Portland State
Civil & Environmental
Engineering

Effect of Residential Street Speed Limit Reduction from 25 to 20 mi/hr on Driving Speeds in Portland, Oregon

FINAL REPORT

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INTRODUCTION

In 2015, the City of Portland adopted Vision Zero's objective of eliminating transportation-related fatalities and serious injuries. Speed, through analysis of crash data, was determined to be a contributing factor in 47% of the fatal crashes observed in Portland between 2004-2013 (*City of Portland, 2016*). Additionally, it is well-established that higher motor vehicle speeds result in more serious outcomes for the vulnerable road user, and the severity of an injury exponentially increases with speeds (Tefft, 2013). Thus, one of the pillars in the Vision Zero Action Plan is reductions in motor vehicle speeds.

The Portland City Council approved an ordinance reducing the speed limit on all residential streets to 20 mi/hr in January 2018. A residential street is a street that is in a residence district according to ORS 801.430 and has a statutory speed limit. Federally classified collectors and arterials are excluded. The 20 mi/hr speed limit went into effect on April 1, 2018. The city installed new speed limit signs and updated existing signs to over the period of February 2018 to May 2019. The final 20 mph sign installation increased the number of residential speed limit signs from fewer than 1,000 signs to more than 2,000. An educational and awareness campaign "*20 Is Plenty*" was also conducted. As part of the effort, nearly 7,000 yard signs were distributed to residents. Figure 1 shows a photo of yard signs and speed limit signs at a press event.

The objective of this study is to determine if there was a change in observed speeds of vehicles following the residential speed limit reduction from 25 to 20 mi/hr. The data used for this analysis was before and after observations of vehicle speeds collected by pneumatic tube traffic counters before and after the speed limits were changed.

Photo by Hannah Schafer, Portland Bureau of Transportation

Figure 1: "20 Is Plenty" Event, February 2018

DATA

The City of Portland, Bureau of Transportation (PBOT) provided data for the analysis that was collected before and after the reduction in speed limits at 59 sites (Figure 2). At many of these sites, speed data before 2018 (collected between 2013 and 2017) were available. At sites where the before speed data were not available, the speed data was collected between January 2018 and March 2018, before the speed limit reduction was implemented. Speed data after the reduced speed limit was introduced was collected between February 2019 and July 2019. All data were collected using pneumatic tube counters, which were placed perpendicular to the direction of traffic. Both before and after speed data were collected during weekdays and a few weekends, with the duration varying between 24-97 hours at each location. A timeline showing the sites and data collection dates is shown in Figure 3.

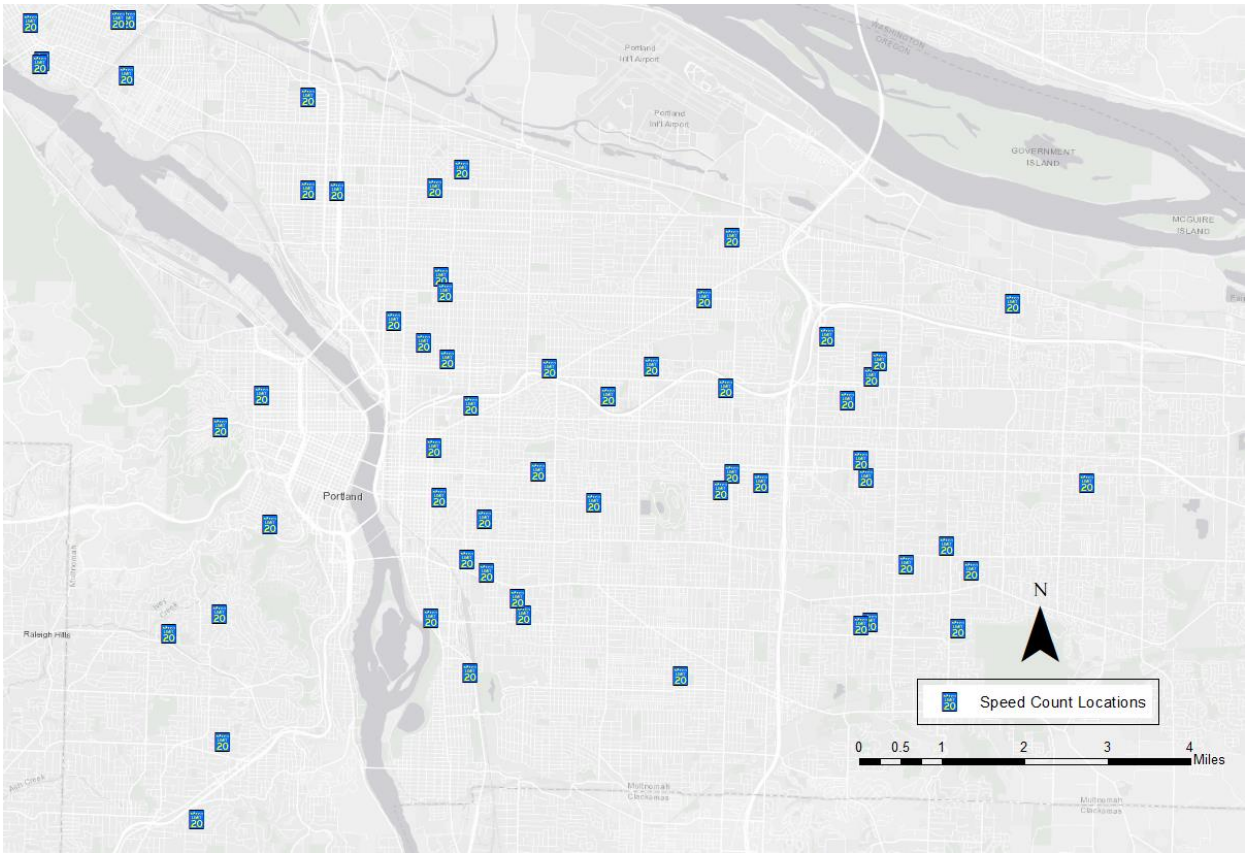

Figure 2: Location of Speed Data Collection Sites

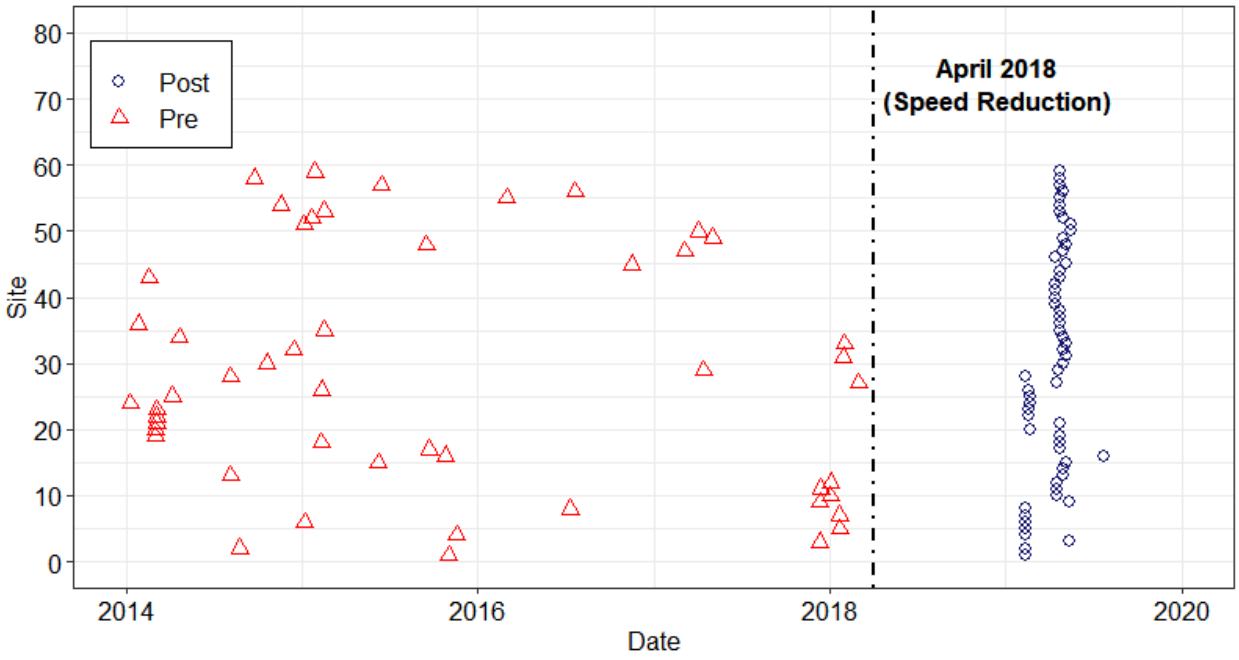

Figure 3: Timeline of Data Collection by Site Number[1]

The data from all the sites were combined to yield 142,389 observations of individual vehicle speeds before and 90,075 after the speed change. Prior to data analysis, a data clearing process was conducted. Observations where the traffic counter failed to record a speed (0 mi/hr in the data) were removed. In addition, speeds over 100 mi/hr were also removed as unreasonable. As a final data quality check, histograms of observed speeds distribution plots were inspected at each site in both the before and after periods, excluding all removed speed observations. These plots are shown in Appendix . Upon inspection, site *#13 - NE 21st Ave, South of Oregon St.*- was found to have an atypical before speed distribution. The data included many speeds exceeding 50 mi/hr which are not reasonable given street geometry and adjacent traffic control (stop signs on adjacent blocks). This site was removed from the data, leaving 58 sites for analysis.

Table 1 shows a summary of the analyzed speed data. At the 58 sites used for analysis, 10,937 before observations and 7,307 after observations were removed by the 0 mi/hr or greater than 100 mi/hr criteria. The removed data, as a percentage of total observations, is very consistent between the two periods suggesting that the data cleaning did not introduce any bias to the analysis data set.

[1] Refer to Appendix AAppendix for Site Numbers with Location Names

Table 1: Summary of Analyzed Speed Data

Period	All Observations	Observations Not Removed from Data	% Difference (Relative to All Observations)
Before	142,389	131,452	-7.99%
After	90,075	82,768	-8.46%
Total	**232,464**	**214,220**	**-8.17%**

*Note: All NE 21st Ave, South of Oregon St., data removed due to speed distribution shown in Figure B.25 and is not included in this table.

RESULTS

The data were analyzed using descriptive statistics, log-linear regression, and binary logit modeling.

Descriptive Statistics

Descriptive statistics for the pooled data and each site were tabulated for changes in common speed measures:

- Mean (average) speed
- Median (50th percentile) speed
- 85th percentile speed
- Percentage of vehicles traveling greater than 25 mi/hr
- Percentage of vehicles greater than 30 mi/hr
- Percentage of vehicles greater than 35 mi/hr

Table 2 shows the average speeds in the pooled before and after data. Overall, the observed mean speed increased from 21.63 mi/hr to 21.70 mi/hr (an increase of approximately 0.37%). This change was statistically significant at the 95th confidence interval due to the large sample size but is not a practically significant change. The other typical measures of speed - the median speed and the 85th percentile speed - remained the same. However, the percentage of vehicles traveling with speeds greater than 25 mi/hr, 30 mi/hr, and 35 mi/hr all decreased in the after condition compared to the before condition. Specifically, the percentage of vehicles with speeds greater than:

- 25 mi/hr decreased by 0.53% (from 24.13% to 23.60%)
- 30 mi/hr decreased by 1.66% (from 6.49% to 4.83%).
- 35 mi/hr decreased by 0.52% (from 1.11% to 0.59%)

All differences were statistically significant at the 95th confidence interval.

Table 2: Summary Statistics of Observed Vehicle Speeds and Percent of Vehicles Exceeding 25 mi/hr, 30 mi/hr, and 35 mi/hr

Period	Mean	Median	85th Percentile	Greater Than 25 mi/hr	Greater Than 30 mi/hr	Greater Than 35 mi/hr
Before (n = 131,452)	21.66	22	27	24.13%	6.49%	1.11%
After (n = 82,768)	21.70	22	27	23.60%	4.83%	0.59%
Number of Sites with Decrease Observed	33	43	50	43	40	42
Percentage of Sites with Decrease Observed	56.9%	74.1%	86.2%	74.1%	69.0%	72.4%

*Note: NE 21st Ave, South of Oregon St., not included based on the speed distribution shown in Figure B.25

At individual locations (sites), the changes in the speed measures vary by location. As shown in Table 2, at 33 of 58 sites (56.9%), a decrease in the average speeds was observed. A larger percentage of sites 43 of 58 (74.1.4%) had a decrease in the median speeds. Similarly, decreases were observed for the 85th percentile speed (86.2% of sites), the percentage of vehicles traveling faster than 25 mi/hr (74.1%), 30 mi/hr (69.0%), and 35 mi/hr (72.4%).

Figure 4 shows the difference in mean speeds for the before and after periods spatially. The blue circles represent sites were the mean speeds reduced; the size of the circle is proportional to the change. The red circles represent increases. Figure 5 is the same type of map, but illustrating median speeds. Figure 6 shows the change in 85th percentile speeds. There is not any apparent spatial pattern to the differences in speed changes.

Figure 7 shows these same changes graphically in a bar plot, sorted by the magnitude of the change. For the mean speeds, the changes range from a decrease of 3.5 mi/hr to an increase of 2.14 mi/hr. For sites with a decrease, the average change was 1.41 mi/hr. For sites with an increase, the average change was 0.65 mi/hr. Figure 8 shows the change in the percentage of vehicles traveling greater than 30 mi/hr. The changes range from a decrease of 29.45% to an increase of 4.36%. For sites with a decrease, the average change was 3.79%. For sites with an increase, the average change was 0.84%.

Overall, the descriptive analysis suggests that the reduction of posted speed limits to 20 mi/hr has resulted narrowing the speed distribution so that fewer vehicles are traveling over 30 mi/hr. Shifts in the average speed can be small when the speed limit change is small (Monsere, 2004). In this case, the 5 mi/hr change occurred on roadways with already low 25 mi/hr speed limits so a small or no change would be expected. Shifts in higher speeds are often observed in effective speed limit reductions. Overall, the data in

this analysis show that the number of higher-speed vehicles have been reduced. It is most noteworthy that the reduction in the percentage of vehicles faster than 30 mi/hr and 35 mi/hr are larger in magnitude than the other changes. These changes are more meaningful for the Vision Zero speed reduction efforts than the change in average speed, given the link to crash severity for vulnerable road users. For comparison, the 1% reduction in the proportion of speeds greater than 25 mi/hr was also observed by Hu and Cicchino (2020) in their study of 30 mi/hr to 25 mi/hr speed changes in Boston, MA. The reduction in the proportion of the speeds greater than 30 mi/hr is moderately greater in the present study.

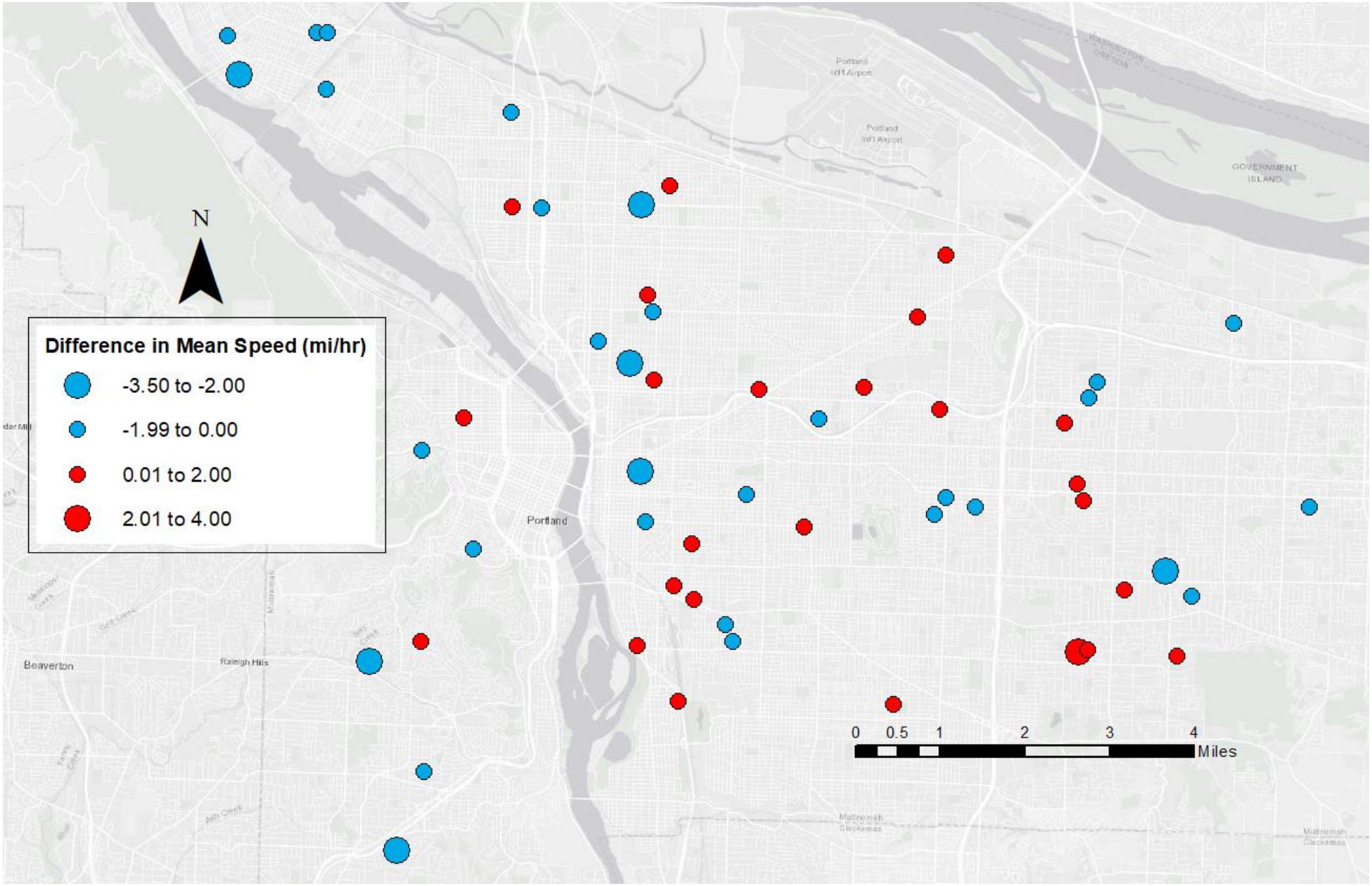

Figure 4: Change in Mean Speeds (mi/hr) by Site

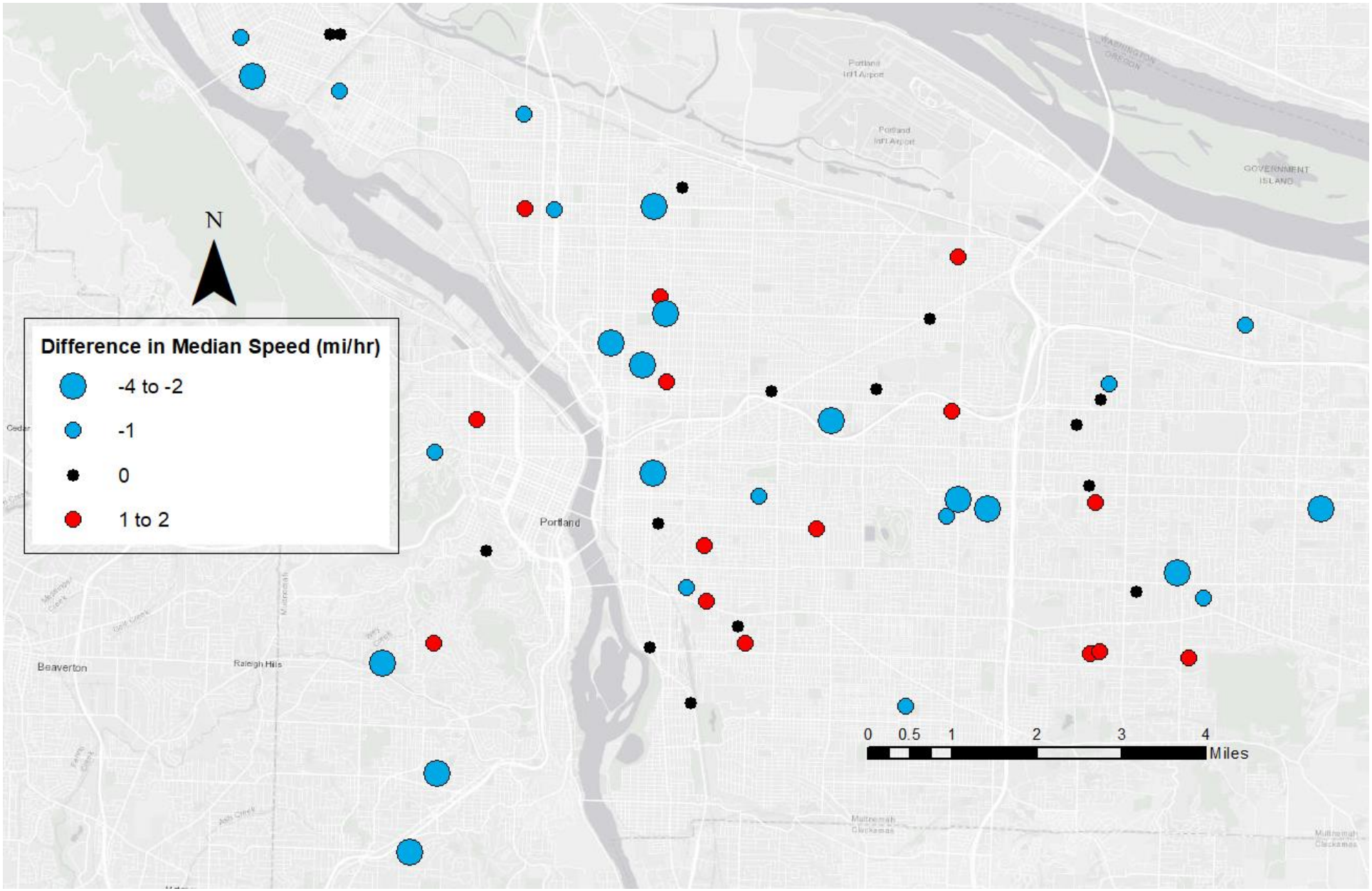

Figure 5: Change in Median Speed (mi/hr) at Study Site

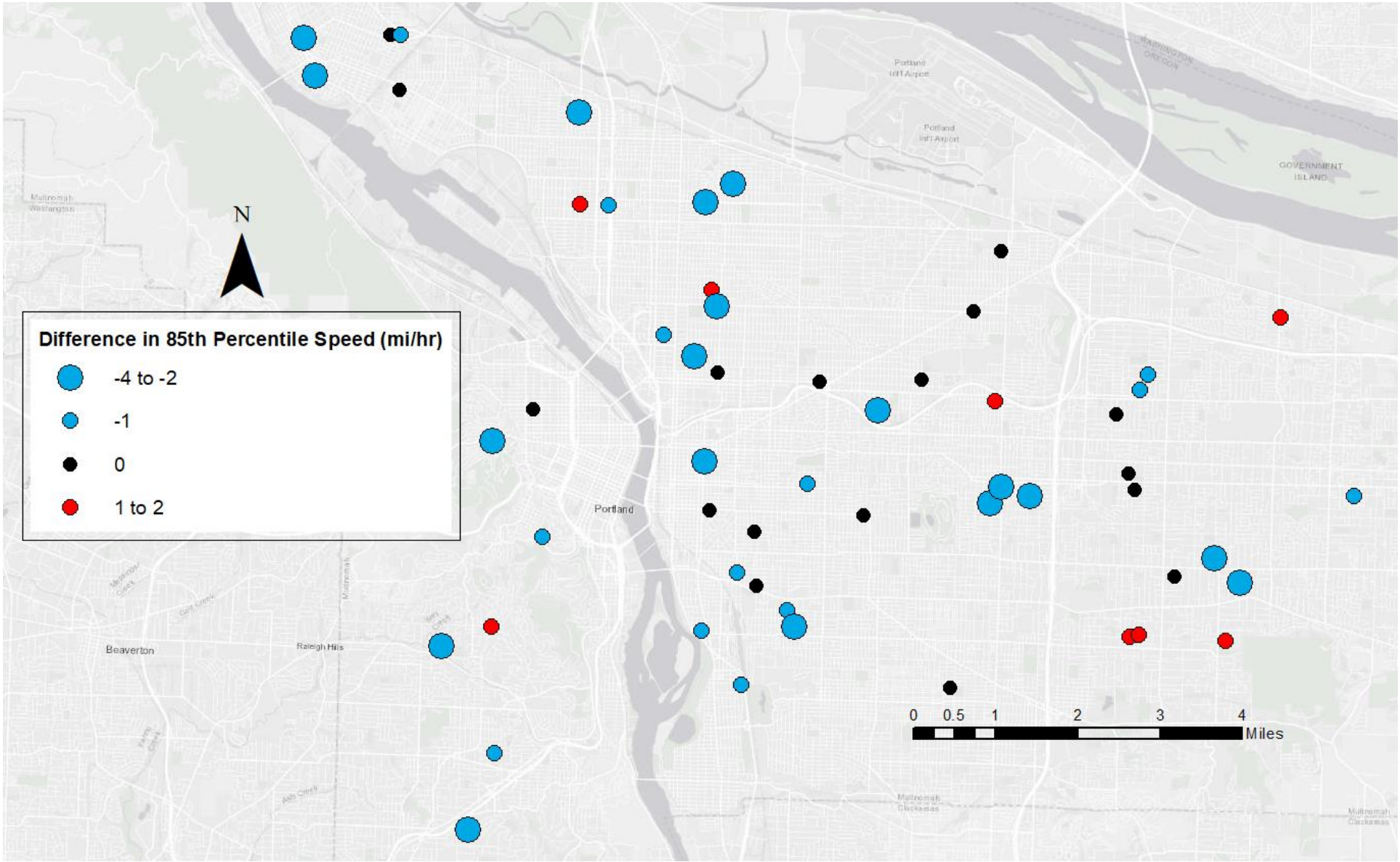

Figure 6: Change in 85th Percentile Speeds (mi/hr) by Site

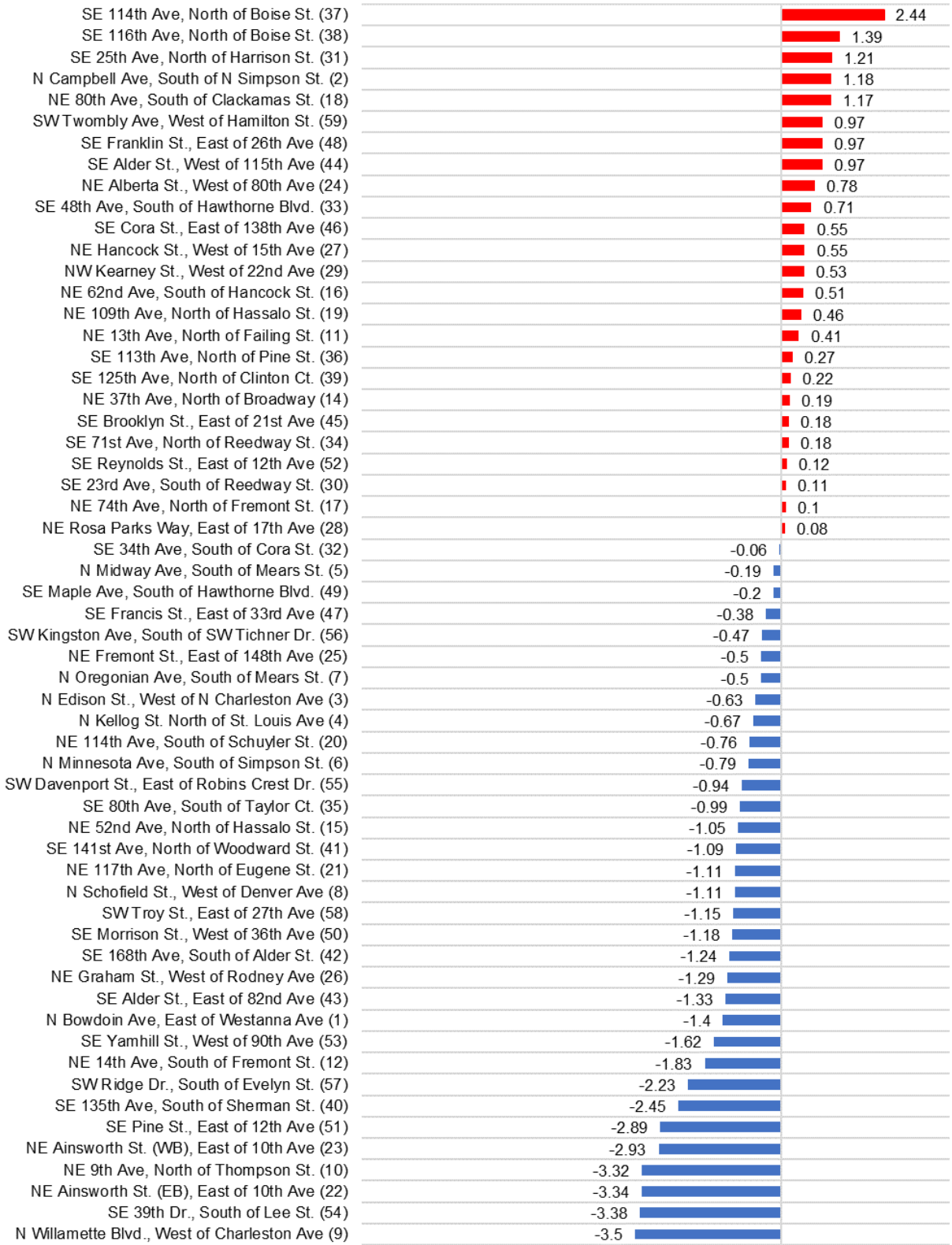

Figure 7: Change in Mean Speeds (mi/hr) by Site

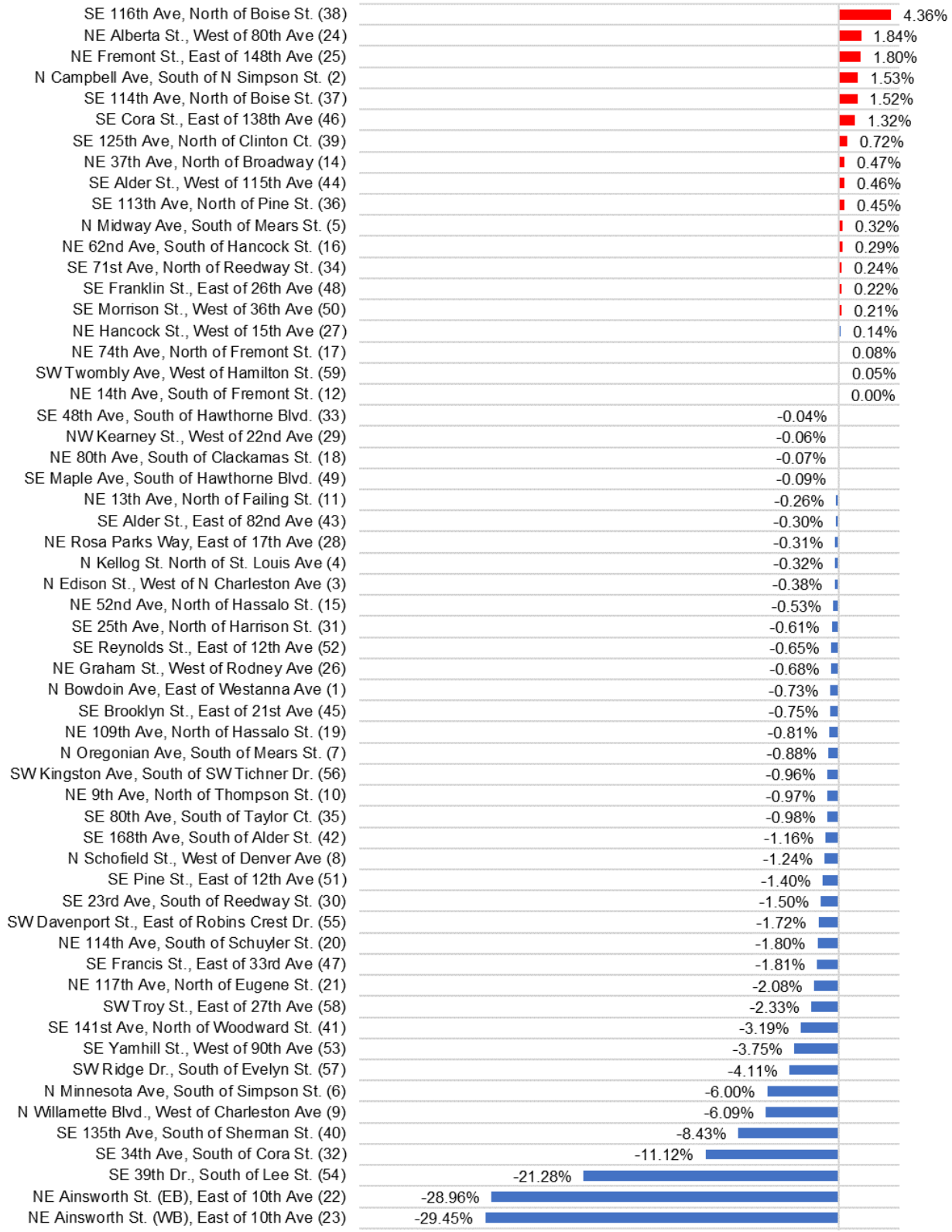

Figure 8: Change in Percentage of Vehicles with Speed Greater than 30 mi/hr by Site

Modeling

A series of statistical models were developed to determine the effects of the speed limit reduction while controlling for other factors available in the data (which the descriptive analysis does not do). An indicator variable (1 if after speed limit reduction, 0 if before) was created so that the effects of the speed limit reduction could be modeled. Available controlling factors included time-of-day periods, day of the week, and vehicle classification from the counter data files and supplemental data extracted from the city's GIS files including curb-to-curb pavement width, number of travel lanes, presence of sidewalks, curb height, presence of parking signs, and pavement type. Table 3 presents the summary of all variables tested in the modeling effort.

Table 3: Summary of Potential Controlling Explanatory Variables

Variable	Frequency	Mean	St. Dev.	Minimum	Maximum
After Speed Reduction Indicator					
1 if After Speed Reduction, 0 if Before	82,768	0.386	0.487	—	—
Speed Bins					
1 if Greater Than 25 mi/hr, 0 Otherwise	51,262	0.239	0.427	—	—
1 if Greater Than 30 mi/hr, 0 Otherwise	12,536	0.059	0.235	—	—
1 if Greater Than 35 mi/hr, 0 Otherwise	1,953	0.009	0.095	—	—
Time-of-Day Indicators					
1 if 6:00 a.m. to 10:00 a.m., 0 Otherwise	69,259	0.323	0.468	—	—
1 if 10:00 a.m. to 4:00 p.m., 0 Otherwise	47,821	0.223	0.416	—	—
1 if 4:00 p.m. to 8:00 p.m., 0 Otherwise	3,752	0.018	0.131	—	—
1 if 8:00 p.m. to 6:00 a.m., 0 Otherwise	93,388	0.436	0.496	—	—
Day-of-Week Indicators					
1 if Monday, 0 Otherwise	21,219	0.099	0.299	—	—
1 if Tuesday, 0 Otherwise	40,592	0.189	0.392	—	—
1 if Wednesday, 0 Otherwise	49,528	0.231	0.422	—	—
1 if Thursday, 0 Otherwise	57,468	0.268	0.443	—	—
1 if Friday, 0 Otherwise	29,524	0.138	0.345	—	—
1 if Weekend, 0 Otherwise	15,889	0.074	0.262	—	—
Vehicle Classification Indicators					
1 if Motorcycle/Bike, 0 Otherwise	7,362	0.034	0.182	—	—
1 if Passenger Car, 0 Otherwise	166,130	0.776	0.417	—	—
1 if 2-axle Long, 0 Otherwise	29,655	0.138	0.345	—	—
1 if Bus, 0 Otherwise	6,737	0.031	0.175	—	—
Roadway Characteristics					
Surface Width (ft)	214,220	30.742	3.953	18	40
Pavement Condition Index	214,220	58.189	14.794	13	100
Curb Height (in)	214,220	4.091	1.590	0	7
Adjacent Signage					
1 if No Parking Sign, 0 Otherwise	44,231	0.206	0.405	—	—
1 if Stop Sign, 0 Otherwise	71,523	0.334	0.472	—	—
Pavement Type					
1 if Composite Pavement, 0 Otherwise	13,867	0.065	0.246	—	—
1 if Flexible Pavement, 0 Otherwise	182,398	0.851	0.356	—	—
1 if OLIM Pavement, 0 Otherwise	9,390	0.044	0.205	—	—
1 if Rigid Pavement, 0 Otherwise	8,565	0.040	0.196	—	—

* For indicators, the mean can also be interpreted as the proportion of observations. For example, the indicator for Monday has a mean of 0.099, indicating that the percent of Monday observations is 9.9%.

Log-Linear Regression Model

The first model was a log-linear regression model in which the dependent variable, observed vehicle speed, was log-transformed. In this model, and the premise behind selecting a log-linear regression model, parameter estimates for explanatory variables can be interpreted as an elasticity; that is, a one-unit change in an explanatory variable results in a percent change in observed speed. This value is approximately the same value when computing the change by exponentiating the parameter estimates and multiplying by 100 and is common practice in econometrics.

The final model specifications for the log-linear regression model are shown in Table 4. Of interest in Table 4 is the indicator for the after-speed limit reduction. The estimate for after speed limit reduction indicates a decrease in observed speed of approximately 1.0%, on average. Additionally, this indicator is highly significant with well over 99% confidence (p-value of the table of 0.000). The indicator for after the speed limit reduction indicates a 1.0% decrease in observed speed, on average. This expected decrease is approximately 3-times greater than the expected decrease of -0.30% observed by Hu and Cicchino (2020). A possible reason may stem from the number of controlling factors in the regression model (i.e., the current study controls for the effects of other factors, such as time-of-day, day-of-week, and roadway characteristics).

Of the controlling factors, three have a negative relationship with observed speed. Interpreting the parameter estimates, observed vehicle speeds are expected, on average, to decrease by:

- 0.70% from 6:00 a.m. to 10:00 a.m.,
- 8.10% on weekend days, and
- 1.10 % for every one-unit increase in curb height (inches).

Other controlling factors were found to have a positive relationship with observed speed. Interpreting the parameter estimates, observed vehicle speeds are expected, on average, to increase by:

- 2.8% from 4:00 p.m. to 8:00 p.m.,
- 5.6% on Wednesday, 2.5% Thursday, and 1.6% Friday,
- 8.8 % for every one-unit increase in surface width (ft), and
- 10.7 % for every one-unit increase in the pavement condition index.

These modeling results align with expectations about vehicle speeds. Street width is associated with higher speeds (Fitzpatrick, 2000). Curb height is likely associate with on-street parking and contributes to narrow available travel way (decrease in speeds) Pavement quality and ride are likely related to vehicle speed but the literature is sparse. This finding corresponds to previous studies in which observed speeds were found to be less on weekends (Giles, 2004; Barnioli et al., 2018). In addition, Shankar and Mannering (1998) found speeds in the left lane on multi-lane roadways to be reduced on weekends.

Table 4: Log-Linear Regression Model Specifications for Observed Speed

Variable	Coefficient	Std. Error	*p*-value
Constant	2.341	0.020	0.000
Before/After Period			
1 if After Speed Reduction, 0 if Before	-0.010	0.001	0.000
Time-of-Day			
1 if 6:00 a.m. to 10:00 a.m., 0 Otherwise	-0.007	0.001	0.000
1 if 4:00 p.m. to 8:00 p.m., 0 Otherwise	0.028	0.005	0.000
Day-of-Week			
1 if Wednesday, 0 Otherwise	0.056	0.002	0.000
1 if Thursday, 0 Otherwise	0.025	0.002	0.000
1 if Friday, 0 Otherwise	0.016	0.002	0.000
1 if Weekend, 0 Otherwise	-0.081	0.003	0.000
Roadway Characteristics			
Natural Logarithm of Surface Width	0.088	0.005	0.000
Natural Logarithm of Pavement Condition Index	0.107	0.002	0.000
Curb Height	-0.011	0.000	0.000

Binary Logit Models

To model specific thresholds of speed, binary logit models were used. These thresholds modeled include speeds greater than 25 mi/hr, speeds greater than 30 mi/hr, and speeds greater than 35 mi/hr. In each case, an indicator variable was created (e.g., 1 if speed is greater than 25 mi/hr, 0 otherwise).

There are two options to interpret estimates from the binary logit model: odds ratios or marginal effects. Although marginal effects are typically the preferred method, odds ratios are used for comparison with the analysis by Hu and Cicchino (2020). Marginal effects are also presented for reference and show an absolute change in probability of observing the value one (e.g., speeds greater than 30 mi/hr).

Table 5 shows the final binary logit model specifications for the three speed thresholds and statistically significant variables including the odds ratios, in absolute value, increase as the speed threshold increases. Therefore, for the 'after' indicator, the change in odds increases in magnitude as the speed threshold increases. This confirms the interpretation from the descriptive analysis, that the percentage of vehicles traveling in the higher speed bins decreased in the after condition, after controlling for the differences between sites in the model variables. The modeling results, with respect to significant controlling variables and their effect on observed speed, increase (+) or decrease (-), are consistent with the exception of curb height, which switches for the speeds greater than 35 mi/hr or higher and surface width which is no longer statistically significant (*p*-value 0.39). There are fewer observations in the 35 mi/hr bins (0.9% of the sample) which may explain these modeling outcomes.

Table 6 is a summary of odds ratios and marginal effects. As shown, the estimated change in odds of *not* observing speeds greater than the thresholds after the speed limit reduction increases as the speed threshold increases. Model parameter estimates, with respect to sign and significance, are consistent with the log-linear models. Table 7 interprets results of the marginal effects modeling of the before and after indicator

variable. For the odds of observing speeds greater than 25 mi/hr, the parameter estimate for after the speed limit reduction suggests a 15.9% reduction in odds of observing speeds greater than 25 mi/hr. Considering speeds greater than 30 mi/hr, the parameter estimate for after the speed limit reduction suggests a 33.6% reduction in odds of observing speeds greater than 30 mi/hr. Lastly, considering speeds greater than 35 mi/hr, the parameter estimate for after the speed limit reduction suggests a 49.6% reduction in odds of observing speeds greater than 35 mi/hr. These results confirm the descriptive analysis that vehicles traveling in the higher speed bins decreased in the after condition.

Table 5: Binary Logit Model Specifications of Speeds Greater Than 25 mi/hr, 30 mi/hr, and 35 mi/hr

Variable	Greater Than 25 mi/hr			Greater Than 30 mi/hr			Greater Than 35 mi/hr		
	Coefficient	Std. Error	*p*-value	Coefficient	Std. Error	*p*-value	Coefficient	Std. Error	*p*-value
Constant	-5.256	0.167	0.000	-9.728	0.329	0.000	-12.289	0.829	0.000
Before/After Period									
1 if After Speed Reduction, 0 if Before	-0.173	0.011	0.000	-0.409	0.020	0.000	-0.686	0.054	0.000
Time-of-Day									
1 if 6:00 a.m. to 10:00 a.m., 0 Otherwise	-0.090	0.011	0.000	-0.204	0.021	0.000	-0.373	0.056	0.000
1 if 4:00 p.m. to 8:00 p.m., 0 Otherwise	0.181	0.037	0.000	0.318	0.059	0.000	0.796	0.110	0.000
Day-of-Week									
1 if Wednesday, 0 Otherwise	0.543	0.014	0.000	0.810	0.030	0.000	0.784	0.082	0.000
1 if Thursday, 0 Otherwise	0.433	0.014	0.000	0.938	0.028	0.000	1.094	0.075	0.000
1 if Friday, 0 Otherwise	0.373	0.017	0.000	1.182	0.031	0.000	1.419	0.077	0.000
1 if Weekend, 0 Otherwise	-0.757	0.028	0.000	-0.985	0.070	0.000	-1.177	0.197	0.000
Roadway Characteristics									
Natural Logarithm of Surface Width	0.348	0.041	0.000	0.408	0.077	0.000	0.162	0.189	0.390
Natural Logarithm of Pavement Condition Index	0.734	0.018	0.000	1.268	0.040	0.000	1.568	0.108	0.000
Curb Height	-0.057	0.003	0.000	-0.015	0.006	0.011	0.040	0.015	0.009

Table 6: Marginal Effects and Odds Ratios on Speeds Greater Than 25 mi/hr, 30 mi/hr, and 35 mi/hr

Variable	Greater Than 25 mi/hr		Greater Than 30 mi/hr		Greater Than 35 mi/hr	
	Marginal Effects	Odds Ratio	Marginal Effects	Odds Ratio	Marginal Effects	Odds Ratio
Before/After Period						
1 if After Speed Reduction, 0 if Before	-0.030	0.841	-0.021	0.664	-0.006	0.504
Time-of-Day						
1 if 6:00 a.m. to 10:00 a.m., 0 Otherwise	-0.016	0.914	-0.011	0.816	-0.003	0.688
1 if 4:00 p.m. to 8:00 p.m., 0 Otherwise	0.034	1.199	0.019	1.374	0.010	2.217
Day-of-Week						
1 if Wednesday, 0 Otherwise	0.103	1.721	0.054	2.247	0.009	2.191
1 if Thursday, 0 Otherwise	0.080	1.542	0.061	2.555	0.013	2.985
1 if Friday, 0 Otherwise	0.070	1.452	0.091	3.261	0.021	4.132
1 if Weekend, 0 Otherwise	-0.112	0.469	-0.037	0.374	-0.006	0.308
Roadway Characteristics						
Natural Logarithm of Surface Width	0.062	1.417	0.022	1.504	0.001	1.176
Natural Logarithm of Pavement Condition Index	0.130	2.084	0.608	3.554	0.014	4.797
Curb Height	-0.010	0.945	-0.001	0.985	0.000	1.040

Table 7: Estimated Change in Odds of Observing Speed Thresholds

Speed Threshold	Estimated Change in Odds
Greater Than 25 mi/hr	-15.9%
Greater Than 30 mi/hr	-33.6%
Greater Than 35 mi/hr	-49.6%

CONCLUSION

The objective of this study was to determine if there was a change in observed speeds of vehicles following the residential speed limit reduction from 25 to 20 mi/hr. Before and after speed data was collected by pneumatic traffic tube counters on residential streets in Portland, OR where speed limits were changed. After data cleaning, a total of 58 sites with 131,452 observations of motor vehicle speeds with 25 mi/hr limits and 82,768 observations with 20 mi/hr limits were analyzed.

Descriptive statistics for the pooled data (all sites) found that median speed (22 mi/hr) and 85th percentile (27 mi/hr) were unchanged, following the speed limit reduction. The average speed increased 0.04 mi/hr (from 21.66 mi/hr before to 21.70 mi/hr after). Given the speed limit was only changed 5 mi/hr and was lowered from a low speed already (25 mi/hr), any changes in these typical speed measures would be expected to be small. The largest difference in the before and after periods was observed for the proportion of speeds exceeding 30 mi/hr which decreased by 1.66% (from 6.49% to 4.83%).

There were site-level differences. The average speed decreased at 57% of the sites. A larger percentage of sites were found to have a reduction in 85th percentile speed (86% of sites), the percentage of vehicles traveling faster than 25 mi/hr (74%), 30 mi/hr (69%) and 35 mi/hr (72%). The average reductions in average speed for sites that experienced a speed reduction (-1.41 mi/hr) and the percentage of vehicles traveling faster than 30 mi/hr (-3.79%) were larger than the average increases at sites that experienced an increase in speed (+0.65 mi/hr, +0.84%).

Four sets of models were developed to determine the effects of the speed limit reduction while controlling for site-level variations. The models further confirmed the descriptive analysis. The log-linear regression model in which the dependent variable, speed, was log-transformed. This was done to interpret the parameter estimates as elasticities (e.g., 1-unit change in x results in a percent change in y). Estimates from the log-linear regression model suggested that speeds in the after period were expected to have a 1.0% reduction in speed, on average.

The remaining three models focused on specific speed thresholds: speeds exceeding 25 mi/hr, 30 mi/hr, and 35 mi/hr. In each scenario, parameter estimates indicated a substantial reduction in odds of observing speeds over these thresholds. Specifically, there was a 15.9% reduction in odds of observing speeds greater than 25 mi/hr, a 33.6% reduction in odds of observing speeds greater than 30 mi/hr, and a 49.6% in odds of observing speeds greater than 35 mi/hr. Based on the data, there is evidence showing that the speed limit reduction significantly decreases the odds of observed high speeds.

Overall, the analysis suggests that the reduction of posted speed limits to 20 mi/hr has resulted in lower observed vehicle speeds and fewer vehicles traveling at higher speeds (e.g. over 30 mi/hr). It is most noteworthy that the reduction in the percentage of vehicles faster than 30 mi/hr and 35 mi/hr are larger in magnitude than the other changes. These

changes are more meaningful for the Vision Zero speed reduction efforts, given the link to crash severity for vulnerable road users. The models also suggest the role that roadway characteristics such as surface width, pavement condition, and presence of curbs contribute to vehicle operating speeds.

There are limitations to this analysis. The before speed data were collected over five years (2013 – 2018) across various sites, while the after speed data were collected during five months (February 2019 – July 2019). Thus, enough time may not have elapsed to fully capture the changes in speed, as drivers may need time to adapt and change behaviors. Seasonality exists in speed and count data, and there was not a reasonable way to account for this in the analysis. The site-level changes show that while the observed average speeds decreased in the after condition at the majority of sites, they did increase at a few sites. Studies have shown that drivers' speed choice is also affected by geometric characteristics of the roadway and driver preferences, not all of which were included in this analysis. Enforcement, education, and awareness campaigns, which can influence user behavior, also take time both for implementation and to observe any changes. The “20 is Plenty” campaign was highly visible and likely contributed to the observed changes but was not explicitly included in the analysis. From a methodological perspective, additional methods can be applied to account for specific data limitations that may improve parameter estimates (e.g., heterogeneity, spatial correlation). Additionally, the speed data can be treated as a panel to determine within- or between-group effects of the speed limit reduction.

