voting equipment' received high ranks, as did 'donated space or other low cost option.' Workshop participants from Anderson and Loudon counties placed a high rating on the cost variable, citing budget limitations that make no-cost space 'essential.'

Square footage requirements also ranked high among site/facility criteria. These are discussed further in the next section.

C5. Participant Discussion about Site/Facility Criteria

Considerable discussion on square footage requirements for vote centers was offered at the workshop. Formalized standards and definitions have not been developed for use in Tennessee's polling places. Some local election administrators (for example, Knox County) have evaluated voter carrying capacities of sites, based on time needed to vote and number of voting machines available. Otherwise, detailed study has not been given to the matter locally. Officials in Tippecanoe County, Indiana conducted pre-election voter surveys in a recent election to determine which of their sites would receive most traffic. They also estimated space needs to accommodate voting machines, based on a standard number of voters that each machine could handle per day (225 voters per machine per day).

Similarly, the consensus of local workshop participants was that floor space requirements were driven heavily by the number of voting machines needed (anticipated prior to the election) or available. No minimum or maximum footage numbers were offered, although a Knox County administrator stated that the smallest facility operated locally in recent elections was a 300-square foot polling place. It was also noted that state requirements for polling stations dictate that voting machines be placed no closer than 10 feet apart, further helping define minimum space needs.

Lastly on the matter of space requirements, workshop invitees discussed a need for room to accommodate voters waiting their turn to cast ballots. It was largely agreed that overflow space for waiting voters ideally should include an area sheltered from inclement weather.

Temporary structures were rated 'important' by representatives of the smaller communities. These counties have areas that are rural and somewhat remote. In consideration of providing vote centers within certain travel time and distance maximums, temporary structures offer suitable alternatives for decentralized voters. Representatives of Loudon County noted that modular (trailer) units could adequately operate as temporary voting places in its outlying areas. Highly urbanized Knox County would have less need for temporary space, explaining its lower rating in this criterion.

Security of polling stations is mandated by state law. Facilities must be able to be locked, and locks must be changed at the time the polling station occupies a selected site. Space with walls, doors, cameras, access control, and alarm systems is preferable.

Workshop members representing the two smaller counties, Anderson and Loudon, placed greater emphasis on using sites that did not charge a rental fee, citing budget constraints. Loudon officials stated a strong preference for public buildings and churches among donated space options. In fact, Loudon members were in favor of using schools for vote centers, unlike representatives from the other two counties. Loudon officials cited the cost factor, but they also noted that in outlying areas of their county, schools often represent the only option if public buildings must be used.

Loudon County representatives identified two additional site requirements: restrooms and break rooms/kitchens to accommodate poll workers. They noted that restrooms for voter use might be useful, but not essential. In the absence of restrooms dedicated to public use,

voters would not be denied access to restrooms otherwise intended for poll workers, but, under this informal arrangement, restrooms would not have to meet accessibility requirements.

Telephone equipment was given low priority by most participants at the workshop. Some cited their importance for poll worker use (Knox County), while others indicated that workers are provided cellular telephones for use at stations, thereby making landlines unnecessary. None of the workshop invitees felt a strong need to provide telephone equipment to the voting public at polling stations. Additionally, dedicated phone lines to accommodate voter calls for information, such as hours of operation, locations of vote centers, or other requests, are handled through telephone service at the central election commission offices, not at the polling stations.

While other communities across the country (for example, in Nevada) permit voting on Sundays and state holidays, Tennessee legislators are opposed. The vote center proposal pending before the Tennessee legislature includes language prohibiting Sunday/holiday voting.

Participants stated it was essential that all vote centers within a county operate on the same schedule to ensure equal access to sites.

C6. Types of Sites for Vote Centers

During the *Site and Location Criteria Workshop*, lists of traditional and non-traditional polling sites were reviewed:

a. Traditional sites
- Courthouses
- Municipal centers
- Schools
- Fire stations
- Churches
- Libraries
- Recreation/community centers
- Community organizations (e.g., American Legion, Elks)

b. Non-traditional sites
- Hotels
- Office buildings
- Apartment complexes
- Shopping centers/malls
- Big-box retail centers
- Supermarkets
- Convenience stores
- Medical clinics/hospitals
- Nursing homes
- Mobile voting places

C7. Participant Discussion about Traditional and Non-Traditional Sites

Participants stated that a *Convenience Voting* program consisting of smaller numbers of vote centers replacing numerous precincts will necessitate new thinking on traditional sites.

Because the program would consist of a 20-day voting period, centers at schools, churches, and fire stations no longer would be preferable (see discussion above regarding use of schools in Loudon County). For schools, security concerns and logistical challenges make long-term use undesirable, a growing consensus across the country (Moretti, 2007). Regarding churches, owners would be unlikely to approve use of their facilities for such an extended period of time because of state law that permits candidate signage near polling stations. The use of fire stations for 20 days, with the obvious conflicts between station operations and the numerous citizens and their vehicles, was discouraged.

Because fewer centers operate in a *Convenience Voting* program, as compared to a precinct voting system, vote centers would need to be larger to handle greater numbers of voters. As a result, small facilities such as libraries were considered less attractive. Other types of traditional sites (courthouses, municipal centers, community centers, and organizations) would still be good choices.

Workshop participants agreed that several of the non-traditional options were potentially viable. As long as costs were low or waived and other location/site criteria were met, centers in private facilities, such as office buildings, hotels, and shopping centers, would be acceptable. Concerns were raised about the suitability of medical clinics, hospitals, and nursing homes because, as participants pointed out, disturbance of residents, limited parking, and other issues would render those sites less attractive. Non-traditional sites have been used successfully in other communities. Stein and Garcia-Monet (1997) demonstrated that non-traditional sites attract slightly higher numbers of early voters than traditional sites. In turn, increases in rates of early voting correlate to higher rates of voter turnout.

Several workshop members were opposed to offering mobile vote centers, citing concerns about adequately informing the public of times and locations of operation. In the absence of a clearly articulated and thoroughly advertised information campaign, it was feared that voters would be highly critical if they missed an opportunity to use a mobile vote center because they did not know about operating hours and locations.

Lastly, it was noted that, by Tennessee law, county courthouses must serve as polling places, whether counties use precinct voting, early voting, or a *Convenience Voting* program. Some differences in opinion about acceptable categories of sites emerged between county representatives. Types of sites deemed suitable are summarized in Table 17.

C8. Identification of Potential Sites

As a final workshop task, invitees were asked to generate lists of potential vote center locations. These locations were solicited to supplement an inventory of sites compiled from several other data sources (see *Vote Center Location Modeling* below) to ensure that the most comprehensive list of potential sites was assembled.

C9. Evaluation Checklist

Based on the work completed at the *Site and Location Criteria Workshop*, a field inspection checklist and a database application were created to record site-specific information and to evaluate potential vote centers for compliance with mandatory, essential, and important site criteria (Figure 19). Field inspections will be conducted in conjunction with the vote center location modeling process, detailed in the next section.

Figure 19. Site Evaluation Checklist

VOTE CENTER SITE EVALUATION

Facility: KNOX COUNTY COURTHOUSE
Address: 300 Main St, Knoxville, TN 37902
Contact: Greg Mackay, Election Commission   Phone: 215-2483   Alt. phone:

Describe the facility/space selected for use
Lobby area on lower level of courthouse. Three points of access, two of which are ADA compliant.

Facility Size (square feet)		Facility Availability	
Total area:	1186	Number of days available:	20
Voting area:	1186	Number of hours available per day:	12
Storage:		Notes: No availability constraints. Can operate 8:00a-8:00p schedule. Can operate entire voting period and allow days for set-up and dismantling.	
Sheltered waiting area:			
Office/work area:		Is facility available for future elections? (Check box if "Yes") ☑	
Notes: Storage and work areas accommodated by main Election Commission office located elsewhere in building.		Notes:	

Other Facility Criteria		Site Accessibility	
Number of restrooms:	2	Number of parking spaces available:	0
Rental fee ($):	0	Average walking distance to door (ft.):	
Fee notes: Public building. No fees for vote center operation.		Describe vehicle access to site: No "official" parking on site, however building management allows some short-term parking during voting period. Surface-street parking available throughout downtown.	

Feature Availability (Check box if "Yes")	Notes
☑ Entry doors to voting area can be locked	
☑ Interior work rooms/storage rooms can be locked	Part of Election Commission offices.
☑ For multi-use building, vote center can be secured separately	
☑ Compliant with Americans With Disabilities Act (ADA)	Entire building is ADA compliant, including entrances, restrooms, other public spaces.
☑ Adequate electrical equipment, capacity, outlets, other	
☑ Adequate indoor and outdoor lighting	
☑ Adequate heating and air conditioning	
☑ High-speed network connectivity	

Additional Feature Availability (Check box if "Yes")	
☑ Kitchen/break room	☐ Temporary structure (trailer) can be placed
☑ Outdoor "Vote Center" sign can be posted	☑ Telephones or telephone lines available
☑ Line/crowd control equipment can be placed	

Friday, June 27, 2008   Site ID: 861_Knox

D. Vote Center Location Modeling

With a literature-based inventory of location and site criteria, and practitioner-based assessment of comparative importance of criteria, the next step in our project was the construction of a computer model to select optimal numbers and optimal locations of vote centers to serve each of three different sized jurisdictions: Knox County (large), Anderson

County (medium), and Loudon County (small). Our approach relied on location-allocation models, constructed and run within a geographic information system (GIS).

D1. Basics of Location-Allocation Modeling

Location-allocation models (LAMs) can be very useful in solving problems that many organizations in the public and private sectors face: where to locate multiple service centers that will serve geographically dispersed demand. The first objective of these models, the location component, is to optimize the spatial configuration of the supply centers in a manner that will most efficiently meet the organization's needs. The second objective of the model, the allocation component, establishes the supply centers that will serve each demand location.

a. Minimum distance models

The P-median model, also known as the Minimum Distance LAM, is primarily used in the private sector. Its objective is to minimize the total distance traveled between all supply centers and the demand locations they serve. The minimized travel distance would then minimize shipping costs associated with distributing goods to demand locations. This LAM also can accommodate weighted distance to individual demand locations. If certain high demand locations must be resupplied more frequently than others, their demand weight can be increased accordingly. The model, which aims to minimize the total weighted distance between all supply and demand locations, would then be more likely to locate one of the supply facilities closer to higher demand locations. When applied to establishing locations for vote centers, this model can be thought of as maximizing collective voter convenience because it would minimize the total, demand-weighted distance that citizens travel to vote. However, this approach is prone to producing inequitable results that would require those living in low-demand areas, such as rural areas with low population density, to travel unreasonably far distances to reach the nearest vote center.

b. Maximum coverage models

A different LAM, primarily used in the public sector, solves the maximal covering location problem (MCLP). This model does not attempt to minimize travel distances. Instead, its objective is to establish supply centers in a spatial configuration that will maximize the total number of demand locations that can be reached within a user-specified maximum travel distance or maximum travel time. Like the P-median model, the individual locations can be weighted relative to demand found there. Hence, the objective becomes maximization of total weighted demand that is served by the supply facilities rather than the total number of individual demand locations.

When executed, the MCLP model requires the user to specify the number of supply centers to establish, but that number is often unknown and is one of the decisions that the user wants the model to inform. Accordingly, if the model is run repeatedly, and the number of centers to establish is increased each time, a curve similar to that in Figure 20 can be generated to show incremental service coverage gain. The curve data then can be used to determine a suitable number of centers.

Using the example in Figure 20, if only one vote center was established, it would serve roughly 28 percent of the population. As the number of vote centers increases, the rate of gain in population service coverage diminishes. In other words, the marginal benefit of establishing additional vote centers decreases as the number of centers increases. In this example, 12 vote centers would be needed to serve 100 percent of the population. Funding and other resource

limitations may not allow as many as the optimal 12 centers, but the maximum number of voters will be served by the resources that are available.

Figure 20. Percentage of Population Served by Increasing the Number of Voting Centers
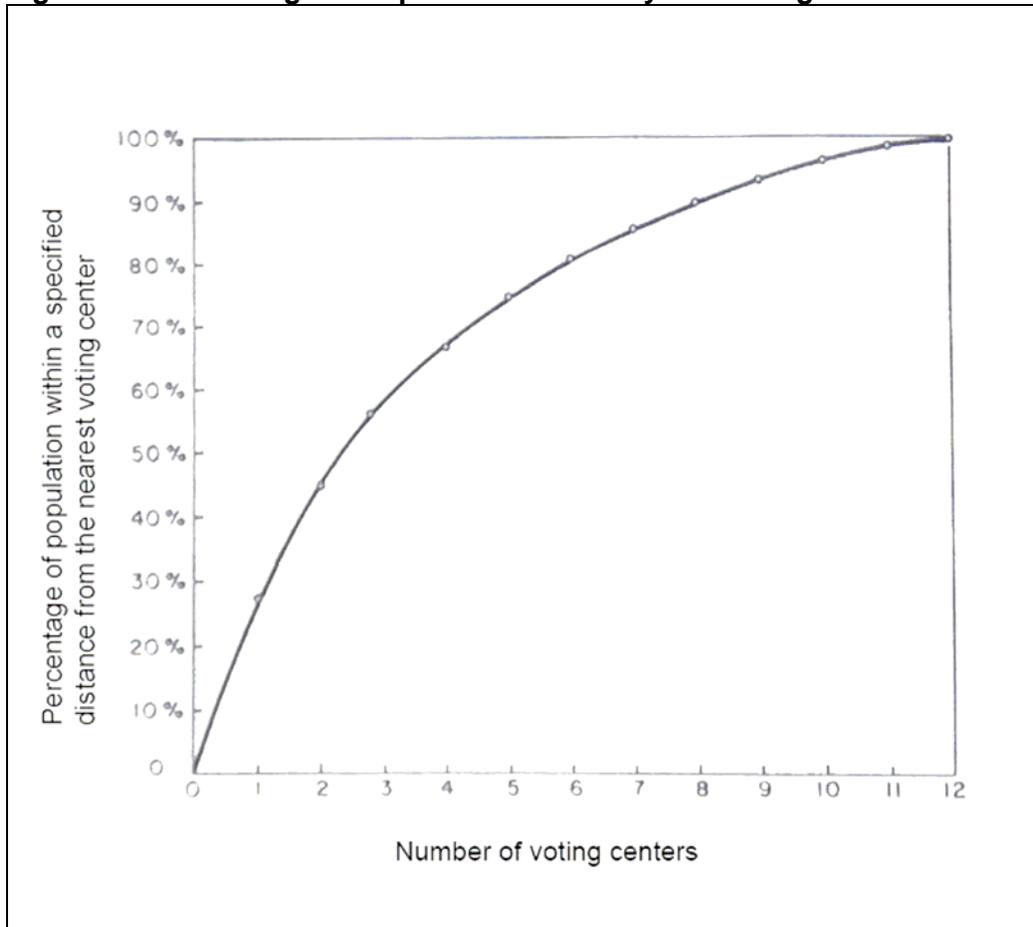
c. Model variations

Because the P-median problem tends to place supply centers in the middle of high density demand locations, supply centers can be placed unreasonably far from outlying demand locations if they are relatively small in number and/or their demand values are relatively low. To reduce this less equitable outcome, a maximum distance constraint can be placed on the P-median model, forming a model that has traits similar to the MCLP model. In theory, this model would aim to minimize the total weighted travel distance while simultaneously trying to ensure that no demand locations are beyond a maximum distance.

This model with distance constraints can become problematic, however, if some demand locations cannot be served because maximum allowable travel distance is too restrictive or supply facilities to locate are too few (ESRI, 2001). This limitation suggests two important notions. First, the revised P-median model will not produce optimal results if some demand locations cannot be served within the maximum allowable distance. Second, when such conditions occur, the model's objective mimics the MCLP model: minimizing the number of

locations that are outside of the allowable travel distance is conceptually the same as maximizing the number of demand locations that are within the allowable travel distance.

Both the Maximum Covering Location Problem LAM and the P-median with Maximum Distance Constraint LAM were tested for suitability in this project. A comparison of model performance and subsequent model choice is discussed later in this report.

D2. Heuristic Procedures in Location-Allocation Models

Location-allocation models have the potential to require large numbers of calculations. First, the road network distance between all candidate-demand pairs must be calculated, a sizeable but reasonable number of calculations for modern personal computers. However, the process of optimally selecting supply sites from a large candidate pool can require an enormous number of hypothetical combinations. The number of possible combinations for facility sites can be represented as:

$$\frac{n!}{p!(n-p)!}$$

where:
n = number of candidate locations
p = number of sites to choose

(ESRI, 1994).

Consider a hypothetical example in which 639 candidate locations exist. If 15 supply centers are to be chosen from the 639 candidates, then approximately 3.0463 x 10^{35} comparisons would have to be made to establish the optimal configuration. This overwhelming task would require a prohibitive amount of computing time. Scott (1970) remarked that most location-allocation problems are solvable only through the use of heuristic procedures, which have been developed to address problems of this nature. Heuristic methods are those that consist of "a sequence of trials yielding approximate results with control of the progression towards an acceptable final result" (Spencer, 1994). Hence, heuristic procedures cannot guarantee an optimal solution, but if well designed, they tend to converge in the direction of an optimal solution.

Densham and Rushton (1991) commented on the well-designed heuristic procedure developed by Teitz and Bart in the late 1960s to solve location-allocation problems. They noted that their colleagues' heuristic was usually accurate (that is, it did, in fact, converge on an optimal solution), fast, and versatile. Densham and Rushton identified some opportunities to improve the heuristic in a manner that required fewer computations and less computer memory. Their heuristic, called the global-regional interchange algorithm (GRIA), and the Teitz and Bart heuristic are available in the commercial software that we used in this project to run the LAMs.

D3. Modeling Road Networks in a GIS Model

Humans, goods, and services typically move along road networks rather than straight lines across landscapes. Hence, modeling road networks is crucial when analyzing movement. Roads are comprised of arcs, or links, that are joined to one another at intersections (Figure 21). Each arc is comprised of vertices that represent a series of georeferenced points with x and y coordinates. Nodes exist at the dead-end of an arc, at the intersection of two or more

arcs, or at a point where the nature of an arc changes (for example, where a four-lane divided highway narrows to two lanes).

Both arcs and nodes have attribute tables that contain data describing each of these individual features. Each arc's attribute table contains a reference to the nodes found at its end points, one being the *from node* (FNODE) and the other the *to node* (TNODE), depending on the direction in which the arc was digitized and its intersection with another arc. Hence, intersecting arcs can be identified through these tabular entries rather than by a spatial search for two arcs intersecting at a common location in continuous space. Arcs representing a road segment typically have attributes such as name and street type (for example, divided highway, secondary road, and gravel road).

GIS road networks are capable of modeling overpasses and underpasses. This is accomplished by assigning an elevation value to an arc's end-point and beginning-point. If elevation values of two intersecting arcs do not match, then the system is directed to disallow movement from one arc to the other. Illustrated in Figure 21, a turn from overpass arc 10221 to Interstate highway arc 10220 would not be permitted due to the mismatching elevation values in the FROM_ELEV and TO_ELEV columns of the Arc Attribute Table.

Figure 21. Example of a GIS Road Network Data Model

Arc Attribute Table

FNODE	TNODE	ARC ID	NAME	TYPE	LENGTH_FEET	FROM_ELEV	TO_ELEV
23250	23269	10213	I-95 Access		1079.1	0	0
23146	23269	10220	I-95		1164.8	0	0
23150	23146	10221	Mudd Tavern	Rd	317.4	0	1
23269	23145	10222	I-95 Access		1119.3	0	0
23146	23145	10223	Mudd Tavern	Rd	301.3	1	0
23135	23126	10242	Mudd Tavern	Rd	347.8	0	0
22996	23126	10395			1092.3	0	0
23145	22970	10419	I-95 Access		1547.2	0	0
23146	22970	10420	I-95		1428.4	0	0
23150	22970	10421	I-95 Access		1374.4	0	0

Node Attribute Table

NODE_ID	DEMAND_WEIGHT
22970	2
22996	2
23126	2
23135	2
23145	3
23146	3
23150	3
23269	4

D4. Model Construction Methodology

a. Software

GIS software from Environmental Systems Research Institute, Inc. (ESRI) was used in this research project. Currently, location-allocation models can only be run using the *Network* module of ESRI's older command line *ArcInfo Workstation* software. However, LAM capabilities will be included in the forthcoming Release 9.4 of the *Network Analyst* extension for *ArcGIS Desktop* software. *ArcGIS Desktop* provides a user-friendly graphical interface to comprehensive GIS functionality and is commonly used in public, private, and academic sectors. Although our LAM was executed using *ArcInfo Workstation*, most of the input data preparation and model output post-processing was conducted using *ArcGIS Desktop*.

b. Road network preparation

We selected TeleAtlas North America, Inc.'s *Dynamap* streets GIS map layer for use in this analysis. Several factors contributed to this choice. First, this commercial dataset is readily available for every county in the United States, which supports replication of our methodology by any community wanting to build a vote center LAM. Second, this dataset is seamless across county lines, providing an intact, functional, inter-county road network. Third, it includes road attributes necessary to model bridges and overpasses. Fourth, it has the addressing attributes needed to map (*geocode*) registered voters and candidate vote center locations.

All streets within our three-county study area, plus a three-mile buffer beyond the county boundaries, were extracted from the Tennessee *Dynamap* database for use in our analysis. The buffer ensured that we accommodated voters who might select routes to vote centers that include travel through adjacent counties.

When running location-allocation models, the *Network* module of *ArcInfo* requires that all supply and demand locations be assigned to nodes. To ensure that node assignments would not be too far from actual locations, all road segments greater than one-half mile in length were split into half-mile (or shorter) segments. Road segments that had a *from* or *to* elevation not equal to zero (that is, grade-separated) were not split, avoiding network errors that could disrupt modeled road connectivity. Splitting line segments at appropriate locations produced artificial nodes on the road network to which supply and demand values could be applied.

All line segments representing driveways and parking lots were deleted from the streets database because they did not have the attributes necessary for geocoding voters and candidate sites. Removing these line segments also reduced network complexity and the number of nodes that must be processed during the LAM operation. Street segments passable only to four-wheel-drive vehicles also were deleted.

c. Geocoding overview

Geocoding is the process of determining the geographic coordinates (for example, latitude and longitude) of a location from some source of descriptive information, most commonly address data. Using the TeleAtlas road network, *ArcGIS Desktop* can geocode addresses and generate a map layer showing address locations. Once geocoded, locations can be displayed on digital maps and participate in spatial analysis.

d. Mapping voters and assigning them to nodes

Election officials from the three study counties provided a database of all registered voter addresses. Knox County voters were geocoded using an address map layer maintained by the Knoxville/Knox County Metropolitan Planning Commission (MPC). Voters in Anderson

and Loudon counties were geocoded using the TeleAtlas streets map layer because digital countywide address point locations with necessary attributes are not maintained by county sources. Voters that were successfully geocoded were then assigned to the nearest node on the road network using a spatial join.

Addresses of some voters could not be geocoded due to inaccuracies and omissions in the list of addresses to be geocoded and/or the reference map layer data (that is, MPC address locations or the TeleAtlas map layer). More than 95 percent (41,829 of 43,999) of voters were successfully geocoded for Anderson County; 220,718 of 231,057 (95.5 percent) voters were successfully geocoded for Knox County; and, 28,078 of 29,643 (94.7 percent) were successfully geocoded for Loudon County. Voters that could not be geocoded were proportionally assigned to nodes throughout their respective counties. For example, 48 geocoded voters in Knox County were assigned to a node in an apartment complex, which represented a 0.0217 percent share of all geocoded voters countywide. The total number of ungeocoded voters (10,339) was then multiplied by this percentage, resulting in an additional 2.24 voters assigned to that apartment node. (This process slightly increased the total number of voters in each county by a negligible amount, as shown in the *Voters* row in Table 6 below.)

e. Vote center location preferences
At this point it is necessary to revisit the concept of vote center location preferences. In the public opinion survey that was conducted during previous stages of the *Convenience Voting* project, respondents were asked if they would prefer a voting location that is 'closer to home,' 'closer to work,' 'closer to shopping,' or 'closer to school' (Table 18). Some indicated that they would prefer voting locations that were closer to 'someplace else' and others were 'not sure' of a location preference.

Because it was impractical to map locations for the 'someplace else' and 'not sure' responses, the shares of these responses were proportionally reallocated to the other, mappable response classes. For example, 7.1 percent of the Anderson County responses needed to be reassigned to the mappable response classes. Ninety-three percent of the total responses were mappable, and the 'closer to home' responses comprised 78.0 percent of the mappable responses. As a result, the 'closer to home' response received an additional 5.5 percentage share. Table 19 shows the results of the reallocated response shares.

f. Mapping vote center location demand: closer to work, shopping, and school
The data underlying the travel behavior of voters stating a preference to vote 'closer to home' were comprised of the voter assignments to network nodes that were nearest to home addresses, as described above. Other data were needed to accommodate modeled travel to vote centers closer to work, shopping, and school. For the work and shopping components, establishment and employment data were purchased from infoUSA Corporation, providing latitude and longitude coordinates of businesses and other places of employment. The number of employees at each location (Table 20) was assigned to nearest county network nodes (by conducting a spatial join using *ArcGIS*), thereby representing the relative attractiveness, or demand, at nodes to accommodate the 'closer to work' element of our vote center travel model. For the 'closer to shopping' component, the number of employees at retail locations (Table 20 in all three counties (derived from the infoUSA database) was used as a surrogate to measure relative demand. Retail employee locations were assigned to nearest nodes on the road network.

In a similar manner, the 'closer to school' element was accommodated by a surrogate measure. The number of enrolled students at public schools (Table 20) was assigned to nearest road network nodes to represent relative demand of schools.

g. Allocating total voters by vote center location preference
Using the vote center location preferences calculated earlier (Table 19) and the adjusted total number of voters (Table 20), voters were allocated by preferred vote center location, summarized in Table 21. As examples, Knox County is comprised of 231,057 registered voters. Of that total, 77.8 percent stated a preference to vote closer to home, or 179,737 voters choosing that option. Similarly, of the total 231,057 Knox voters, 10.4 percent claimed a preference to vote closer to work, representing 24,108 voters. (Note: The actual calculated values were derived from source data tabulated to several decimal places. Using the rounded values in the examples will result in slightly different totals.)

h. Assigning total demand to network nodes
The location-allocation model of voter travel behavior and, subsequently, selection of vote centers relied on demand values assigned to each node in the county-specific road networks. Demand was calculated for each node and was comprised of the weighted sum of voters' homes, total workers, retail workers, and student enrollment. Demand was calculated in three steps.

The first step was the calculation of percentage shares of overall county totals held by each node for each demand component (voters' homes, overall employment, retail employment, and school enrollment). A particular node in downtown Knoxville, for example, represented 4.18 voter homes, comprising 0.0018 percent of the 231,057 total of Knox County voters' homes. The node also represented 345 total workers, 2 retail workers, and 0 students, or 0.1459 percent, 0.0067 percent, and 0.0000 percent of their respective classes.

In the second step, the percentage shares in each demand component at each node were applied to the corresponding countywide voter totals allocated to each category of voter preference. Using the same downtown Knoxville node as an example: a) node demand to vote closer to home was represented as 3.25, calculated as 179,737 (total countywide voters that stated a preference to vote closer to home) multiplied by 0.0018 percent (the share of voters' homes held by the selected downtown node), b) node demand to vote closer to work was 35.18, calculated as 24,108 multiplied by 0.1459 percent, c) node demand to vote near a shopping area was 1.13, calculated as 16,947 multiplied by 0.0067 percent, and, d) node demand to vote closer to school was 0.00, calculated as 10,263 multiplied by 0.0000 percent.

In step three, the four demand components were summed at each node, to represent total voter demand at each node. For the sample downtown node, total demand was calculated as 39.56. The sum of the total voter demand for all nodes representing Knox County voters was 231,057.37, which confirmed that voters had been correctly allocated to nodes based on vote center location preferences. The same quality control summation was conducted for Anderson and Loudon counties.

i. Establishing candidate vote center locations
A list of acceptable candidate sites was compiled for each county using the guidelines established during the *Site and Location Criteria Workshop.* Classes of sites and geographic data sources are shown in Table 22. Knoxville/Knox County/Knoxville Utilities Board Geographic Information System, or KGIS (a government organization that serves as central repository of local GIS data), infoUSA, and MPC market studies provided existing map layers

that did not require additional geocoding (discussed above). Data from county election commissions were provided as lists of addresses. Their locations were geocoded in *ArcGIS* using the TeleAtlas street data. Locations that failed to geocode in *ArcGIS* were mapped manually.

Small, historic churches are common in the three-county study area, but they are unsuitable for use as vote centers due to their size. Larger churches, however, were included in the model (although not preferred locations in two study counties). The number of employees working at a church was used as a surrogate for size. Churches with eight or more employees were added to the candidate site database.

MPC market studies were used to identify office buildings, hotels, shopping centers, and supermarkets in Knox County. Data from infoUSA were used to identify these establishment types in Loudon and Anderson counties. Business establishments that had a North American Industry Classification System (NAICS) code indicative of office-like activities were extracted from the infoUSA database. These establishments were assigned to the nearest node, and, each node could represent one or more establishments. If twenty or more office employees were present at a single node, that node was considered suitably sized to accommodate a vote center and was included in the candidate site database. A similar method was used to identify potentially viable voting locations at shopping centers and supermarkets where NAICS codes indicated such activity.

D5. Model Selection

Both the Maximum Covering Location Problem LAM and the P-median LAM with a maximum allowable distance constraint were tested using our study data. After comparing the model results and assessing their success in achieving their intended objectives, the MCLP LAM was selected. Accordingly, only the MCLP model results will be discussed in the main body of this report. (Performance comparisons are provided in Appendix D.)

D6. Executing the Model

The first step in executing the location-allocation model involved specifying the input road map layer database and the field in the road network nodes attribute table that stored the quantitative demand values represented at each node. Second, the nodes representing the candidate sites were specified. At this step, the user can specify whether or not certain candidate sites must be selected by the model. (For example, in our project, county courthouses must serve as vote centers, as stipulated by Tennessee state law.) Third, the type of location-allocation problem to solve was specified. We chose the Maximal Covering Location Problem. Fourth, the maximum allowable driving distance was specified. County-specific median travel distances were taken from the public opinion survey conducted earlier in the project (Table 23).

