

**Many Voters May Have to Wait
30 Minutes or Longer
to Vote on a DRE during Peak Voting Hours**

**A Report by the
Task Force on Election Integrity, Community Church of New York
Teresa Hommel, Chairwoman
January 3, 2007**

The New York State Board of Elections will soon establish the maximum number of registered voters to be assigned to vote on each new voting system that may be certified by New York.

In preparation for this task, the State Board commissioned a study, known as the AIR Study, to measure how long it takes for voters to vote on the different DRE and optical scan systems that have been submitted to New York State for certification.[1] The AIR Study resulted in a measurement of approximately four minutes per voter to vote on Avante and Sequoia DREs.

The AIR Study also calculated the “MDR” or Maximum Daily Rate for each voting machine in the study. The MDR represents the maximum number of voters who can vote on a machine in 15 hours, the length of New York’s election day, assuming that voters arrive in a steady continuous flow. This calculation was done for each machine by dividing 15 hours by the time required for a voter to vote on that machine. The MDRs for Avante and Sequoia DREs were:

Avante 218–247 voters
Sequoia 207–243 voters

The lower MDR results from use of the mean (or average) voter time, and the higher MDR results from use of the median (or “middle time,” such that half of test voters took less time and half took more time to vote on that machine).

One prominent criticism of the AIR Study is that, in calculating the MDR, it did not consider the effect of peak and slow voting hours or the creation of long waiting times for voters. New Yorkers for Verified Voting addressed this problem by using queuing theory to predict the length of the longest wait time and how frequently it would occur.[2]

The Task Force on Election Integrity of Community Church of New York wanted to know how long each voter would have to wait to vote on a DRE during two consecutive peak hours on election day. We assumed that there are 5 peak hours per election day (morning before work, lunchtime, and evening after work). We further assumed that 50% or 60% of all voters who vote at their pollsite would vote during peak time. We created a spreadsheet to correlate three factors:

- number of registered voters assigned per DRE, with an assumed 50% pollsite turnout
- percentage of pollsite voters who arrive to vote during peak hours, either 50% or 60%
- wait time per voter.

We discovered that, depending on the number of voters assigned per DRE and the peak hour pollsite turnout, many voters would have to wait thirty minutes or longer. For example:

| registered voters/DRE | pollsite voters/DRE | average wait in mins | longest wait in mins | percent of voters who will wait 30 or more minutes |
|-----------------------|---------------------|----------------------|----------------------|----------------------------------------------------|
| 300 | 150 | 0 - 12 | 0 - 23 | 0% |
| 350 | 175 | 12 - 23 | 23 - 47 | 0 - 36% |
| 400 | 200 | 20 - 35 | 39 - 71 | 25 - 58% |
| 450 | 225 | 31 - 47 | 63 - 94 | 52 - 69% |
| 500 | 250 | 39 - 59 | 78 - 118 | 62 - 75% |
| 550 | 275 | 51 - 71 | 102 - 142 | 70 - 79% |

We believe that wait times of thirty minutes or longer are excessive. Long wait times can disenfranchise a significant number of would-be voters who cannot wait due to the pressures of jobs, babysitters, health, and other concerns.

Peak hours and maximum acceptable voter wait time need to be considered

We urge the State Board of Elections to discuss and establish a policy on maximum acceptable voter wait time before setting the maximum number of voters to be assigned per DRE.

A policy on voter wait time should provide a method for both estimating and measuring voter wait time, and establishment of the maximum wait time that is to be considered acceptable for the average voter and for any voter under reasonably foreseeable conditions. In addition, we urge the State Board to establish procedures for complaints, remedies for voters when their wait time is unacceptably long, and remedies for candidates when they believe that the outcome of elections may have been affected by loss of votes from would-be voters who left their pollsite without voting due to unacceptably long wait time.

Methodology -- The concept of one waiting line

To determine the wait time for each voter, we used the idea of a single waiting line in front of the DREs at a pollsite. After a voter has checked in with poll workers and has received permission to vote (and a Voter Access Card if that is needed), the voter then joins the end of the waiting line. After the voter reaches the front of the line, he/she continues to wait until the next available DRE becomes available. At that time the voter leaves the front of the line and proceeds to the available DRE to begin voting.

We measured the wait time as follows.

- beginning when the voter joins the end of the line, and
- ending when the voter leaves the front of line to proceed to the next available DRE.

