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Graduate Transportation Planning Studio Projects (DCRP CP 218)

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Aligning Street Safety and Emergency Response in the Berkeley Hills

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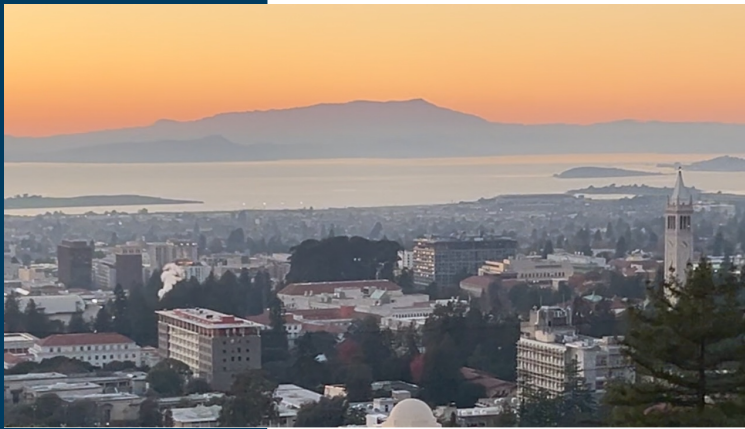
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ALIGNING STREET SAFETY AND EMERGENCY RESPONSE IN THE BERKELEY HILLS



TO
BY

CITY OF BERKELEY

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UC BERKELEY
MASTER OF CITY PLANNING
TRANSPORTATION PLANNING STUDIO

DECEMBER 2024

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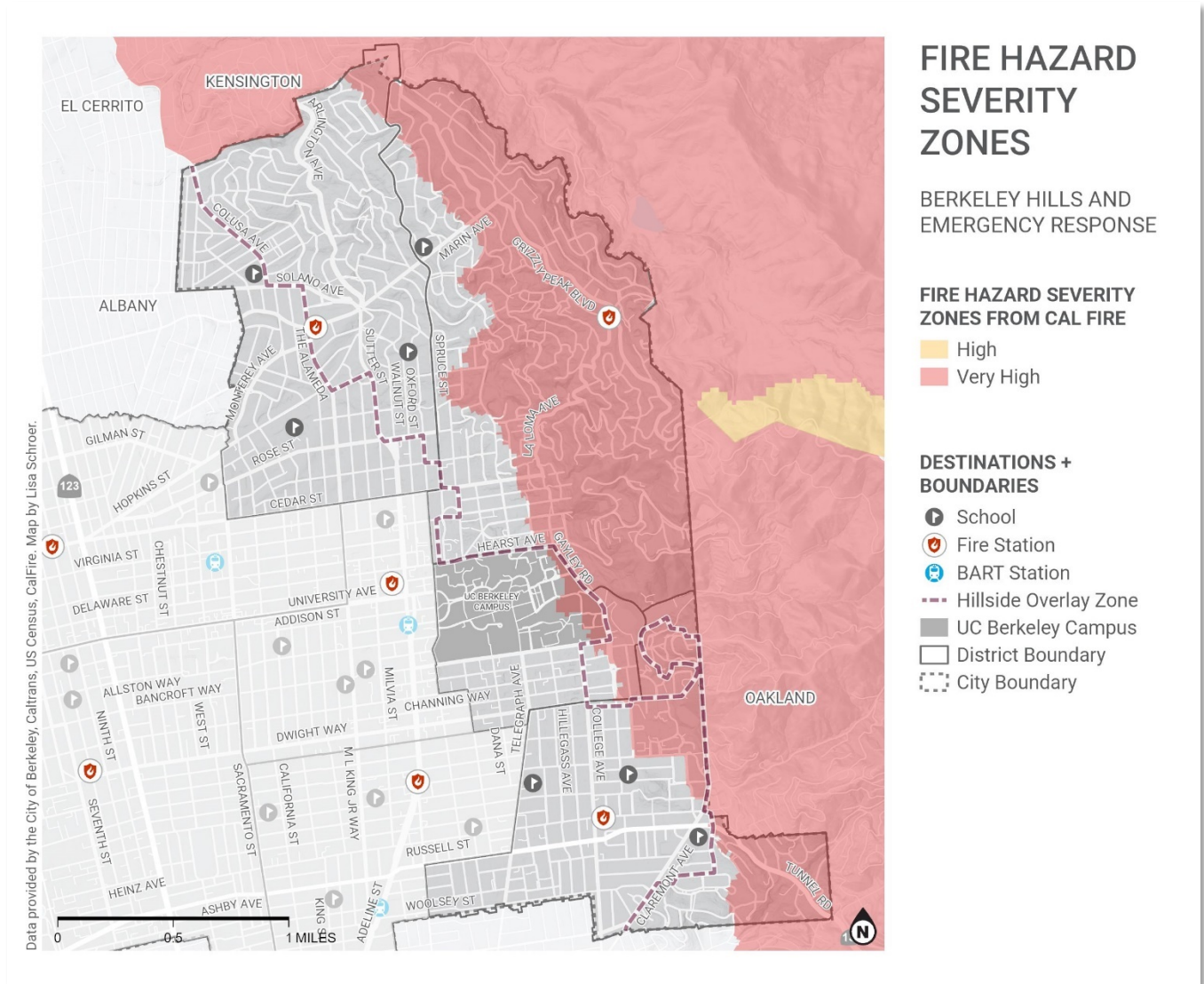
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Executive Summary