Finally, the modeling software prompted users to specify the number of sites to select from the candidate locations. Because the best number of vote centers to establish was unknown at this point, the model was run iteratively 40 times, and the number of sites to establish was increased by one with each iteration. During this final step, the user could also specify whether the software used the Teitz and Bart (TAB) or the Global Regional Interchange Algorithm (GRIA) heuristic. As noted in the *ArcInfo* help files, "when candidate locations are different than demand locations, TAB may do better than GRIA. This is because [one] phase of GRIA only evaluates those candidates that are also demand locations" (ESRI, 2001). Many, but not all, nodes in the three study counties represented both candidate site locations and demand locations. In Knox County, for example, 196 of the 748 nodes that represented candidate sites did not represent demand locations. For this reason, we chose the TAB heuristic. (Note: In subsequent portions of this report, use of the words 'maximize' and 'optimal' carries the assumption that the heuristic did in fact select the optimal configuration of vote centers, unless otherwise noted.)

D7. Model Output: Knox County

a. Two scenarios
        In the Knox County analysis, the location-allocation model was run for 40 iterations under two separate scenarios. In Scenario One, no candidate sites were pre-selected. The model ran unconstrained, free to select any of the candidate sites during each iteration. For Scenario Two, Knox County's Administrator of Elections specified five locations that should be selected regardless of model outcomes. The five sites were used in previous local elections and are well-known to voters, they are rent-free, and they meet all mandatory, essential, and important site criteria. The Scenario Two location model was directed to always select those five sites before considering any others. Summary output from both Knox County location models is shown in Table 24 and Figure 22.

b. Scenario One: No pre-selected sites
        During the first iteration in Scenario One, the model selected the single candidate site that could reach the maximum number of voters within the maximum five-mile driving distance. This center, located in downtown Knoxville, served 63,044 Knox County voters (Table 24). When directed to establish two centers, the locations served over half (118,077) of the registered voters. The location selected in the first iteration was also selected when two vote centers were established. This, however, should not imply that a selected location in one iteration must be chosen in subsequent iterations. On the contrary, each new iteration of the model executes independently of the previous iterations.

        The two centers chosen in the first two model iterations were selected again in the third round, but the number of voters assigned to the downtown site decreased due to overlap with a center to its northwest. Despite the overlap, this configuration of vote centers served the maximum number of voters. On the fourth iteration, the downtown site shifted a short distance to the south because a newly-added vote center to its north served some of the demand in its original service area. This shift covered additional voters in south Knoxville that were not previously served by three centers. The pattern of retaining some vote centers and shifting others continued in subsequent iterations of the Scenario One model.

        At nine vote centers, over 90 percent (211,330) of voters were served. By the 12th iteration, 95 percent service coverage was achieved, and incremental improvements began to diminish (Figure 22). An interesting occurrence was measured at the 14-center solution. The

configuration served a smaller number of voters than that covered by 13 vote centers, indicating the heuristic failed to select the 14 locations that would maximize voter coverage (Table 24).

At the 15th iteration, service coverage flattened (Figure 22). Finally, at the 34-center solution, all 229,670 voters (of the 231,057 countywide total) that were located within five miles of the closest candidate site were served (Table 24). The remaining 1,387 voters lived beyond a five-mile maximum distance to any candidate site and could not be accommodated by any model configuration, regardless of the number of vote centers established.

The 15-center model solution for Scenario One is depicted in Figure 23. Red points on the map represent selected vote center locations, and adjacent values indicate the number of voters assigned to centers. Red lines connect voters to their assigned center. (Each iteration of Scenario One was characterized in map form to demonstrate the progression of voter service coverage. The complete series is provided in Appendix E.) An additional consideration needs to be noted. In this scenario, and all others, the location-allocation modeling software assigned demand nodes, and ultimately, voters, to the nearest vote center, which represents the allocation component of LAMs. In reality, voters will be permitted to participate at any center, a fundamental premise of our *Convenience Voting* program. However, the total number of voters that the software assigned to each center is useful in estimating the required capacity of each facility.

c. Scenario Two: Five pre-selected sites
The five pre-selected sites in Scenario Two served only 148,476 Knox County voters, as compared to the 179,633 voters accommodated by five centers in the unconstrained model of Scenario One (Table 24). With the sixth iteration of Scenario Two, the model was free to select a site from the entire remaining inventory of the candidate locations, producing a steep gain in service coverage. Subsequent iterations of the model reported further coverage as additional site choices (beyond the pre-determined five) were no longer constrained.

The Scenario Two model achieved 95 percent coverage with a 14-center solution. By the 17th iteration, incremental improvements in service began to flatten (Figure 22). Finally, all 229,670 voters that were located within five miles of the closest candidate site could be served by a 34-vote center configuration.

Figure 22. Knox County Voter Service Coverage

Total Number of Voters Served - Knox County

Scenario 1:No voting centers pre-selected

Scenario 2: Five pre-selected voting centers

Total Number of Voters Served

Number of Vote Centers
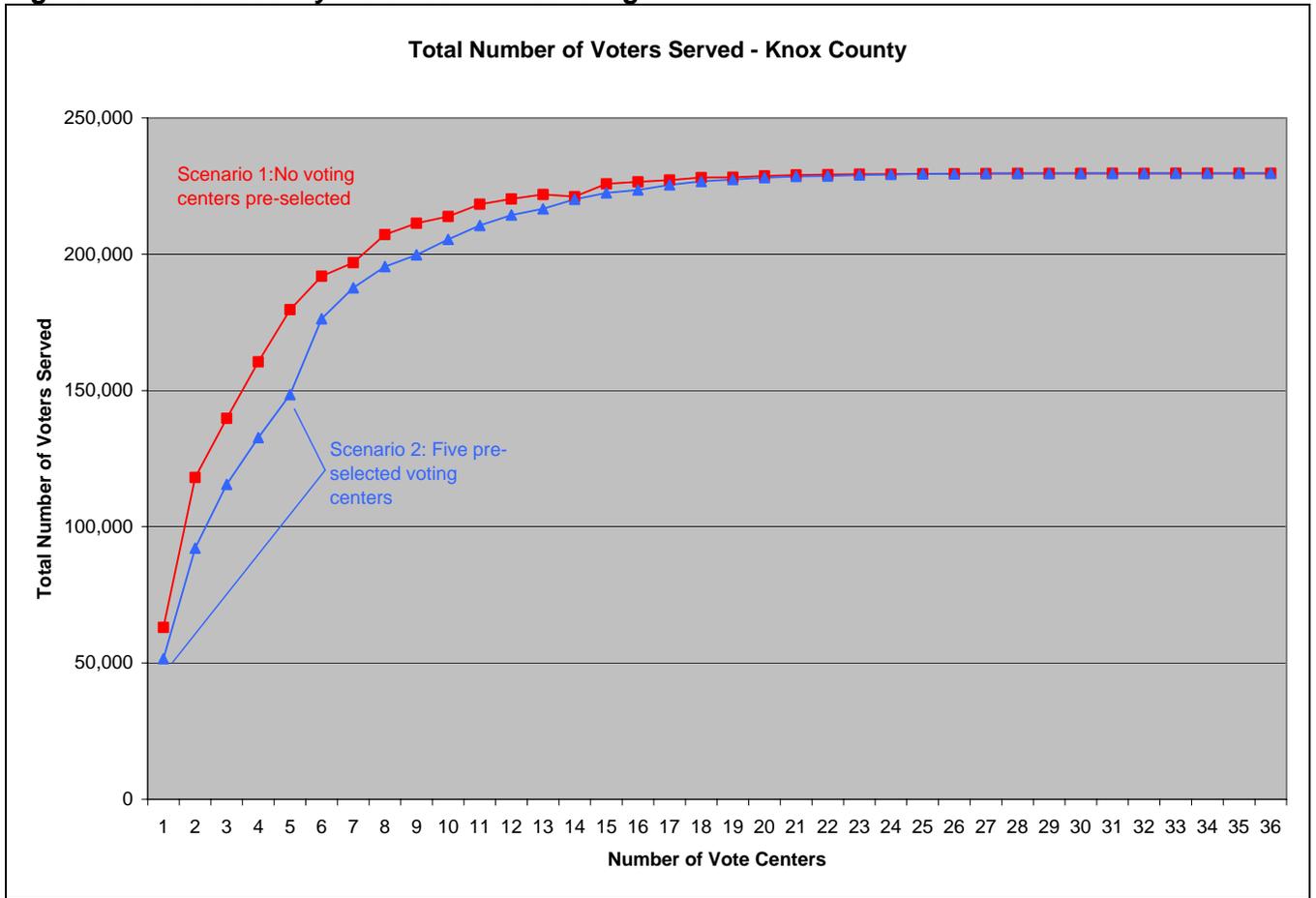
Figure 23. Knox County Voter Service Coverage, 15-Location Solution
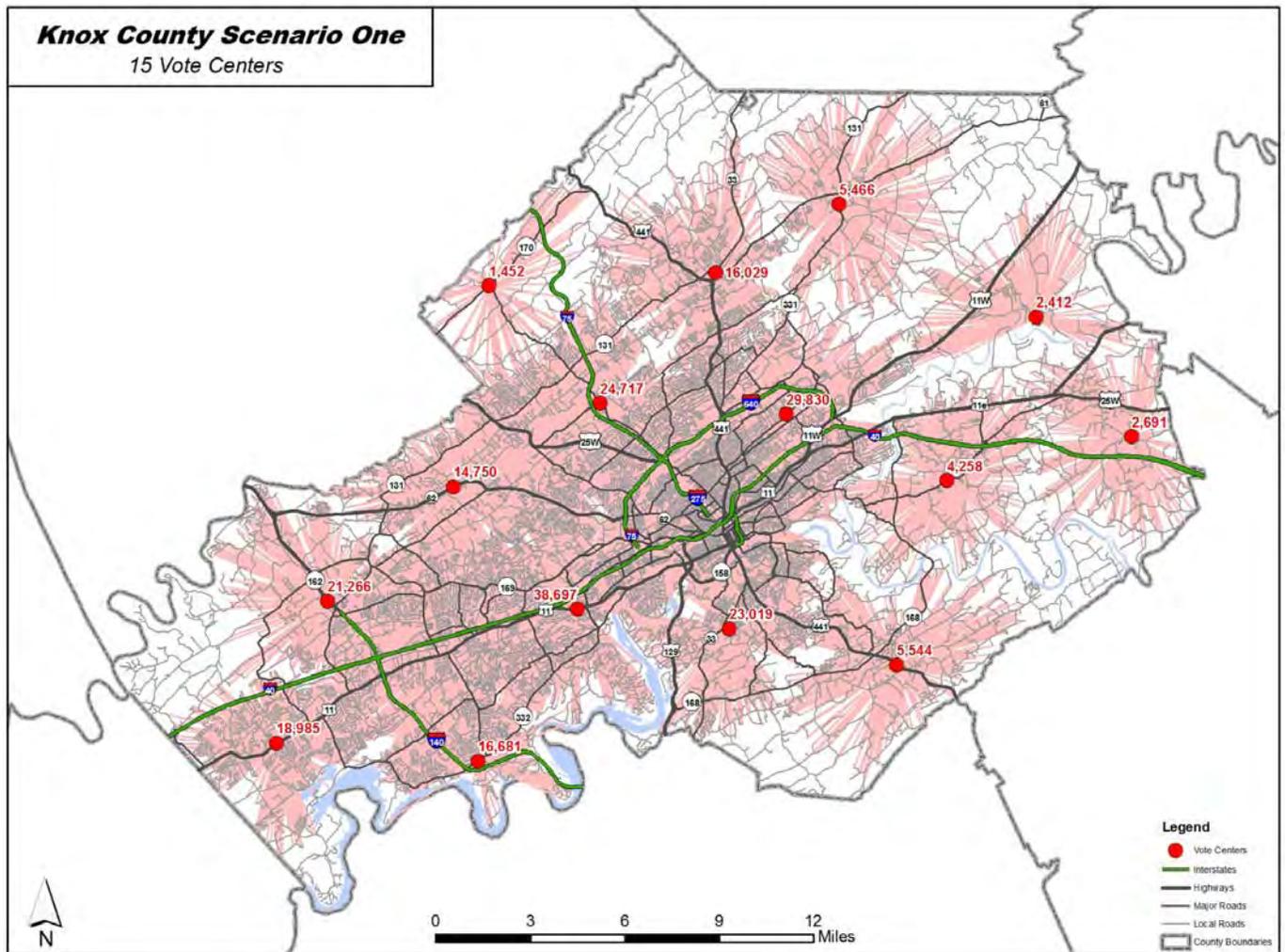
d. Comparison of scenarios

Both Knox County model scenarios achieved full coverage of voters (that is, those within five miles of a candidate site) with 34-center solutions. Before the 34th iteration, the number of voters served under Scenario Two was consistently lower than that of Scenario One, indicating that pre-selection of five centers produced a less efficient arrangement of locations. As the number of vote centers increased, though, the gap in service coverage between the two scenarios decreased.

Each scenario showed a decrease in incremental service coverage gains near the 12-center solution, with particularly slow growth after the 15-center solution in Scenario One and the 17-center mark in Scenario Two, evidenced by flat curves (Figure 22). Accordingly, the two location-allocation models for Knox County indicated a suitable number of vote centers in the range of 12 to 17 optimally-configured locations. This was acceptable for local application because state mandates call for one vote center for every 25,000 voters, meaning that a minimum of 10 centers is needed to serve the 231,057 registered voters in Knox County. Both scenarios accommodated the state requirement.

The map in Figure 24 compares the 15 vote centers that were selected under Scenarios One and Two. The models selected four of the same locations, however, that may be partially explained by the fact that they were located in rural areas with fewer candidate sites from which to choose. The two models also selected several proximal centers. The remainder showed noteworthy differences, both in service coverage and in geographic location.

Finally, Scenario One, operating unconstrained, was more efficient, but Scenario Two was more realistic, given its pre-determined elements recommended by the actual users of the models.

Figure 24. Comparison of Two Knox County Models, 15-Location Solution
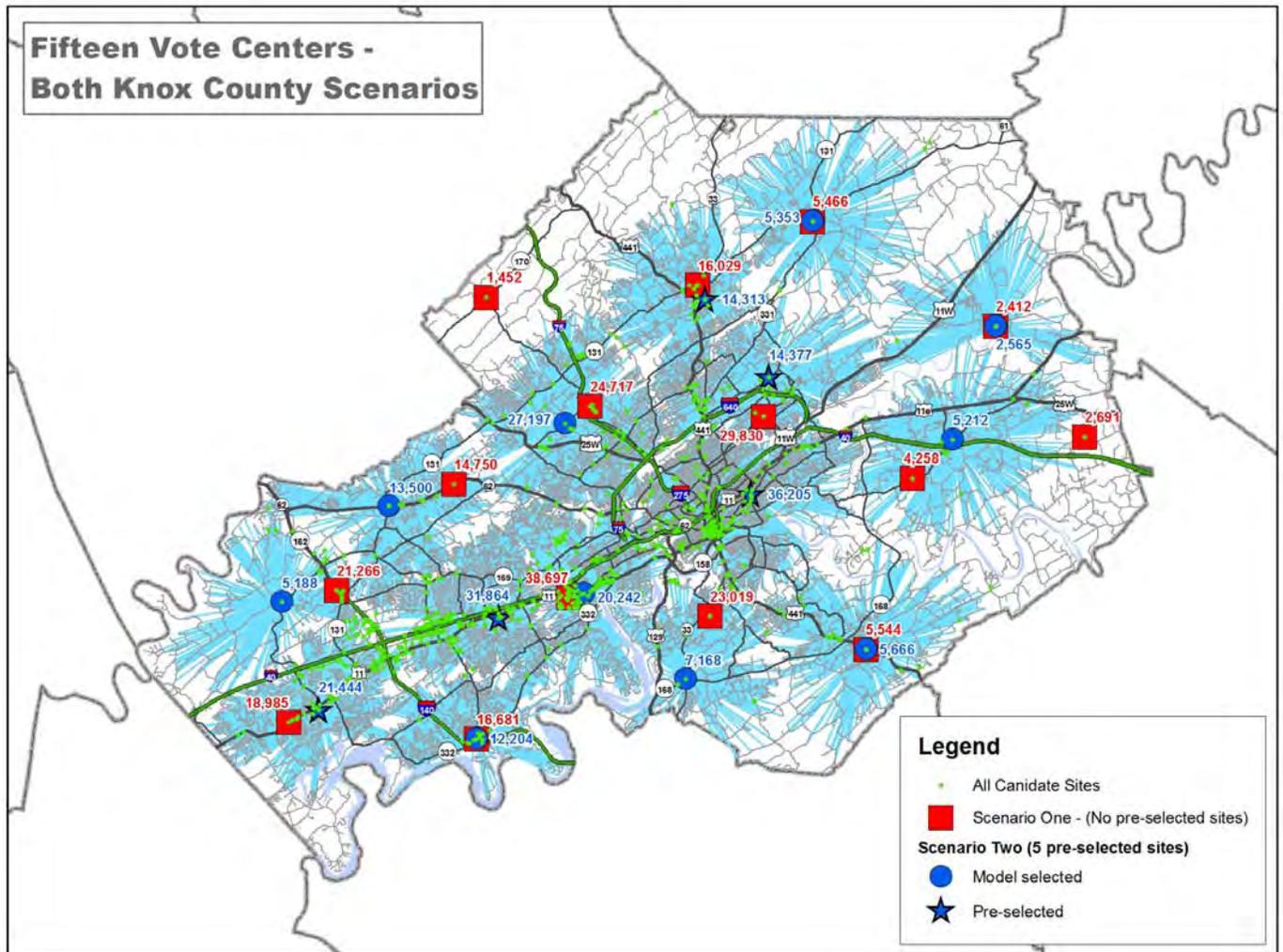
D8. Model Output: Anderson County

a. Two scenarios

As directed by state law, Anderson County required a vote center at its courthouse in Clinton. This pre-selected site was accommodated in Scenario One of the Anderson location-allocation model. To isolate the effect of requiring this site, a second model was run in which no centers were pre-selected. Voter service coverage at each iteration of both models is summarized in Table 25 and Figure 25.

Figure 25. Anderson County Voter Service Coverage
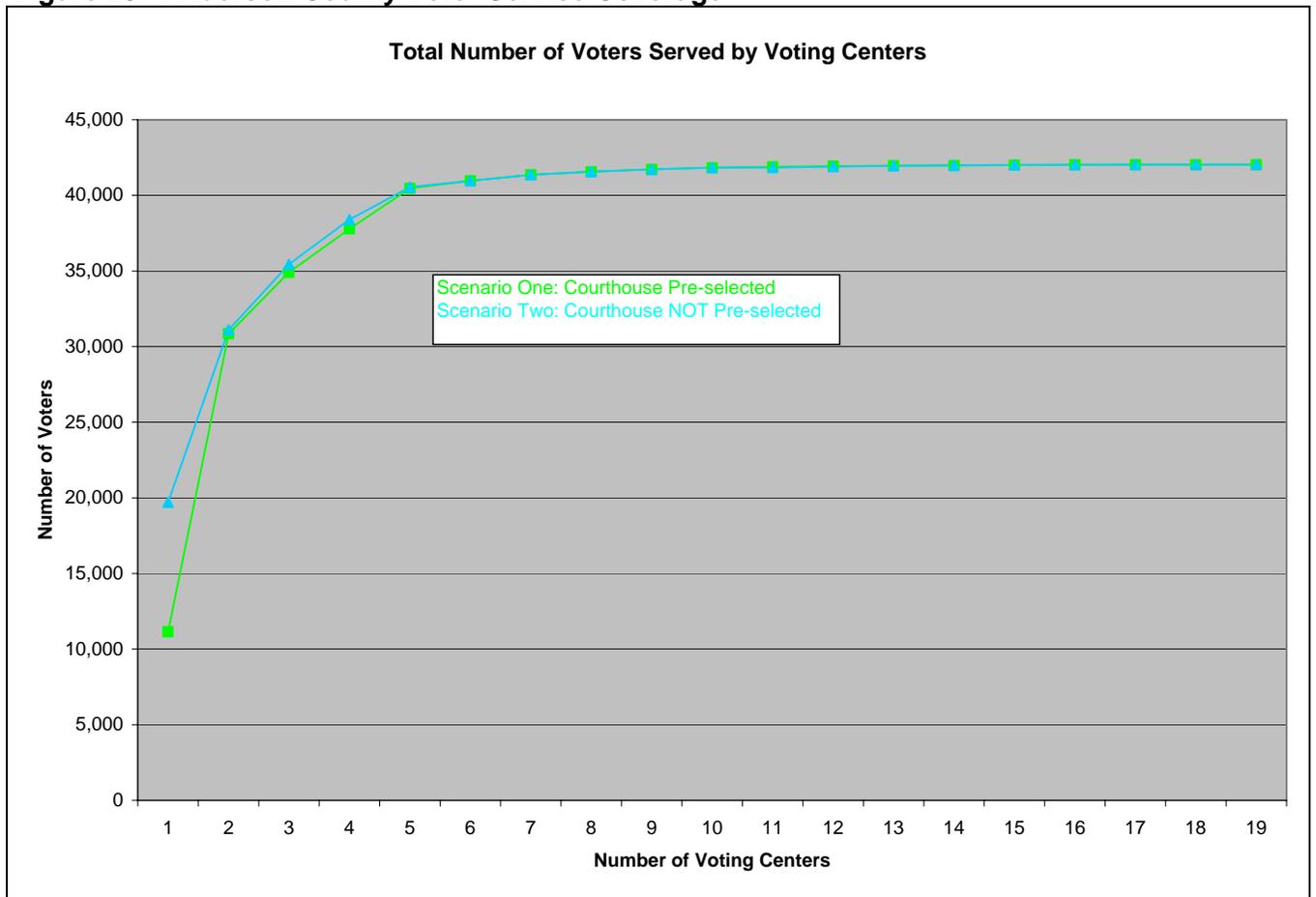
b. Comparison of scenarios: One pre-selected site and no pre-selected sites

Over one quarter (11,142) of Anderson County voters were served by the pre-selected courthouse location in the town of Clinton, represented by the first iteration of Scenario One (Table 25). The unconstrained model (Scenario Two) selected a different single location in the more populous Oak Ridge. That location served nearly twice the number of voters (19,709) as Scenario One's courthouse.

In the second iteration of the unconstrained scenario, the Oak Ridge location was again selected, and the model chose a site very close to the Anderson County courthouse in Clinton. The model selected this nearby location, rather than the courthouse itself, because it served slightly more Clinton area voters. With iterations three through five, the unconstrained model continued to select a non-courthouse location in or near Clinton. Interestingly, the two models selected identical locations in iterations six, seven, and eight, signifying that the courthouse was included in the optimum arrangement at these numbers of vote centers. On iterations 11 through 13, the number of voters served by the Scenario Two model was slightly lower than Scenario One. The lower figures indicated that the heuristic in Scenario Two, which was free to select any configuration of candidate sites, failed to select the Scenario One 11- to 13-center configuration that resulted in higher service coverage.

The 42,032 voters that were located within five miles of the nearest candidate site were accommodated in iteration 18 of Scenario One and iteration 17 of Scenario Two. The remaining 1,970 voters lived beyond the five-mile maximum distance to any candidate site and could not be served by any model configuration.

Finally, in terms of total service coverage, both models performed nearly equally after the fourth iteration. Further, the five-center solution in each marked the level at which incremental service coverage gains began to sharply diminish (Figure 25). By the seventh iteration, coverage curves for both models flattened, indicating a suitable solution in the range of five to seven optimally-configured vote centers (Figure 26). If state approval for a vote center pilot project similar to that for Knox County is extended to Anderson County, the minimum service requirement of one vote center per 25,000 voters will necessitate at least two centers for the county's 44,002 registered voters. Both model scenarios met that requirement.

Figure 26. Anderson County Voter Service Coverage, Seven-Location Solution
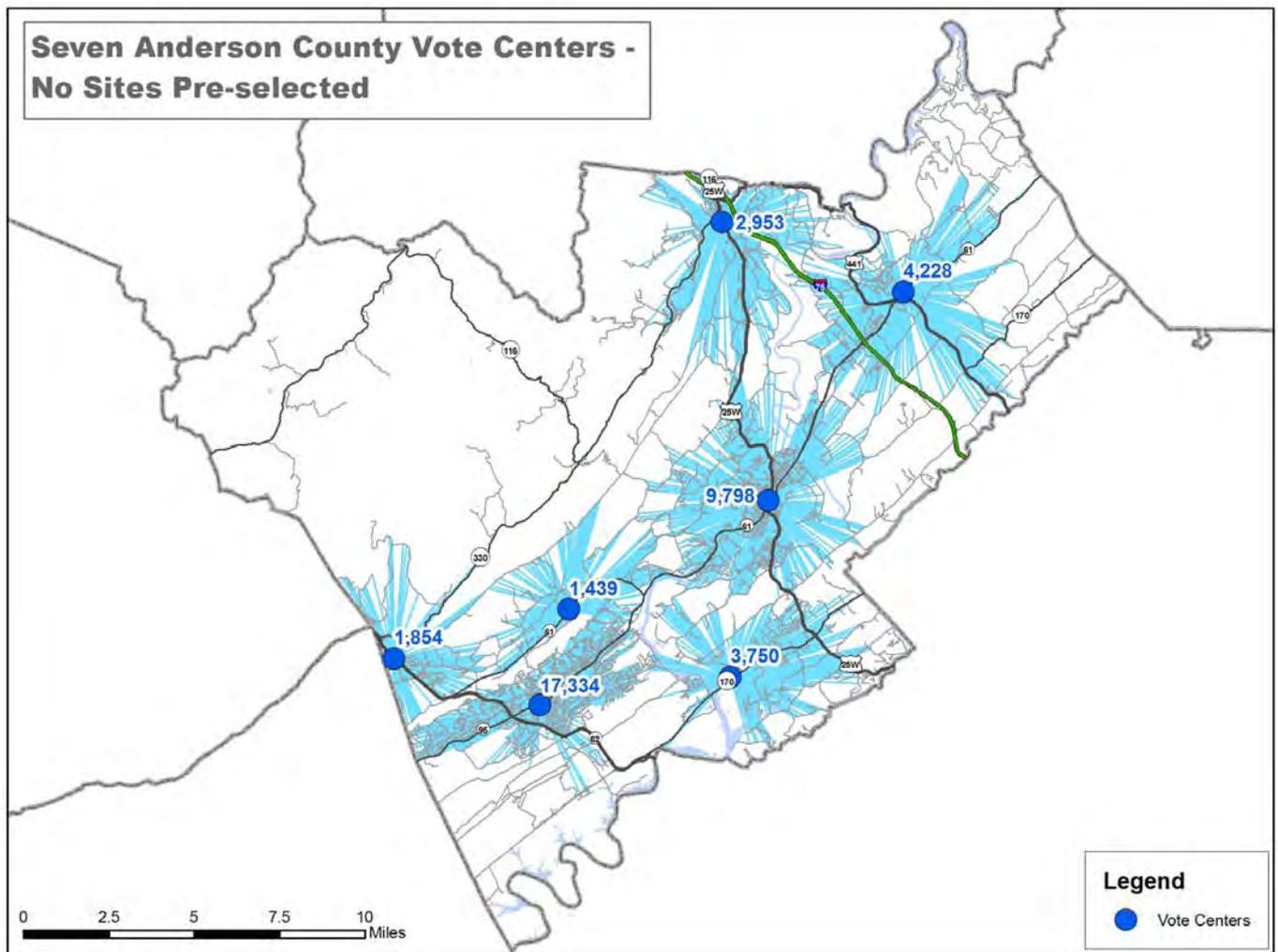
D9. Model Output: Loudon County

a. Two scenarios
  Like the analyses for Knox and Anderson counties, the Loudon County model was executed under two scenarios. By mandate, a vote center must be established at the Loudon County Election Commission office (the Loudon County courthouse is not fully compliant with provisions of the Americans With Disabilities Act). Additionally, the election administrator for Loudon County stated a preference for continued use of an existing early voting center at Roane State Community College in Lenoir City. These two locations were pre-selected in Scenario One. For the second scenario, only the Election Commission office was pre-selected. Output of the two models is shown in Table 26 and Figure 27.

Figure 27. Loudon County Voter Service Coverage
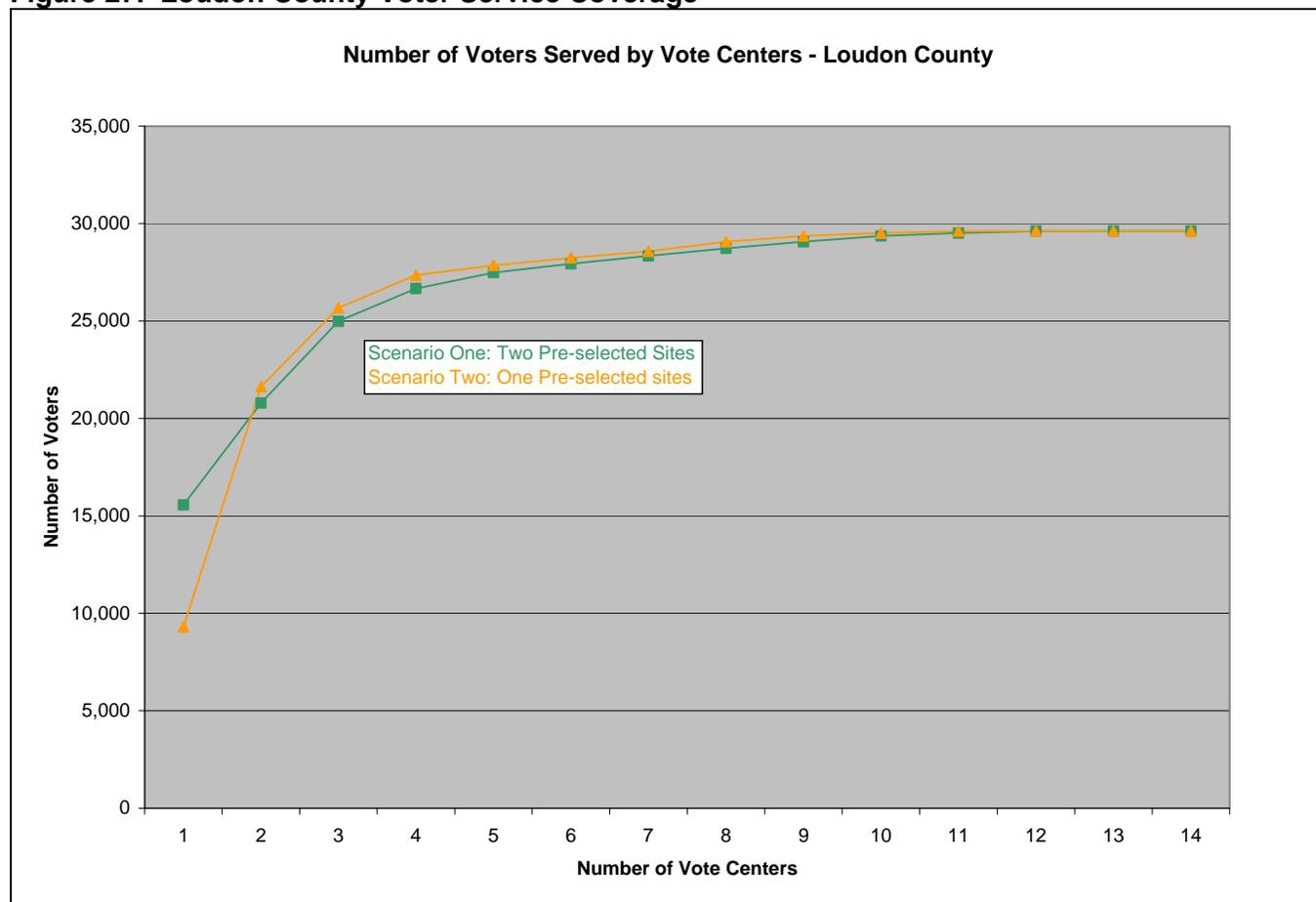
b. Comparison of scenarios: Two pre-selected sites and one pre-selected site
  The location-allocation models for Loudon County behaved as expected. That is, the least constrained model (Scenario Two) consistently outperformed the more-constrained model, providing vote center configurations that served a greater number of voters (Figure 27). An exception to this observation occurred with iteration one. In the least-constrained model of Scenario Two, the required Election Commission office site reached only 9,296 voters, while the

single location chosen in Scenario One (Roane State Community College) covered 15,565 voters (Table 26).