We found that when voters join the end of the line more frequently than they leave the front of the line, both the line and wait time grow progressively longer.

Methodology -- Assumptions

We used the following assumptions:

1. The election day is 15 hours.
2. There are 5 peak hours during the election day.
3. A percentage of pollsite voters will arrive during peak hours. We used two assumptions:
 - 50%
 - 60%
4. During peak hours voters will arrive in a steady, continuous stream at regular intervals.
5. Voter check-in with poll workers will not be a bottle-neck preventing voters from getting in the line to wait for the next available DRE.
6. The peak time period of two hour duration that we examine will start with no voters waiting in line to vote.
7. No equipment failures will occur.

Methodology – Rows at the top of the Spreadsheet

Our spreadsheet starts with the following rows (the right end of these rows is not illustrated here due to the width limitations of this page). The row labels are in the first column.

| | | | | | | | | | | | | |
|-----------------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| registered voters/DRE | 300 | 300 | 350 | 350 | 400 | 400 | 450 | 450 | 500 | 500 | 550 | 550 |
| pollsite voters/DRE | | | | | | | | | | | | |
| 50%turnout | 150 | 150 | 175 | 175 | 200 | 200 | 225 | 225 | 250 | 250 | 275 | 275 |
| peak time voters: % | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 |
| number | 75 | 90 | 88 | 105 | 100 | 120 | 113 | 135 | 125 | 150 | 138 | 165 |
| voters per peak hour | 15 | 18 | 18 | 21 | 20 | 24 | 23 | 27 | 25 | 30 | 28 | 33 |
| voters in 2 peak hrs | 30 | 36 | 36 | 42 | 40 | 48 | 46 | 54 | 50 | 60 | 56 | 66 |
| how often a voter joins end of line (in minutes) | 4.00 | 3.33 | 3.33 | 2.86 | 3.00 | 2.50 | 2.61 | 2.22 | 2.40 | 2.00 | 2.14 | 1.82 |
| how often a voter leaves front of line (in minutes) | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

Table 1

1. registered voters/DRE is the number of registered voters assigned to each DRE. We used nine different assumptions: 300, 350, 400, 450, 500, 550, 600, 650, and 700. Each of these numbers is displayed twice in a wide column because this wide column will be divided into two narrow columns, one each to display the wait times for 50% and for 60% peak hour turnout.

| | | |
|-----------------------|-----|-----|
| registered voters/DRE | 300 | 300 |
| pollsite voters/DRE | | |
| 50%turnout | 150 | 150 |
| peak time voters: % | 50 | 60 |
| number | 75 | 90 |

This is the beginning of the first three rows. The numbers mean that if there are 300 registered voters assigned to each DRE, with 50% pollsite turnout there will be 150 pollsite voters per DRE.

Left narrow column:
if peak time voters are 50%,
then 50% of 150 is 75 voters
who will vote during peak time.

Right narrow column:
if peak time voters are 60%
then 60% of 150 is 90 voters
who will vote during peak time.

Table 2

2. pollsite voters/DRE, 50% turnout. This row displays the number of registered voters who will turn out to vote at their pollsite. For convenience in calculations we assumed that 50% of registered voters would vote at their pollsite. This is a conservative estimate because the actual pollsite turnout in New York City in November, 2004, was 53.42%, and some pollsites had higher turnout such as 60 to 70 percent.

3. peak time voters: %, number. We used two different assumptions for the percentage of pollsite voters who would vote during the 5 peak hours: 50% and 60%. We then calculated the number of voters for 50% and 60%. This is described above next to Table 2.

4. voters per peak hour is the number of voters arriving during one peak hour. To calculate this simply we assumed that the same number of voters would arrive during each of the 5 peak hours, and we divided the number of peak time voters by 5 hours.

5. voters in 2 peak hours is the number of voters arriving during two consecutive peak hours. To calculate this simply we multiplied the number of voters per peak hour by 2.

6. how often a voter joins end of line (in minutes) is the number of minutes between checked-in voters joining the end of the line where they will wait for the next available DRE. We called this number the “join interval” and calculated it simply by dividing 60 minutes per hour by the number of voters per peak hour.

7. how often a voter leaves front of line (in minutes) is the number of minutes between voters leaving the front of the waiting line to proceed to the next available DRE. We called this number the “leave interval” and used 4 minutes because the AIR Study found that voting on Sequoia and Avante DREs took approximately 4 minutes. Therefore we assumed that every 4 minutes one voter would finish voting and leave one DRE, which allows one person waiting in line to leave the front of the line and proceed to vote.