The Berkeley Hills are a designated Very High Fire Hazard Severity Zone located on the eastern edge of the City of Berkeley. While the Berkeley Hills are not a geographic monolith, many of the roads in the Berkeley Hills are narrow and windy. People often park legally or illegally on the street, further narrowing the right-of-way. These two issues present a transportation challenge. High fire risk increases the danger of living in the Berkeley Hills, necessitating the ability to easily evacuate in the event of a fire. Additionally, emergency vehicles must be able to quickly access the Berkeley Hills. Narrow roads, further constrained by parked cars, can hamper evacuation efforts and the ability of emergency vehicles to access the Berkeley Hills.



Parallel to these challenges, the City is also prioritizing traffic violence reduction in the form of traffic calming implementation, most notably through the newly approved Street Trauma Prevention Program. However, because of the Berkeley Hills' unique conditions, prescribing traffic calming interventions is more complicated than in other areas of Berkeley. Due to the increased fire risk and narrow roads in some parts of the Berkeley Hills, traffic calming may not be appropriate in many areas due to the need for ingress and egress.

To better understand these differing transportation challenges in the Berkeley Hills, the project team conducted the following:

- Interviews with academic and professional subject matter experts
- Review of relevant City of Berkeley plans and documents
- Case studies of Portland, Los Angeles, and Boulder
- Spatial data analysis
- Academic literature review

Our work revealed that the current status quo may be dangerous for people living in the Berkeley Hills. As the City considers upzoning single-family residential districts in the Berkeley Hills, impeded emergency response access, hindered evacuation, and traffic violence have the potential to compound existing risk. To address these challenges, a diverse set of infrastructure and policy prescriptions should be implemented.

Our project team recommends the following, organized by need:

Recommendation	Need
Enforce Existing Parking Regulations	High
Implement No Parking on Red Flag Days Program	
Purchase smaller fire apparatuses, when feasible	
Increase No Parking Zones	
Implement Residential Parking Program	Medium
Improve Transit Options	
Pedestrian Safety Improvements	
Implement Traffic Calming in High Needs/Benefits Areas	
If Upzoned, conduct Traffic Study to determine traffic calming needs	Lower
Interdepartmental Cooperation between Fire and Transportation Depts.	
Subsidize Transportation Network Company Trips (Uber/Lyft etc.)	

Introduction

Safety has long been a pressing issue in the Berkeley Hills. Characterized by a history of catastrophic fires, including the 1991 Tunnel Fire in which 25 lives were lost and thousands of homes were destroyed, fire concerns remain fresh in the minds of residents and City staff. In addition to emergency response needs, the City of Berkeley is also working to improve street safety through the City's Vision Zero Action Plan. Each year, hundreds of people biking and walking on Berkeley's streets are injured in car collisions. Traffic calming measures such as lower speed limits, traffic diverters, separated bikeways, and protected intersections are one solution for improving street safety. As the City continues to increase collaboration between the Transportation Division and the Fire Department through the newly approved Street Trauma Prevention program, our understanding of safe streets must be expanded to include emergency response needs and safe infrastructure for all modes.

Streets in the Berkeley Hills pose a unique challenge for planners and first responders as there is a need for emergency response vehicles to quickly move along the street network, and a need to improve safety for people biking and walking. We argue that emergency response vehicle needs and traffic calming infrastructure can be mutually beneficial and effectively work together to create a safer street network.

The following report seeks to address today's ongoing transportation challenges related to fire safety, emergency response vehicle access, evacuation routes, and overall street safety in the Berkeley Hills. First, we provide an overview of the project area and Berkeley's existing planning documents related to our topic. Next, we shared findings from our literature review related to emergency response and traffic calming. Third, we research other cities in the United States with similar geographies to the Berkeley Hills to understand how other cities are approaching the issues faced by Berkeley. Last, we provide recommendations for how the City of Berkeley can move forward with improving emergency vehicle access and street safety in the Berkeley Hills.