The second model served all 29,621 voters (that is, those that were located within 6.5 miles of the nearest candidate site) with a 12-vote center configuration. (Focus group respondents in Loudon County stated a willingness to travel as far as 6.5 miles, on average, to vote. Knox and Anderson respondents chose a five-mile maximum.) The first model accommodated complete service coverage at its 13th iteration.

The four-center solution in each marked the level at which incremental service coverage began to diminish (Figure 27). At the 10th iteration, coverage curves for both models flattened, however, the gains recorded from the fifth through ninth iterations were small. Given the size of the total voting population in Loudon County (29,649), 10 vote centers simply would be impractical and would far exceed state minimums which require only two centers. Instead, based on model output for both scenarios, a suitable solution should fall in the range of four to six optimally-configured vote centers (Figure 28).

Figure 28. Loudon County Voter Service Coverage, Six-Location Solution
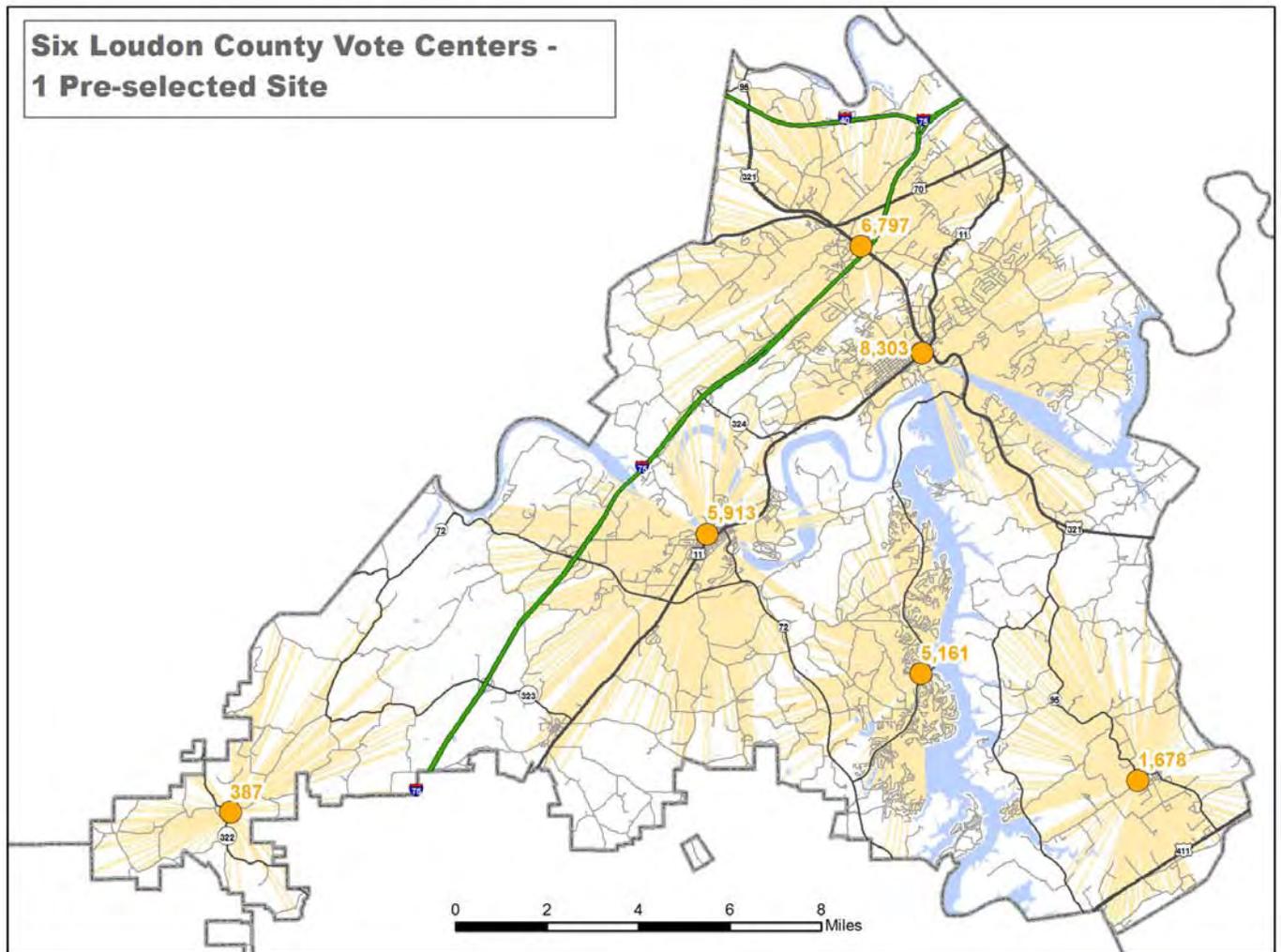
D10. Adjustment to Research Methodology

Early in the design stages of our modeling methodology, some consideration was given to conducting field inspections of candidate sites prior to including them in the location-allocation models. This approach would have incorporated the relative importance of location/site criteria and eliminated unsuitable sites prior to model execution. Only sites that could serve as vote centers would have been included in the models, and, therefore, any sites selected by the models would have immediately been deemed suitable. It was observed, however, that with hundreds of potential sites, a field inspection program of that magnitude was not practical. Additionally, the location-allocation models were easily robust enough to accommodate hundreds of sites, regardless of their ultimate suitability. It was decided to let the models run with all candidates. Then, those locations and several others immediately adjacent to them would comprise the inventory to be field inspected and evaluated based on important location/site criteria.

D11. Model Assessment Using Cost Figures

Identification of a suitable number of vote centers relied on location-allocation model output, namely, measures of incremental gains in service coverage with each additional location. Data review involved professional judgment, requiring end users to make a determination of a suitable stopping point for the model. In preliminary analysis, the solution at which only small gains were made in service coverage was considered a probable stopping point. To strengthen that decision process, a second level of analysis, tied to vote center operating costs, was added.

Fixed and variable costs of vote centers were estimated for Knox, Anderson, and Loudon counties using data from a recent election. Specifically, costs to operate early voting stations, rather than precinct locations, were used since they best approximated vote centers as defined in our *Convenience Voting* program. Fixed costs were treated as a constant but not allocated across all vote centers. To allocate them would mean that the total cost would actually go down as more vote centers were added, which is not the case. Rather, fixed costs were omitted from the analysis, and only variable costs were used.

Variable costs of operating one vote center were applied to each center added in the iterative location modeling process. They were tabulated on a per voter basis in two forms: a) total voter service coverage, and b) incremental gains in voter service coverage with each additional vote center.

a. Knox County models

Variable costs in the unconstrained Knox County location model are presented in Table 27. A suitable number of vote centers based on total voter coverage and incremental gains in coverage fell into the range of 12 to 17 centers. Adding variable cost numbers to the analysis, that range was reaffirmed. Variable cost per voter served grew steadily with the addition of vote centers as gains in the number of voters did not keep pace with cost increases. More notably, variable cost per additional voter increased sharply at the outer limits of the range, nearly tripling from the 12-center solution to the 17-center model, while service coverage grew only three percentage points.

As stated earlier, Tennessee law requires at least one vote center for every 25,000 voters. With 231,057 voters in Knox County, a minimum of 10 centers is necessary. At that level of coverage, 213,824 voters were served by the location model, representing 92.5 percent

of the registered total, and variable costs were $8.22 per voter served. Adding an 11th center increased coverage to 94.5 percent, a two-percentage point gain, and variable cost per voter served climbed 7.7 percent, or $0.63, to $8.85 per voter. The 11th center resulted in an additional 4,516 voters, roughly $38.90 in variable costs per additional voter, down from $70.41 per voter when the 10th center was added.

With the addition of a 12th center, the number of voters served improved less than one percent to 95.3 percent coverage, and variable cost per voter increased 8.1 percent, or $0.72, for a total of $9.57 per voter. The 12th center accommodated an additional 1,927 voters for an average variable cost of $91.17 per added voter, a sizeable increase from the previous iteration. Similar increases occurred with a 13th vote center, while a 14th station resulted in poorer service performance (see earlier discussion about model performance analytics). With 15 centers, 97.7 percent of all area voters were served, and total variable costs per voter increased to $11.67. Also, the variable cost per additional voter fell below triple digits to $37.37 as the 15th center covered 4,701 new voters. After 15 centers, the model showed only small service coverage improvements, and per voter costs escalated rapidly, proving additional centers less viable fiscally.

Similar analysis was conducted for the Knox County model with five pre-selected vote center sites (Table 28). Once again, analysis began with a 10-vote center model to accommodate state law. At that level, 205,427 registered voters (88.9 percent of the total) were served, at an average cost of $8.55 per voter. Addition of an 11th center increased service coverage to 91.1 percent, and variable costs grew $0.63 per voter to $9.18. The 11th center captured 5,142 new voters for an average variable cost of $34.16 per new voter. A 12th center resulted in a 7.1 percent increase in variable costs averaged across all voters served. That included a 34.7 percent hike in the costs associated with additional voters served. While sizeable, that increase was in the middle of the range of costs associated with the 8th through 12th additions. Total service coverage grew 1.8 percent with the 12th addition. Similar performance numbers were measured with iterations up to and including a 15th vote center. Thereafter, total service gains began to level, and variable costs per additional voter served climbed sharply.

Based on service coverage and variable costs, both Knox County models demonstrated that a suitable number of centers was in the range of 12 to 15. This is a refinement of the estimated range of 12 to 17 centers offered in the analysis based only on service coverage.

b. Anderson County models
Variable cost tabulations for the unconstrained Anderson County location model are presented in Table 29. If state approval for a vote center pilot project similar to that for Knox County is extended to Anderson County, the minimum service requirement of one vote center per 25,000 voters will necessitate at least two centers for the county's 44,000 registered voters. At the two-center mark, 31,113 voters were covered by the unconstrained location model, representing 70.7 percent of the total (Table 29). Variable costs were $0.21 per voter served. With each subsequent vote center, steadily decreasing numbers of new voters were added, resulting in continually increasing variable costs per voter. Shares of accommodated voters grew with each new center, but gains began to level after an eighth center was added. However, that eighth center resulted in nearly double the per voter variable costs for additional service. As a result, a suitable count of vote centers for Anderson was in the range of five to seven centers, confirming earlier findings based on measures of service coverage. Very similar findings resulted from the Anderson model that included one pre-selected site (Table 30).

c. Loudon County models

Variable cost tabulations for the Loudon County location model with one pre-selected site are presented in Table 31. Loudon County will need at least two vote centers to meet state requirements for service coverage if a program of *Convenience Voting* similar to that for Knox County is approved. Based on the first coverage model devised for Loudon County, two centers accommodated 21,624 of the county's 29,649 registered voters. It took four centers to reach 90 percent coverage, costing the county an average $1.63 per registered voter served (Table 31). A fifth center served an additional 504 voters, bringing total coverage to 93.9 percent, however, variable cost per additional voter more than tripled to $22.16. A 95-percent coverage rate was achieved with six vote centers, but variable cost per voter (total) was double the two-center rate. Variable costs per additional voter served also were substantial, reaching $28.82. Total variable costs and voter coverage indicated a solution in the range of four to six centers, although service (and cost) increases showed steady upward movement through a nine-center solution, where service coverage leveled in the 99 percent range.

The location-allocation model with two pre-selected sites for Loudon County vote centers performed in a manner very similar to the model based on one pre-selected site. Again, a solution in the range of four to six centers appeared reasonable, but service improvements continued steadily with incremental additions through a 10-center model (Table 32). Cost data supported the findings based on service coverage, but they could not strengthen an assertion about the best number of vote centers to operate. As a result, the most suitable solution was less evident in the Loudon County models, compared to Knox and Anderson.

E. Local Review and Site Inspection

E1. Model Output Review

Analysis of county-specific location-allocation model output resulted in ranges of numbers and locations of vote centers, based on voter service coverage and variable operating costs. The Knox County models showed a solution range of 12 to 15 optimally-configured centers; Anderson County models produced a five- to seven-center solution; and, Loudon County results showed a four- to six-center range. The location-allocation models optimally configured the vote centers locations at each iteration. However, analysts must determine which iteration (that is, number of centers) is most suitable, thereby moving from a range of solutions to one final outcome. To accomplish this, we convened our research team and the election administrators from each county to review the model output. Participants were asked to balance service coverage and operating costs to generate logistically and fiscally sensible plans for vote centers.

As a first step, election officials and GIS analysts examined several map and data products showing service coverage and costs from varying numbers of vote centers. (For this process, models that included pre-determined sites were used. Those models provided realistic choices because they included locations that election administrators said they likely would use regardless of the findings of our modeling process. Sites included those that were used successfully as early voting centers in past elections and offered cost, location, and other proven advantages to administrators. Their continued use was considered probable.) Generally speaking, the point at which incremental service coverage began to flatten marked the likely place to stop analysis. Comparison with variable costs for total voter service and variable costs per additional voter served provided further validation of stopping points.

The next step was a close examination of actual sites selected by the location models (those not otherwise pre-determined in the models). Each model-selected site and adjacent alternatives were considered individually. The personal knowledge of election officials and analysts provided a coarse screening for suitability. If a site was known to have some deficiency (as defined by site criteria identified earlier), it was discarded in favor of the geographically closest alternate (within a one-mile radius). For example, in the Knox County review session, a location designated to serve a northwest portion of the county was sited by the computer model in a small volunteer fire station. As noted earlier, the consensus of election officials at our *Site and Location Criteria Workshop* was that fire stations should be avoided due to conflicts between voter traffic and emergency services equipment. Additionally, the site was undersized, adequate parking was unavailable, and other essential site criteria were known to be unmet. Accordingly, the fire station was discarded and other sites in the immediate vicinity were examined. A nearby community college facility, situated less than one mile from the model-identified site, met all mandatory and essential criteria and was chosen as the likely vote center for the area.

In the course of evaluating sites in the Knox County solution, there were a few instances when neither the model-identified locations nor nearby alternatives were suitable. Deviation from previously-determined site requirements was necessary. For example, in northeast Knox County, the location model selected a site at a small commercial center. With no known vacancies, it was improbable that the Election Commission could use the site, so it was discarded. Nearest alternatives included a church, which, as discussed at the *Site and Location Criteria Workshop*, was not considered preferable, and a public library, which not only contradicted the findings of the workshop, but it was more than one mile from the model-identified location. Given the lack of other alternatives, both the church and library were left in the inventory of candidate sites for further consideration.

As an aside, when confronted with the lack of viable options, as described above, a third option was raised: placement of a modular (trailer) unit near the model-selected site. In fact, that option was given serious consideration for a few locations in Knox County that presented site challenges. It may turn out to be a viable option once further study is undertaken.

E2. Field Inspections and Site Inventory

The review process continued until all model-specified sites and reasonable adjacent alternatives were considered. The result was a refined list of candidate sites, still not a final list. Since the review process included a combination of model results, personal knowledge, and anecdotal impressions, additional fact finding was necessary. This took the form of field inspection of all sites on the refined candidate list. Inspections were made using the facility evaluation checklist (Figure 1), and site details were recorded in a database. Because this phase of our larger *Convenience Voting* program was intended for project planning and design, only a sample of sites was field inspected to test and validate our methodology. During implementation, all sites will be checked, and those that fail to meet mandatory or essential criteria will be discarded. Remaining sites will be reviewed by the project team for final selection as vote centers.

F. CONCLUDING REMARKS

F1. Assessment of Location Modeling

GIS-based location-allocation models and interaction with local officials provided a sound methodology to identify locations for vote centers in Knox, Anderson, and Loudon counties. Model-derived service coverage in each of the three areas exceeded 90 percent of voters, with locations optimally configured based on acceptable travel distances. Variable cost figures provided an additional level of analysis to help local experts decide suitable numbers of vote centers, when given a range of choices. Model-selected sites were field inspected to ensure compliance with mandatory, essential, and important site and location criteria, as measured by local election officials and voters. While this study represents a portion of the planning and design work for our *Convenience Voting* program, the methodology devised and tested here will be applied to a pilot project to select actual vote centers in an upcoming city election in Knox County.

The location-allocation models delivered output to inform decisions on suitable numbers and locations of vote centers at three geographic scales of analysis: large, medium, and small communities. Models for Knox and Anderson counties, representative of large and medium communities, showed clear ranges of suitable model solutions. Models for Loudon County, a small community, offered a less evident solution. However, logistical and fiscal realities were provided by local experts (that is, election administrators) to extract a solution from the model output.

Dense population covers much of the geographic area of Knox County, making vote center location choices and voter allocation a complex undertaking. In previous local elections, selection of a small number of early voting centers was based on an informal process, reliant more on local knowledge and judgment than scientific methodology. Our *Convenience Voting* program, which will result in the replacement of precincts and early voting places, demands more rigorous geographic analysis, and the location models were particularly valuable in that role. In contrast, the medium and small communities of Anderson and Loudon counties are characterized by simpler population distributions in geographically isolated centers. The sites selected by the location models were, in several instances, expected. In Anderson County, for example, vote centers were placed by the location models in Oak Ridge, Clinton, Lake City, Norris, and Oliver Springs, that is, all of the towns within the county. Back-of-the-envelope methods might work adequately for smaller communities, but the use of location-allocation models provides statistically sound basis, an important consideration when attempting allocations with limited resources.

That said, development and operation of location-allocation models require investments in datasets, software, hardware, and trained analysts. Commercial geographic information systems continue to improve, with simpler modeling applications forthcoming in a new release of ESRI software, for example. Still, expertise in development and analysis will be needed. Public sector data were available for much of the Knox County models. Commercial data were needed for Anderson and Loudon, which resulted in higher costs for model development for those counties.

F2. Future Research: Alternative Vote Center Models

a. City-only election

A location-allocation model using only registered voters in the City of Knoxville could be developed to accommodate city-only elections. A set of optimally-located vote centers for city elections would be useful during cycles in which there is no simultaneous countywide election. Further, the sites chosen for a city-only election could be treated as pre-determined sites for countywide modeling. In so doing, continuity of site usage from election to election could be established. Rather than having one set of vote centers for combined city and county elections, and a second set for city-only elections, those sites designated in the city-only model would be used in all types of elections. This alternative model would include two steps: a) run the city model to determine optimal locations for city-only election vote centers, and b) force those locations as preferred sites in a countywide model.

b. Low-turnout election

A location-allocation model using fewer registered voters could be developed to replicate a county primary or other minor election that would likely have lower turnout, say 20 to 50 percent of full election turnout. This version could test for impacts on number and location of centers. The model could be run unconstrained (that is, no pre-determined sites) or, in a variation, pre-selected sites could be incorporated. Specifically, those sites identified in a full election model could be pre-selected as candidates in the scaled-back model. As the model runs iteratively and individual pre-selected sites are added, incremental service coverage gains would show the point at which a suitable number of sites have been provided. Those sites would then be opened for the primary or minor election, and the others would remain unused. Similar to the city-only alternative above, this type of model could accommodate continuity of site usage from election to election.

VIII. Conclusion

The only way to assess the efficacy and wisdom of the array of changes being proffered by election administration reformers is to test them in the field. As Alvarez and Hall have averred, "pilot testing can be an effective means of learning about the efficacy of a voting system (2004: 11). It seems wise to test these ideas in small-scale field trials so that their strengths and weaknesses, costs and benefits, can be carefully evaluated. To that end this feasibility study for convenience voting centers in Anderson, Knox, Loudon counties was undertaken.

The purpose of this project, then, was to provide the framework for designing a convenience voting system that can be field tested in elections in three Tennessee counties. Based on the findings reported above, this system should be designed to:

1. Include the involvement of key stakeholders in the system design and implementation phase, e.g. establish a stakeholder advisory group;

2. Carefully consider a system that involves the youngest voting cohort in the design and implementation of the system;

3. Take advantage of twenty-four years of experience in administering early voting, which constitutes a basic form of convenience voting;

4. Include time and resources for enhanced poll worker recruitment and training—including real-time assessment and accountability of worker performance as the system is field tested;

5. Limit the employment of new technology to only the most essential features of the system to facilitate comparisons with precinct-based elections and to reduce the number of variables involved in the test;

6. Conduct a small-scale pilot field test of the system, in a municipal election for one county, well before implementation on a county-wide basis. Small-scale testing should minimize risks if things do not work out as expected, yet provide the data and experience needed to increase the effectiveness of the full field system test in three county-wide settings.

 Limited testing, followed by an appropriate comparative evaluation—which employs the cost, turnout, and public opinion data reported here as well as data to be gathered when the system is deployed—can provide policy makers and the public with the information needed to make intelligent decisions regarding current best practices and future election administration reform.

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APPENDIX A: TABLES

**Table 1. Election Administration Costs for Loudon County, Tennessee
2004 and 2006 August and November General County and State/Federal Elections**

	Pollworkers	Advertising	Other Contracted	Cell Phones	Office Supplies
Aug-06	28,000.00	3,200.00	6,000.00	1,700.00	502.00
Nov-06	30,094.00	6,000.00	6,300.00	1,800.00	675.00
Aug-04	18,900.00	1,800.00	6,445.00	1,600.00	542.00
Nov-04	22,200.00	2,000.00	7,240.00	1,900.00	645.00

	Paper	Printing	Postage	Overtime Pay	Custodial	**Total**
Aug-06	120.00	1,500.00	425.00	1,200.00	505.00	**$43,152.00**
Nov-06	124.00	2,000.00	750.00	1,450.00	555.00	**$49,748.00**
Aug-04	102.00	1,800.00	602.00	1,200.00	505.00	**$33,496.00**
Nov-04	208.00	1,800.00	875.00	1,200.00	505.00	**$38,573.00**

Source: Loudon County Election Commission.

**Table 2. Cost Per Vote for Anderson, Loudon, and Knox County, Tennessee
2004 and 2006 August and November General County and State/Federal Elections**

		Total Votes	**Cost Per Vote (CPV)**
	Anderson		
2006 August	$42,702.91	15,250	$2.80
2006 November	$38,778.00	23,966	$1.62
2004 August	$29,461.63	7,116	$4.14
2004 November	$58,708.93	31,920	$1.84
Average CPV			*$2.60*
	Loudon		
2006 August	$43,152.00	8,480	$5.09
2006 November	$49,748.00	16,761	$2.97
2004 August	$33,496.00	2,644	$12.67
2004 November	$38,573.00	19,959	$1.93
Average CPV			*$5.66*
	Knox		
2006 August	$227,618.00	52,136	$4.37
2006 November	$241,899.00	126,639	$1.91
2004 August	$221,753.00	40,983	$5.41
2004 November	$263,838.00	180,112	$1.46
Average CPV			*$3.29*

Table 3. Selected Features of the Three Counties

	Anderson County	Knox County	Loudon County
Staff FTE	4	10	2
Operating Budget	653,612	936,160	212,321
Early Voting Sites	2	8	2
Site Rental Cost	0	0	0
Registered Voters	46,945	257,150	29,165
Total Voters	15,344	92,707	11,501
Early Voters	4,011	36,774	4,411
Percent of Total	26%	40%	38%

Table 4. Total Operating Cost Model

	Anderson County	Knox County	Loudon County
Make Ready Costs			
Site Preparation	$ 1,010	$ 9,315	$ 3,370
Publication	$ 707	$ 12,400	$ 1,297
Operating Costs			
Equipment	$ 130	$ 630	$ 260
Printing	$ 2,955	$ 122	$ 3,773
Personnel	$ 1,095	$ 151,790	$ 13,492
Take Down Costs			
Remove Equipment	$ 500	$ 700	$ 100
Other	$ 100	$ 700	$ 36
Total Operating Cost	**$ 6,497**	**$ 175,657**	**$ 22,328**

Table 5. Operating Costs as % of Basic Activities

	Anderson County	Knox County	Loudon County
Make Ready Costs	26%	12%	21%
Operating Costs	64%	87%	78%
Take Down Costs	9%	1%	1%

Table 6. Comparative Operating Costs, Early v. Election Day

	Anderson County	Knox County	Loudon County
Total Operating Cost - Early Voting	$ 6,497	$ 175,657	$ 22,328
Operating Cost per Early Voter	$ 1.62	$ 4.78	$ 5.06
Operating Cost Per Early Voting Site	$ 3,249	$ 21,957	$ 11,164
Total Operating Cost - Election Day	24,549	176,407	31,981
Operating Cost per Election Day Voter	$ 2.19	$ 3.15	$ 4.59
Operating Cost per Election Day Site (Pre	$ 847	$ 1,917	$ 2,284

Table 7. Operating and Fixed Costs as a Proportion of Early Voters

	Anderson County	Knox County	Loudon County	Applied Portion
Personal services	$ 199,955	$ 529,411	$ 133,486	100%
Employee benefits	$ 45,982	$ 145,286	$ 19,243	100%
Contractual services	$ 30,643	$ 162,000	$ 38,919	60%
Supplies and materials	$ 3,118	$ 28,500	$ 3,000	75%
Other	$ 373,914	$ 70,963	$ 17,673	75%
Total	$ 653,612	$ 936,160	$ 212,321	

Table 8. Comparative Costs Per Registered Voter

	Anderson County	Knox County	Loudon County
Operating Cost per Voter	$ 1.62	$ 4.78	$ 5.06
Operating Cost per Site	$ 3,248.50	$ 21,957.13	$ 11,164.00
Fixed Cost (Applied)	$ 28,449	$ 67,720	$ 14,560
Ratio Operating to Fixed	0.23	2.59	1.53
Total Cost per Voter	$ 8.71	$ 6.62	$ 8.36
Total Cost per Registered Voter	$ 0.74	$ 0.95	$ 1.26

Table 9. Early Voting and Election Day Voting Cost Comparisons

	Anderson County	Knox County	Loudon County
Operating Cost	$ 24,549	$ 176,407	$ 31,981
Election Day Votes	10,973	54,316	6,837
Absentee Votes	239	1,617	130
Operating Election Day Cost per Voter	$ 2.19	$ 3.15	$ 4.59
Election Day Voters as Percent of Total Vote	74%	60%	62%
Fixed Cost (Applied)	$ 80,970	$ 101,579	$ 23,757
Ratio Variable to Fixed	$ 0.30	$ 1.74	$ 1.35
Total Election Day Cost per Voter	$ 9.41	$ 4.97	$ 8.00

Table 10. Total Cost per Voter, Early Voting and Election Day, February 2008

	Anderson County	Knox County	Loudon County
Operating Cost per Early Voter	$ 1.62	$ 4.78	$ 5.06
Total Cost per Early Voter	$ 8.71	$ 6.62	$ 8.36
Operating Cost per Election Day Voter	$ 2.19	$ 3.15	$ 4.59
Total Cost per Election Day Voter	$ 9.41	$ 4.97	$ 8.00

Table 11. State Reimbursement for February 2008 Election Costs

	Anderson County	Knox County	Loudon County
Total Cost Early Voting	$ 34,946	$ 243,377	$ 36,888
Total Cost Election Day Voting	$ 105,519	$ 277,986	$ 55,737
Total Election Cost	$ 140,465	$ 521,363	$ 92,626
Amount Reimbursed	$ 35,287	$ 284,623	$ 43,032
Percent Reimbursed	25%	55%	46%

Table 12. Voter Turnout for Anderson, Knox, and Loudon County, Tennessee
All County-Wide Elections 1994-2006

Anderson County	Registered	Votes	Early	Turnout	%Early	Absentee	%Early & Absentee
2006 August	46,628	15,250	6558	32.71	43.0	286	44.88
2006 November	46,983	23,966	11503	51.01	48.0	679	50.83
2004 Presidential Primary	42,700	6,089	1282	14.26	21.05	99	22.68
2004 August	43,701	7,116	2421	16.28	34.02	122	35.74
2004 November	45,114	31,920	15197	70.75	47.61	980	50.68
2002 August	43,479	19,750	7391	45.42	37.42	220	38.54
2002 November	43,954	23,623	8941	53.74	37.85	453	39.77
2000 Presidential Primary	41,090	6,456	1248	15.71	19.33	202	22.46
2000 August	41,469	4,675	1087	11.27	23.25	101	25.41
2000 November	42,856	29,096	10406	67.89	35.76	955	39.05
1998 August	42,766	16,897	3,979	39.51	23.55	220	24.85
1998 November	43,011	16,238	3,212	37.75	19.78	478	22.72
1996 Presidential Primary	38,401	7,701	659	20.05	8.56	134	10.3
1996 August	35,184	8,399	893	23.87	10.63	190	12.89
1996 November	36,934	27,782	5,667	75.22	20.4	675	22.83
1994 August	35,622	17,693	1,854	49.67	5.2	218	11.71
1994 November	36,247	21,902	2,862	60.42	13.07	291	14.4

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Table 12 (continued). Voter Turnout for Anderson, Knox, and Loudon County

Knox County	Registered	Votes	Early	Turnout	%Early	Absentee	%Early & Absentee
2006 August	262,176	52,136	24042	19.89	46.11	564	47.2
2006 November	268,324	126,639	67833	47.2	53.56	2,636	55.65
2004 Presidential Primary	235,186	34,882	11906	14.83	34.13	521	36.63
2004 August	257,243	40,983	16879	15.93	41.19	706	42.91
2004 November	278,325	180,112	108722	64.71	60.36	3,879	62.52
2002 August	218,037	67,539	25190	30.98	37.3	629	38.23
2002 November	222,854	119,368	53370	53.56	44.71	1,878	46.28
2000 Presidential Primary	222,999	39,800	10592	17.85	26.61	568	28.02
2000 August	219,005	19,808	5627	9.04	28.41	452	30.69
2000 November	232,534	152,098	70463	65.41	46.33	3,337	48.52
1998 August	212,485	54,465	13,934	25.63	25.58	602	26.69
1998 November	213,883	67,677	12,180	31.64	18.0	2,127	21.14
1996 Presidential Primary	188,753	27,007	4,632	14.31	17.15	817	20.18
1996 August	189,215	27,711	2,885	14.65	10.41	850	13.48
1996 November	203,750	141,018	41,844	69.21	29.67	2,800	31.66
1994 August	173,125	70,960	4,072	40.99	2.35	859	6.95
1994 November	178,374	104,185	11,747	58.41	11.28	1,299	12.52

Table 12 (continued). Voter Turnout for Anderson, Knox, and Loudon County

Loudon County	Registered	Votes	Early	Turnout	%Early	Absentee	%Early and Absentee
2006 August	28,479	8,480	4218	29.78	49.74	127	51.24
2006 November	28,999	16,761	9678	57.8	57.74	411	60.19
2004 Presidential Primary	24,570	2,641	692	10.75	26.2	48	28.02
2004 August	25,380	2,644	740	10.42	27.99	70	30.64
2004 November	26,869	19,959	10564	74.28	52.93	502	56.44
2002 August	25,030	8,687	2498	34.71	28.76	79	41.54
2002 November	25,466	14,545	5349	57.12	36.78	470	40.01
2000 Presidential Primary	23,489	838	595	3.57	71	64	78.64
2000 August	23,930	3,264	809	13.64	24.79	46	26.19
2000 November	24,946	16,407	4706	65.77	28.68	623	32.48
1998 August	21,426	7,203	1,434	33.62	19.91	231	23.12
1998 November	24,070	7,308	1,025	30.36	14.03	251	17.46
1996 Presidential Primary	18,649	2,811	295	15.07	10.49	79	13.3
1996 August	19,408	3,654	387	18.83	10.59	25	11.28
1996 November	21,744	13,859	1,976	63.74	14.26	147	16.76
1994 August	18,289	8,261	1,191	45.17	6.51	204	16.89
1994 November	18,680	10,547	1,343	56.46	12.73	188	14.47

SOURCE: Anderson, Knox, and Loudon County Elections Commissions and State of Tennessee, Secretary of State, Division of Elections at http://www.state.tn.us/sos/election/statecom.htm.

