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Following the Red Line of Air Pollution: Berkeley & Oakland vs. Danville & Pleasanton

I. Abstract

In this project, we study air quality in Danville, Pleasanton, South Berkeley, and West Oakland — two suburban areas and two urban areas. We are motivated to raise awareness for environmental justice and sustainable development in our local communities. Our aim is to observe the effects of historical redlining on current levels of PM2.5 pollutants. Specifically, we measure and compare PM2.5 particle concentrations in low-income areas with affluent areas. In exploration of this topic, we ask the following question: Has historical redlining predisposed the low-income areas to worse air quality? This leads to our primary research question: How does air quality in South Berkeley and West Oakland differ from Danville and Pleasanton? Utilizing the Dustrak and preexisting census data, we collect quantitative and qualitative measurements of air pollution to explore this question. Our study collects PM2.5 readings every 30 seconds for 5 minutes at two sites within each location — one street site and one non-street site. We find that the low-income areas of South Berkeley and West Oakland have worse average AQIs than their affluent suburban neighbors. Also, air quality is generally worse near a street or road. Proximity to invasive infrastructure such as freeways, industrial plants, and airports influence pollution levels. Additional factors such as wind speed, relative humidity, traffic, population density, and construction can also influence PM2.5 concentrations in the atmosphere. Measuring these factors, this study analyzes how air quality fluctuates with living conditions. Redlining, a historical cause of present-day living conditions, creates air pollution disparities. Analyzing these disparities, we observe the importance of environmental justice in building a more equal and sustainable future.

II. Introduction

We compare concentrations of particulate matter in the atmosphere of historically redlined districts to high-income suburbs. Differences in air quality in these areas with income disparities

reflect environmental injustice. High concentrations of particulate matter are linked to "premature death in people with heart or lung disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing" (EPA 2022). The overarching issue of environmental injustice has an intriguing history rooted in redlining and unequal access to resources in low-income and underrepresented communities.

Redlining, or "segregation of housing stock reinforcing unjust living conditions for minority residents nationwide," was part of a 1930s governmental housing policy color-coding certain communities as hazardous (University of Michigan 2021). Racist redlining practices specifically targeted minority neighborhoods, deeming them "risky for investment" (University of Michigan 2021). As a result, lack of financial care and environmental protection exposed residents to dangerous living conditions, including high concentrations of PM2.5 pollution. According to a study on redlining and air pollution directed by UC Berkeley researchers from the Department of Civil and Environmental Engineering, "redlining is associated with substantial intraurban air pollution disparities for NO2 and PM2.5" (Lane, Frosch, and Marshall 2022). Furthermore, "64%" of communities historically redlined into grade D — the lowest tier for neighborhood classification — have a majority nonwhite POC population, and 74% of the communities have "low to moderate median income" (Lane, Frosch, and Marshall 2022).

This association between redlining, systemic inequality, environmental injustice, and air pollution drives our research project. By comparing and contrasting concentrations of particulate matter in the historically redlined neighborhoods of South Berkeley and West Oakland with the high-income suburbs of Danville and Pleasanton, we explore the connection between income and air pollution. According to Data USA, Berkeley has a population of 123,065 people and a median household income of $91,259. Oakland has 422,575 people and a median income of $80,143. Whereas, Danville only has 44,933 people and a median income of $167,827. Pleasanton has 79,975 people and a median income of $160,689. Expanding on this census data, our primary research question is: How does air quality differ between the historically redlined low-income urban cities of South Berkeley and West Oakland and the high-income suburbs of Danville and Pleasanton? From this, we will also explore the following questions: What environmental and health effects might result from observed air quality disparities? What might our findings indicate about the importance of increasing environmental justice and equality? *We infer air pollution will be worse in the*

historically redlined urban cities, and consequential health effects will be more observable than in affluent suburbs.

III. Methods

We utilize the Dustrak to collect readings of PM2.5 concentrations at several key sites. At each location, we measure at two different sites: the first site located near a street and the second site located away from the street in suburbs or parks. The purpose of our location selection is to highlight air quality differences between low income urban areas and high income suburban areas. We expect proximity to invasive infrastructure, such as busy freeways and industrial sites, to impact urban air quality. A map of the historically redlined cities of Berkeley and Oakland is located in Figure 14. Furthermore, Google maps of Danville, Pleasanton, South Berkeley, and West Oakland are located in Figures 15, 16, 17, and 18. Including a street site and non-street site at every location establishes a variable of street proximity and its impact on air quality. While we consistently apply this variable to each location, their unique environments will yield different PM2.5 concentrations.

To measure these PM2.5 concentrations, we collect data with the Dustrak. For Danville, Site 1 is downtown next to a busy main street, collected at 2:00pm on Saturday 11/5. Danville's Site 2 is in the suburbs away from busy streets and collected at 2:30pm the same day. For Pleasanton, we collect Site 1 data downtown on Main Street at 3:00pm on 11/5. Pleasanton's Site 2 is in the suburbs away from the street at 3:30 the same day. For South Berkeley, Site 1 is on the corner of Ashby Supermarket at 2:00pm on Sunday 11/6. South Berkeley's Site 2 is at Grove Park away from the street at 2:30pm the same day. For West Oakland, Site 1 is at Krispy Krunchy Chicken near busy streets and freeways at 3:00pm on 11/6. West Oakland Site 2 is at West Oakland Farm Park away from the street at 3:30pm the same day. At each site, we observe and account for weather conditions and any confounding factors for each site, day, and time.

First, we gather census and income data for each site through Data USA. Next, we check the site's closest AQI reading on Purple Air for context prior to collection. These two preliminary steps direct our comparative discussion of affluence and community conditions. After these steps, we conduct our site testing trial, using the PM2.5 nozzle for the Dustrak. For each site trial, we log Dustrak recordings every 30 seconds for a 5-minute period. Next, we convert the PM2.5 concentration readings from mg/m^3 to ug/m^3 and take the mean recording

of each data set. To convert to AQI, we input each mean PM2.5 reading into the AirNow AQI Calculator. Prior to departing from the site, we record qualitative observations of weather temperature, wind speed, and relative humidity using the Weather App. We also observe the amount of people and trees within a 50-foot radius of the testing site, as well as how many cars drive by during our 5-minute testing period and whether or not construction is taking place nearby. We finish by taking pictures of the site from several angles.

After recording the air quality data with the Dustrak for each site and location, we synthesize and examine our data, comparing the low-income historically redlined locations with the high-income suburbs. Once data is collected we compare all areas and analyze why those areas have better or worse air quality, providing reasoning from our quantitative and qualitative observations. Extending data collection methods from Lab 3, we examine specific locations impacted by a history of redlining in contrast to high-income suburbs. This geographical method is similar to the study "Historical Redlining Is Associated with Present-Day Air Pollution Disparities in U.S. Cities" by UC Berkeley faculty. Furthermore, our examination of maps and health effects of particular neighborhoods is similar to the "Air pollution and Health in West Oakland" study by the Environmental Defense Fund. Ultimately, our research and testing methods evaluate environmental, social, and historical factors to determine the impact of redlining and income inequality on air pollution.