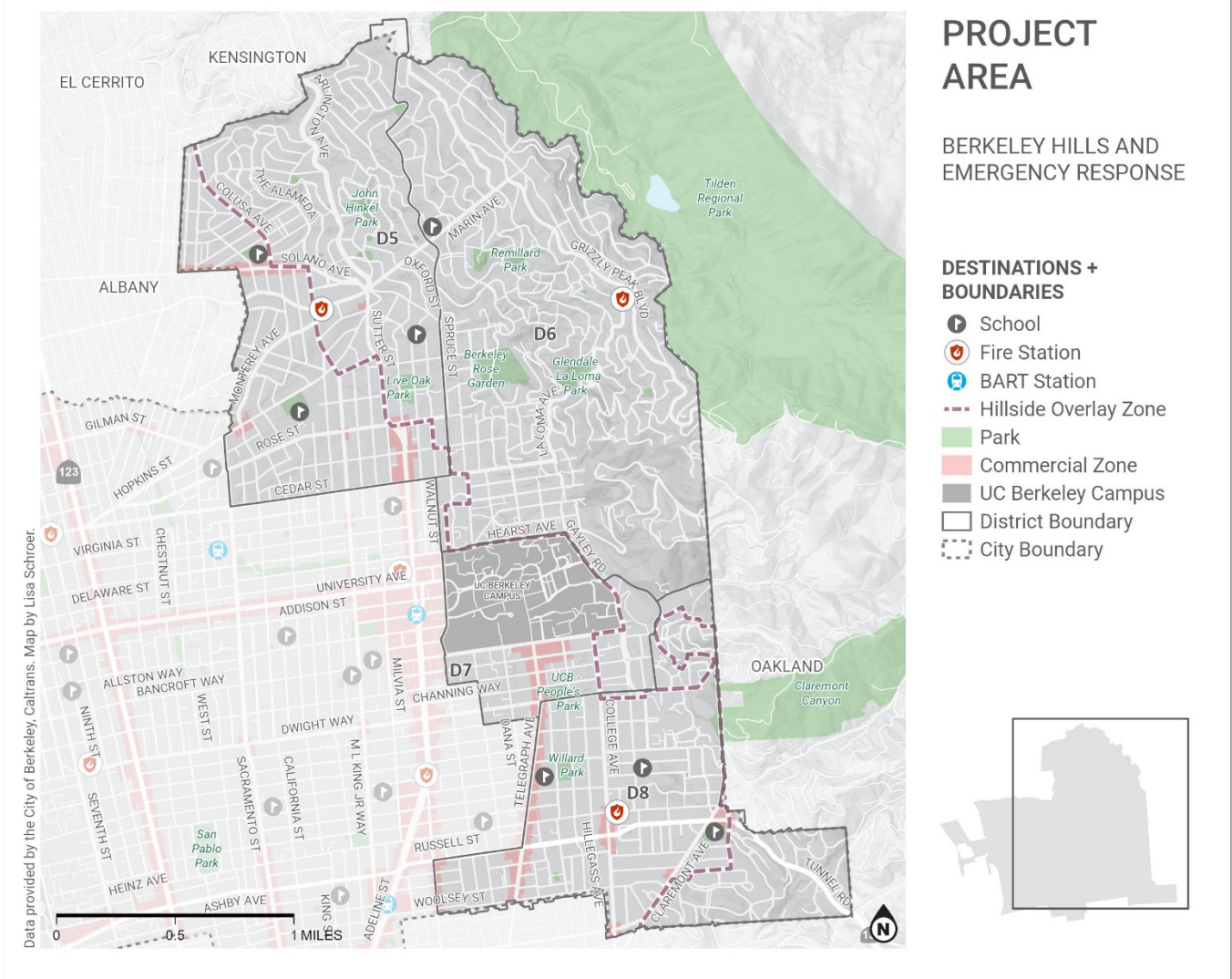
Existing Conditions

Characterized by narrow streets, steep elevation, and dense vegetation, residents of the Berkeley Hills and emergency response vehicles face unique transportation challenges. This section leverages data analysis to understand current transportation patterns in the Berkeley Hills.

Project Area

This report focuses on the neighborhoods clustered in the hills along Berkeley's eastern boundary, as shown in Figure 1 below. The Berkeley Hills, Cragmont, La Loma Park, Panoramic Hill, Southside, and Claremont neighborhoods are situated in the City's designated hillside overlay zone. Characterized by steep topography, windy and narrow streets, and high fire hazard severity, the study area faces unique challenges from a public safety and transportation needs perspective. Throughout this report, we will use the terms "study area," "hillside overlay zone," and "the Berkeley Hills" interchangeably to refer to the following twelve Alameda County census tracts: 4211, 4212, 4213, 4215, 4216, 4217, 4225, 4237, 4238, and 9821.