Table 13. Anderson, Knox, and Loudon County Turnout Compared to State and National Turnout, 2002 to 2006
(Voted as percent of Registered Voters)

	2002	2004	2006
Anderson County	54	71	51
Knox County	54	65	47
Loudon County	57	74	57
State of Tennessee	73	85	71
United States	69	89	71

SOURCE: Anderson, Knox, and Loudon County Elections Commissions, State of Tennessee, Secretary of State, Division of Elections at http://www.state.tn.us/sos/election/statecom.htm, and Project Vote http://projectvote.org.

Table 14. Voting Turnout Rates for Selected Countries, 1945-2007

Average percent of registered voters voting in all national legislative elections from 1945 through 2007.[1]
(Number of Elections held during the period is shown in parentheses)

Australia (24)	94.5
Belgium (21)	92.6
Iceland (19)	89.1
New Zealand (21)	89.0
Italy (16)	89.4
Austria *Presidential* (11)	89.2
Sweden (19)	85.5
Netherlands (19)	86.6
Denmark (25)	85.7
Germany (16)	84.6
France *Presidential* (8)	82.1
Turkey (12)	81.3
Iceland *Presidential* (6)	81.1
Brazil *Presidential* (8)	78.4
Brazil (15)	78.2
United States *Presidential* (9)[2]	77.1
Austria (19)	74.8
France (16)	74.8
United Kingdom (17)	74.4
Spain (9)	73.9
Canada (20)	72.7
Ireland (17)	72.2
Japan (23)	70.1
United States (18)[3]	67.4
Mexico Presidential (7)	66.5
Mexico (21)	63.7
India (14)	59.2
Switzerland (15)	55.8

SOURCE: Institute for Democracy and Electoral Assistance (IDEA), Stockholm, Sweden, at http://www.idea.in.

[1]Turnout percentages are for national elections to the lower house/chamber of the national legislature. Percentages for presidential elections in Austria, France, Iceland, Brazil, Mexico, and the United States are also reported.
[2] U.S. presidential elections for 1964 to 2000 taken from IDEA. The 2004 data taken from the U.S. Census.
[3]Only elections for House of Representatives 1968 reported by IDEA.

Table 15. Vote Center Location Criteria (Sorted by Average Rating)

Location Criteria	Ratings By County			
	Knox	**Anderson**	**Loudon**	**Average**
Minimum number of sites based on population served[1]	1.0	1.0	NR	1.0
Along major thoroughfares/high traffic areas	2.5	2.0	2.0	2.2
Distance/travel time from home to vote center	2.0	3.0	2.0	2.3
Distance/travel time to complementary areas[2]	3.0	2.0	NR	2.5
Close to shopping centers, schools, daytime activity centers	3.0	2.0	4.0	3.0
Distance/travel time from work to vote center	4.0	3.0	2.0	3.0
Familiar location, used from election to election	4.0	3.0	2.0	3.0
Located in centers of residential population[3]	4.5	3.0	2.0	3.2
At least one vote center in selected legislative district[4]	4.0	3.0	NR	3.5
Located in centers of employment	4.5	3.0	3.0	3.5
Along public transit routes	3.0	4.0	5.0	4.0
Demographics of population served[5]	4.0	5.0	4.0	4.3

Ratings:
1.0 = Mandatory (state law); 2.0 = Essential (not required by law, but necessary to run a polling place); 3.0 = Important; 4.0 = Useful; 5.0 = Not important; NR = Not rated.

Notes:
[1]Vote center bills recently passed by the Tennessee legislature require a minimum of one vote center for every 25,000 registered voters. Service standards in Colorado and Indiana require one center for every 10,000 active voters.
[2]Complementary areas include shopping centers, schools, and other daytime activity centers, such that voters could accomplish more tasks, in addition to voting, while away from home.
[3]Locate vote centers in residential areas with high population densities, rather than disbursing centers widely across several residential locations. That is, look at cores of population concentration more than areal coverage.
[4]For example, Utah law requires at least one polling place within each state senate district, wholly or partially in a county.
[5]Research indicates that age, income, and education affect early voting participation rates. For example, elderly voters participate less when polling places change. Higher income and more educated voters are more likely to vote early/absentee, using vote centers.

Table 16. Vote Center Site/Facility Criteria (Sorted by Average Rating)

Site/Facility Criteria	Ratings By County			Average
	Knox	Anderson	Loudon	
Ability to secure center[1]	1.0	1.0	1.0	1.0
Compliant with provisions of *Americans With Disabilities Act*	1.0	1.0	1.0	1.0
Adequate electrical service[2]	2.0	1.0	2.0	1.7
Good lighting and heating[3]	2.0	1.0	2.0	1.7
Secure, high speed network connectivity[4]	2.0	1.0	2.0	1.7
Square footage for office space, work areas, storage[5]	2.0	1.0	2.5	1.8
Adequate parking, vehicle accessibility, walking distance	2.0	2.0	2.0	2.0
Break room, kitchen for poll workers	NR	NR	2.0	2.0
Number of days available[6]	NR	2.0	2.0	2.0
Restrooms	NR	NR	2.0	2.0
Adequate number of trained workers, voting equipment[7]	2.0	2.0	2.5	2.2
Donated space or other low cost option	3.0	2.0	2.0	2.3
Hours of operation (availability and consistency)	3.0	2.0	2.0	2.3
Square footage for anticipated voter turnout and poll workers	2.0	3.0	2.5	2.5
Square footage for voter overflow	2.0	3.0	2.5	2.5
Square footage for voting equipment	2.0	3.0	2.5	2.5
Outdoor signage identifying location as polling center	2.0	2.0	4.0	2.7
Accommodate equipment for line control, crowd management	3.0	3.0	2.5	2.8
Temporary structures	4.0	3.0	3.5	3.5
Telephones for poll worker use	2.0	4.0	5.0	3.7
Signage identifying locations of other vote centers	4.0	4.0	NR	4.0
Outdoor signage indicating peak voting times	5.0	4.0	NR	4.5
Telephones for general public use	5.0	4.0	5.0	4.7
Operation on Sundays and state holidays	5.0	5.0	4.5	4.8
Telephone lines for information requests	5.0	5.0	5.0	5.0

Ratings:
1.0 = Mandatory (state law); 2.0 = Essential (not required by law, but necessary to run a polling place); 3.0 = Important; 4.0 = Useful; 5.0 = Not important; NR = Not rated.

Notes:
[1]Ability to secure office space, work areas, equipment, supplies, power control before/during/after hours of operation.
[2] As drafted in bills before the Tennessee House and Senate (at the time the workshop was held), adequate electrical systems to accommodate voting machines, check-in computers, printers, and other hardware will be required in vote centers.
[3]As drafted in pending legislation (at the time the workshop was held).
[4]As drafted in pending legislation (at the time the workshop was held).
[5]Pending legislation (at the time the workshop was held) states only that square footage for vote centers must be "adequate." No detailed definition is provided. See *Participant Discussion about Site/Facility Criteria*.
[6]Sites must be available for the full voting period (20 days) under bills pending before the Tennessee legislature (at the time the workshop was held).
[7]Adequacy was discussed in terms of keeping wait times reasonable (for example, Larimer County, Colorado uses a 20-minute standard).

Table 17: Preferable Vote Center Sites by County

Type of Site	Knox	Anderson	Loudon
Traditional Sites			
Courthouses	✓	✓	✓
Municipal centers	✓	✓	✓
Schools			✓
Fire stations			✓
Churches			✓
Libraries	✓		✓
Recreation centers	✓	✓	✓
Community centers	✓	✓	✓
Community organizations	✓	✓	✓
Existing polling stations	✓	✓	✓
Non-Traditional Sites			
Hotels	✓	✓	✓
Office buildings	✓	✓	✓
Apartment complexes			
Shopping centers/malls	✓	✓	✓
Big-box retail centers	✓	✓	✓
Supermarkets	✓	✓	✓
Convenience stores			
Medical clinics/hospitals			
Nursing homes			
Mobile voting places			

Table18. Vote Center Location Preferences by County

Preference	Anderson	Knox	Loudon
Closer to home	72.6%	75.3%	73.9%
Closer to work	8.8%	10.1%	7.0%
Closer to shopping	5.8%	7.1%	6.3%
Closer to school	5.8%	4.3%	4.3%
Someplace else	3.8%	1.0%	3.3%
Not sure	3.3%	2.3%	5.3%

Table 19. Reallocated Vote Center Location Preferences by County

Preference	Anderson	Knox	Loudon
Closer to home	78.1%	77.8%	80.8%
Closer to work	9.5%	10.4%	7.7%
Closer to shopping	6.2%	7.3%	6.9%
Closer to school	6.2%	4.4%	4.7%

Table 20. Voters, Total Workers, Retail Workers, and Students

Demand Measure	Anderson	Knox	Loudon
Voters	44,002	231,057	29,649
Total Workers	39,960	236,401	15,774
Retail Workers	4,211	29,965	1,870
School Enrollment	12,070	51,808	7,228

Table 21. Voters Allocated by Vote Center Location Preference

Preference	Anderson	Knox	Loudon
Closer to home	34,350	179,737	23,946
Closer to work	4,163	24,108	2,268
Closer to shopping	2,744	16,947	2,041
Closer to school	2,744	10,263	1,393
Total	44,002	231,057	29,649

Table 22. Classes of Candidate Sites and Data Sources

Anderson County	Data Source
Municipal centers	Election commission
Community centers	Election commission
Recreation centers	Election commission
Hotels	infoUSA
Office buildings	infoUSA
Shopping centers/malls	infoUSA
Big-box retail centers	infoUSA
Supermarkets	infoUSA
Existing polling stations	Election commission
Knox County	**Data Source**
Municipal centers	KGIS
Fire stations	KGIS
Churches	infoUSA
Libraries	KGIS
Community centers	KGIS
Recreation centers	KGIS
Hotels	MPC market study
Office buildings	MPC market study
Shopping centers/malls	MPC market study
Big-box retail centers	MPC market study
Supermarkets	MPC market study
Existing polling stations	KGIS
Loudon County	**Data Source**
Municipal centers	Election commission
Schools	MPC GIS
Fire stations	Election commission
Churches	Election commission and infoUSA
Libraries	Election commission
Community centers	Election commission
Recreation centers	Election commission
Hotels	infoUSA
Office buildings	infoUSA
Shopping centers/malls	infoUSA
Big-box retail centers	infoUSA
Supermarkets	infoUSA
Existing polling stations	Election commission

Table 23. Maximum Travel Distance to Vote Centers

County	Maximum Travel Distance (miles)
Anderson	5.0
Knox	5.0
Loudon	6.5

Table 24. Knox County: Number of Vote Centers and Voter Service Coverage

Number of Vote Centers	Scenario 1: No Pre-Selected Sites		Scenario 2: Five Pre-Selected Sites	
	Voters Served	Share (%) of Registered Voters	Voters Served	Share (%) of Registered Voters
1	63,044	27.29	51,554	22.31
2	118,077	51.10	92,119	39.87
3	139,755	60.48	115,556	50.01
4	160,483	69.46	132,698	57.43
5	179,633	77.74	148,476	64.26
6	191,918	83.06	176,307	76.30
7	196,867	85.20	187,669	81.22
8	207,174	89.66	195,457	84.59
9	211,330	91.46	199,724	86.44
10	213,824	92.54	205,427	88.91
11	218,340	94.50	210,569	91.13
12	220,267	95.33	214,387	92.79
13	221,886	96.03	216,663	93.77
14	221,097	95.69	220,121	95.27
15	225,798	97.72	222,498	96.30
16	226,526	98.04	223,567	96.76
17	227,216	98.34	225,446	97.57
18	228,116	98.73	226,696	98.11
19	228,205	98.77	227,402	98.42
20	228,718	98.99	228,091	98.72
21	229,059	99.14	228,547	98.91
22	229,203	99.20	228,685	98.97
23	229,372	99.27	229,065	99.14
24	229,406	99.29	229,267	99.22
25	229,531	99.34	229,476	99.32
26	229,554	99.35	229,423	99.29
27	229,590	99.36	229,587	99.36
28	229,633	99.38	229,587	99.36
29	229,645	99.39	229,603	99.37
30	229,645	99.39	229,630	99.38
31	229,666	99.40	229,630	99.38
32	229,661	99.40	229,654	99.39
33	229,666	99.40	229,665	99.40
34	229,670	99.40	229,670	99.40
35	229,670	99.40	229,670	99.40
36	229,670	99.40	229,670	99.40

Note: Knox County location models were run for 40 iterations. Iterations 37 through 40 resulted in the same output as that reported in iterations 34 through 36.

Table 25. Anderson County: Number of Vote Centers and Voter Service Coverage

Number of Vote Centers	Scenario 1: One Pre-Selected Site		Scenario 2: No Pre-Selected Sites	
	Voters Served	Share (%) of Registered Voters	Voters Served	Share (%) of Registered Voters
1	11,142	25.32	19,709	44.79
2	30,851	70.11	31,113	70.71
3	34,906	79.33	35,441	80.54
4	37,782	85.86	38,396	87.26
5	40,468	91.97	40,550	92.15
6	40,968	93.10	40,968	93.10
7	41,357	93.99	41,357	93.99
8	41,565	94.46	41,565	94.46
9	41,711	94.79	41,722	94.82
10	41,825	95.05	41,836	95.08
11	41,891	95.20	41,839	95.08
12	41,935	95.30	41,905	95.23
13	41,970	95.38	41,949	95.33
14	41,973	95.39	41,984	95.41
15	42,005	95.46	42,020	95.50
16	42,027	95.51	42,030	95.52
17	42,030	95.52	42,032	95.52
18	42,032	95.52	42,032	95.52
19	42,032	95.52	42,032	95.52

Table 26. Loudon County: Number of Vote Centers and Voter Service Coverage

Number of Vote Centers	Scenario 1: Two Pre-Selected Sites		Scenario 2: One Pre-Selected Site	
	Voters Served	Share (%) of Registered Voters	Voters Served	Share (%) of Registered Voters
1	15,565	52.50	9,296	31.35
2	20,791	70.12	21,624	72.93
3	24,985	84.27	25,671	86.58
4	26,663	89.93	27,349	92.24
5	27,481	92.69	27,853	93.94
6	27,936	94.22	28,240	95.25
7	28,340	95.59	28,577	96.38
8	28,728	96.89	29,065	98.03
9	29,065	98.03	29,364	99.04
10	29,364	99.04	29,513	99.54
11	29,513	99.54	29,612	99.87
12	29,612	99.87	29,621	99.90
13	29,621	99.90	29,621	99.90
14	29,621	99.90	29,621	99.90

Table 27: Variable Costs to Operate Knox County Vote Centers (Unconstrained Model)

Number of Vote Centers	Unconstrained (No Pre-Selected Sites)				
	Voters Served	Share of Registered Voters (%)	Variable Cost Per Voter Served ($)	Additional Voters Served	Variable Cost Per Additional Voter Served ($)
1	63,044	27.29	2.79	63,044	2.79
2	118,077	51.10	2.98	55,033	3.19
3	139,755	60.48	3.77	21,678	8.10
4	160,483	69.46	4.38	20,728	8.47
5	179,633	77.74	4.89	19,150	9.17
6	191,918	83.06	5.49	12,286	14.30
7	196,867	85.20	6.25	4,949	35.49
8	207,174	89.66	6.78	10,307	17.04
9	211,330	91.46	7.48	4,155	42.27
10	213,824	92.54	8.22	2,495	70.41
11	218,340	94.50	8.85	4,516	38.90
12	220,267	95.33	9.57	1,927	91.17
13	221,886	96.03	10.29	1,619	108.52
14	221,097	95.69	11.12	-789	--
15	225,798	97.72	11.67	4,701	37.37
16	226,526	98.04	12.41	728	241.19
17	227,216	98.34	13.14	690	254.76
18	228,116	98.73	13.86	900	195.11
19	228,205	98.77	14.62	89	1,975.89
20	228,718	98.99	15.36	514	342.08
21	229,059	99.14	16.10	341	515.12
22	229,203	99.20	16.86	144	1,224.09
23	229,372	99.27	17.61	169	1,039.39
24	229,406	99.29	18.38	34	5,136.17
25	229,531	99.34	19.13	125	1,404.13
26	229,554	99.35	19.90	23	7,704.25
27	229,590	99.36	20.66	36	4,839.04
28	229,633	99.38	21.42	43	4,056.74
29	229,645	99.39	22.18	12	15,274.52
30	229,645	99.39	22.95	0	--
31	229,666	99.40	23.71	21	8,324.98
32	229,661	99.40	24.48	-5	--
33	229,666	99.40	25.24	5	36,595.21
34	229,670	99.40	26.00	4	42,843.17
35	229,670	99.40	26.77	0	--
36	229,670	99.40	27.53	0	--

Note: Voter counts were tabulated to the nearest one-hundredth by the location model, but figures were rounded to the nearest whole number for reporting purposes. Cost calculations were based on the model-tabulated voter counts.

Table 28. Variable Costs to Operate Knox County Vote Centers
(Pre-Selected Sites Model)

Number of Vote Centers	Five Pre-Selected Sites				
	Voters Served	Share of Registered Voters (%)	Variable Cost Per Voter Served ($)	Additional Voters Served	Variable Cost Per Additional Voter Served ($)
1	51,554	22.31	3.41	51,554	3.41
2	92,119	39.87	3.81	40,565	4.33
3	115,556	50.01	4.56	23,437	7.49
4	132,698	57.43	5.29	17,142	10.25
5	148,476	64.26	5.92	15,778	11.13
6	176,307	76.30	5.98	27,832	6.31
7	187,669	81.22	6.55	11,362	15.46
8	195,457	84.59	7.19	7,789	22.55
9	199,724	86.44	7.92	4,267	41.17
10	205,427	88.91	8.55	5,703	30.80
11	210,569	91.13	9.18	5,142	34.16
12	214,387	92.79	9.83	3,818	46.01
13	216,663	93.77	10.54	2,276	77.17
14	220,121	95.27	11.17	3,458	50.80
15	222,498	96.30	11.84	2,377	73.90
16	223,567	96.76	12.57	1,069	164.37
17	225,446	97.57	13.25	1,880	93.46
18	226,696	98.11	13.95	1,250	140.50
19	227,402	98.42	14.68	705	249.05
20	228,091	98.72	15.40	690	254.76
21	228,547	98.91	16.14	456	384.96
22	228,685	98.97	16.90	138	1,273.80
23	229,065	99.14	17.64	380	462.13
24	229,267	99.22	18.39	201	873.05
25	229,476	99.32	19.14	210	838.46
26	229,423	99.29	19.91	-53	--
27	229,587	99.36	20.66	164	1,071.08
28	229,587	99.36	21.42	0	--
29	229,603	99.37	22.19	16	11,332.71
30	229,630	99.38	22.95	27	6,434.32
31	229,630	99.38	23.71	0	--
32	229,654	99.39	24.48	24	7,443.09
33	229,665	99.40	25.24	11	15,408.51
34	229,670	99.40	26.00	5	35,848.37
35	229,670	99.40	26.77	0	--
36	229,670	99.40	27.53	0	--

Note: Voter counts were tabulated to the nearest one-hundredth by the location model, but figures were rounded to the nearest whole number for reporting purposes. Cost calculations were based on the model-tabulated voter counts.

Table 29: Variable Costs to Operate Anderson County Vote Centers (Unconstrained Model)

Number of Vote Centers	Unconstrained (No Pre-Selected Sites)				
	Voters Served	Share of Registered Voters (%)	Variable Cost Per Voter Served ($)	Additional Voters Served	Variable Cost Per Additional Voter Served ($)
1	19,709	44.79	0.16	19,709	0.16
2	31,113	70.71	0.21	11,404	0.28
3	35,441	80.54	0.28	4,328	0.75
4	38,396	87.26	0.34	2,954	1.10
5	40,550	92.15	0.40	2,154	1.51
6	40,968	93.10	0.48	418	7.77
7	41,357	93.99	0.55	389	8.36
8	41,565	94.46	0.63	209	15.57
9	41,722	94.82	0.70	157	20.70
10	41,836	95.08	0.78	114	28.59
11	41,839	95.08	0.85	3	1,124.22
12	41,905	95.23	0.93	67	48.77
13	41,949	95.33	1.01	44	73.96
14	41,984	95.41	1.08	35	92.70
15	42,020	95.50	1.16	36	90.15
16	42,030	95.52	1.24	10	329.51
17	42,032	95.52	1.31	2	1,981.10
18	42,032	95.52	1.39	0	--
19	42,032	95.52	1.47	0	--

Note: Voter counts were tabulated to the nearest one-hundredth by the location model, but figures were rounded to the nearest whole number for reporting purposes. Cost calculations were based on the model-tabulated voter counts.

Table 30. Variable Costs to Operate Anderson County Vote Centers
(Pre-Selected Site Model)

Number of Vote Centers	One Pre-Selected Site				
	Voters Served	Share of Registered Voters (%)	Variable Cost Per Voter Served ($)	Additional Voters Served	Variable Cost Per Additional Voter Served ($)
1	11,142	25.32	0.29	11,142	0.29
2	30,851	70.11	0.21	19,709	0.16
3	34,906	79.33	0.28	4,055	0.80
4	37,782	85.86	0.34	2,875	1.13
5	40,468	91.97	0.40	2,687	1.21
6	40,968	93.10	0.48	500	6.50
7	41,357	93.99	0.55	389	8.36
8	41,565	94.46	0.63	209	15.57
9	41,711	94.79	0.70	146	22.28
10	41,825	95.05	0.78	114	28.59
11	41,891	95.20	0.85	67	48.77
12	41,935	95.30	0.93	44	73.94
13	41,970	95.38	1.01	35	92.70
14	41,973	95.39	1.08	3	1,124.22
15	42,005	95.46	1.16	32	101.47
16	42,027	95.51	1.24	22	149.24
17	42,030	95.52	1.31	3	987.54
18	42,032	95.52	1.39	2	1,981.10
19	42,032	95.52	1.47	0	--

Note: Voter counts were tabulated to the nearest one-hundredth by the location model, but figures were rounded to the nearest whole number for reporting purposes. Cost calculations were based on the model-tabulated voter counts.

Table 31. Variable Costs to Operate Loudon County Vote Centers
(Model with One Pre-Selected Site)

Number of Vote Centers	One Pre-Selected Site				
	Voters Served	Share of Registered Voters (%)	Variable Cost Per Voter Served ($)	Additional Voters Served	Variable Cost Per Additional Voter Served ($)
1	9,296	31.35	1.20	9,296	1.20
2	21,624	72.93	1.03	12,328	0.91
3	25,671	86.58	1.30	4,047	2.76
4	27,349	92.24	1.63	1,678	6.65
5	27,853	93.94	2.00	504	22.16
6	28,240	95.25	2.37	387	28.82
7	28,577	96.38	2.73	337	33.15
8	29,065	98.03	3.07	487	22.91
9	29,364	99.04	3.42	300	37.26
10	29,513	99.54	3.78	148	75.25
11	29,612	99.87	4.15	99	112.87
12	29,621	99.90	4.52	9	1,190.19
13	29,621	99.90	4.90	0	--
14	29,621	99.90	5.28	0	--

Note: Voter counts were tabulated to the nearest one-hundredth by the location model, but figures were rounded to the nearest whole number for reporting purposes. Cost calculations were based on the model-tabulated voter counts.

**Table 32. Variable Costs to Operate Loudon County Vote Centers (
Model with Two Pre-Selected Sites)**

Number of Vote Centers	Voters Served	Share of Registered Voters (%)	Variable Cost Per Voter Served ($)	Additional Voters Served	Variable Cost Per Additional Voter Served ($)
		Two Pre-Selected Sites			
1	15,565	52.50	0.72	15,565	0.72
2	20,791	70.12	1.07	5,226	2.14
3	24,985	84.27	1.34	4,194	2.66
4	26,663	89.93	1.67	1,678	6.65
5	27,481	92.69	2.03	818	13.65
6	27,936	94.22	2.40	455	24.52
7	28,340	95.59	2.76	404	27.63
8	28,728	96.89	3.11	387	28.82
9	29,065	98.03	3.46	337	33.15
10	29,364	99.04	3.80	300	37.26
11	29,513	99.54	4.16	148	75.25
12	29,612	99.87	4.52	99	112.87
13	29,621	99.90	4.90	9	1,190.19
14	29,621	99.90	5.28	0	--

Note: Voter counts were tabulated to the nearest one-hundredth by the location model, but figures were rounded to the nearest whole number for reporting purposes. Cost calculations were based on the model-tabulated voter counts.