IV. Results

After utilizing our research and testing methods in our comparative study of air pollution in affluent suburbs and historically redlined neighborhoods, we discovered higher levels of PM2.5 pollutants in South Berkeley and West Oakland than in Danville and Pleasanton. Referencing Table 1, our Danville data collection resulted in a mean PM2.5 concentration of 26.2 ug/m^3 for Site 1 in Downtown next to the street, resulting in a moderate AirNow AQI conversion of 81, as depicted in Figure 5. For Danville Site 2 in the suburbs away from the street, the mean PM2.5 concentration was 25.6 ug/m^3, resulting in a moderate AQI conversion of 79, which is slightly better than Site 1 as seen in Figure 1, Figure 6, and Figure 13. Referencing Table 2, our Pleasanton data collection resulted in a mean PM2.5 concentration of 25.6 ug/m^3 for Site 1 in Downtown on Main Street, resulting in a moderate AirNow AQI conversion of 79, as depicted in Figure 7. For Pleasanton Site 2 in the suburbs away from the

street, the mean PM2.5 concentration was 22.5 ug/m^3, resulting in an AQI conversion of 73, which is slightly better than Site 1 as seen in Figure 2, Figure 8, and Figure 13.

After collecting data at the historically redlined locations of South Berkeley and West Oakland, we noticed a marginal uptick in PM2.5 concentrations, most notably accredited to more invasive industrial infrastructure. Referencing Table 3, our South Berkeley data collection resulted in a mean PM2.5 concentration of 29.8 ug/m^3 for Site 1 on the corner of Ashby Supermarket, resulting in a high moderate AirNow AQI conversion of 88, as depicted in Figure 9. For South Berkeley Site 2 at Grove Park away from the street, the mean PM2.5 concentration was 30 ug/m^3, resulting in a high moderate AQI conversion of 89, which is slightly worse than Site 1, as seen in Figure 3, Figure 10, and Figure 13. Referencing Table 4, our West Oakland data collection resulted in a mean PM2.5 concentration of 32.7 ug/m^3 for Site 1 at Krispy Krunchy Chicken near the street and bisected by freeways, resulting in a very high moderate AirNow AQI conversion of 94, as depicted in Figure 11. For West Oakland Site 2 at West Oakland Farm Park away from the street, the mean PM2.5 concentration was 31.4 ug/m^3, resulting in a very high moderate AQI conversion of 92, which is slightly better than Site 1 as shown in Figure 4, Figure 12, and Figure 13.

Qualitatively, we noticed more green space and vegetation overall in the more affluent suburbs than in the redlined low-income neighborhoods. At Danville Site 1, the weather temperature was 59° with a wind speed of 7mph and 86% humidity. There was limited sun and a very cloudy sky with a cool breeze. As summarized in pictures in Figures 19, 20, and 21, there were about 25 cars that drove by during the 5 minute testing period, but several more parked nearby. Within a 50 foot radius, there were about 6 trees and no construction. At Danville Site 2, the same weather conditions applied but with more wind speed at 9 mph and no people during testing. As summarized in Figures 22, 23, and 24, within a 50 foot radius, there were about 20 trees and no construction. At Pleasanton, both Site 1 and Site 2 had a temperature of 61° and 80% humidity at 3:00 and 3:30 on 11/5, except Site 2 has a wind speed of 7 mph compared to Site 1's 8 mph. As summarized in Figures 25, 26, and 27, for Site 1, about 100 people passed by during testing and 0 cars were present due to the closed street, with no construction. Within 50 feet, there were about 15 trees. As summarized in Figures 29, 30, and 31, for Pleasanton Site 2, there were no people and no cars driving by during testing, with about 15 trees and no construction within 50 feet. For South Berkeley, both Site 1 and 2 had a temperature of 59° and

humidity of 66%, except Site 1 had a wind speed of 11 mph compared to Site 2's 13 mph. Shown in Figures 32, 33, and 34, for Site 1, about 20 people and 50 cars passed by during testing, with about 10 trees and no construction within 50 feet. As seen in Figures 35, 36, and 37, for Site 2, about 50 people were at the park, and about 150 feet away, about 60 cars passed by during testing. There were 10 trees and no construction within 50 feet. For West Oakland, both Site 1 and 2 had a temperature of 59° and wind speed of 10 mph, except Site 1 had 66% humidity compared to Site 2's 67%. As seen in Figures 38, 39, and 40, for Site 1, about 20 people and 50 cars passed by during testing, with 20 trees and no construction within 50 feet. Shown in Figures 41, 42, and 43, for Site 2, no people or cars passed by during testing, and there were 50 trees and no construction within 50 feet. Ultimately, through these quantitative and qualitative observations, we discovered worse overall air quality in South Berkeley and West Oakland than in Danville and Pleasanton, with street sites generally having higher PM2.5 concentrations than non-street sites.

V. Discussion

Based on our quantitative and qualitative results, Danville and Pleasanton both had lower AQI readings and concentrations of PM2.5 pollutants than South Berkeley and West Oakland. For each location, the street site had a higher concentration of PM2.5, except for South Berkeley Site 2. Although stronger winds typically disperse contaminants throughout the air and reduce PM2.5, South Berkeley and West Oakland had worse air quality — regardless of their higher wind speeds. In these densely populated neighborhoods, the higher overall numbers of people and cars increases pollution. Specifically, West Oakland Site 1's location near freeways and the Oakland Airport could explain it having the highest mean PM2.5 concentration of all sites at 32.7 ug/m^3. Contrarily, Pleasanton Site 2 had the lowest PM2.5 concentration at 22.5 ug/m^3, and it had no cars, minimal invasive infrastructure, and low human activity.

In response to our background literature, the EPA's stated health impacts of high PM2.5 concentrations — including but not limited to aggravated asthma and decreased lung function — remain serious concerns. Peak PM2.5 concentrations in South Berkeley and West Oakland almost reached Tier 3 "Unhealthy for Sensitive Groups" on the Air Quality Index. University of Michigan's stated environmental impacts of redlining — including unjust living conditions — are also serious concerns. These unjust living conditions were visible in the redlined low-income

locations where freeways bisect neighborhoods and busy streets pollute housing areas. Close proximity to industrial plants and infrastructure adversely impact residential health. This is a major consequence of redlining. On the other hand, the affluent suburbs had less polluting infrastructure and more green space, as seen in Figures 15 and 16. The study by UC Berkeley researchers from the Department of Civil and Environmental Engineering found an association between redlining and higher PM2.5 levels. Our findings support this study. This observed intraurban air pollution disparity inspires us to continue to advocate for environmental justice.

Exploring project limitations and improvements, we could include an extra Dustrak next time to test South Berkeley and West Oakland on the same day as Danville and Pleasanton. This would reduce confounding variables of time and weather, resulting in more valid data. We also lacked enough renting time to perform numerous trials over the course of several weeks with the Dustrak. Recording data on a single weekend leaves out potential fluctuations in PM2.5 levels resulting from weather changes and natural disasters. Furthermore, we could improve our research by reaching out to hospitals at each of our locations for data on health issues resulting from air pollution. We could also survey residents within these locations to learn about their experience with air pollution. This would contribute more firsthand qualitative data to support our quantitative results. Overall, repeating trials and expanding our data intake would increase accuracy and provide information on how to combat environmental injustice.