REFERENCES

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APPENDIX A – SUMMARY STATISTICS BY SITE

Note Site #13 removed from analysis presented in report body.

Site	Description	Period	Number of Observations	Mean Speed (mi/hr)	Median Speed (mi/hr)	85th Percentile Speed (mi/hr)	Greater Than 25 mi/hr	Greater Than 30 mi/hr	Greater Than 35 mi/hr
1	N Bowdoin Ave, East of Westanna Ave	Before	188	17.44	17	21	3.19%	1.06%	0.00%
		After	301	16.04	16	21	2.33%	0.33%	0.00%
2	N Campbell Ave, South of N Simpson St.	Before	359	20.92	21	26	20.61%	3.06%	0.56%
		After	588	22.10	22	27	23.13%	4.59%	0.51%
3	N Edison St., West of N Charleston Ave	Before	757	16.64	17	22	4.23%	0.79%	0.13%
		After	731	16.01	16	21	3.69%	0.41%	0.00%
4	N Kellog St. North of St. Louis Ave	Before	341	17.03	18	24	7.62%	1.17%	0.00%
		After	469	16.36	17	22	3.62%	0.85%	0.00%
5	N Midway Ave, South of Mears St.	Before	3,112	21.61	22	26	17.32%	1.74%	0.16%
		After	6,030	21.42	22	26	16.43%	2.06%	0.13%
6	N Minnesota Ave, South of Simpson St.	Before	1,479	26.15	26	31	56.66%	19.74%	3.92%
		After	1,710	25.36	25	30	48.89%	13.74%	2.28%
7	N Oregonian Ave, South of Mears St.	Before	1,041	18.32	18	23	5.96%	1.15%	0.19%
		After	728	17.82	18	22	5.49%	0.27%	0.14%
8	N Schofield St., West of Denver Ave	Before	1,170	20.75	21	26	17.44%	2.22%	0.60%
		After	1,839	19.64	20	24	7.67%	0.98%	0.11%
9	N Willamette Blvd., West of Charleston Ave	Before	11,035	24.91	25	29	44.60%	7.97%	0.81%
		After	8,333	21.41	22	26	16.09%	1.88%	0.24%
10	NE 9th Ave, North of Thompson St.	Before	434	23.10	23	26	23.27%	1.84%	0.92%
		After	577	19.78	20	24	7.45%	0.87%	0.17%
11	NE 13th Ave, North of Failing St.	Before	2,277	17.93	18	22	4.70%	0.26%	0.00%
		After	322	18.34	19	23	6.52%	0.00%	0.00%
12	NE 14th Ave, South of Fremont St.	Before	553	18.75	19	23	5.79%	0.36%	0.00%
		After	277	16.92	17	21	2.53%	0.36%	0.00%
~~*13*~~	~~*NE 21st Ave, South of Oregon St.*~~	~~*Before*~~	~~*1,818*~~	~~*25.65*~~	~~*22*~~	~~*38*~~	~~*42.13%*~~	~~*34.38%*~~	~~*21.95%*~~
		~~*After*~~	~~*1,412*~~	~~*17.50*~~	~~*17.5*~~	~~*21*~~	~~*0.85%*~~	~~*0.00%*~~	~~*0.00%*~~
14	NE 37th Ave, North of Broadway	Before	4,184	20.64	21	25	12.55%	1.17%	0.05%
		After	4,681	20.83	21	25	13.69%	1.64%	0.15%
15	NE 52nd Ave, North of Hassalo St.	Before	9,522	19.32	20	24	7.07%	0.53%	0.06%
		After	1,492	18.27	18	22	2.35%	0.00%	0.00%
16	NE 62nd Ave, South of Hancock St.	Before	1,646	21.14	22	26	18.59%	2.25%	0.06%
		After	984	21.65	22	26	17.99%	2.54%	0.10%
17		Before	1,117	17.31	18	22	3.31%	0.09%	0.00%

Site	Description	Period	Number of Observations	Mean Speed (mi/hr)	Median Speed (mi/hr)	85th Percentile Speed (mi/hr)	Greater Than 25 mi/hr	Greater Than 30 mi/hr	Greater Than 35 mi/hr
	NE 74th Ave, North of Fremont St.	After	577	17.41	18	22	3.64%	0.17%	0.00%
18	NE 80th Ave, South of Clackamas St.	Before	755	20.96	21	26	17.22%	3.97%	1.19%
		After	385	22.13	22	27	22.34%	3.90%	0.52%
19	NE 109th Ave, North of Hassalo St.	Before	746	19.98	20	25	14.08%	2.82%	0.00%
		After	497	20.44	20	25	13.88%	2.01%	0.20%
20	NE 114th Ave, South of Schuyler St.	Before	1,072	22.22	22	27	23.60%	4.20%	0.56%
		After	1,250	21.46	22	26	17.92%	2.40%	0.24%
21	NE 117th Ave, North of Eugene St.	Before	1,592	22.93	23	28	27.70%	5.84%	1.44%
		After	905	21.82	22	27	21.77%	3.76%	0.44%
22	NE Ainsworth St. (EB), East of 10th Ave	Before	4,621	29.37	30	34	82.38%	40.75%	7.21%
		After	8,115	26.03	26	30	54.59%	11.79%	1.20%
23	NE Ainsworth St. (WB), East of 10th Ave	Before	4,327	30.12	30	34	86.41%	48.60%	9.43%
		After	7,837	27.19	27	31	67.25%	19.15%	2.45%
24	NE Alberta St., West of 80th Ave	Before	376	19.96	20	26	17.29%	3.46%	0.53%
		After	302	20.74	21	26	15.89%	5.30%	0.99%
25	NE Fremont St., East of 148th Ave	Before	4,981	20.26	20	25	11.18%	1.20%	0.04%
		After	2,100	19.76	19	27	19.52%	3.00%	0.48%
26	NE Graham St., West of Rodney Ave	Before	2,469	19.30	20	24	11.02%	0.81%	0.08%
		After	777	18.01	18	23	3.35%	0.13%	0.13%
27	NE Hancock St., West of 15th Ave	Before	549	17.21	17	21	1.28%	0.00%	0.00%
		After	709	17.76	18	21	0.56%	0.14%	0.00%
28	NE Rosa Parks Way, East of 17th Ave	Before	319	18.03	18	24	7.84%	0.31%	0.00%
		After	232	18.11	18	22	2.16%	0.00%	0.00%
29	NW Kearney St., West of 22nd Ave	Before	2,041	15.23	15	21	2.35%	0.15%	0.00%
		After	1,138	15.76	16	21	2.64%	0.09%	0.00%
30	SE 23rd Ave, South of Reedway St.	Before	446	19.65	20	25	11.66%	2.02%	0.22%
		After	194	19.76	20	24	10.31%	0.52%	0.00%
31	SE 25th Ave, North of Harrison St.	Before	488	18.04	19	23	4.10%	0.61%	0.00%
		After	666	19.25	20	23	4.20%	0.00%	0.00%
32	SE 34th Ave, South of Cora St.	Before	1,493	21.99	21	29	27.53%	13.46%	6.23%
		After	640	21.93	22	26	22.34%	2.34%	0.31%

33	SE 48th Ave, South of Hawthorne Blvd.	Before	828	16.00	16	22	3.86%	0.48%	0.12%
		After	679	16.71	17	22	3.39%	0.44%	0.29%
34	SE 71st Ave, North of Reedway St.	Before	451	18.04	19	22	3.33%	0.22%	0.00%
		After	218	18.22	18	22	2.29%	0.46%	0.00%
35	SE 80th Ave, South of Taylor Ct.	Before	1,611	20.33	21	26	15.83%	1.80%	0.19%
		After	850	19.34	20	24	9.18%	0.82%	0.24%
36	SE 113th Ave, North of Pine St.	Before	1,396	20.75	21	25	11.39%	1.29%	0.00%
		After	2,179	21.02	21	25	11.89%	1.74%	0.32%
37	SE 114th Ave, North of Boise St.	Before	894	19.17	19	25	11.74%	2.68%	0.89%
		After	333	21.61	21	26	19.22%	4.20%	0.90%
38	SE 116th Ave, North of Boise St.	Before	2,805	22.70	23	28	30.45%	5.45%	0.64%
		After	1,366	24.09	24	29	37.41%	9.81%	0.95%
39	SE 125th Ave, North of Clinton Ct.	Before	1,821	19.37	19	25	12.90%	1.81%	0.33%
		After	2,887	19.59	19	25	12.85%	2.53%	0.52%
40	SE 135th Ave, South of Sherman St.	Before	7,364	24.95	25	30	45.55%	13.04%	2.66%
		After	3,146	22.50	23	27	24.73%	4.61%	0.67%
41	SE 141st Ave, North of Woodward St.	Before	1,215	21.15	21	27	22.55%	5.68%	1.15%
		After	682	20.06	20	25	13.34%	2.49%	0.88%
42	SE 168th Ave, South of Alder St.	Before	1,242	21.19	22	26	18.76%	2.09%	0.08%
		After	539	19.95	20	25	12.24%	0.93%	0.00%
43	SE Alder St., East of 82nd Ave	Before	1,754	18.88	19	23	5.70%	0.68%	0.06%
		After	791	17.55	17	21	2.65%	0.38%	0.13%
44	SE Alder St., West of 115th Ave	Before	1,289	19.87	20	25	11.09%	1.71%	0.08%
		After	276	20.84	21	25	13.04%	2.17%	0.36%
45	SE Brooklyn St., East of 21st Ave	Before	730	18.97	20	24	7.26%	1.23%	0.27%
		After	838	19.15	19	23	4.89%	0.48%	0.00%
46	SE Cora St., East of 138th Ave	Before	437	20.34	20	25	14.65%	2.29%	0.46%
		After	249	20.89	21	26	16.47%	3.61%	0.40%
47	SE Francis St., East of 33rd Ave	Before	2,758	21.40	21	26	18.06%	3.23%	0.18%
		After	1,618	21.02	21	25	15.02%	1.42%	0.31%
48	SE Franklin St., East of 26th Ave	Before	2,104	17.49	18	24	8.17%	0.95%	0.05%
		After	1,027	18.46	19	24	9.25%	1.17%	0.29%
49	SE Maple Ave, South of Hawthorne Blvd.	Before	1,063	15.62	15	20	1.79%	0.09%	0.00%
		After	345	15.42	15	20	0.87%	0.00%	0.00%
50	SE Morrison St., West of 36th Ave	Before	1,477	19.50	20	24	6.70%	0.34%	0.00%
		After	366	18.32	19	23	6.01%	0.55%	0.00%
51	SE Pine St., East of 12th Ave	Before	971	20.62	21	25	13.70%	1.54%	0.21%
		After	709	17.73	18	22	2.12%	0.14%	0.14%
52	SE Reynolds St., East of 12th Ave	Before	611	17.87	18	23	6.06%	0.65%	0.00%
		After	348	17.99	18	22	2.01%	0.00%	0.00%
53	SE Yamhill St., West of 90th Ave	Before	1,665	23.57	24	28	33.21%	6.49%	0.72%
		After	840	21.95	22	26	19.88%	2.74%	0.12%

54	SE 39th Dr., South of Lee St.	Before	1,097	28.07	28	33	70.46%	31.91%	6.65%
		After	856	24.69	25	30	44.04%	10.63%	0.93%
55	SW Davenport St., East of Robins Crest Dr.	Before	1,263	24.03	24	29	40.70%	7.05%	0.71%
		After	488	23.09	24	28	33.81%	5.33%	0.00%
56	SW Kingston Ave, South of SW Tichner Dr.	Before	19,551	20.40	21	25	11.93%	1.03%	0.07%
		After	3,067	19.93	20	23	4.63%	0.07%	0.00%
57	SW Ridge Dr., South of Evelyn St.	Before	5,129	22.93	23	28	31.20%	5.44%	0.58%
		After	452	20.70	21	25	12.17%	1.33%	0.00%
58	SW Troy St., East of 27th Ave	Before	1,597	23.49	24	27	30.81%	4.01%	0.50%
		After	1,546	22.34	22	26	20.50%	1.68%	0.13%
59	SW Twombly Ave, West of Hamilton St.	Before	2,839	19.49	20	24	7.54%	0.53%	0.04%
		After	687	20.46	21	25	10.19%	0.58%	0.00%

APPENDIX B – SPEED DISTRIBUTION PLOTS

This Appendix presents speed distribution plots by site for both before and after periods. Overall, the collected speed data appears to have reasonable distributions except for NE 21st Ave (South of Oregon St.) which was removed from the analysis. See Figure D.25.

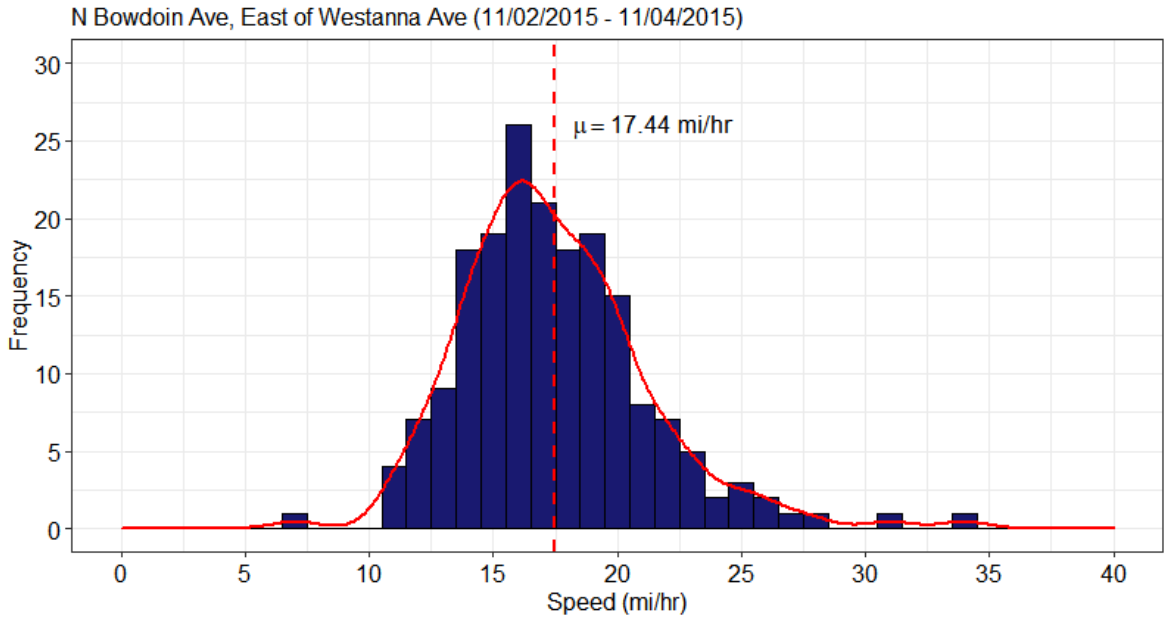

Figure B.1: Speed Distribution at N Bowdoin Ave (East of Westanna) Before Speed Reduction

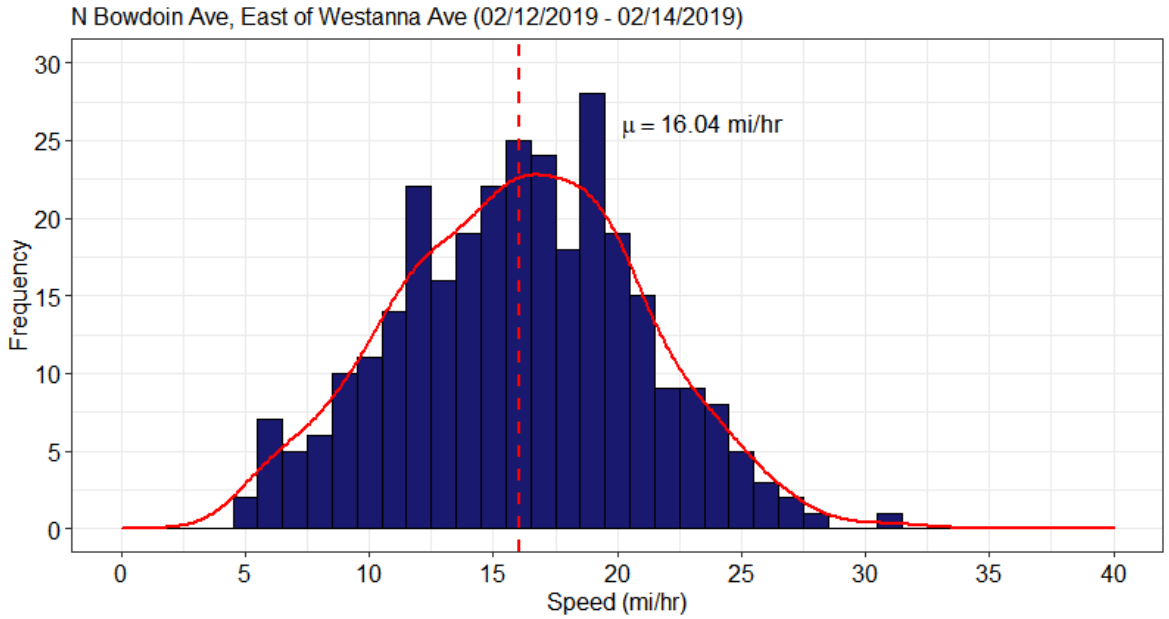

Figure B.2: Speed Distribution at N Bowdoin Ave (East of Westanna) After Speed Reduction

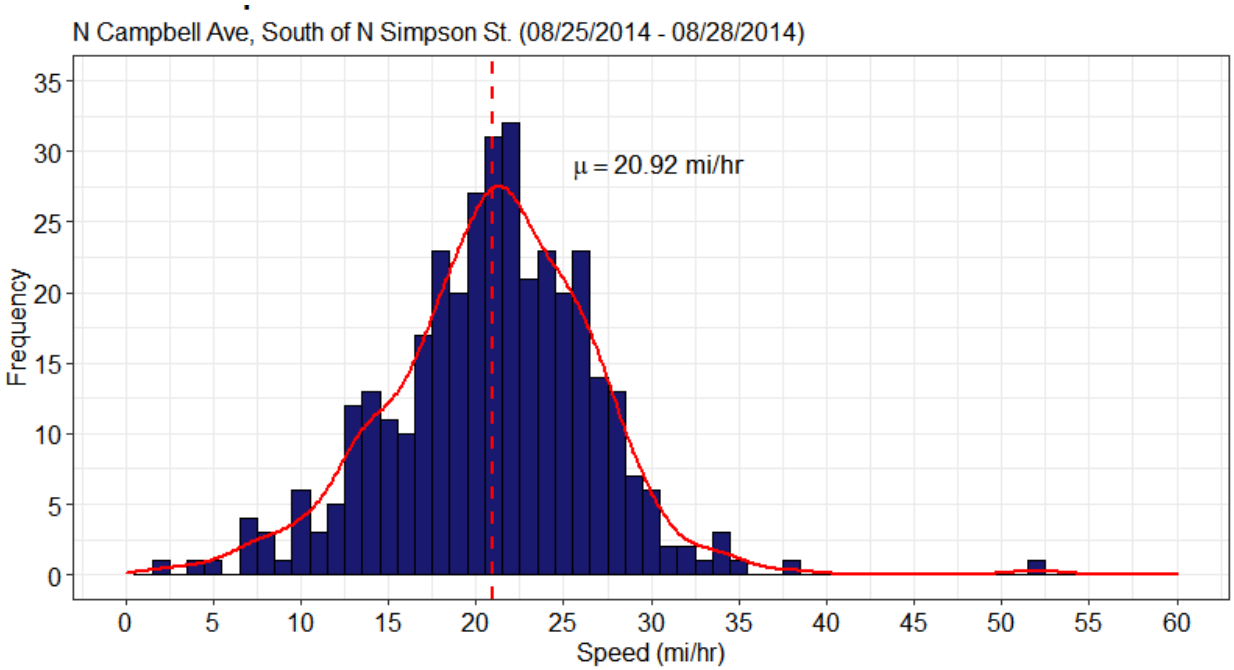

Figure B.3: Speed Distribution at N Campbell Ave (South of N Simpson St.) Before Speed Reduction

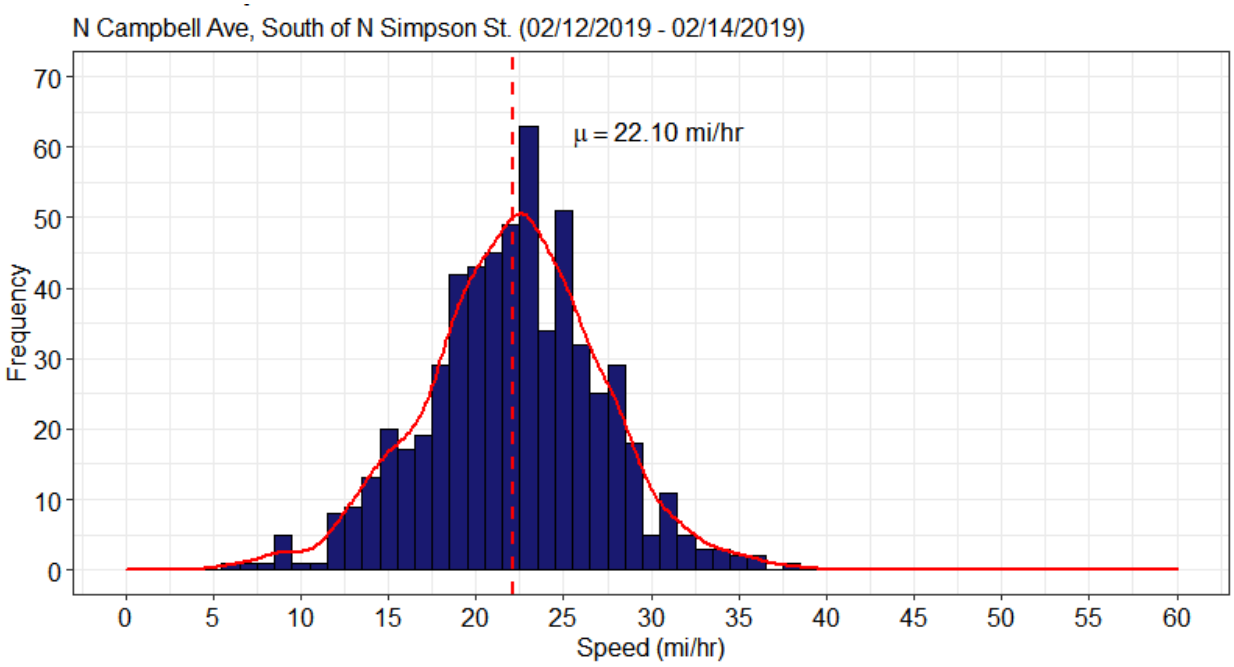

Figure B.4: Speed Distribution at N Campbell Ave (South of N Simpson St.) After Speed Reduction

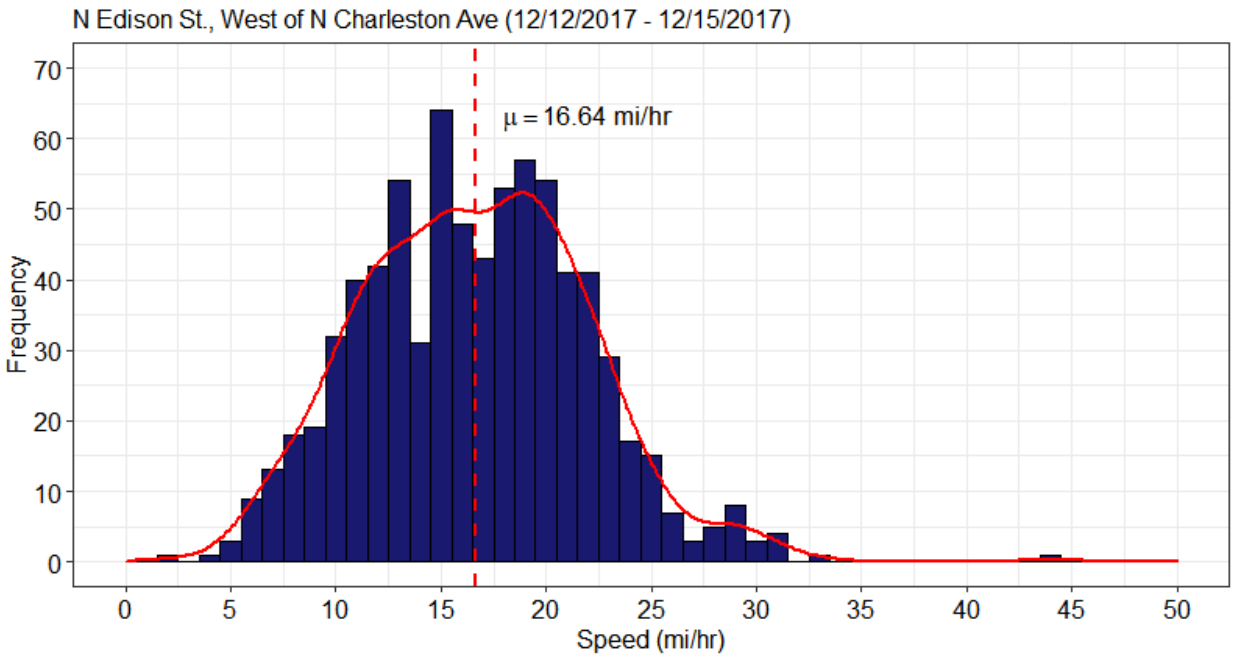

Figure B.5: Speed Distribution at N Edison St. (West of N Charleston Ave) Before Speed Reduction

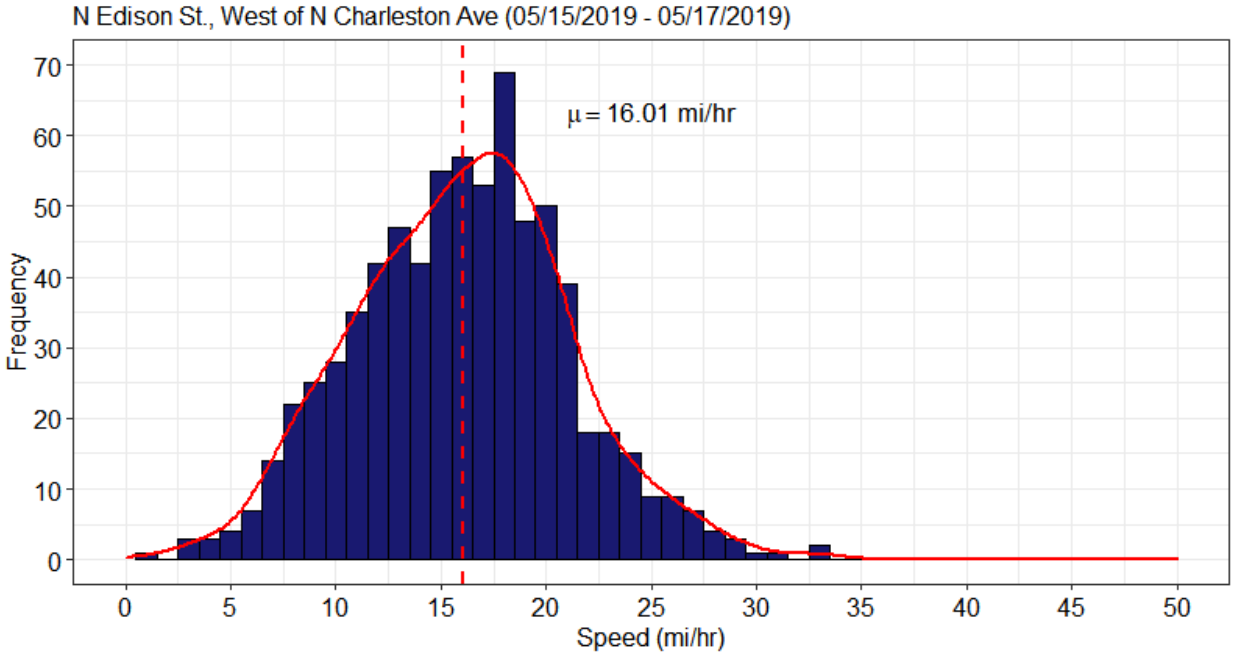

Figure B.6: Speed Distribution at N Edison St. (West of N Charleston Ave) After Speed Reduction

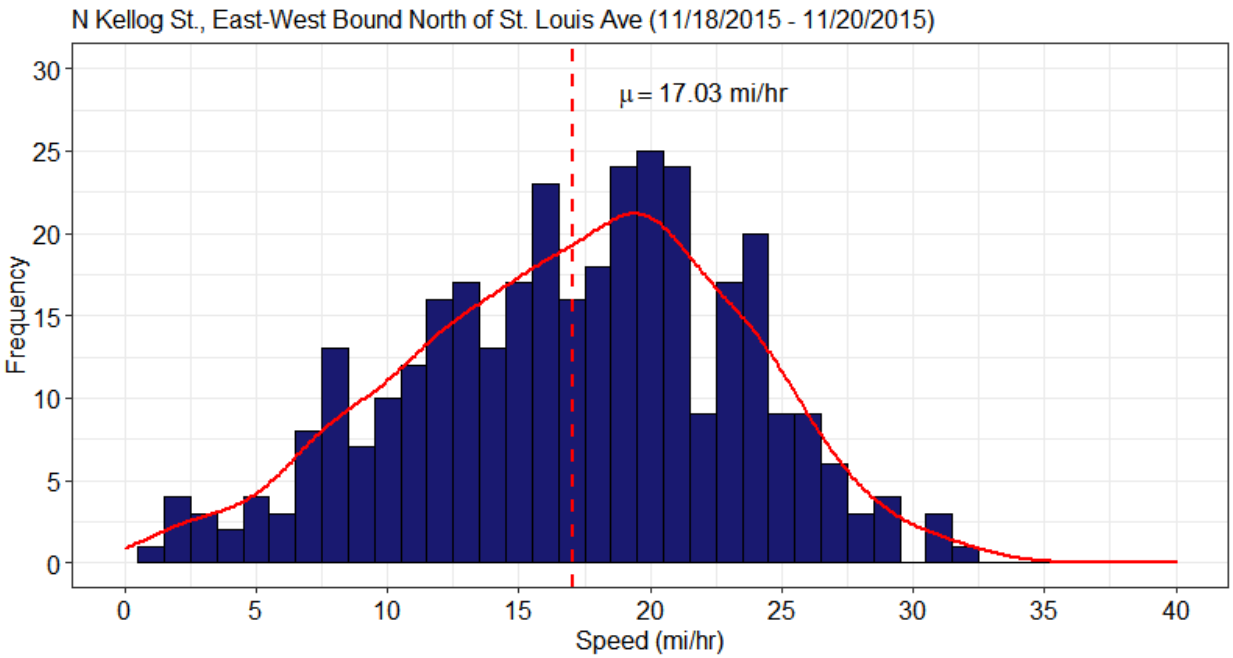

Figure B.7: Speed Distribution at N Kellog St. North of St. Louis Ave Before Speed Reduction

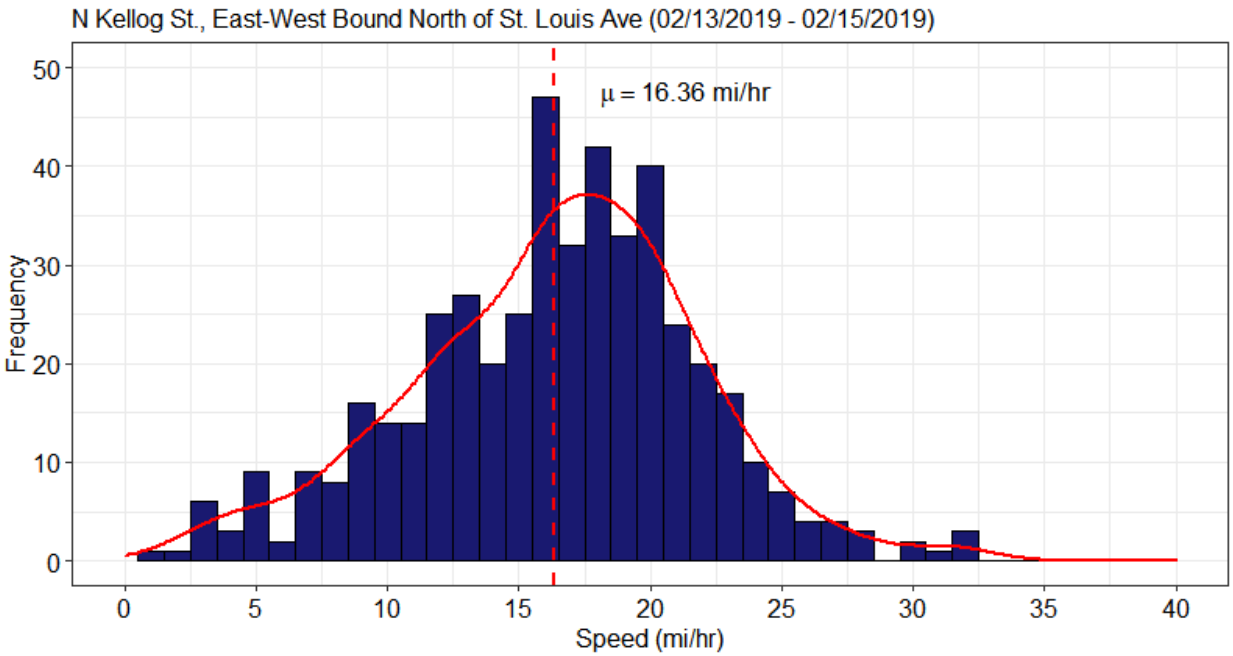

Figure B.8: Speed Distribution at N Kellog St. North of St. Louis Ave After Speed Reduction

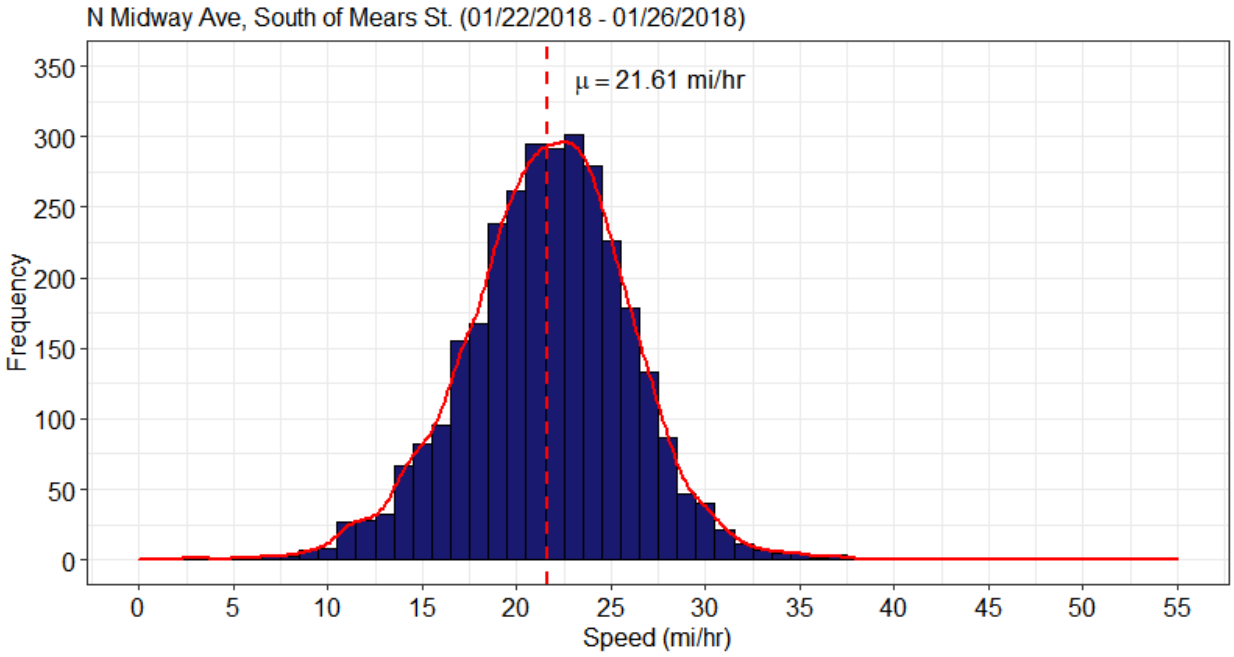

Figure B.9: Speed Distribution at N Midway Ave (South of Mears St.) Before Speed Reduction

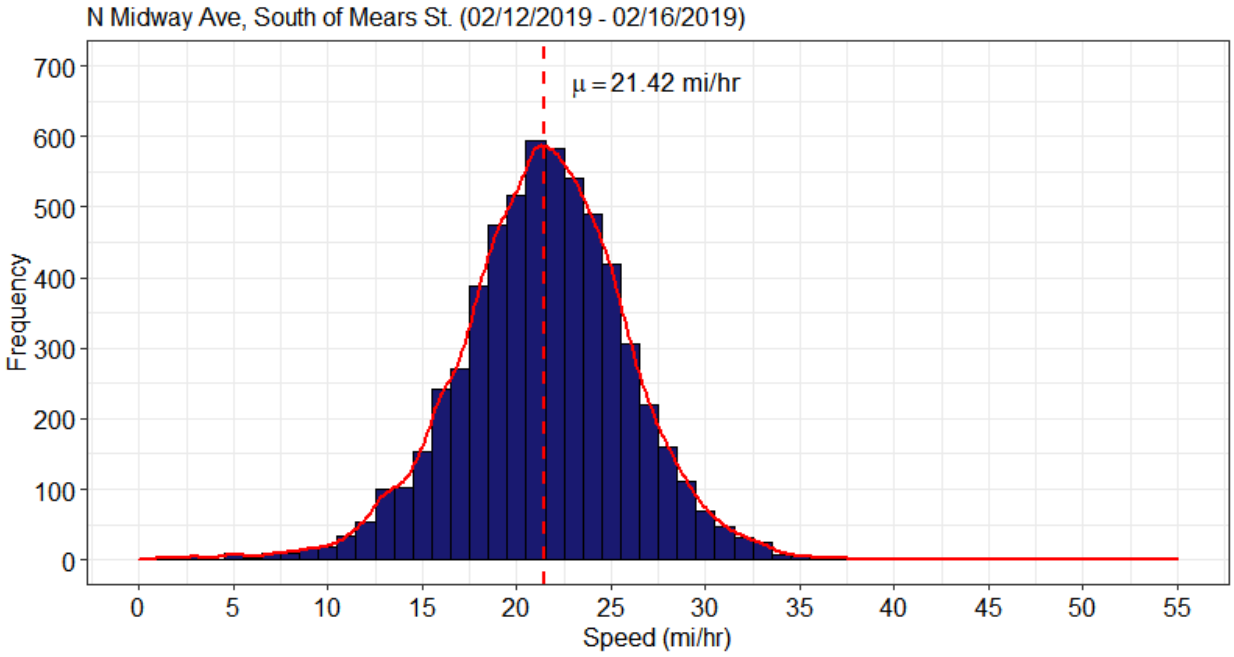

Figure B.10: Speed Distribution at N Midway Ave (South of Mears St.) After Speed Reduction

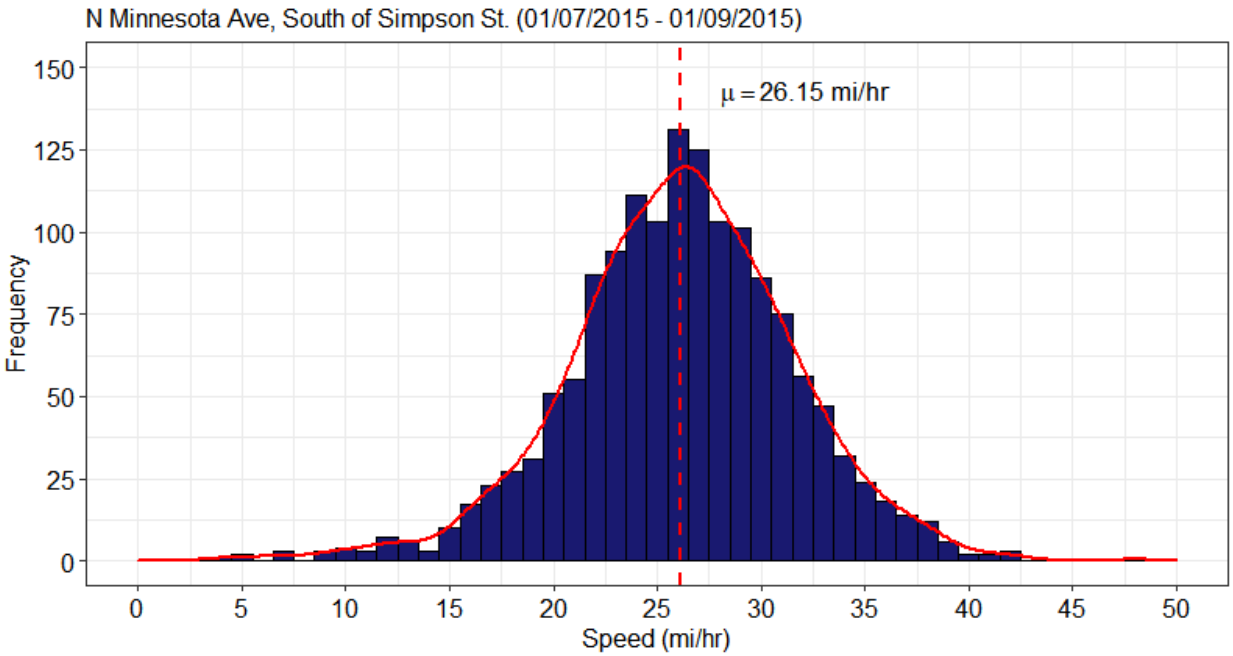

Figure B.11: Speed Distribution at N Minnesota Ave (South of Simpson St.) Before Speed Reduction

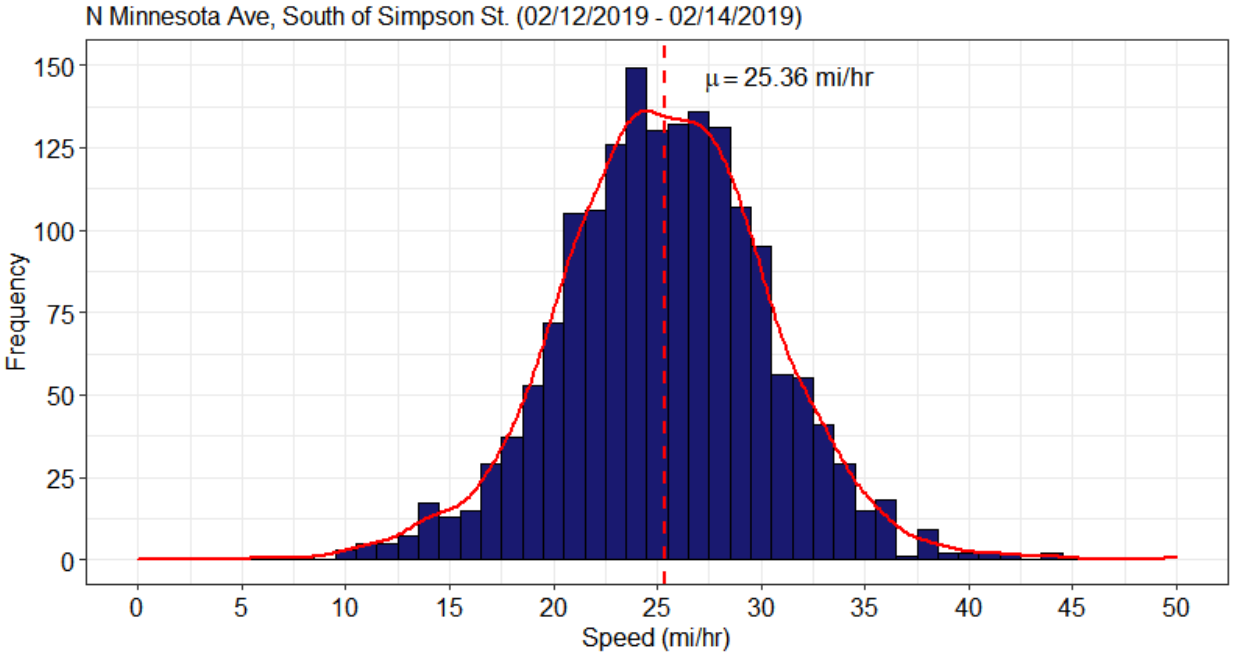

Figure B.12: Speed Distribution at N Minnesota Ave (South of Simpson St.) After Speed Reduction

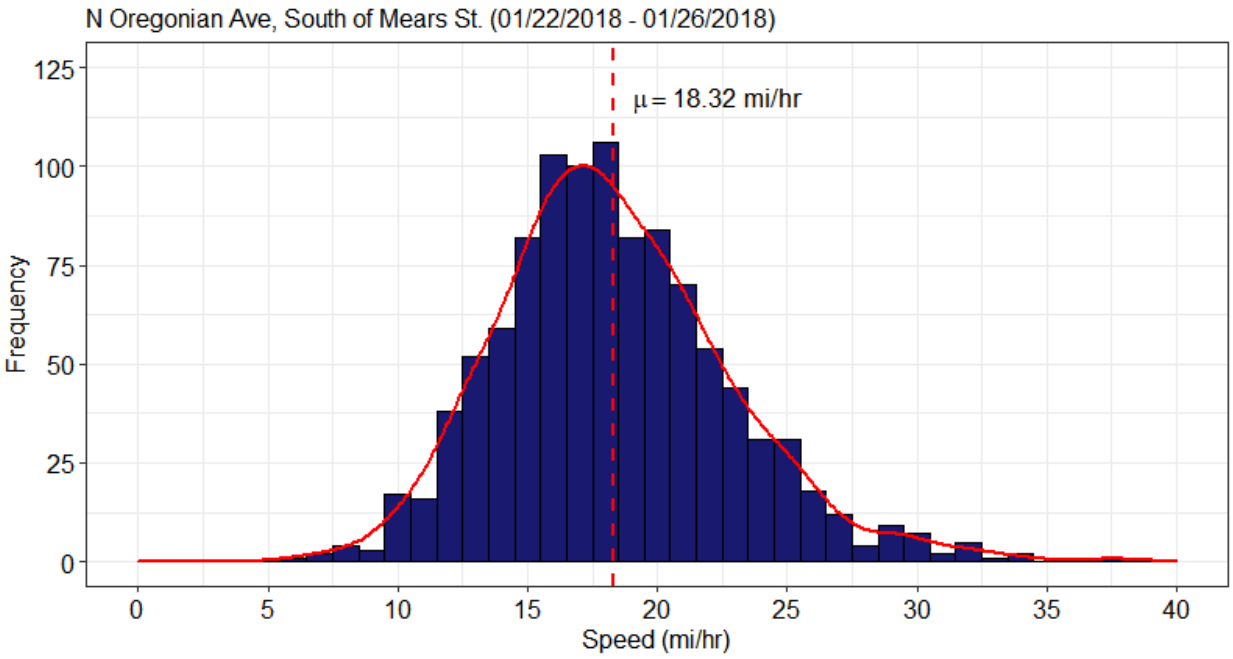

Figure B.13: Speed Distribution at N Oregonian Ave (South of Mears St.) Before Speed Reduction

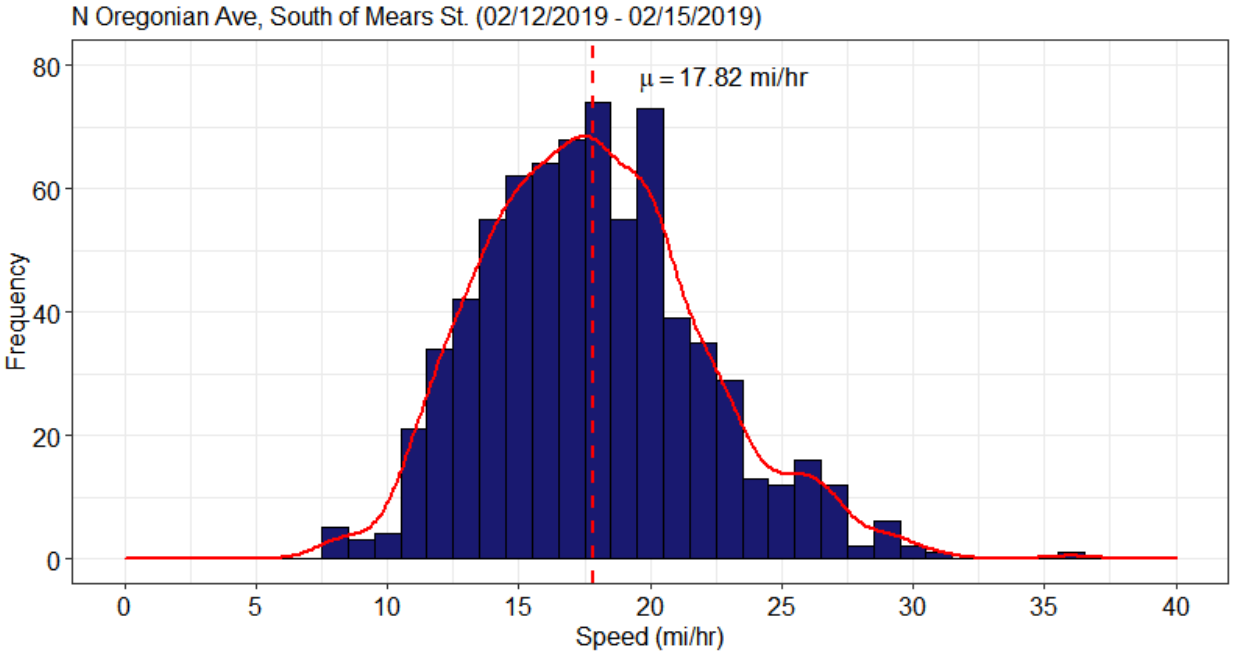

Figure B.14: Speed Distribution at N Oregonian Ave (South of Mears St.) After Speed Reduction