Table B1. Opinion on Replacing Precinct Polling Places with Voting Centers, by County

	County			
	1 Anderson County	2 Knox County	3 Loudon County	Total
1 Oppose	26.4%	19.9%	24.0%	23.5%
2 Neither favor nor oppose	21.2%	22.7%	23.8%	22.5%
3 Favor	48.9%	53.7%	49.8%	50.7%
8 Not sure	3.5%	3.8%	2.5%	3.2%
Total N	401	397	404	1202
Total %	100.0%	100.0%	100.0%	100.0%

Table B2. Reason for opposing Voting Centers, by County

	County			
	1 Anderson County	2 Knox County	3 Loudon County	Total
1 Don't like change	13.2%	20.5%	13.5%	15.4%
2 Will create confusion among voters	24.5%	17.9%	30.2%	24.6%
3 Will make it harder for some voters to participate	24.5%	26.9%	12.5%	21.1%
4 Other	31.1%	34.6%	42.7%	36.1%
8 Not sure	6.6%		1.0%	2.9%
Total N	106	78	96	280
Total %	100.0%	100.0%	100.0%	100.0%

Table B3. Reason for favoring Voting Centers, by County

	County			
	1 Anderson County	2 Knox County	3 Loudon County	Total
1 Will be more convenient	39.0%	49.3%	40.8%	43.2%
2 Will reduce confusion about where to vote	14.4%	14.1%	17.4%	15.3%
3 Might increase participation	28.7%	17.8%	26.4%	24.1%
4 Will reduce the cost of elections	8.2%	7.0%	7.0%	7.4%
5 Other	6.7%	9.4%	8.0%	8.0%
8 Not sure	3.1%	2.3%	.5%	2.0%
Total N	195	213	201	609
Total %	100.0%	100.0%	100.0%	100.0%

Table B4. Most convenient location for Voting Center, by County

	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Closer to home	72.6%	75.3%	73.9%	74.0%
2 Closer to work	8.8%	10.1%	7.0%	8.6%
3 Closer to where you shop	5.8%	7.1%	6.3%	6.4%
4 Closer to school	5.8%	4.3%	4.3%	4.8%
5 Someplace else	3.8%	1.0%	3.3%	2.7%
8 Not sure	3.3%	2.3%	5.3%	3.6%
Total N	398	397	399	1194
Total %	100.0%	100.0%	100.0%	100.0%

Table B5. Maximum distance, in miles, voters are willing to travel to vote at a Voting Center, by County

Miles	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
.00		.8%	.8%	.5%
.10	2.0%	1.0%	.5%	1.2%
.12		.3%		.1%
.15	.3%			.1%
.20		1.0%		.3%
.25	.3%	.8%	1.0%	.7%
.30	.3%	.5%	.8%	.5%
.45		.3%		.1%
.50	4.1%	3.1%	3.3%	3.5%
.60			.3%	.1%
.66	.3%			.1%
.70		.3%	.8%	.3%
.75	6.3%	4.6%	5.1%	5.3%
.80		.3%		.1%
1.00	4.1%	2.8%	3.3%	3.4%
1.25		.5%		.2%
1.50		.3%		.1%
2.00	6.3%	5.1%	3.5%	5.0%
3.00	5.8%	8.5%	4.5%	6.3%
3.50	.3%			.1%
4.00	2.0%	3.9%	1.5%	2.5%
5.00	21.3%	24.9%	20.7%	22.3%
6.00	.5%	1.8%	2.0%	1.4%
6.50			.3%	.1%
7.00	1.5%	1.8%	.8%	1.4%
8.00	1.5%	.3%	1.3%	1.0%

9.00	.5%			.2%
10.00	21.1%	21.1%	23.7%	22.0%
11.00			.5%	.2%
12.00	.8%	1.0%	1.0%	.9%
13.00	.3%		.3%	.2%
15.00	6.3%	4.1%	7.8%	6.1%
20.00	6.3%	3.9%	5.8%	5.3%
25.00	1.0%	.3%	1.5%	.9%
30.00	.3%	.8%	2.0%	1.0%
32.00		.3%		.1%
35.00	.3%			.1%
37.00			.3%	.1%
40.00		.3%	.5%	.3%
45.00		.3%		.1%
50.00	.5%	.5%	.8%	.6%
60.00			.8%	.3%
89.00			.3%	.1%
100.00	.5%	1.0%	.8%	.8%
888.00 Not Sure	5.3%	3.9%	3.8%	4.3%
Mean	7.93	7.92	10.09	8.65
Median	5.0	5.0	6.5	5.0
Mode	5.0	5.0	10.0	5.0
Total N	373	374	381	1128
Total %	100.0%	100.0%	100.0%	100.0%

Table B6. Maximum amount of time, in minutes, that voters are willing to travel to vote at a Voting Center, by County

	County			Total
Minutes	1 Anderson County	2 Knox County	3 Loudon County	
.00		.8%	.8%	.5%
.10	.3%			.1%
.15	.3%			.1%
.20		.3%		.1%
.25	.5%	.5%	.5%	.5%
.30			.3%	.1%
.50		.3%		.1%
.75	.5%	.3%		.3%
2.00	1.3%	.8%	.3%	.8%
3.00	.3%	.3%	.5%	.3%
4.00	.3%	.3%	.3%	.3%
5.00	5.1%	7.7%	4.0%	5.6%
6.00			.5%	.2%
7.00			.3%	.1%
8.00	.8%	.5%	.8%	.7%
9.00		.3%		.1%

120

10.00	20.1%	22.9%	15.2%	19.4%
12.00	1.3%	.5%	.3%	.7%
15.00	27.0%	22.7%	27.0%	25.6%
17.00		.5%		.2%
18.00	.3%			.1%
20.00	13.0%	14.7%	15.9%	14.5%
23.00			.3%	.1%
25.00	1.3%	1.5%	1.8%	1.5%
30.00	16.8%	14.7%	18.7%	16.7%
35.00	.3%	.3%	.3%	.3%
40.00		.3%	1.0%	.4%
45.00	1.0%	1.8%	2.3%	1.7%
60.00	3.1%	3.1%	3.0%	3.1%
88.00			.3%	.1%
90.00	.3%	.5%	.3%	.3%
99.00			.3%	.1%
105.00	.3%			.1%
120.00	.8%	.8%	1.0%	.8%
130.00		.3%	.3%	.2%
145.00			.3%	.1%
160.00			.3%	.1%
180.00			.3%	.1%
240.00	.3%			.1%
303.00		.3%		.1%
888.00 Not Sure	5.3%	3.4%	3.5%	4.1%
Mean	20.043	20.109	22.834	21.009
Median	15.0	15.0	15.0	15.0
Mode	15.0	10.0	15.0	15.0
Total N	372	375	382	1129
Total%	100.0%	100.0%	100.0%	100.0%

Table B7. Maximum distance, in miles, that voters are willing to deviate from regular travel routes to vote in a Voting Center, by County

Miles	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
.00	2.8%	4.4%	4.6%	3.9%
.10	.8%	1.0%	.3%	.7%
.12			.3%	.1%
.15	.3%	.3%		.2%
.20	.3%	1.0%	.3%	.5%
.23	.3%			.1%
.25	.8%	.5%	1.0%	.8%
.30	.3%			.1%
.33		.3%		.1%
.45		.3%		.1%
.50	2.1%	3.1%	3.6%	2.9%
.53		.3%		.1%
.60			.3%	.1%
.66	.3%			.1%
.70	.3%	.3%	.3%	.3%
.75	4.6%	2.8%	2.8%	3.4%
1.00	3.4%	1.0%	3.9%	2.7%
1.50	.5%	.3%		.3%
2.00	3.1%	8.5%	4.6%	5.4%
2.50	.3%			.1%
2.75		.3%		.1%
3.00	3.4%	6.7%	4.1%	4.7%
4.00	2.1%	1.8%	1.3%	1.7%
5.00	25.8%	22.9%	21.1%	23.3%
6.00	.8%	.3%	1.3%	.8%
7.00	.8%	1.0%	1.8%	1.2%
8.00	1.5%	1.0%	.5%	1.0%
9.00	.3%			.1%
10.00	20.1%	21.1%	21.1%	20.8%
11.00			.3%	.1%
12.00	1.3%		.8%	.7%
13.00			.3%	.1%
15.00	5.9%	5.4%	6.2%	5.8%
20.00	4.4%	2.8%	4.9%	4.0%
25.00	1.3%	.5%	1.0%	.9%
29.00			.3%	.1%
30.00	.3%	1.3%	3.6%	1.7%
40.00			.3%	.1%
45.00	.3%	.3%		.2%
50.00	.8%	.5%	1.5%	.9%
60.00		.3%		.1%
89.00			.3%	.1%

90.00		.3%		.1%
100.00	.3%	.3%		.2%
888.00 Not Sure	11.1%	9.5%	7.5%	9.4%
Mean	7.84	7.55	9.02	8.148
Median	5.0	5.0	5.0	5.0
Mode	5.0	5.0	5.0	5.0
Total N	345	352	359	1056
Total %	100.0%	100.0%	100.0%	100.0%

Table B8. Importance that a Voting Center be Located Within Walking Distance, by County

	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Very Important	13.4%	15.9%	12.2%	13.8%
2 Important	13.6%	12.8%	12.9%	13.1%
3 Somewhat Important	9.6%	7.8%	8.2%	8.5%
4 Not at All Important	62.0%	63.0%	66.0%	63.7%
8 Not Sure	1.5%	.5%	.7%	.9%
Total N	397	397	403	1197
Total %	100.0%	100.0%	100.0%	100.0%

Table B9. Importance of how easy it is to find a parking place close to a Voting Center entrance, by County

	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Very Important	32.8%	35.1%	29.9%	32.6%
2 Important	29.6%	30.8%	30.2%	30.2%
3 Somewhat Important	20.6%	19.5%	20.0%	20.0%
4 Not at All Important	16.5%	14.5%	19.7%	16.9%
8 Not Sure	.5%		.2%	.3%
Total N	399	399	401	1199
Total %	100.0%	100.0%	100.0%	100.0%

Table B10. Importance of how easy it is to get in and out of the Voting Center parking lot onto the highway, by County

	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Very Important	33.0%	39.2%	30.0%	34.1%
2 Important	33.2%	30.4%	34.3%	32.6%
3 Somewhat Important	16.6%	18.8%	20.0%	18.5%
4 Not at All Important	16.4%	11.3%	15.5%	14.4%
8 Not Sure	.8%	.3%	.3%	.4%
Total N	397	398	400	1195
Total %	100.0%	100.0%	100.0%	100.0%

Table B11. Importance of the hours of operation of Voting Center polling place (when a Voting Center is open), by County

	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Very Important	45.6%	46.5%	41.4%	44.5%
2 Important	30.8%	34.7%	29.6%	31.7%
3 Somewhat Important	12.3%	10.6%	13.3%	12.0%
4 Not at All Important	10.8%	7.8%	15.3%	11.3%
8 Not Sure	.5%	.5%	.5%	.5%
Total N	399	398	399	1196
Total %	100.0%	100.0%	100.0%	100.0%

Table B12. Importance of the amount of time voter has to stand in line to cast a ballot at a Voting Center, by County

	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Very Important	41.4%	42.7%	38.7%	40.9%
2 Important	27.6%	29.4%	28.7%	28.5%
3 Somewhat Important	18.3%	18.1%	19.7%	18.7%
4 Not at All Important	11.8%	9.5%	12.5%	11.3%
8 Not Sure	1.0%	.3%	.5%	.6%
Total N	399	398	401	1198
Total %	100.0%	100.0%	100.0%	100.0%

Table B13. Importance of whether the Voting Center polling place is located near respondent's work, home or school, by County

	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Very Important	32.2%	38.3%	31.4%	34.0%
2 Important	32.2%	34.5%	26.7%	31.1%
3 Somewhat Important	21.7%	16.5%	23.2%	20.5%
4 Not at All Important	13.4%	10.5%	17.7%	13.9%
8 Not Sure	.5%	.3%	1.0%	.6%
Total N	397	400	401	1198
Total %	100.0%	100.0%	100.0%	100.0%

Table B14. Which time of the day does the voter find most convenient to vote, by County

	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Early morning (before 8 a.m.)	9.4%	12.5%	10.8%	10.9%
2 Mid to late morning (8 a.m. to noon)	31.7%	32.0%	34.0%	32.5%
3 Mid afternoon (noon to 5 p.m.)	29.9%	27.3%	21.6%	26.3%
4 Late afternoon or early evening (5 p.m. to 7:30 p.m.)	22.6%	22.1%	28.3%	24.3%
5 Evening (after 7:30 p.m.)	6.5%	6.0%	5.4%	6.0%
Total N	385	384	371	1140
Total %	100.0%	100.0%	100.0%	100.0%

Table B15. What is the maximum amount of time voter is willing to stand in line to wait to vote, by County

Minutes	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
.00	.8%	.3%	1.8%	.9%
.20		.3%		.1%
.25	.3%			.1%
.30		.3%		.1%
.50	.5%	.5%		.3%
.75			.3%	.1%
1.00	.3%			.1%
2.00		.5%	.3%	.3%
5.00	3.1%	2.6%	1.5%	2.4%
7.00	.3%		.3%	.2%
9.00	.3%			.1%
10.00	9.8%	9.6%	9.8%	9.7%
14.00			.3%	.1%
15.00	12.9%	14.2%	14.4%	13.8%
17.00	.3%			.1%
20.00	10.1%	9.6%	11.1%	10.2%
23.00	.3%			.1%
25.00	1.0%	.5%	1.3%	.9%
30.00	21.7%	24.8%	25.2%	23.9%
35.00	.3%	.3%		.2%
37.00			.3%	.1%
40.00	1.8%	1.0%	.5%	1.1%
45.00	5.2%	7.0%	6.4%	6.2%
60.00	17.3%	11.6%	13.1%	14.0%
75.00	.3%			.1%
90.00	1.0%	1.0%	1.0%	1.0%
100.00	.3%		.3%	.2%

120.00	3.6%	4.1%	4.4%	4.0%
145.00			.3%	.1%
150.00	.3%		.3%	.2%
160.00	.3%		.5%	.3%
180.00	.8%	.8%	.3%	.6%
240.00	.3%	.8%		.3%
720.00		.3%		.1%
DK/missing 888.00	7.2%	10.1%	6.7%	8.0%
Mean	36.736	38.19	35.25	36.705
Median	30.0	30.0	30.0	30.0
Mode	30.0	30.0	30.0	30.0
Total N	359	348	363	1070
Total %	100.0%	100.0%	100.0%	100.0%

Table B16. About how long voter usually has to stand in line to vote where ballot is cast, by County

| Minutes | County | | | Total |
	1 Anderson County	2 Knox County	3 Loudon County	
.00	8.3%	12.3%	11.9%	10.8%
.10	.5%	.5%		.3%
.15		.3%		.1%
.25	.3%		.5%	.3%
.50	.8%		.2%	.3%
1.00	1.0%	2.5%	2.0%	1.8%
1.50		.3%		.1%
2.00	2.5%	3.0%	3.7%	3.1%
3.00	2.8%	2.0%	2.2%	2.3%
4.00		1.3%	.2%	.5%
5.00	18.8%	17.6%	21.1%	19.2%
6.00	.3%			.1%
7.00	.8%	.5%	.2%	.5%
8.00	.5%	.8%	.2%	.5%
10.00	21.1%	20.9%	18.4%	20.1%
12.00	.5%	.3%	.2%	.3%
13.00			.2%	.1%
15.00	15.8%	10.6%	13.6%	13.3%
20.00	8.0%	7.0%	7.4%	7.5%
23.00			.2%	.1%
25.00	1.3%	1.0%	1.0%	1.1%
30.00	7.5%	11.6%	7.9%	9.0%
35.00	.5%	.5%	.5%	.5%
38.00	.3%			.1%
40.00	.8%	.5%		.4%
45.00	2.3%	2.3%	2.7%	2.4%
60.00	3.0%	2.3%	3.5%	2.9%

70.00		.3%		.1%
75.00	.3%		.2%	.2%
90.00		.5%	.2%	.3%
120.00		.5%	.5%	.3%
160.00			.2%	.1%
DK/ Missing 888.00	2.3%	1.0%	.5%	1.3%
Mean	13.827	14.124	14.346	14.10
Median	10.0	10.0	10.0	10.0
Mode	10.0	10.0	5.0	10.0
Total N	389	394	401	1184
Total %	100.0%	100.0%	100.0%	100.0%

Table B17. When voter leaves work, home, school or some other place to go vote, about how many miles traveled to the place where their ballot is usually cast, by County

Miles	County 1 Anderson County	2 Knox County	3 Loudon County	Total
.00	.8%	1.8%	1.5%	1.4%
.10	1.3%	1.5%	.8%	1.2%
.12	.3%	.3%	.3%	.3%
.20	.8%	.8%	1.0%	.8%
.25	3.8%	2.8%	3.0%	3.2%
.30	.5%	1.0%	.3%	.6%
.33	.5%	.3%	.3%	.3%
.35		.3%		.1%
.40	.3%		.3%	.2%
.50	9.3%	7.2%	5.3%	7.3%
.60			.5%	.2%
.66	.8%	.3%	.3%	.4%
.70	.3%		.3%	.2%
.75	6.8%	5.2%	3.8%	5.3%
1.00	16.7%	11.1%	7.8%	11.9%
1.50	2.5%	2.3%	1.5%	2.1%
1.75	.3%			.1%
2.00	15.2%	14.2%	8.4%	12.6%
2.50	1.3%	.5%	.3%	.7%
3.00	11.1%	13.1%	14.2%	12.8%
3.50	.5%	.5%	.8%	.6%
3.66		.3%		.1%
4.00	4.5%	5.2%	6.8%	5.5%
4.50	.3%	.5%		.3%
5.00	10.6%	14.9%	13.4%	13.0%
5.50			.3%	.1%
6.00	2.3%	3.4%	3.3%	3.0%
7.00	1.8%	2.8%	2.5%	2.4%

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Minutes	1 Anderson County	2 Knox County	3 Loudon County	Total
7.50			.3%	.1%
8.00	2.8%	2.1%	3.5%	2.8%
9.00	.3%	.3%	.3%	.3%
10.00	2.3%	3.9%	7.8%	4.7%
11.00	.3%		1.0%	.4%
12.00	.3%	.3%	1.8%	.8%
15.00	1.0%	1.3%	5.3%	2.5%
17.00			.3%	.1%
18.00			.8%	.3%
20.00		.8%	1.0%	.6%
22.00	.5%		.3%	.3%
25.00	.3%	.5%		.3%
30.00		.3%	.3%	.2%
35.00	.3%		.3%	.2%
40.00		.3%		.1%
45.00			.3%	.1%
50.00			.3%	.1%
75.00		.3%		.1%
Mean	2.944	3.788	5.209	3.98
Median	2.0	3.0	3.5	3.0
Mode	1.0	5.0	3.0	5.0
Total N	396	388	395	1179
Total %	100.0%	100.0%	100.0%	100.0%

Table B18. When voter leaves work, home, school or some other place to go vote, about how many minutes it takes to get to the place where voter usually votes, by County

	County			Total
Minutes	1 Anderson County	2 Knox County	3 Loudon County	
.00	.7%	.8%	.7%	.7%
.05	.5%			.2%
.06	.2%			.1%
.10		.5%		.2%
.15			.2%	.1%
.20			.2%	.1%
.25	.2%	.5%	.2%	.3%
.50	.2%			.1%
.75	.2%	.3%		.2%
1.00	2.7%	2.5%	2.2%	2.5%
2.00	8.5%	6.5%	4.7%	6.6%
3.00	7.2%	6.0%	4.0%	5.7%
4.00	2.2%	3.8%	1.7%	2.6%
5.00	34.4%	28.0%	25.2%	29.2%
5.50	.2%			.1%
6.00	1.0%	1.0%	1.7%	1.2%

7.00	1.2%	2.8%	2.0%	2.0%
8.00	2.2%	2.0%	2.5%	2.2%
9.00	.7%	.3%	.2%	.4%
10.00	23.2%	23.8%	23.8%	23.6%
12.00	.7%	1.3%	1.7%	1.2%
13.00	.2%	.3%	.2%	.2%
15.00	6.5%	10.8%	13.1%	10.1%
20.00	2.5%	3.8%	8.4%	4.9%
25.00	.7%	.8%	2.0%	1.2%
30.00	1.0%	1.8%	2.0%	1.6%
35.00	.2%			.1%
45.00	.5%	.5%	1.0%	.7%
50.00			.2%	.1%
60.00			.2%	.1%
888.00 Not Sure	1.0%	2.0%	.7%	1.2%
999.00 missing	.5%	.5%	.7%	.6%
Mean	7.4586	8.3909	10.2578	8.7077
Median	5.0	5.5	10.0	6.0
Mode	5.0	5.0	5.0	5.0
Total N	395	390	398	1183
Total	100.0%	100.0%	100.0%	100.0%

Table B19. Whether respondent voted during the Early Voting period in the last election in which they voted, by County

	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 No	48.8%	43.0%	41.8%	44.5%
2 Yes	50.3%	55.5%	55.9%	53.9%
8 Not Sure	1.0%	1.5%	2.2%	1.6%
Total N	400	400	404	1204
Total %	100.0%	100.0%	100.0%	100.0%

Table B20. In thinking about the early voting polling place where you last voted, how would you rate its convenience in terms of the features most important to you, by County

	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Very Inconvenient	2.5%	3.6%	2.7%	2.9%
2 Somewhat Inconvenient	3.0%	5.9%	4.0%	4.3%
3 Somewhat Inconvenient	1.5%	2.7%	2.2%	2.2%
4 Somewhat Convenient	21.4%	21.3%	23.0%	21.9%
5 Very Convenient	70.1%	66.1%	68.1%	68.1%
8 Not Sure	1.5%	.5%		.6%
Total N	201	221	226	648
Total %	100.0%	100.0%	100.0%	100.0%

Table B21. What voter thinks about the idea of having a mobile voting unit that would visit different locations around voter's county with advance publicity of its schedule, by County

| | County | | | Total |
	1 Anderson County	2 Knox County	3 Loudon County	
1 Bad Idea	32.5%	36.3%	32.5%	33.7%
2 Good Idea	40.8%	36.5%	37.2%	38.2%
3 No Opinion	25.3%	25.8%	29.8%	26.9%
8 Not Sure	1.5%	1.5%	.5%	1.2%
Total N	400	400	403	1203
Total %	100.0%	100.0%	100.0%	100.0%

Table B22. What voter thinks about the idea of having polling places open on Sundays, by County

| | County | | | Total |
	1 Anderson County	2 Knox County	3 Loudon County	
1 Bad Idea	59.9%	55.9%	63.1%	59.6%
2 Good Idea	25.7%	30.3%	21.8%	25.9%
3 No Opinion	13.2%	13.0%	14.9%	13.7%
8 Not Sure	1.2%	.8%	.2%	.7%
Total N	401	399	404	1204
Total %	100.0%	100.0%	100.0%	100.0%

Table B23. What voter thinks about the idea of no-excuse absentee voting where registered voters can request an absentee ballot for any reason and where signature on the mailed-in ballot is compared with voter's signature on file and must match before vote is counted, by County

| | County | | | Total |
	1 Anderson County	2 Knox County	3 Loudon County	
1 Bad Idea	31.5%	31.5%	31.1%	31.4%
2 Good Idea	45.5%	44.8%	44.5%	44.9%
3 No Opinion	22.8%	22.3%	23.4%	22.8%
8 Not Sure	.3%	1.5%	1.0%	.9%
Total N	400	400	402	1202
Total %	100.0%	100.0%	100.0%	100.0%

Table B24. How important it is to the respondent to have access to public transit in order to get to a polling place, by County

	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Not very important	72.9%	77.4%	80.1%	76.9%
2 Somewhat important	14.0%	7.5%	10.7%	10.7%
3 Very important	12.3%	14.3%	7.7%	11.4%
8 Not sure	.8%	.8%	1.5%	1.0%
Total N	399	399	403	1201
Total %	100.0%	100.0%	100.0%	100.0%

Table B25. How likely the respondent is to vote in the election for county offices to be held in August 2008 (even though its some time away), by County

	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Not very likely	3.5%	4.3%	3.5%	3.7%
2 Somewhat likely	13.2%	17.8%	13.4%	14.8%
3 Very likely	81.8%	78.0%	82.6%	80.8%
8 Not sure	1.5%		.5%	.7%
Total N	401	400	403	1204
Total %	100.0%	100.0%	100.0%	100.0%

Table B26. Whether respondent voted in the last election in which county officials such as County Mayor, Sheriff or Property Assessor were elected, by County

	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 No	13.0%	23.5%	12.2%	16.2%
2 Yes	84.0%	75.3%	85.9%	81.7%
8 Not sure	3.0%	1.3%	2.0%	2.1%
Total N	401	400	403	1204
Total %	100.0%	100.0%	100.0%	100.0%

Table B27. Reason why respondent did not vote in last county election, by County

Reason	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Too busy	9.6%	18.1%	10.2%	13.8%
2 Out of town	11.5%	11.7%	16.3%	12.8%
3 Not aware of election	9.6%	9.6%	22.4%	12.8%
4 Not registered to vote at that time	3.8%	3.2%	6.1%	4.1%
5 Did not think election was important	11.5%	20.2%	12.2%	15.9%
6 Did not know where to vote	3.8%	2.1%	6.1%	3.6%
7 Other	40.4%	35.1%	20.4%	32.8%
8 Not Sure	9.6%		6.1%	4.1%
Total N	52	94	49	195
Total %	100.0%	100.0%	100.0%	100.0%

Table B28. Reason that comes closest to why respondent did vote in the 2004 election for county officers, by County

Reason	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Considered the election important	56.6%	62.4%	62.6%	60.5%
2 Wanted to see new candidates elected	20.2%	13.9%	9.9%	14.7%
3 Wanted to see a change in local services	14.2%	13.6%	18.7%	15.6%
4 Wanted to keep incumbents in office	5.4%	5.8%	6.1%	5.8%
8 Not sure	3.6%	4.4%	2.6%	3.5%
Table N	332	295	342	969
Total %	100.0%	100.0%	100.0%	100.0%

Table B29. About how long respondent has been a resident in Tennessee, by County

years	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
.16	.2%			.1%
.25	.5%			.2%
.50	.2%	.3%	.5%	.3%
.57	.2%			.1%
.66	.5%		.2%	.2%
.75	.5%	.3%	.2%	.3%
.79		.3%		.1%

1.00			1.2%	.4%
1.50		.5%	.5%	.3%
1.75			.2%	.1%
2.00	1.0%	1.8%	2.0%	1.6%
3.00	.7%	.5%	2.2%	1.2%
4.00		1.3%	2.0%	1.1%
4.50	.2%		.2%	.2%
5.00	1.7%	2.0%	3.5%	2.4%
6.00	.5%	1.8%	4.5%	2.2%
7.00	2.0%	1.3%	3.0%	2.1%
7.50			.2%	.1%
8.00	.5%	.8%	2.2%	1.2%
9.00	.5%	.8%	1.5%	.9%
9.50			.2%	.1%
10.00	.5%	2.3%	3.0%	1.9%
11.00		1.0%	.7%	.6%
12.00	2.7%	1.3%	2.2%	2.1%
13.00	1.0%	.3%	1.0%	.7%
14.00	1.0%	1.0%	1.2%	1.1%
15.00	1.7%	2.3%	2.5%	2.2%
16.00	1.2%	.8%	2.0%	1.3%
17.00	.7%	1.0%	.7%	.8%
18.00	.5%	1.5%	.5%	.8%
19.00	.5%	2.3%	.5%	1.1%
20.00	2.7%	3.3%	2.0%	2.7%
21.00	.5%	1.0%		.5%
22.00	1.0%	1.0%	.2%	.7%
23.00	.5%	1.0%	.7%	.7%
24.00	1.0%	.3%	.5%	.6%
25.00	1.5%	2.5%	1.2%	1.7%
26.00	.2%	.8%	1.0%	.7%
27.00	.7%	.5%	1.5%	.9%
28.00		.5%	1.0%	.5%
29.00		.8%	.2%	.3%
30.00	3.0%	3.3%	3.0%	3.1%
31.00	1.2%	.3%	1.0%	.8%
32.00	2.2%	.8%	.2%	1.1%
33.00	1.0%	1.3%	.5%	.9%
34.00	.7%	.5%	.7%	.7%
35.00	1.7%	.8%	1.2%	1.2%
36.00	1.0%	1.5%	1.0%	1.2%
37.00	1.5%	1.0%	.7%	1.1%
38.00	1.0%	.8%	1.0%	.9%
39.00	.5%	1.0%	.2%	.6%
40.00	5.0%	3.0%	1.7%	3.2%
41.00	1.2%	.5%	1.2%	1.0%

42.00	.2%	.3%	1.2%	.6%
43.00	.5%	1.0%	1.0%	.8%
44.00	.7%	1.3%	.5%	.8%
45.00	1.2%	3.0%	1.5%	1.9%
46.00	.5%	1.0%	1.2%	.9%
47.00	2.5%	1.5%	.5%	1.5%
48.00	1.0%	.3%	2.5%	1.2%
49.00	1.5%	.8%	1.0%	1.1%
50.00	5.0%	2.5%	2.2%	3.2%
51.00	1.2%	.8%	1.2%	1.1%
52.00	1.0%	1.8%	1.2%	1.3%
53.00	2.2%	1.0%	1.2%	1.5%
54.00	1.7%	.3%	1.0%	1.0%
55.00	1.5%	1.0%	1.0%	1.2%
55.50	.2%			.1%
56.00	1.2%	1.0%	1.2%	1.2%
57.00	1.7%	.5%	1.0%	1.1%
58.00	1.5%	1.5%	.7%	1.2%
59.00	.5%	.5%	.5%	.5%
60.00	3.7%	3.0%	2.5%	3.1%
61.00	2.0%	2.0%	.7%	1.6%
62.00	1.0%	.5%	.5%	.7%
63.00	1.7%	2.0%	1.0%	1.6%
64.00	1.0%	1.3%	.2%	.8%
65.00	2.2%	2.3%	1.2%	1.9%
66.00	.2%	1.8%	1.0%	1.0%
66.50	.2%			.1%
67.00	.5%	.5%	.5%	.5%
68.00	.5%	1.0%	.5%	.7%
69.00	1.5%	1.0%	.2%	.9%
70.00	1.5%	1.0%	1.5%	1.3%
71.00	.7%	1.5%	.5%	.9%
72.00	1.2%	1.3%	.2%	.9%
73.00	.5%	1.5%	.5%	.8%
74.00	.7%	.8%	.5%	.7%
75.00	1.0%	1.8%	1.0%	1.2%
76.00	.2%	1.0%	.7%	.7%
77.00	1.0%	.8%	1.0%	.9%
78.00	.2%	.3%		.2%
79.00	.7%	.3%	2.0%	1.0%
80.00	1.5%	.8%	.2%	.8%
81.00		.3%	.2%	.2%
82.00			.2%	.1%
84.00	.7%	.3%		.3%
85.00		.3%	.2%	.2%
86.00		.3%	.5%	.2%

	1 Anderson County	2 Knox County	3 Loudon County	Total
87.00	.2%		.2%	.2%
88.00	.5%		.7%	.4%
90.00		.5%		.2%
91.00			.2%	.1%
97.00		.3%		.1%
99.00 missing	.2%	1.8%	.2%	.7%
Mean	41.859	40.084	33.336	38.411
Median	45.0	40.0	30.0	40.0
Mode	40.0	20.0	6.0	40.0
Total N	398	393	400	1191
Total %	100.0%	100.0%	100.0%	100.0%

Table B30. About how long respondent has lived in the county of current residence, by County

Years	County 1 Anderson County	2 Knox County	3 Loudon County	Total
.00	.2%			.1%
.15			.2%	.1%
.25	.2%			.1%
.33			.2%	.1%
.40	.2%			.1%
.50		.3%	.2%	.2%
.65		.3%		.1%
.66	.2%		.2%	.2%
.75	.2%	.5%		.2%
.76	.5%			.2%
.79			.2%	.1%
.84	.2%			.1%
1.00	.2%	1.3%	1.5%	1.0%
1.50		.5%	.5%	.3%
1.75			.2%	.1%
2.00	1.5%	1.8%	3.2%	2.2%
2.50		.3%		.1%
3.00	1.2%	1.0%	5.7%	2.7%
3.50		.3%		.1%
4.00	.5%	2.0%	1.5%	1.3%
4.33		.3%		.1%
4.50	.2%		.5%	.2%
5.00	2.2%	4.0%	5.7%	4.0%
6.00	1.2%	1.5%	5.0%	2.6%
7.00	2.2%	1.8%	5.0%	3.0%
7.50			.2%	.1%
8.00	1.2%	1.5%	2.7%	1.8%
9.00	.7%	1.8%	3.2%	1.9%
9.50			.2%	.1%

