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PRELIMINARY VOTING MACHINE ALLOCATION REPORT RELEASED; IMPORTANCE OF ABSENTEE VOTING STRESSED

July 30, 2008 (Columbus, Ohio): The Franklin County Board of Elections today announced the release of a preliminary report containing voting machine allocation recommendations for the November 4, 2008 General Election. A public hearing is scheduled for Thursday, August 14 at 6:30 p.m. to accept public comment on the draft proposal.

"We're trying to reduce the possibility of long lines that could result this fall from record turnout and a long ballot that will take time for voters to complete," said Dennis L. White, Director of the Franklin County Board of Elections. "Voting machine allocation is just one part of our strategy for mitigating waiting times."

Ted Allen, associate professor of industrial and systems engineering at The Ohio State University and project manager for the Board's consultant, Sagata, Ltd., studied election data from 2004, 2006, and 2008 to produce preliminary recommendations to the Board. "We've documented the time it actually takes to vote a mock 2008 General Election ballot and the frequency with which voters have arrived at the polls in the past to determine voter servicing times and to predict possible waiting times."

Both Director White and Dr. Allen stressed, however, that while the projections are

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BOARD OF ELECTIONS

based upon simulations and defensible formulas, voting and waiting times could be longer or shorter than estimated. "More than anything, this report underscores the critical importance for Franklin County to vote early by mail using an absentee ballot," said Director White. "The only way to guarantee you won't have to wait in line is to vote early by mail."

Deputy Director Matthew Damschroder noted that the Board has changed several of its Election Day procedures to streamline Election Day voting to reduce waiting times. "Voters now sign-in by the first letter of their last name instead of having to remember their precinct name or figuring out in which precinct's line to stand." The new procedure was implemented in March to positive reviews from voters and poll workers alike.

In addition to making the check-in process more efficient, Director White said that a voter will be able to use any machine in the voting location. Before this year, a voter had to wait to use a voting machine assigned to the voter's precinct while machines assigned to another precinct in the same location may have sat idle. The Board is also seeking supplemental funding from the County Commissioners to rent additional voting machines, in the event that rental units are available.

The Columbus-based consulting team included the team from Sagata, Ltd, Dr. Ted Allen and Dr. Mikhail Bernshteyn, and Chris Rockwell of Lextant, a local research and user-experience firm.

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HELPING FRANKLIN COUNTY VOTE IN 2008: WAITING LINES

REPORT TO THE FRANKLIN COUNTY BOARD OF ELECTIONS

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INTRODUCTION

Many challenges are faced by our voting systems going into the November 2008 election. It is easy to sound alarmist. Challenges include: poll worker recruitment and training, voter suppression efforts, and substandard protections against computer security attacks cited by Balzarotti, Banks, Cova, Felmetsger, R. Kemmerer, Robertson, Valeur, and Vigna (2008).

Waiting lines on Election Day are a problem only some of the time. In 2004, at poll closing times lines were documented to last longer than five hours (Allen and Bernshteyn, 2006). In the lead up to the 2006 primary election day, lines longer than six hours were observed at the Board of Elections itself. Yet, in 2000 and 2006, lines were not considered to be important.

Moreover, even during elections with serious waiting issues, a recent report predicted that the vast majority of voters experienced waits of fewer than five minutes (Samuelson, Allen, and Bernshteyn, 2007). From examination of those simulations, we estimate that the total human hours wasted in the 2004 election in Franklin County were on the order of 40,000 person hours, which might be considered acceptable.

At the same time, Mebane and Herron (2005) estimated that African Americans who did vote in Franklin County in 2004 waited on average over thirty minutes longer than others. Allen and Bernshteyn (2006) further estimated that between 20,000 and 30,000 people were deterred from voting by lines costing the Democratic candidate John Kerry approximately 7,000 votes. Therefore, it seems likely that the primary harmful effects of waiting lines (if any) come through depriving voters the "equal access to voting" guaranteed by the Voting Rights act and the Help America Vote Act (HAVA).