Figure 1 Project Area Map



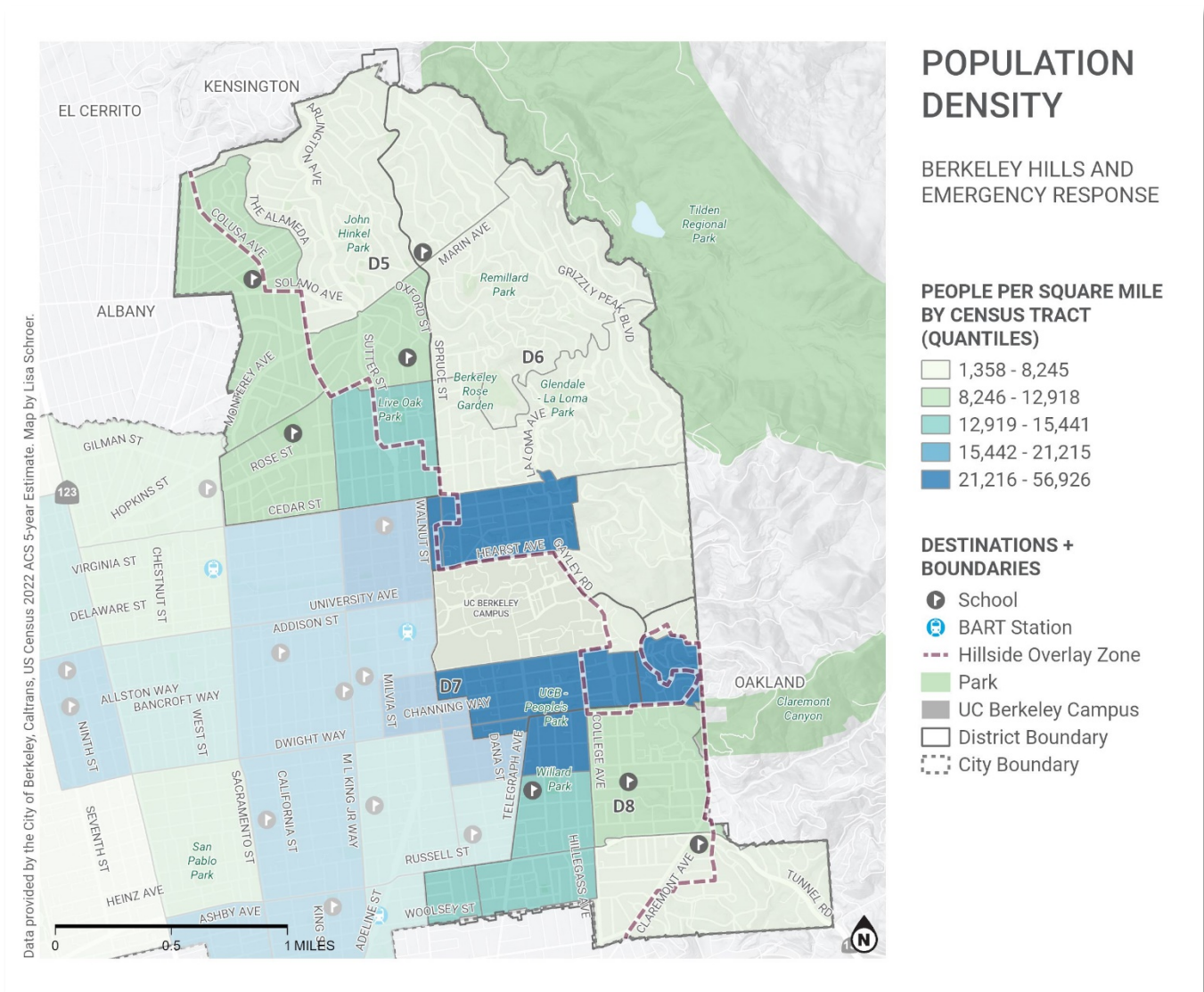
The hillside overlay zone is a designated geographical area where special requirements or limitations are outlined in the City's municipal code. In contrast to the topologically flat areas that make up the majority of Berkeley, the hillside overlay zone requires modified zoning codes to address the unique land use needs and limitations. Specifically, according to the City, the overlay's purpose is to:

- Protect the safety of residents where steep topography, narrow street conditions, and proximity to wildland vegetation creates severe wildfire risks
- Protect the character of the Berkeley hillside
- Give protection to views while allowing appropriate development
- Allow modifications to building requirements when justified due to steep topography or unusual conditions