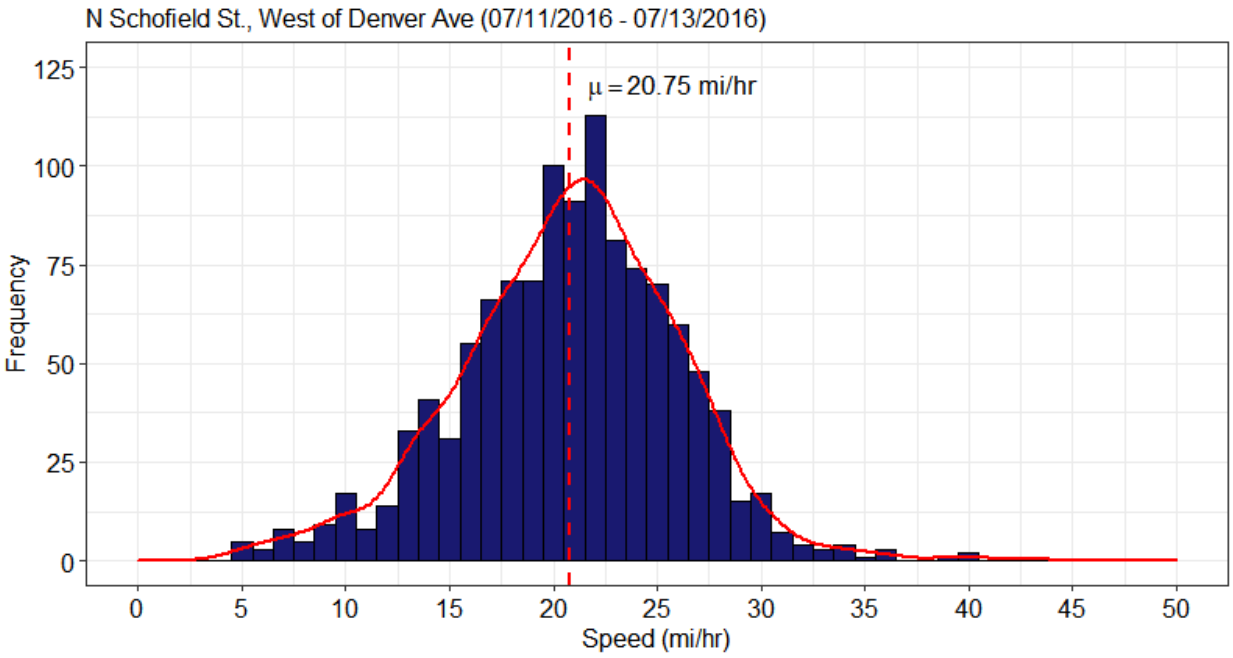

Figure B.15: Speed Distribution at N Schofield St. (West of Denver Ave) Before Speed Reduction

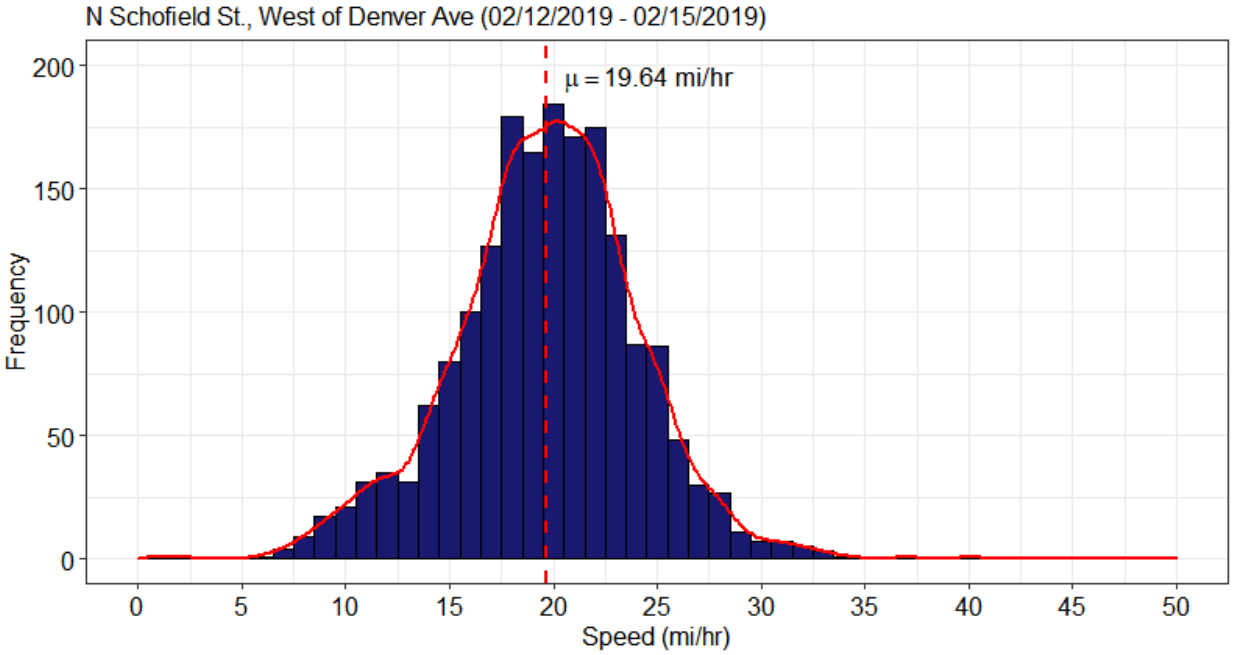

Figure B.16: Speed Distribution at N Schofield St. (West of Denver Ave) After Speed Reduction

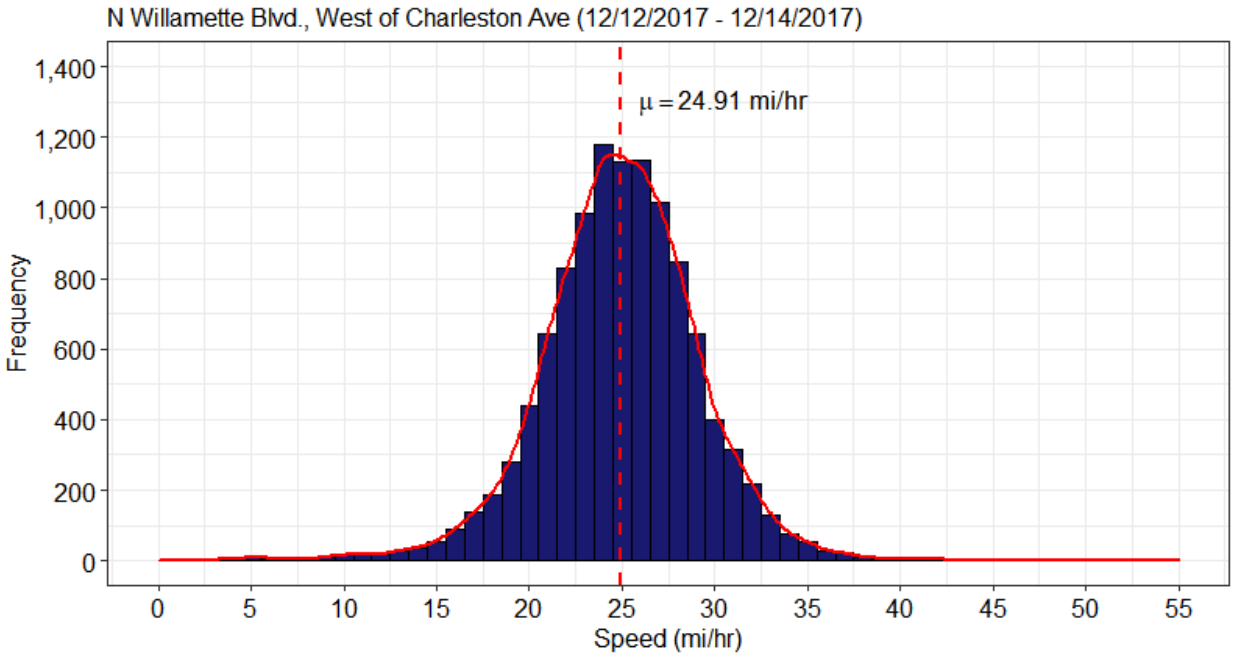

Figure B.17: Speed Distribution at N Willamette Blvd. (West of Charleston Ave) Before Speed Reduction

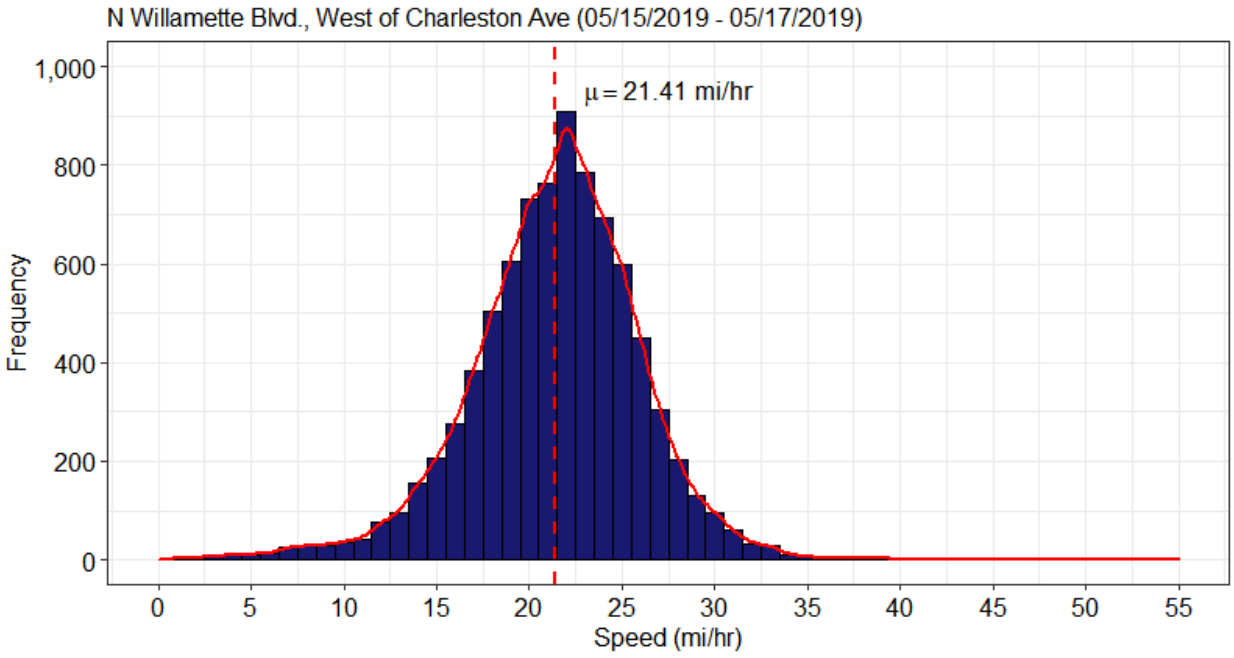

Figure B.18: Speed Distribution at N Willamette Blvd. (West of Charleston Ave) After Speed Reduction

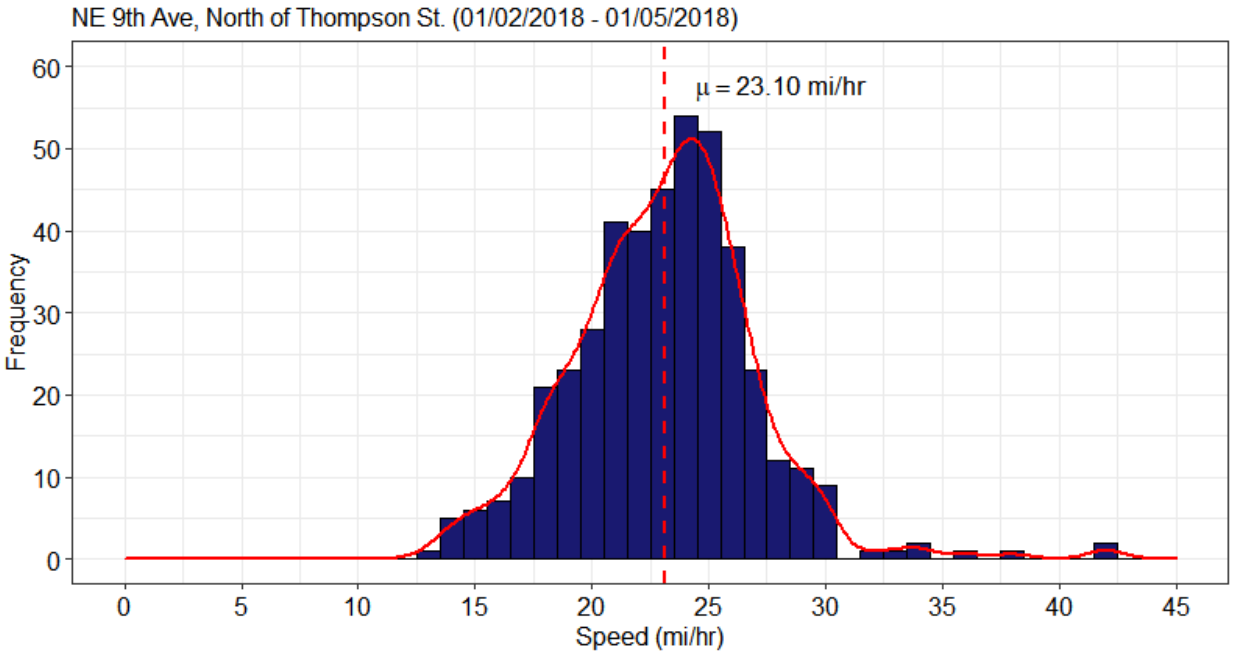

Figure B.19: Speed Distribution at NE 9th Ave (North of Thompson St.) Before Speed Reduction

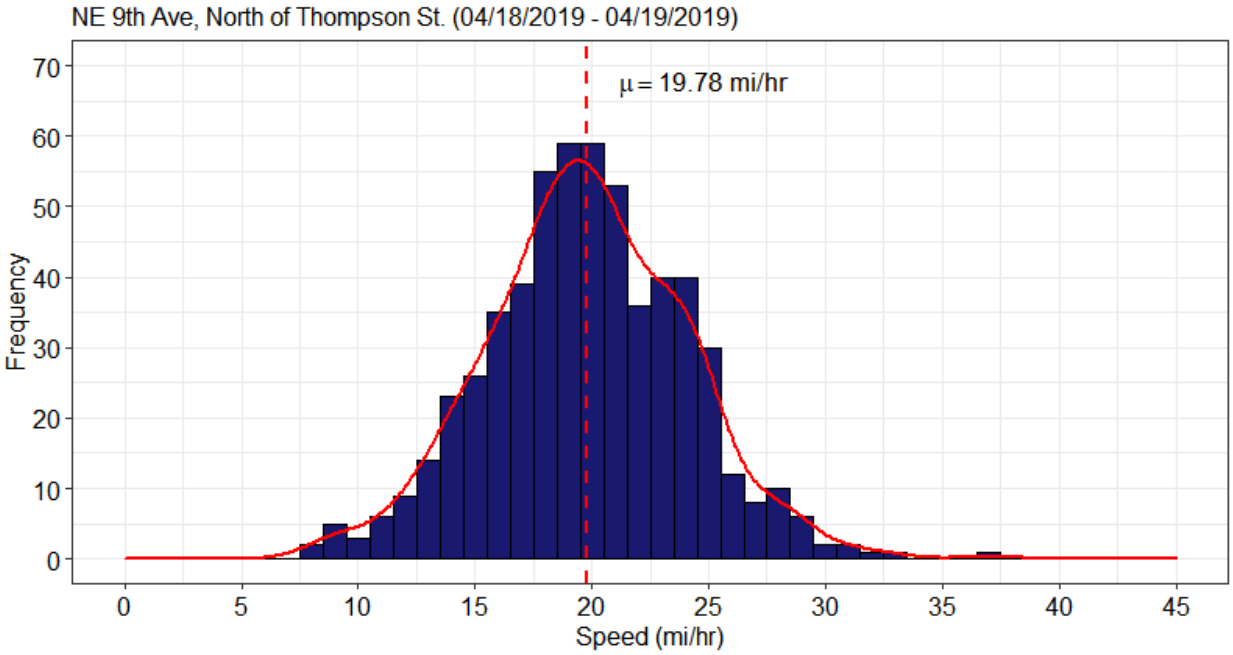

Figure B.20: Speed Distribution at NE 9th Ave (North of Thompson St.) After Speed Reduction

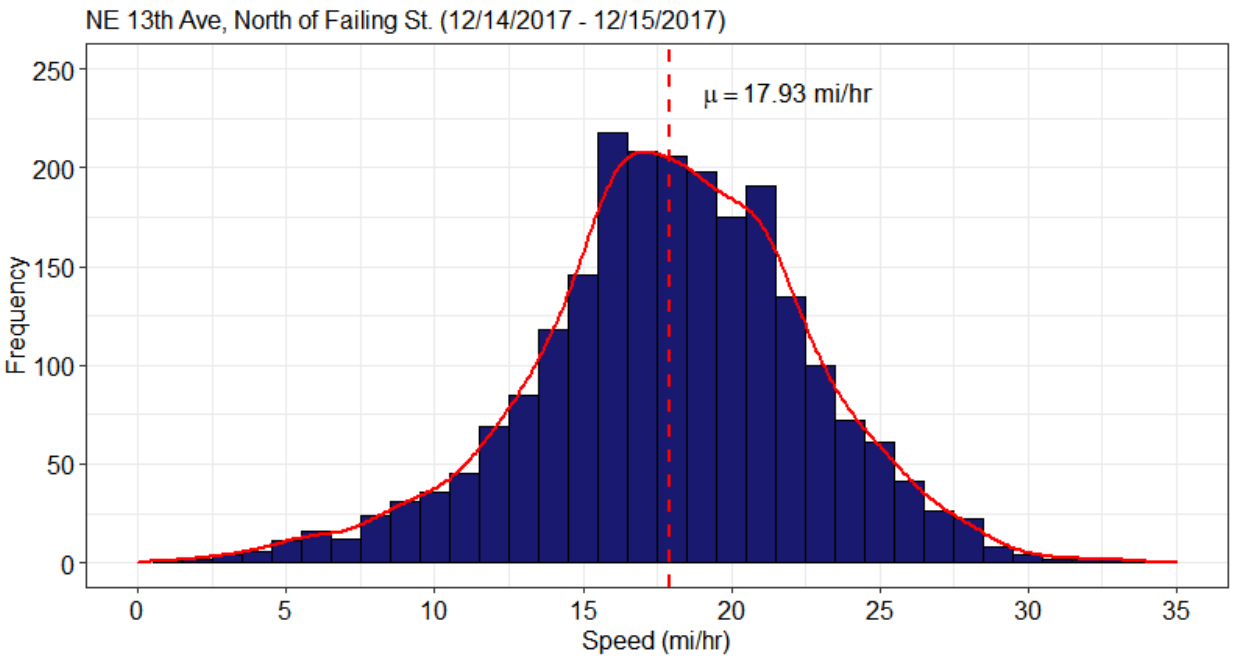

Figure B.21: Speed Distribution at NE 13th Ave (North of Failing St.) Before Speed Reduction

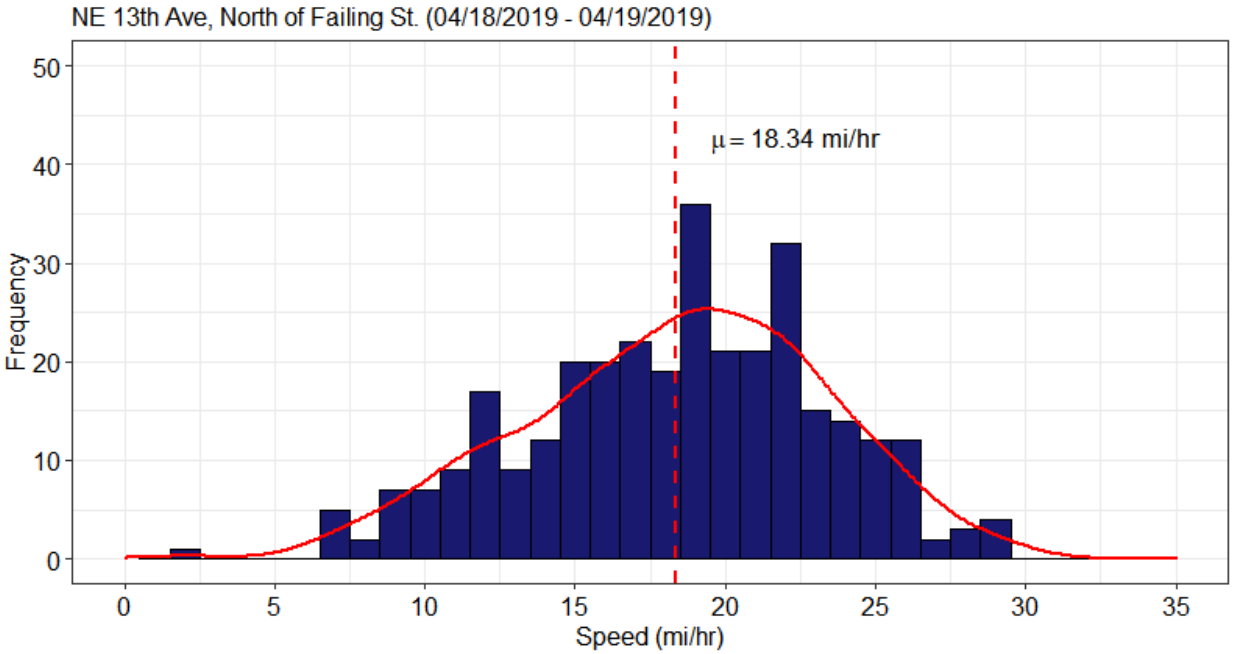

Figure B.22: Speed Distribution at NE 13th Ave (North of Failing St.) After Speed Reduction

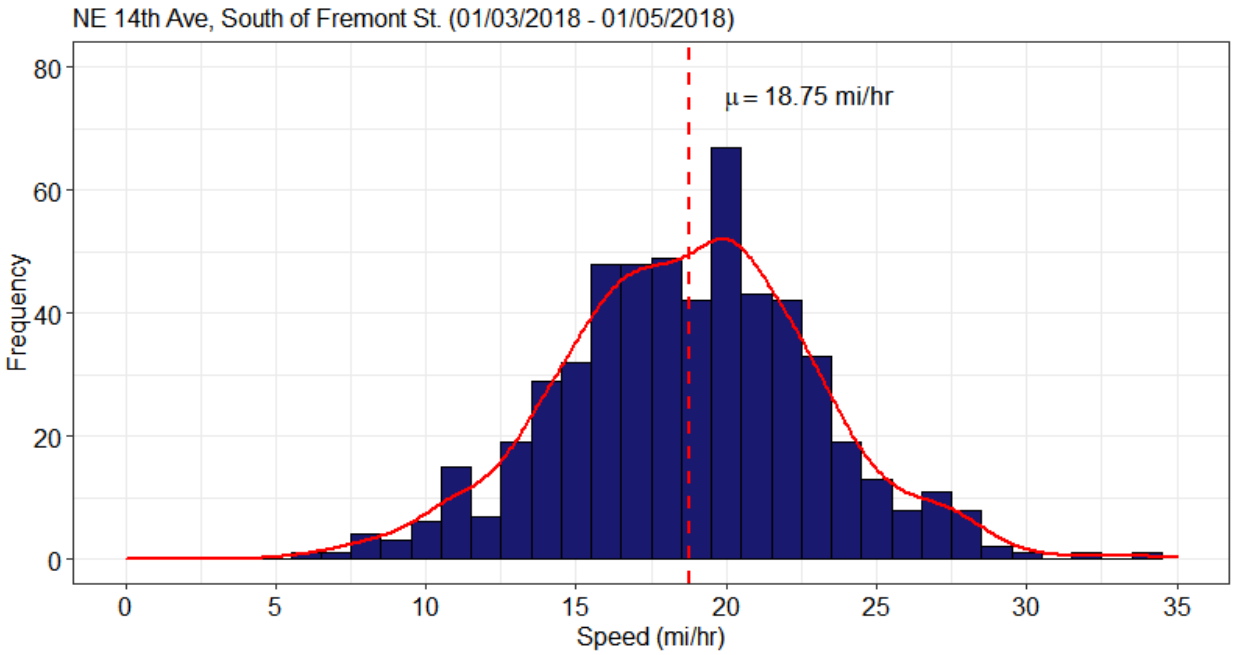

Figure B.23: Speed Distribution at NE 14th Ave (South of Fremont St.) Before Speed Reduction

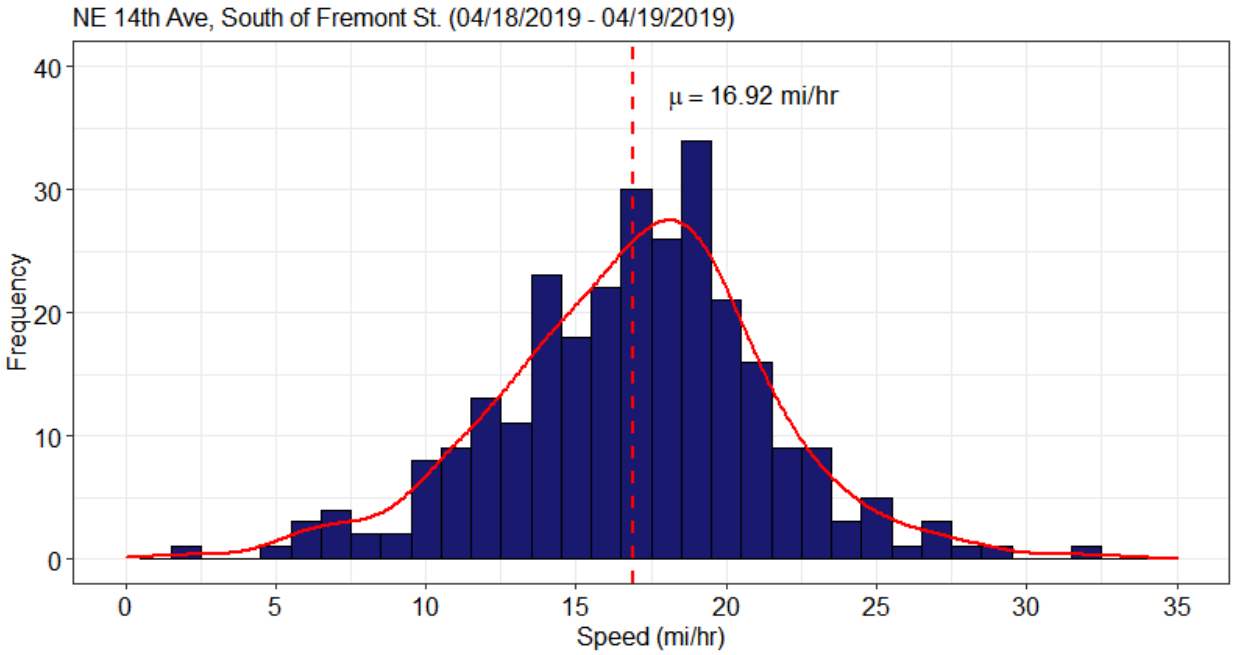

Figure B.24: Speed Distribution at NE 14th Ave (South of Fremont St.) After Speed Reduction

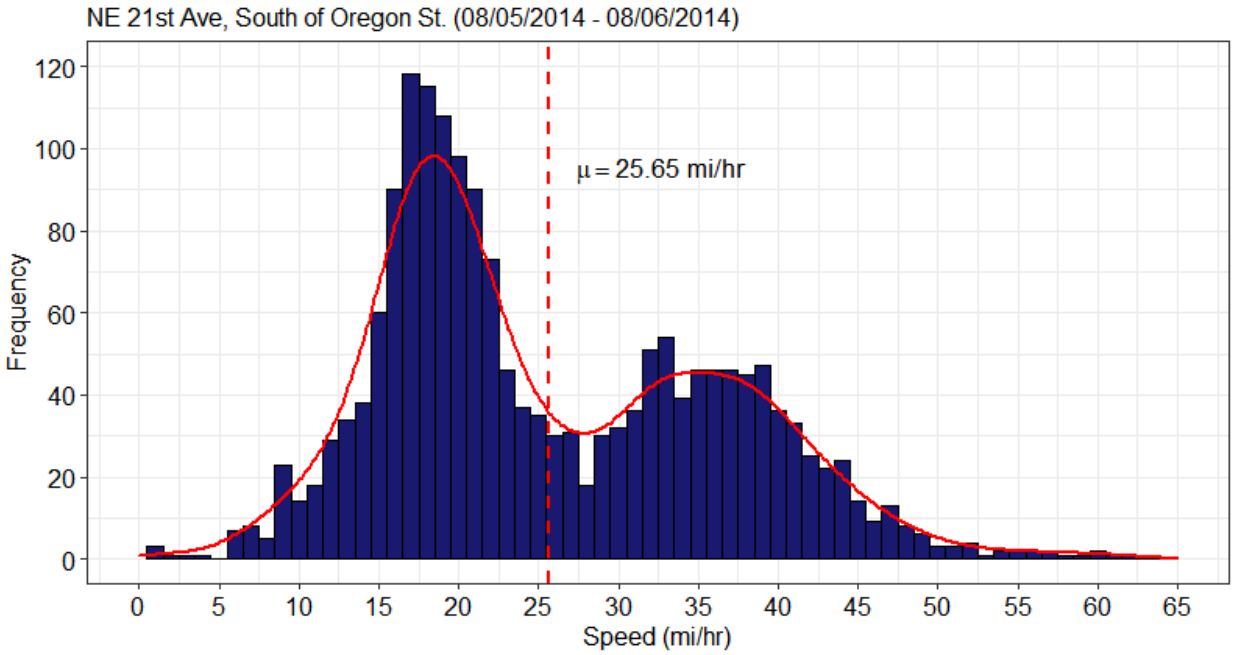

Figure B.25: Speed Distribution at NE 21st Ave (South of Oregon St.) Before Speed Reduction

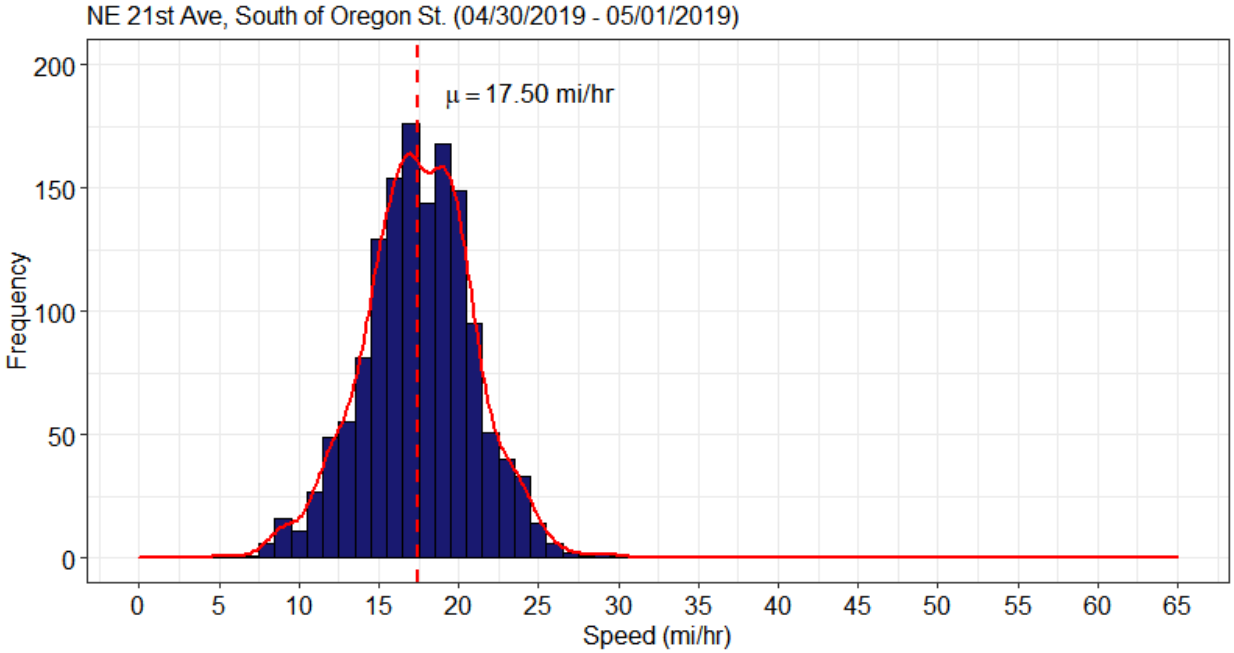

Figure B.26: Speed Distribution at NE 21st Ave (South of Oregon St.) After Speed Reduction

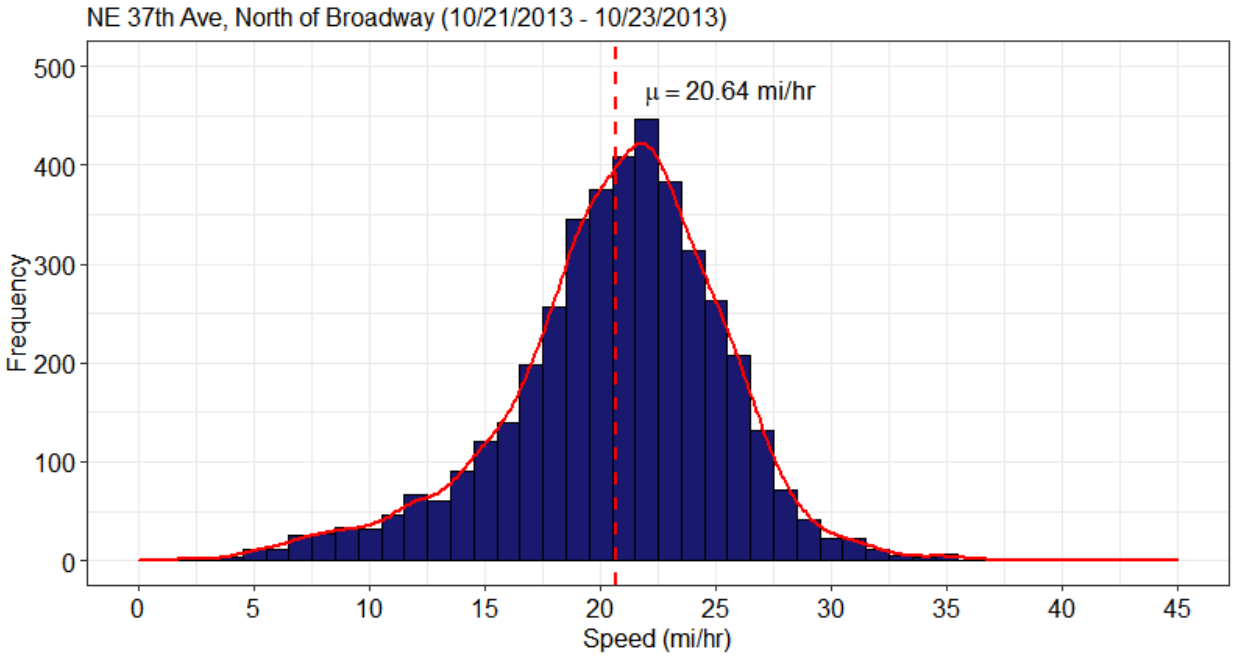

Figure B.27: Speed Distribution at NE 37th Ave (North of Broadway) Before Speed Reduction

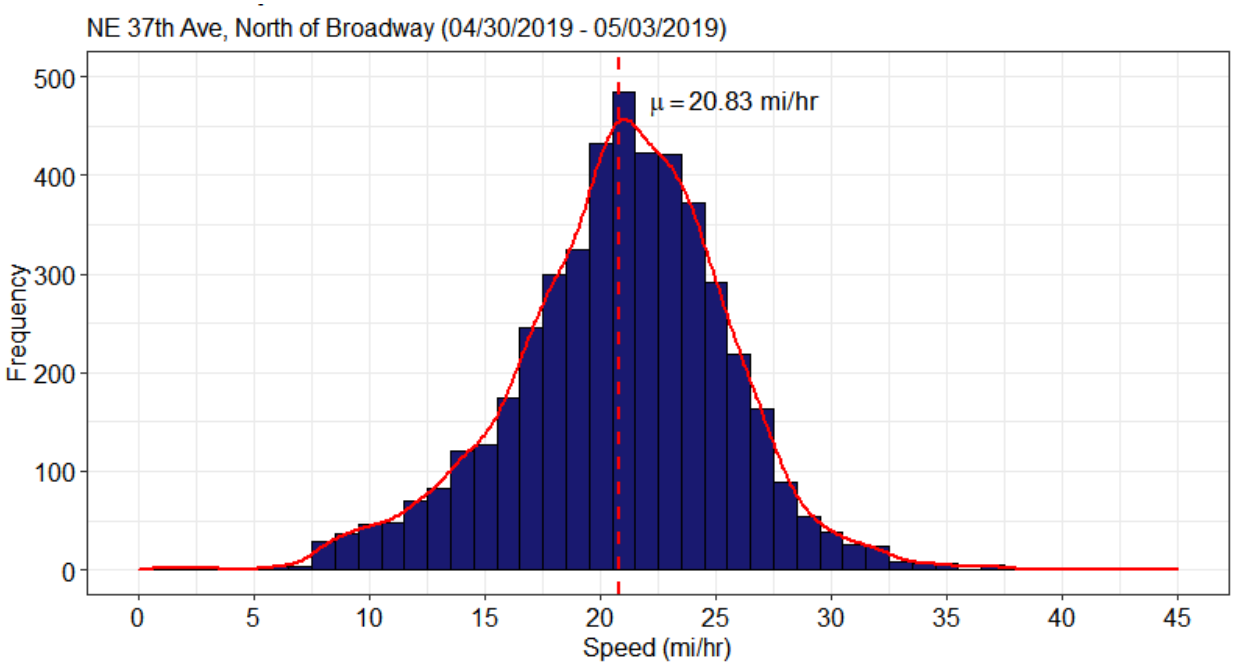

Figure B.28: Speed Distribution at NE 37th Ave (North of Broadway) After Speed Reduction

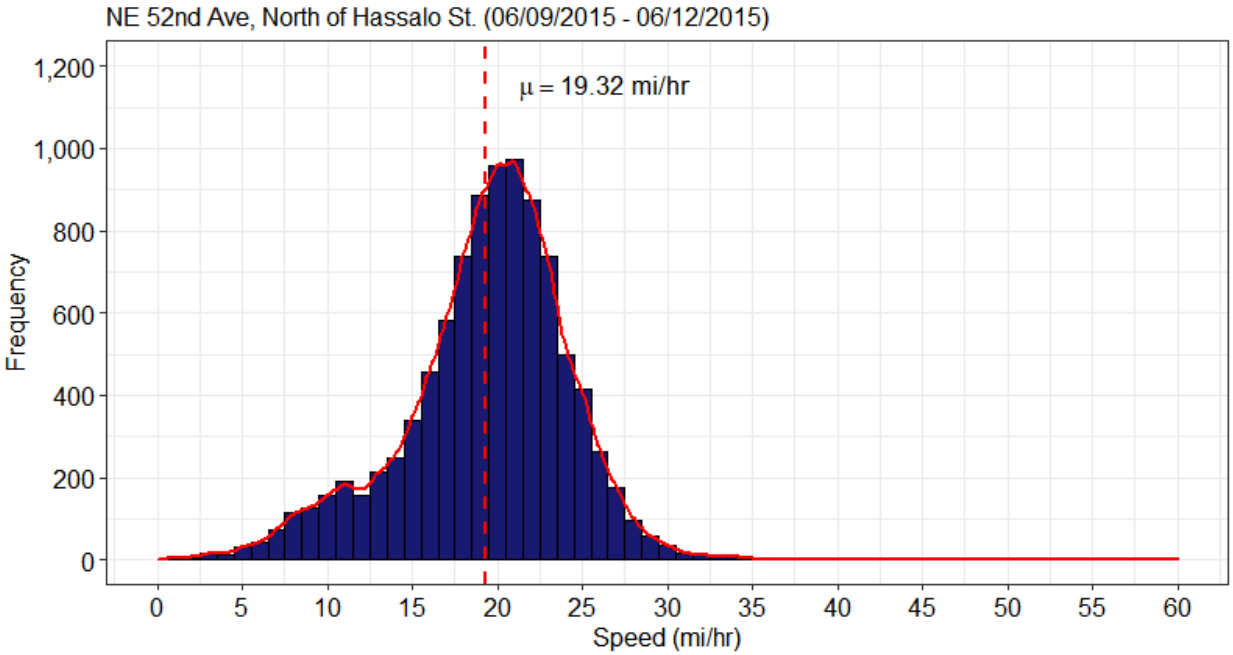

Figure B.29: Speed Distribution at NE 52nd Ave (North of Hassalo St.) Before Speed Reduction

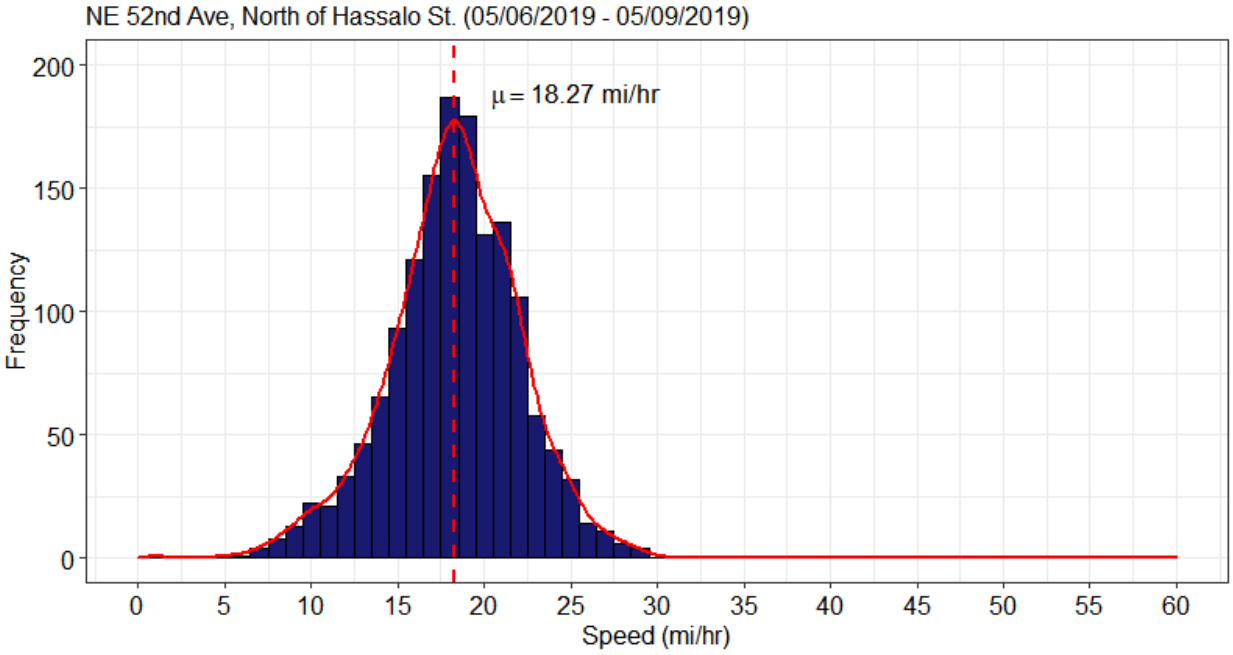

Figure B.30: Speed Distribution at NE 52nd Ave (North of Hassalo St.) After Speed Reduction

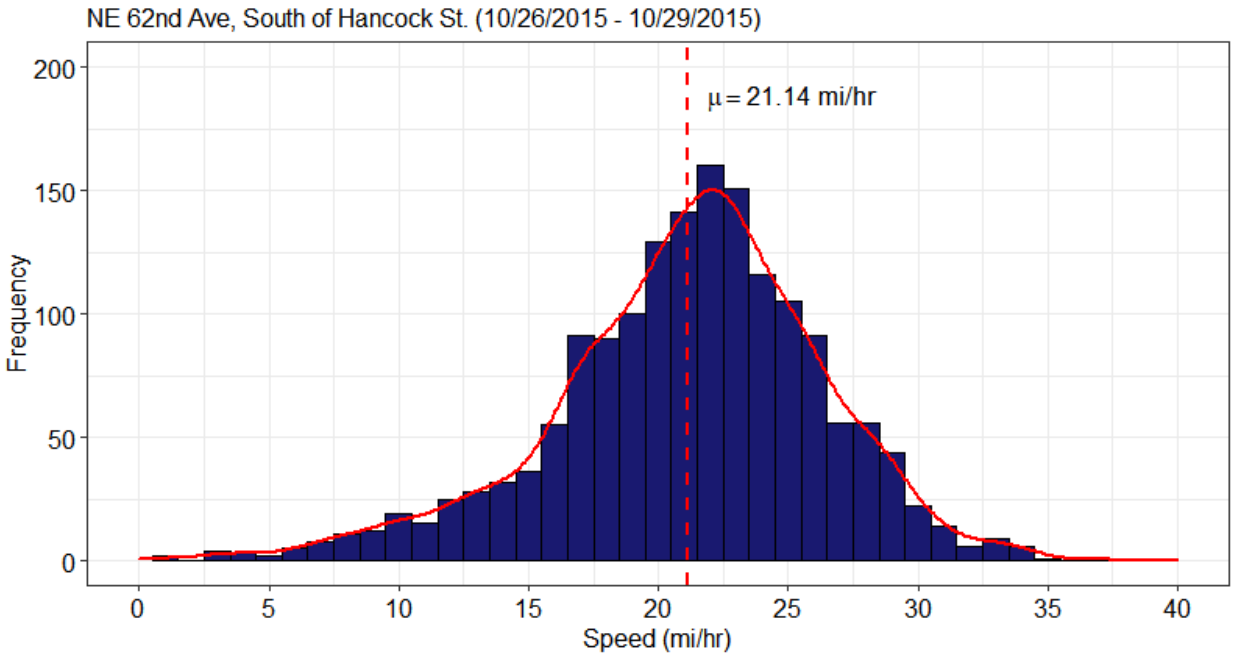

Figure B.31: Speed Distribution at NE 62nd Ave (South of Hancock St.) Before Speed Reduction

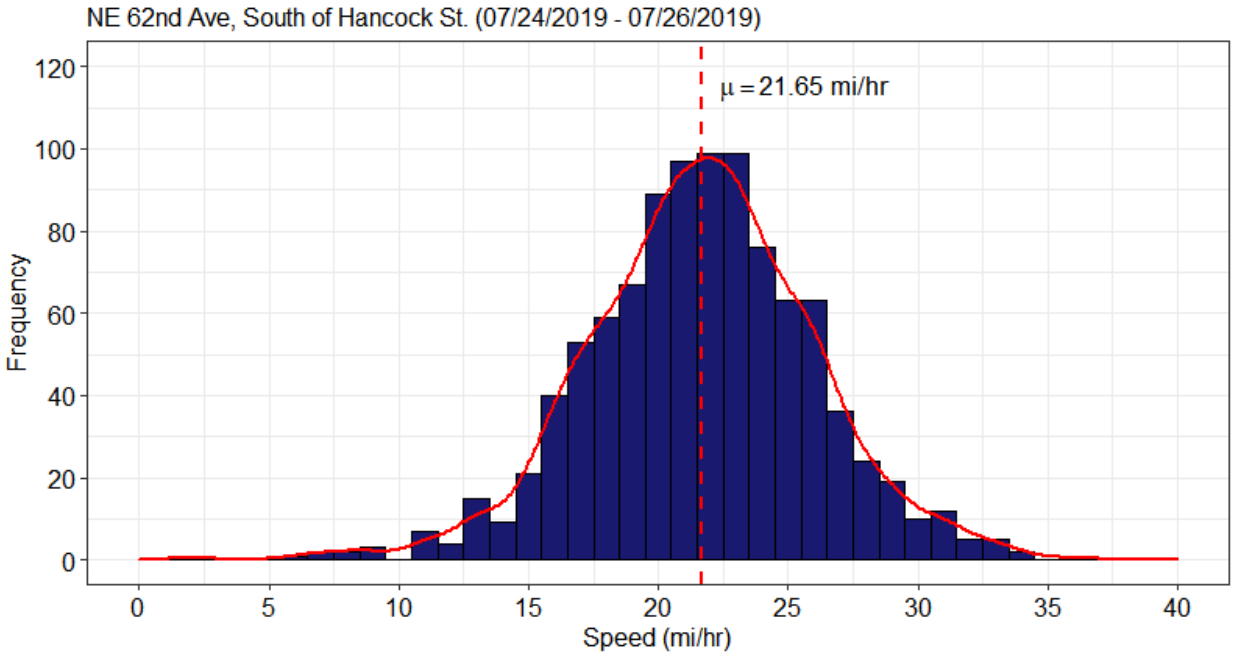

Figure B.32: Speed Distribution at NE 62nd Ave (South of Hancock St.) After Speed Reduction

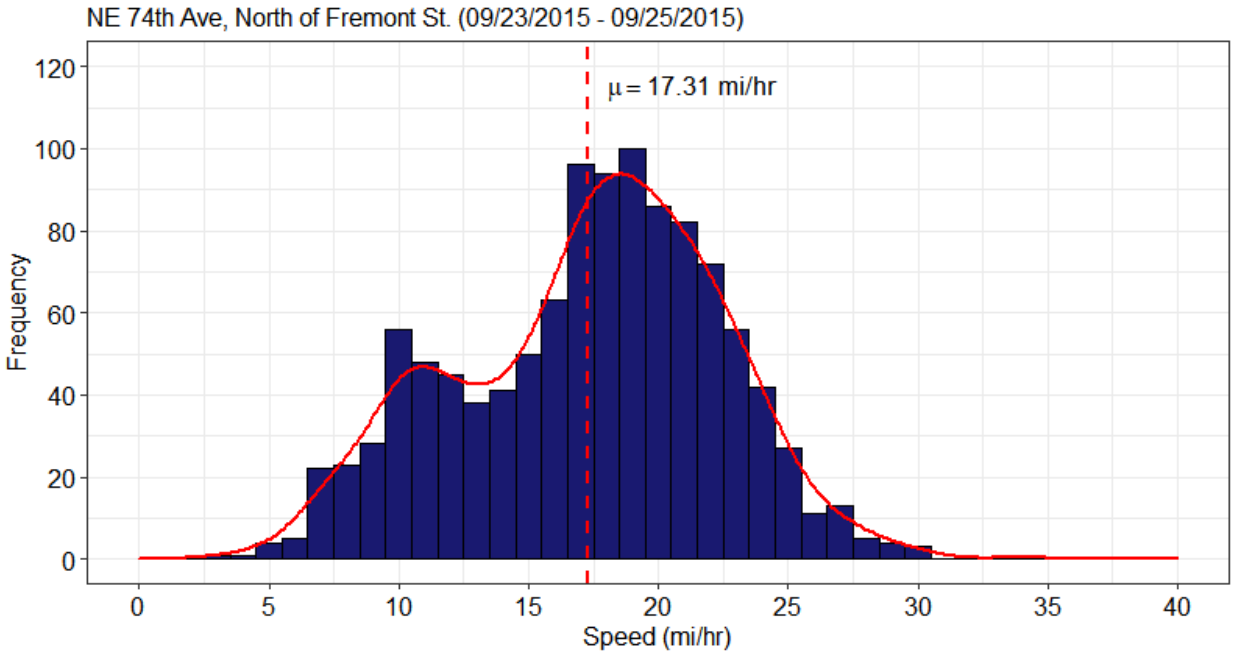

Figure B.33: Speed Distribution at NE 74th Ave (North of Fremont St.) Before Speed Reduction

