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OTS CALIFORNIA OFFICE OF TRAFFIC SAFETY

Perceptions of Bicycle Safety: A Data and User-Experience Approach

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Introduction and Methodology

Climate change has caused unprecedented problems, which has increased efforts to fund sustainable green alternatives. In California, the transportation sector accounts for approximately 50 percent of the state's greenhouse gas emissions[1]. California's Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP) provides $100 million annually to develop and deploy alternative fuel options, including infrastructure for zero and near-zero emission vehicles. In addition to ARFVTP, Senate Bill 743 was passed in 2013 which re-shaped the focus of traffic analysis from congestion and level of service impacts towards a more health-centric focus on the effects vehicle miles traveled has on people. This has directly led to increased funding for alternative means of transportation such as active transportation and micro-mobility infrastructure improvements. In this brief, we will explore the existing bicycle infrastructure in the City of Oakland as it relates to cyclist safety from a qualitative and quantitative perspective.

We hope to look at this infrastructure considering quantitative data from high-injury zones and qualitative reports from field observation and cyclist interviews. The method of analyses will rely on crash data from California's Statewide Integrated Traffic Record System (SWITRS) and Lyft's Bay Wheels bicycle trip data. Once high-injury zones are identified, we will overlay shared bicycle origin/destination trip data to identify potential routes within the high-injury zones. Field observations and user experiences will then be surveyed to help better understand the elements that contribute to perceived cycle safety.

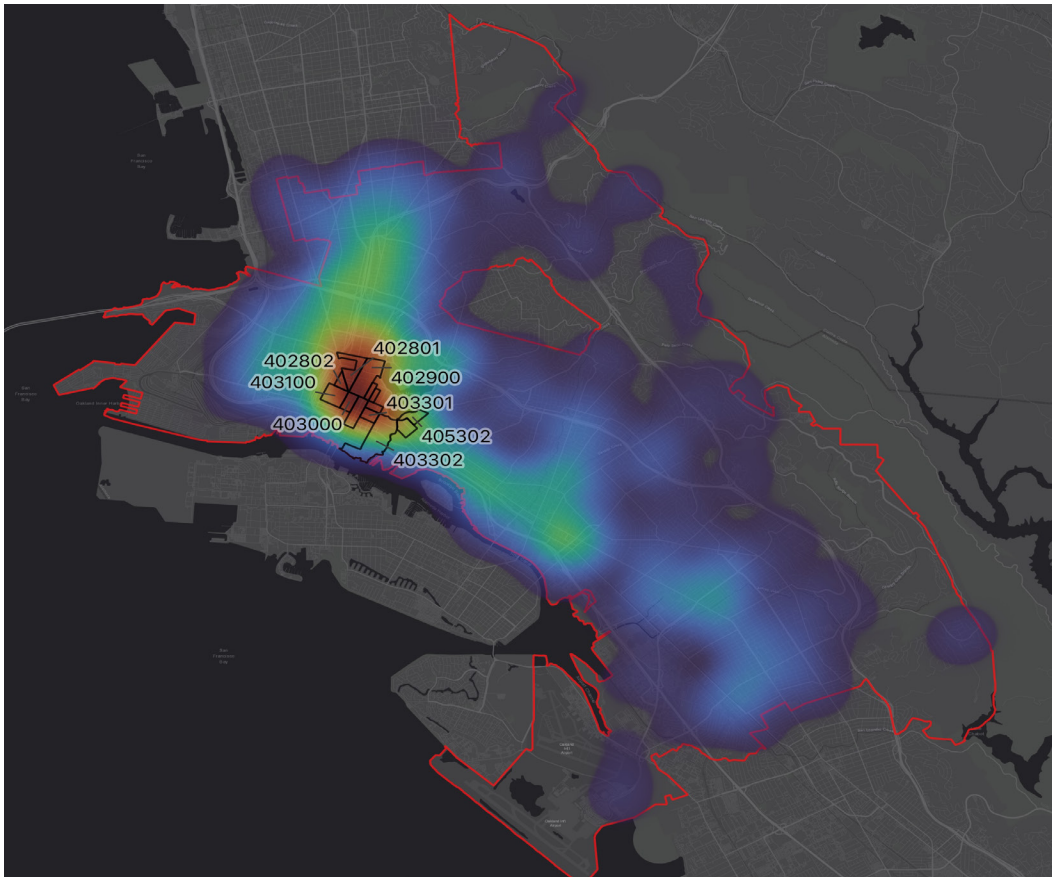

Figure 1 - Bicycle Crashes (2015-2019)

1 Commission, "Transforming Transportation."

High-Crash Zones

For the purposes of this analysis, we observed crash data over a five-year period from a census blocks level in the city of Oakland [2].