10.00	1.7%	2.8%	4.0%	2.8%
11.00	.2%	1.0%	1.5%	.9%
12.00	3.2%	1.8%	2.2%	2.4%
13.00	1.5%	1.0%	1.7%	1.4%
14.00	1.0%	1.3%	1.7%	1.3%
15.00	1.0%	3.5%	3.0%	2.5%
16.00	1.5%	1.5%	2.2%	1.7%
17.00	2.5%	1.3%	1.0%	1.6%
18.00	1.0%	1.5%	1.0%	1.2%
19.00	.2%	2.3%	.7%	1.1%
20.00	3.7%	4.5%	2.7%	3.7%
21.00	1.0%	1.0%	.2%	.7%
22.00	1.2%	1.3%	1.2%	1.2%
23.00	.2%	.8%	.7%	.6%
24.00	.7%	.8%	.5%	.7%
25.00	2.7%	3.5%	1.2%	2.5%
26.00	.2%	1.0%	1.7%	1.0%
27.00	1.5%	.5%	1.0%	1.0%
28.00	.5%	.5%	.7%	.6%
29.00	.7%	.8%		.5%
30.00	5.5%	4.0%	3.0%	4.1%
31.00	.7%		.7%	.5%
32.00	1.2%	.5%	.2%	.7%
33.00	1.7%	.8%	.7%	1.1%
34.00	1.2%	1.5%	1.0%	1.2%
35.00	2.0%	1.3%	1.7%	1.7%
36.00	.5%	.8%	.5%	.6%
37.00	1.5%	1.3%	1.0%	1.2%
38.00	1.2%	1.0%	.7%	1.0%
39.00	.7%	1.0%		.6%
40.00	4.7%	2.8%	1.5%	3.0%
41.00	.7%	.8%		.5%
42.00	1.2%	.3%	.2%	.6%
43.00	.5%	1.3%	.7%	.8%
44.00	.5%	.3%		.2%
45.00	2.5%	2.0%	1.2%	1.9%
46.00	.7%	.5%	1.0%	.7%
47.00	1.7%	1.3%		1.0%
48.00	1.0%	.8%	1.0%	.9%
49.00	.7%	.5%	.2%	.5%
50.00	4.7%	3.3%	2.2%	3.4%
51.00	1.5%	1.0%	.5%	1.0%
52.00	.7%	1.0%	1.7%	1.2%
53.00	1.2%	.8%	1.0%	1.0%
54.00	2.0%		.5%	.8%
55.00	2.0%	.8%	.7%	1.2%

55.50	.2%			.1%
56.00	1.5%	.8%	.7%	1.0%
57.00	.7%	.3%	.2%	.4%
58.00	1.2%	1.3%	1.0%	1.2%
59.00	1.0%	.3%	.2%	.5%
60.00	1.7%	2.8%	1.7%	2.1%
61.00	1.0%	1.3%	.5%	.9%
62.00	1.0%	.3%	.2%	.5%
63.00	1.7%	1.3%	.7%	1.2%
64.00	.5%	.8%	.2%	.5%
65.00	1.2%	1.3%	.5%	1.0%
66.00	.2%	.8%	.7%	.6%
67.00	.2%	.3%	.2%	.2%
68.00		.8%	.5%	.4%
69.00	.5%	.3%	.2%	.3%
70.00	.5%	.8%	1.5%	.9%
71.00	.2%	1.0%		.4%
72.00	.5%	1.0%	.2%	.6%
73.00		.5%		.2%
74.00	.2%	.3%		.2%
75.00	.2%	.8%		.3%
76.00		.5%	.2%	.2%
77.00	.5%	.8%		.4%
78.00		.3%	.2%	.2%
79.00			.5%	.2%
80.00	.2%			.1%
81.00		.3%		.1%
84.00	.2%	.3%		.2%
85.00			.2%	.1%
87.00	.2%			.1%
88.00 (not sure)	.5%	.5%	.7%	.6%
90.00		.5%		.2%
91.00			.2%	.1%
99.0 (missing)	.2%	.8%	.2%	.4%
Mean	34.10	31.73	23.65	29.8194
Median	34.0	27.0	15.0	26.0
Mode	30.0	20.0	3.0	30.0
Total N	398	395	400	1193
Total	100.0%	100.0%	100.0%	100.0%

Table B31. Respondent's Age (years), by County

Years	1 Anderson County	2 Knox County	3 Loudon County	Total
18	.3%	.5%		.3%
19	.5%	.8%		.4%
21	.3%	.3%		.2%
22	.3%			.1%
23	.5%			.2%
24	.5%	.3%	1.0%	.6%
25		1.0%	.3%	.4%
26		.5%	.5%	.3%
27	.3%	.8%	.3%	.4%
28	.3%	.5%		.3%
29		.3%	.3%	.2%
30	.3%	.5%		.3%
31	.3%	.5%	.3%	.3%
32	1.0%	.8%	.3%	.7%
33		1.0%	.3%	.4%
34	.8%		.8%	.5%
35	.3%	.8%	.5%	.5%
36	.3%	1.5%	.3%	.7%
37	1.5%	1.3%	.3%	1.0%
38	1.3%	1.0%	.8%	1.0%
39	.5%	1.0%	.5%	.7%
40	1.0%	1.0%	.5%	.8%
41	1.3%	1.0%	1.3%	1.2%
42	.8%	.8%	2.0%	1.2%
43	.8%	1.8%	2.5%	1.7%
44	1.8%	2.8%	.3%	1.6%
45	1.0%	2.5%	1.3%	1.6%
46	1.0%	1.0%	2.0%	1.3%
47	2.0%	2.3%	1.3%	1.8%
48	2.3%	2.3%	2.0%	2.2%
49	2.3%	2.0%	1.8%	2.0%
50	2.8%	2.0%	1.8%	2.2%
51	1.8%	1.0%	2.5%	1.8%
52	1.5%	3.6%	3.0%	2.7%
53	2.3%	1.3%	1.5%	1.7%
54	2.5%	1.8%	1.8%	2.0%
55	1.8%	1.8%	2.8%	2.1%
56	2.3%	2.0%	2.5%	2.3%
57	2.8%	1.3%	1.8%	1.9%
58	3.8%	4.3%	1.8%	3.3%
59	1.5%	1.3%	3.0%	1.9%
60	4.5%	3.6%	4.0%	4.0%

61	3.0%	2.3%	3.3%	2.9%
62	3.8%	2.5%	2.3%	2.9%
63	1.8%	2.8%	2.5%	2.4%
64	2.8%	2.3%	2.8%	2.6%
65	3.8%	4.3%	5.0%	4.4%
66	1.3%	1.8%	2.8%	1.9%
67	2.3%	1.5%	3.3%	2.4%
68	1.0%	1.0%	2.3%	1.4%
69	2.3%	1.8%	2.5%	2.2%
70	2.3%	.8%	4.0%	2.4%
71	2.0%	2.8%	1.8%	2.2%
72	2.5%	2.3%	1.5%	2.1%
73	1.8%	2.5%	2.8%	2.4%
74	1.8%	1.5%	1.5%	1.6%
75	3.0%	1.3%	1.3%	1.8%
76	1.8%	2.0%	2.5%	2.1%
77	2.5%	1.3%	2.0%	1.9%
78	1.5%	1.0%	.5%	1.0%
79	2.0%	.8%	2.3%	1.7%
80	1.3%	1.8%	.8%	1.3%
81	1.8%	1.0%	.5%	1.1%
82	.5%	.8%	.5%	.6%
83	.8%	.5%	1.0%	.8%
84	1.0%	.5%	.3%	.6%
85	.5%	1.8%	.5%	.9%
86	.5%	.3%	.8%	.5%
87	.5%	.5%	.3%	.4%
88	.3%	.3%	.8%	.4%
90		.5%	.3%	.3%
91			.3%	.1%
92		.3%		.1%
97		.3%		.1%
99		.5%		.2%
Mean	59.83	57.91	60.38	59.38
Median	60.0	59.0	61.0	60.0
Mode	60.0	58.0	65	65.0
Total N	399	394	397	1190
Total	100.0%	100.0%	100.0%	100.0%

Table B32. Level that best describes respondent's education, by County

Education Level	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Not HS Grad	6.0%	3.3%	6.2%	5.2%
2 HS Grad	45.7%	40.1%	43.8%	43.2%
3 Some education beyond HS	28.6%	35.5%	30.3%	31.5%
4 College Grad	19.6%	21.2%	19.7%	20.1%
Total N	398	397	402	1197
Total %	100.0%	100.0%	100.0%	100.0%

Table B33. When it comes to politics generally, how respondent describes self, by County

Ideological Orientation	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Liberal	17.2%	19.7%	13.8%	16.9%
2 Moderate	33.4%	31.3%	30.5%	31.7%
3 Conservative	40.3%	42.3%	50.5%	44.4%
8 Not sure	9.1%	6.7%	5.3%	7.0%
Total N	395	390	400	1185
Total %	100.0%	100.0%	100.0%	100.0%

Table B34. Respondent's Party Identification, by County

Party Identification	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Strong Democrat	12.0%	11.1%	6.4%	9.8%
2 Democrat	19.6%	15.0%	5.9%	13.5%
3 Independent leaning Democrat	8.7%	8.0%	8.4%	8.4%
4 Independent	19.3%	18.6%	18.6%	18.9%
5 Independent leaning Republican	12.2%	9.3%	16.1%	12.5%
6 Republican	17.0%	24.8%	26.8%	22.9%
7 Strong Republican	7.1%	10.3%	13.3%	10.2%
8 Not Sure	4.1%	2.8%	4.6%	3.8%
Total N	393	387	393	1172
Total %	100.0%	100.0%	100.0%	100.0%

Table B35. Respondent's Gender, by County

Gender	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Male	38.9%	34.8%	37.1%	36.9%
2 Female	61.1%	65.3%	62.9%	63.1%
Total N	401	400	404	1205
Total %	100.0%	100.0%	100.0%	100.0%

Table B36. Respondent's Marital Status, by County

	County			
	1 Anderson County	2 Knox County	3 Loudon County	Total
1 Single	10.3%	9.3%	4.5%	8.0%
2 Married	69.2%	70.6%	80.7%	73.5%
3 Divorced	9.0%	7.3%	5.2%	7.2%
4 Widowed	11.5%	12.8%	9.7%	11.3%
Total N	399	398	404	1201
Total %	100.0%	100.0%	100.0%	100.0%

Table B37. Respondent's Race, by County

	County			
Race	1 Anderson County	2 Knox County	3 Loudon County	Total
1 Black	1.8%	5.3%	1.0%	2.7%
2 White	97.5%	94.2%	98.3%	96.6%
3 Hispanic			.3%	.1%
4 Asian	.5%			.2%
5 Indian		.5%	.3%	.3%
8 Not Sure	.3%		.3%	.2%
Total N	397	397	400	1194
Total %	100.0%	100.0%	100.0%	100.0%

Table B38. Range of total 2006 Household Income, counting income from all sources, by County

	County			Total
	1 Anderson County	2 Knox County	3 Loudon County	
1 Less than $25,000	15.1%	14.3%	11.2%	13.5%
2 $25,001 - $50,000	30.8%	26.5%	29.6%	29.0%
3 $50,000 - $100,000	34.6%	37.3%	37.4%	36.4%
4 Over $100,000	15.1%	18.8%	17.3%	17.1%
8 Not Sure	4.5%	3.1%	4.4%	4.0%
Total N	292	287	294	873
Total %	100.0%	100.0%	100.0%	100.0%

APPENDIX C: TENNESSEE VOTE CENTER BILLS SB3894/HB3687

When the *Convenience Voting* planning effort began in Fall 2007, legislation was pending before the Tennessee House and Senate to create a pilot project in one or more municipalities to allow the replacement of precinct-based voting systems in favor of anywhere, anytime, multiple-day vote centers. Senate Bill 3894 and House Bill 3687, as amended, were signed into law in June, 2008. While our project was designed to establish vote centers in three counties (Knox, Anderson, and Loudon), only Knox was approved for the pilot project. Still, we are encouraged by the opportunity to demonstrate our project and serve as a model for all of Tennessee and elsewhere. A summary of Tennessee's recent vote center legislation is presented below.

SB3894 by *Burchett. (*HB3687 by *Tindell, *Armstrong, *Hood, *Hardaway, *Ferguson, *Rinks, *Litz.)

Election Laws - Creates a pilot project to be implemented by the state election coordinator in one or more municipalities holding a municipal election in 2009 to determine whether convenient voting centers could successfully be established for local and state elections. - Amends TCA Title 2, Chapter 3.

Bill Summary for SB3894 / *HB3687

This bill creates a pilot project to determine whether convenient voting centers could successfully be established for local and state elections to make it convenient for voters to vote at centralized voting areas in the county in which a voter is registered, regardless of the voter's precinct. This bill requires the state election coordinator to select one or more municipalities that indicate willingness to participate in the pilot project at their municipal elections to be held in 2009. A resolution adopted by a majority vote of the municipality's legislative body must be filed with the coordinator of elections in order for participation in the pilot project.

The state election coordinator, in collaboration with the county election commission where the participating municipality is located, would establish a program that allows the municipality to combine precincts or polling places or establish one or more convenient voting centers for the 2009 municipal election. If convenient voting centers are used in the election, precinct polling places would not be used.

A convenient voting center must have a secure electronic connection to the county's computerized voter registration system. The county election commission would determine the number of convenient voting centers at the election, but there must be at least one vote center for each 15,000 registered voters in any county that uses vote centers, or some other ratio established by the coordinator of elections in consultation with the county election commission. The voting center must comply with all applicable state and federal laws including the accessibility requirements of the *Help America Vote Act*.

If the county election commission combines polling places, precincts, or establishes one or more vote centers, it must publicize the new locations for voting in a newspaper of general circulation and must mail to each voter whose polling place is changed a notice of the voter's new convenient voting center location. The commission must also give notice of such changes to the office of local government in the office of the comptroller and to the coordinator of elections.

The voting period for convenient voting centers under the pilot project would begin on the 20th day before election day and would continue through the day of election. The voting centers would be closed on all Sundays and state holidays during the voting period.

This bill requires the state election coordinator to report the state and local government committees of the senate and house by January 31 following any municipal election conducted under the pilot project. The report would contain the coordinator's evaluation of the project and recommendations as to whether convenient voting centers should continue on a limited basis or whether they should be implemented on a statewide basis.

ON MAY 6, 2008, THE HOUSE ADOPTED AMENDMENT #1 AND PASSED HOUSE BILL 3687, AS AMENDED.

AMENDMENT #1 requires a super majority of at least four out of five county election commissioners to approve their willingness to participate in the pilot program for convenient voting centers for any municipality that is selected by the state coordinator of elections for inclusion in the program. This amendment also provides that approval by the state coordinator of elections would be limited to one county from each grand division and to three additional counties that are included in a study on convenience voting that is being conducted at the University of Tennessee.

This amendment increases the maximum number of registered voters per convenient voting center from 15,000 to 25,000.

ON MAY 13, 2008, THE SENATE SUBSTITUTED HOUSE BILL 3687 FOR SENATE BILL 3894, ADOPTED AMENDMENT #2, AND PASSED HOUSE BILL 3687, AS AMENDED.

AMENDMENT #2 provides that approval by the state coordinator of elections for a county to participate in the convenient voting center pilot project would be limited to Knox County.

Signed by Governor, 6/3/2008.

APPENDIX D. MODEL COMPARISONS

The Maximum Covering Location Problem (MCLP) location-allocation model (LAM) and the P-median LAM with maximum allowable distance constraint (hereafter referred to as the P-median model) produced similar results. Earlier in the report, it was noted that the P-median model, as implemented in the *ArcInfo* software package, can mimic the MCLP when the entire demand population cannot be served by the given number of vote centers. The software documentation specifically states:

> "If there are too few facilities, p, to locate, or the distance, S, [the user-specified maximum allowable travel distance] is too restrictive (too small) then there may be no feasible solution. With Hillsman Editing, feasible solutions can be 'forced.' Penalties are added during the editing process. All distances greater than S are converted to a high penalty value. The objective is optimized by minimizing the number of demand points that are not within distance S" (ESRI, 2001).

The voting population in each of the three study counties was never completely served by a LAM, regardless of the number of vote centers established. This was not due to a shortcoming of the software or the heuristic algorithm. Rather, some demand locations were situated farther than the specified maximum allowable travel distance to the nearest candidate site. Furthermore, it is unlikely that officials in any of the three counties would actually operate the number of vote centers that served all of their 'reachable' voting population. Doing so would be logistically and fiscally prohibitive. Consequently, the model was faced with the conditions described in the first sentence of the above statement. The documentation then strongly implies that the P-median LAM essentially becomes a MCLP LAM under these conditions. This trend appeared to occur when the P-median LAM (with the maximum distance constraint) was tested on Knox and Anderson Counties.

Comparisons of the two models are summarized here (Table D1 and Figure D1 for Knox County and Table B2 and Figure B2 for Anderson County). Using the Knox County example, the curve produced by the P-median model was nearly identical to the curve produced by the MCLP model (Figure D1). Interestingly, the P-median model produced 12 vote center configurations that served slightly more voters than the MCLP (highlighted in the final column of Table D1: *Total Voters Percentage Difference*). However, the differences in the numbers of voters served were small, ranging from -0.002 percent to -0.733 percent. Overall, the average of the non-zero values of the *Total Voters Percentage Difference* column was +0.318 percent, indicating that the MCLP performed 0.318 percent better in maximizing the number of voters served. This small figure supports the notion that the P-median model mimicked the MCLP until nearly all voters were served.

The P-median model did not reduce substantially the aggregate driving distance between voter locations and nearest vote centers until nearly all reachable voters were served. At the 29th iteration of the Knox County model, nearly all of the reachable voters were served, and the problematic conditions (as outlined in the software documentation) no longer existed. At this point, the average driving distance in the P-median model began to drop substantially more than the MCLP model (Table D1: *P-Median Average Distance* and *MCLP Average Distance*). The average distance calculations are useful in comparing the results of the two models, but comparisons should be made with caution. Average driving distance was merely the average distance between a demand node and the supply node to which it was assigned. This figure did not account for the weight found at each demand node, and the P-median model's objective was to minimize the total *weighted* distance (TWD). Hence, comparison of total weighted distance is more appropriate. The TWD from the P-median model began to drop more substantially than the MCLP TWD around iteration 29. These observations about average distances and total weighted distances support the notion that the P-median model behaved nearly the same as the MCLP until all reachable voters were served.

Furthermore, the MCLP model frequently produced TWD figures that were slightly lower than the P-median model (highlighted in Table D1: *TWD % Difference*). Finally, the highlighted TWD percentage difference values were substantially larger than highlighted values for *Total Voters Percentage Difference*. These higher values indicated that the magnitude of the P-median model's failure to meet its objective

(minimizing total weighted distance) was greater than the MCLP model's failure to meet its objective (maximizing the number of voters served).

The MCLP and TWD models produced very similar results when both were run for Anderson County also (Table D2 and Figure D2). However, the primary difference between the Knox and Anderson events was that Anderson's P-median model never served more voters than its MCLP model. On the third iteration, the MCLP served 2.984 percent more voters than the P-median model. However, the differences were negligible in all other iterations.

If the entire voting population can not be served within the maximum travel distance, we recommend that users employ the MCLP model instead of the P-median model, for a number of reasons. First, the software documentation suggests that the objective of the two models is nearly the same under this condition. The output shown here for Knox and Anderson counties supports that assertion. Second, the MCLP model maximized the total number of voters served more often than the P-median model. Third, the magnitude of the P-median model's failure to reach its objective was higher than the MCLP model's failure. Fourth, the two models frequently selected the same (or very close) vote center locations. Fifth, the MCLP model was simpler in concept, which eased communication about the model's objective and its results. Finally, the MCLP model appeared to require substantially less time to compute, but actual processing times were not measured and compared.

Table D1: Comparison of Two Location-Allocation Models for Knox County

# Vote Ctrs.	P-median Avg. Dist. (mi)	MCLP Avg. Dist. (mi)	Diff. Avg. Dist.	P-median Total Weighted Distance (TWD)[1]	MCLP Total Weighted Distance (TWD)	TWD % Diff.[2]	P-median Voters Served	P-median % Voters Served	MCLP Voters Served	MCLP % Voters Served	Total Voters % Diff.[3]
1	3.09	3.09	0.00	1,009,439,000	1,009,439,000	0.000	63,044	27.29	63,044	27.29	0.000
2	3.12	3.15	0.04	1,873,791,000	1,916,621,000	2.235	117,878	51.02	118,077	51.10	0.168
3	3.07	3.12	0.05	2,142,208,000	2,252,645,000	4.903	138,352	59.88	139,755	60.48	1.004
4	3.06	3.09	0.02	2,458,879,000	2,521,386,000	2.479	159,032	68.83	160,483	69.46	0.904
5	3.05	3.03	-0.02	2,779,598,000	2,801,780,000	0.792	178,867	77.41	179,633	77.74	0.426
6	3.03	3.04	0.02	2,882,304,000	2,962,266,000	2.699	187,082	80.97	191,918	83.06	2.520
7	3.10	2.96	-0.15	3,092,851,000	2,933,687,000	-5.425	193,931	83.93	196,867	85.20	1.491
8	3.06	2.98	-0.08	3,135,133,000	3,161,278,000	0.827	199,369	86.29	207,174	89.66	3.767
9	3.01	3.00	-0.01	3,275,134,000	3,242,656,000	-1.002	211,434	91.51	211,330	91.46	-0.049
10	3.03	2.81	-0.22	3,406,241,000	3,071,260,000	-10.91	214,891	93.00	213,824	92.54	-0.499
11	2.95	2.98	0.03	3,250,880,000	3,290,205,000	1.195	218,141	94.41	218,340	94.50	0.092
12	3.02	2.91	-0.11	3,356,044,000	3,309,632,000	-1.402	219,871	95.16	220,267	95.33	0.180
13	2.89	2.78	-0.11	3,323,747,000	3,175,192,000	-4.679	222,242	96.18	221,886	96.03	-0.161
14	2.83	2.71	-0.13	3,296,753,000	3,099,244,000	-6.373	222,718	96.39	221,097	95.69	-0.733
15	2.80	2.91	0.11	3,256,015,000	3,445,902,000	5.511	224,854	97.32	225,798	97.72	0.418
16	2.75	2.89	0.13	3,246,306,000	3,397,795,000	4.458	225,967	97.80	226,526	98.04	0.247
17	2.88	2.88	0.00	3,448,044,000	3,401,687,000	-1.363	227,101	98.29	227,216	98.34	0.051
18	2.87	2.86	-0.01	3,379,048,000	3,397,967,000	0.557	227,253	98.35	228,116	98.73	0.378
19	2.70	2.73	0.03	3,171,708,000	3,237,335,000	2.027	228,386	98.84	228,205	98.77	-0.079
20	2.67	2.68	0.01	3,148,879,000	3,157,308,000	0.267	228,523	98.90	228,718	98.99	0.085
21	2.66	2.56	-0.10	3,148,297,000	2,977,822,000	-5.725	229,143	99.17	229,059	99.14	-0.036
22	2.50	2.55	0.05	2,876,331,000	2,961,120,000	2.863	229,126	99.16	229,203	99.20	0.033
23	2.50	2.45	-0.06	2,926,104,000	2,809,391,000	-4.154	229,424	99.29	229,372	99.27	-0.023
24	2.50	2.43	-0.08	2,936,353,000	2,802,609,000	-4.772	229,486	99.32	229,406	99.29	-0.035
25	2.40	2.41	0.00	2,768,002,000	2,785,628,000	0.633	229,486	99.32	229,531	99.34	0.020
26	2.40	2.41	0.01	2,764,201,000	2,796,013,000	1.138	229,526	99.34	229,554	99.35	0.012
27	2.33	2.38	0.05	2,746,593,000	2,803,471,000	2.029	229,624	99.38	229,590	99.36	-0.015
28	2.28	2.46	0.18	2,669,223,000	2,912,904,000	8.366	229,640	99.39	229,633	99.38	-0.003
29	2.19	2.47	0.28	2,491,295,000	2,951,702,000	15.598	229,639	99.39	229,645	99.39	0.003
30	2.17	2.38	0.22	2,470,056,000	2,801,229,000	11.822	229,650	99.39	229,645	99.39	-0.002
31	2.12	2.37	0.25	2,431,148,000	2,800,502,000	13.189	229,658	99.39	229,666	99.40	0.004
32	2.09	2.28	0.20	2,392,564,000	2,696,118,000	11.259	229,658	99.39	229,661	99.40	0.001
33	2.07	2.32	0.25	2,404,649,000	2,754,858,000	12.712	229,670	99.40	229,666	99.40	-0.002
34	2.02	2.31	0.29	2,293,912,000	2,716,549,000	15.558	229,670	99.40	229,670	99.40	0.000
35	1.95	2.28	0.33	2,219,767,000	2,673,496,000	16.971	229,670	99.40	229,670	99.40	0.000
36	1.88	2.19	0.31	2,148,279,000	2,550,982,000	15.786	229,670	99.40	229,670	99.40	0.000
37	1.86	2.15	0.29	2,098,498,000	2,499,064,000	16.029	229,670	99.40	229,670	99.40	0.000
38	1.82	2.15	0.33	2,052,717,000	2,498,977,500	17.858	229,670	99.40	229,670	99.40	0.000
39	1.81	2.11	0.31	2,024,342,000	2,425,018,000	16.523	229,670	99.40	229,670	99.40	0.000
40	1.78	2.10	0.32	1,988,012,000	2,406,890,000	17.403	229,670	99.40	229,670	99.40	0.000
41	1.74	2.08	0.34	1,945,395,000	2,381,330,000	18.306	229,670	99.40	229,670	99.40	0.000
42	1.71	1.99	0.28	1,912,892,000	2,285,221,000	16.293	229,670	99.40	229,670	99.40	0.000
43	1.68	1.99	0.31	1,884,134,000	2,279,465,000	17.343	229,670	99.40	229,670	99.40	0.000
44	1.66	1.98	0.31	1,857,172,000	2,262,062,000	17.899	229,670	99.40	229,670	99.40	0.000
45	1.64	1.96	0.32	1,827,806,000	2,231,427,000	18.088	229,670	99.40	229,670	99.40	0.000

[1]The total weighted distance is calculated as follows: First, the driving distance (in feet) between the demand node and its assigned supply center is calculated. This figure is then multiplied by the demand value of the demand node, yielding the weighted distance for this single supply-demand pair. The total weighted distance is the sum of the weighted distance for all supply-demand pairs.
[2]The percentage difference was calculated as the Total Weighted Distance (TWD) of the MCLP model minus the TWD of the P-median model. The difference was then divided by the TWD of the MCLP.
[3]The percentage difference was calculated as the number of voters served by the MCLP model minus the number of voters served by the P-median model. The difference was then divided by the number of voters served by the MCLP.