VI. Conclusion

In conclusion, our hypothesis that air pollution would be worse in the redlined low-income neighborhoods was correct. West Oakland Site 1 had the worst AQI reading at 94, nearing Tier 3 “Unhealthy for Sensitive Groups.” Whereas Pleasanton Site 2 had the best AQI reading at 73. For each location, the street site had higher PM2.5 concentrations than the non-street site, except for South Berkeley Site 2 where readings could have been influenced by cars driving 150 feet away and large amounts of dust. Ultimately, we observed intraurban air pollution disparities and the impacts of historical redlining. Therefore, we must continue to fight environmental injustice and mitigate health issues from high concentrations of PM2.5 pollutants. In the future, we hope to survey residents and solicit more medical data to learn how we can reduce PM2.5 pollution in our local communities. Overall, we had an excellent experience learning more about air pollution and the history of environmental justice.

VII. Works Cited

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VIII. Tables

Table 1. Air Quality Data Collection (Danville).

Location 1 (Danville) Saturday 11/5	**Site 1 at Downtown Danville (near busy street) 2:00 pm**	**Site 2 at Danville Suburbs (away from busy street) 2:30**
Time (MM:SS)	**PM2.5 concentration Units: ug/m^3**	**PM2.5 concentration Units: ug/m^3**
0:30	26 ug/m^3	25 ug/m^3
1:00	26 ug/m^3	26 ug/m^3
1:30	26 ug/m^3	26 ug/m^3
2:00	27 ug/m^3	26 ug/m^3
2:30	27 ug/m^3	26 ug/m^3
3:00	27 ug/m^3	26 ug/m^3
3:30	26 ug/m^3	26 ug/m^3
4:00	26 ug/m^3	25 ug/m^3
4:30	25 ug/m^3	25 ug/m^3
5:00	26 ug/m^3	25 ug/m^3
Mean	26.2 ug/m^3	25.6 ug/m^3
Max	27 ug/m^3	26 ug/m^3
Min	25 ug/m^3	25 ug/m^3
AQI Conversion (from mean)	81, Moderate Sensitive Groups: People with respiratory or heart disease, the elderly and children are the groups most at risk.	79, Moderate Sensitive Groups: People with respiratory or heart disease, the elderly and children are the groups most at risk. Health Effects Statements:

	Health Effects Statements: Unusually sensitive people should consider reducing prolonged or heavy exertion. Cautionary Statements Unusually sensitive: people should consider reducing prolonged or heavy exertion.	Unusually sensitive people should consider reducing prolonged or heavy exertion. Cautionary Statements Unusually sensitive: people should consider reducing prolonged or heavy exertion.

Table 2. Air Quality Data Collection (Pleasanton).

Location 2 (Pleasanton) Saturday 11/5	**Site 1 at Downtown Pleasanton (near Street) 3:00 pm**	**Site 2 at Pleasanton Suburbs (away from street) 3:30 pm**
Time (MM:SS)	**PM2.5 concentration Units: ug/m^3**	**PM2.5 concentration Units: ug/m^3**
0:30	24 ug/m^3	23 ug/m^3
1:00	25 ug/m^3	23 ug/m^3
1:30	27 ug/m^3	23 ug/m^3
2:00	25 ug/m^3	23 ug/m^3
2:30	26 ug/m^3	23 ug/m^3
3:00	26 ug/m^3	22 ug/m^3
3:30	25 ug/m^3	22 ug/m^3
4:00	26 ug/m^3	22 ug/m^3
4:30	26 ug/m^3	22 ug/m^3
5:00	26 ug/m^3	22 ug/m^3
Mean	25.6 ug/m^3	22.5 ug/m^3
Max	27 ug/m^3	22 ug/m^3
Min	24 ug/m^3	23 ug/m^3
AQI Conversion (from mean)	79, Moderate Sensitive Groups: People with respiratory or heart disease, the elderly and children are the groups most at risk. Health Effects Statements:	73, Moderate Sensitive Groups: People with respiratory or heart disease, the elderly and children are the groups most at risk. Health Effects Statements: Unusually sensitive people should consider reducing prolonged or heavy exertion.

	Unusually sensitive people should consider reducing prolonged or heavy exertion. Cautionary Statements Unusually sensitive: people should consider reducing prolonged or heavy exertion.	Cautionary Statements Unusually sensitive: people should consider reducing prolonged or heavy exertion.

Table 3. Air Quality Data Collection (South Berkeley).

Location 3 (South Berkeley) Sunday 11/6	**Site 1 at Ashby Supermarket on Ashby Avenue (near Street) 2:00 pm**	**Site 2 at Grove Park (away from street) 2:30 pm**
Time (MM:SS)	**PM2.5 concentration Units: ug/m^3**	**PM2.5 concentration Units: ug/m^3**
0:30	29 ug/m^3	29 ug/m^3
1:00	29 ug/m^3	29 ug/m^3
1:30	29 ug/m^3	29 ug/m^3
2:00	29 ug/m^3	30 ug/m^3
2:30	29 ug/m^3	28 ug/m^3
3:00	30 ug/m^3	30 ug/m^3
3:30	30 ug/m^3	30 ug/m^3
4:00	31 ug/m^3	31 ug/m^3
4:30	31 ug/m^3	32 ug/m^3
5:00	31 ug/m^3	32 ug/m^3
Mean	29.8 ug/m^3	30 ug/m^3
Max	31 ug/m^3	32 ug/m^3
Min	29 ug/m^3	28 ug/m^3
AQI Conversion (from mean)	88, Moderate Sensitive Groups: People with respiratory or heart disease, the elderly and children are the groups most at risk.	89, Moderate Sensitive Groups: People with respiratory or heart disease, the elderly and children are the groups most at risk. Health Effects Statements:

	Health Effects Statements: Unusually sensitive people should consider reducing prolonged or heavy exertion. Cautionary Statements Unusually sensitive: people should consider reducing prolonged or heavy exertion.	Unusually sensitive people should consider reducing prolonged or heavy exertion. Cautionary Statements Unusually sensitive: people should consider reducing prolonged or heavy exertion.

Table 4. Air Quality Data Collection (West Oakland).

Location 4 (West Oakland) Sunday 11/6	**Site 1 at Krispy Krunchy Chicken (near street and bisected by freeways) 3:00 pm**	**Site 2 at West Oakland Farm Park (away from street) 3:30 pm**
Time (MM:SS)	**PM2.5 concentration Units: ug/m^3**	**PM2.5 concentration Units: ug/m^3**
0:30	32 ug/m^3	31 ug/m^3
1:00	30 ug/m^3	30 ug/m^3
1:30	31 ug/m^3	30 ug/m^3
2:00	33 ug/m^3	31 ug/m^3
2:30	31 ug/m^3	31 ug/m^3
3:00	32 ug/m^3	31 ug/m^3
3:30	38 ug/m^3	32 ug/m^3
4:00	35 ug/m^3	32 ug/m^3
4:30	33 ug/m^3	33 ug/m^3

5:00	32 ug/m^3	33 ug/m^3
Mean	32.7 ug/m^3	31.4 ug/m^3
Max	38 ug/m^3	33 ug/m^3
Min	30 ug/m^3	30 ug/m^3
AQI Conversion (from mean)	94, Moderate Sensitive Groups: People with respiratory or heart disease, the elderly and children are the groups most at risk. Health Effects Statements: Unusually sensitive people should consider reducing prolonged or heavy exertion. Cautionary Statements Unusually sensitive: people should consider reducing prolonged or heavy exertion.	92, Moderate Sensitive Groups: People with respiratory or heart disease, the elderly and children are the groups most at risk. Health Effects Statements: Unusually sensitive people should consider reducing prolonged or heavy exertion. Cautionary Statements Unusually sensitive: people should consider reducing prolonged or heavy exertion.