Demographics

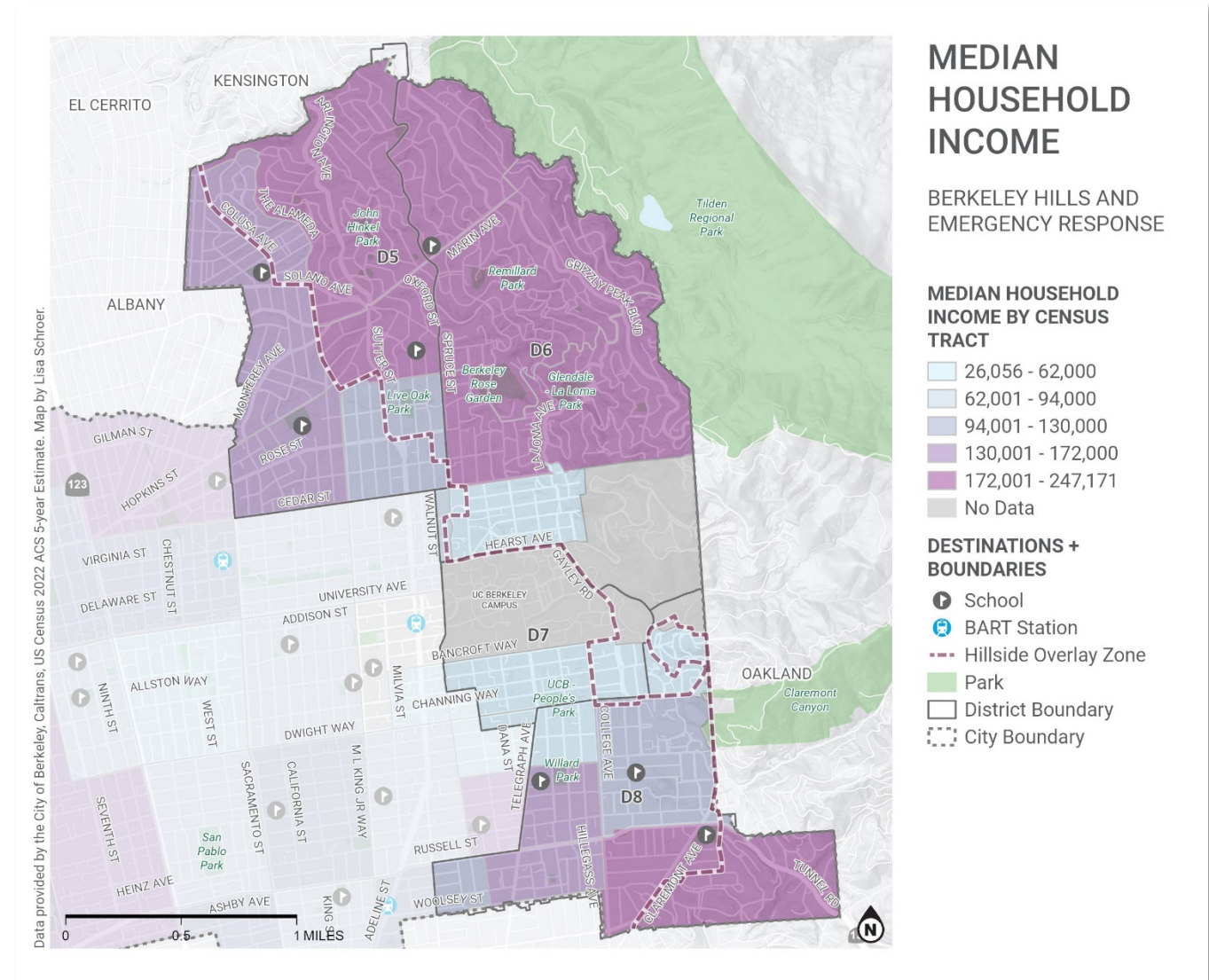
Of Berkeley's 121,385 residents in 2022, 39,000 live within or in close proximity to the hillside overlay zone (32%). Of hillside overlay residents, 22% are ages 18 to 24, and 22% are ages 65 or older. Figure 2 shows the variation in population density throughout the hills area. Reflecting the City's zoning codes, the majority of hills residents have the lowest population density relative to other areas within Berkeley. It is notable, however, that the north and south sides of UC Berkeley's campus are both located in the hills overlay zone and have the highest population density within the City. Residents in this area are majority students.