*Figure D1: Total Demand Served by Two Different Models for Knox County*
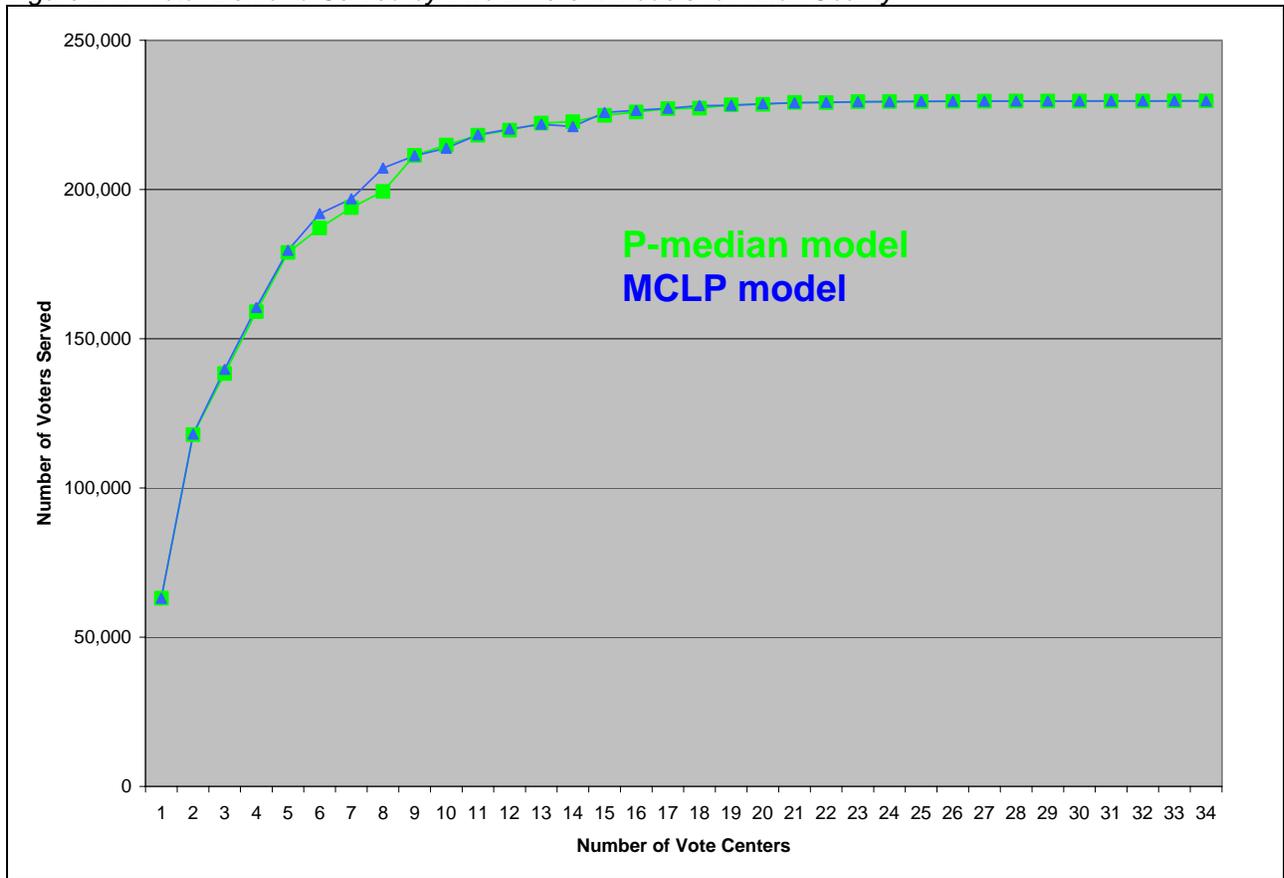
Table D2: Comparison of Two Location-Allocation Models for Anderson County

| # Vote Ctrs.	P-median Avg. Dist. (mi)	MCLP Avg. Dist. (mi)	Diff. Avg. Dist.	P-median Total Weighted Distance (TWD)	MCLP Total Weighted Distance (TWD)	TWD % Diff.	P-median Voters Served	P-median % Voters Served	MCLP Voters Served	MCLP % Voters Served	Total Voters % Diff.
1	2.66	2.66	0.00	135,615,500	135,615,500	0.000	11,142	25.32	11,142	25.32	0.000
2	2.69	2.69	0.00	410,636,100	410,636,100	0.000	30,851	70.11	30,851	70.11	0.000
3	2.61	2.67	-0.05	442,885,800	461,718,000	4.079	33,865	76.96	34,906	79.33	2.984
4	2.59	2.59	0.00	490,528,200	491,463,900	0.190	37,777	85.85	37,782	85.86	0.011
5	2.56	2.57	0.00	519,466,900	520,402,700	0.180	40,464	91.96	40,468	91.97	0.010
6	2.38	2.36	0.02	470,696,300	463,023,300	-1.657	40,949	93.06	40,968	93.10	0.048
7	2.33	2.33	0.00	465,500,700	466,436,400	0.201	41,352	93.98	41,357	93.99	0.010
8	2.33	2.25	0.08	466,999,200	453,653,700	-2.942	41,466	94.24	41,565	94.46	0.239
9	2.25	2.18	0.07	454,546,400	442,792,700	-2.654	41,666	94.69	41,711	94.79	0.109
10	2.18	2.19	0.00	443,685,400	444,291,200	0.136	41,811	95.02	41,825	95.05	0.032
11	2.18	2.18	0.00	443,377,600	443,879,300	0.113	41,884	95.19	41,891	95.20	0.018
12	2.15	2.17	-0.03	436,037,100	443,510,100	1.685	41,916	95.26	41,935	95.30	0.046
13	2.12	2.15	-0.02	431,669,700	438,641,000	1.589	41,958	95.36	41,970	95.38	0.028
14	2.03	2.06	-0.03	393,985,000	402,926,600	2.219	41,961	95.36	41,973	95.39	0.028
15	2.02	2.02	0.00	393,552,500	395,586,000	0.514	41,983	95.41	42,005	95.46	0.053
16	1.96	2.02	-0.05	381,696,900	395,369,400	3.458	41,986	95.42	42,027	95.51	0.097
17	1.96	1.96	0.00	381,543,500	383,513,800	0.514	42,030	95.52	42,030	95.52	0.000
18	1.90	1.91	-0.01	358,920,800	364,496,600	1.530	42,032	95.52	42,032	95.52	0.000
19	1.84	1.90	-0.06	338,269,700	364,287,500	7.142	42,032	95.52	42,032	95.52	0.000
20	1.82	1.90	-0.09	327,057,600	363,542,800	10.036	42,032	95.52	42,032	95.52	0.000
21	1.79	1.90	-0.11	315,790,000	362,992,400	13.004	42,032	95.52	42,032	95.52	0.000
22	1.78	1.90	-0.12	310,055,500	362,622,900	14.496	42,032	95.52	42,032	95.52	0.000
23	1.77	1.90	-0.13	305,361,800	362,526,300	15.768	42,032	95.52	42,032	95.52	0.000
24	1.75	1.89	-0.14	300,874,600	361,019,700	16.660	42,032	95.52	42,032	95.52	0.000
25	1.74	1.89	-0.15	297,070,800	360,911,500	17.689	42,032	95.52	42,032	95.52	0.000
26	1.72	1.89	-0.17	294,131,900	360,856,100	18.491	42,032	95.52	42,032	95.52	0.000
27	1.71	1.88	-0.18	291,022,900	359,671,600	19.086	42,032	95.52	42,032	95.52	0.000
28	1.69	1.88	-0.18	288,596,900	357,364,700	19.243	42,032	95.52	42,032	95.52	0.000
29	1.69	1.87	-0.18	286,231,400	355,322,600	19.445	42,032	95.52	42,032	95.52	0.000
30	1.68	1.87	-0.19	283,933,500	355,085,100	20.038	42,032	95.52	42,032	95.52	0.000
31	1.67	1.87	-0.19	281,690,200	355,040,700	20.660	42,032	95.52	42,032	95.52	0.000
32	1.67	1.87	-0.20	279,768,500	354,962,600	21.184	42,032	95.52	42,032	95.52	0.000
33	1.65	1.87	-0.22	277,839,000	354,955,800	21.726	42,032	95.52	42,032	95.52	0.000
34	1.64	1.86	-0.22	275,689,400	354,759,700	22.288	42,032	95.52	42,032	95.52	0.000
35	1.64	1.86	-0.22	274,023,200	354,743,700	22.755	42,032	95.52	42,032	95.52	0.000
36	1.64	1.86	-0.23	272,691,900	354,742,800	23.130	42,032	95.52	42,032	95.52	0.000
37	1.63	1.86	-0.23	271,505,300	354,614,500	23.436	42,032	95.52	42,032	95.52	0.000
38	1.63	1.86	-0.23	270,358,300	353,941,000	23.615	42,032	95.52	42,032	95.52	0.000
39	1.63	1.86	-0.23	269,250,300	353,757,800	23.889	42,032	95.52	42,032	95.52	0.000
40	1.62	1.86	-0.24	268,483,000	353,139,200	23.972	42,032	95.52	42,032	95.52	0.000

Figure D2: Total Demand Served by Two Different Models for Anderson County
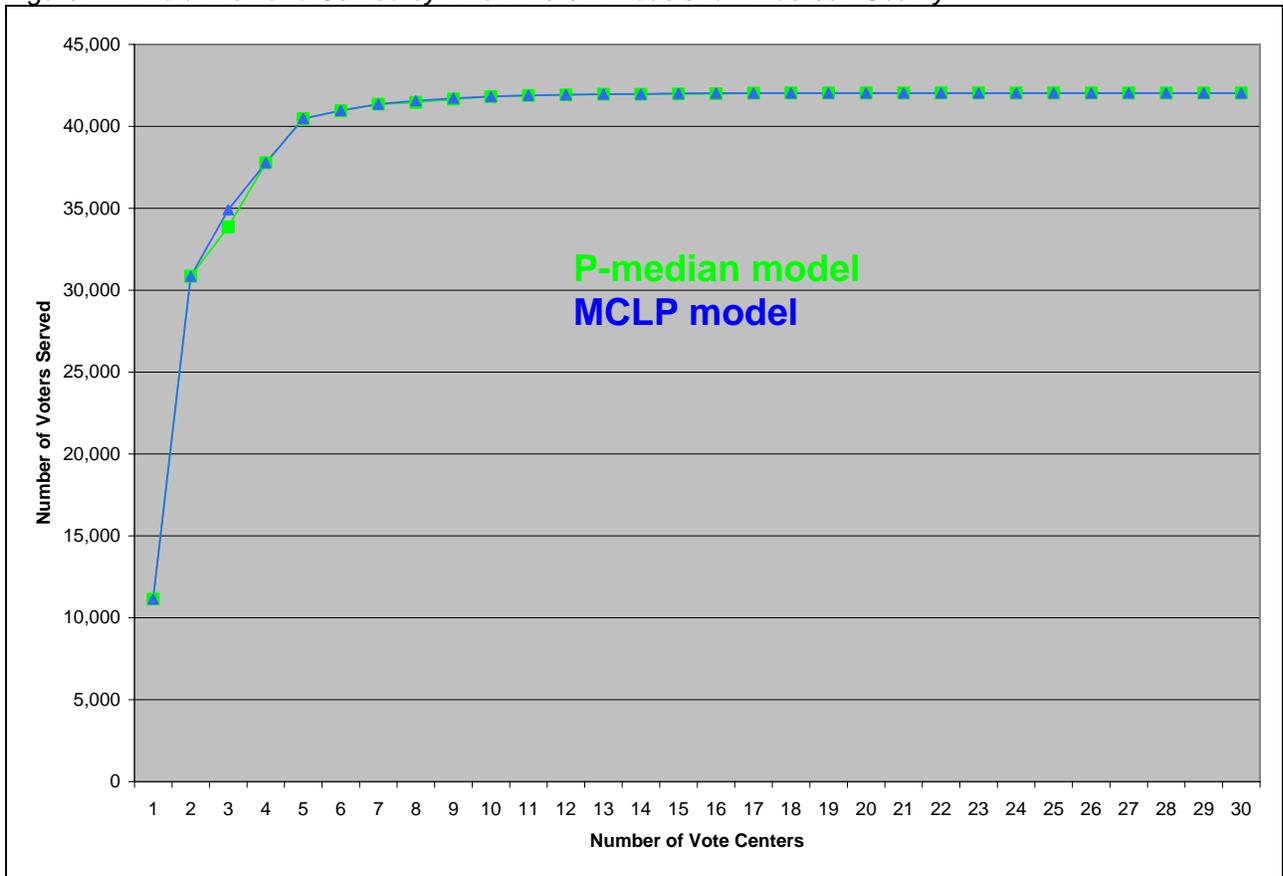
**APPENDIX E: KNOX COUNTY VOTE CENTER LOCATION MAPS: SCENARIO ONE, ITERATIONS 1-15**
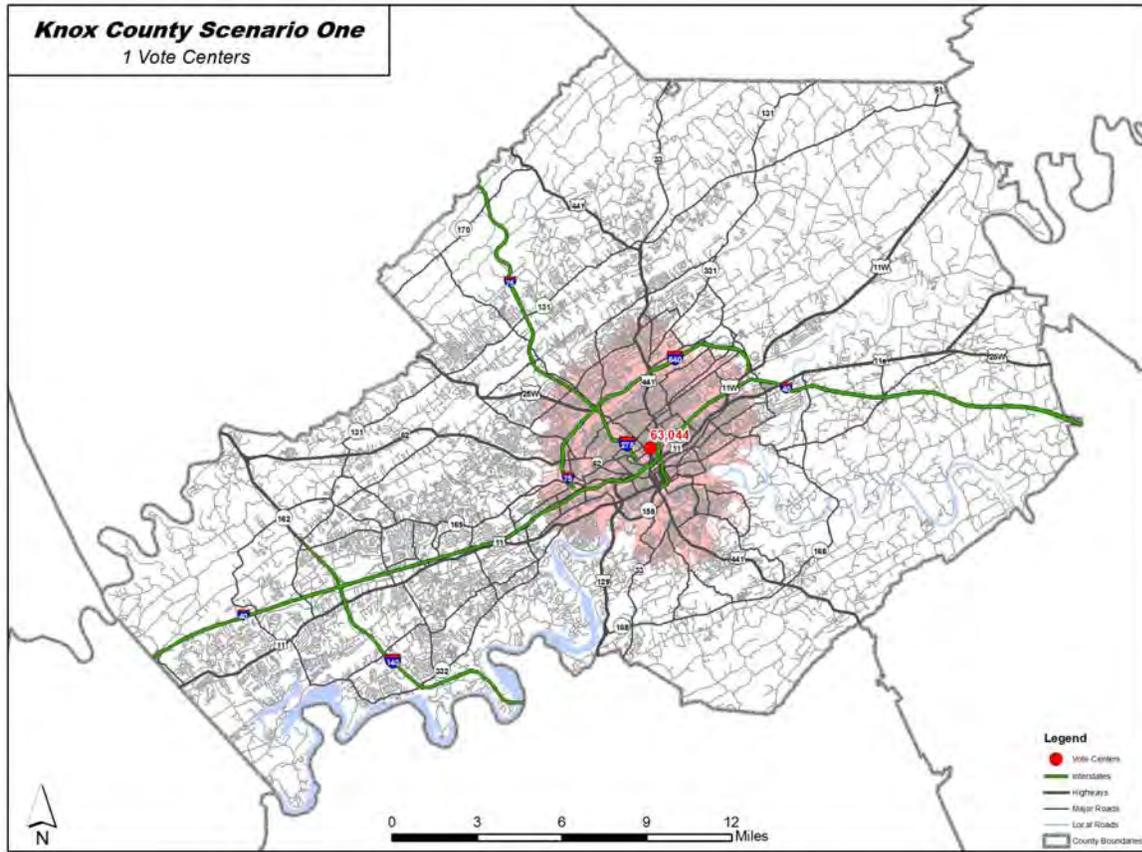
Knox County Scenario One
2 Vote Centers
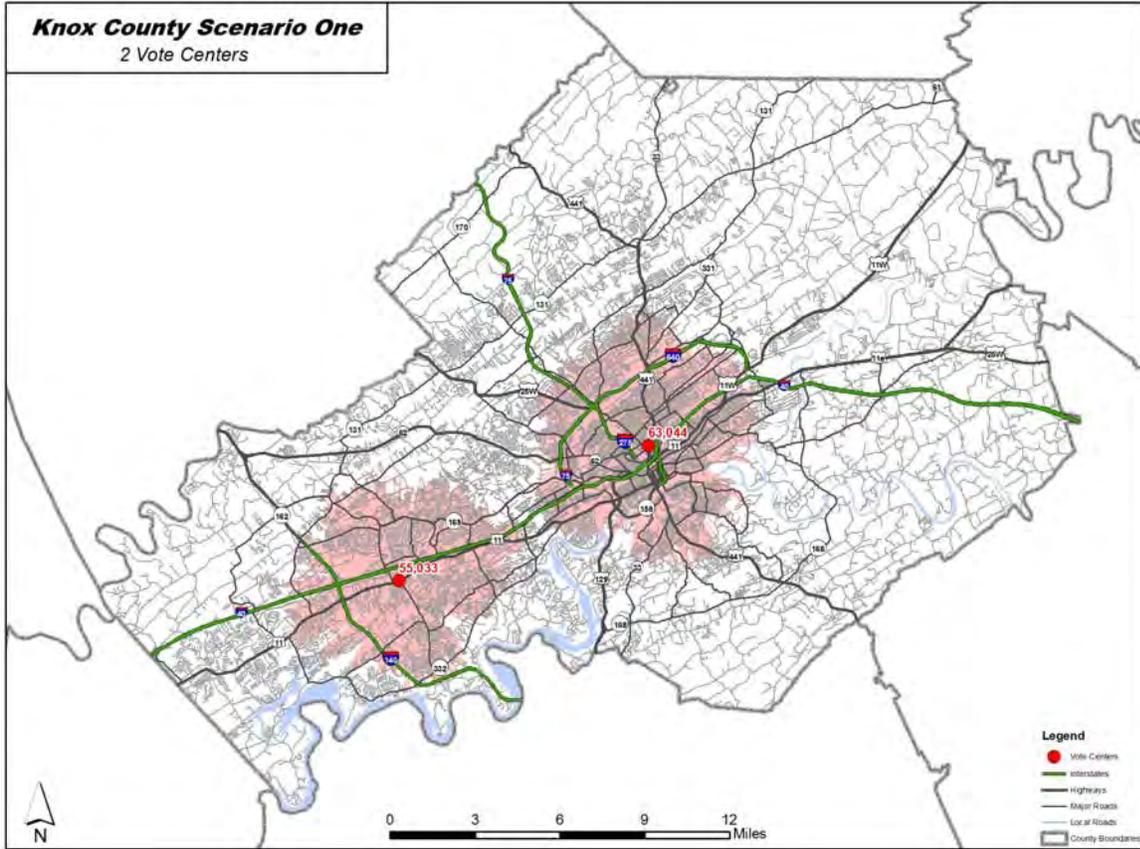
Knox County Scenario One
3 Vote Centers

26,929
57,803
55,023

Legend
Vote Centers
Interstates
Highways
Major Roads
Local Roads
County Boundaries

0   3   6   9   12 Miles

N
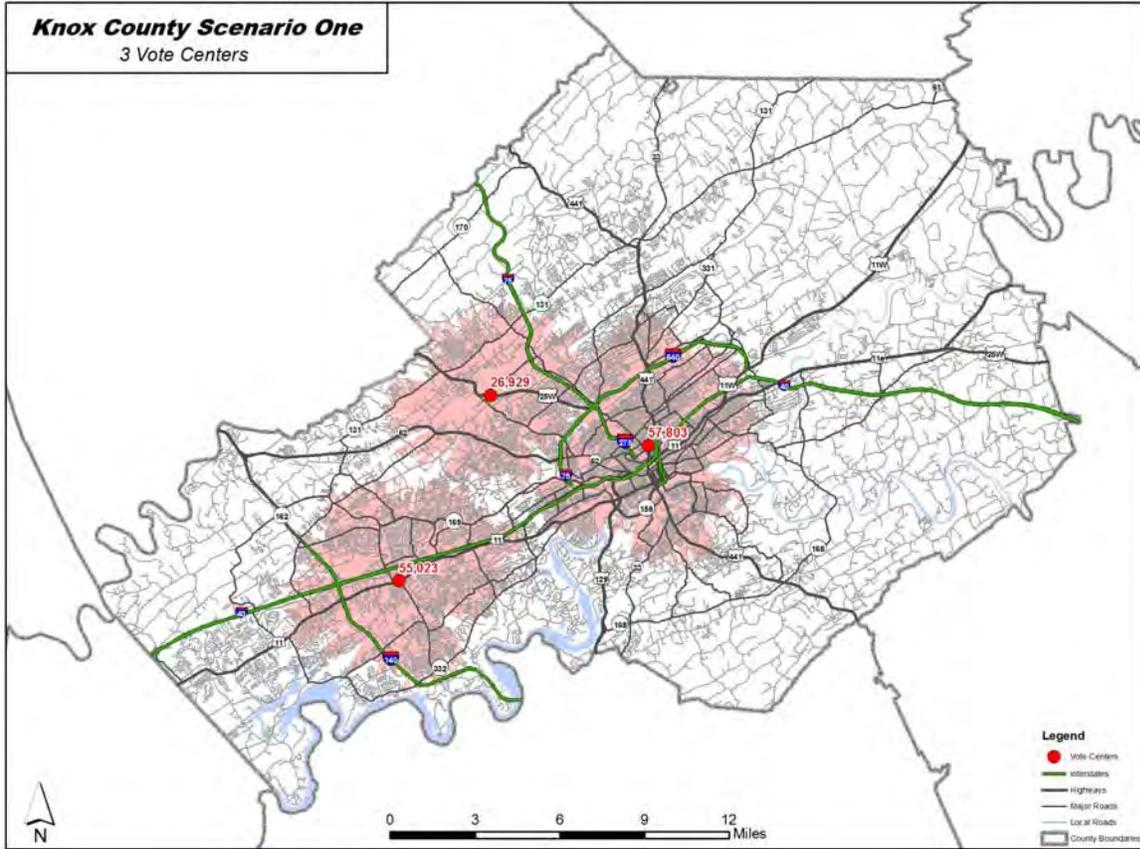
Knox County Scenario One
4 Vote Centers

Legend
- Vote Centers
- Interstates
- Highways
- Major Roads
- Local Roads
- County Boundaries

N

0   3   6   9   12 Miles
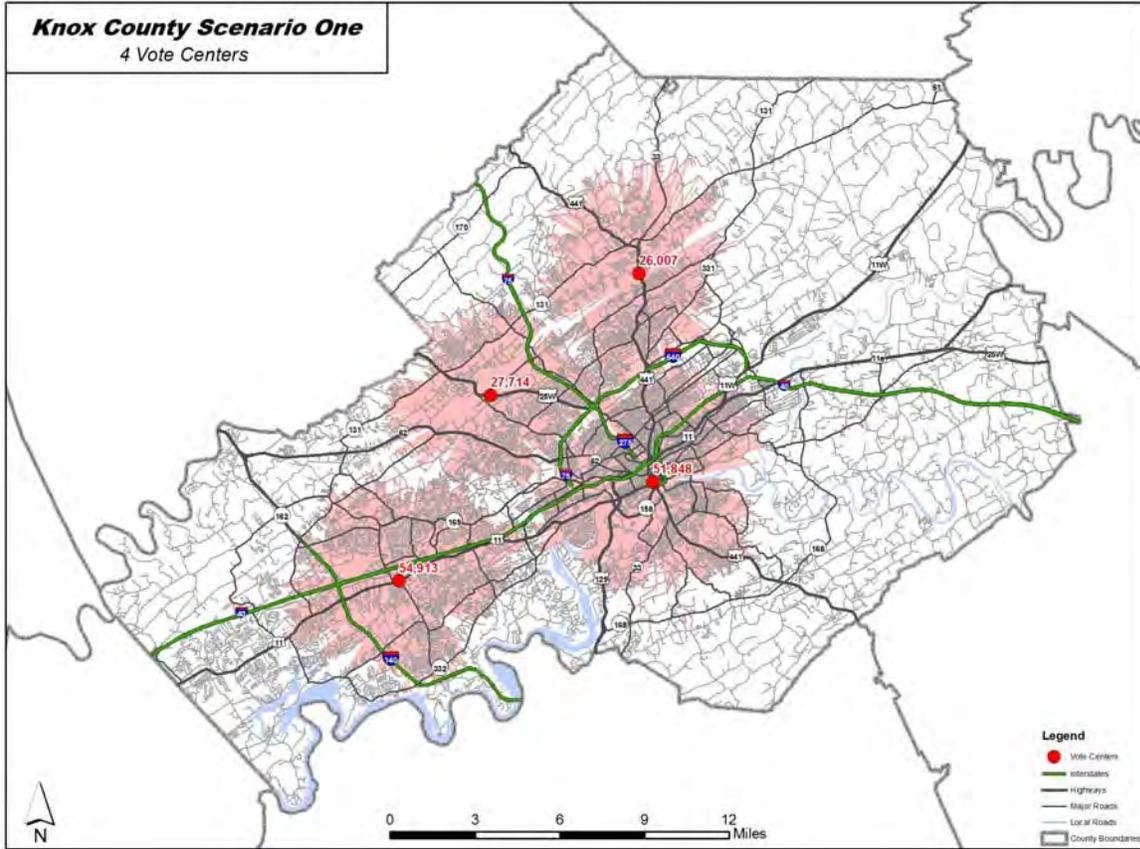
Knox County Scenario One
5 Vote Centers

Legend
● Vote Centers
━━ Interstates
━━ Highways
━━ Major Roads
━━ Local Roads
▱ County Boundaries

N

0   3   6   9   12
Miles
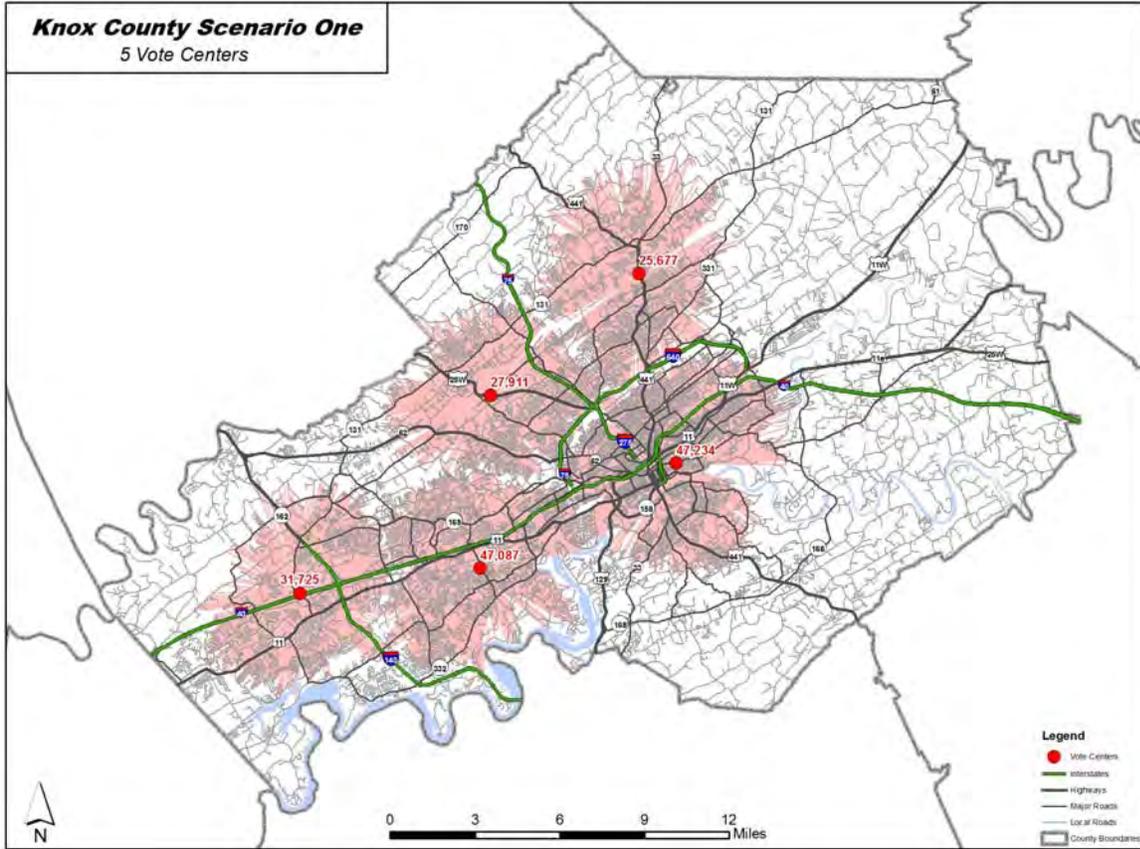
Knox County Scenario One
6 Vote Centers

Legend
● Vote Centers
— Interstates
— Highways
— Major Roads
— Local Roads
☐ County Boundaries

N

0   3   6   9   12
Miles
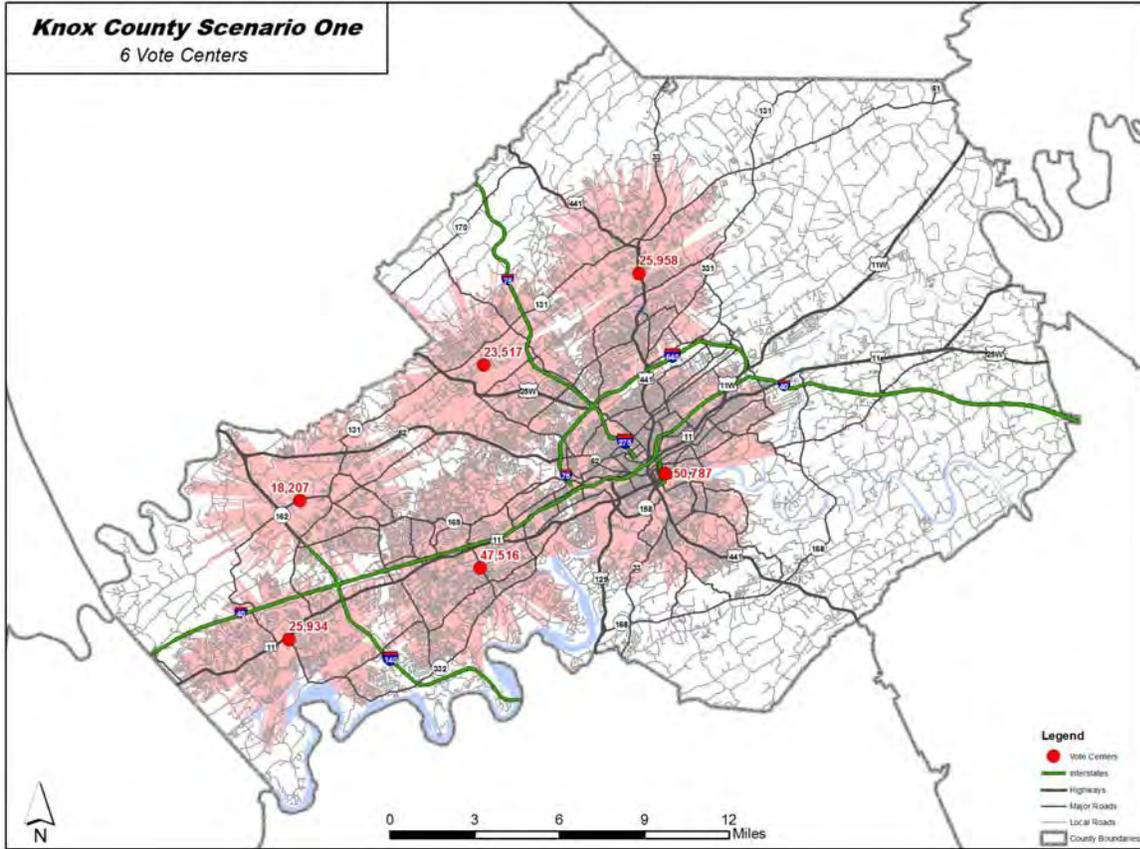
Knox County Scenario One
7 Vote Centers

25,958

23,128

50,832

18,060

43,507

21,875

13,508

Legend
- Vote Centers
- Interstates
- Highways
- Major Roads
- Local Roads
- County Boundaries

0   3   6   9   12
Miles

N
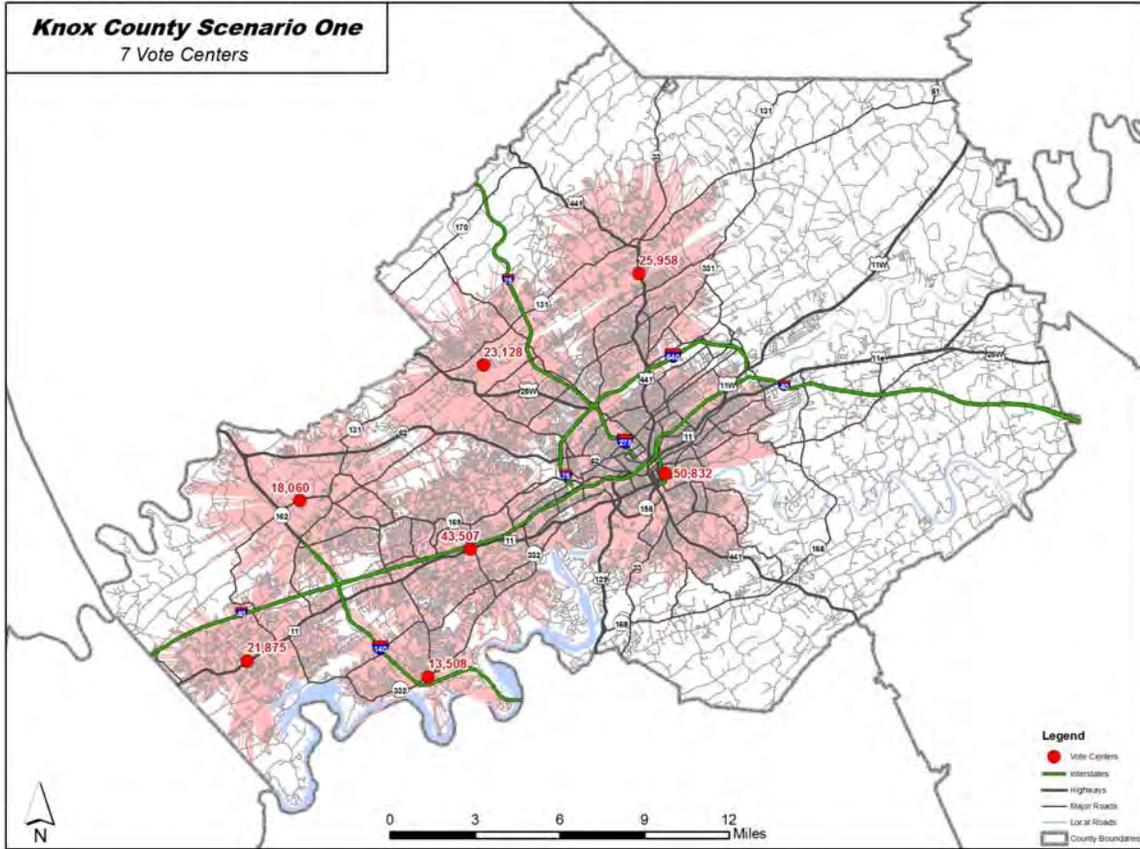
Knox County Scenario One
8 Vote Centers