IX. Figures

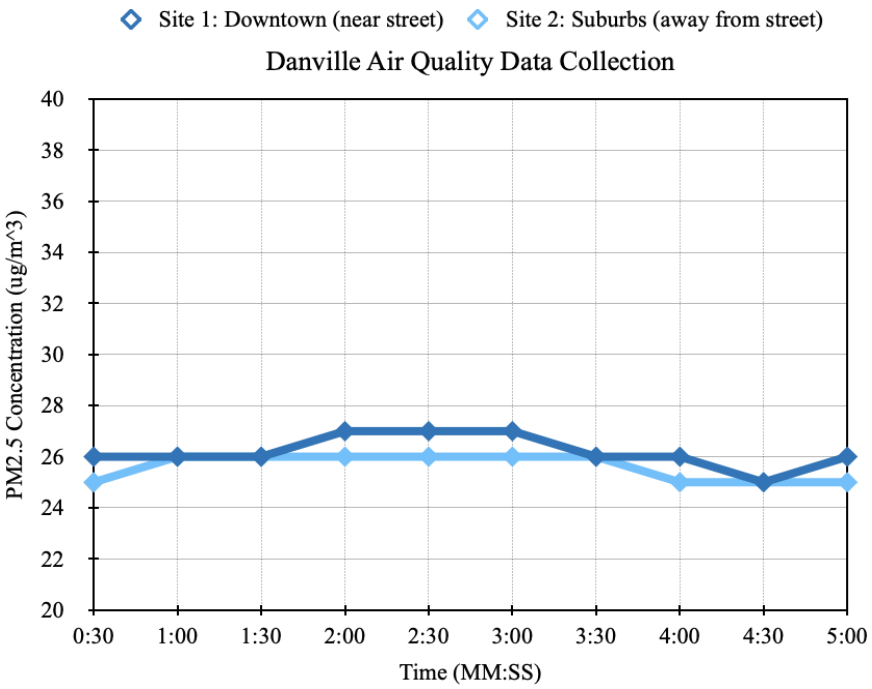


Fig. 1. Danville Air Quality Data Collection

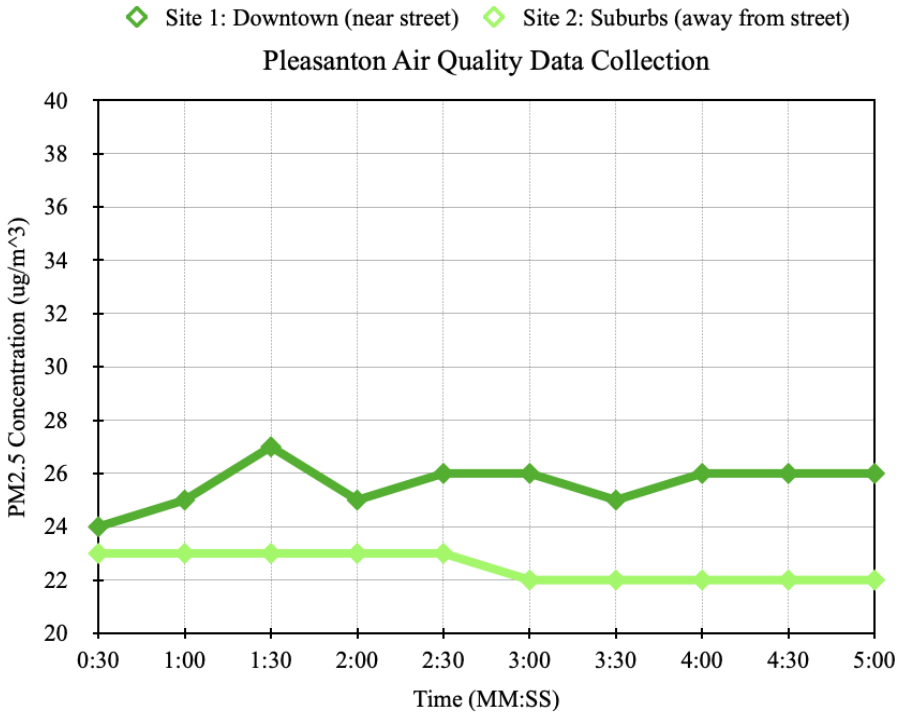


Fig. 2. Pleasanton Air Quality Data Collection

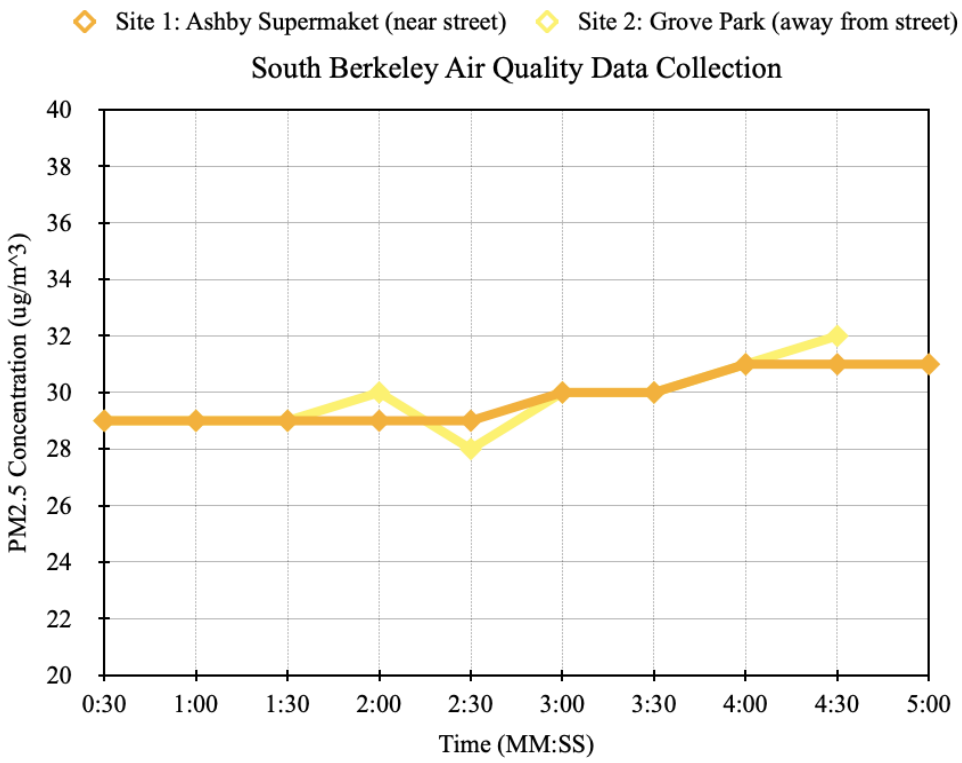


Fig. 3. South Berkeley Air Quality Data Collection

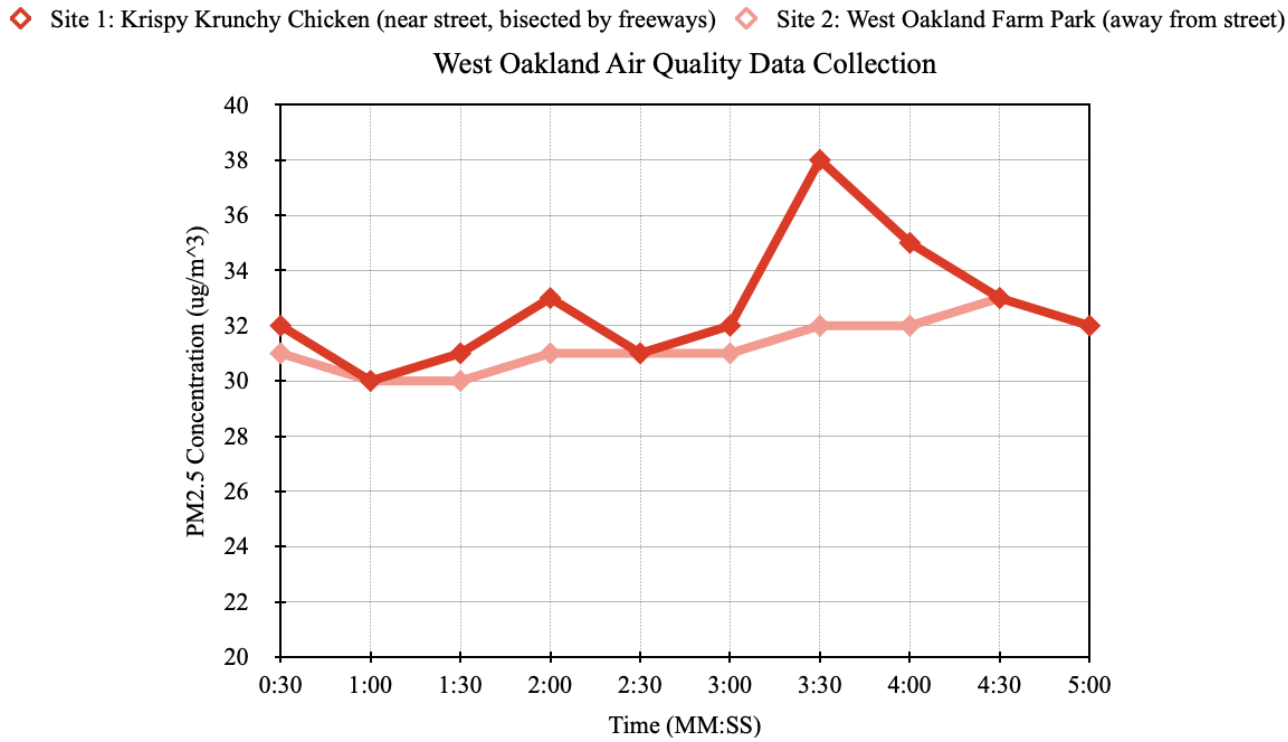
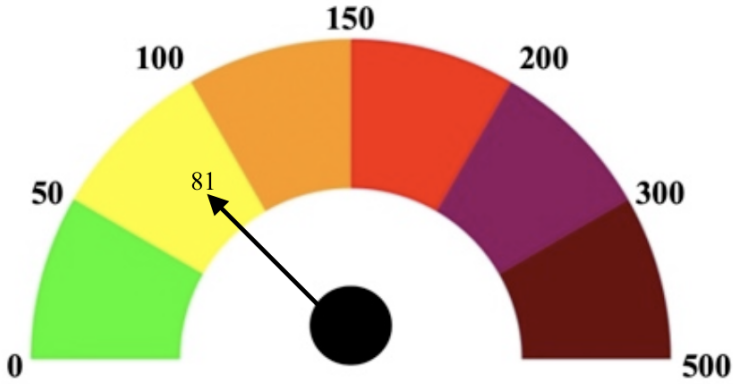


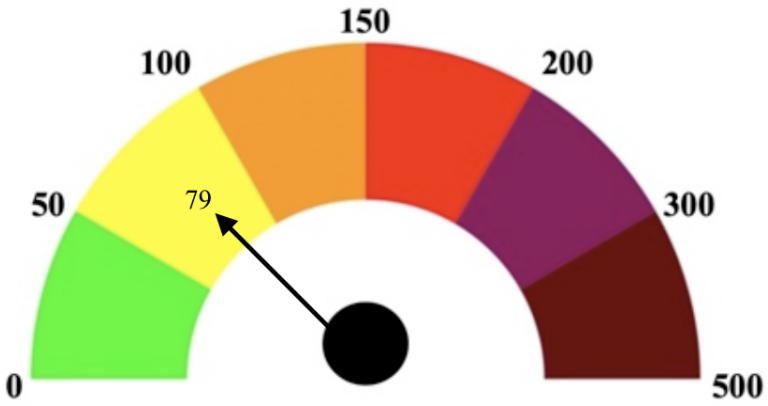
Fig. 4. West Oakland Air Quality Data Collection



Air Quality Index | Danville Site 1: Downtown (near street)