Figure 2 Population Density Map



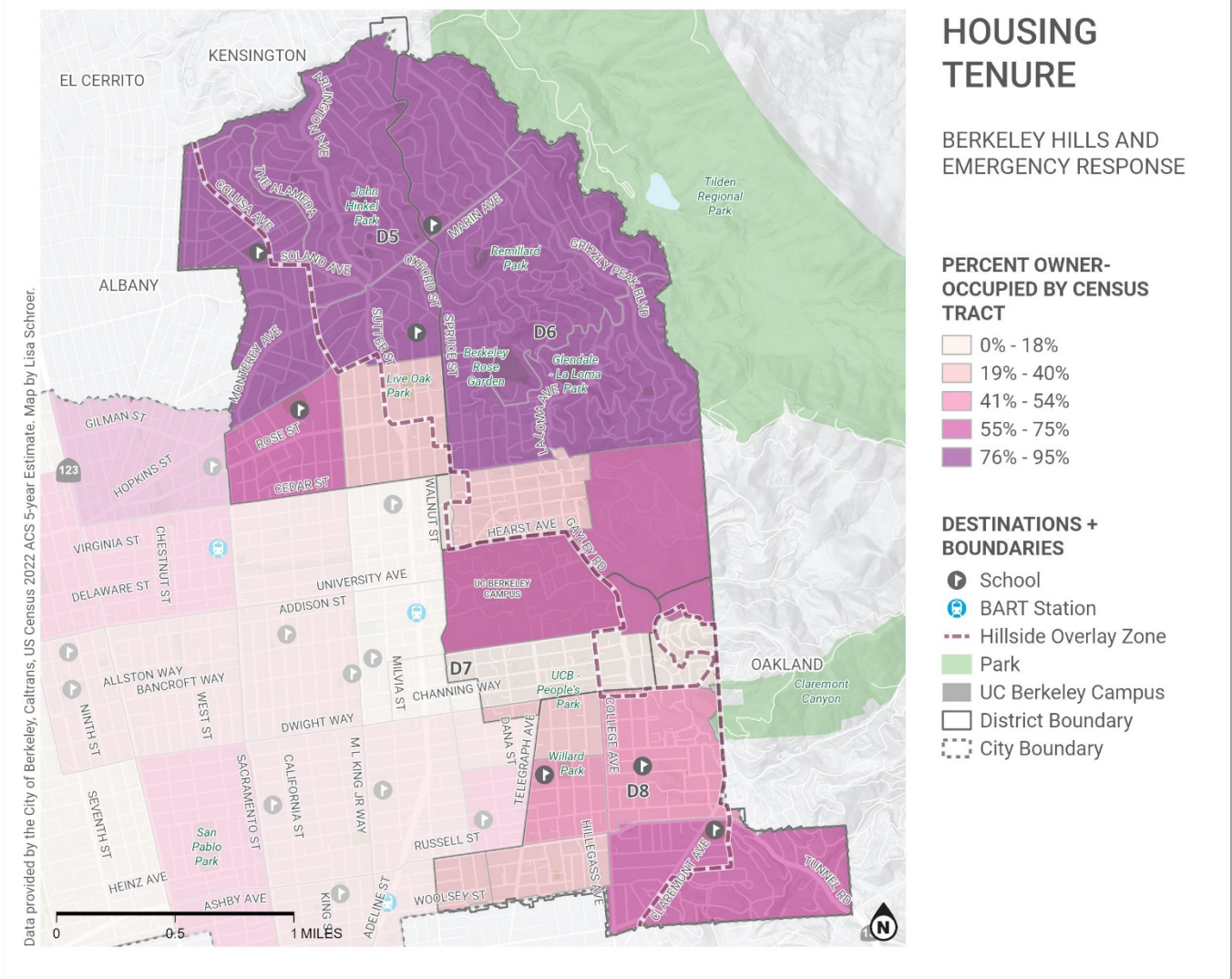
According to 2022 American Community Survey 5-year estimates, residents located within the study area have a higher median household income (\$150,830) compared to the citywide average (\$121,368) and the average of those living outside of the hillside overlay (\$103,690). Figure 3 below shows the variation in median household income throughout the study area. The Berkeley Hills, Cragmont, La Loma Park, and Claremont neighborhoods have the highest average median household income (\$217,015), whereas the north and southside of UC Berkeley’s campus have the lowest average median household income in the study area (\$58,945).

Figure 3 Median Household Income Map



Housing units within the study area are majority owner-occupied (64.9%), compared to the City’s average where less than half of units are owner-occupied (44.9%). Similar to the geographical distribution of median household income, the neighborhoods located to the north and south sides of UC Berkeley have distinct housing tenure characteristics with low owner-occupancy (19%), whereas the Berkeley Hills, Cragmont, La Loma Park, and Claremont neighborhoods have high owner-occupancy (73.9%).