Methodology -- Calculation of wait time for each voter

We calculated wait time for each voter based on his/her arrival sequence. The voter who joins the line first during the two peak hours will not wait (we assumed that there was no waiting line at the beginning of the two peak hours). The voter who joins the line second will wait for the first voter to finish. The voter who joins the line third will wait for the first two voters to finish, etc.

Here are the terms we used:

- **this voter** -- sequence number of the voter for whom we are calculating wait time.
- **previous voters** -- number of voters who already joined the waiting line ahead of this voter during the two peak hours.
- **join interval** -- number of minutes between voters joining the end of the line.
- **leave interval** -- number of minutes between voters leaving the front of the line, which is always 4 minutes.

A. For each voter, we calculated the number of previous voters. For example, voter 5 has 4 previous voters. "Previous voters" is always one less than this voter's sequence number.

$$\text{previous voters} = \text{this voter's sequence number} - 1$$

B. Then we calculated the "join minute" when this voter would join the end of the line. We multiplied the number of previous voters by the join interval to determine the minute during the two peak hours when this voter would join the end of the line.

$$\text{join minute} = \text{previous voters} \times \text{join interval}$$

For example, if the two peak hours begin at 7 AM and 30 voters will vote during each peak hour, a voter will join the end of the line every two minutes:

Voter 1 joins line at 7:00 -- no previous voters in line
Voter 2 joins line at 7:02 -- number of previous voters is 1. join minute is 1 x 2 min, or 2.
Voter 3 joins line at 7:04 -- number of previous voters is 2. join minute is 2 x 2 min, or 4.
Voter 4 joins line at 7:06 -- number of previous voters is 3. join minute is 3 x 2 min, or 6.

C. Next, we calculated the "leave minute" when this voter would leave the front of the line. We multiplied the number of previous voters by the leave interval of 4 minutes to determine how long it would take previous voters to finish using the DREs.

$$\text{leave minute} = \text{previous voters} \times 4 \text{ minutes}$$

For example, if the two peak hours begin at 7 AM and 30 voters will vote during each peak hour:

Voter 1 joins line at 7:00, previous voters is 0, DRE is available at 7:00, voter leaves line at 7:00
Voter 2 joins line at 7:02, previous voters is 1, DRE is available at 7:04, voter leaves line at 7:04
Voter 3 joins line at 7:04, previous voters is 2, DRE is available at 7:08, voter leaves line at 7:08

Voter 4 joins line at 7:06, previous voters is 3, DRE is available at 7:12, voter leaves line at 7:12

D. Last, we calculated the wait time for this voter by subtracting his/her join minute from his/her leave minute.

$$\text{wait time} = \text{leave minute} - \text{join minute}$$

For example, if the two peak hours begin at 7 AM and 30 voters will vote during each peak hour:

| Voter number | join minute | leave minute | wait time in minutes |
|--------------|-------------|--------------|----------------------|
| Voter 1 | 7:00 | 7:00 | 0.00 |
| Voter 2 | 7:02 | 7:04 | 2.00 |
| Voter 3 | 7:04 | 7:08 | 4.00 |
| Voter 4 | 7:06 | 7:12 | 6.00 |

We found that a large number of voters would wait 30 minutes or more. We highlighted these wait times in **boldface**.

Conclusions

When voters join the end of the line more frequently than they leave the front of the line, both the line and wait time grow progressively longer. We found that when as few as 350 to 400 registered voters are assigned per DRE, the wait time during peak voting hours can become unreasonably long. For example:

- with 400 registered voters per DRE and 60% peak time turnout, average wait time is 35.25 minutes, the longest wait is 70.5 minutes, and 58% of peak time voters will wait 30 or more minutes.
- with 400 registered voters per DRE and 50% peak time turnout, average wait time is 19.5 minutes, the longest wait is 39 minutes, and 25% of peak time voters will wait 30 or more minutes.
- with 350 registered voters per DRE and 60% peak time turnout, average wait time is 23.43 minutes, the longest wait is 46.86 minutes, and 36% of peak time voters will wait 30 or more minutes.
- with 350 registered voters per DRE and 50% peak time turnout, average wait time is 11.67 minutes, the longest wait time is 23.33 minutes, and no peak time voters will wait 30 or more minutes.