18,972
24,566
29,107
22,412
31,995
31,298
28,289
20,535

Legend
● Vote Centers
— Interstates
— Highways
— Major Roads
— Local Roads
□ County Boundaries

N

0   3   6   9   12
Miles
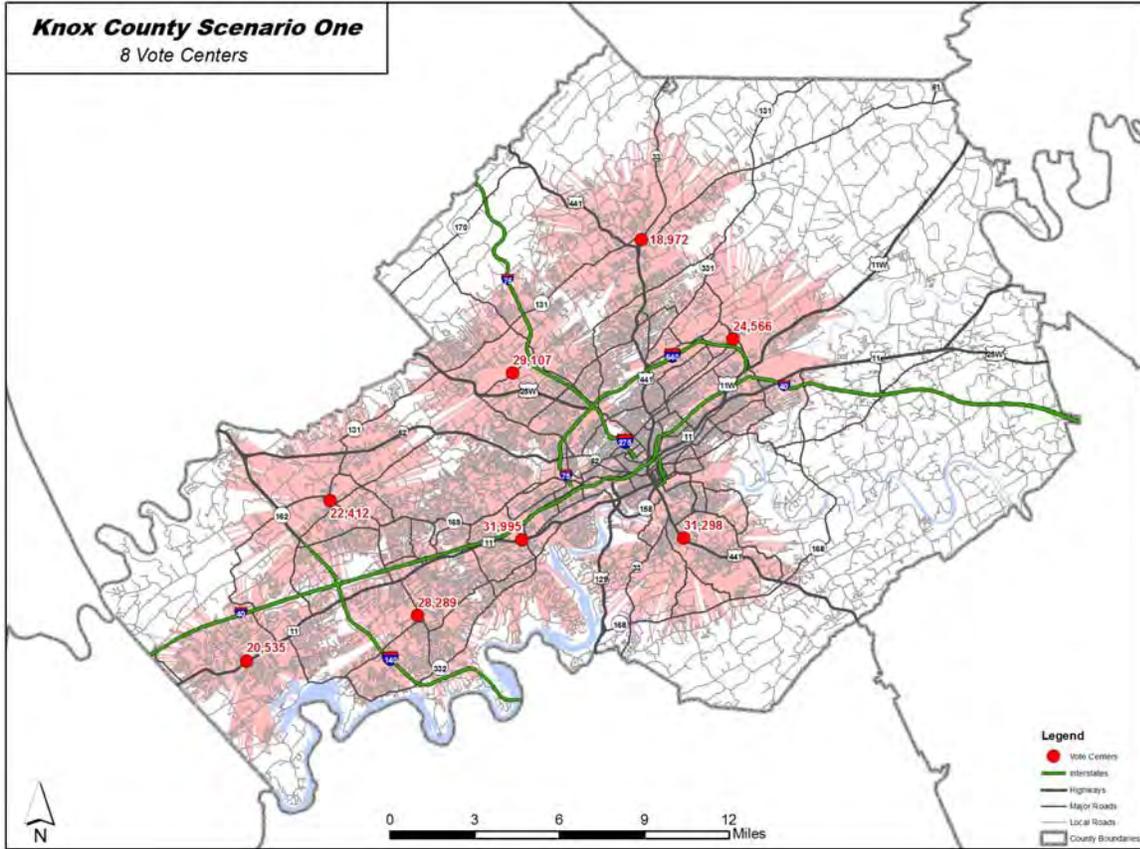
Knox County Scenario One
9 Vote Centers
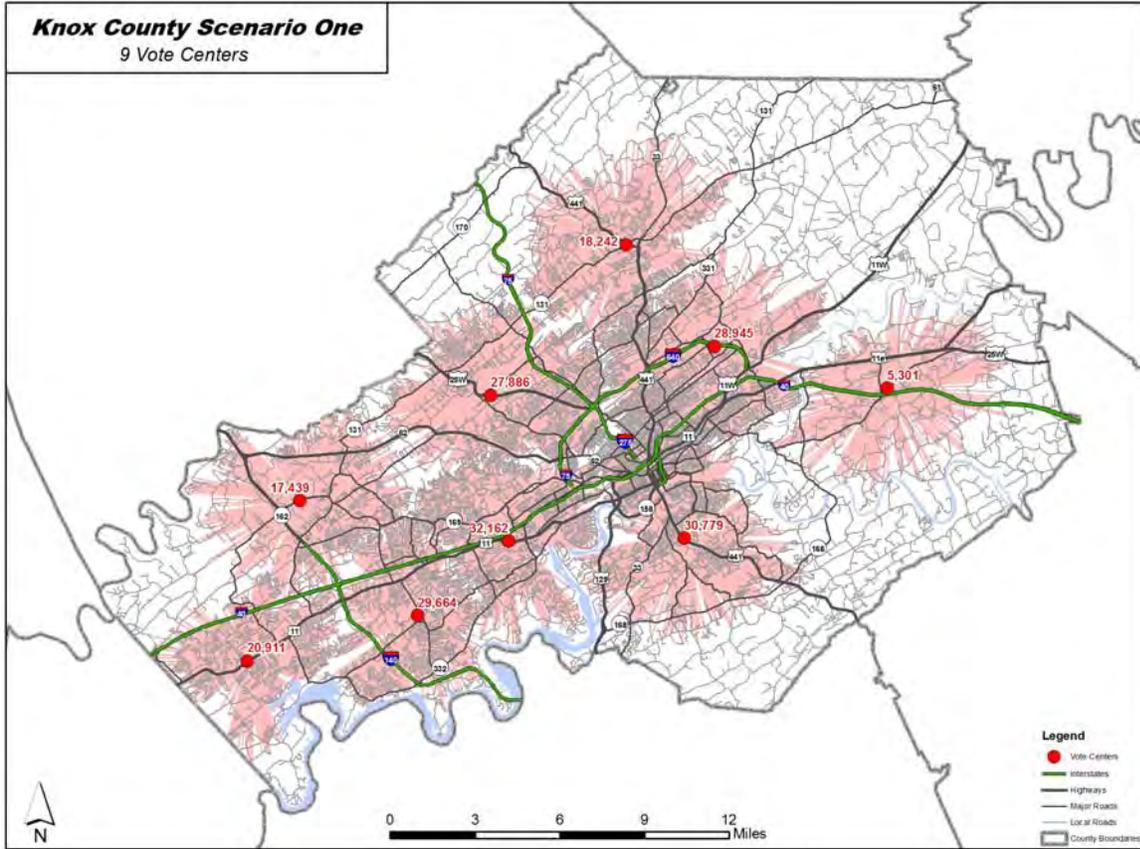
Knox County Scenario One
*10 Vote Centers*
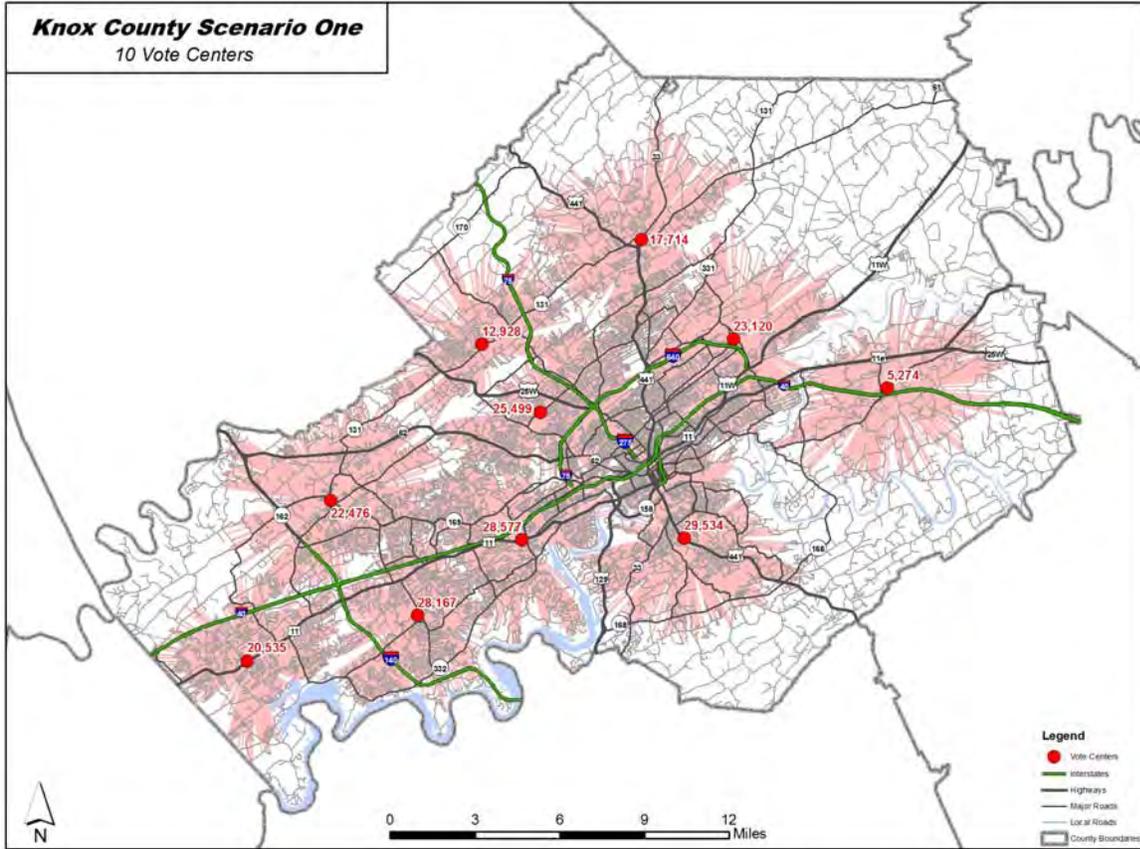
Knox County Scenario One
11 Vote Centers

Legend
- Vote Centers
- Interstates
- Highways
- Major Roads
- Local Roads
- County Boundaries

160
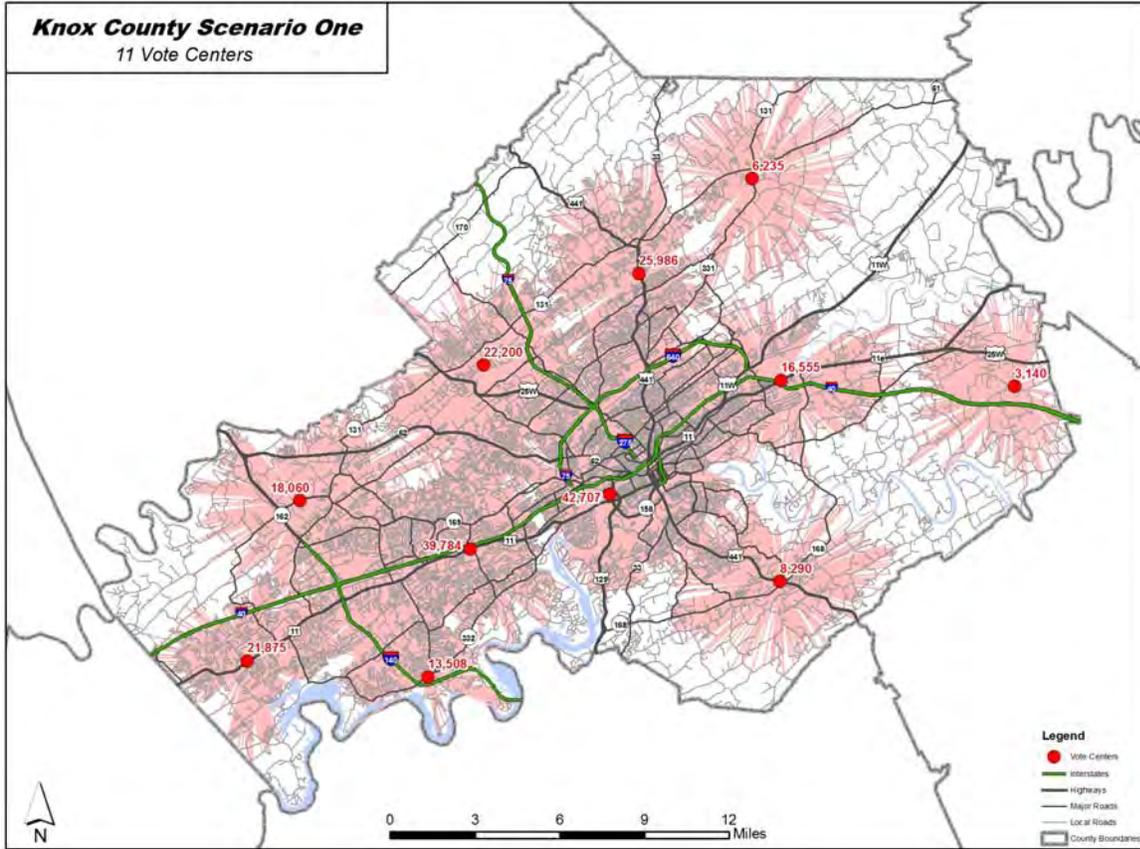
Knox County Scenario One
12 Vote Centers

6,235
21,718
25,539
17,316
3,140
14,674
12,942
31,102
30,863
5,050
31,476
20,209

Legend
Vote Centers
Interstates
Highways
Major Roads
Local Roads
County Boundaries

0   3   6   9   12
Miles

N
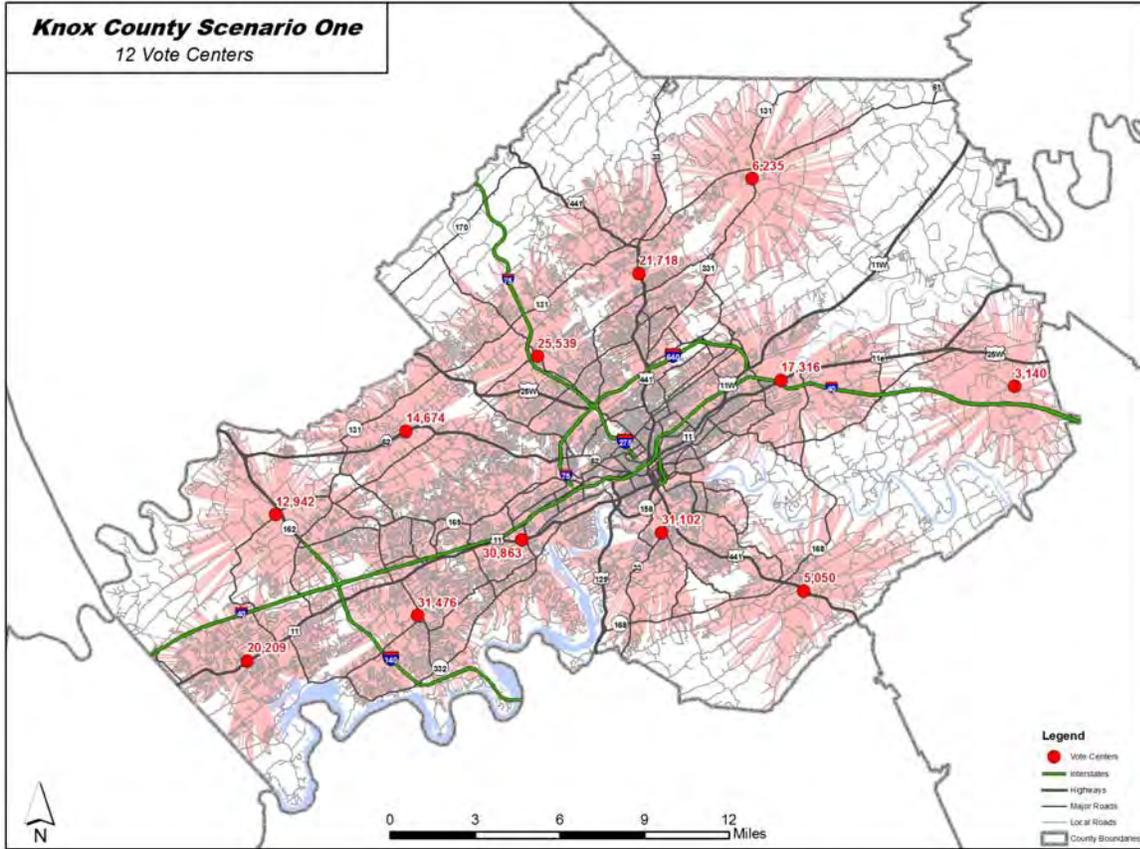
Knox County Scenario One
13 Vote Centers

Legend
- Vote Centers
- Interstates
- Highways
- Major Roads
- Local Roads
- County Boundaries
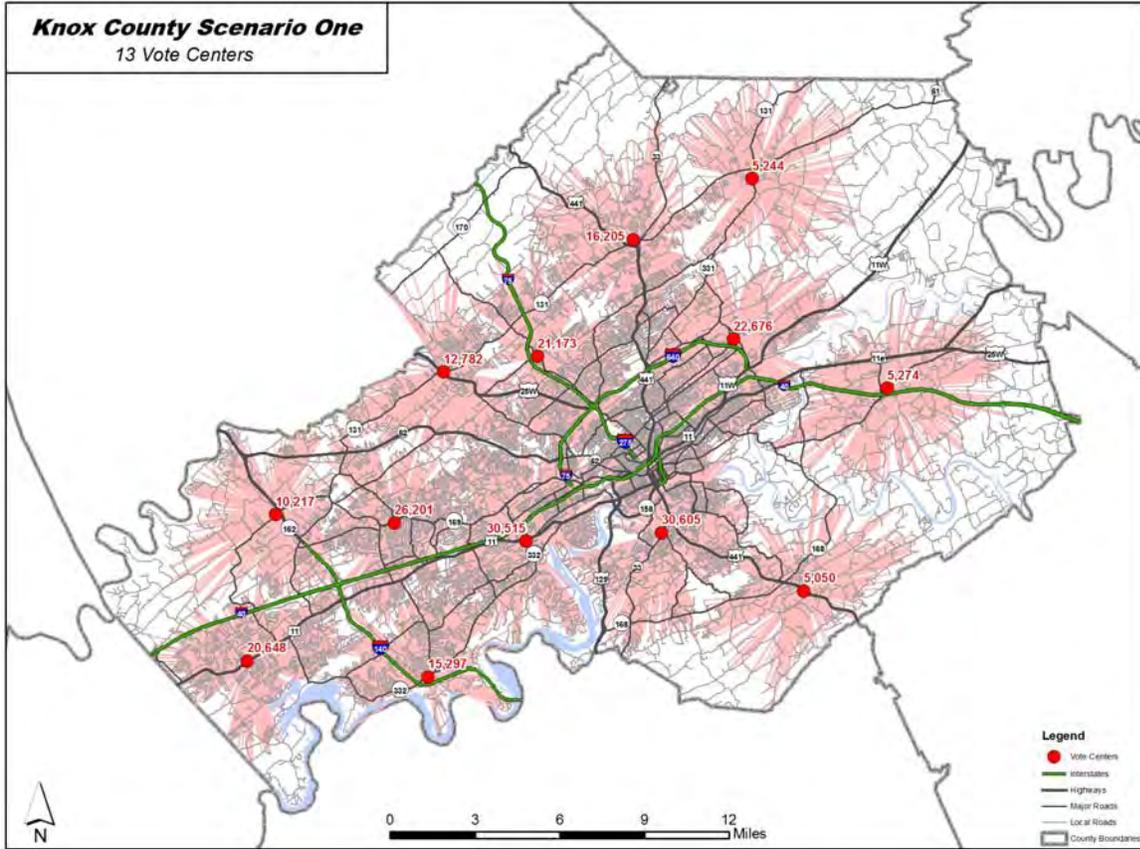
Knox County Scenario One
14 Vote Centers

Legend
● Vote Centers
— Interstates
— Highways
— Major Roads
— Local Roads
☐ County Boundaries

16,900
8,182
3,771
3,145
19,987
12,782
3,891
10,217
26,201
30,537
12,335
20,648
15,297

0 3 6 9 12
Miles

N
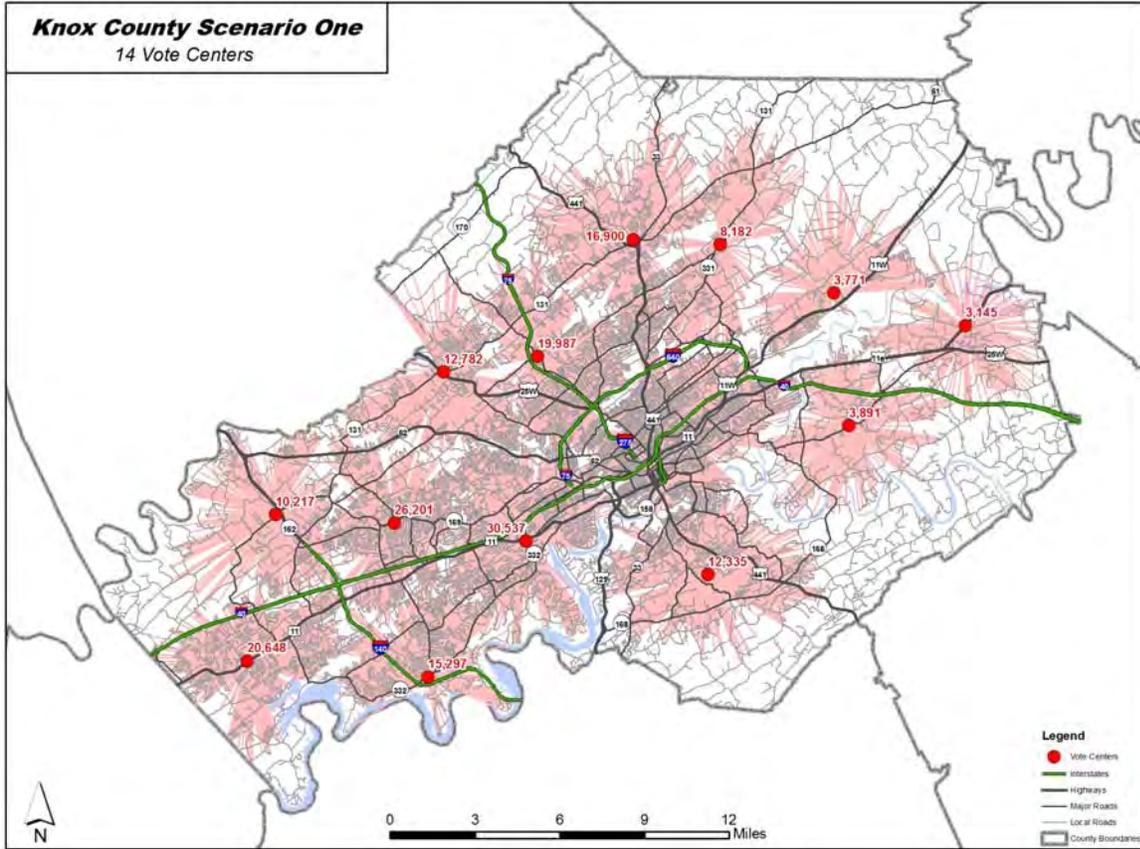
Knox County Scenario One
15 Vote Centers
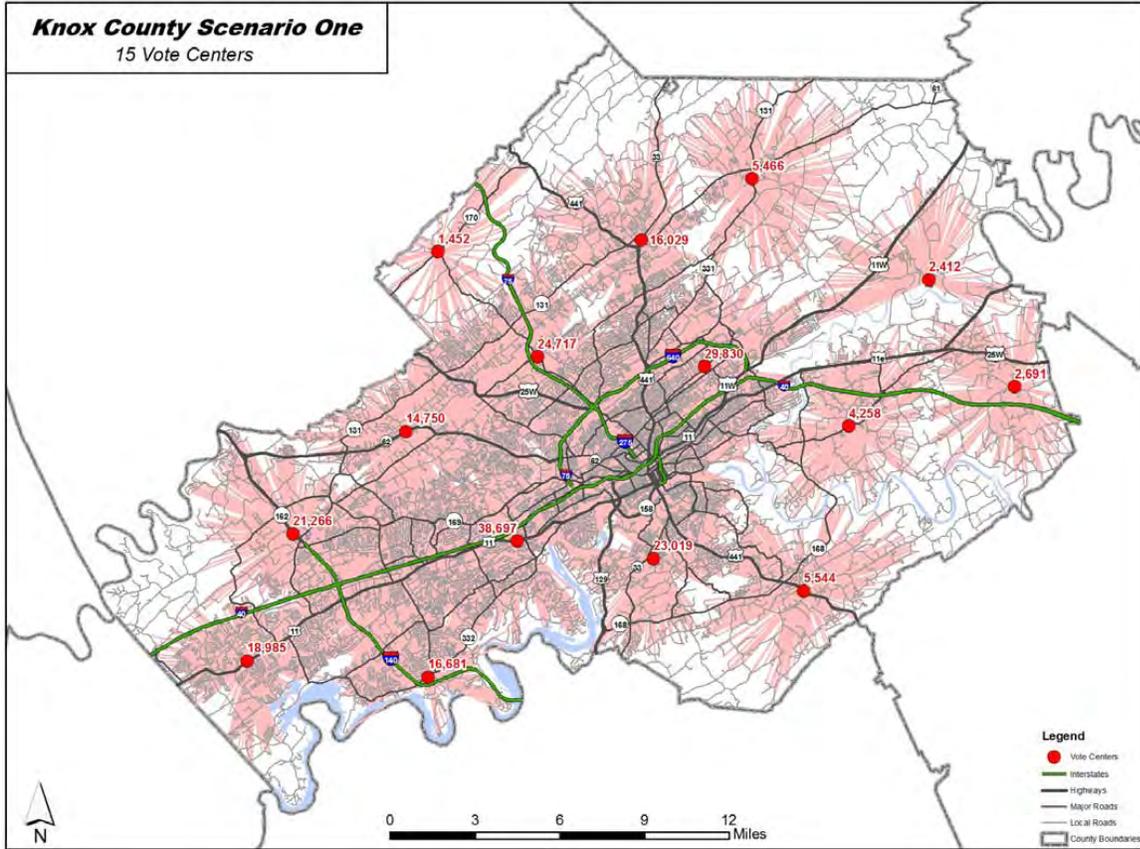
APPENDIX F: BUDGET SECTION – GRANT PROPOSAL

Make Voting Work
Pew Center on the States

The proposed budget for the implementation of convenience voting in Knox County, Tennessee grant reflects three elements of cost associated with the vote center model. The first is non-reimbursable implementation cost for the actual vote centers for three Knox County elections:

Farragut municipal election April 7   **One Vote Center**
Knoxville municipal election September 22   **Six Vote Centers**
Knox County general election November 3   **Seventeen Vote Centers**

Non-reimbursable cost include notification and advertising cost to inform registered voters of the new voting system, (e.g., newspaper advertisements, banners and signage at the sites), security costs, and supplies cost associated with the 17 vote centers proposed in the cost and coverage model. For the municipal elections, the sites were derived using the same model but limited to the municipal boundaries.

Estimates of the cost were derived from the full cost allocation model associated with a single early voting site and multiplied by the number of convenience voting sites (for example, Knox County has 17 sites). The category "postage" was added so that each registered voter (257,150) would receive a letter from the Knox County Election Commission describing the location of each convenience voting center and describing how the convenience voting model works. Another letter would be sent to the registered voters in the two municipal elections with the same content. Farragut has 15,016 registered voters and the City of Knoxville has 93,869 registered voters.

The second portion of the budget presents the cost of gathering actual cost data from each of the 24 convenience voting centers and analyzing them to produce a full cost model of convenience voting. In previous reports, the cost estimation methodology has been predicated on the similarity between existing early voting centers and convenience voting centers.

At the conclusion of these elections the analysis should produce two products. The first is a model that any county could use to enter in its demographic information and other variables and predict with some precision how much the convenience voting system would cost to implement. The second is a report about how convenience voting cost are incurred and distributed, with recommendations about the most efficient way to implement the convenience voting system in order to control elections costs. The budgeted cost of the second portion is incurred with consulting services of a qualified accountant to prepare for data collection, data analysis and modeling and report preparation

The third portion of the budget is the most critical, because it offers a comprehensive review of the implementation of the convenience voting system. The report produced by the review team, combined with the cost report, would effectively enumerate the costs and benefits associated with implementing the convenience voting system and identify obstacles and opportunities that other counties need to consider as they deliberate implementation of the system. Members of the review team include scholars of elections and voting behavior drawn from the University of Tennessee, Knox County Election Commission staff, and members of the Knox County Metropolitan Planning Commission. Costs for the review team include consulting costs for members, clerical and administrative support, and production staff for the final report.

Proposed Budget

Part One - Non-reimbursable Implementation Costs

Countywide Shared Cost

Produce public service announcement	$8,000

Farragut Municipal Election

Design and printing of announcement letters	$2,000
Letters to registered voters	$8,709
Newspaper advertisement	$3,000
Banners and signage	$1,700
Additional training for pollworkers	$600
Redirection workers	$400
Security	$700
Supplies	$150

Knoxville Municipal Election

Design and printing of announcement letters	$2,000
Letters to registered voters	$54,444
Newspaper advertisement	$6,500
Banners and signage	$3,400
Additional training for pollworkers	$3,6000
Redirection workers	$4,500
Security	$4,200
Supplies	$900

Knox County General Election

Design and printing of announcement letters	$2,000
Letters to registered voters	$149,147
Newspaper advertisement	$10,000
Banners and signage	$6,800
Additional training for pollworkers	$10,200
Security	$11,900
Supplies	$2,550

Part Two - Cost Model Preparation and Analysis

Consulting Services	$20,000
Administrative Support	$9,000

Part Three - Comprehensive System wide Review

Review Team Compensation	UT $40,000
Review Team Compensation	KCMPC $10,000
Administrative Support	$9,000