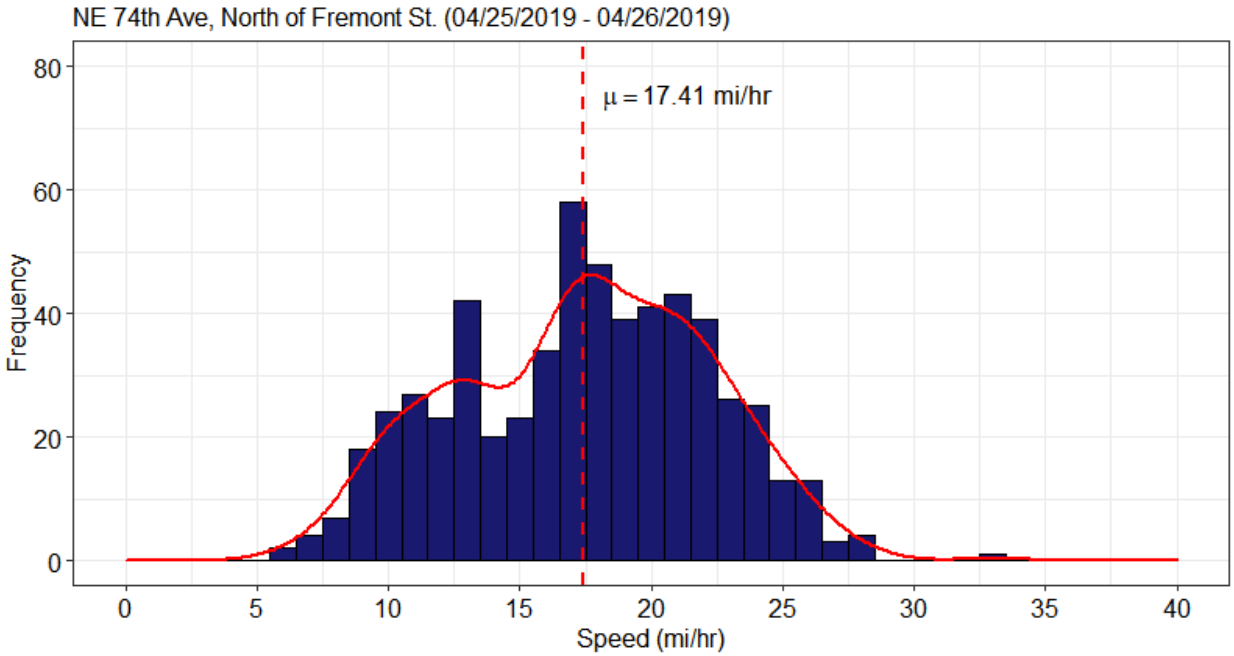

Figure B.34: Speed Distribution at NE 74th Ave (North of Fremont St.) After Speed Reduction

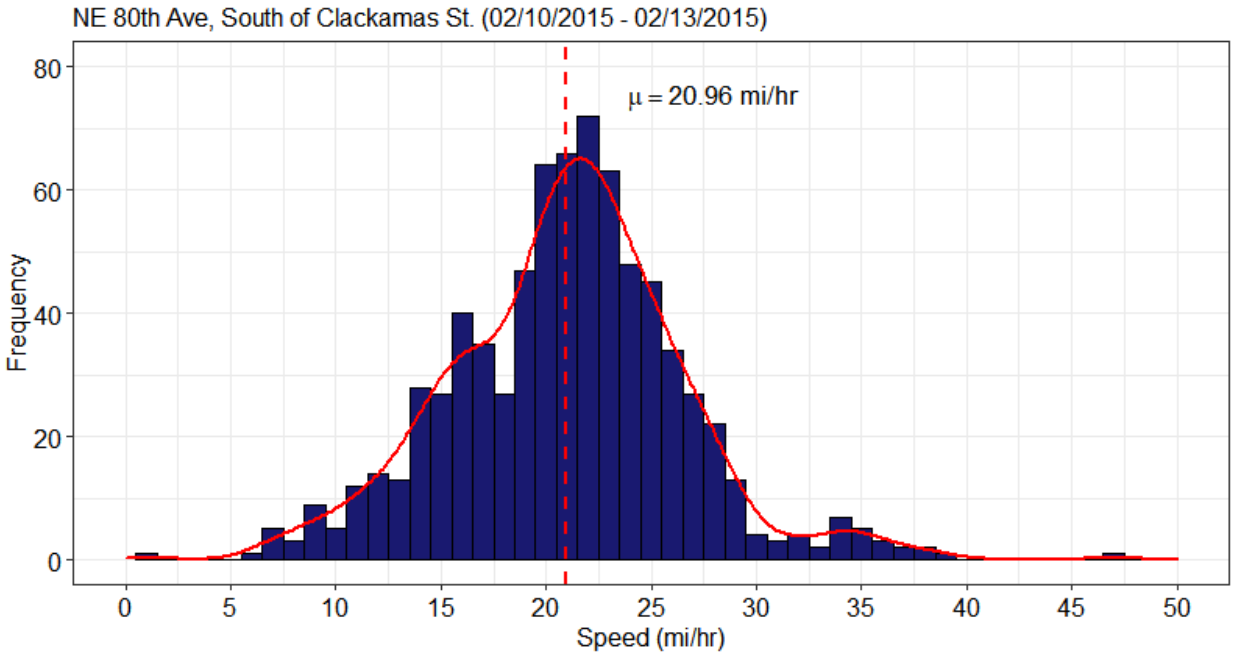

Figure B.35: Speed Distribution at NE 80th Ave (South of Clackamas St.) Before Speed Reduction

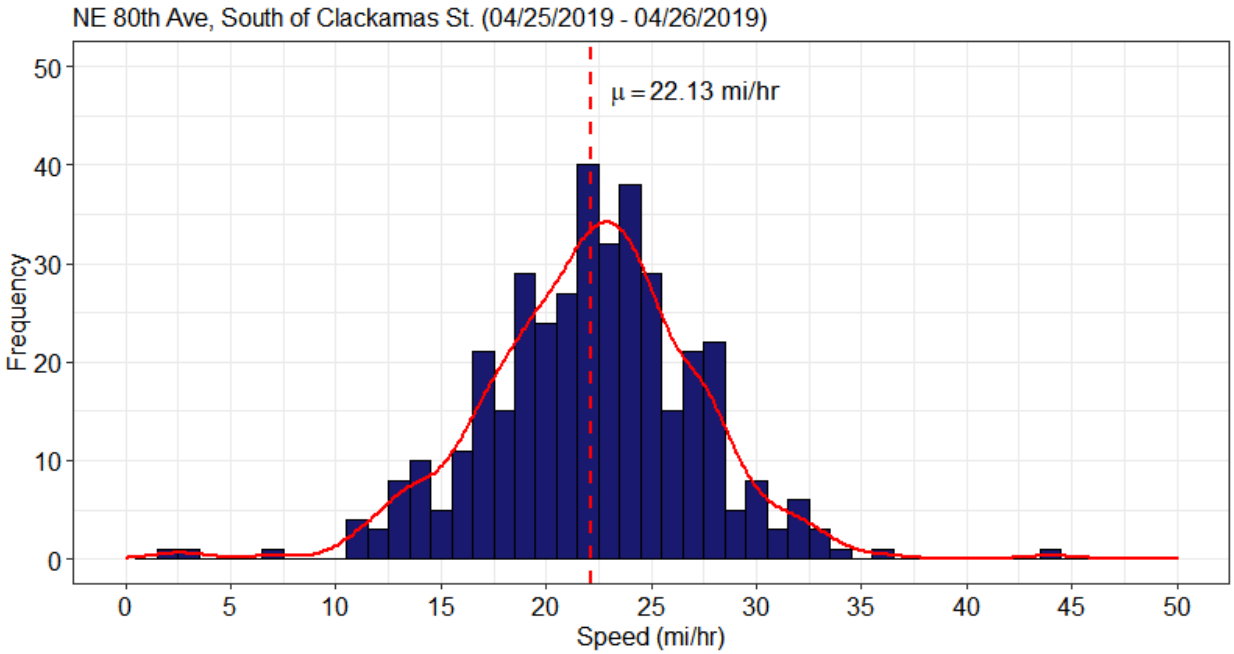

Figure B.36: Speed Distribution at NE 80th Ave (South of Clackamas St.) After Speed Reduction

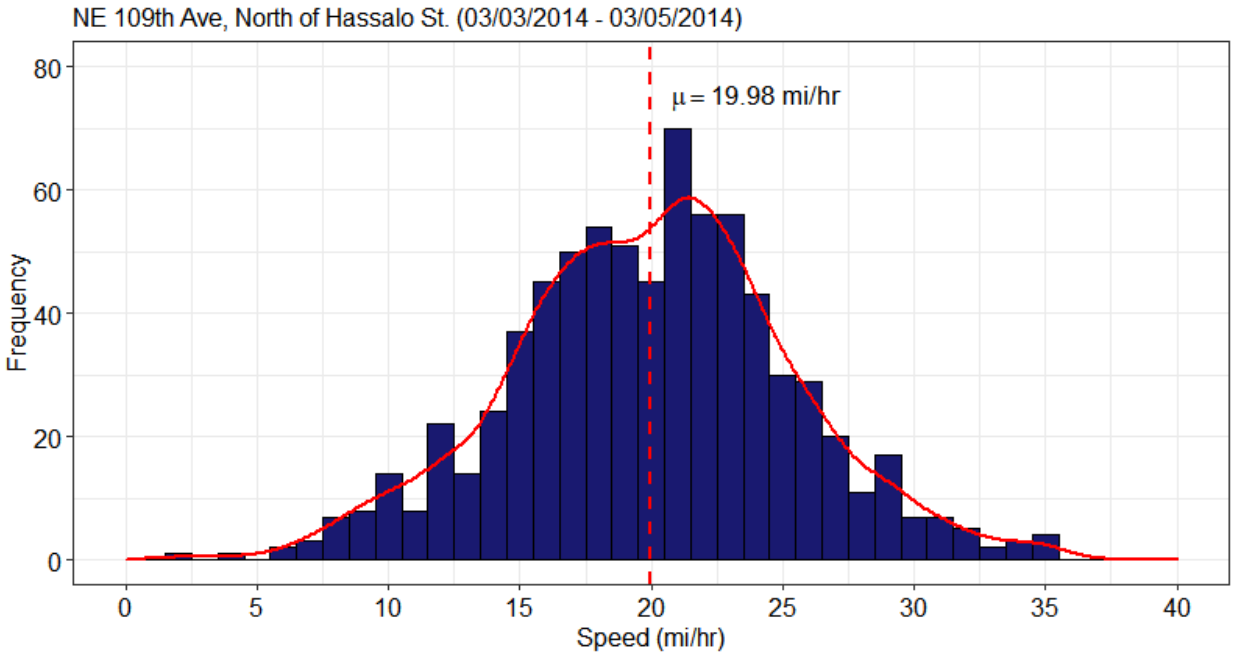

Figure B.37: Speed Distribution at NE 109th Ave (North of Hassalo St.) Before Speed Reduction

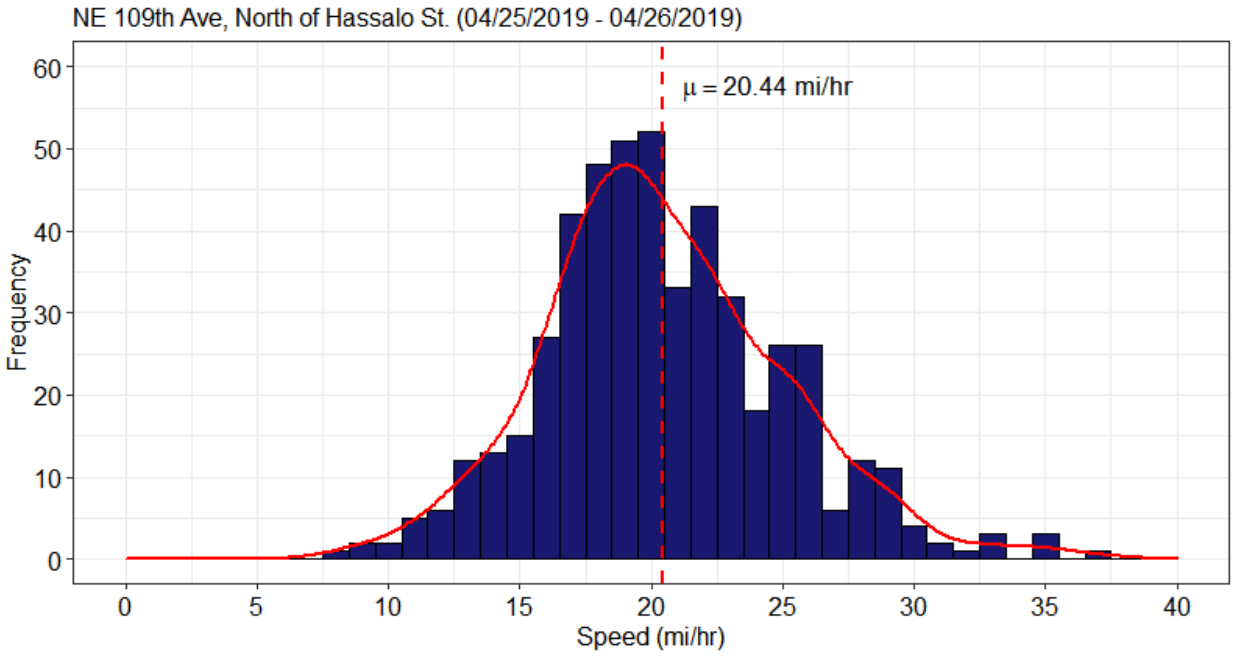

Figure B.38: Speed Distribution at NE 109th Ave (North of Hassalo St.) After Speed Reduction

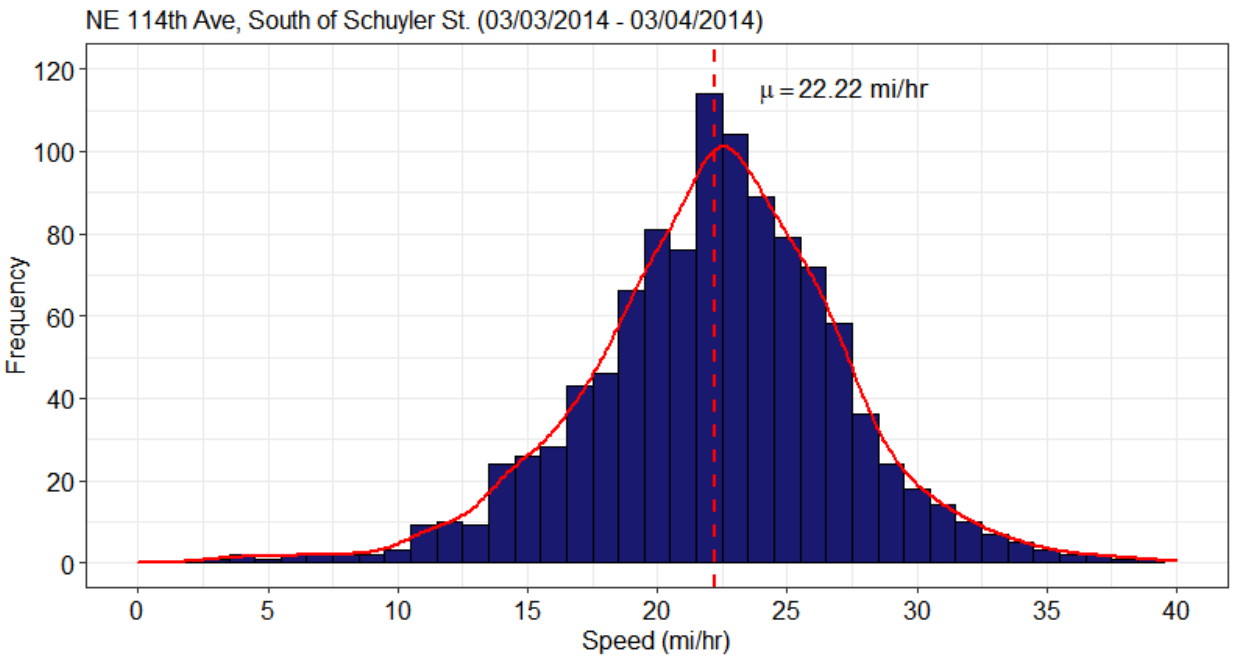

Figure B.39: Speed Distribution at NE 114th Ave (South of Schuyler St.) Before Speed Reduction

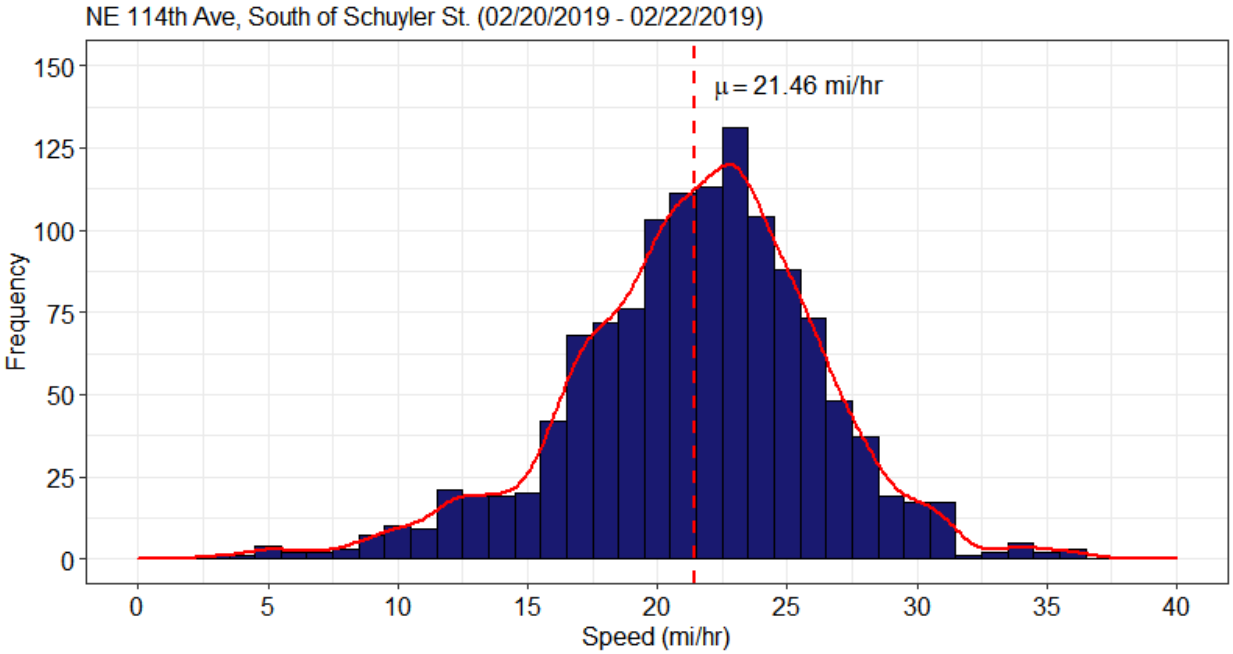

Figure B.40: Speed Distribution at NE 114th Ave (South of Schuyler St.) After Speed Reduction

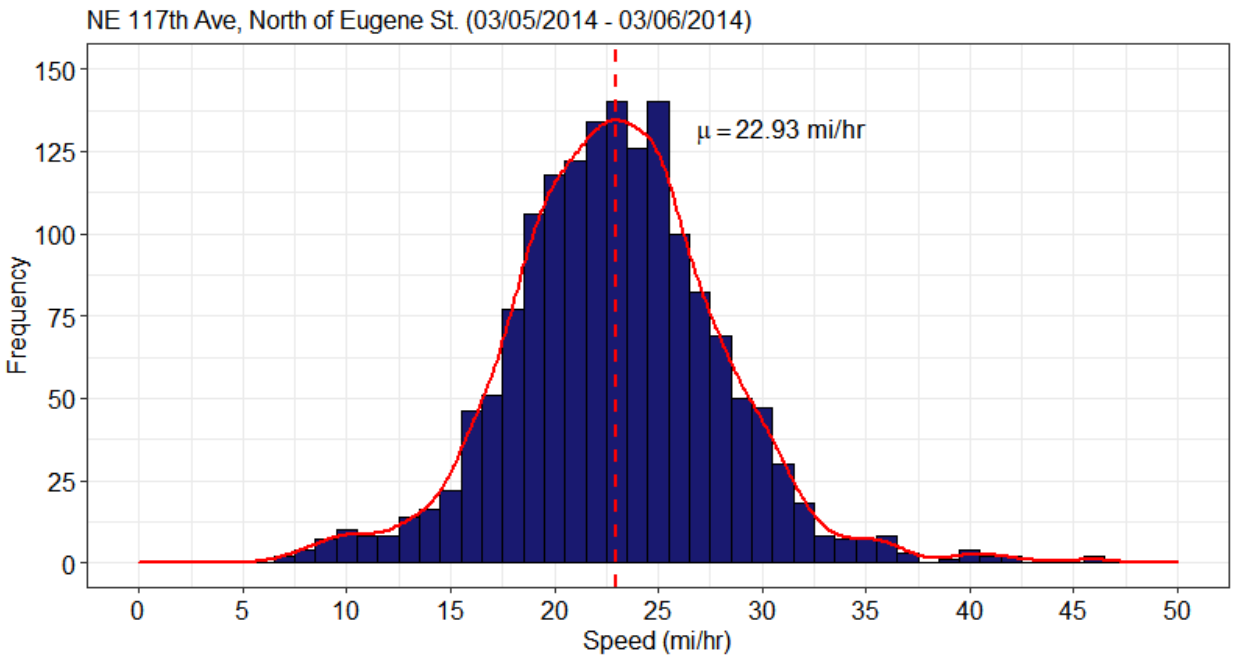

Figure B.41: Speed Distribution at NE 117th Ave (North of Eugene St.) Before Speed Reduction

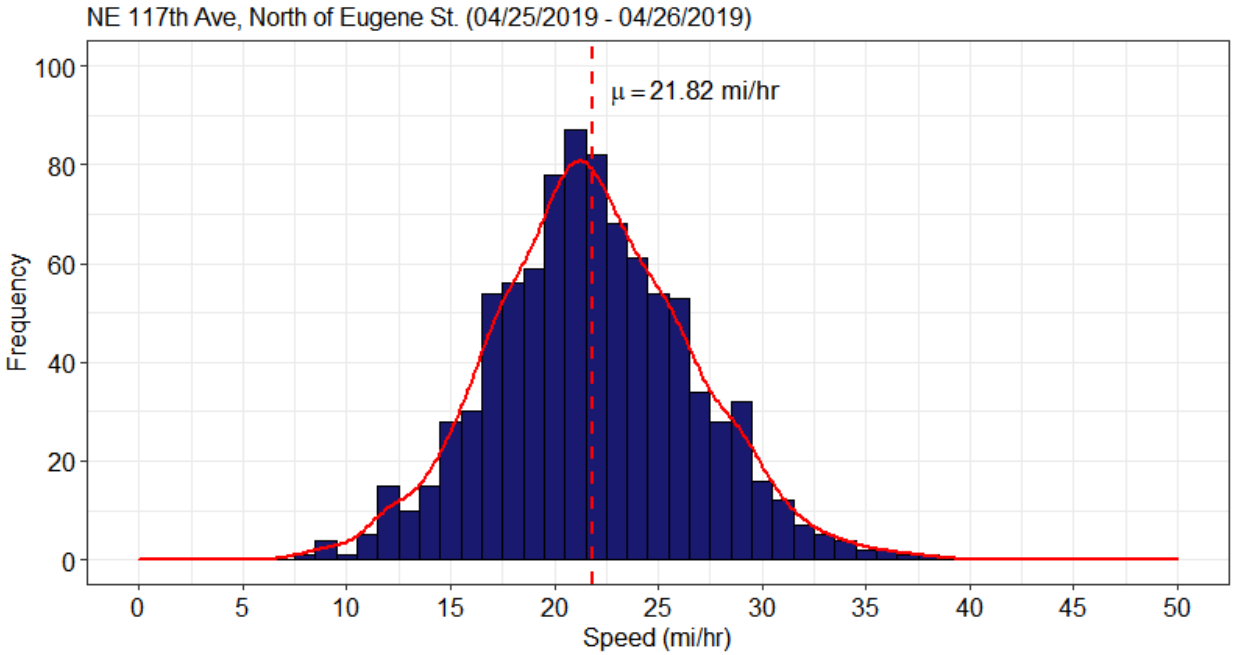

Figure B.42: Speed Distribution at NE 117th Ave (North of Eugene St.) After Speed Reduction

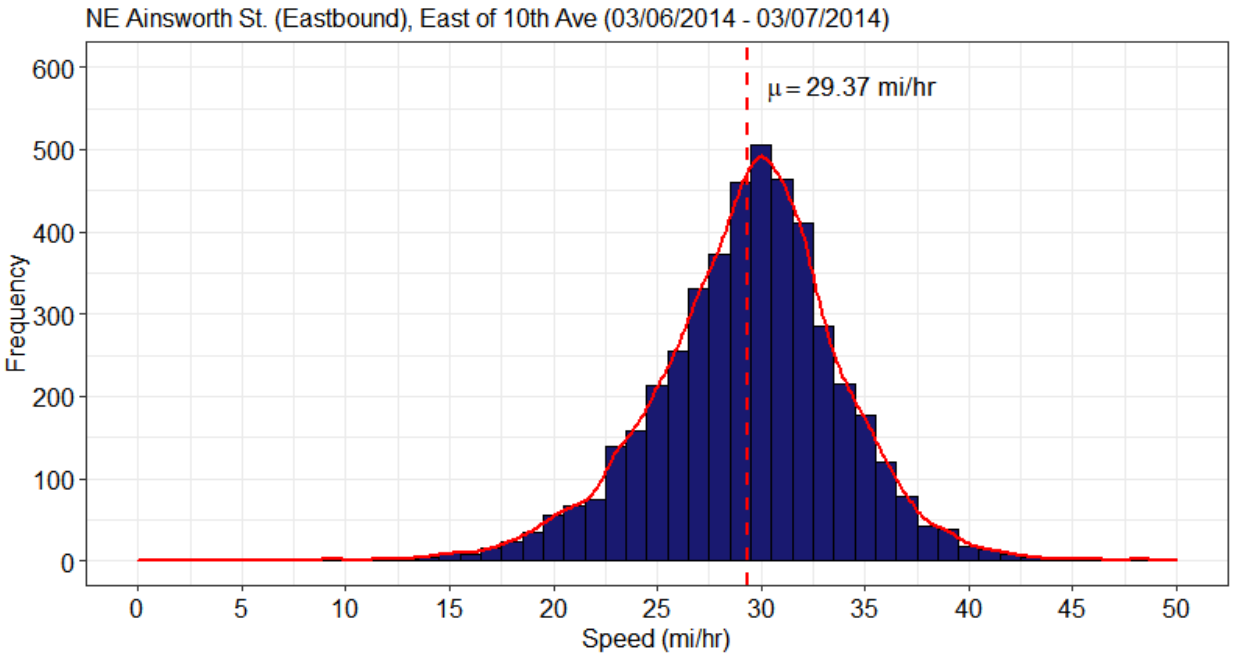

Figure B.43: Speed Distribution at NE Ainsworth St. EB (East of 10th Ave) Before Speed Reduction

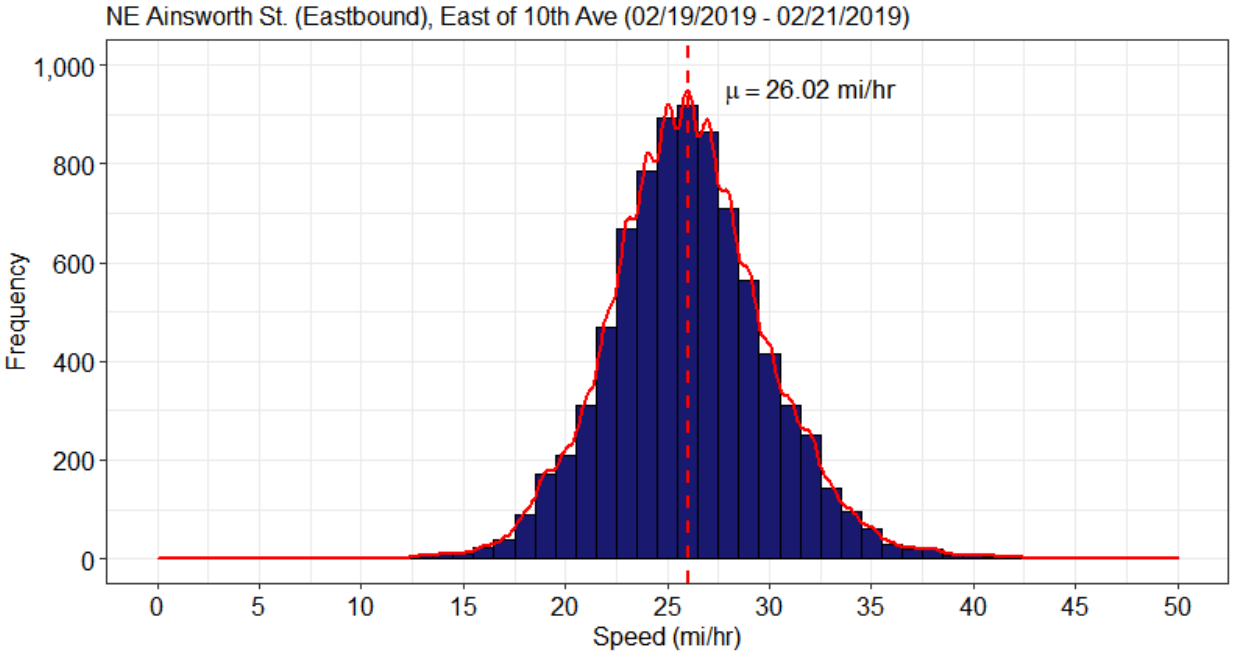

Figure B.44: Speed Distribution at NE Ainsworth St. EB (East of 10th Ave) After Speed Reduction

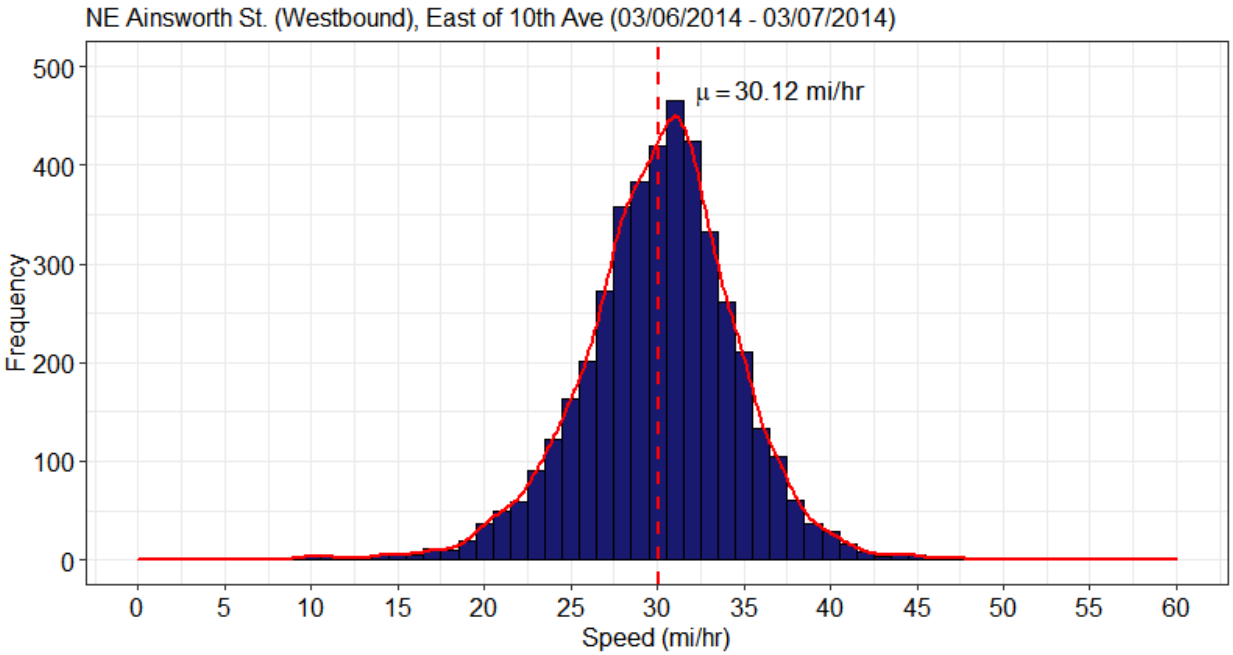

Figure B.45: Speed Distribution at NE Ainsworth St. WB (East of 10th Ave) Before Speed Reduction

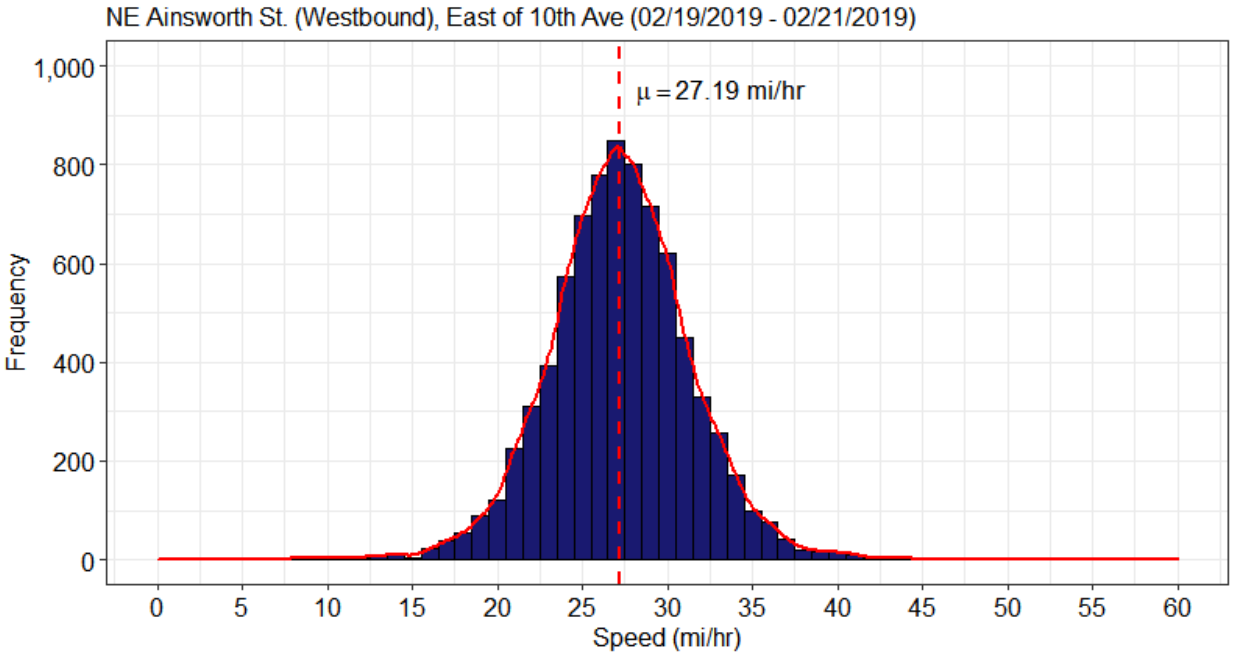

Figure B.46: Speed Distribution at NE Ainsworth St. WB (East of 10th Ave) After Speed Reduction

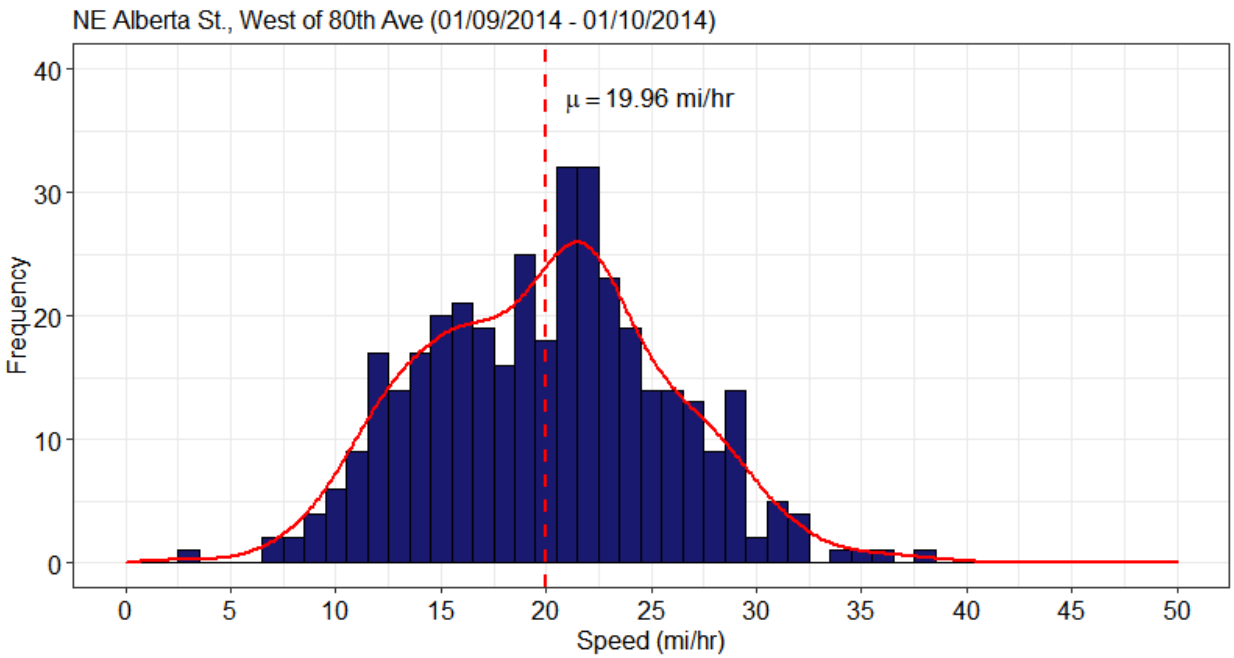

Figure B.47: Speed Distribution at NE Alberta St. (West of 80th Ave) Before Speed Reduction

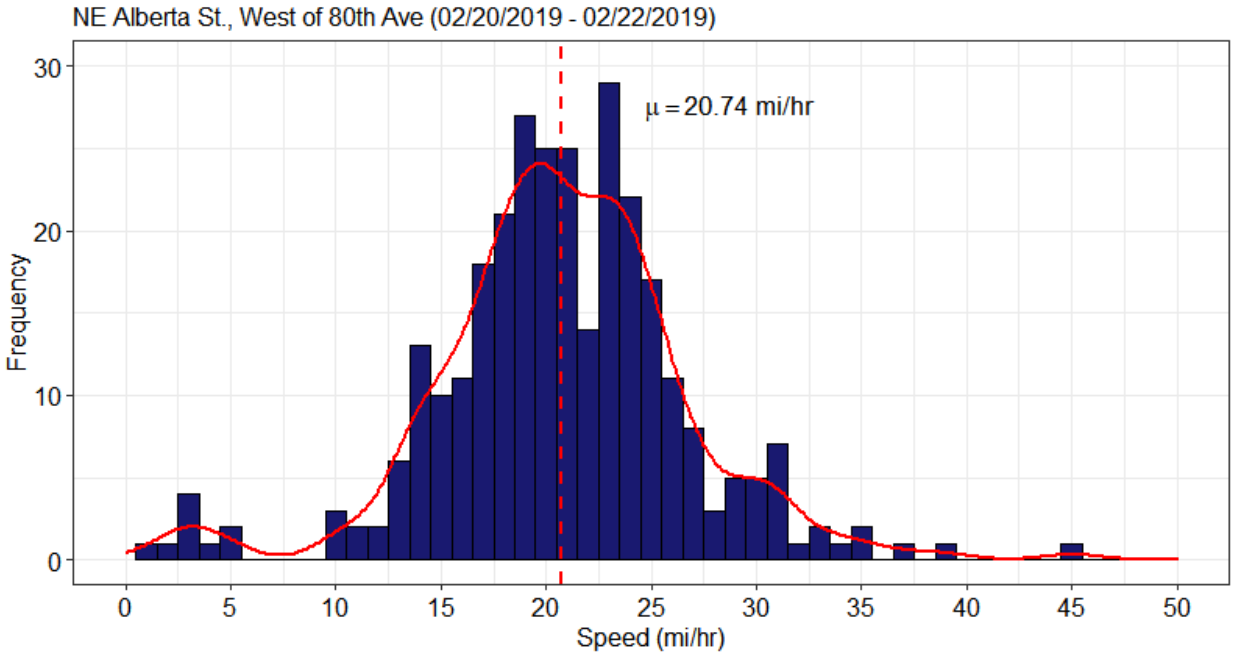

Figure B.48: Speed Distribution at NE Alberta St. (West of 80th Ave) Before After Reduction

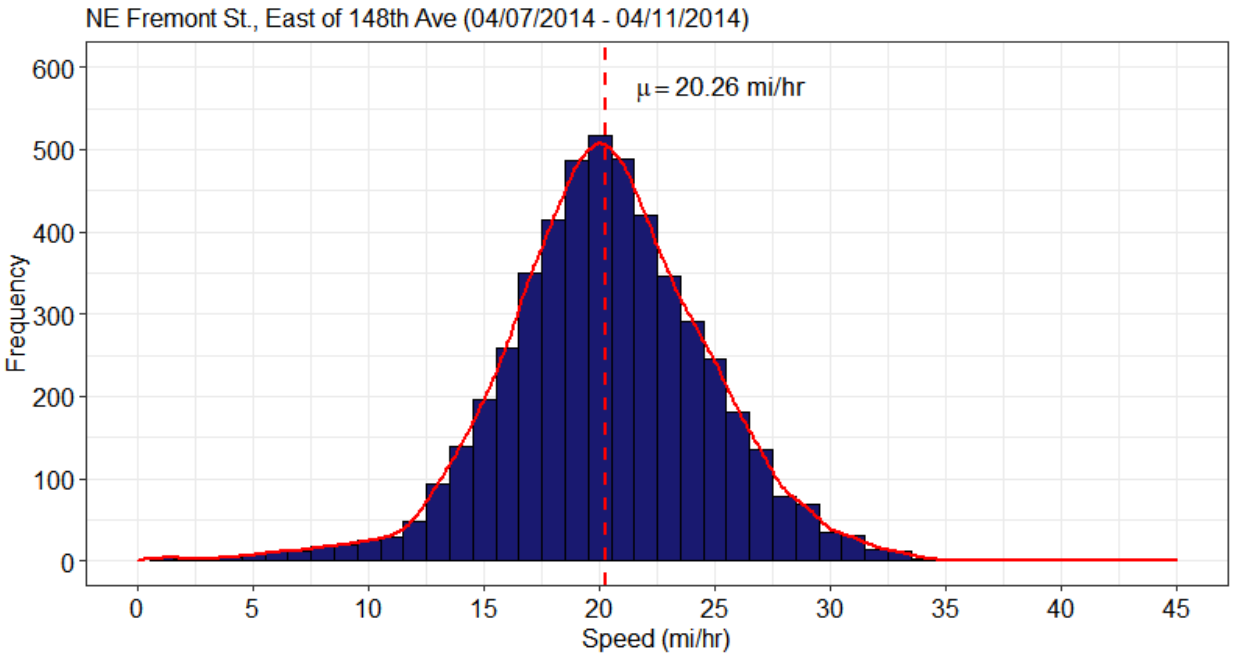

Figure B.49: Speed Distribution at NE Fremont St. (East of 148th Ave) Before Speed Reduction

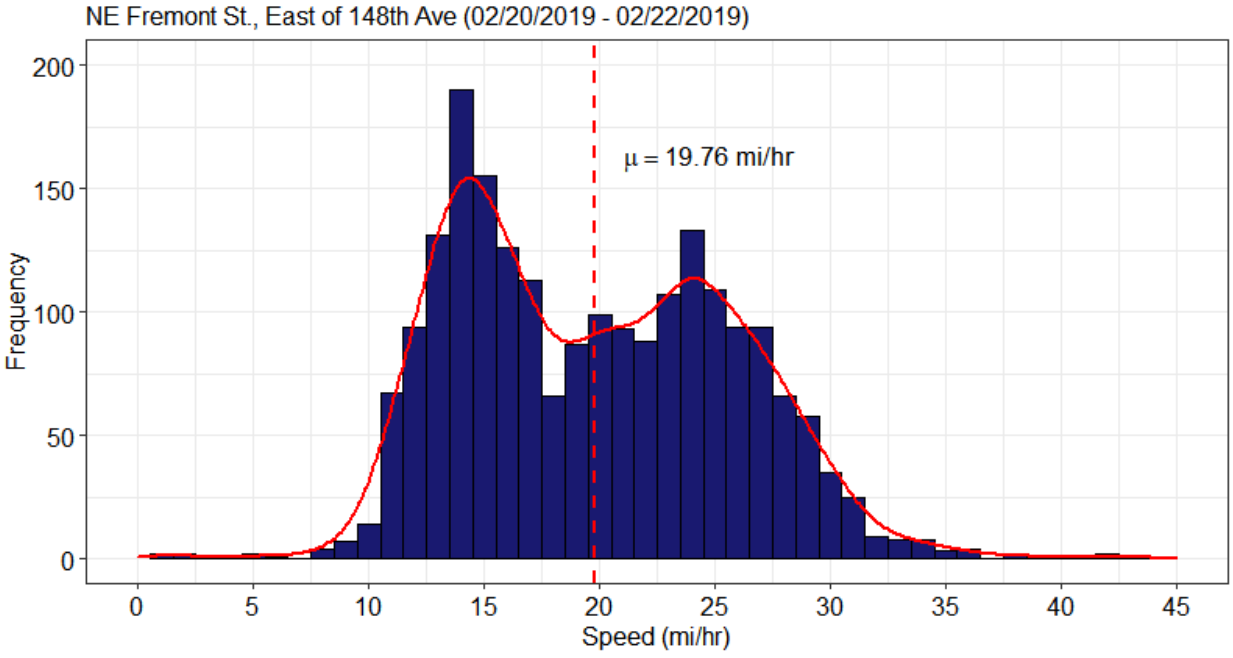

Figure B.50: Speed Distribution at NE Fremont St. (East of 148th Ave) After Speed Reduction

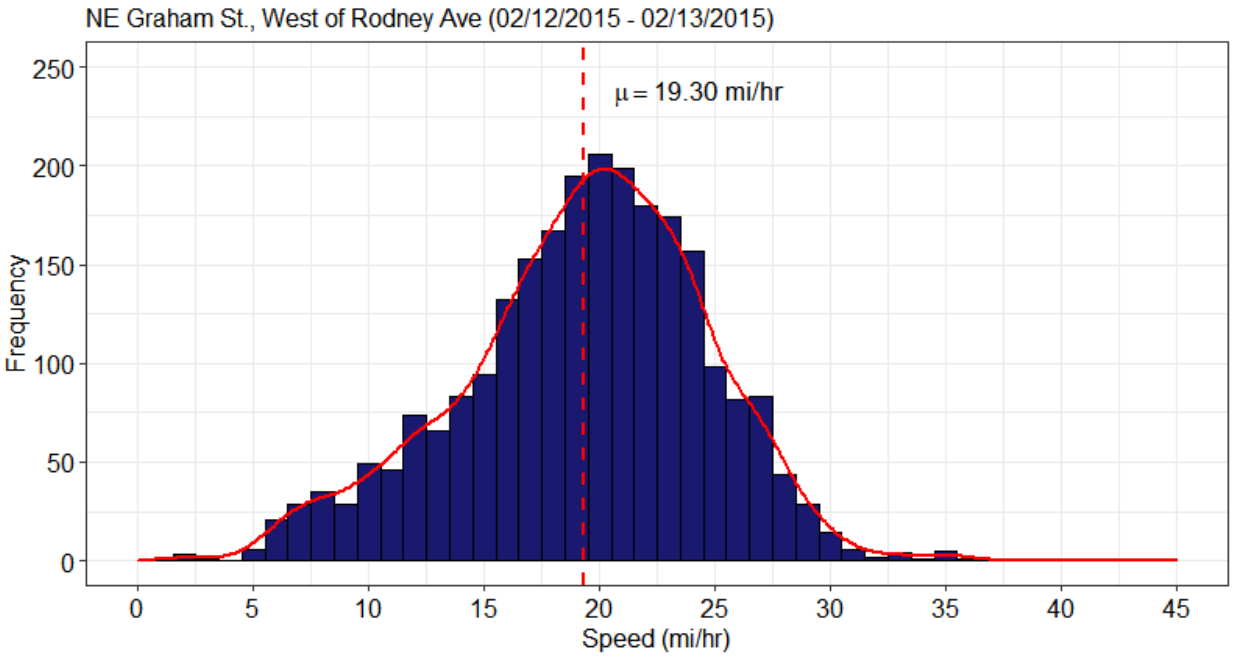

Figure B.51: Speed Distribution at NE Graham St. (West of Rodney Ave) Before Speed Reduction