Because elections can be decided by a small number of votes, it is important for all voters who come to a pollsite to be able to vote within a reasonable amount of time.

We urge The New York State Board of Elections to set the maximum number of registered voters to be assigned to vote on Sequoia and Avante DREs to a number not greater than 300 registered voters.

Limitations

1. Simple calculations. The calculations performed by this study were simple. We chose assumptions that were reasonable and conservative, and that allowed simplicity and the use of grade school arithmetic.
2. Rounding of fractions. The spreadsheet uses two decimal places in all calculations with fractions. For example, the join interval for 18 voters per peak hour is handled as 3.33 rather than 3.333333. Rounding of fractions causes some wait times to be a few hundredths higher or lower than they would have been if calculations had used more decimal places.
3. Liberty DRE. In the AIR Study the time to vote on Liberty DREs was shorter than the time to vote on Avante and Sequoia DREs. We speculate that this may have been due to the inability of test voters to verify a final paper printout of their voting choices, and the fact that in an unrevealed percentage of instances the test voters were not even instructed to look for the paper printout. Once difficulties with the Liberty DRE paper printout are eliminated, the time to vote and verify a final printout on Liberty DREs may well be consistent with the times recorded for Avante and Sequoia DREs.

Our results should be considered optimistic, however, because of the following.

4. Machine failure. We did not take machine failure into consideration. Because federal standards allow 9.2% failure rate during election day[3], the number of DREs available at any pollsite may be reduced. One simple way to compensate for machine failure would be to set a 9.2% lower limit for intolerable voter wait time, such as 27 or 28 rather than 30 minutes.
5. Elderly and non-computer-literate voters. The time required by elderly and non-computer-literate voters may not have been adequately tested in the AIR Study. This is due to relatively low participation of elderly test voters and the fact that computer literacy was not used as a demographic category. In real elections such voters may require longer vote times than those recorded by the study.
6. Voters with disabilities. The time required by voters with disabilities may not have been adequately measured by the AIR Study, nor has the future pollsite percentage of such voters been predicted. Our calculations of voter wait time did not include a factor for the extra vote time that may be needed by voters with disabilities.
7. Minority languages. The time required by voters with minority languages may not have been adequately tested in the AIR study due to low participation of such test voters and the lack of separate measurements of their vote times. This is a concern especially in New York City where the number of such voters is high. It is unknown whether such voters will require the same, shorter or longer times to vote than those recorded by the study.

ENDNOTES

1. “New York State Voter System User Rate Assessment Study. Research Report Draft” Dec. 11, 2006, by American Institutes for Research.
<http://www.elections.state.ny.us/NYSBOE/hava/DRAFTAIRSTUDY.pdf>
2. “New Voting Systems for NY--Long Lines and High Cost” by William A. Edelstein, Ph.D. November 14, 2006. <http://www.nyvv.org/voterlines.shtml>
3. “DRE Reliability: Failure by Design?” by Howard Stanislevic, Research Consultant, VoteTrustUSA E-Voter Education Project, March 13, 2006.
http://www.votetrustusa.org/pdfs/DRE_Reliability.pdf

Voter Wait-time to Vote on a DRE During Two Consecutive Peak Hours
Teresa Hommel, Jan. 3, 2007

| | | | | | | | | | | | | | | | | | | |
|-----------------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| registered voters/DRE | 300 | 300 | 350 | 350 | 400 | 400 | 450 | 450 | 500 | 500 | 550 | 550 | 600 | 600 | 650 | 650 | 700 | 700 |
| pollsite voters/DRE | | | | | | | | | | | | | | | | | | |
| 50%turnout | 150 | 150 | 175 | 175 | 200 | 200 | 225 | 225 | 250 | 250 | 275 | 275 | 300 | 300 | 325 | 325 | 350 | 350 |
| peak time voters: % | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 |
| number | 75 | 90 | 88 | 105 | 100 | 120 | 113 | 135 | 125 | 150 | 138 | 165 | 150 | 180 | 163 | 195 | 175 | 210 |
| voters per peak hour | 15 | 18 | 18 | 21 | 20 | 24 | 23 | 27 | 25 | 30 | 28 | 33 | 30 | 36 | 33 | 39 | 35 | 42 |
| voters in 2 peak hrs | 30 | 36 | 36 | 42 | 40 | 48 | 46 | 54 | 50 | 60 | 56 | 66 | 60 | 72 | 66 | 78 | 70 | 84 |
| how often a voter joins end of line (in minutes) | 4.00 | 3.33 | 3.33 | 2.86 | 3.00 | 2.50 | 2.61 | 2.22 | 2.40 | 2.00 | 2.14 | 1.82 | 2.00 | 1.67 | 1.82 | 1.54 | 1.71 | 1.43 |
| how often a voter leaves front of line (in minutes) | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