Good Moderate Unhealthy for Sensitive Groups Unhealthy Very Unhealthy Hazardous

Fig. 5. AQI Meter for Danville at Site 1: Downtown (near street)



Air Quality Index | Danville Site 2: Suburbs (away from street)

Good Moderate Unhealthy for Sensitive Groups Unhealthy Very Unhealthy Hazardous

Fig. 6. AQI Meter for Danville at Site 2: Suburbs (away from street)

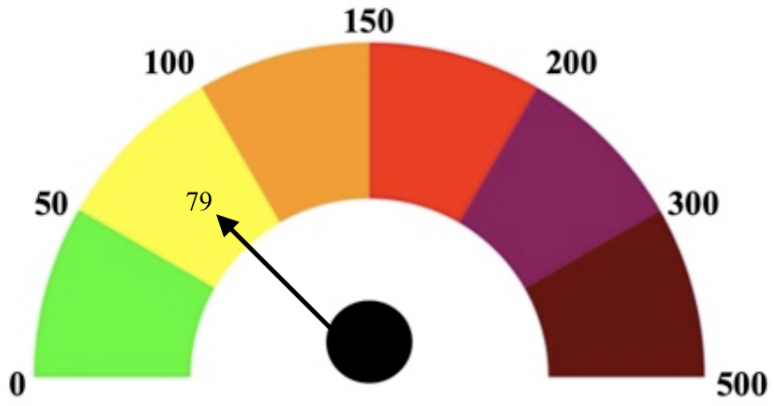


Fig. 7. AQI Meter for Pleasanton at Site 1: Downtown (near street)