Some have argued that unequal access to voting is inevitable given the way that machines are assigned by state law

(Samuelson, Allen, and Bernshteyn 2007). This occurs because the law generally (while vague) does not account for the variable ballot lengths across precincts in determining how machines are assigned. This could be a major issue in November of this year because Columbus (+6 issues) and, to a lesser extent, Gahanna (+1 issue) have longer ballots than other precincts. This issue provides much of the motivation for this report. One of its goals is to offer a simple way to correct for this and to permit outcomes in the spirit of HAVA.

Will there be lines in November? The answer relates to the balancing of positive and negative developments. The positive ones are obvious. Since 2004, the number of easily available direct recording equipment (DRE) machines has increased from approximately 2,800 to approximately 4,565. Also, the percentage of registered voters who voted prior to Election Day in 2006 was approximately 24%. If this trend continues, turnout on Election Day might represent only 63% of the votes cast.

On the other hand, the number of registered voters has increased. In 2004, Columbus voters faced ballots requiring choices on eleven issues in addition to the political races. Those voters used Danaher 1242 "open-faced" machines. In November 2008, the same voters will face fifteen issues and use screen-by-screen ES&S DREs. Here, we offer evidence that the average times needed to vote or be served by the new DREs will be more than twice the previous times.

How exactly do these balance? There is significant uncertainty mainly in the Election Day turnout. Yet, as we will explain, our unprecedented access to quality data and high fidelity statistical simulations offer cautions for policy makers. There is also unavoidable logic. If doing a task like voting requires double the time per DRE, then double the resources (DREs) are needed to accomplish this task in the same overall time.

EXECUTIVE SUMMARY

Long waiting lines in Franklin, Ohio in November 2008 are a serious likelihood. If the recommendations of this report are not followed, these waiting lines will likely cause a significantly higher loss of person hours waiting in line than in 2004. Moreover, these waiting lines will likely be selective, discriminating against African Americans and others who live in Columbus, Ohio precincts.

THEORY YOU SHOULD KNOW

In general, voting machines allocations across the country by lawmakers are made on a number of machines per registered voter basis. Yet, textbooks on queuing theory teach us that lines depend on both:

- Arrival rates (voters per hour) – In election systems this is proportional to the turnout fraction and, therefore, the number of registered voters assigned to the location times the turnout ratio.
- **Service rates** (voters per hour) – In election systems this relates to how much time voting requires while the voter is monopolizing the DRE depending on the length of the ballot (relatively long and variable in Ohio) and nature of the equipment (relatively slow in Franklin).

The dependence on service rates must be addressed to avoid lines and discrimination.

Another fact is the “explosive” nature of queuing. For example, adding a single issue to a ballot in a certain location can cause the system to go from having minimal waits to long lines. Therefore, it is only possible to guarantee the same wait by assuring that all locations should have minimal waits, which is likely with only 34% more DREs.

WHY LONG LINES ARE LIKELY

Long lines are likely in November simply because of the dramatic increase in the

service times and the corresponding reductions in the service rates. This is occurring because of the increases in the number of issues being voting on (compared with 2004) and the slower nature of the ES&S equipment required by navigation.

Average service times at Columbus precincts greater than 9.7 minutes are predicted both through extrapolations from actual 2006 voting time data and from our mock election, i.e., running 60 voters through ES&S machines and ballots with similar numbers of issues to those in November. Based on a 50% Election Day turnout, our simulations predict 37 locations will likely experience average waits longer than 3 hours.

PRETTY GOOD ALLOCATION

In performing this study, our team invented a simple rule for selecting how many machines are needed overall and how many should be used at specific locations (with minor adjustment). The rule is only marginally more complicated than the 175 per registered rule:

Number of machines =

$$\text{roundup} \left\{ \frac{(\text{avg. voting time mins.})(\#\text{registered})(\text{turnout})}{(0.85)(13 \text{ hr})(60 \text{ mins./hr.})} \right\}$$

where the factor 0.85 is a default value that should be adjusted based on requirements and simulation results for specific settings.

LESSONS FOR THE NATION

Considering the lines in 2004 and the expected lines in 2008, one might reasonably suggest that Franklin County should not be making recommendations to the nation. Yet, if this report’s recommendations are followed, Franklin has the opportunity to lead the country by employing allocation based on service times. Also, operations researchers around the world will agree that significantly worse lines will have been avoided.