Figure 1 highlights the high-crash area for cyclists with an overlay of the census block groups that fall within this region. As shown in Figure 2, census block group 403000 located in downtown Oakland has the highest number of total injury crash incidents (27) from 2015 - 2019, while census block group 402900 has the second largest incidents (26). Census block group 403000 is bounded between 14th Street to the North, I880 to the South, Broadway to the West, and Alice Street to the East. There were no fatal crashes within these census block groups, but census block group 403000 didhave a one (1) severe injury, nine (9) visible injuries, and thirteen (13) incidents of individuals with complaints of pain.

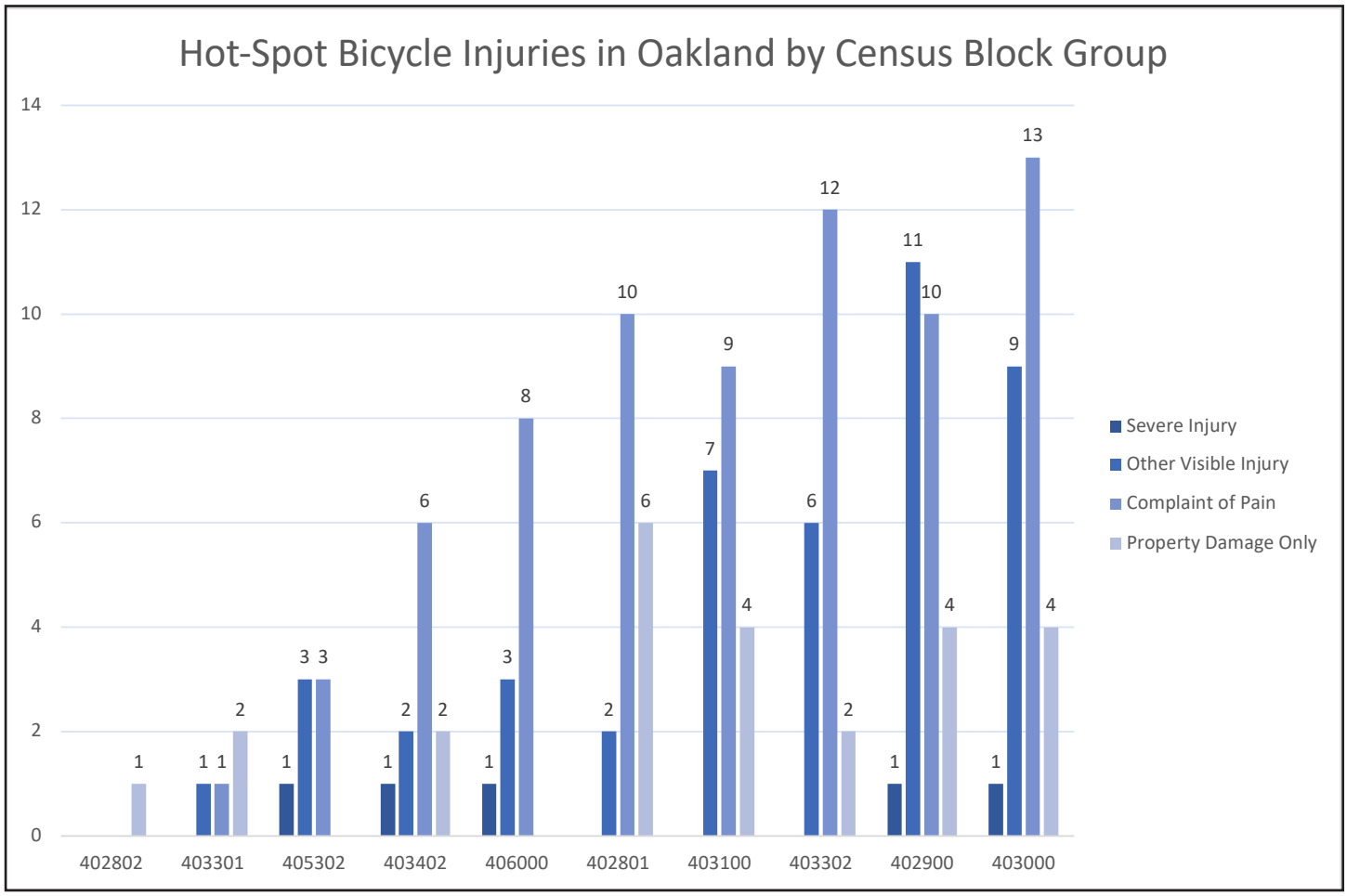

Figure 2 - Hot-Spot Bicycle Injuries by Census Block Group

2 The city of Oakland commonly weights fatal crashes by a factor of 3 and does not weight other categories of crashes. For the purposes of this analysis, we weighted each person injured based on the four severity levels of crashes classified by SWITRS the following way:

- [Fatal] * 3
- [Severe] * 1.5
- [Injury - Other Visible] * 1.25
- [Injury - Complaint of Pain] * 1
- [Property Damage Only] * 0

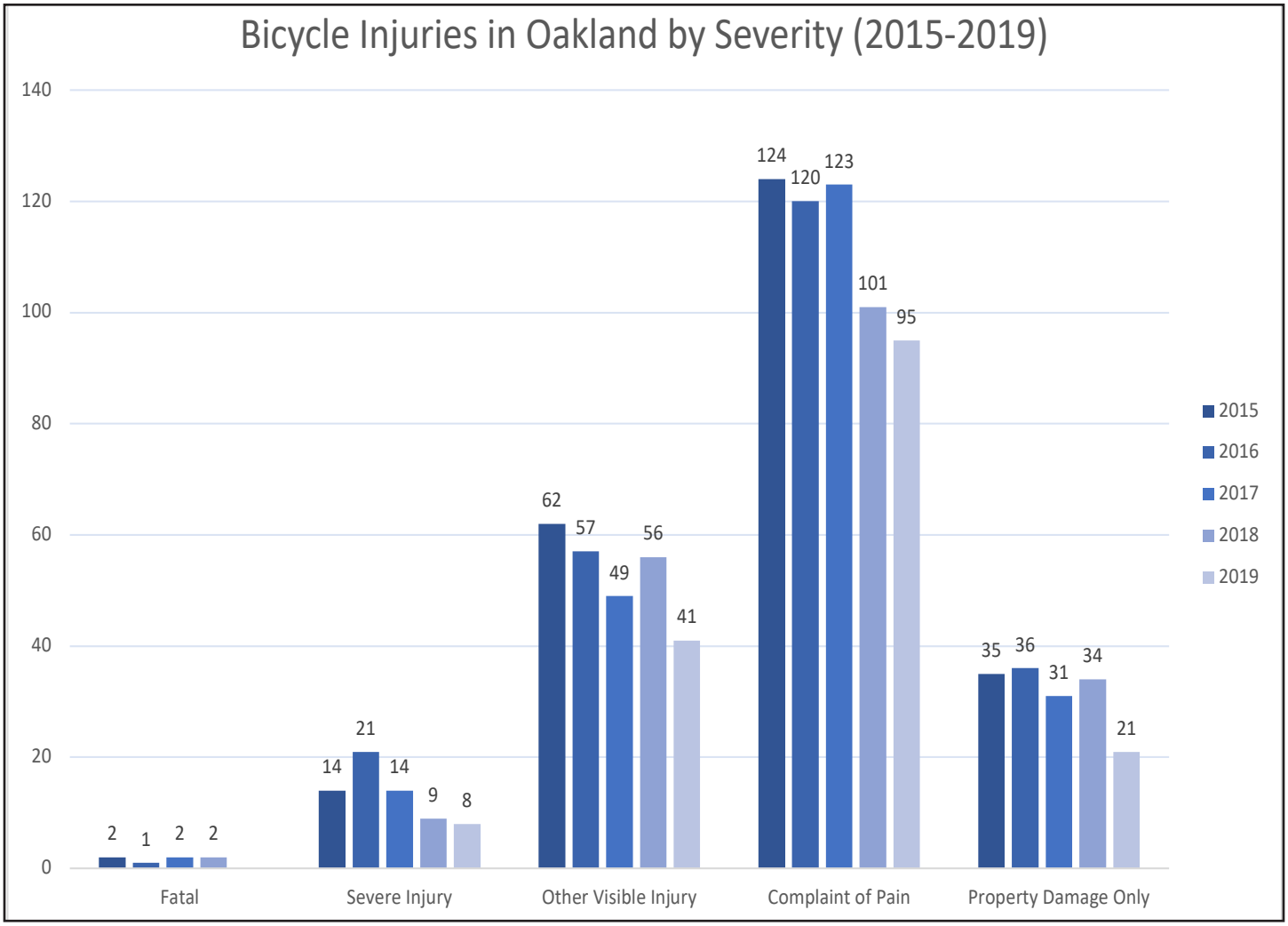

Figure 3 - Bicycle Injuries in Oakland by Severity (2015-2019)