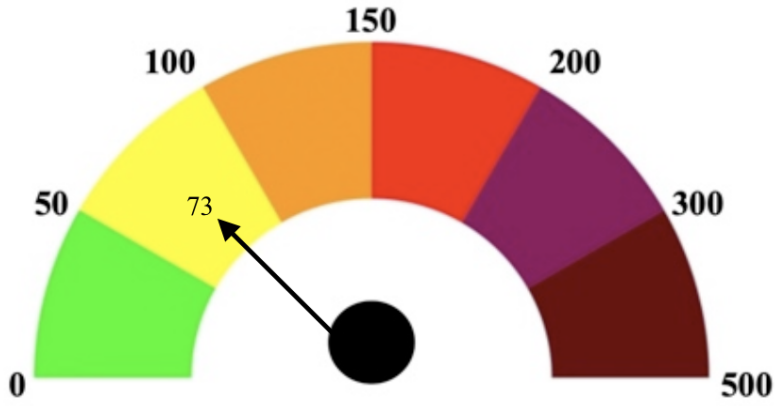
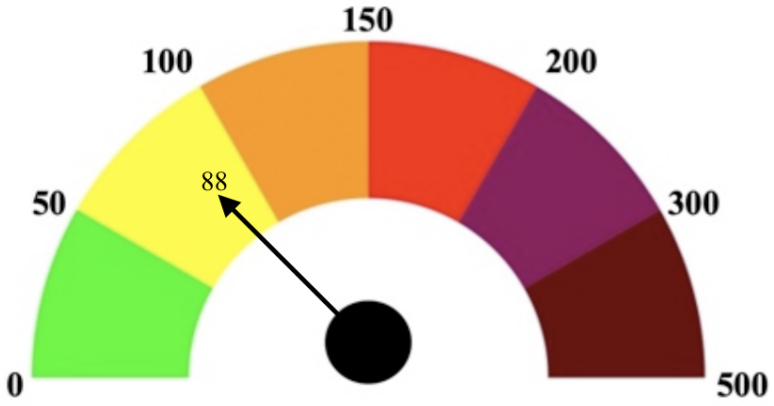


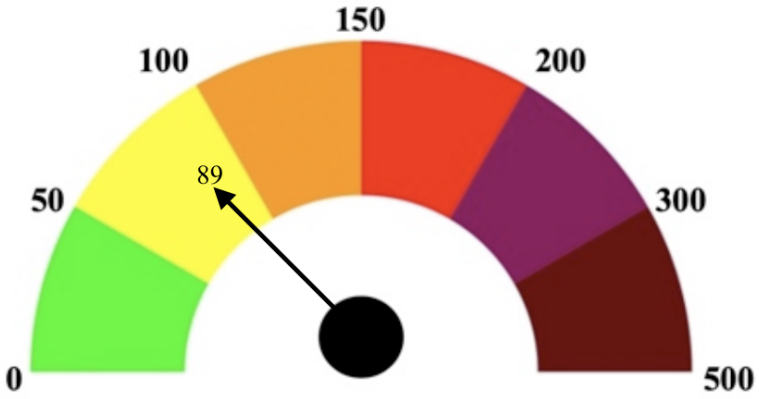
Fig. 8. AQI Meter for Pleasanton at Site 2: Suburbs (away from street)



Air Quality Index | South Berkeley Site 1: Ashby (near street)

Good Moderate Unhealthy for Sensitive Groups Unhealthy Very Unhealthy Hazardous

Fig. 9. AQI Meter for South Berkeley at Site 1: Ashby Supermarket (near street)



Air Quality Index | South Berkeley Site 2: Grove Park (away from street)

Good Moderate Unhealthy for Sensitive Groups Unhealthy Very Unhealthy Hazardous

Fig. 10. AQI Meter for South Berkeley at Site 2: Grove Park (away from street)

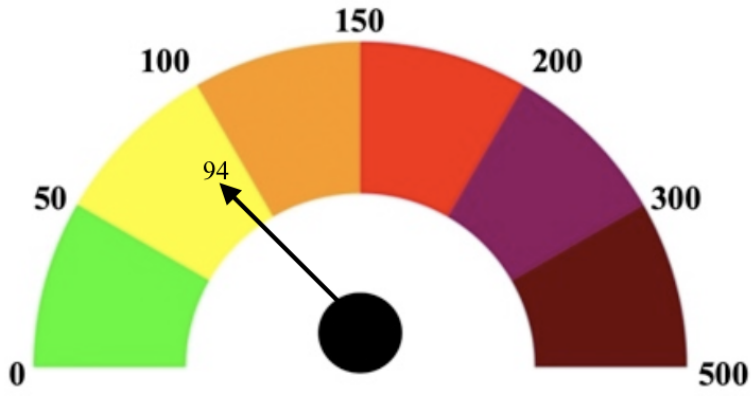


Fig. 11. AQI Meter for West Oakland at Site 1: Krispy (near street, bisected by freeways)

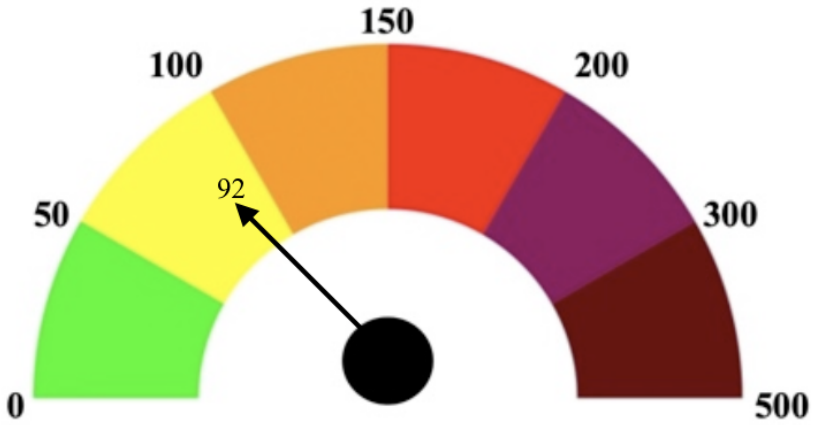


Fig. 12. AQI Meter for West Oakland at Site 2: West Oakland Farm Park (away from street)