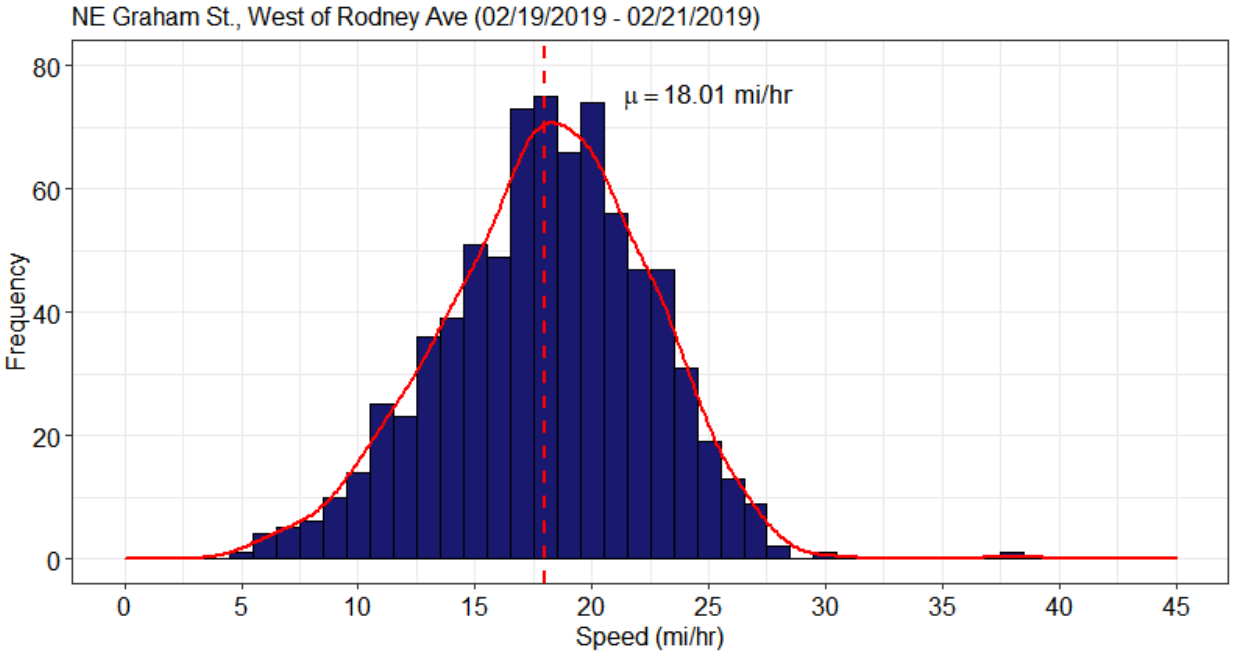

Figure B.52: Speed Distribution at NE Graham St. (West of Rodney Ave) After Speed Reduction

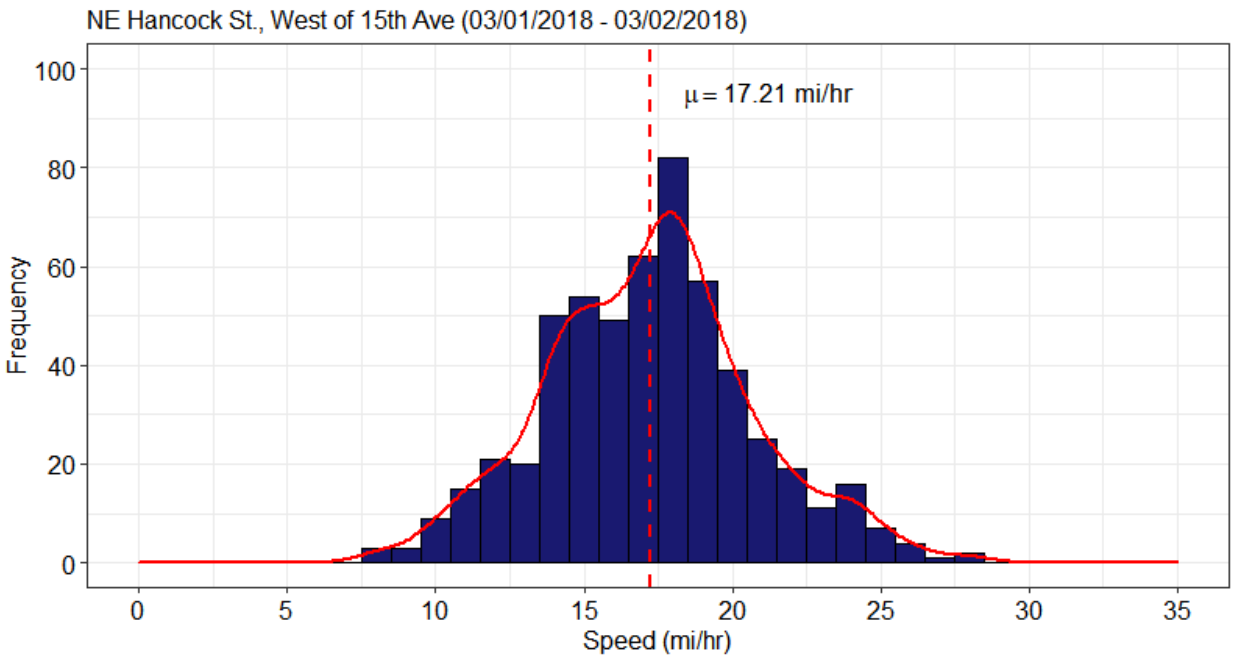

Figure B.53: Speed Distribution at NE Hancock St. (West of 15th Ave) Before Speed Reduction

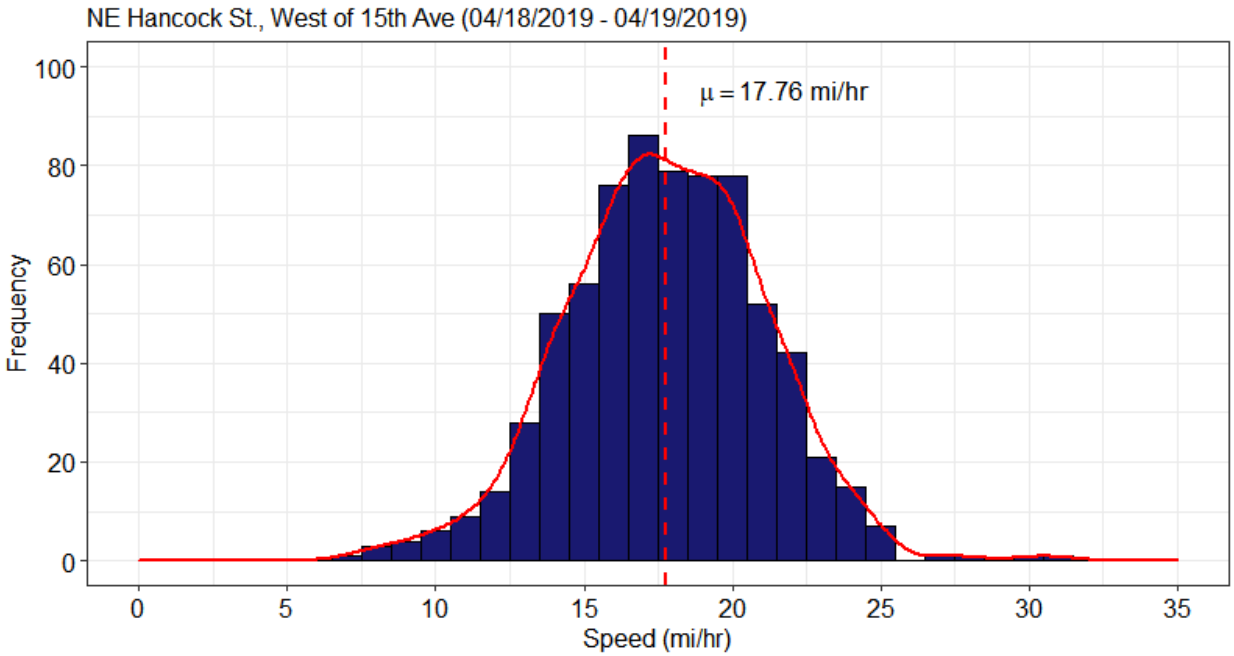

Figure B.54: Speed Distribution at NE Hancock St. (West of 15th Ave) After Speed Reduction

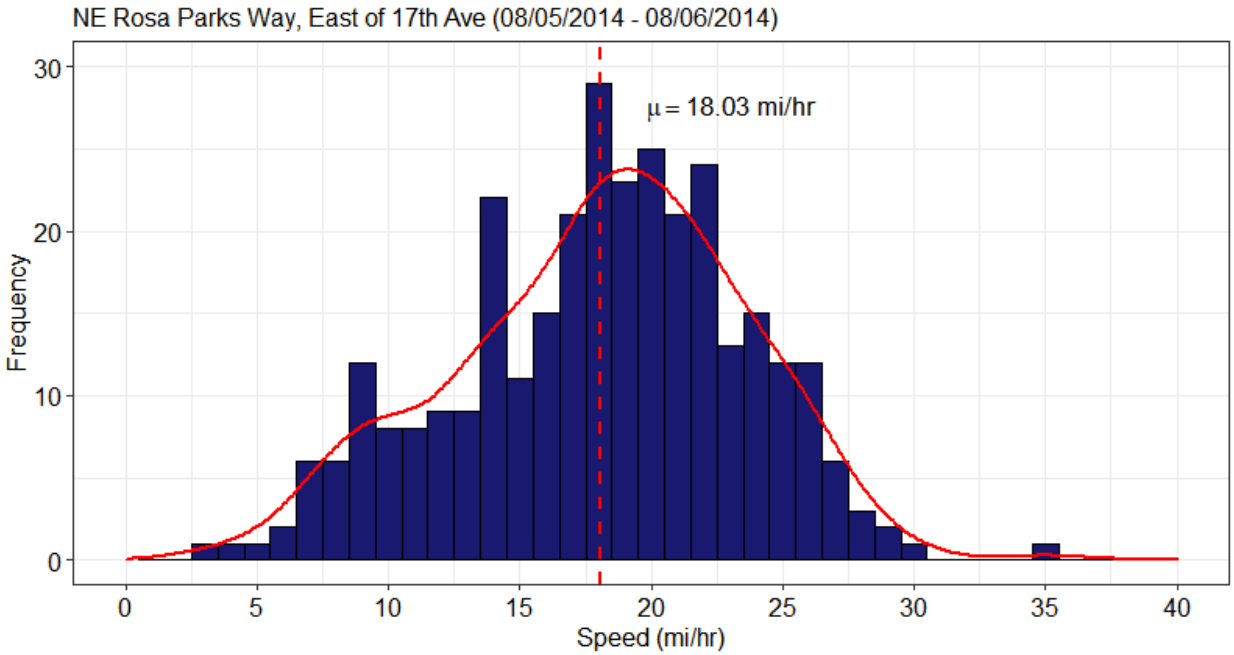

Figure B.55: Speed Distribution at NE Rosa Parks Way (East of 17th Ave) Before Speed Reduction

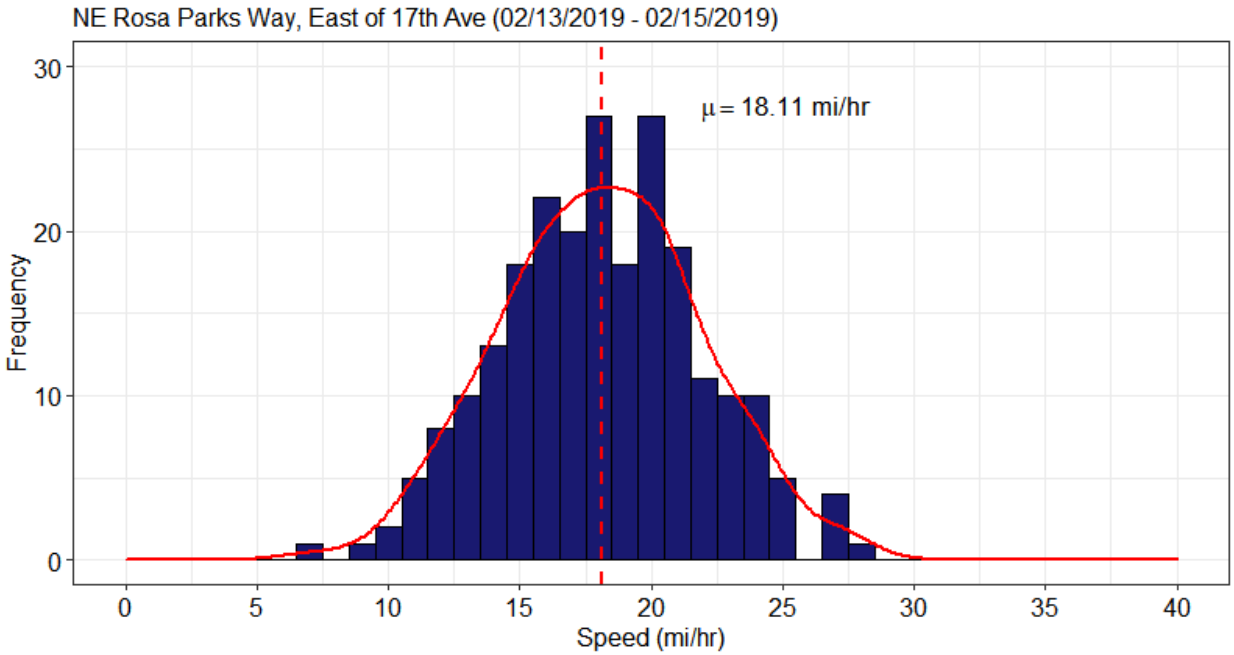

Figure B.56: Speed Distribution at NE Rosa Parks Way (East of 17th Ave) After Speed Reduction

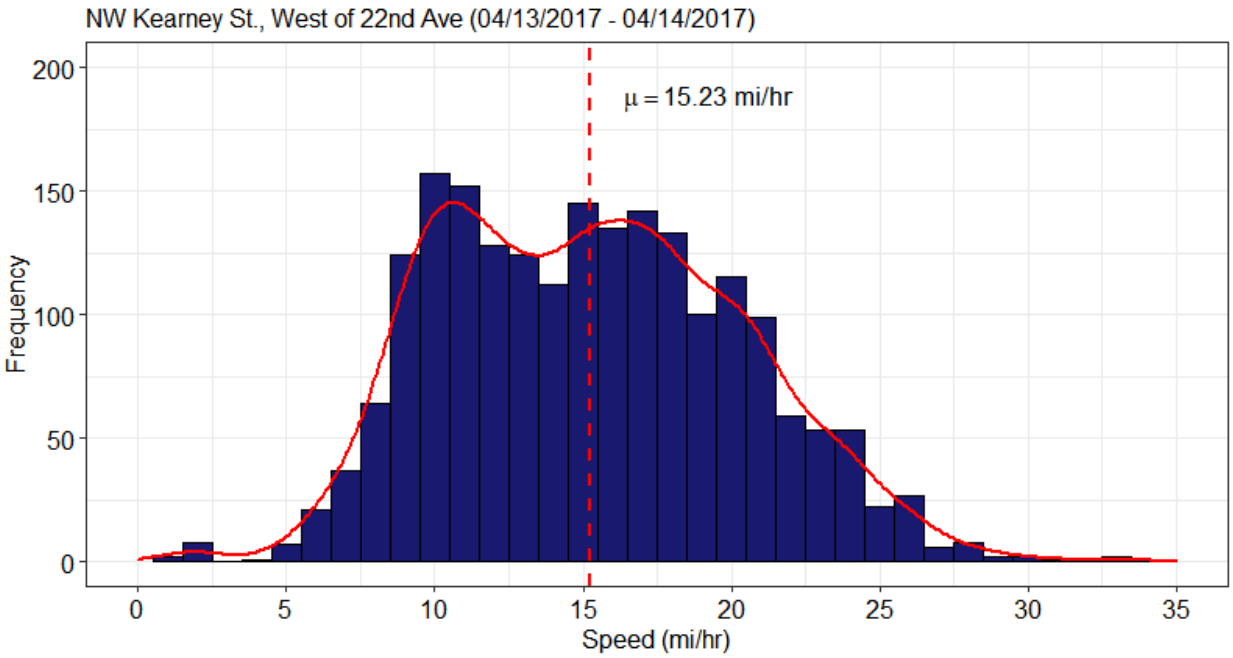

Figure B.57: Speed Distribution at NW Kearney St. (West of 22nd Ave) Before Speed Reduction

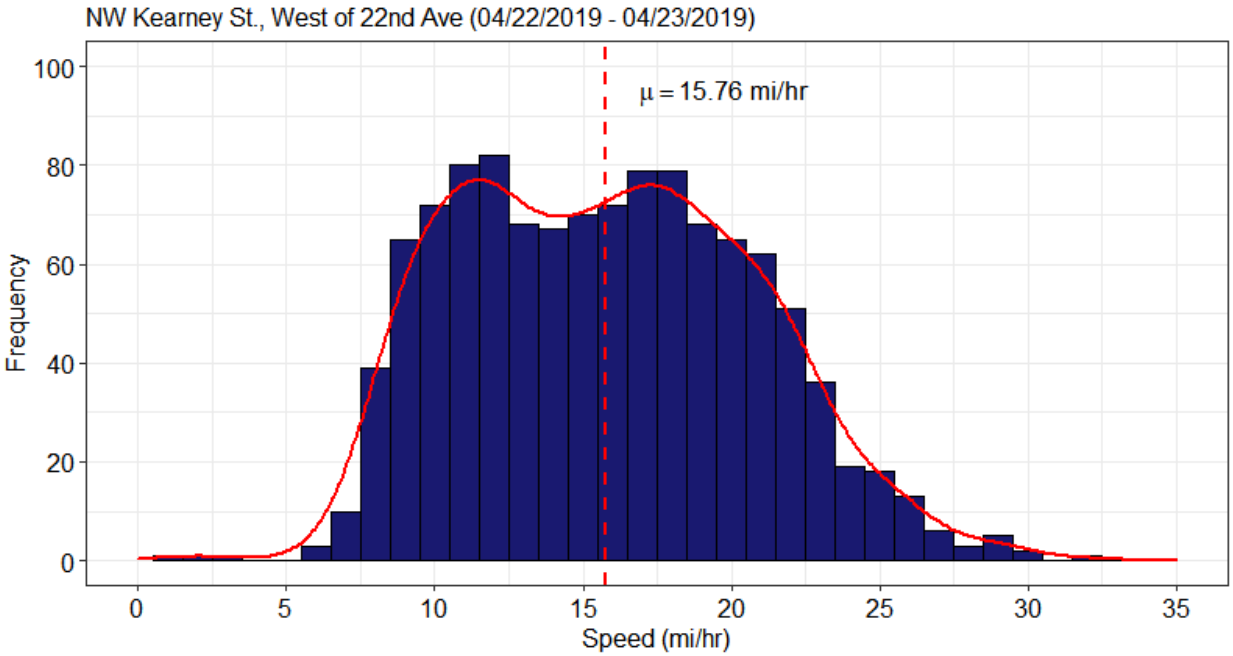

Figure B.58: Speed Distribution at NW Kearney St. (West of 22nd Ave) After Speed Reduction

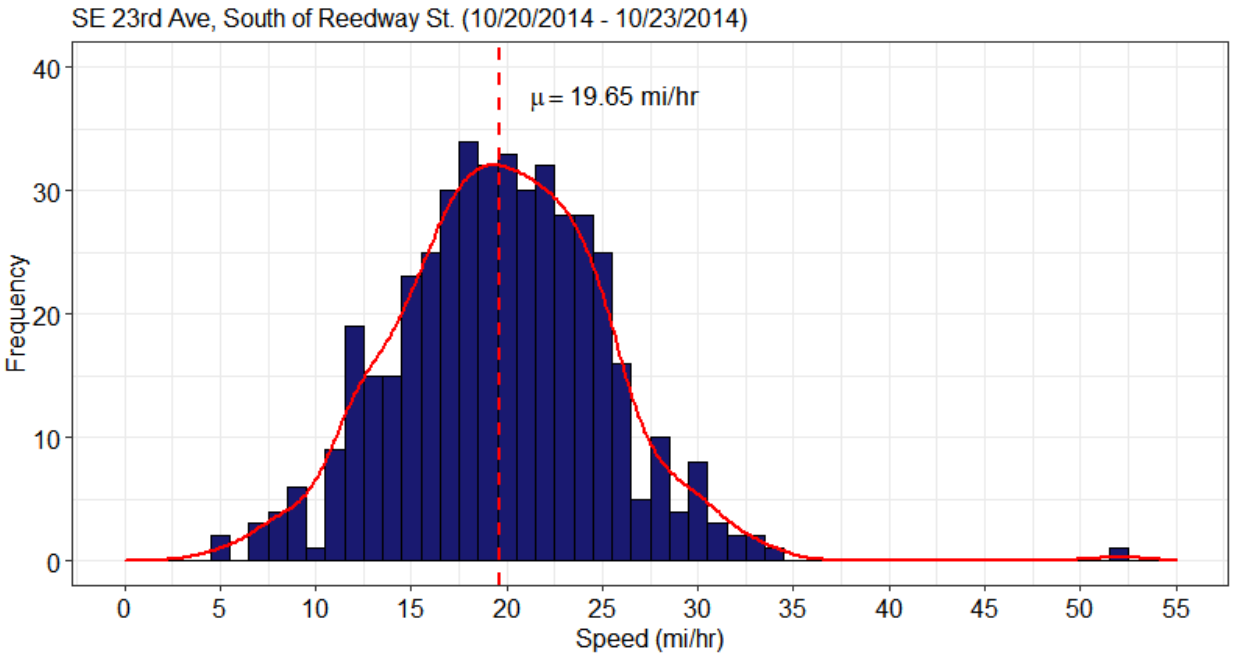

Figure B.59: Speed Distribution at SE 23rd Ave (South of Reedway St.) Before Speed Reduction

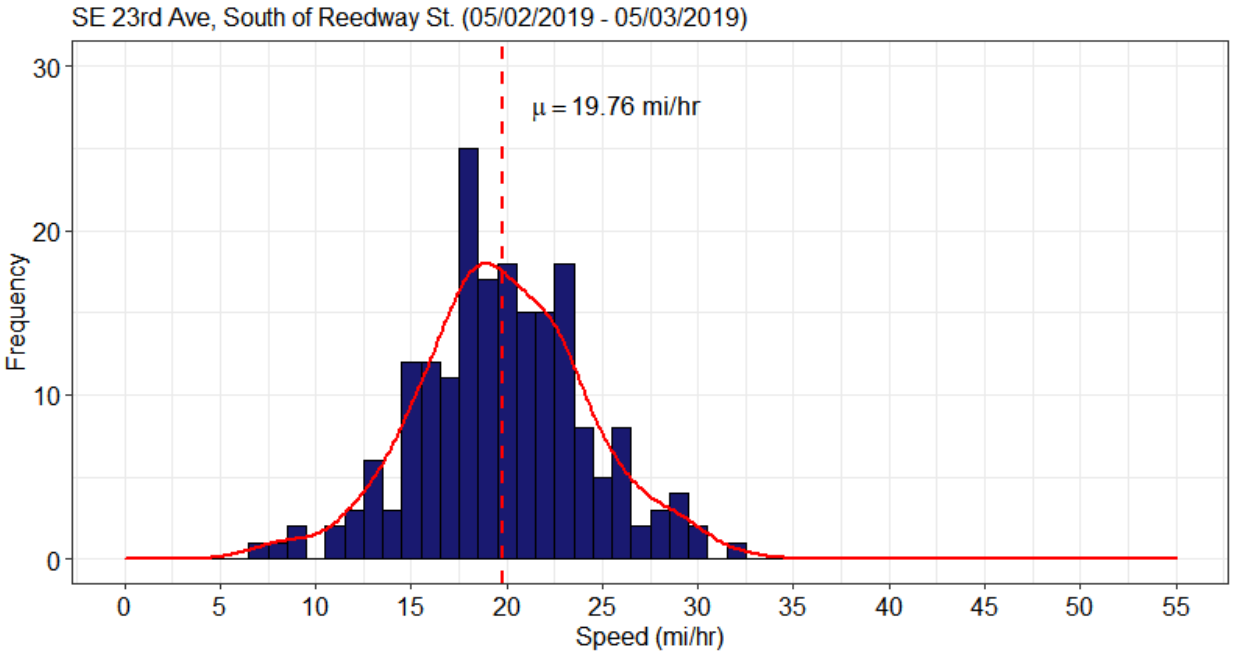

Figure B.60: Speed Distribution at SE 23rd Ave (South of Reedway St.) After Speed Reduction

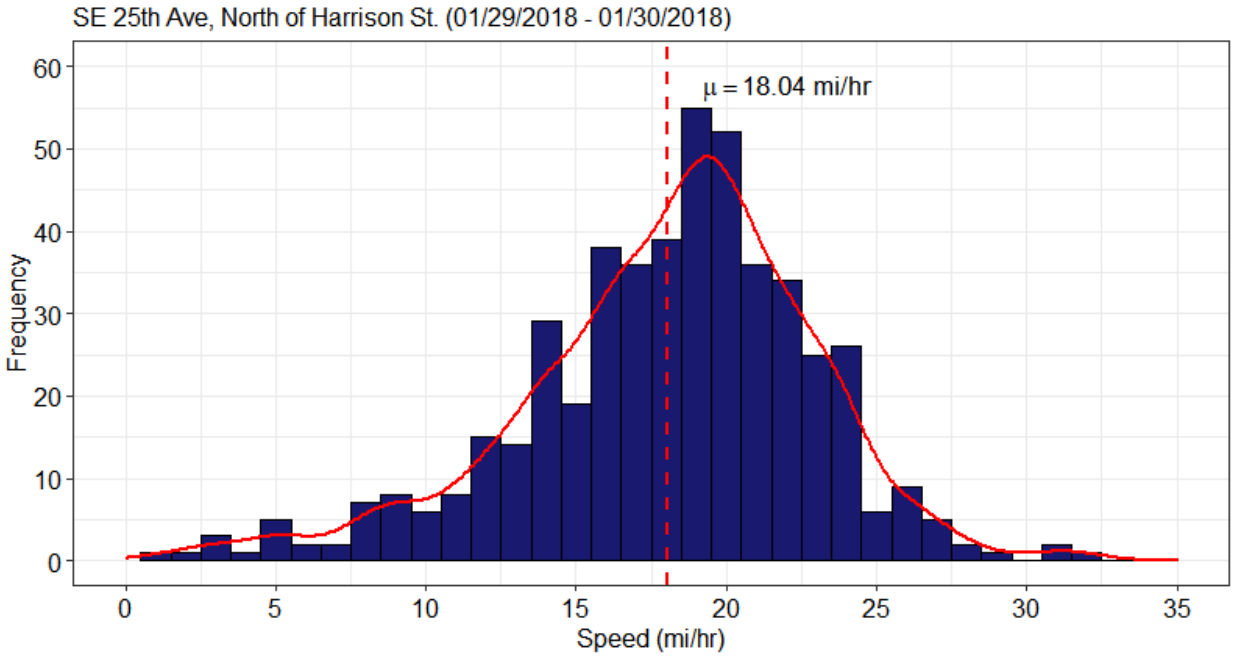

Figure B.61: Speed Distribution at SE 25th Ave (North of Harrison St.) Before Speed Reduction

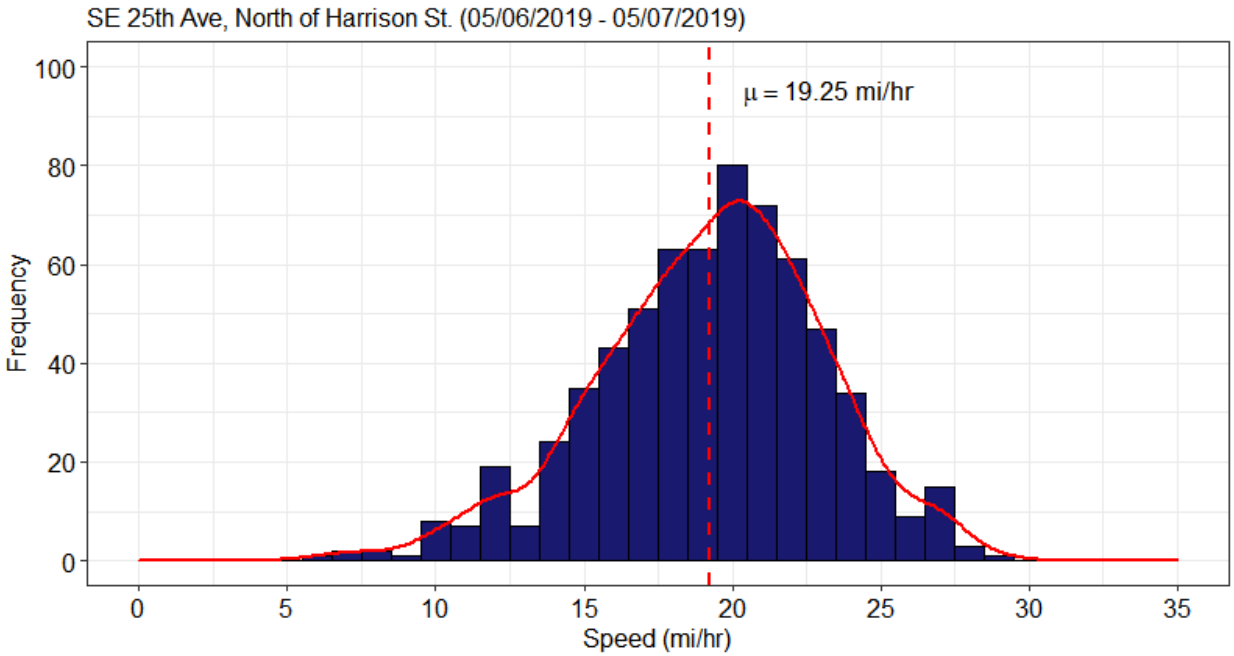

Figure B.62: Speed Distribution at SE 25th Ave (North of Harrison St.) After Speed Reduction

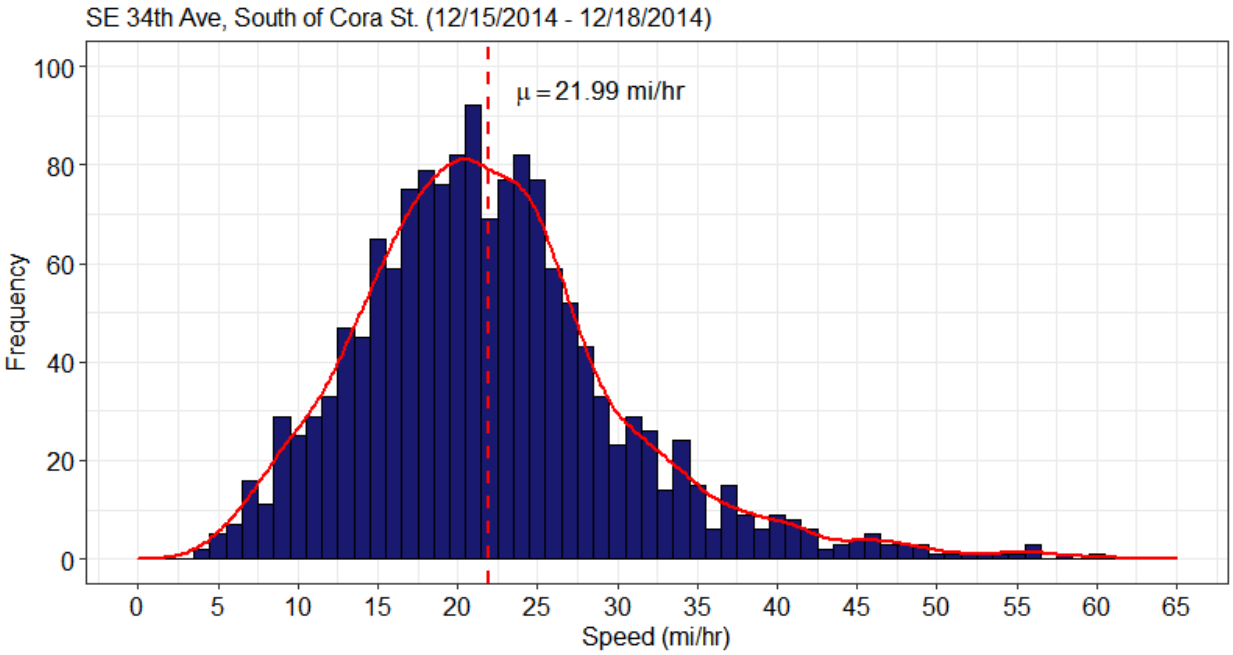

Figure B.63: Speed Distribution at SE 34th Ave (South of Cora St.) Before Speed Reduction

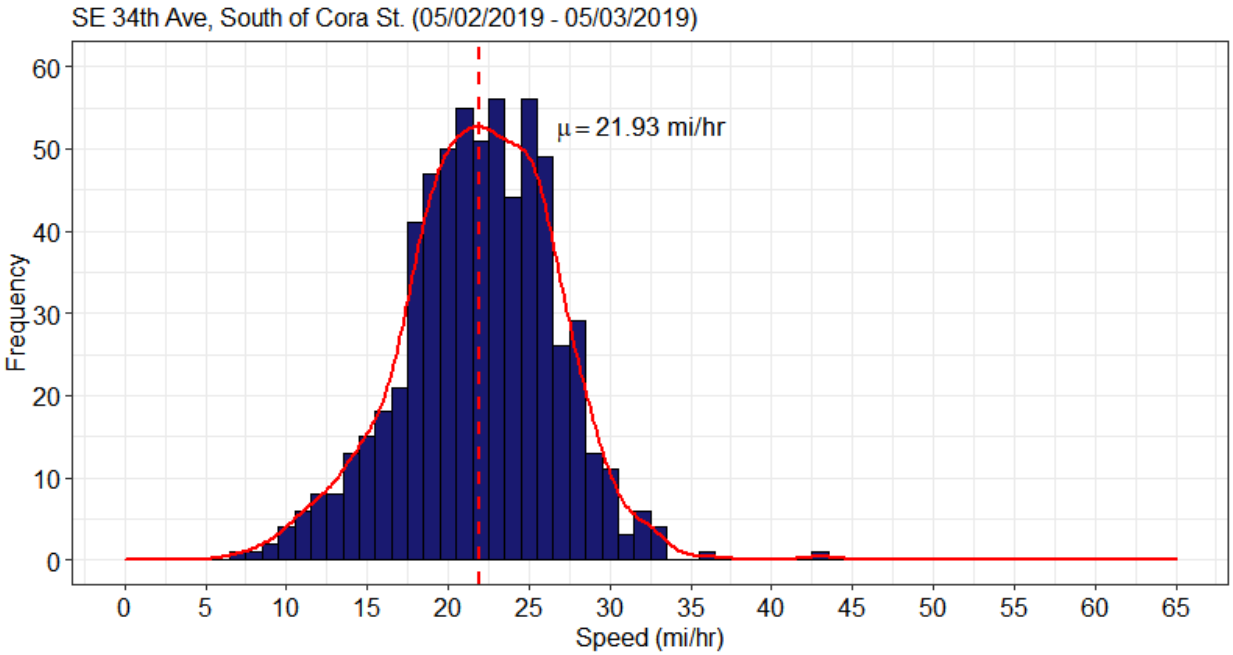

Figure B.64: Speed Distribution at SE 34th Ave (South of Cora St.) After Speed Reduction

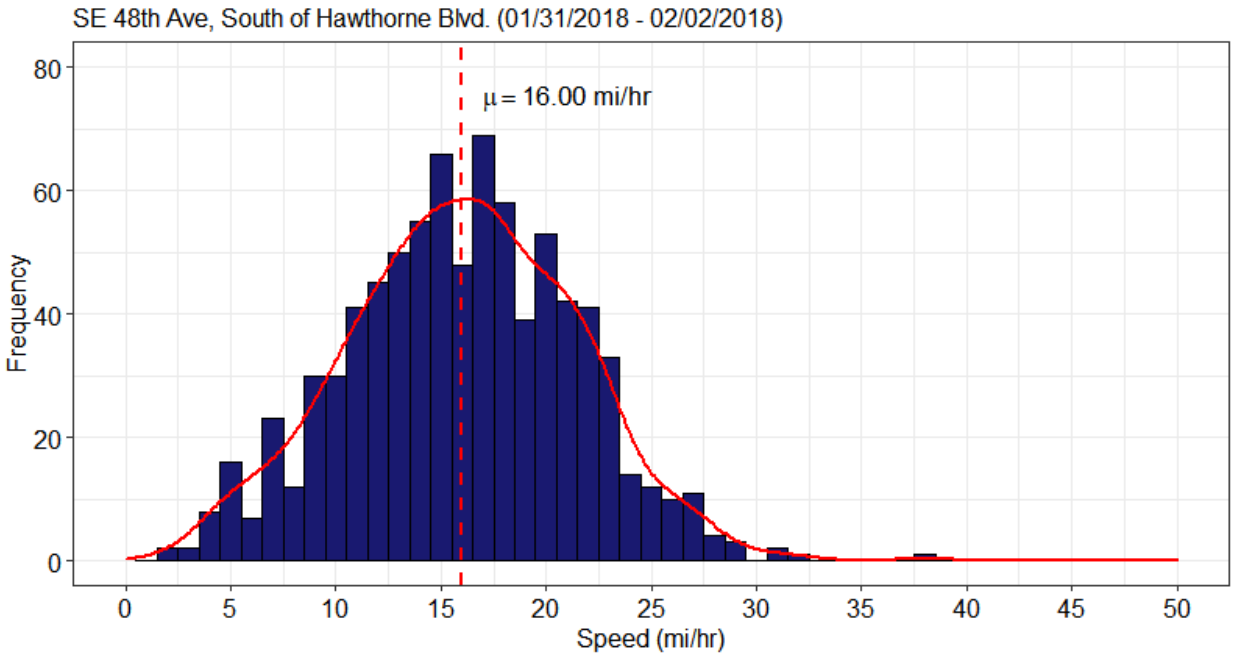

Figure B.65: Speed Distribution at SE 48th Ave (South of Hawthorne Blvd.) Before Speed Reduction

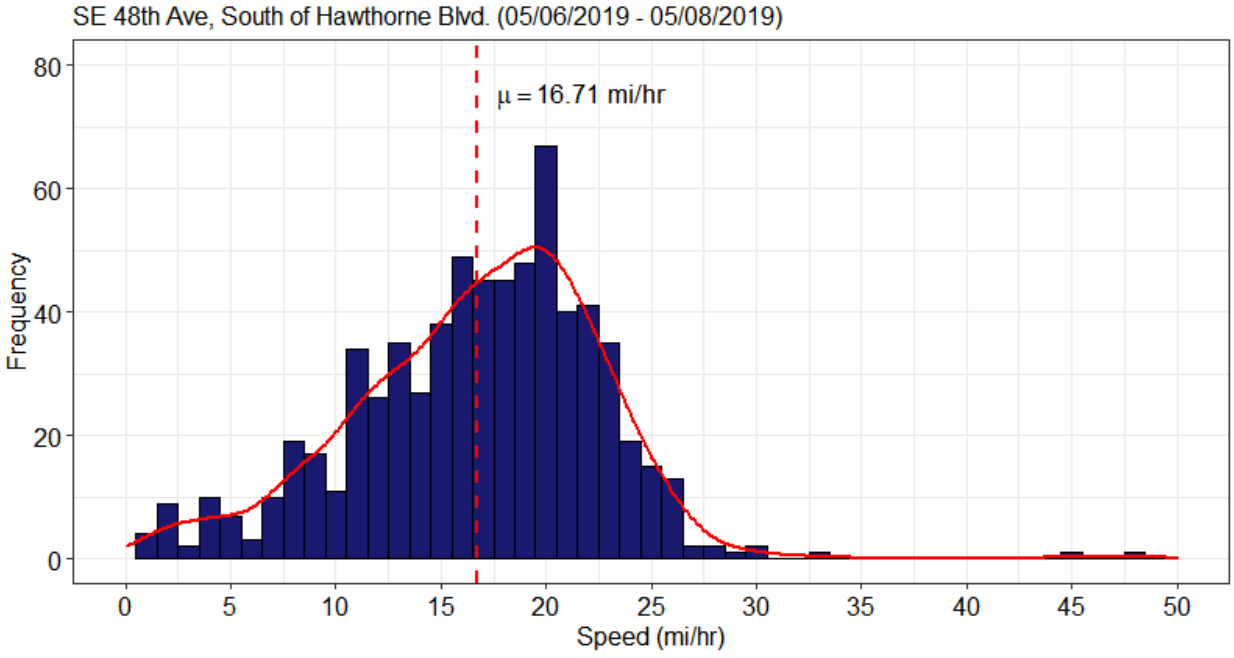

Figure B.66: Speed Distribution at SE 48th Ave (South of Hawthorne Blvd.) After Speed Reduction

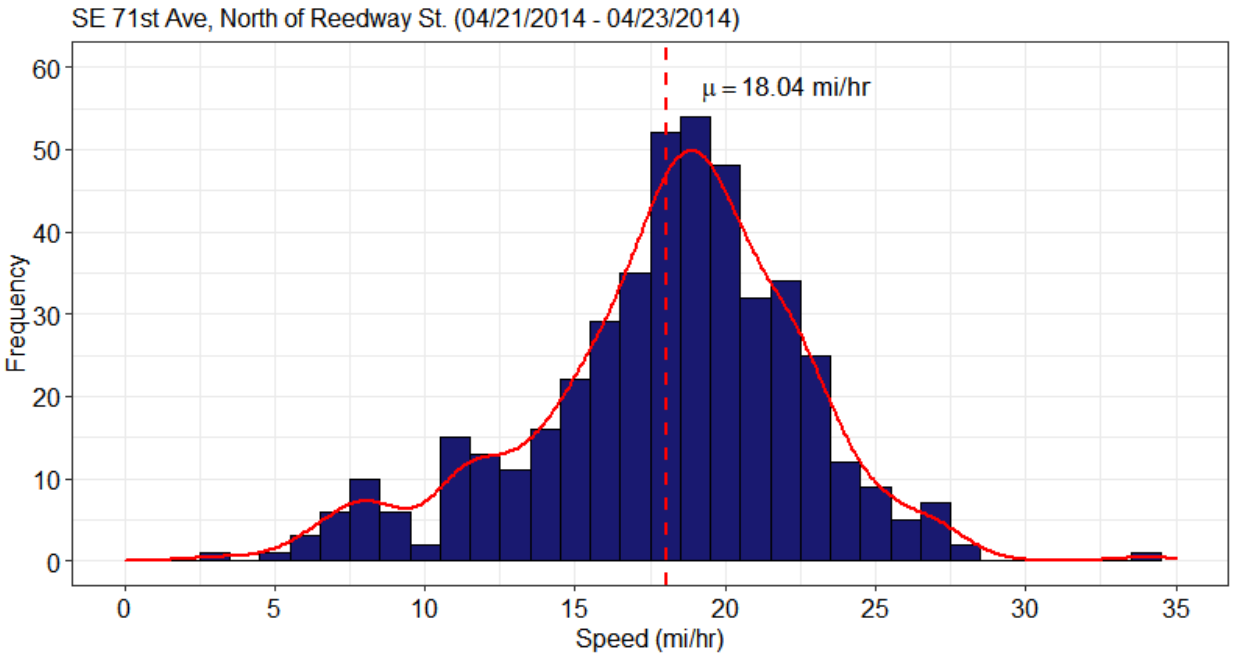

Figure B.67: Speed Distribution at SE 71st Ave (North of Reedway St.) Before Speed Reduction

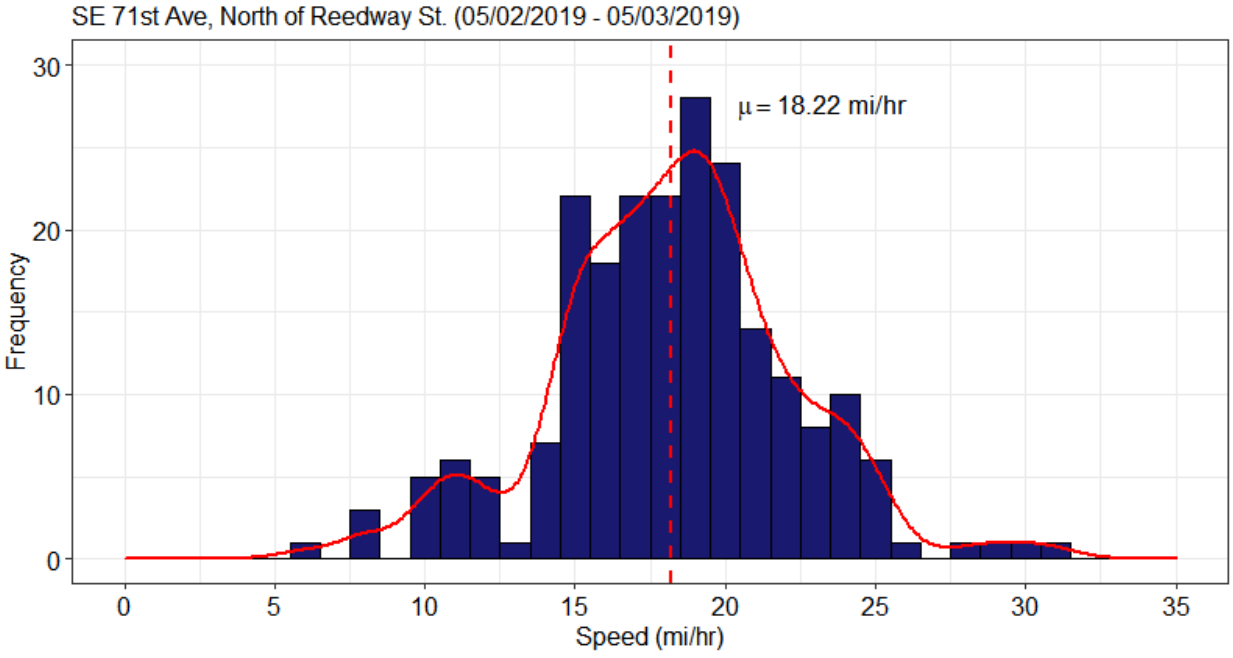

Figure B.68: Speed Distribution at SE 71st Ave (North of Reedway St.) After Speed Reduction

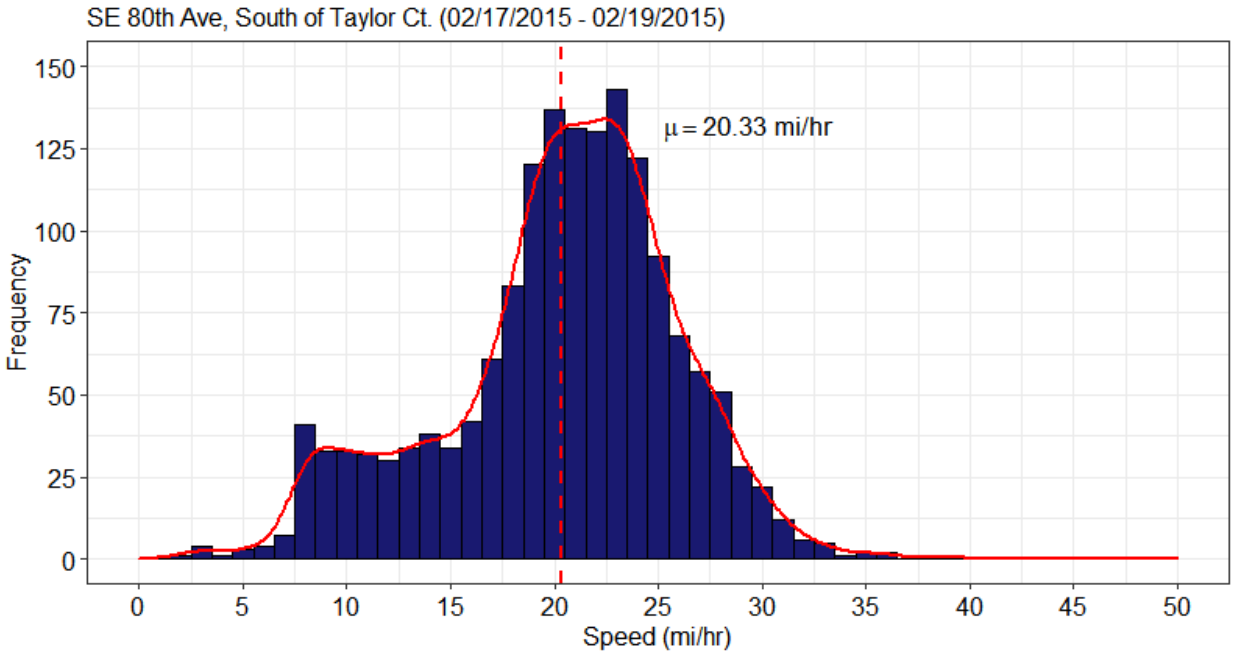

Figure B.69: Speed Distribution at SE 80th Ave (South of Taylor Ct.) Before Speed Reduction