Wait time for each voter:

| | | | | | | | | | | | | | | | | | | |
|----|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 0.00 | 0.67 | 0.67 | 1.14 | 1.00 | 1.50 | 1.39 | 1.78 | 1.60 | 2.00 | 1.86 | 2.18 | 2.00 | 2.33 | 2.18 | 2.46 | 2.29 | 2.57 |
| 3 | 0.00 | 1.33 | 1.33 | 2.29 | 2.00 | 3.00 | 2.78 | 3.56 | 3.20 | 4.00 | 3.71 | 4.36 | 4.00 | 4.67 | 4.36 | 4.92 | 4.57 | 5.14 |
| 4 | 0.00 | 2.00 | 2.00 | 3.43 | 3.00 | 4.50 | 4.17 | 5.33 | 4.80 | 6.00 | 5.57 | 6.55 | 6.00 | 7.00 | 6.55 | 7.38 | 6.86 | 7.71 |
| 5 | 0.00 | 2.67 | 2.67 | 4.57 | 4.00 | 6.00 | 5.57 | 7.11 | 6.40 | 8.00 | 7.43 | 8.73 | 8.00 | 9.33 | 8.73 | 9.85 | 9.14 | 10.29 |
| 6 | 0.00 | 3.33 | 3.33 | 5.71 | 5.00 | 7.50 | 6.96 | 8.89 | 8.00 | 10.00 | 9.29 | 10.91 | 10.00 | 11.67 | 10.91 | 12.31 | 11.43 | 12.86 |
| 7 | 0.00 | 4.00 | 4.00 | 6.86 | 6.00 | 9.00 | 8.35 | 10.67 | 9.60 | 12.00 | 11.14 | 13.09 | 12.00 | 14.00 | 13.09 | 14.77 | 13.71 | 15.43 |
| 8 | 0.00 | 4.67 | 4.67 | 8.00 | 7.00 | 10.50 | 9.74 | 12.44 | 11.20 | 14.00 | 13.00 | 15.27 | 14.00 | 16.33 | 15.27 | 17.23 | 16.00 | 18.00 |
| 9 | 0.00 | 5.33 | 5.33 | 9.14 | 8.00 | 12.00 | 11.13 | 14.22 | 12.80 | 16.00 | 14.86 | 17.45 | 16.00 | 18.67 | 17.45 | 19.69 | 18.29 | 20.57 |
| 10 | 0.00 | 6.00 | 6.00 | 10.29 | 9.00 | 13.50 | 12.52 | 16.00 | 14.40 | 18.00 | 16.71 | 19.64 | 18.00 | 21.00 | 19.64 | 22.15 | 20.57 | 23.14 |
| 11 | 0.00 | 6.67 | 6.67 | 11.43 | 10.00 | 15.00 | 13.91 | 17.78 | 16.00 | 20.00 | 18.57 | 21.82 | 20.00 | 23.33 | 21.82 | 24.62 | 22.86 | 25.71 |
| 12 | 0.00 | 7.33 | 7.33 | 12.57 | 11.00 | 16.50 | 15.30 | 19.56 | 17.60 | 22.00 | 20.43 | 24.00 | 22.00 | 25.67 | 24.00 | 27.08 | 25.14 | 28.29 |

| | | | | | | | | | | | | | | | | | | |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| registered voters/DRE | 300 | 300 | 350 | 350 | 400 | 400 | 450 | 450 | 500 | 500 | 550 | 550 | 600 | 600 | 650 | 650 | 700 | 700 |
| peak % | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 |
| voters in 2 peak hrs | 30 | 36 | 36 | 42 | 40 | 48 | 46 | 54 | 50 | 60 | 56 | 66 | 60 | 72 | 66 | 78 | 70 | 84 |