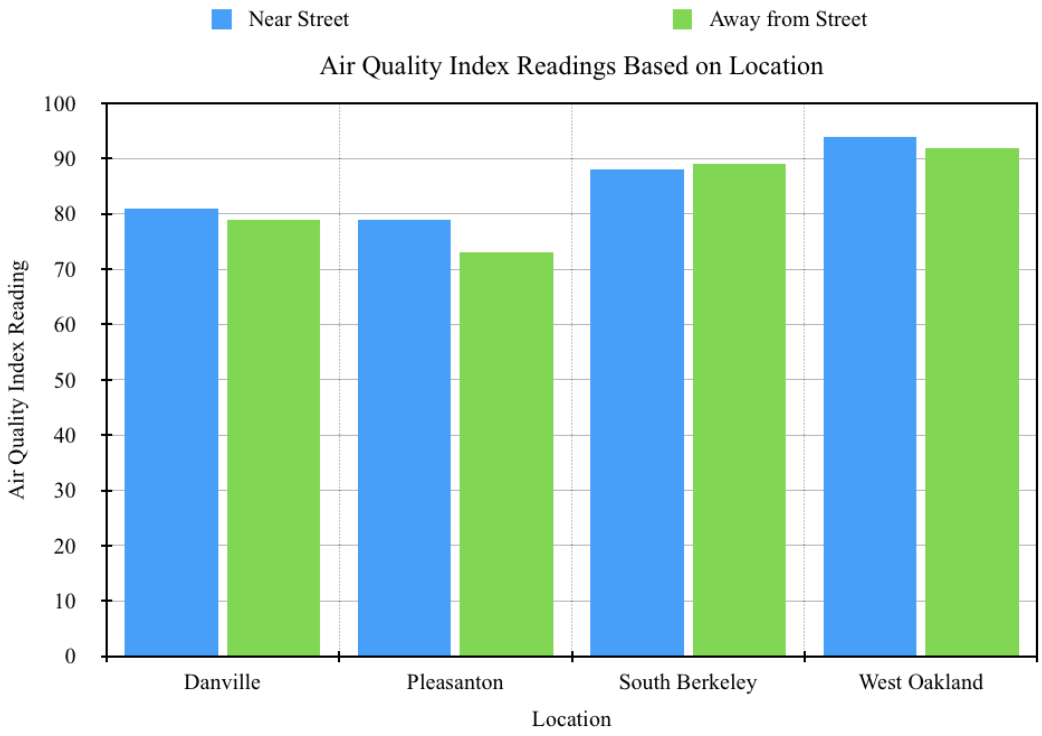


Fig. 13. Air Quality Index Readings Based on Location

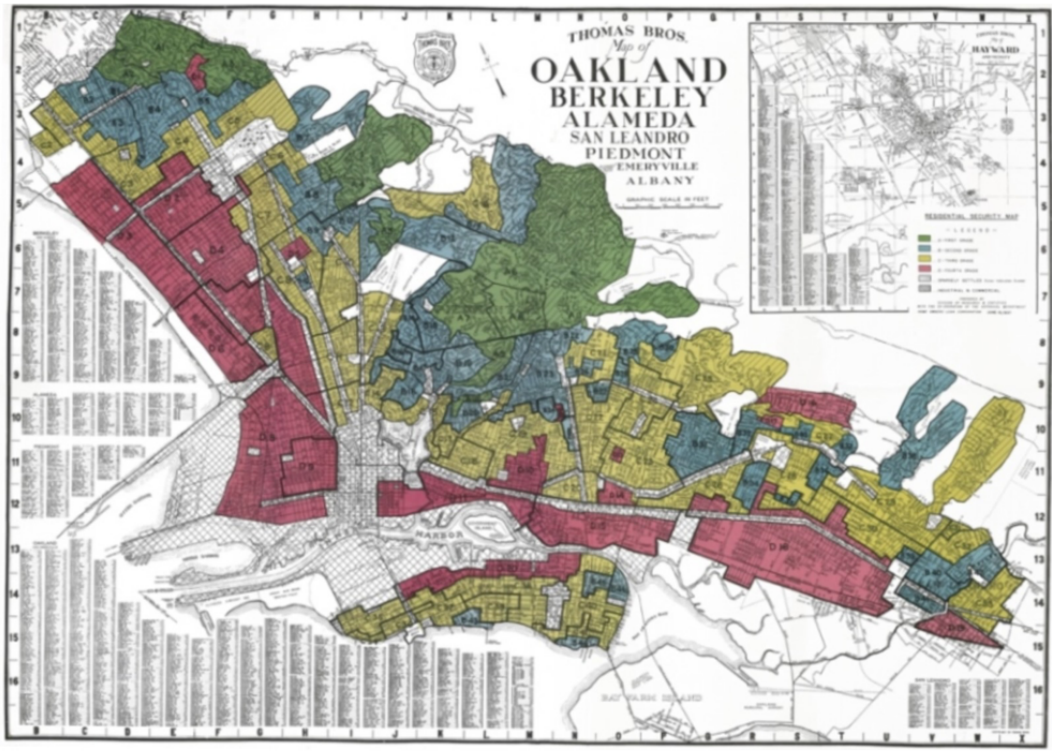


Fig. 14. Map of redlined zones of Berkeley and Oakland

Fig. 15. Map of Danville

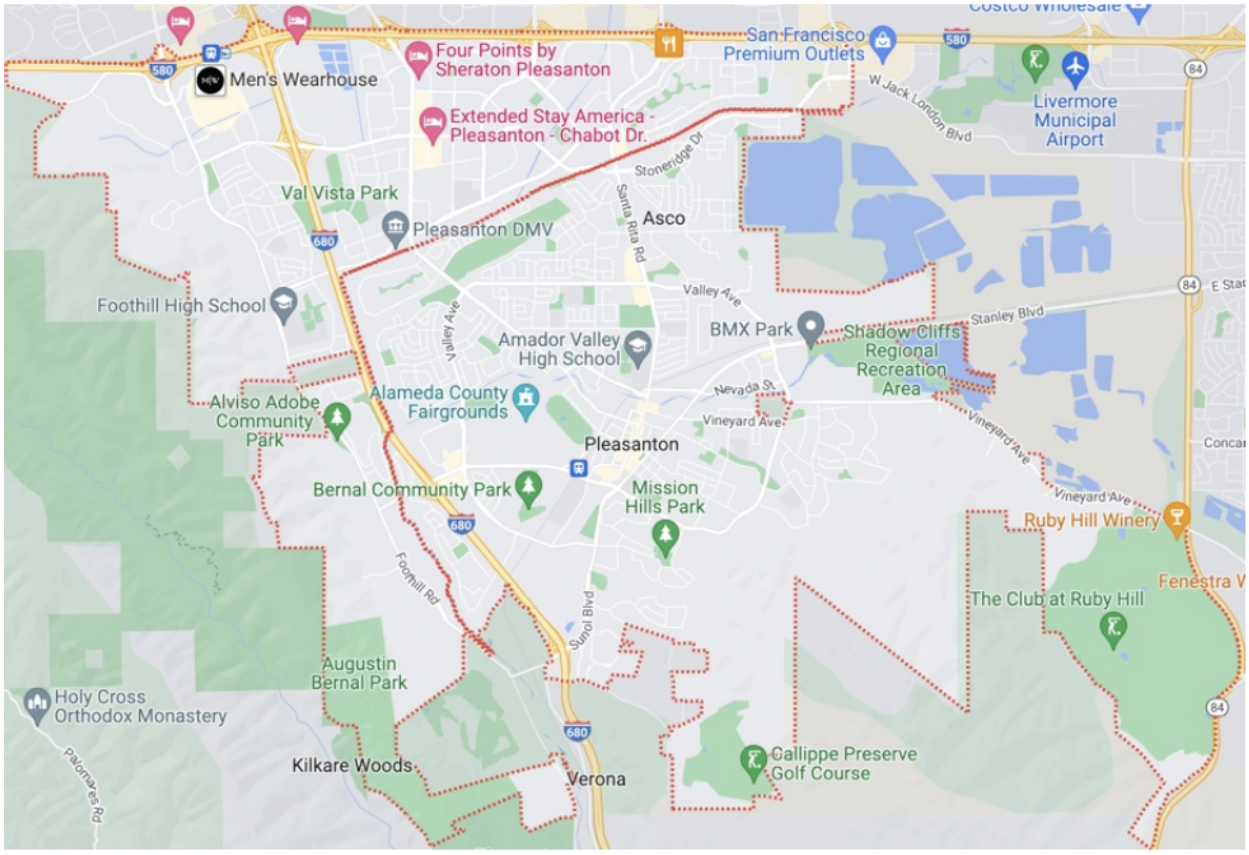


Fig. 16. Map of Pleasanton

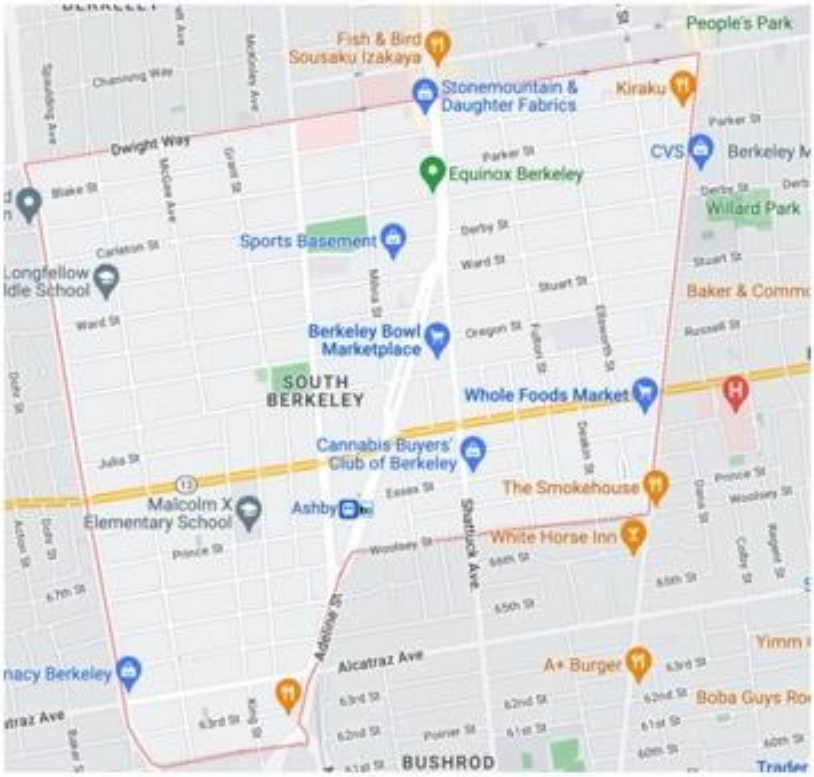


Fig. 17. Map of South Berkeley

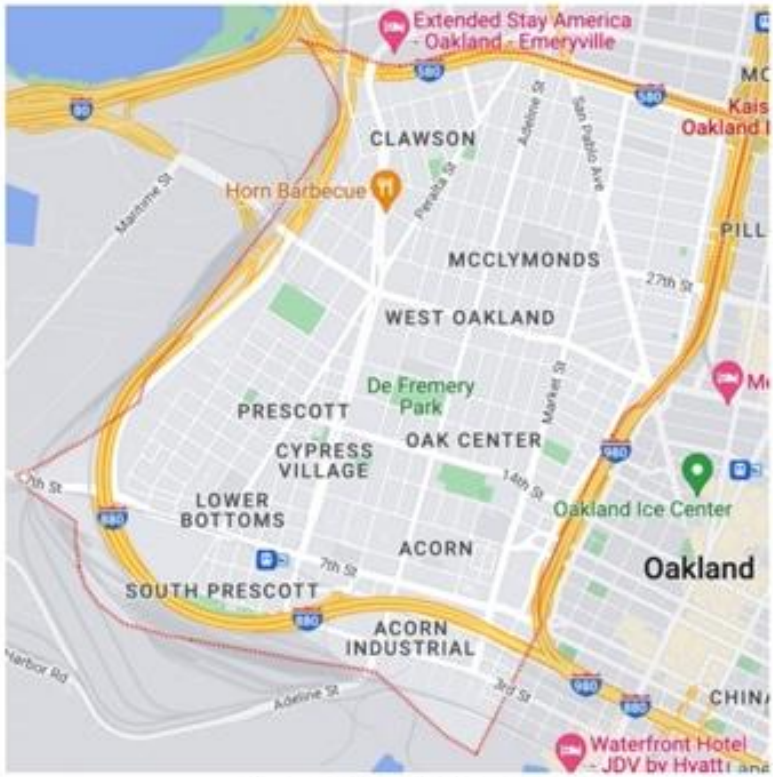


Fig. 18. Map of West Oakland

Fig. 19. Danville Site 1 Street View with Bus

Fig. 20. Danville Site 1 Street View with Parked Cars

Fig. 21. Danville Site 1 Street View with Cars Driving

Fig. 22. Danville Site 2 Suburb View of Empty Residential Street

Fig. 23. Danville Site 2 Suburb View of Trees and Sky

Fig. 24. Danville Site 2 Suburb View of Residential Driveway

Fig. 25. Pleasanton Site 1 Street View of People on Main Street

Fig. 26. Pleasanton Site 1 Street View of Restaurant on Main Street

Fig. 27. Pleasanton Site 1 Street View of Bikes in front of Shop on Main Street

Fig. 28. Pleasanton Site 1 Street View of Sign for Veteran's Day Parade (street closed to cars)

Fig. 29. Pleasanton Site 2 Suburb View of Residential Street and Parked Cars