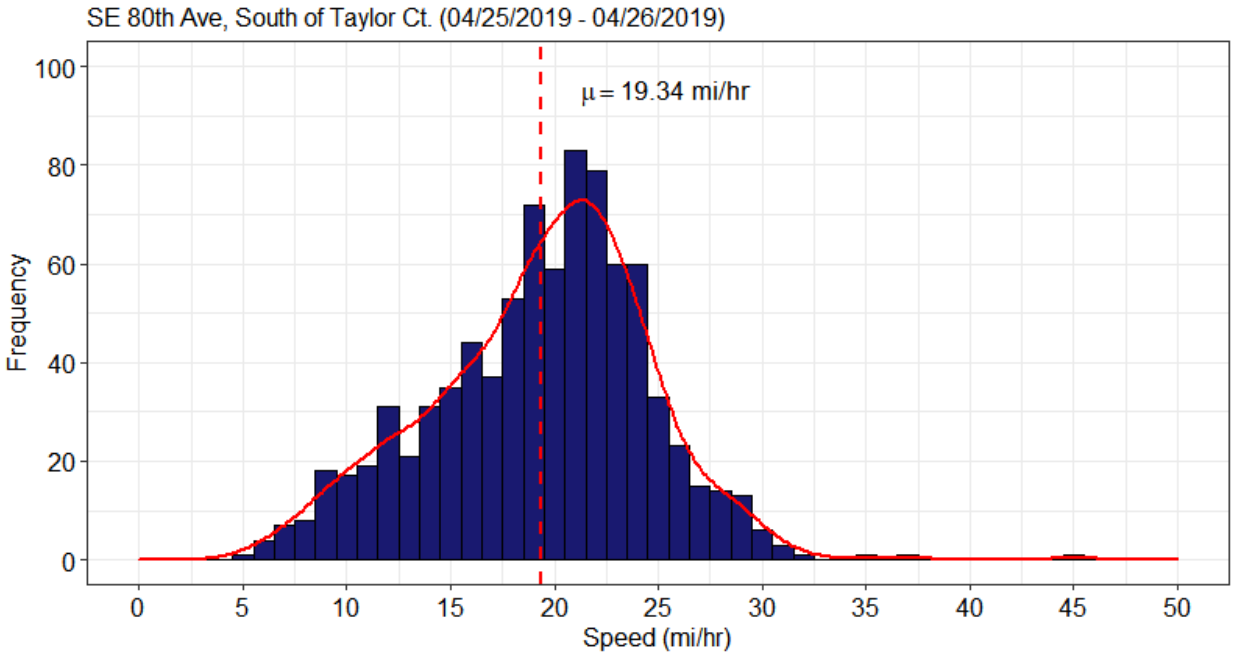

Figure B.70: Speed Distribution at SE 80th Ave (South of Taylor Ct.) After Speed Reduction

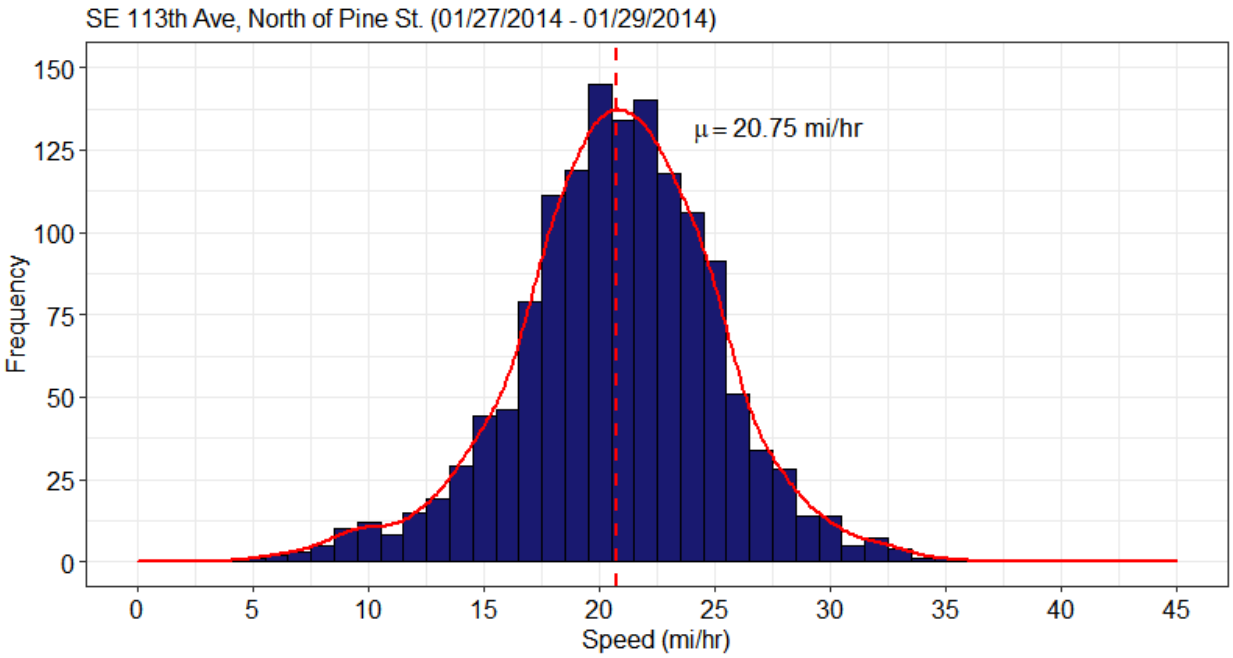

Figure B.71: Speed Distribution at SE 113th Ave (North of Pine St.) Before Speed Reduction

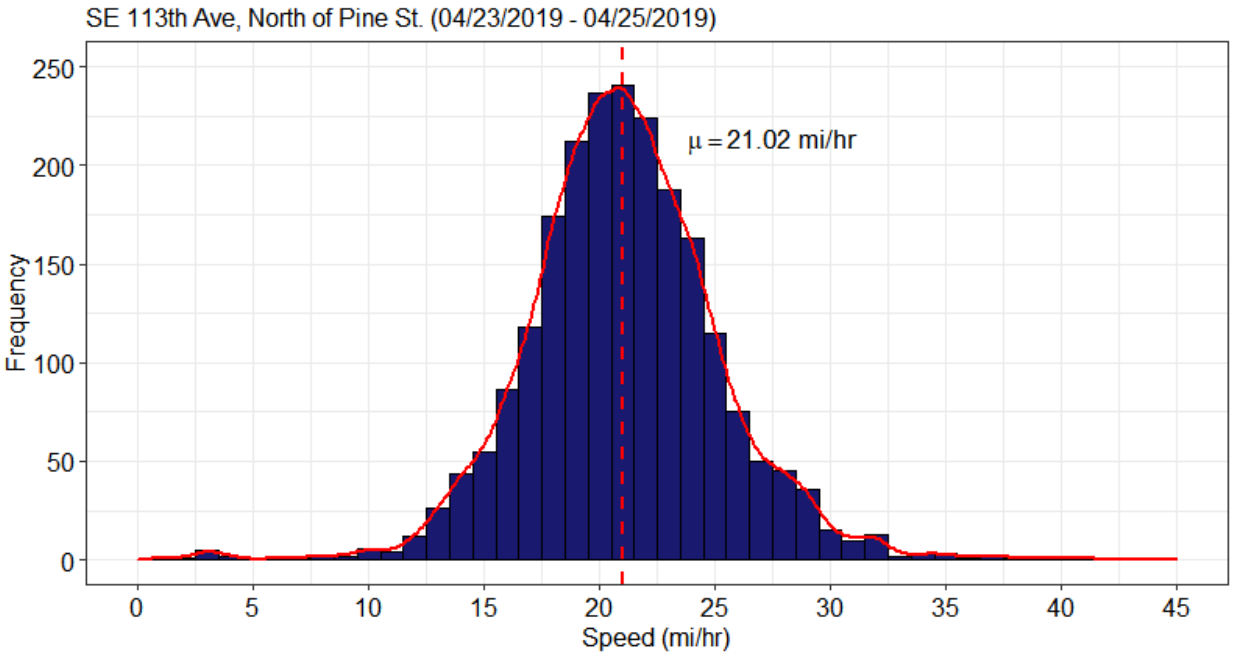

Figure B.72: Speed Distribution at SE 113th Ave (North of Pine St.) After Speed Reduction

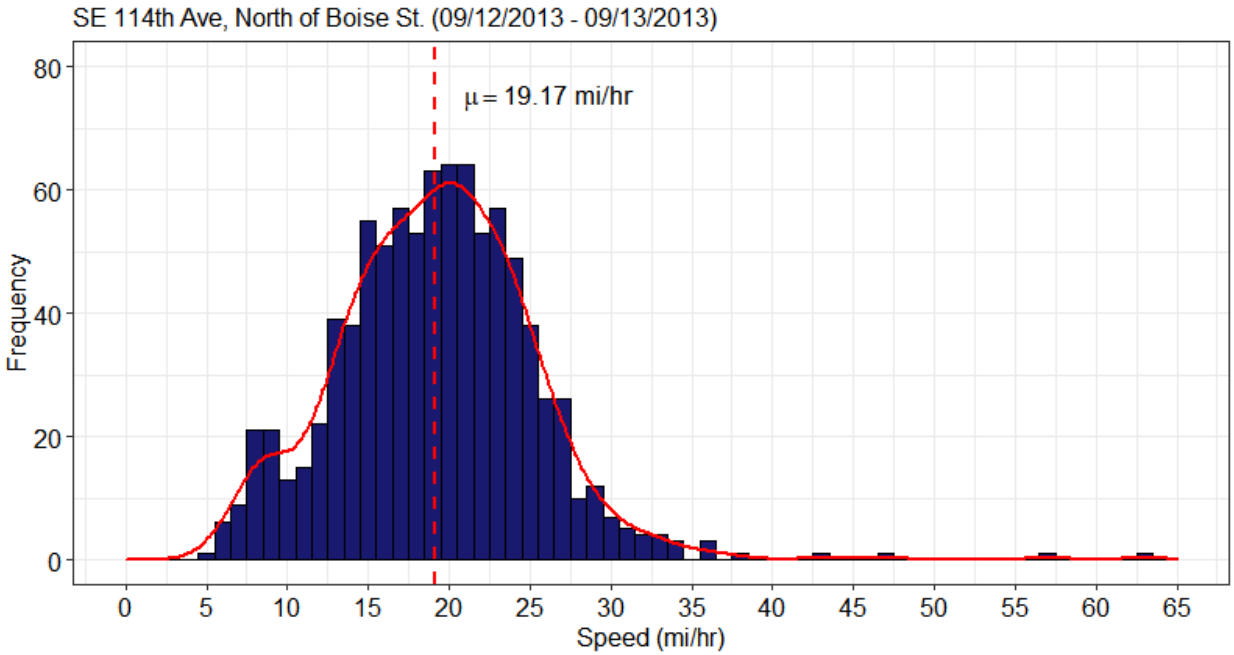

Figure B.73: Speed Distribution at SE 114th Ave (North of Boise St.) Before Speed Reduction

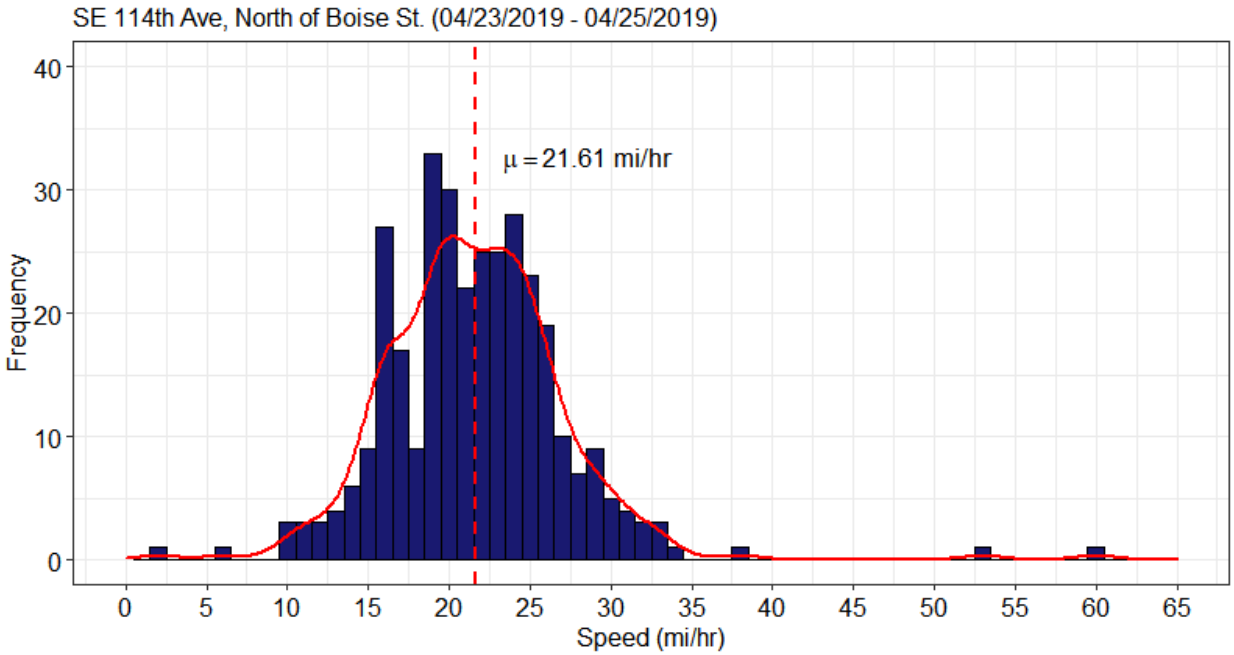

Figure B.74: Speed Distribution at SE 114th Ave (North of Boise St.) After Speed Reduction

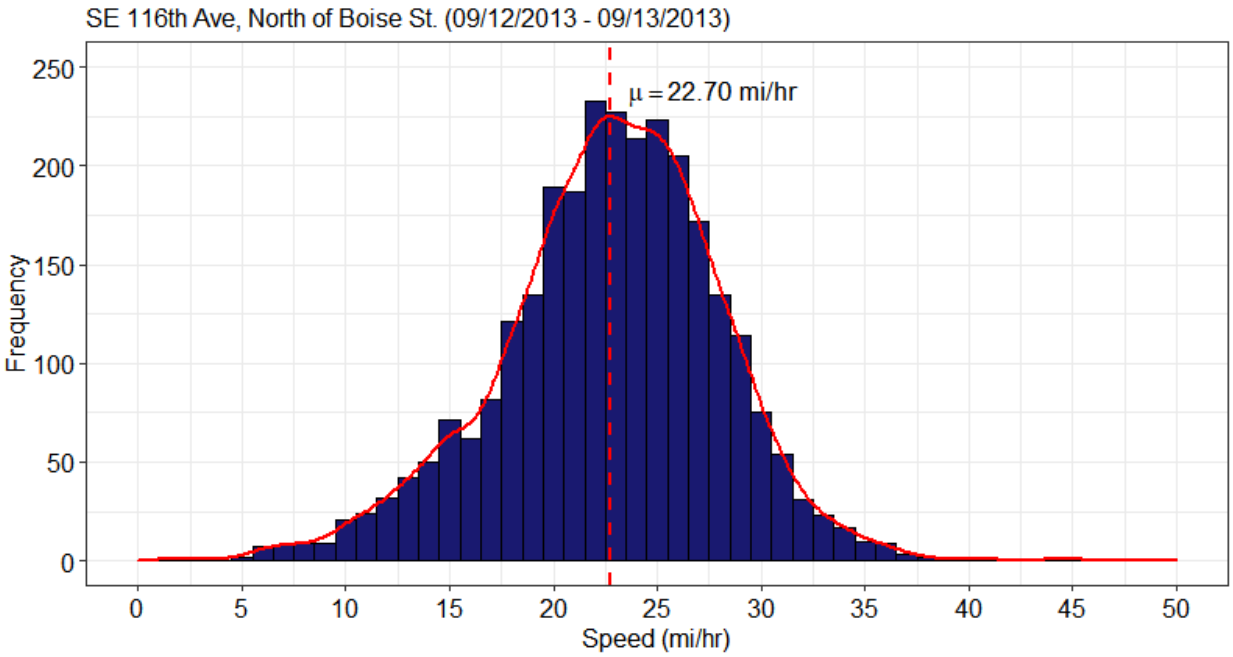

Figure B.75: Speed Distribution at SE 116th Ave (North of Boise St.) Before Speed Reduction

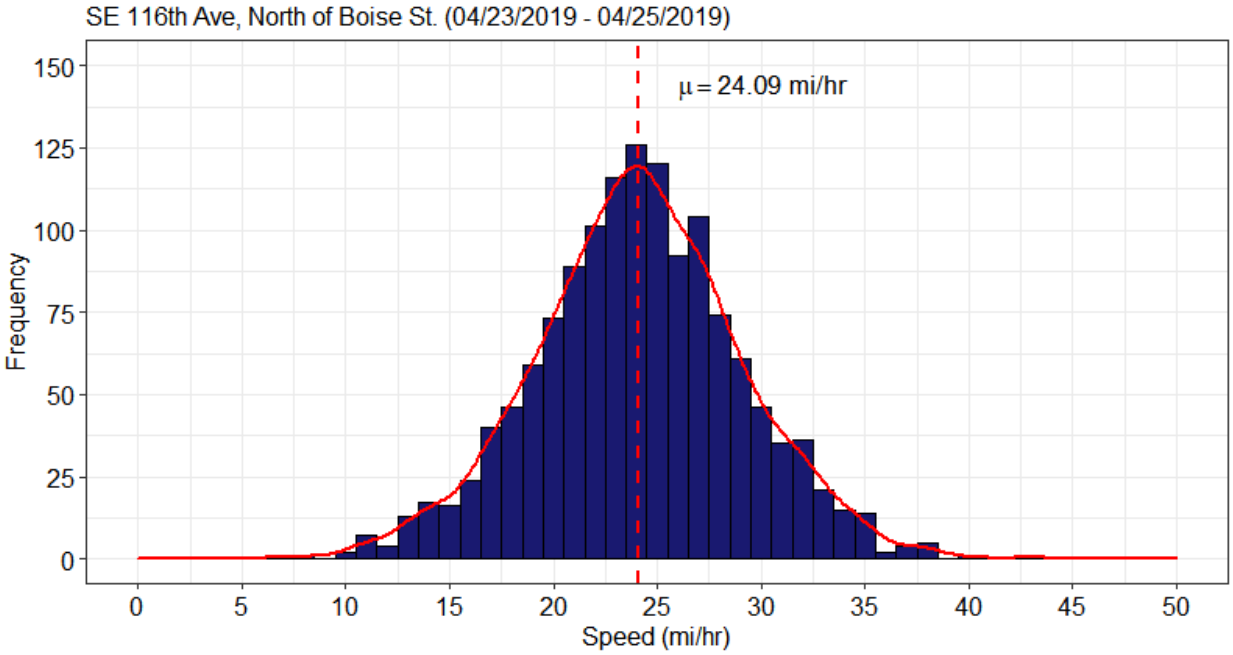

Figure B.76: Speed Distribution at SE 116th Ave (North of Boise St.) After Speed Reduction

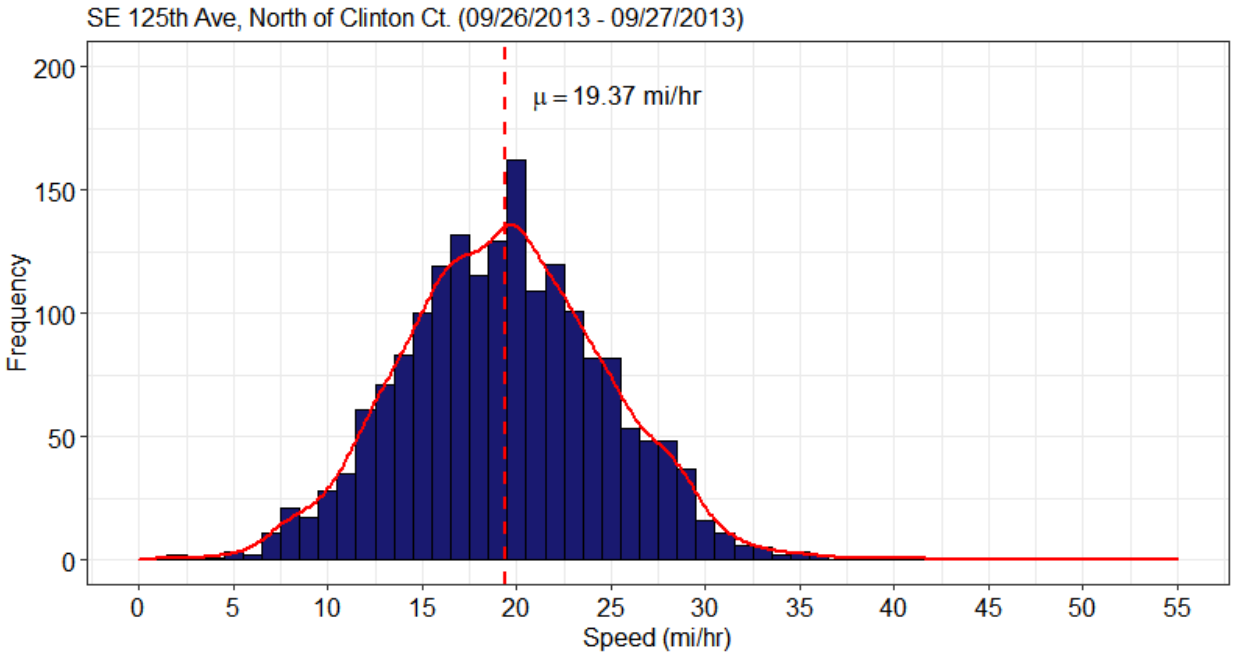

Figure B.77: Speed Distribution at SE 125th Ave (North of Clinton Ct.) Before Speed Reduction

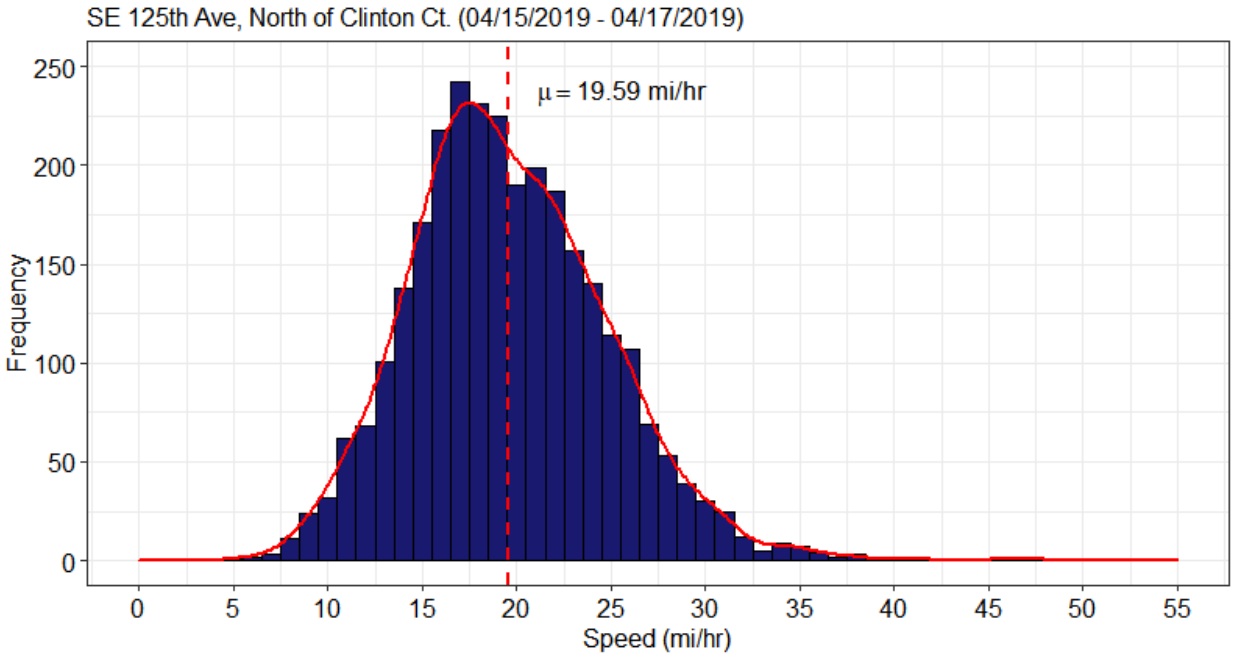

Figure B.78: Speed Distribution at SE 125th Ave (North of Clinton Ct.) After Speed Reduction

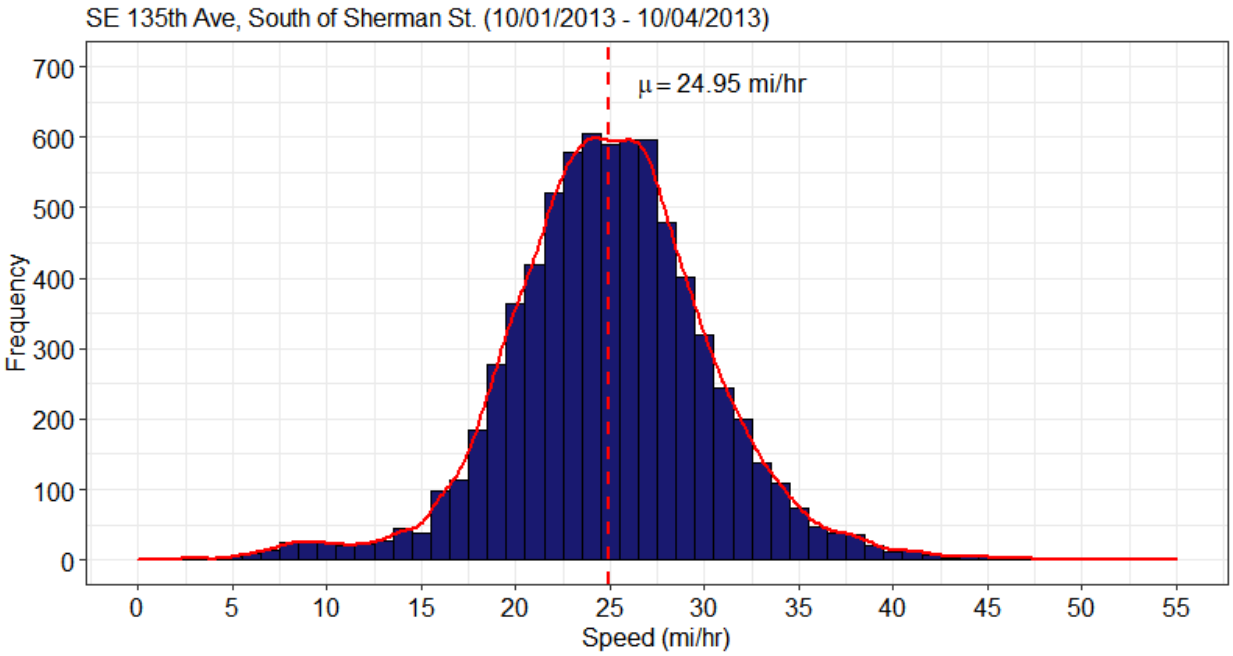

Figure B.79: Speed Distribution at SE 135th Ave (South of Sherman St.) Before Speed Reduction

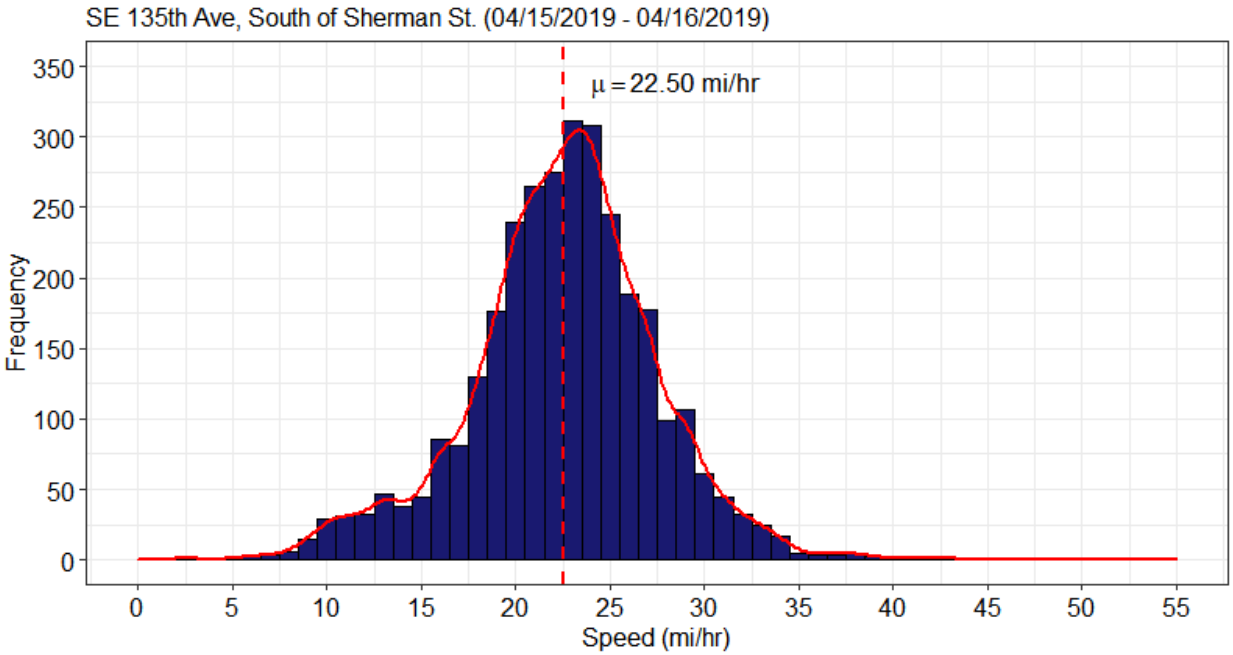

Figure B.80: Speed Distribution at SE 135th Ave (South of Sherman St.) After Speed Reduction

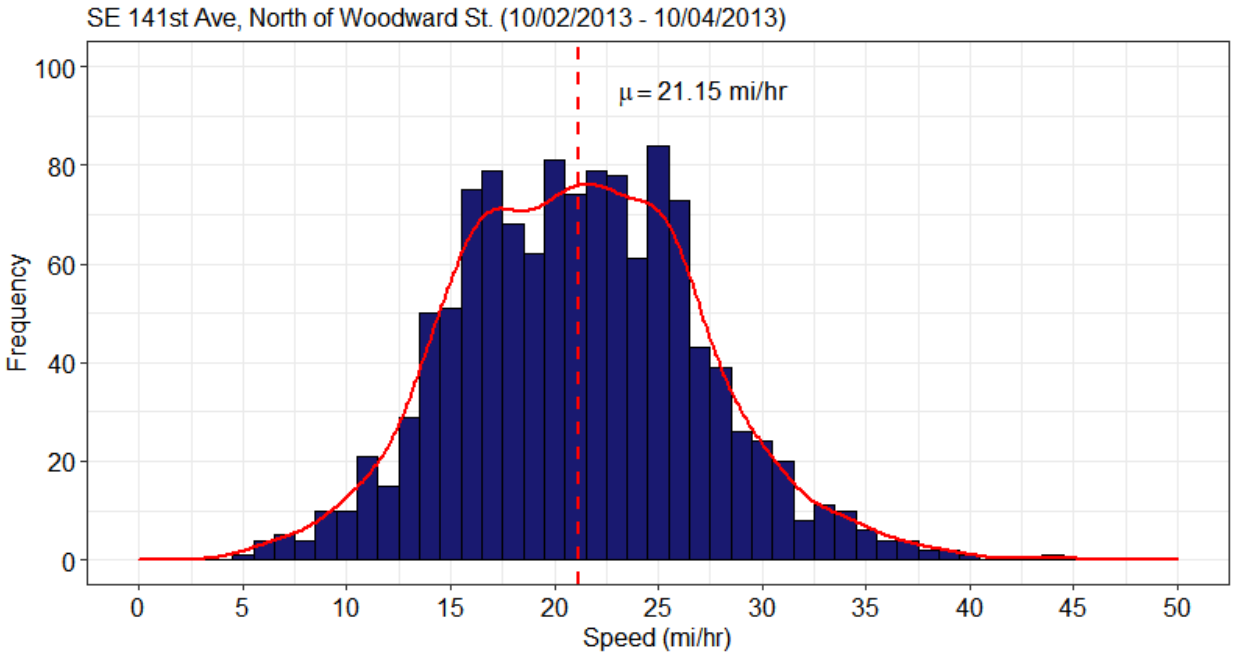

Figure B.81: Speed Distribution at SE 141st Ave (North of Woodward St.) Before Speed Reduction

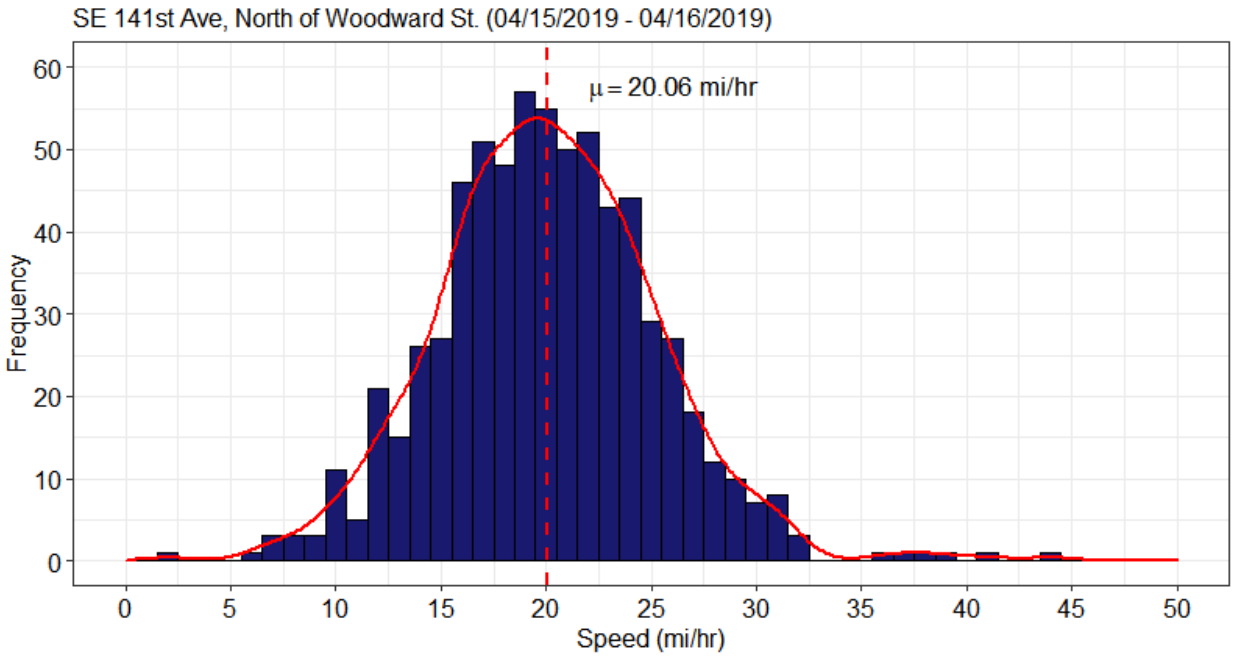

Figure B.82: Speed Distribution at SE 141st Ave (North of Woodward St.) After Speed Reduction

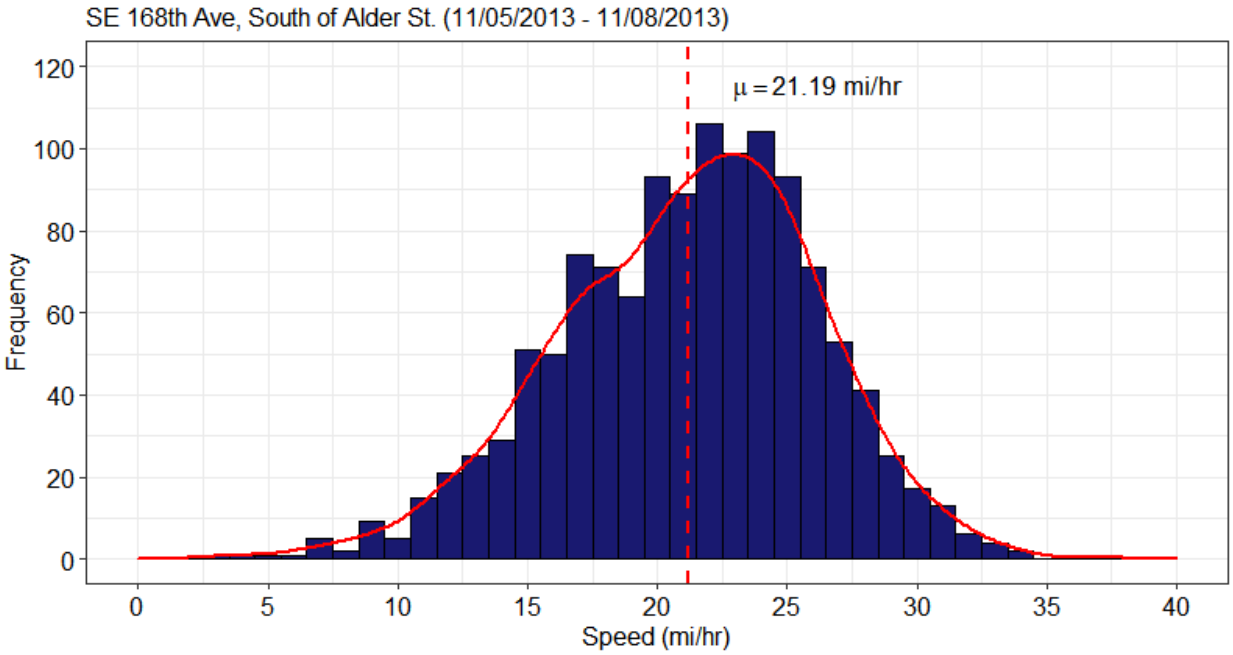

Figure B.83: Speed Distribution at SE 168th Ave (South of Alder St.) Before Speed Reduction

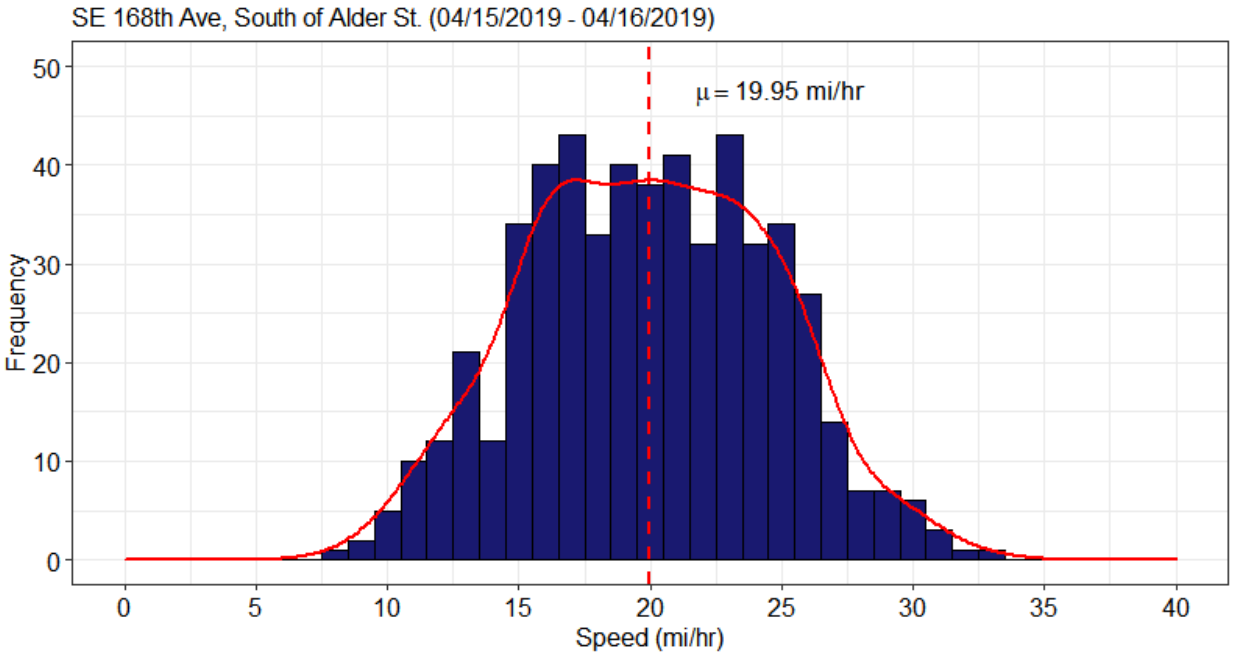

Figure B.84: Speed Distribution at SE 168th Ave (South of Alder St.) After Speed Reduction

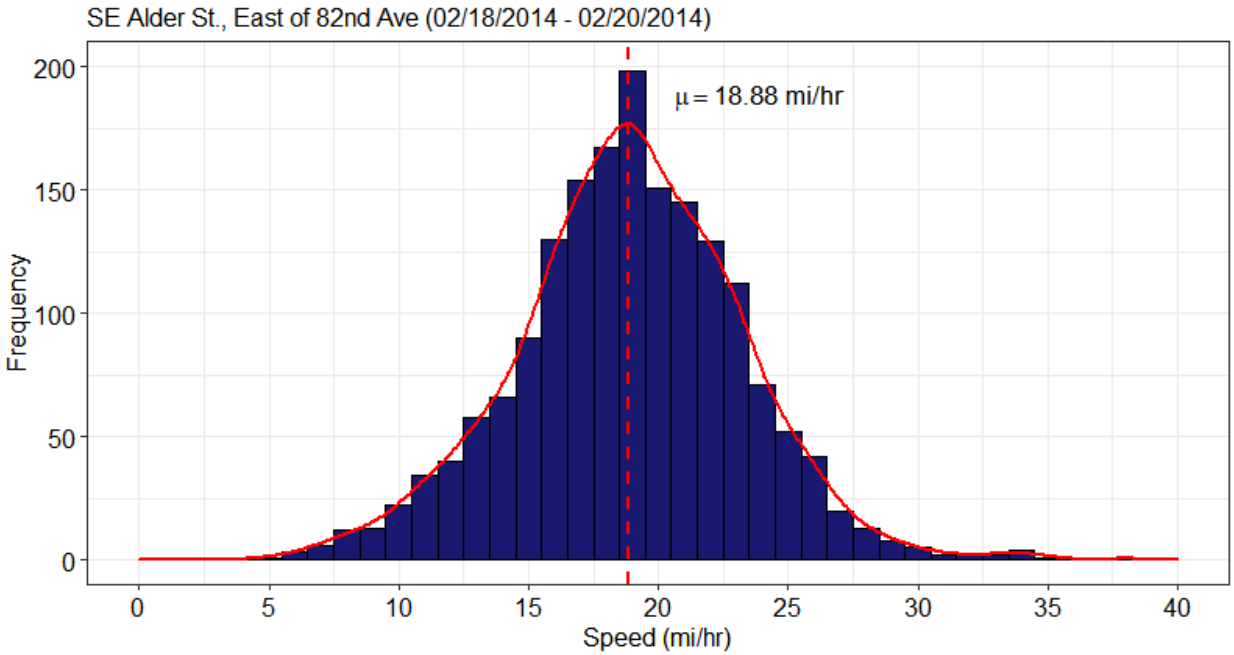

Figure B.85: Speed Distribution at SE Alder St. (East of 82nd Ave) Before Speed Reduction

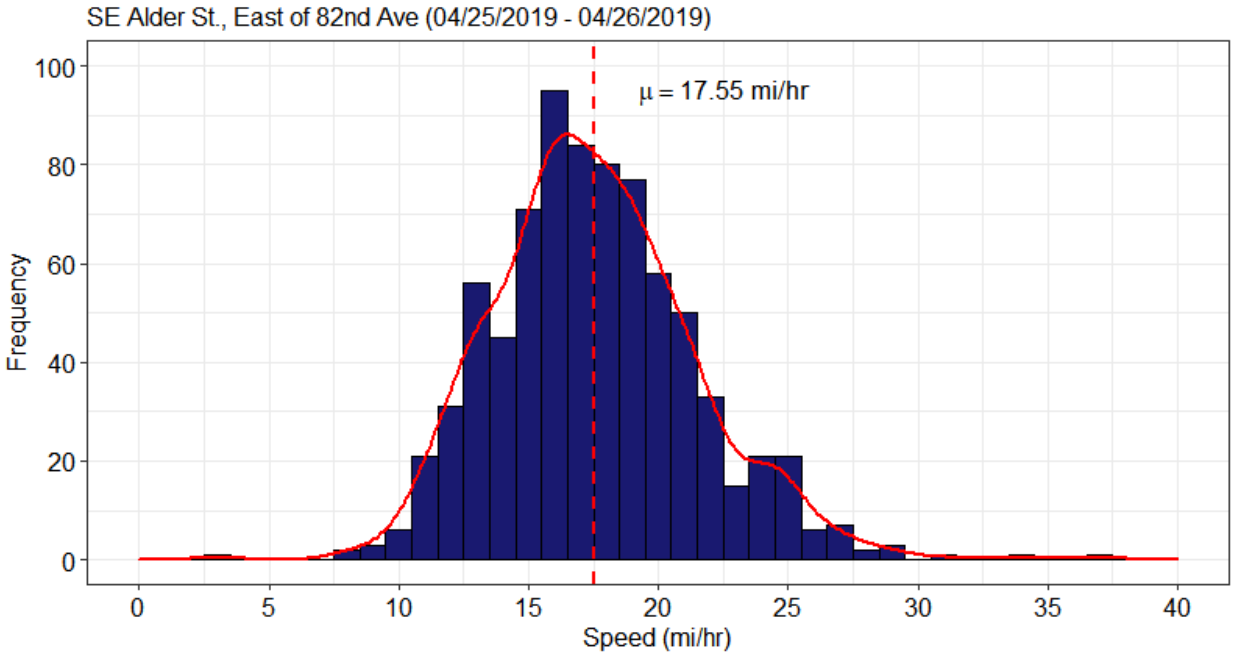

Figure B.86: Speed Distribution at SE Alder St. (East of 82nd Ave) After Speed Reduction

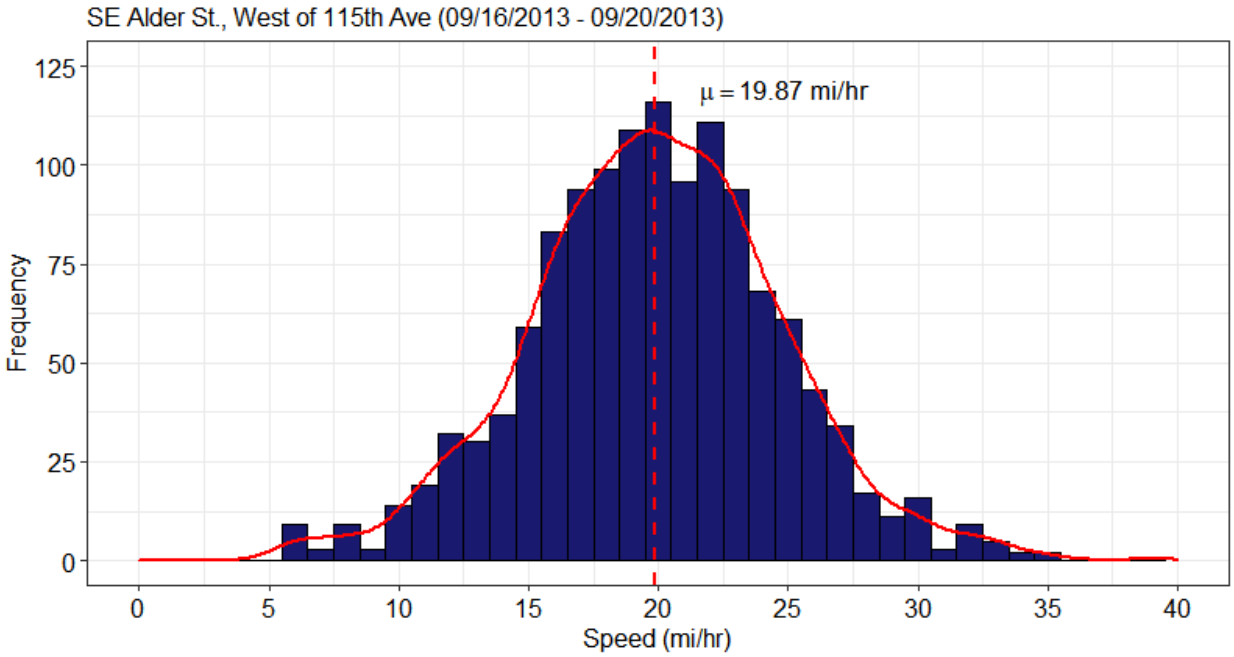

Figure B.87: Speed Distribution at SE Alder St. (West of 115th Ave) Before Speed Reduction

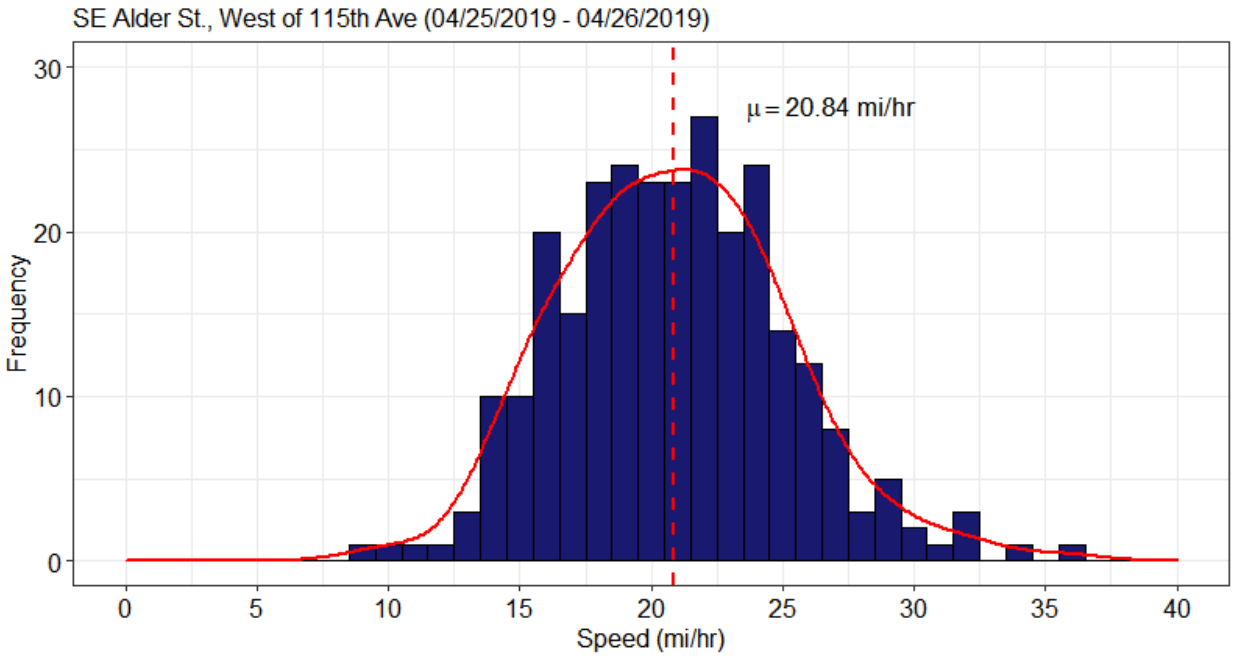

Figure B.88: Speed Distribution at SE Alder St. (West of 115th Ave) After Speed Reduction