Wait time for each voter:

| | | | | | | | | | | | | | | | | | | |
|----|------|-------|-------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|
| 13 | 0.00 | 8.00 | 8.00 | 13.71 | 12.00 | 18.00 | 16.70 | 21.33 | 19.20 | 24.00 | 22.29 | 26.18 | 24.00 | 28.00 | 26.18 | 29.54 | 27.43 | 30.86 |
| 14 | 0.00 | 8.67 | 8.67 | 14.86 | 13.00 | 19.50 | 18.09 | 23.11 | 20.80 | 26.00 | 24.14 | 28.36 | 26.00 | 30.33 | 28.36 | 32.00 | 29.71 | 33.43 |
| 15 | 0.00 | 9.33 | 9.33 | 16.00 | 14.00 | 21.00 | 19.48 | 24.89 | 22.40 | 28.00 | 26.00 | 30.55 | 28.00 | 32.67 | 30.55 | 34.46 | 32.00 | 36.00 |
| 16 | 0.00 | 10.00 | 10.00 | 17.14 | 15.00 | 22.50 | 20.87 | 26.67 | 24.00 | 30.00 | 27.86 | 32.73 | 30.00 | 35.00 | 32.73 | 36.92 | 34.29 | 38.57 |
| 17 | 0.00 | 10.67 | 10.67 | 18.29 | 16.00 | 24.00 | 22.26 | 28.44 | 25.60 | 32.00 | 29.71 | 34.91 | 32.00 | 37.33 | 34.91 | 39.38 | 36.57 | 41.14 |
| 18 | 0.00 | 11.33 | 11.33 | 19.43 | 17.00 | 25.50 | 23.65 | 30.22 | 27.20 | 34.00 | 31.57 | 37.09 | 34.00 | 39.67 | 37.09 | 41.85 | 38.86 | 43.71 |
| 19 | 0.00 | 12.00 | 12.00 | 20.57 | 18.00 | 27.00 | 25.04 | 32.00 | 28.80 | 36.00 | 33.43 | 39.27 | 36.00 | 42.00 | 39.27 | 44.31 | 41.14 | 46.29 |
| 20 | 0.00 | 12.67 | 12.67 | 21.71 | 19.00 | 28.50 | 26.43 | 33.78 | 30.40 | 38.00 | 35.29 | 41.45 | 38.00 | 44.33 | 41.45 | 46.77 | 43.43 | 48.86 |
| 21 | 0.00 | 13.33 | 13.33 | 22.86 | 20.00 | 30.00 | 27.83 | 35.56 | 32.00 | 40.00 | 37.14 | 43.64 | 40.00 | 46.67 | 43.64 | 49.23 | 45.71 | 51.43 |
| 22 | 0.00 | 14.00 | 14.00 | 24.00 | 21.00 | 31.50 | 29.22 | 37.33 | 33.60 | 42.00 | 39.00 | 45.82 | 42.00 | 49.00 | 45.82 | 51.69 | 48.00 | 54.00 |
| 23 | 0.00 | 14.67 | 14.67 | 25.14 | 22.00 | 33.00 | 30.61 | 39.11 | 35.20 | 44.00 | 40.86 | 48.00 | 44.00 | 51.33 | 48.00 | 54.15 | 50.29 | 56.57 |
| 24 | 0.00 | 15.33 | 15.33 | 26.29 | 23.00 | 34.50 | 32.00 | 40.89 | 36.80 | 46.00 | 42.71 | 50.18 | 46.00 | 53.67 | 50.18 | 56.62 | 52.57 | 59.14 |
| 25 | 0.00 | 16.00 | 16.00 | 27.43 | 24.00 | 36.00 | 33.39 | 42.67 | 38.40 | 48.00 | 44.57 | 52.36 | 48.00 | 56.00 | 52.36 | 59.08 | 54.86 | 61.71 |