Fig. 30. Pleasanton Site 2 Suburb View of Residential Houses, Sidewalks, and Parked Cars

Fig. 31. Pleasanton Site 2 Suburb View of Residential Sidewalk and Vegetation

Fig. 32. South Berkeley Site 1 Street View of Corner of Ashby Market with Cars at Crosswalk

Fig. 33. South Berkeley Site 1 Street View of Ashby Market with Cars at Stoplight

Fig. 34. South Berkeley Site 1 Street View of Ashby Market with Cars Crossing Intersection

Fig. 35. South Berkeley Site 2 Park View of Grove Park Grass with Cars in the Background

Fig. 36. South Berkeley Site 2 Park View of Grove Park Baseball Dirt Field

Fig. 37. South Berkeley Site 2 Park View of Grove Park Grass with Basketball Court

Fig. 38. West Oakland Site 1 Street View of Krispy Krunchy with Cars and 580 Freeway

Fig. 39. West Oakland Site 1 Street View of Krispy Krunchy Busy Parking Lot and Freeway

Fig. 40. West Oakland Site 1 Street View of Krispy Krunchy Cars and Vegetation

Fig. 41. West Oakland Site 2 Park View of WO Farm Park with Seating and Vegetation

Fig. 42. West Oakland Site 2 Park View of WO Farm Park Courtyard with Pampas Grass

Fig. 43. West Oakland Site 2 Park View of WO Farm Park Dirt and Brush Open Walkway