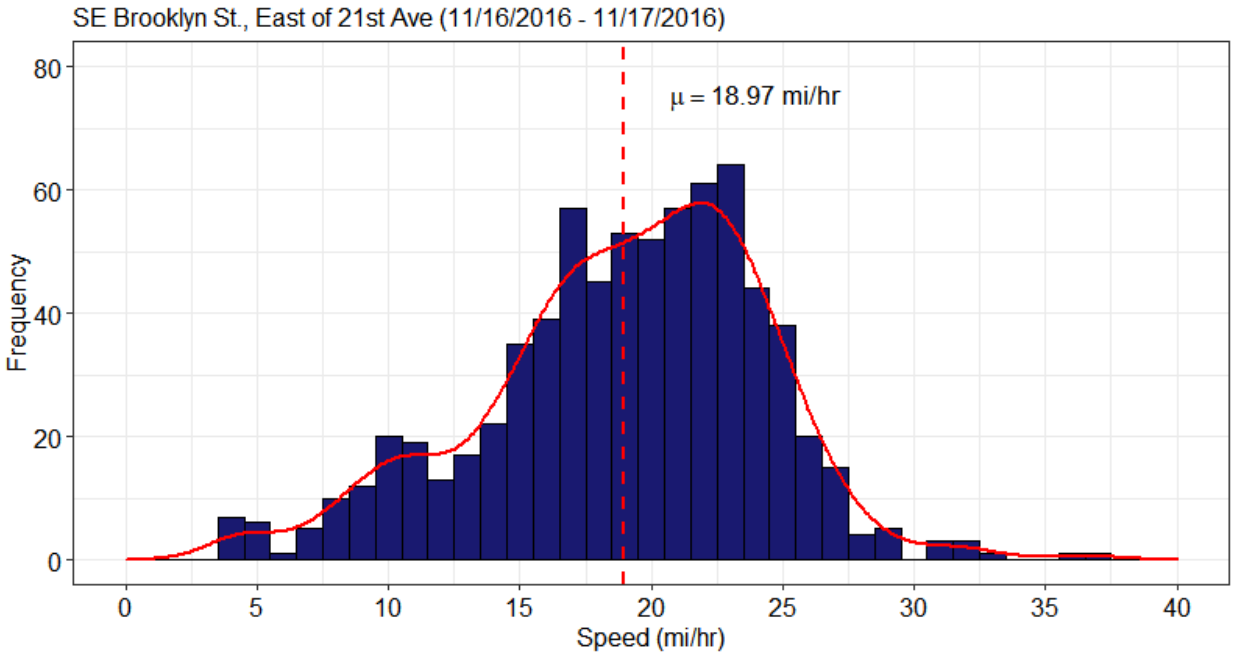

Figure B.89: Speed Distribution at SE Brooklyn St. (East of 21st Ave) Before Speed Reduction

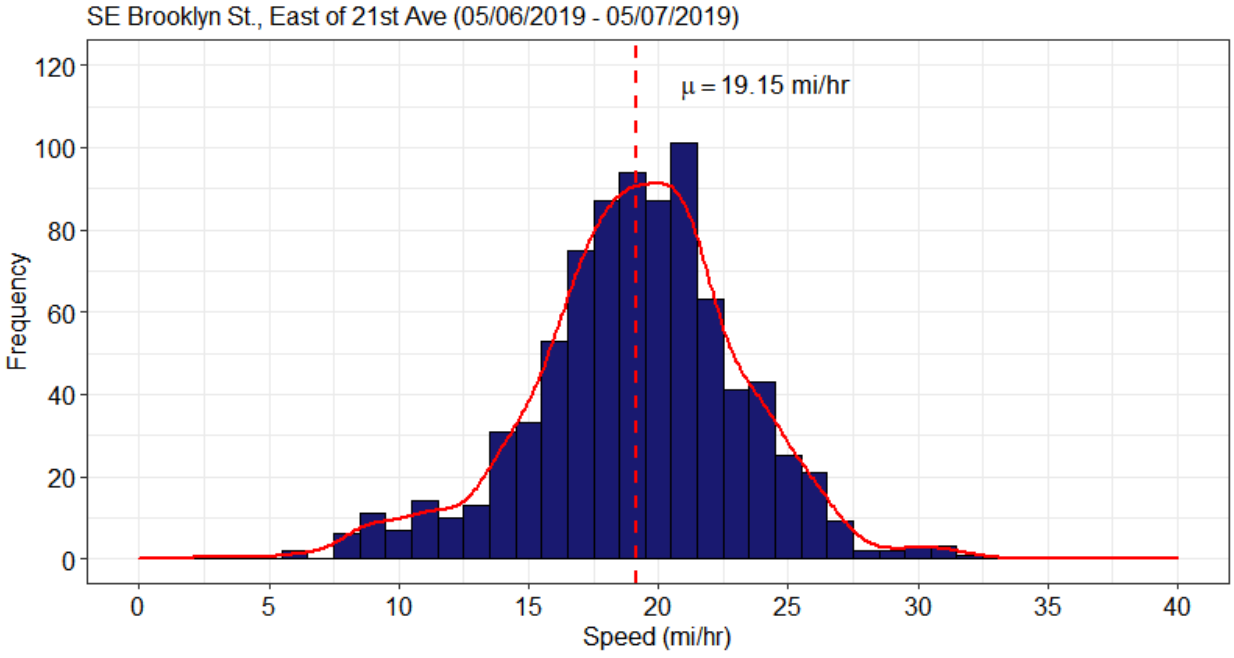

Figure B.90: Speed Distribution at SE Brooklyn St. (East of 21st Ave) After Speed Reduction

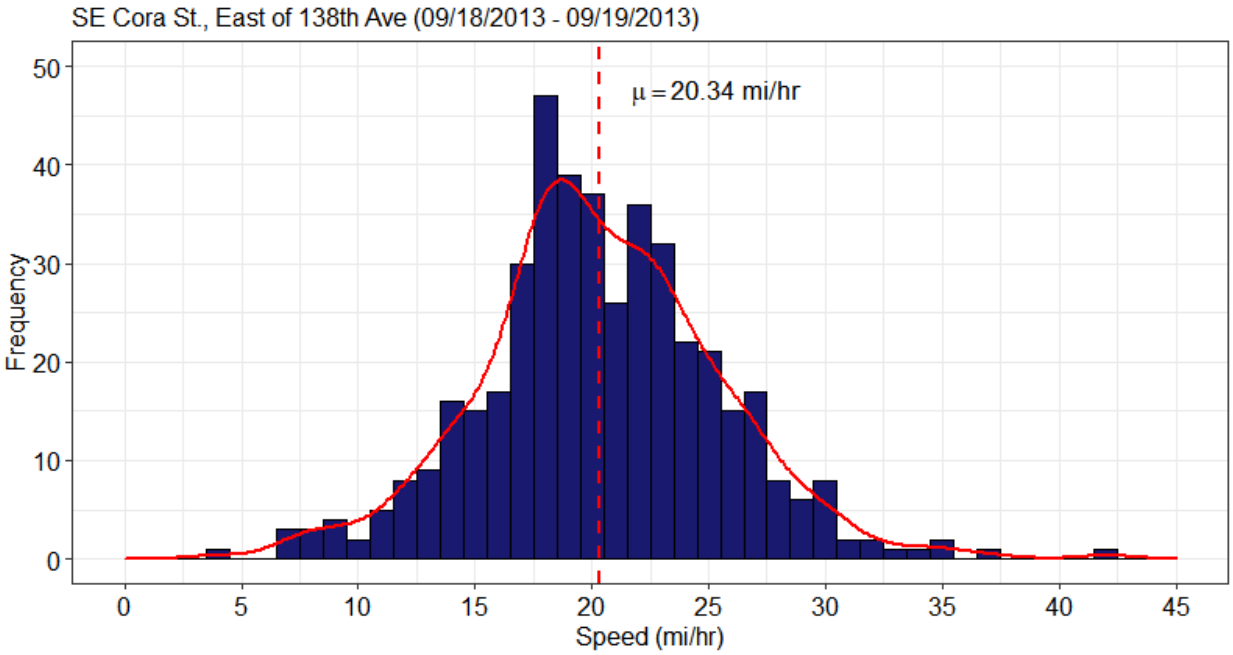

Figure B.91: Speed Distribution at SE Cora St. (East of 138th Ave) Before Speed Reduction

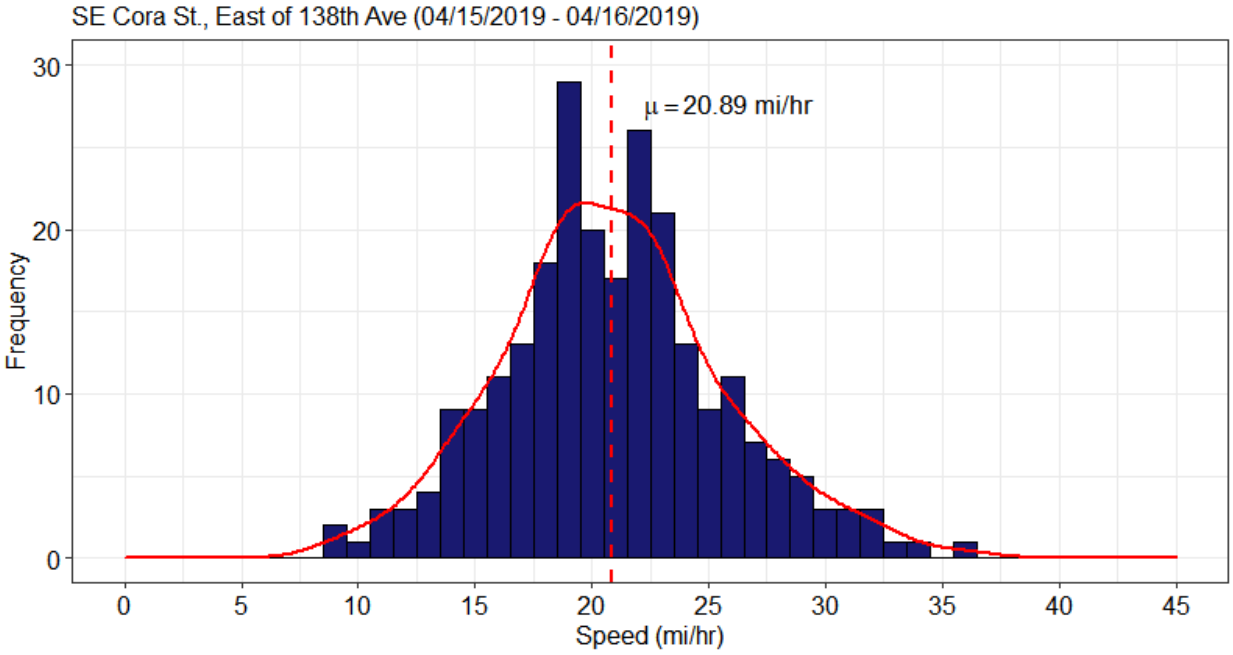

Figure B.92: Speed Distribution at SE Cora St. (East of 138th Ave) After Speed Reduction

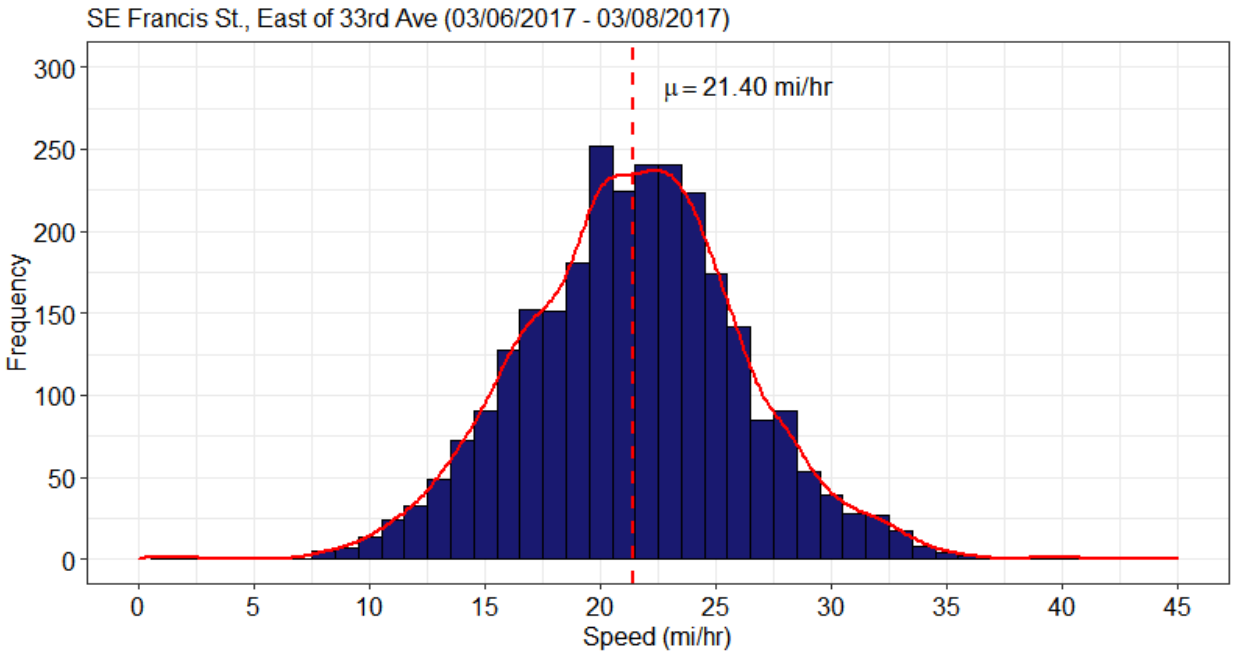

Figure B.93: Speed Distribution at SE Francis St. (East of 33rd Ave) Before Speed Reduction

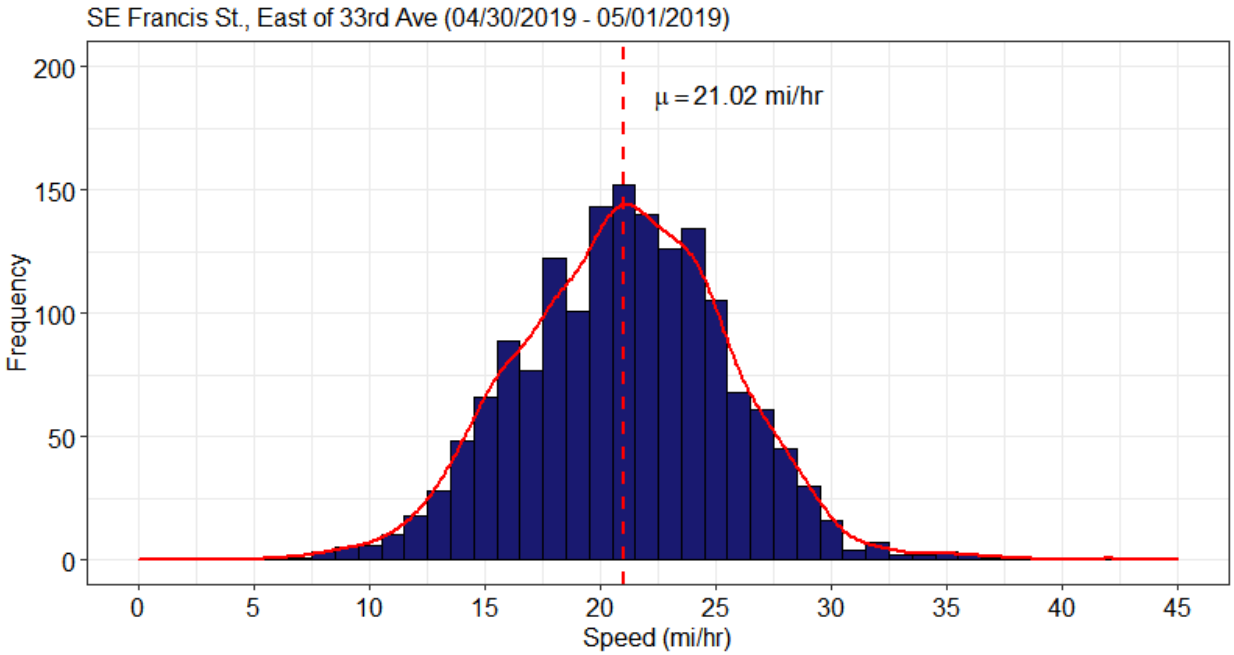

Figure B.94: Speed Distribution at SE Francis St. (East of 33rd Ave) After Speed Reduction

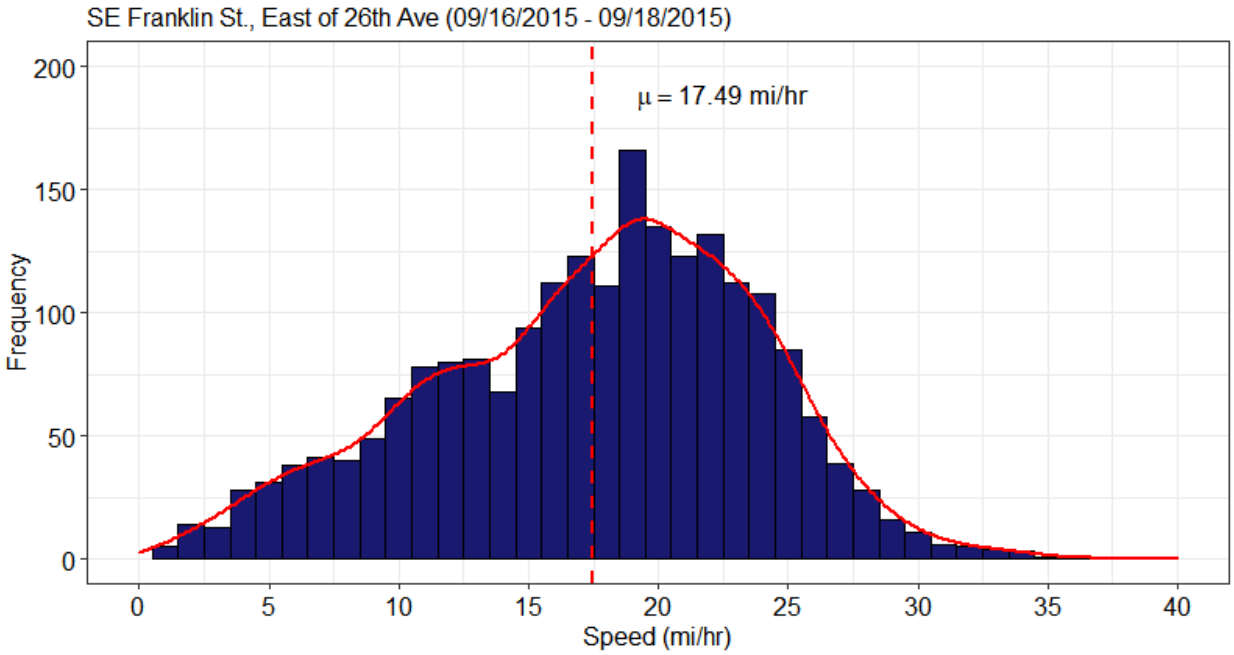

Figure B.95: Speed Distribution at SE Franklin St. (East of 26th Ave) Before Speed Reduction

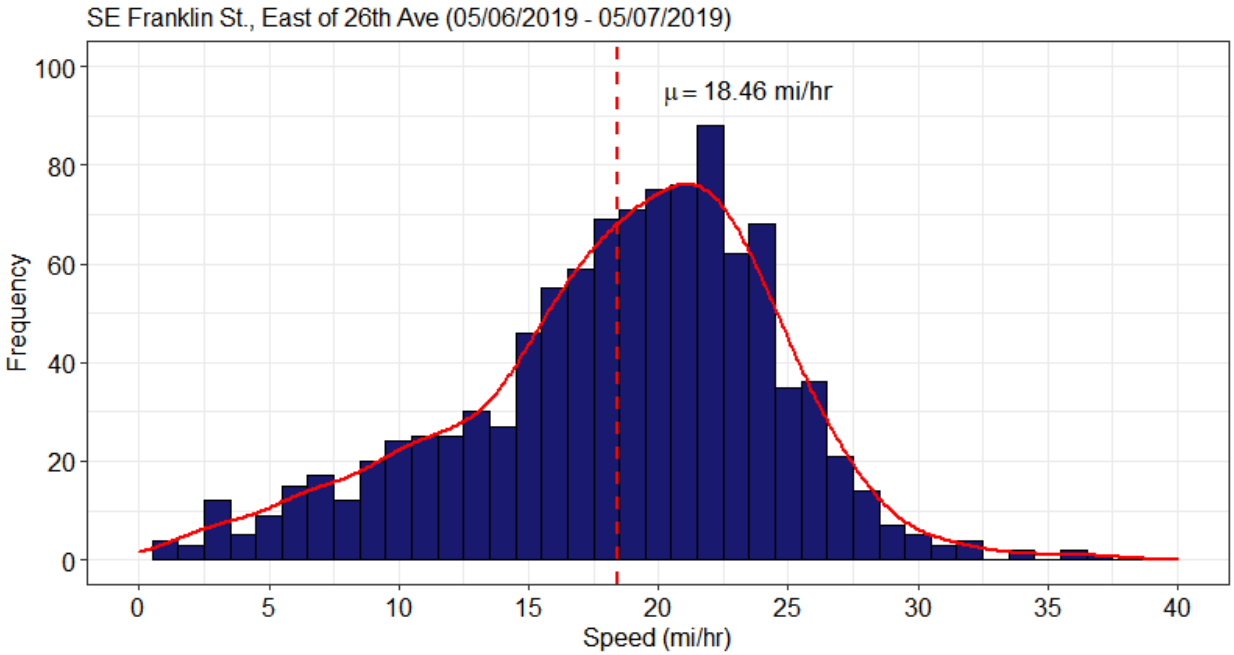

Figure B.96: Speed Distribution at SE Franklin St. (East of 26th Ave) After Speed Reduction

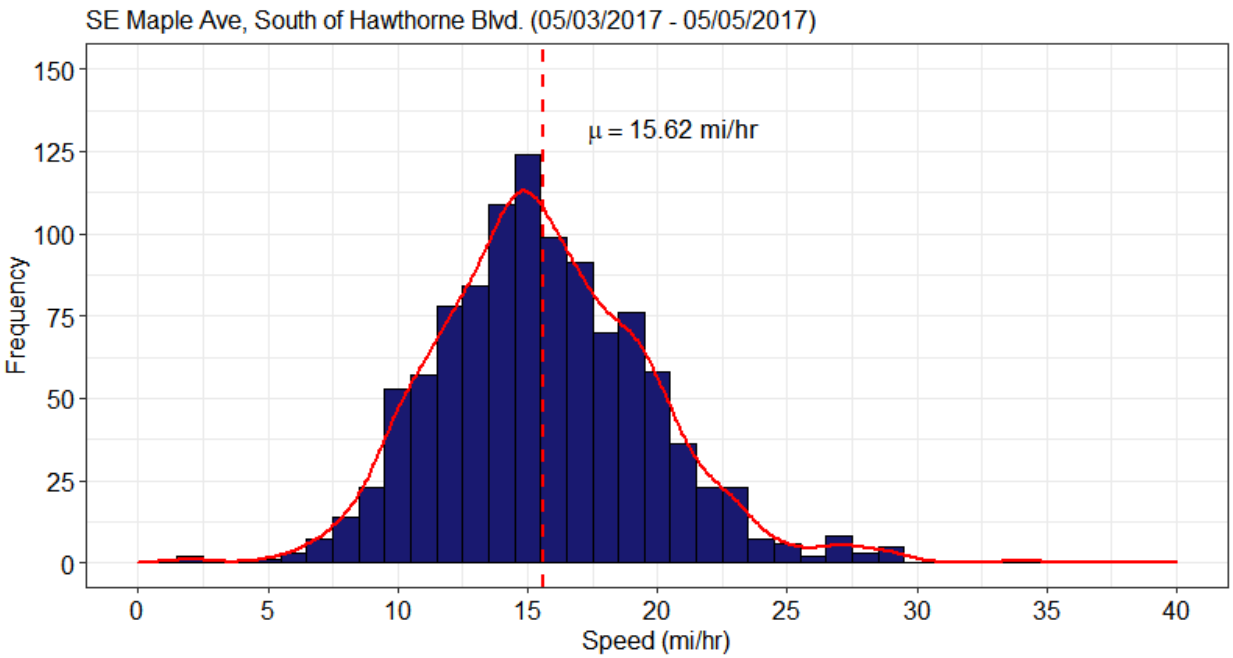

Figure B.97: Speed Distribution at SE Maple Ave (South of Hawthorne Blvd.) Before Speed Reduction

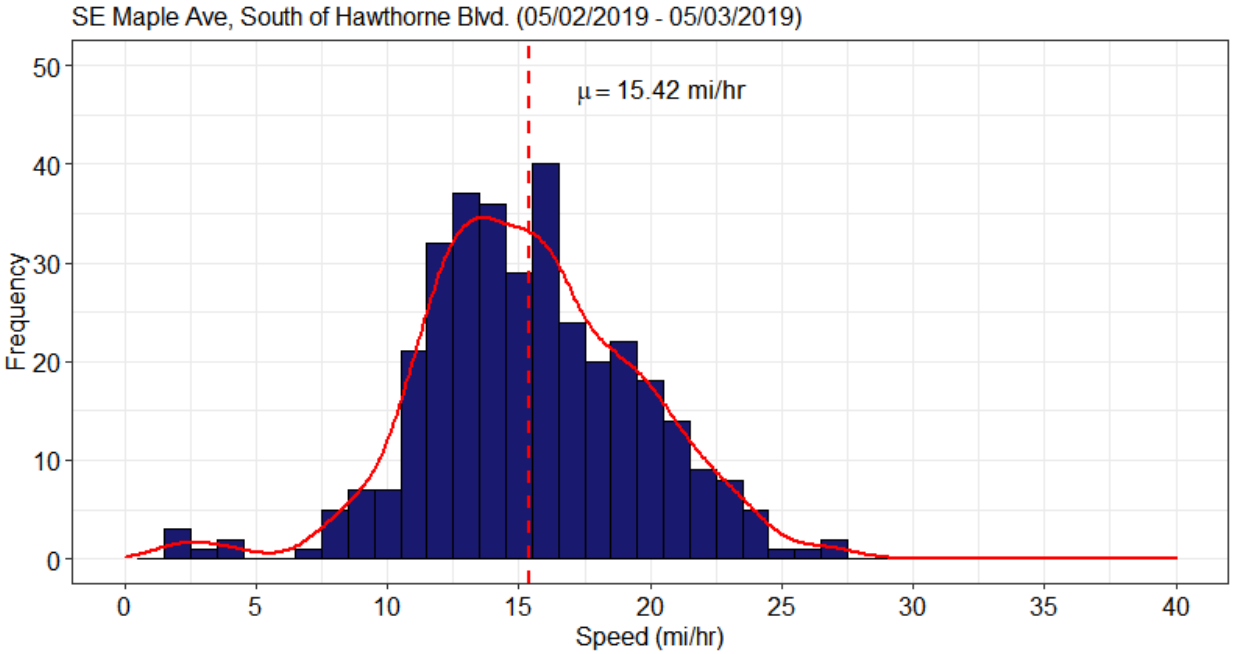

Figure B.98: Speed Distribution at SE Maple Ave (South of Hawthorne Blvd.) After Speed Reduction

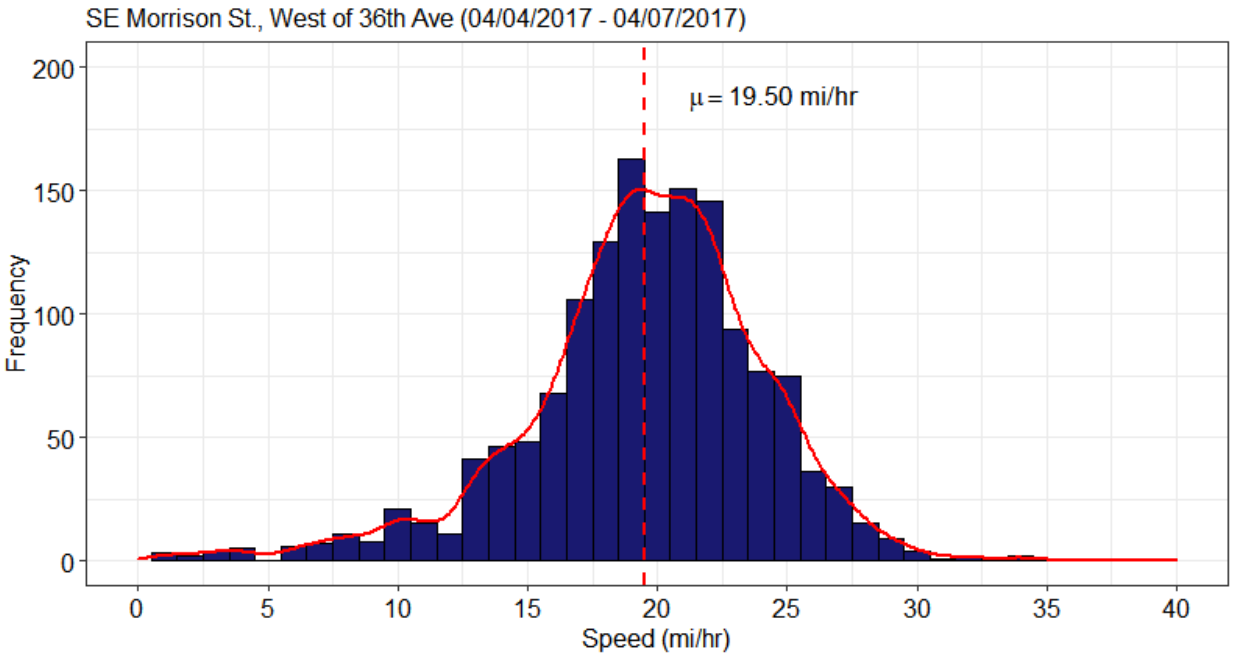

Figure B.99: Speed Distribution at SE Morrison St. (West of 36th Ave) Before Speed Reduction

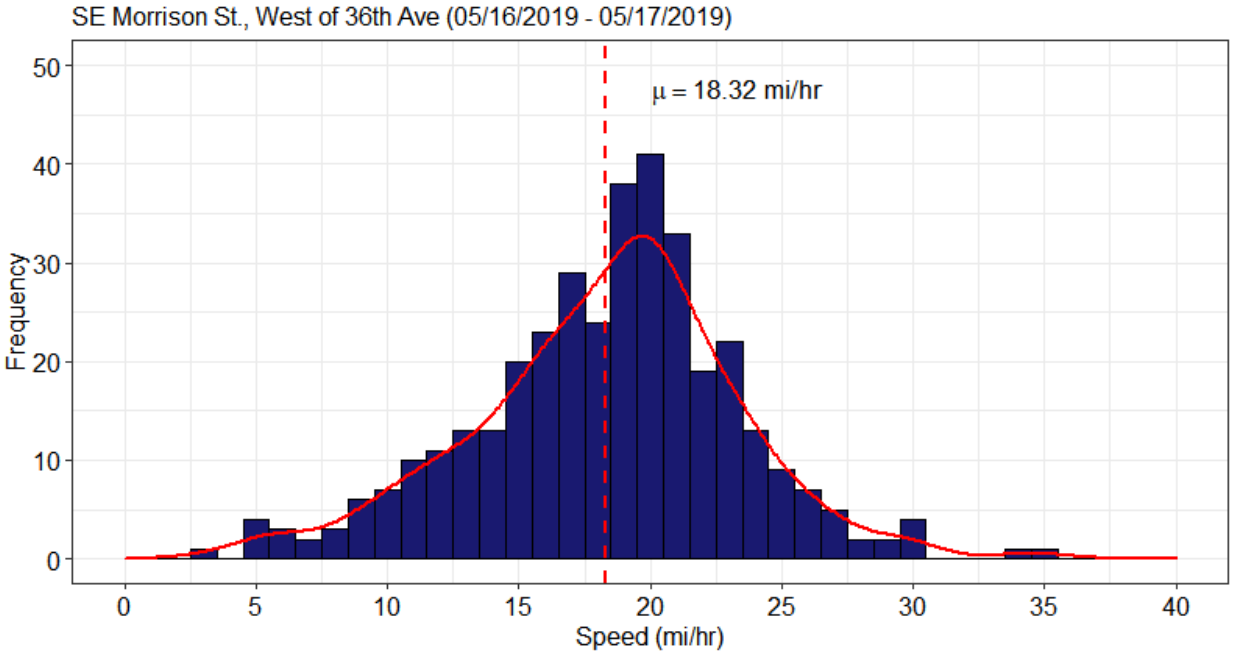

Figure B.100: Speed Distribution at SE Morrison St. (West of 36th Ave) After Speed Reduction

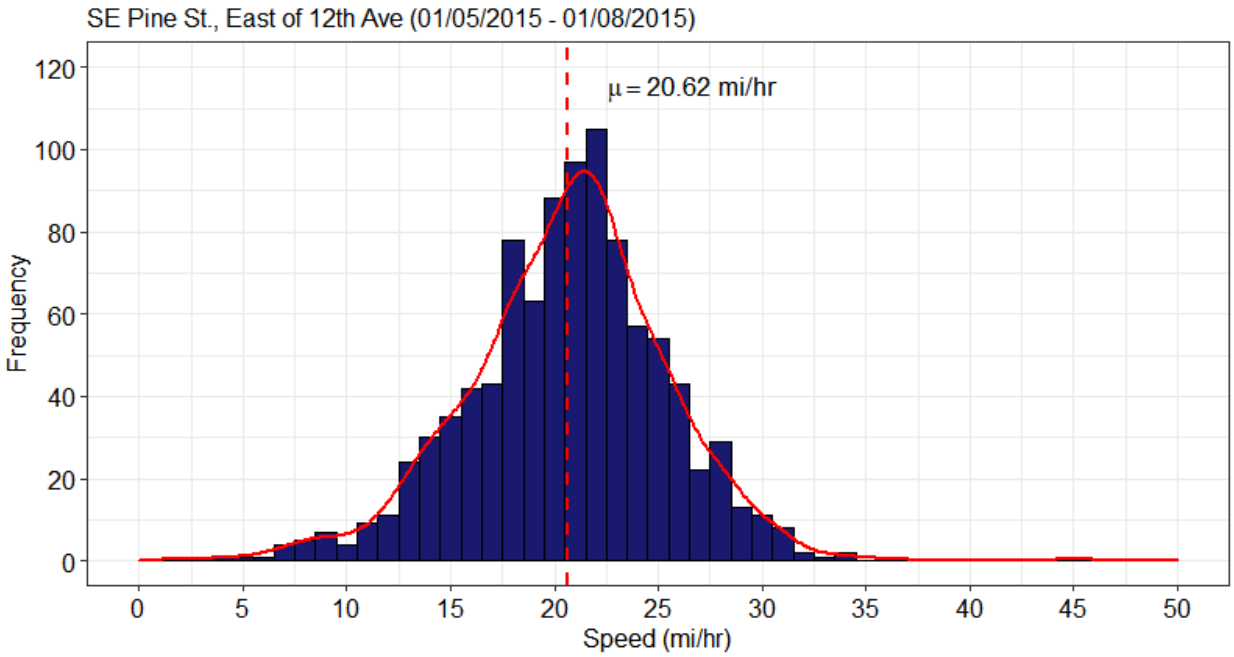

Figure B.101: Speed Distribution at SE Pine St. (East of 12th Ave) Before Speed Reduction

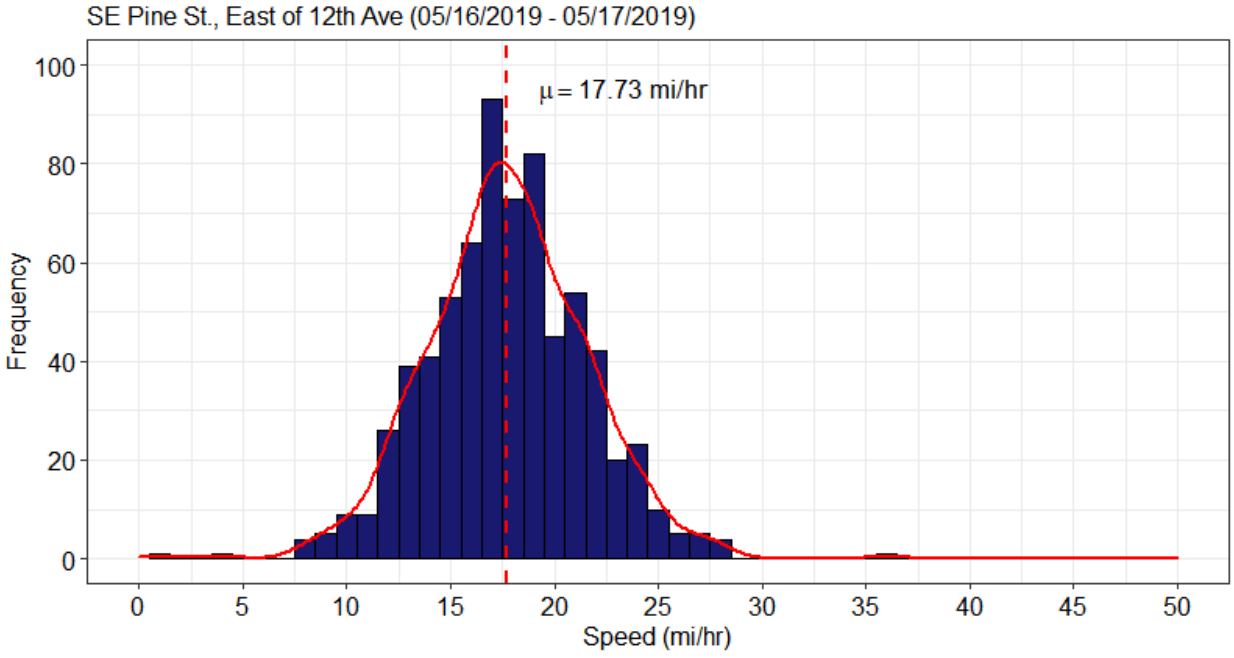

Figure B.102: Speed Distribution at SE Pine St. (East of 12th Ave) After Speed Reduction

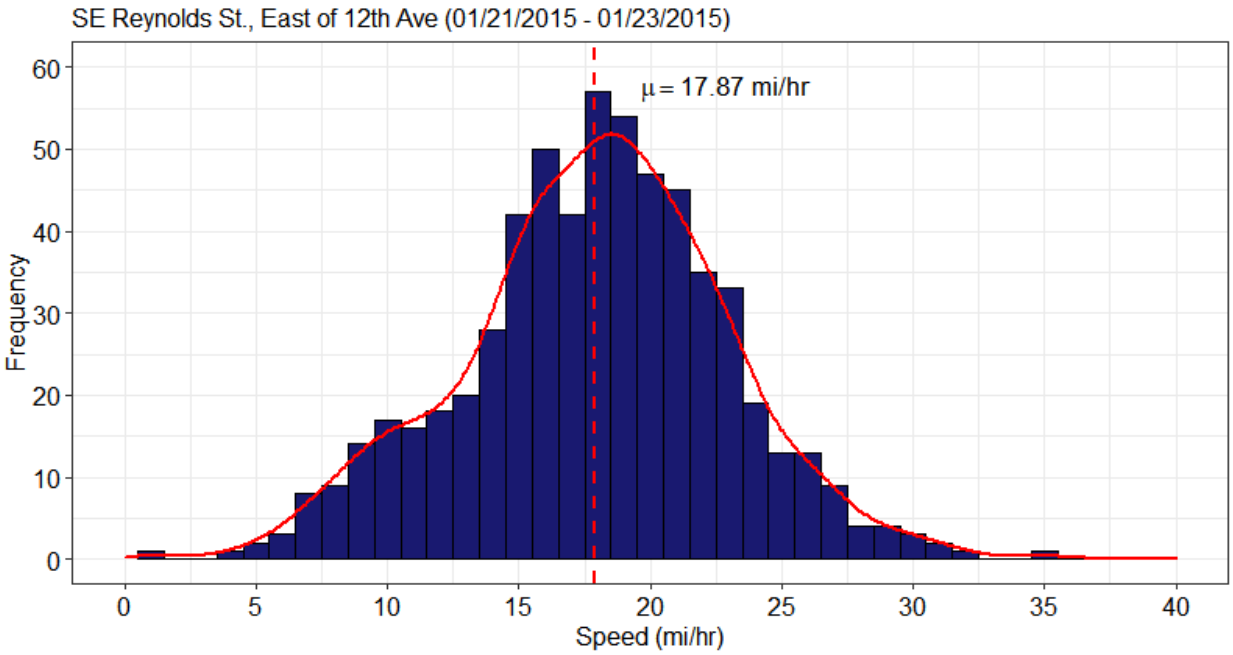

Figure B.103: Speed Distribution at SE Reynolds St. (East of 12th Ave) Before Speed Reduction

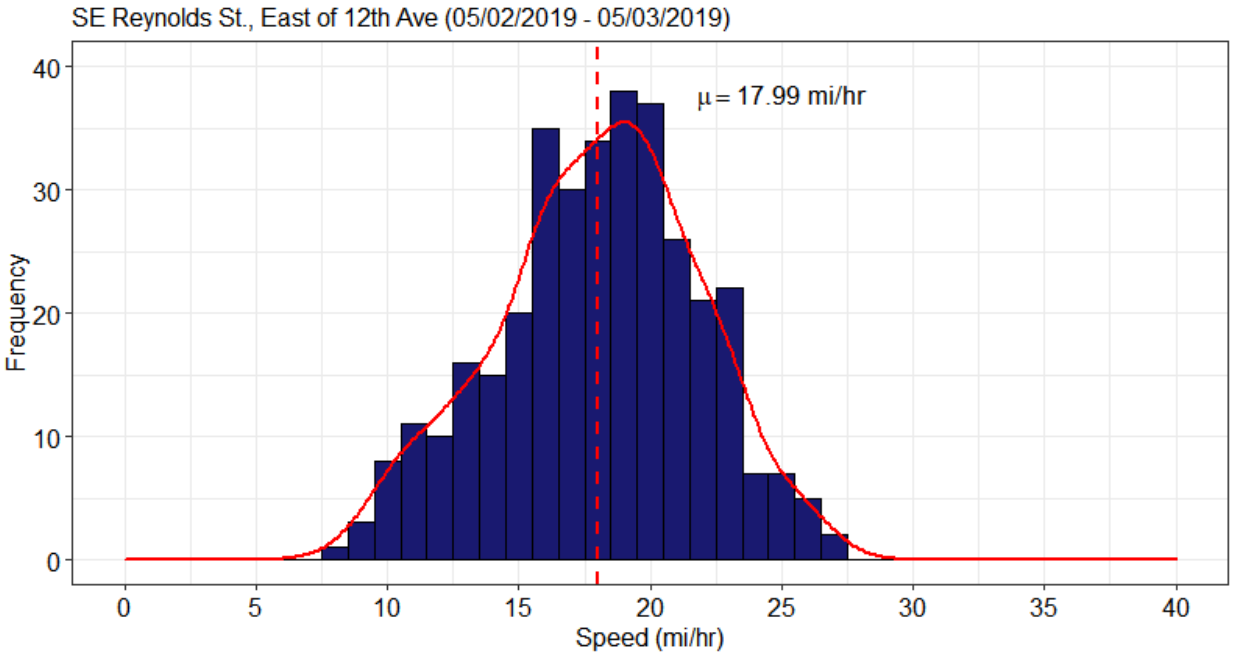

Figure B.104: Speed Distribution at SE Reynolds St. (East of 12th Ave) After Speed Reduction

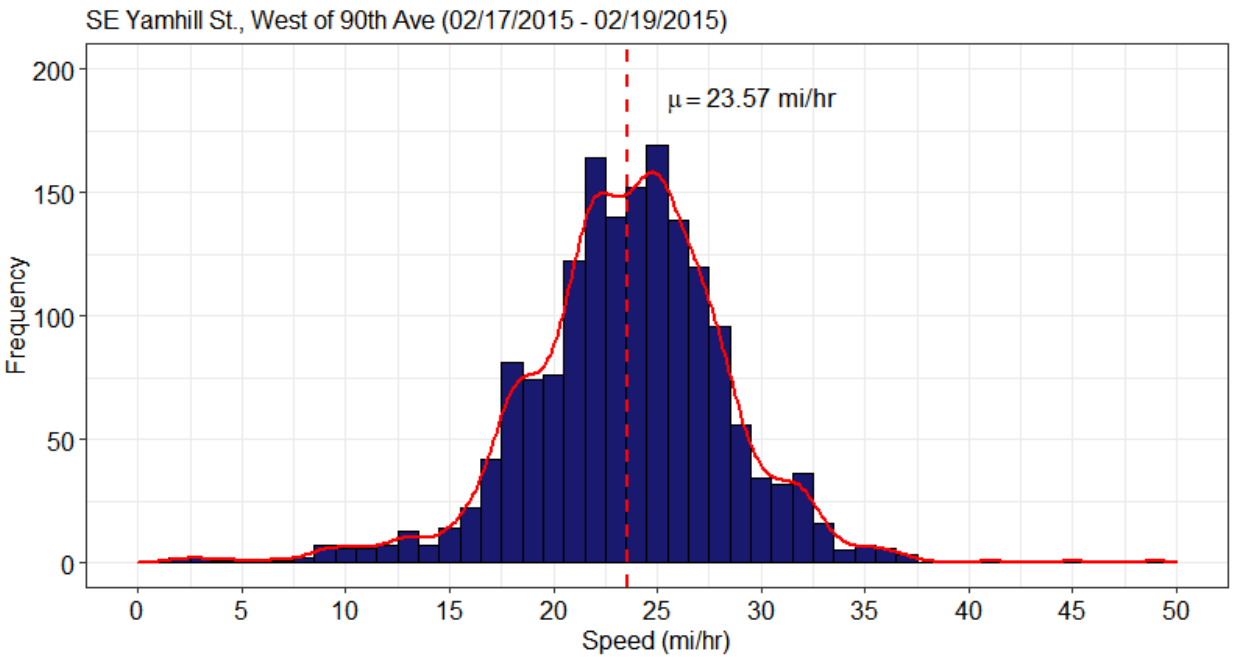

Figure B.105: Speed Distribution at SE Yamhill St. (West of 90th Ave) Before Speed Reduction

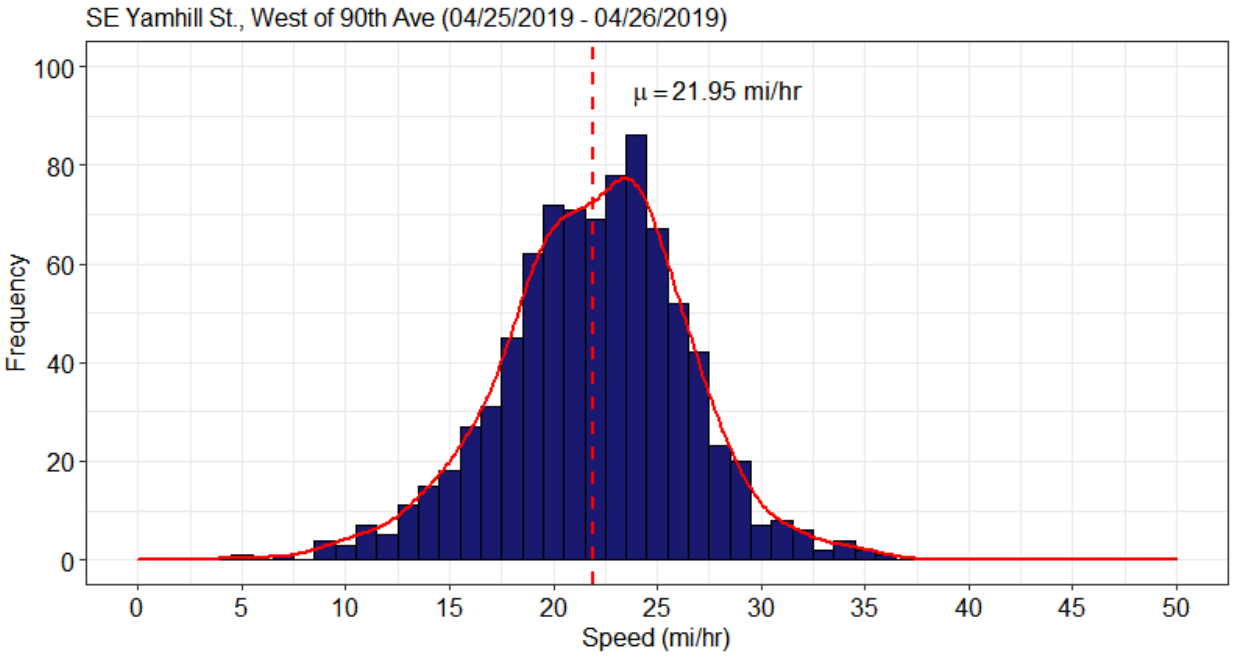

Figure B.106: Speed Distribution at SE Yamhill St. (West of 90th Ave) After Speed Reduction