Figure 3 shows the total number of bicycle crashes in Oakland from 2015 – 2019. From 2015 through 2019 there have been seven (7) total fatal bicycle related crashes, sixty-six (66) severely injured crashes, two-hundred sixty-five (265) crashes with visible injuries, five-hundred sixty-three (563) incidents involving complaints of pain, and one-hundred fifty-seven (157) incidents involving property damage only. The general yearly trend for all severity classifications is decreasing.

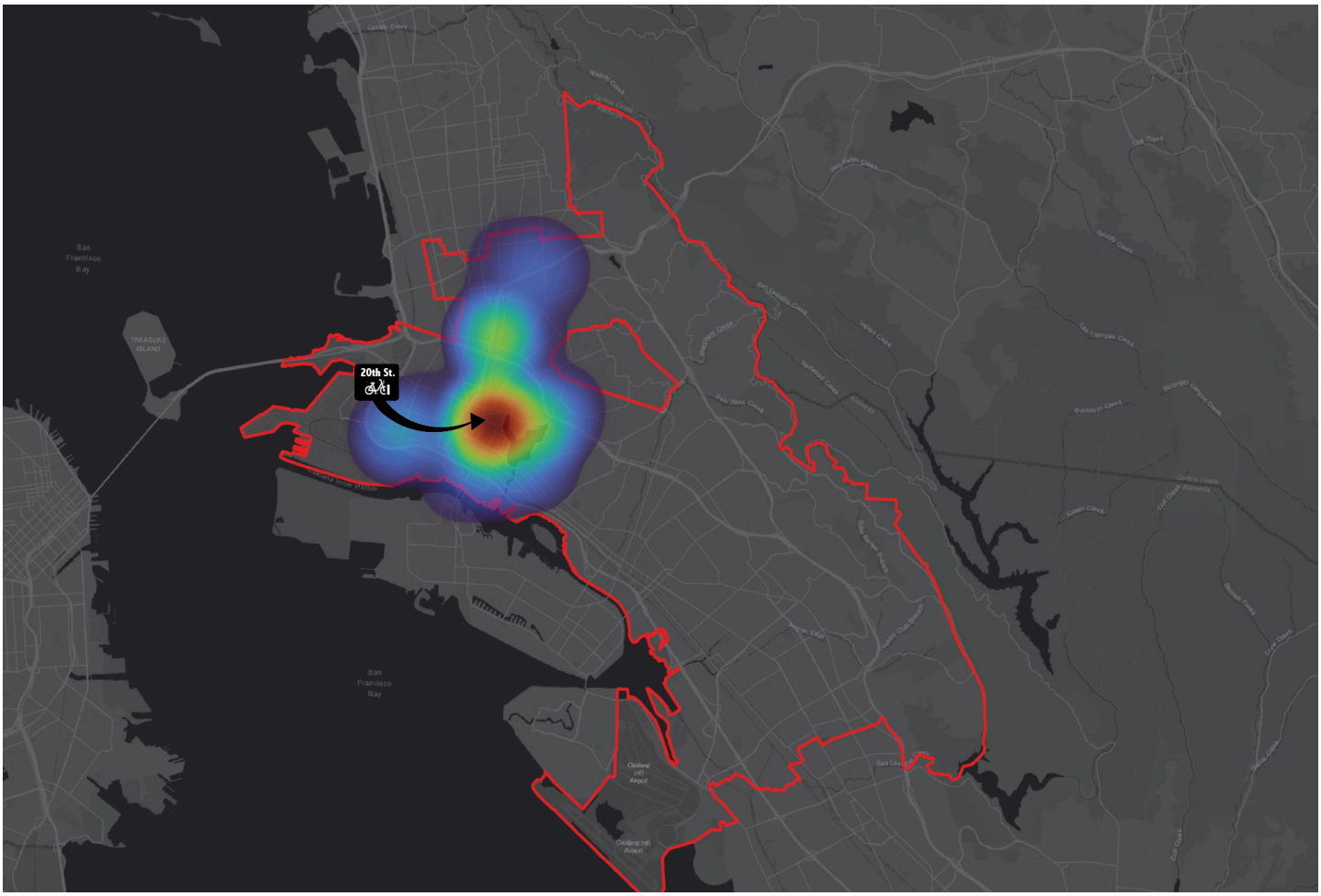

Figure 4 - Heatmap Origin/Destination Bikeshare

Bikeshare Analysis

The rapid growth of bikeshare in the United States has provided an alternative means of active and sustainable transportation. The increase in shared bicycle supply and demand – coupled with California's investments in zero-emission infrastructure alternatives – has provided an opportunity to create a multi-modal experience for all users. This analysis utilizes bikeshare data provided by Lyft as a proxy to understand typical routes of its shared bicycle users and is not intended to insinuate or conclude these users have higher rates of vehicle-involved crashes than personal bicycle users.

Figure 4 shows a heatmap of the most frequented destination bikeshare stations within the city of Oakland in 2019. This hotspot was related to the usage of bikeshare at the 20th Street Bay Wheels location. Figure 5 shows the total number of trips that concluded at 20th St. from each origin location. A total of 3699 trips started from the North Lake Merritt location and concluded at the 20th St. and Broadway location and a large majority of the other trips originated North of 20th Street.