| 26 | 0.00 | 16.67 | 16.67 | 28.57 | 25.00 | 37.50 | 34.78 | 44.44 | 40.00 | 50.00 | 46.43 | 54.55 | 50.00 | 58.33 | 54.55 | 61.54 | 57.14 | 64.29 |
| 27 | 0.00 | 17.33 | 17.33 | 29.71 | 26.00 | 39.00 | 36.17 | 46.22 | 41.60 | 52.00 | 48.29 | 56.73 | 52.00 | 60.67 | 56.73 | 64.00 | 59.43 | 66.86 |
| 28 | 0.00 | 18.00 | 18.00 | 30.86 | 27.00 | 40.50 | 37.57 | 48.00 | 43.20 | 54.00 | 50.14 | 58.91 | 54.00 | 63.00 | 58.91 | 66.46 | 61.71 | 69.43 |
| 29 | 0.00 | 18.67 | 18.67 | 32.00 | 28.00 | 42.00 | 38.96 | 49.78 | 44.80 | 56.00 | 52.00 | 61.09 | 56.00 | 65.33 | 61.09 | 68.92 | 64.00 | 72.00 |
| 30 | 0.00 | 19.33 | 19.33 | 33.14 | 29.00 | 43.50 | 40.35 | 51.56 | 46.40 | 58.00 | 53.86 | 63.27 | 58.00 | 67.67 | 63.27 | 71.38 | 66.29 | 74.57 |
| 31 | | 20.00 | 20.00 | 34.29 | 30.00 | 45.00 | 41.74 | 53.33 | 48.00 | 60.00 | 55.71 | 65.45 | 60.00 | 70.00 | 65.45 | 73.85 | 68.57 | 77.14 |
| 32 | | 20.67 | 20.67 | 35.43 | 31.00 | 46.50 | 43.13 | 55.11 | 49.60 | 62.00 | 57.57 | 67.64 | 62.00 | 72.33 | 67.64 | 76.31 | 70.86 | 79.71 |
| 33 | | 21.33 | 21.33 | 36.57 | 32.00 | 48.00 | 44.52 | 56.89 | 51.20 | 64.00 | 59.43 | 69.82 | 64.00 | 74.67 | 69.82 | 78.77 | 73.14 | 82.29 |
| 34 | | 22.00 | 22.00 | 37.71 | 33.00 | 49.50 | 45.91 | 58.67 | 52.80 | 66.00 | 61.29 | 72.00 | 66.00 | 77.00 | 72.00 | 81.23 | 75.43 | 84.86 |
| 35 | | 22.67 | 22.67 | 38.86 | 34.00 | 51.00 | 47.30 | 60.44 | 54.40 | 68.00 | 63.14 | 74.18 | 68.00 | 79.33 | 74.18 | 83.69 | 77.71 | 87.43 |
| 36 | | 23.33 | 23.33 | 40.00 | 35.00 | 52.50 | 48.70 | 62.22 | 56.00 | 70.00 | 65.00 | 76.36 | 70.00 | 81.67 | 76.36 | 86.15 | 80.00 | 90.00 |
| 37 | | | | 41.14 | 36.00 | 54.00 | 50.09 | 64.00 | 57.60 | 72.00 | 66.86 | 78.55 | 72.00 | 84.00 | 78.55 | 88.62 | 82.29 | 92.57 |
| 38 | | | | 42.29 | 37.00 | 55.50 | 51.48 | 65.78 | 59.20 | 74.00 | 68.71 | 80.73 | 74.00 | 86.33 | 80.73 | 91.08 | 84.57 | 95.14 |
| 39 | | | | 43.43 | 38.00 | 57.00 | 52.87 | 67.56 | 60.80 | 76.00 | 70.57 | 82.91 | 76.00 | 88.67 | 82.91 | 93.54 | 86.86 | 97.71 |
| 40 | | | | 44.57 | 39.00 | 58.50 | 54.26 | 69.33 | 62.40 | 78.00 | 72.43 | 85.09 | 78.00 | 91.00 | 85.09 | 96.00 | 89.14 | 100.29 |