Figure 4 Housing Tenure Map



Transportation

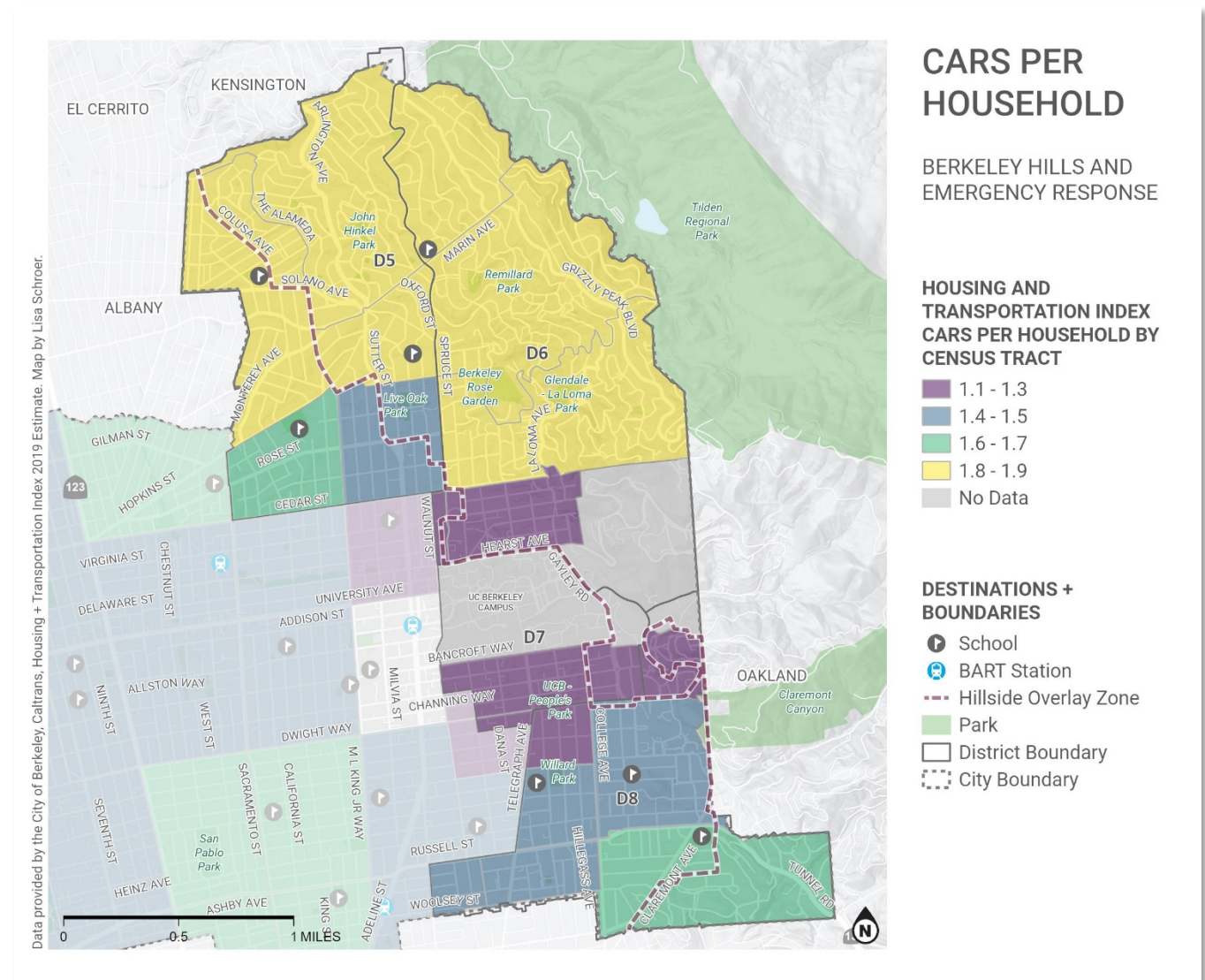
Residents in the hillside overlay zone have unique transportation patterns and mode access compared to other areas in the City of Berkeley. The majority of residents in the hillside overlay zone report driving alone (30%) or carpooling (5%) as their primary means of transportation to work. 31% of workers in the overlay zone report working from home, 22% report biking or walking, and 13% report taking public transit. As shown in Figure 5, car ownership varies geographically throughout the City. Households in the Berkeley Hills report owning more cars on average than downtown, Central, and West Berkeley. Table 1 below compares transportation characteristics for the hillside overlay zone, flatlands, and citywide geographies.

Table 1 Transportation Characteristics in Berkeley

Transportation Metric	Hillside Overlay Zone	Berkeley "Flats"	City of Berkeley
Means of Transportation to Work (Drives Alone)	29.4%	28.8%	29.0%
Cars per Household	1.66	1.46	1.53
Annual VMT per Household	12,620 miles	10,923 miles	11,526 miles
Annual GHG per Household	4.89 CO2	4.13 CO2	4.4 CO2
Annual Transit Trips per Household	445 trips	667 trips	588 trips
Total AC Transit Stops	218	291	509
Miles of Designate Bike Facilities	10.4 miles	42.5 miles	52.9 miles

Data Sources: City of Berkeley, AC Transit, U.S. Census ACS 5-year 2022 and Housing and Transportation Index 2019 Estimates.