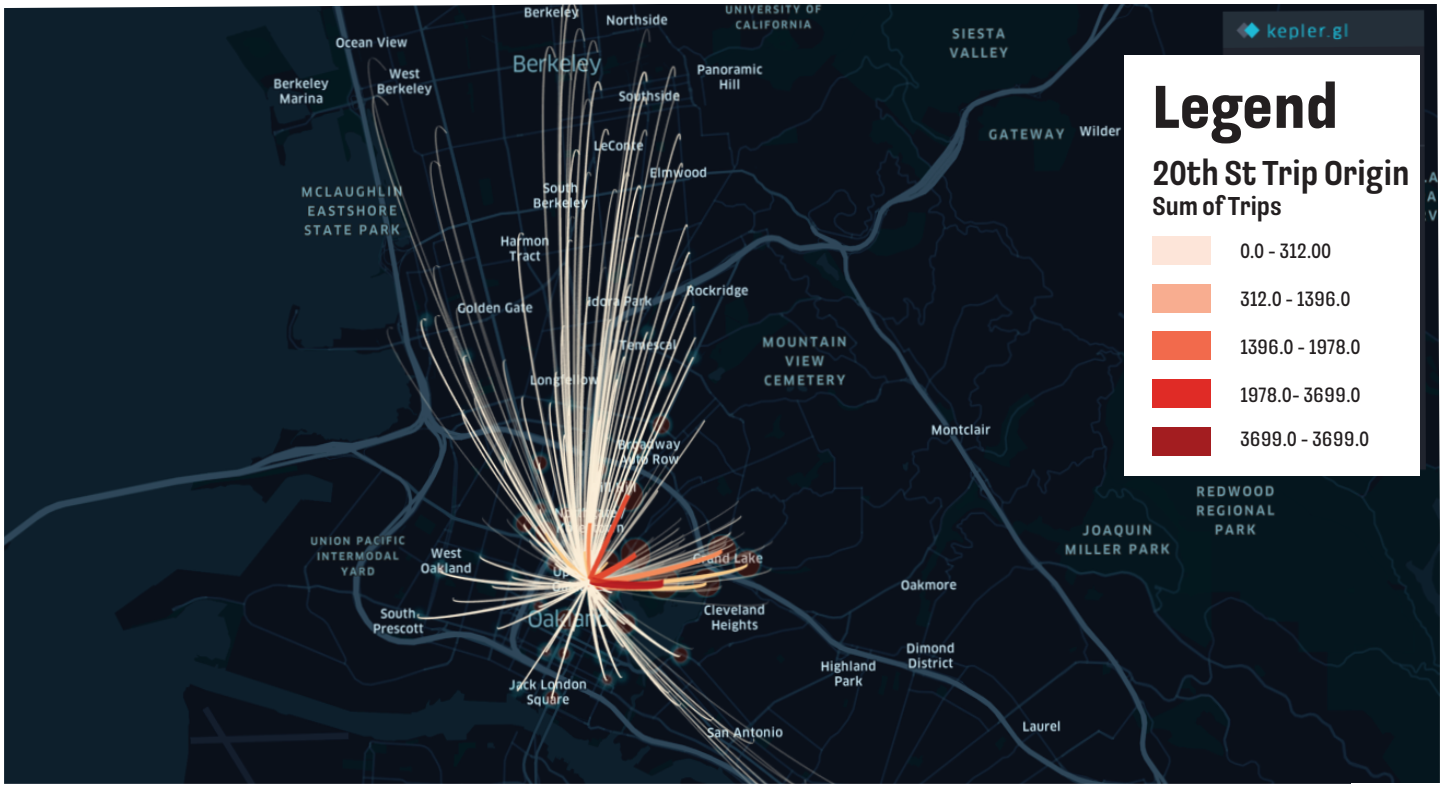

Figure 5 - 20th St. Origin/Destination (2019)

Field Observations

The highlight between the bikeshare trip frequency and cycling crash data occurs West of Lake Merritt in downtown Oakland. Upon further analysis of the bicycle related heatmap, 14th St. between Broadway and Clay St. was found to have a particularly dense collision incident rate. As a result of the high crash rate, the 14th St. location was chosen for field observations.

The physical infrastructure characteristics consisted of many commercial buildings over 10 stories on both sides of the street, two lanes of vehicle traffic in both directions, a park located on the north side of 14th street, no parking allowed on either side of the street, and a mid-street signal with a crosswalk. Street lighting appeared more prominent closer to the park side. No bike lane was observed on the street, but according to Oakland's Bicycle Plan there is a proposed bicycle lane that will be put in place. The mid-street signal had an approximate 35-second green light time and a 25-second red light time. This mid-street signal did not have any cross-vehicle traffic and its intended use was solely for pedestrian crossings.

In addition to the infrastructure observations, a few behavioral observations were noted and three informal interviews with cyclists were conducted. While not generalizable, these behaviors are important to note and the interviews add some insight as to the perception of safety from a cyclist's lens. Cyclists were observed using the full traffic lane, similar to vehicle traffic, reflecting, according to research [3], cyclists very comfortable in a roadway environment. In a one-hour time span on a Saturday afternoon, three motor vehicle drivers were observed going through the redlight once they realized no pedestrians were present crossing the street. In interviews, each participant valued safety,

3 "The 4 Types of Cyclists You'll Meet on U.S. City Streets - Bloomberg." Research has shown that there are different types of riders that may fall into the following categories based on infrastructure quality: 1) Strong and Fearless: People willing to bicycle with limited or no bicycle-specific infrastructure_2) Enthused and Confident: People willing to bicycle if some bicycle-specific infrastructure is in place_3) Interested but Concerned: People willing to bicycle if high-quality bicycle infrastructure is in place_4) No Way, No How: People unwilling to bicycle even if high-quality bicycle infrastructure is in place