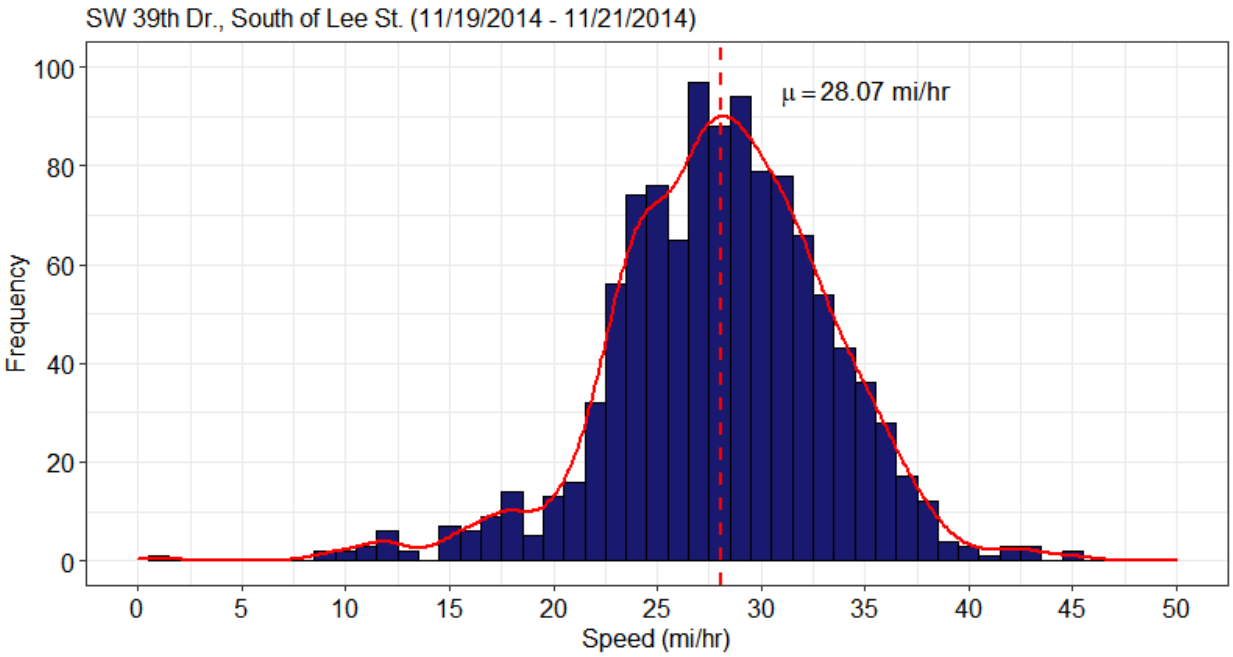

Figure B.107: Speed Distribution at SW 39th Dr. (South of Lee St.) Before Speed Reduction

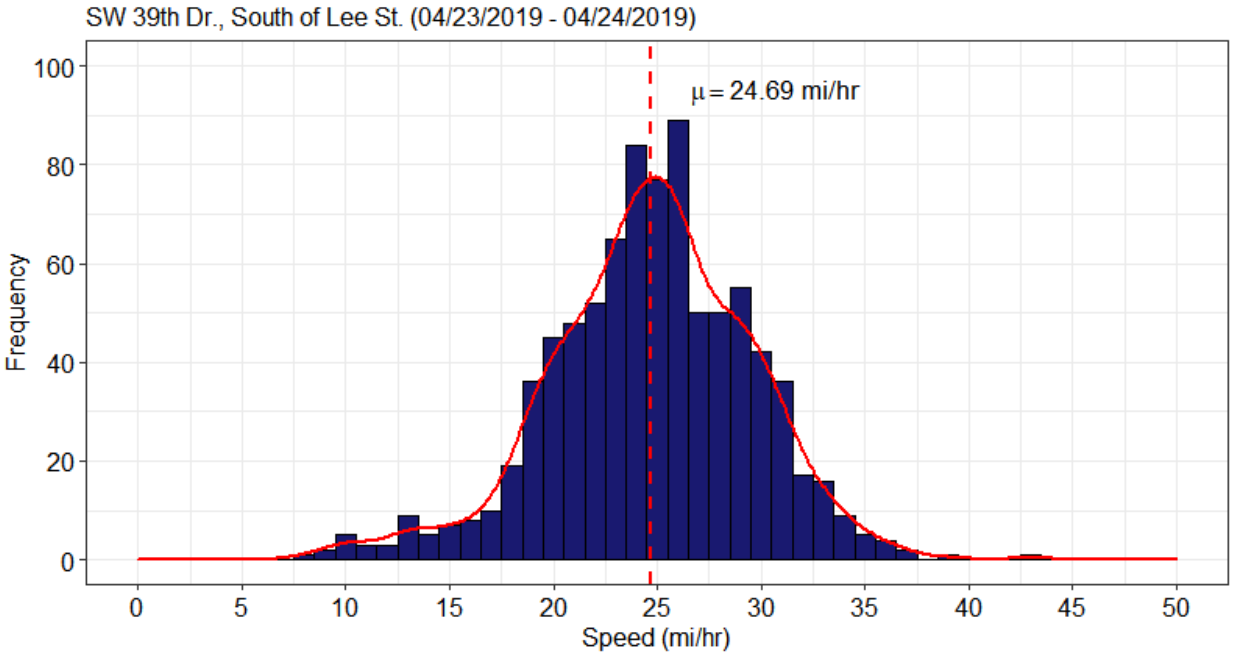

Figure B.108: Speed Distribution at SW 39th Dr. (South of Lee St.) After Speed Reduction

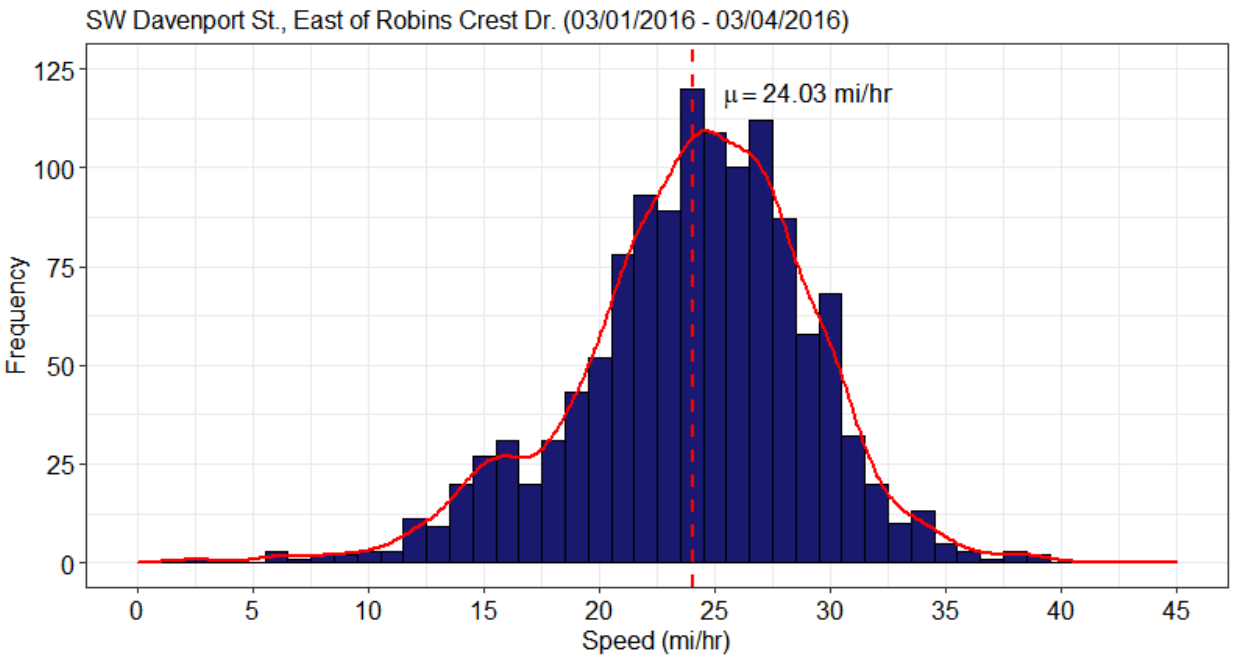

Figure B.109: Speed Distribution at SW Davenport St. (East of Robins Crest Dr.) Before Speed Reduction

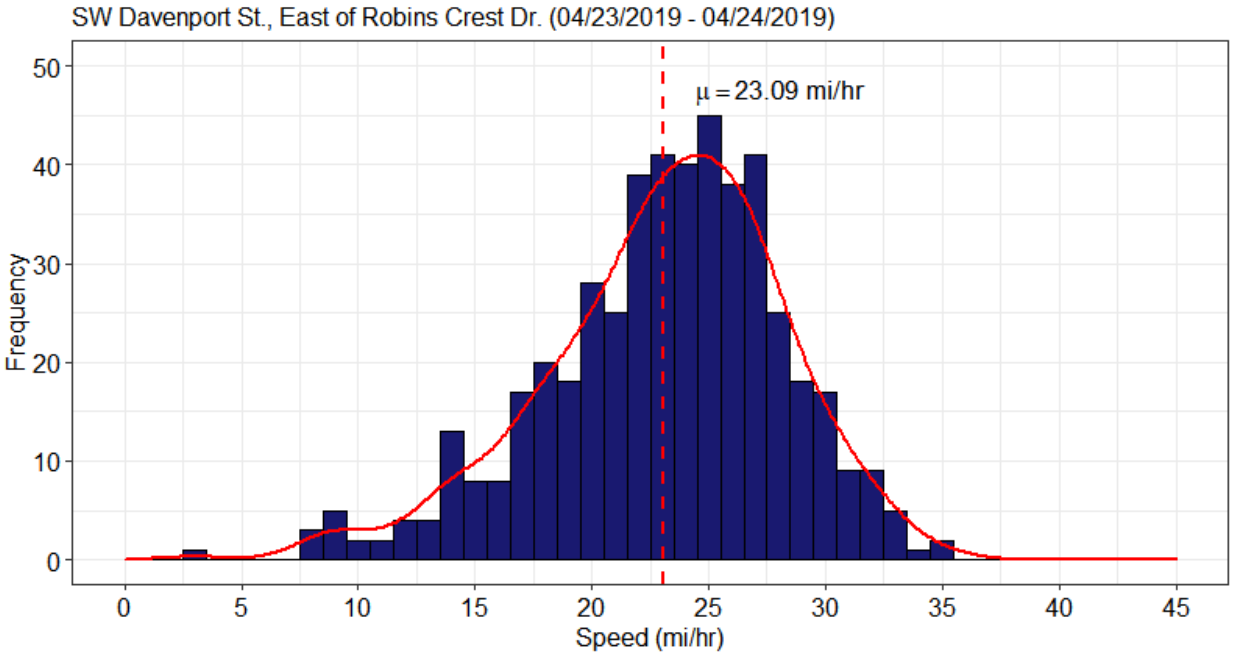

Figure B.110: Speed Distribution at SW Davenport St. (East of Robins Crest Dr.) After Speed Reduction

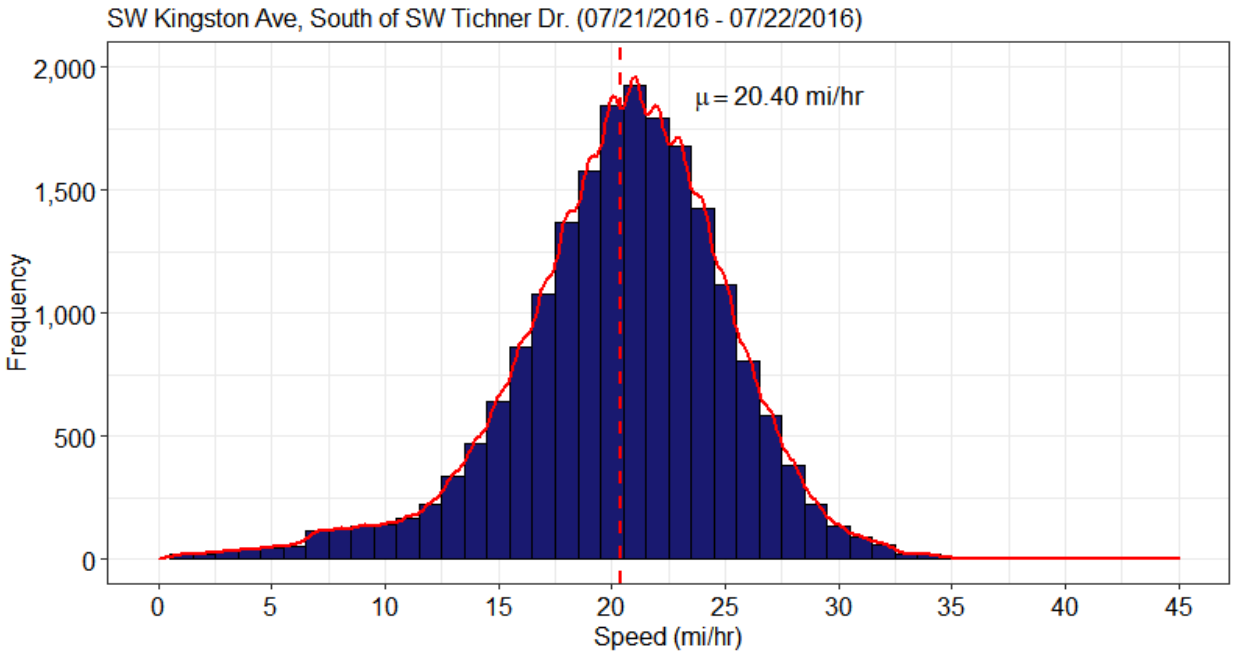

Figure B.111: Speed Distribution at SW Kingston Ave (South of SW Tichner Dr.) Before Speed Reduction

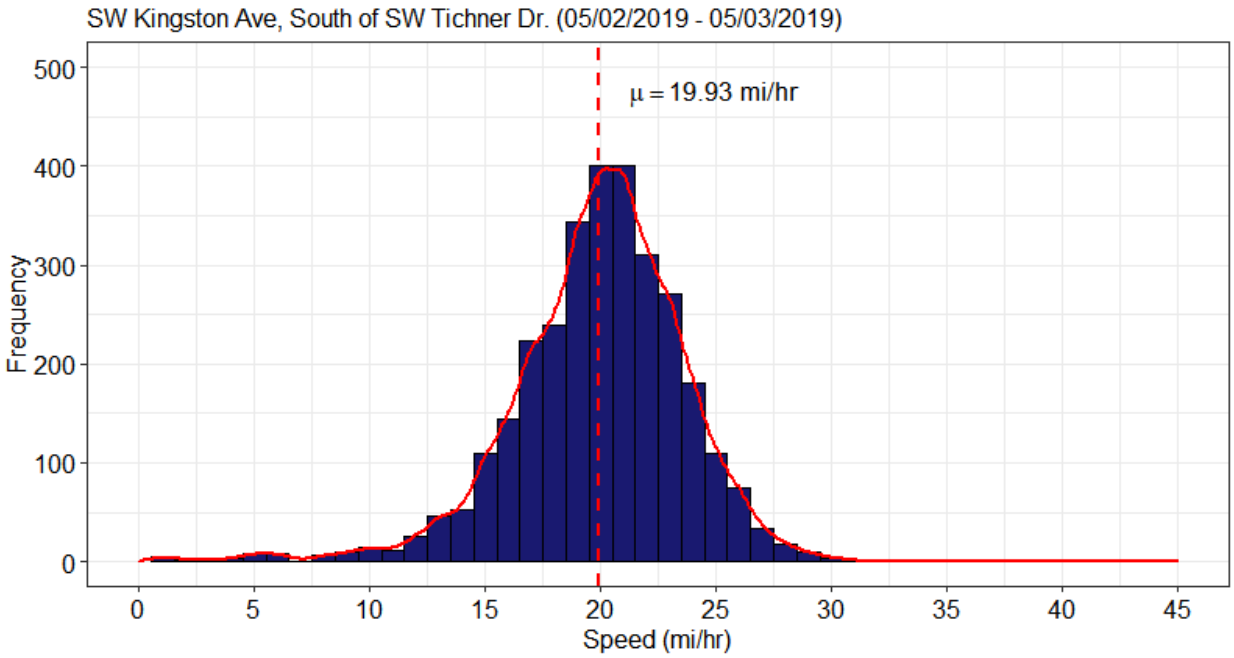

Figure B.112: Speed Distribution at SW Kingston Ave (South of SW Tichner Dr.) After Speed Reduction

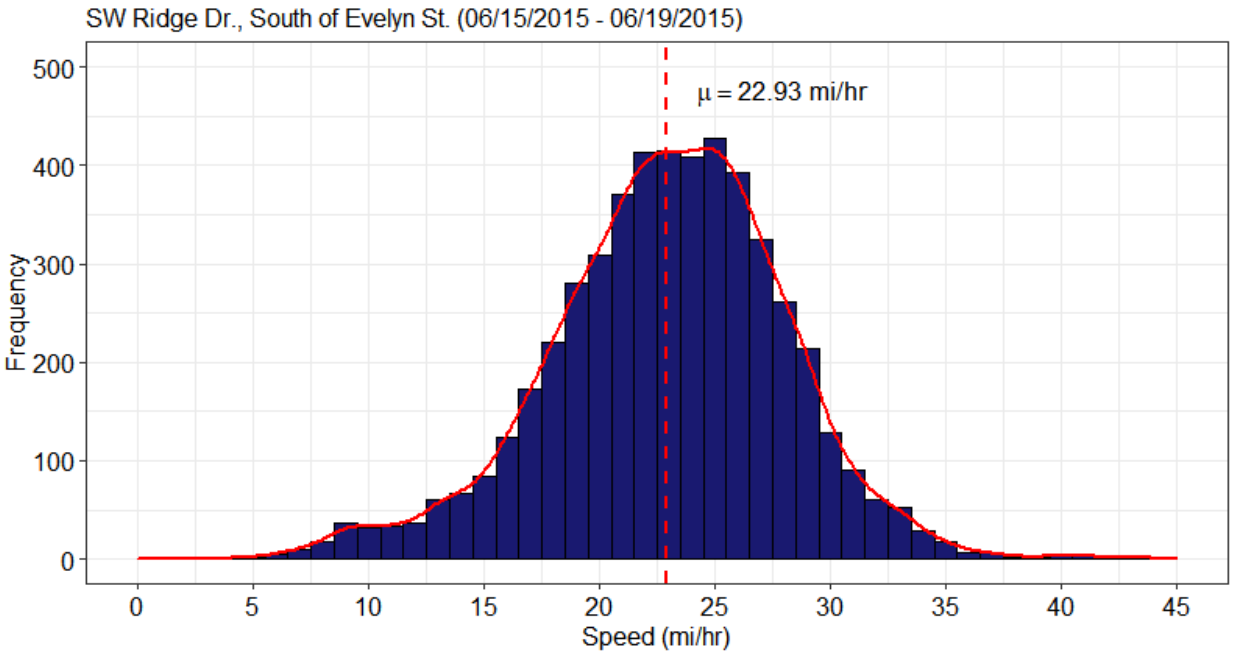

Figure B.113: Speed Distribution at SW Ridge Dr. (South of Evelyn St.) Before Speed Reduction

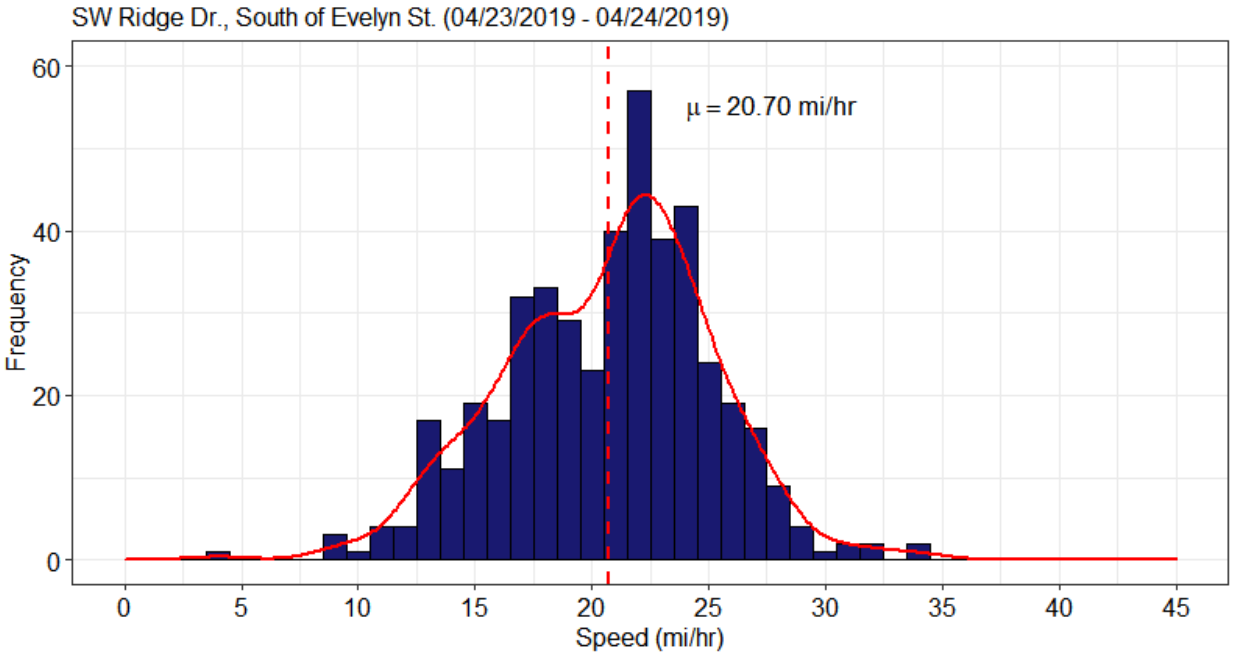

Figure B.114: Speed Distribution at SW Ridge Dr. (South of Evelyn St.) After Speed Reduction

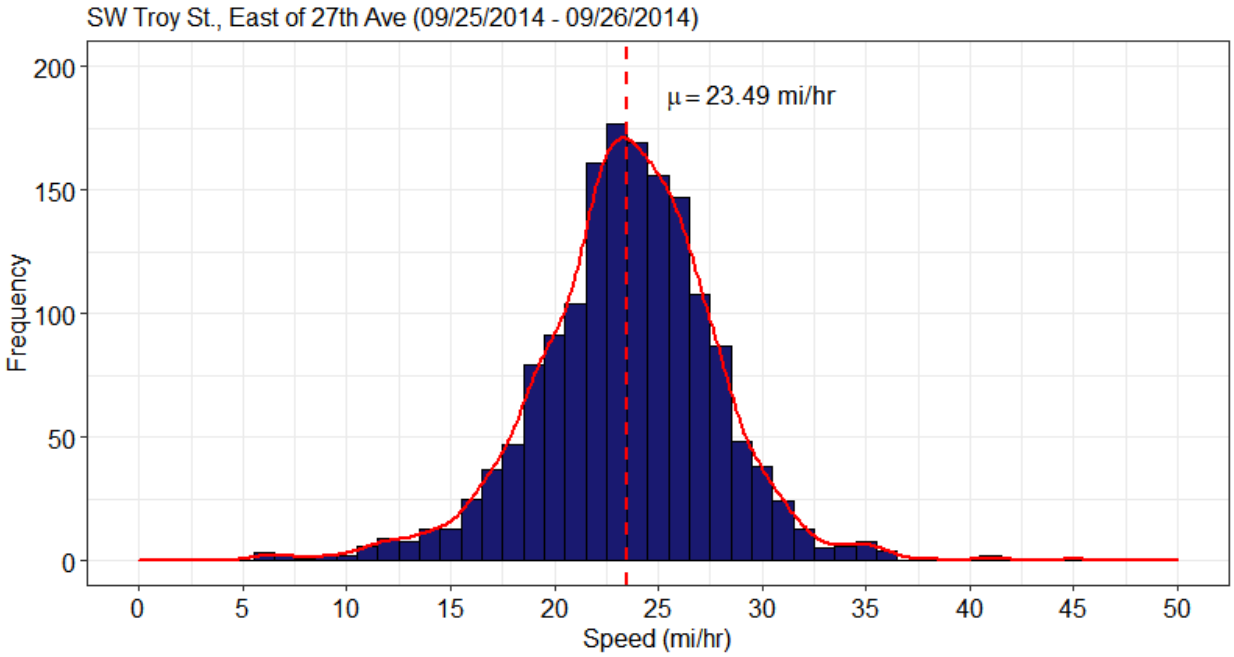

Figure B.115: Speed Distribution at SW Troy St. (East of 27th Ave) Before Speed Reduction

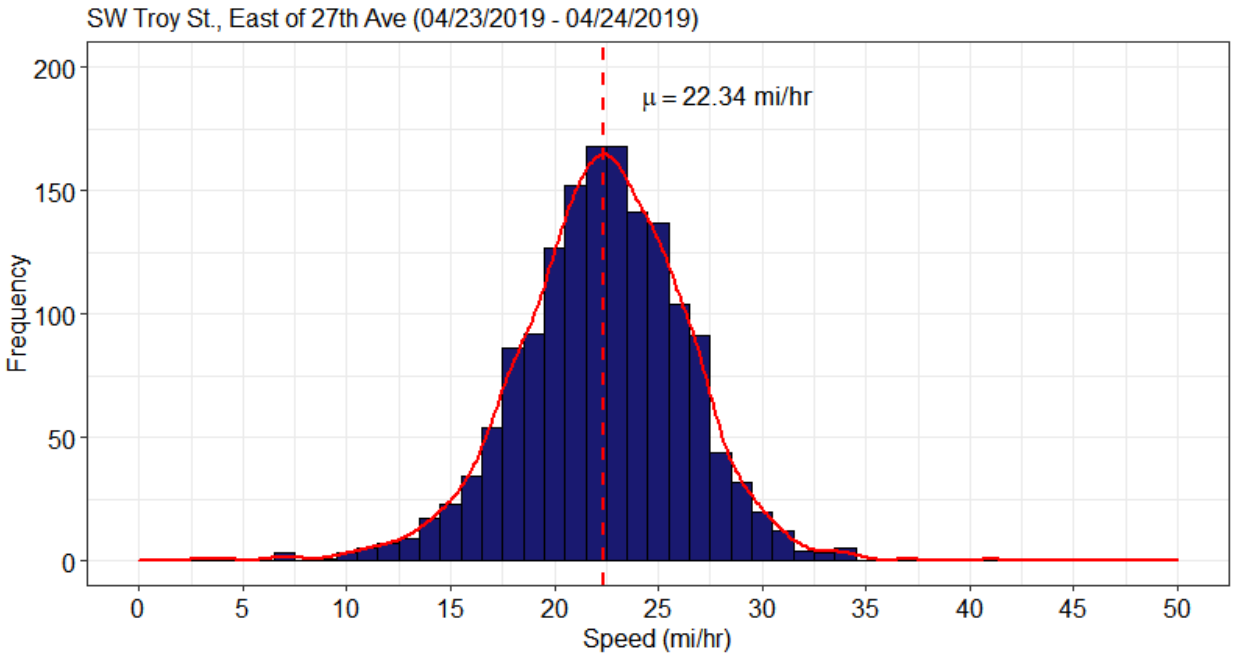

Figure B.116: Speed Distribution at SW Troy St. (East of 27th Ave) After Speed Reduction

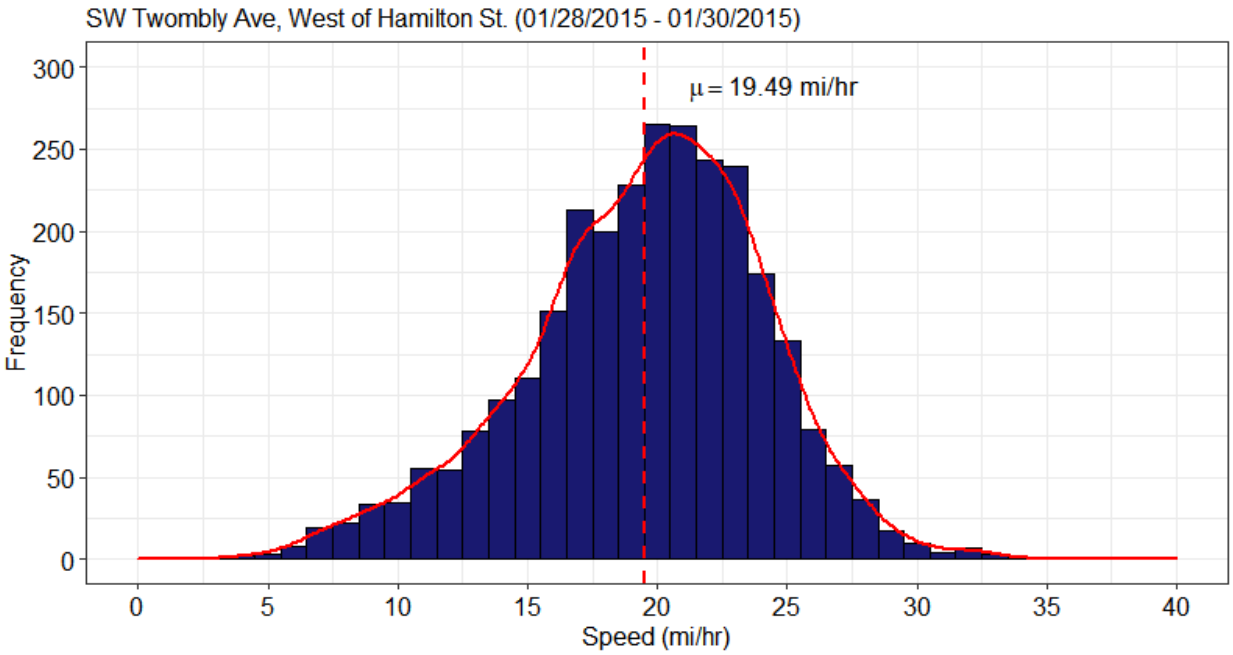

Figure B.117: Speed Distribution at SW Twombly Ave (West of Hamilton St.) Before Speed Reduction

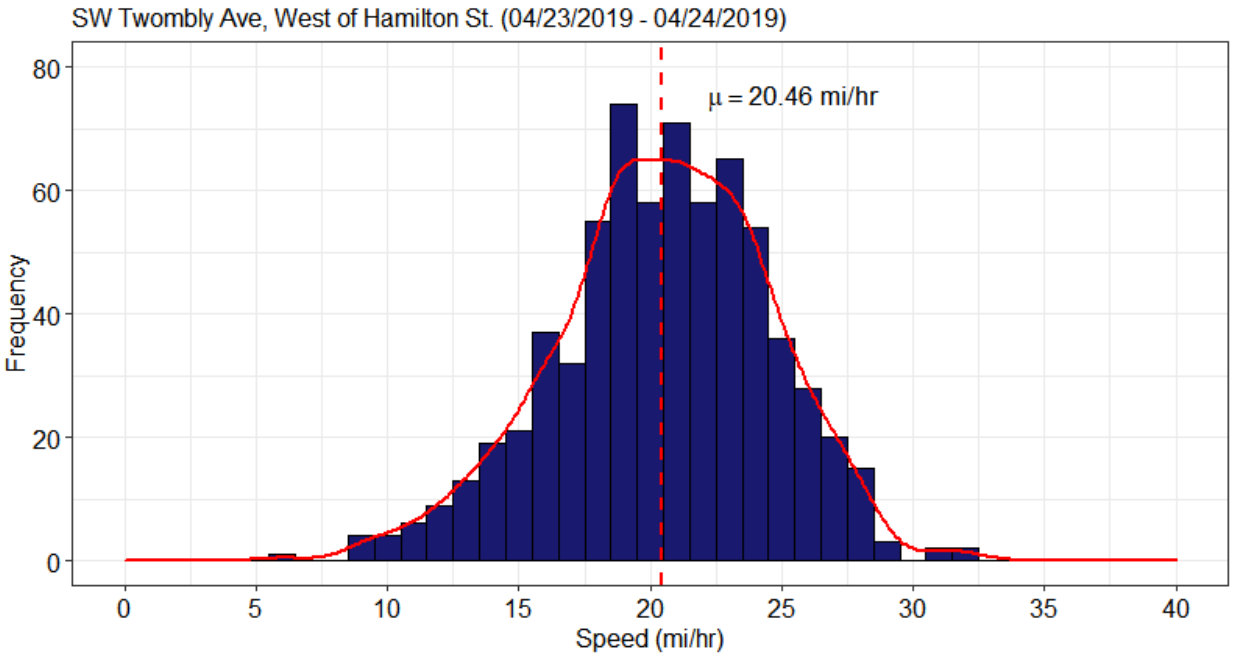

Figure B.118: Speed Distribution at SW Twombly Ave (West of Hamilton St.) After Speed Reduction

APPENDIX C – STREETVIEW IMAGES OF SITES WITH DECREASE

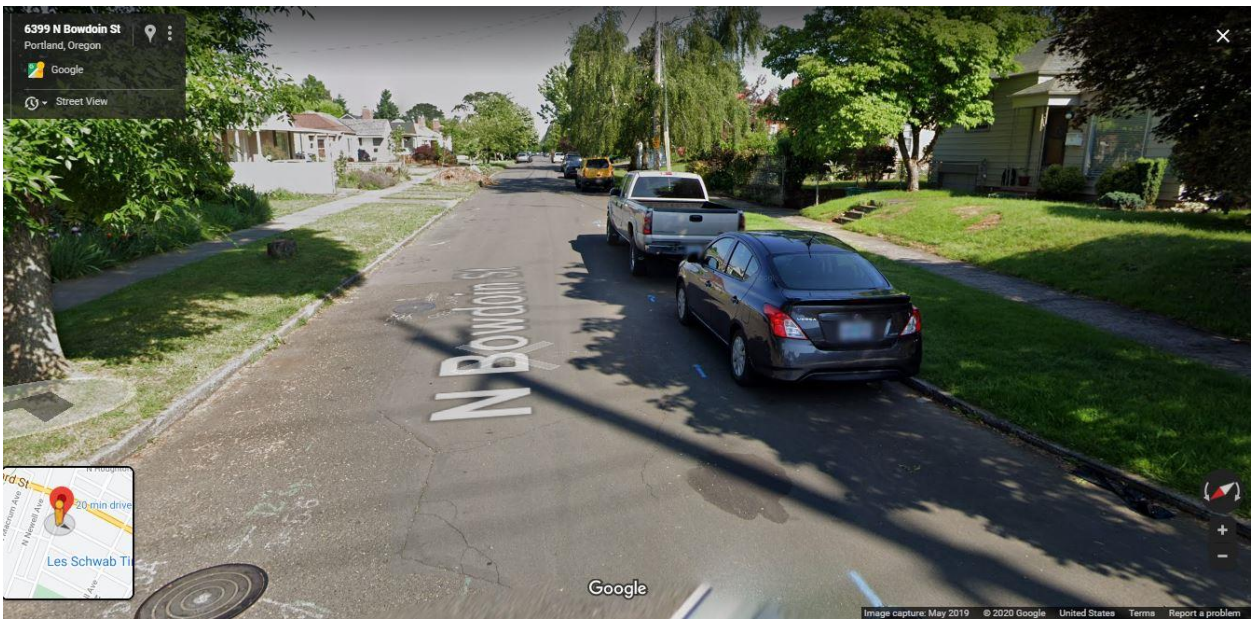

Figure C.119: Site 1 N Bowdoin Ave (East of Westanna) – Decrease

Figure C.120: Site 3 N Edison St. (West of N Charleston Ave) – Decrease

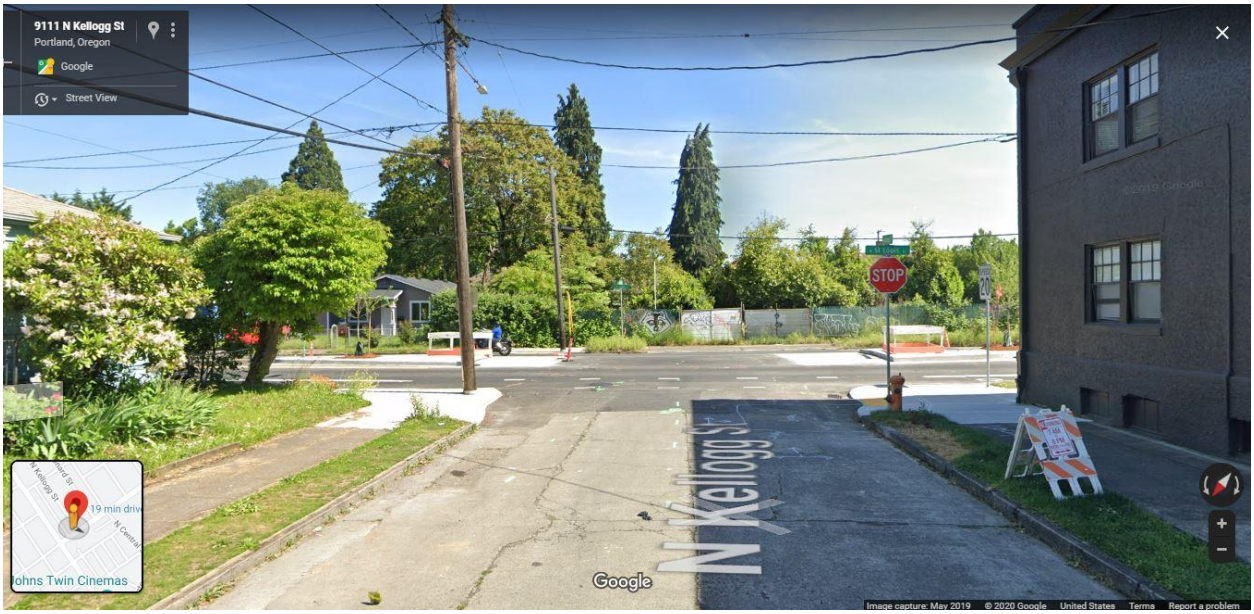

Figure C.121: Site # 4 Kellog St. North of St. Louis Ave – Decrease

Figure C.122: Site # 5 Midway Ave (South of Mears St.) – Decrease

Figure C.123: Site # 6 Minnesota Ave (South of Simpson St.) – Decrease

Figure C.124: Site # 7 Oregonian Ave (South of Mears St.) – Decrease

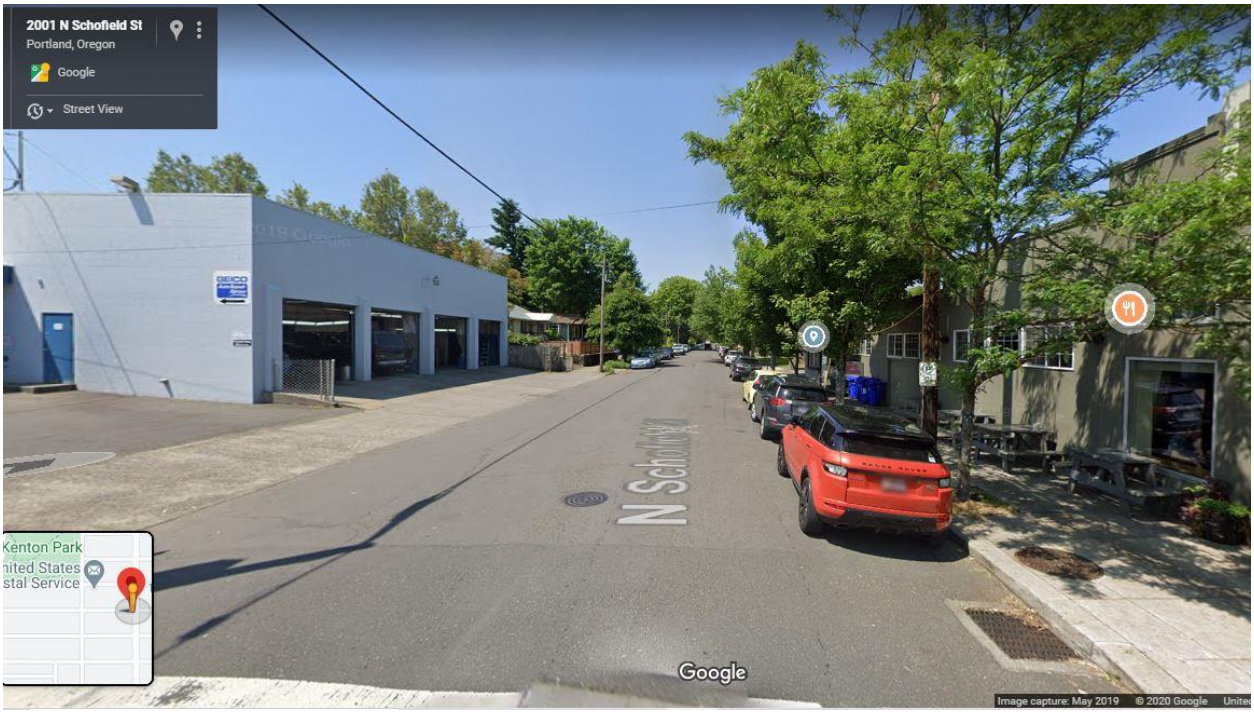

Figure C.125: Site # 8 Schofield St. (West of Denver Ave) - – Decrease

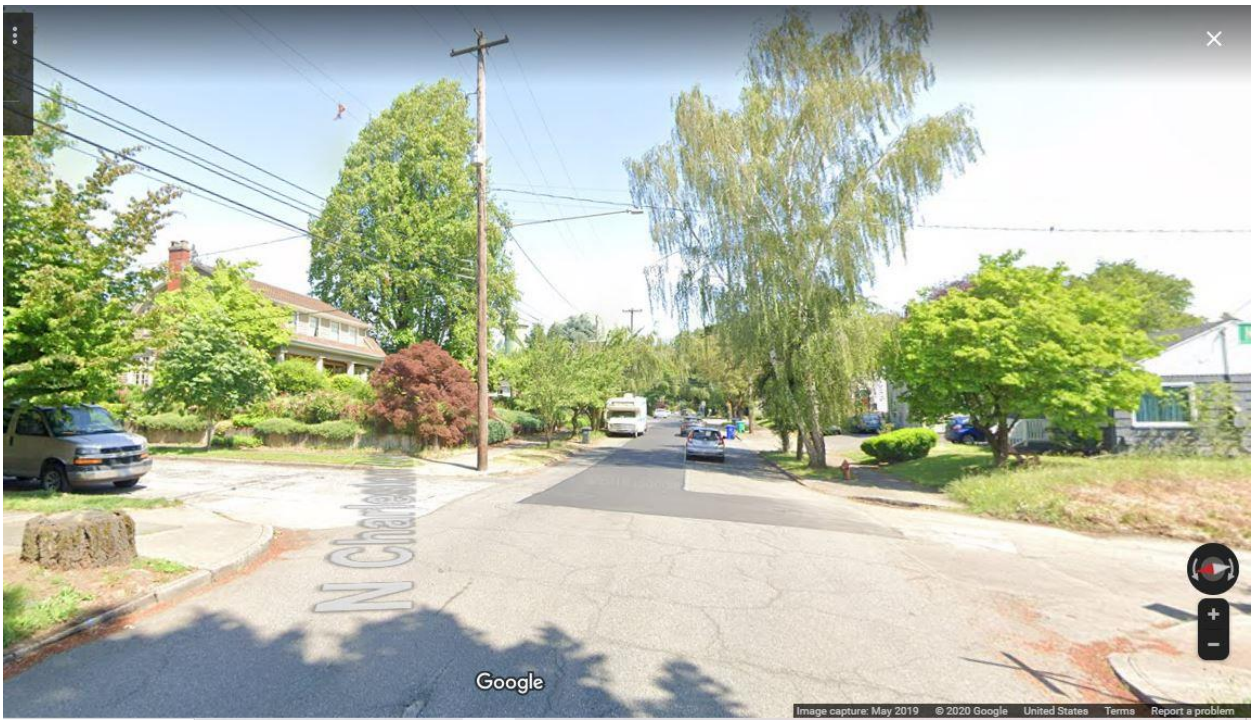

Figure C.126: Site 9 N Willamette Blvd. (West of Charleston Ave) – Decrease

Figure C.127: Site 10 NE 9th Ave (North of Thompson St.) – Decrease

Figure C.128: Site 12 NE 14th Ave (South of Fremont St.) – Decrease

Figure C.129: Site 13 NE 21st Ave (South of Oregon St.) – NOT USED IN ANALYSIS

Figure C.130: Site 15 NE 52nd Ave (North of Hassalo St.) – Decrease

Figure C.131: Site 20 NE 114th Ave (South of Schuyler St.) – Decrease

Figure C.132: Site 21 NE 117th Ave (North of Eugene St.) – Decrease

Figure C.133: Site 22 NE Ainsworth St. EB (East of 10th Ave) – Decrease

Figure F.134: Site 23 NE Ainsworth St. WB (East of 10th Ave) – Decrease

Figure C.135: Site 25 NE Fremont St. (East of 148th Ave) – Decrease

Figure D.136: Site 26 NE Graham St. (West of Rodney Ave) – Decrease

Figure D.137: Site 32 SE 34th Ave (South of Cora St.) – Decrease

Figure D.138: Site 35 SE 80th Ave (South of Taylor Ct.) – Decrease

Figure C.139: Site 40 SE 135th Ave (South of Sherman St.) – Decrease

Figure C.140: Site 41 SE 141st Ave (North of Woodward St.) – Decrease

Figure C.141: Site 42 SE 168th Ave (South of Alder St.) – Decrease

Figure D.142: Site 43 SE Alder St. (East of 82nd Ave) – Decrease

Figure D.143: Site 47 SE Francis St. (East of 33rd Ave) – Decrease

Figure D.144: Site 51 SE Pine St. (East of 12th Ave) – Decrease

Figure E.145: Site 58 SW Troy St. (East of 27th Ave) – Decrease

Figure C.146: Site 49 SE Maple Ave (South of Hawthorne Blvd.) – Decrease

Figure C.147: Site 50 SE Morrison St. (West of 36th Ave) – Decrease

Figure C.148: Site 53 SE Yamhill St. (West of 90th Ave) – Decrease

Figure C.149: Site 54 SW 39th Dr. (South of Lee St.) – Decrease

Figure C.150: Site 55 SW Davenport St. (East of Robins Crest Dr.) – Decrease

Figure C.151: Site 56 SW Kingston Ave (South of SW Tichner Dr.) – Decrease

Figure C.152: Site 57 SW Ridge Dr. (South of Evelyn St.) – Decrease

APPENDIX D –STREETVIEW IMAGES OF SITES WITH INCREASE

Figure D.153: Site 2 N Campbell Ave (South of N Simpson St.) – Increase

Figure E.154: Site 11 NE 13th Ave (North of Failing St.) – Increase

Figure E.155: Site 14 NE 37th Ave (North of Broadway) – Increase

Figure D.156: Site 16 NE 62nd Ave (South of Hancock St.) – Increase

Figure D.157: Site 17 NE 74th Ave (North of Fremont St.) – Increase

Figure D.158: Site 18 NE 80th Ave (South of Clackamas St.) – Increase

Figure D.159: Site 19 NE 109th Ave (North of Hassalo St.) – Increase

Figure C.160: Site 24 NE Alberta St. (West of 80th Ave) – Increase

Figure D.161: Site 27 NE Hancock St. (West of 15th Ave) – Increase

Figure D.162: Site 28 NE Rosa Parks Way (East of 17th Ave) – Increase

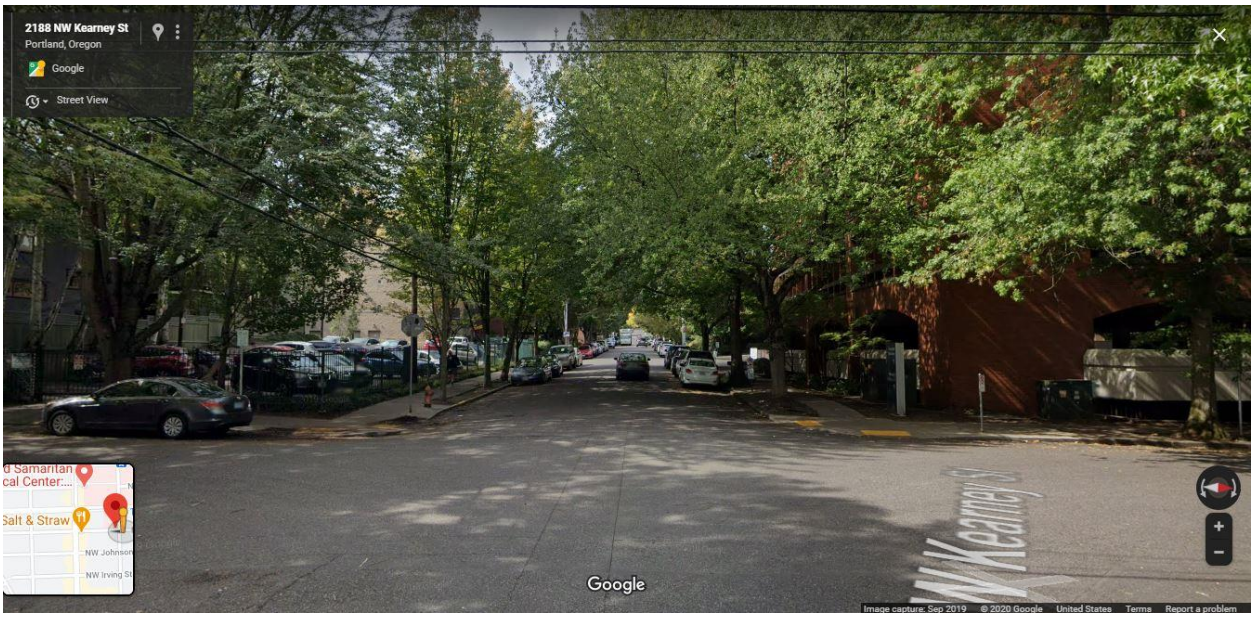

Figure D.163: Site 29 NW Kearney St. (West of 22nd Ave) – Increase

Figure D.164: Site 30 SE 23rd Ave (South of Reedway St.) – Increase

Figure C.165: Site 31 SE 25th Ave (North of Harrison St.) – Increase

Figure D.166: Site 33 SE 48th Ave (South of Hawthorne Blvd.) – Increase

Figure C.167: Site 34 SE 71st Ave (North of Reedway St.) – Increase

Figure D.168: Site 36 SE 113th Ave (North of Pine St.) – Increase

Figure D.169: Site 37 SE 114th Ave (North of Boise St.) – Increase

Figure D.170: Site 38 SE 116th Ave (North of Boise St.) – Increase

Figure C.171: Site 39 SE 125th Ave (North of Clinton Ct.) – Increase

Figure D.172: Site 44 SE Alder St. (West of 115th Ave) – Increase

Figure D.173: Site 45 SE Brooklyn St. (East of 21st Ave) – Increase

Figure C.174: Site 46 SE Cora St. (East of 138th Ave) – Increase

Figure C.175: Site 48 SE Franklin St. (East of 26th Ave) – Increase

Figure C.176: Site 52 SE Reynolds St. (East of 12th Ave) – Increase

Figure C.177: Site 59 SW Twombly Ave (West of Hamilton St.) – Increase