| | | | | | | | | | | | | | | | | | | |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| registered voters/DRE | 300 | 300 | 350 | 350 | 400 | 400 | 450 | 450 | 500 | 500 | 550 | 550 | 600 | 600 | 650 | 650 | 700 | 700 |
| peak % | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 | 50 | 60 |
| voters in 2 peak hrs | 30 | 36 | 36 | 42 | 40 | 48 | 46 | 54 | 50 | 60 | 56 | 66 | 60 | 72 | 66 | 78 | 70 | 84 |

Wait time for each voter:

| | | | | | | | | | | | | | | | | | |
|----|--|--|--------------|--|--------------|--------------|--------------|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| 41 | | | 45.71 | | 60.00 | 55.65 | 71.11 | 64.00 | 80.00 | 74.29 | 87.27 | 80.00 | 93.33 | 87.27 | 98.46 | 91.43 | 102.86 |
| 42 | | | 46.86 | | 61.50 | 57.04 | 72.89 | 65.60 | 82.00 | 76.14 | 89.45 | 82.00 | 95.67 | 89.45 | 100.92 | 93.71 | 105.43 |
| 43 | | | | | 63.00 | 58.43 | 74.67 | 67.20 | 84.00 | 78.00 | 91.64 | 84.00 | 98.00 | 91.64 | 103.38 | 96.00 | 108.00 |
| 44 | | | | | 64.50 | 59.83 | 76.44 | 68.80 | 86.00 | 79.86 | 93.82 | 86.00 | 100.33 | 93.82 | 105.85 | 98.29 | 110.57 |
| 45 | | | | | 66.00 | 61.22 | 78.22 | 70.40 | 88.00 | 81.71 | 96.00 | 88.00 | 102.67 | 96.00 | 108.31 | 100.57 | 113.14 |
| 46 | | | | | 67.50 | 62.61 | 80.00 | 72.00 | 90.00 | 83.57 | 98.18 | 90.00 | 105.00 | 98.18 | 110.77 | 102.86 | 115.71 |
| 47 | | | | | 69.00 | | 81.78 | 73.60 | 92.00 | 85.43 | 100.36 | 92.00 | 107.33 | 100.36 | 113.23 | 105.14 | 118.29 |
| 48 | | | | | 70.50 | | 83.56 | 75.20 | 94.00 | 87.29 | 102.55 | 94.00 | 109.67 | 102.55 | 115.69 | 107.43 | 120.86 |
| 49 | | | | | | | 85.33 | 76.80 | 96.00 | 89.14 | 104.73 | 96.00 | 112.00 | 104.73 | 118.15 | 109.71 | 123.43 |
| 50 | | | | | | | 87.11 | 78.40 | 98.00 | 91.00 | 106.91 | 98.00 | 114.33 | 106.91 | 120.62 | 112.00 | 126.00 |
| 51 | | | | | | | 88.89 | | 100.00 | 92.86 | 109.09 | 100.00 | 116.67 | 109.09 | 123.08 | 114.29 | 128.57 |
| 52 | | | | | | | 90.67 | | 102.00 | 94.71 | 111.27 | 102.00 | 119.00 | 111.27 | 125.54 | 116.57 | 131.14 |
| 53 | | | | | | | 92.44 | | 104.00 | 96.57 | 113.45 | 104.00 | 121.33 | 113.45 | 128.00 | 118.86 | 133.71 |
| 54 | | | | | | | 94.22 | | 106.00 | 98.43 | 115.64 | 106.00 | 123.67 | 115.64 | 130.46 | 121.14 | 136.29 |
| 55 | | | | | | | | | 108.00 | 100.29 | 117.82 | 108.00 | 126.00 | 117.82 | 132.92 | 123.43 | 138.86 |
| 56 | | | | | | | | | 110.00 | 102.14 | 120.00 | 110.00 | 128.33 | 120.00 | 135.38 | 125.71 | 141.43 |
| 57 | | | | | | | | | 112.00 | | 122.18 | 112.00 | 130.67 | 122.18 | 137.85 | 128.00 | 144.00 |
| 58 | | | | | | | | | 114.00 | | 124.36 | 114.00 | 133.00 | 124.36 | 140.31 | 130.29 | 146.57 |
| 59 | | | | | | | | | 116.00 | | 126.55 | 116.00 | 135.33 | 126.55 | 142.77 | 132.57 | 149.14 |
| 60 | | | | | | | | | 118.00 | | 128.73 | 118.00 | 137.67 | 128.73 | 145.23 | 134.86 | 151.71 |
| 61 | | | | | | | | | | 130.91 | | | 140.00 | 130.91 | 147.69 | 137.14 | 154.29 |
| 62 | | | | | | | | | | 133.09 | | | 142.33 | 133.09 | 150.15 | 139.43 | 156.86 |
| 63 | | | | | | | | | | 135.27 | | | 144.67 | 135.27 | 152.62 | 141.71 | 159.43 |
| 64 | | | | | | | | | | 137.45 | | | 147.00 | 137.45 | 155.08 | 144.00 | 162.00 |
| 65 | | | | | | | | | | 139.64 | | | 149.33 | 139.64 | 157.54 | 146.29 | 164.57 |
| 66 | | | | | | | | | | 141.82 | | | 151.67 | 141.82 | 160.00 | 148.57 | 167.14 |
| 67 | | | | | | | | | | | | | 154.00 | | 162.46 | 150.86 | 169.71 |
| 68 | | | | | | | | | | | | | 156.33 | | 164.92 | 153.14 | 172.29 |