KEY FINDINGS

This report includes voting time data from the 2006 November election, the 2008 primary, a mock election involving 60 carefully selected citizens, and results from our simulation models and formulas. These results permit our team to make many findings relevant to the November election.

THE PROBLEM IS REAL

We considered what we feel is the best way to allocate the currently available 4,565 direct recording equipment (DRE) machines. We evaluated these scenarios using possibly the highest fidelity simulations of elections ever and various scenarios about uncertainty.

The largest uncertainty we face is the turnout on Election Day. Franklin County has approximately 798,500 registered voters. We consider ED turnout scenarios ranging from 41% to 55%. These could occur if the number of cast was the same as in 2004 (approximately 67% of those registered now) with between 24% and 37.5% of voters using absentee ballots. The 37.5% number might be reasonable given the experiences of other states offering no fault absentee voting and promises by Barack Obama to encourage it.

We also consider average service times (times each voter takes to monopolize the DRE and cast his or her ballot) to range between 6.6 minutes and 9.7 minutes.

With these assumptions, we predict numerous locations where the average voter waits longer than 60 minutes. The numbers of these locations (out of 543) range between 137 and 229. We also predicted last poll closing times. In our simulations, the expected last poll closing times range from 4.1 hours to 7.5 hours. In other words, the expected line lengths likely will be considerably longer than in 2004. Also, if Election Day turnout exceeds 50% and/or the number of state issues exceeds five, the

aforementioned calculations will be lower than the likely waits that will occur.

NEW MACHINES CAN HELP

We also studied what we feel is the best way to add 200 machines that might be rented for the election. In this scenario, the extra 200 machines reduced the number of locations with average times longer than 60 minutes from 81 to 40 and the expected last poll closing time from 4.1 hours to 3.4 hours.

INCREASING ABSENTEE VOTING IS KEY

We feel that Franklin County needs to make dramatic changes in order to avoid significant waiting times and negative voter experiences. Several actions are possible.

These include efforts to encourage voters to use their no fault absentee option, which could drive the ED turnout down significantly. Also, efforts to prepare voters by supplying them with information about issues in line or otherwise could drive down service times.

ONE-PAGE-PER-ITEM IS NOT JUSTIFIED

Our mock election provided highly trustworthy data as checked using 2006 actual voting times as a reference. The mock election data suggests that putting each issue and office on its own screen adds an average 1.24 minutes to the service times (times each voter needs to monopolize the DRE and cast his or her ballot).

The one-page-per-item approach does this while having no significant effect on the voter's comprehension score (one measure of voter quality). We suggest that implementing this change in our contest would likely take a problematic waiting line situation and make it significantly worse.

PRETTY GOOD ALLOCATION IS VIABLE

We invented a simple and computationally efficient way to apportion machines that accounts for variable ballot lengths across precincts. The proposed approach offers a reasonable and logical way to distribute voting machines based on the number of ballot issues. This can avoid discrimination against those who live in places with long ballots who might share demographic characteristics. The method needs to be tuned for each application with different numbers of locations, numbers of registered voters, and/or ballot lengths. It yields similar allocations and apportionment to much more computationally intensive allocations based on detailed simulations of each location with different numbers of machines.

Also, the resulting formula offers policy makers intuition. If one issue is added, one batch of new machines is needed. If two issues are added, two batches of new

machines are needed equal in size. The formula can also be implemented with minimal training using a standard spreadsheet to generate feasible allocations. These can then be evaluated using high fidelity simulation to check that expected waits fall into an acceptable range.

ONE HALF MINUTE PER ISSUE IS RULE

Our mock election also permitted detailed investigation of the times required by voters to process specific numbers of issues and ballot language. From this study of 60 carefully selected voters (balancing race, education level, and voter experience level) we developed the approximate rule that each issue typically requires 0.5 minutes. This approximate rule is specific to the ES&S DREs used in Franklin County but might help other political systems think about the waiting time implications of their initiatives.