speed, and barriers when choosing any specific route choice. Safety, for participants, was largely defined by adjacent motor vehicle speed, separated motor vehicle and cyclist traffic, and whether a path was a common route for cyclists. Participants felt a need to ride on sidewalks when they did not feel safe riding on a street – whether it be due to high traffic speed, poor lighting conditions, or perceived driver impairment at night. Two out of the three participants expressed favorability towards the Idaho Stop Law, which requires cyclists to yield at stop signs rather than coming to a full stop. Their concerns largely revolved around the decrease in cycling momentum, which affects their ability to quickly evade crashes. Participants also reported that they tended not to wear helmets on shared bikes, but almost always wore helmets on personal owned bicycles. Their reasons for not wearing a helmet on shared bicycles were largely due to inconvenience and lack of prior cycling planning.

Conclusion and Future Considerations

Bikeshare is a novel innovation that has led to increased mobility options for residents, but proper planning and education is needed to ensure safety continues to remain a priority. Oakland's Bicycle Plan involves a robust expansion of bicycle infrastructure within the city and communities should continue to be engaged in the planning process to ensure their needs are met. Crash data and trip data can be used as a proxy to determine safety concerns, but the lived experiences of residents and users should also be factored into decision making. Exploration of equity issues in placement of bikeshare, costs, helmet policy, etc. is necessary to ensure bikeshare users have the means and ability to use bike share conveniently and safely. Safety of all mobility users should continue to be prioritized to create a more user friendly multi-modal experience.

Our field observations and analysis are anecdotal and is not intended to be generalizable. Further in-depth analysis of personal bicycle and share-bicycle usage and a more robust sampling size of survey participants is needed to determine particular routes of safety concern.

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