Figure 5 Cars per Household Map

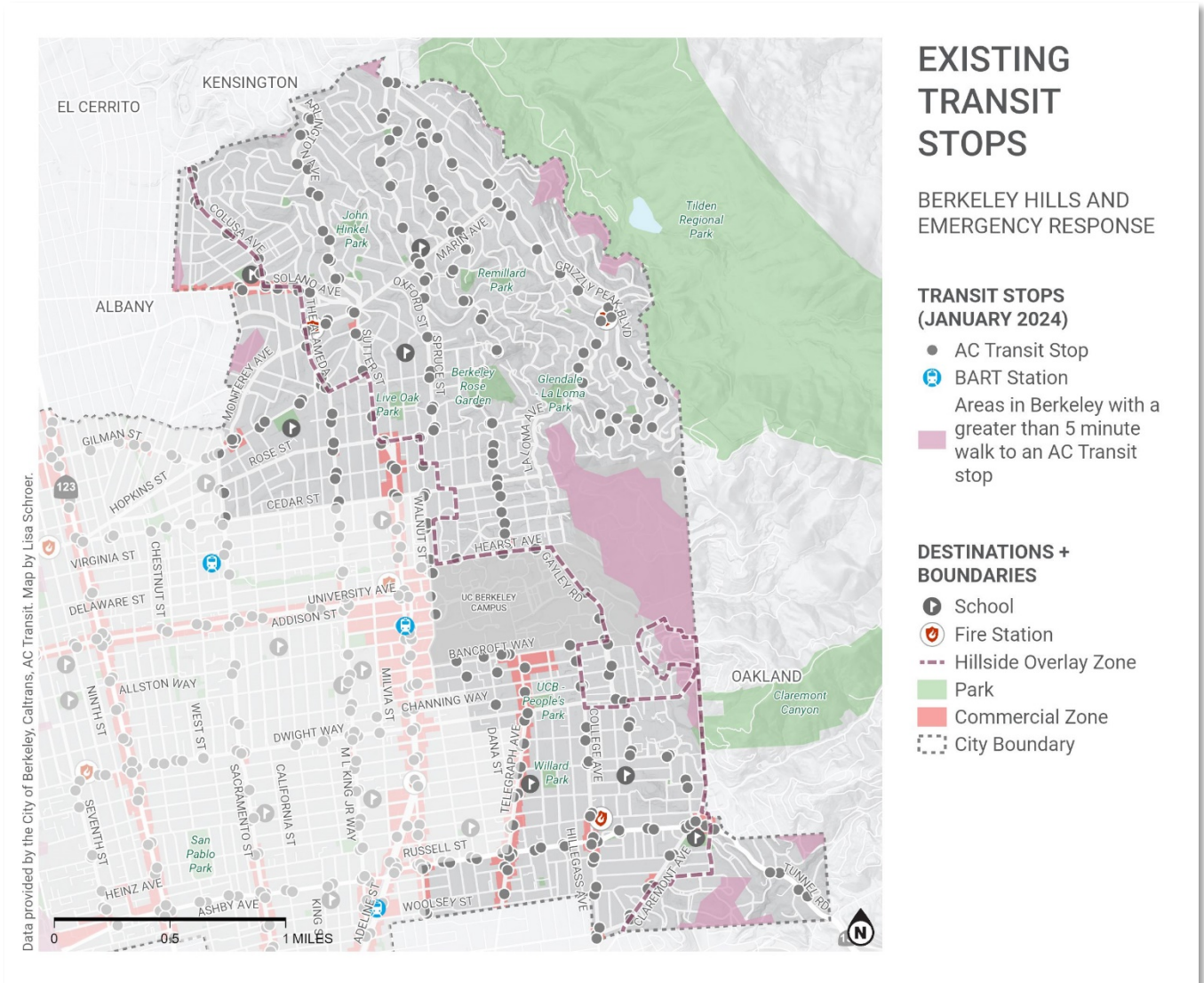


On-street parking is common in the hillside overlay zone. In areas with narrow streets, on-street parking can encroach sidewalks, block the pedestrian right-of-way, hinder mobility for wheeled users, and create pinch points that make it impossible for wide emergency vehicles to pass through. Due to limited data availability on parking in the study area, we are not able to analyze current parking patterns and off-street parking utilization. However, the Berkeley Disaster and Fire Safety Commission recently recommended parking enforcement in the Fire Hazard Severity Zones to address safety concerns in the Berkeley Hills, suggesting a need for further study.¹

Residents of the hillside overlay zone are primarily served by six AC Transit bus lines including the following: 52B University - College - Rockridge, 65 Grizzly Peak - Euclid, 67 Spruce - Oxford, 79 Colusa - The Alameda - Claremont, 604 Head Royce - OHDS - Southside Berkeley, and E Tunnel Road - Claremont Transbay. Using these routes, residents have access to Downtown Berkeley BART, Rockridge BART, downtown Oakland, and the Salesforce Transit Center in San Francisco. Of the 509 AC Transit stops located in the City of Berkeley, 218 are located within the study area. The majority of residents living in the hillside overlay zone are within a five-minute walk of an AC Transit stop, however, limitations around bus frequency and route options make transit an unreliable mode choice for residents.

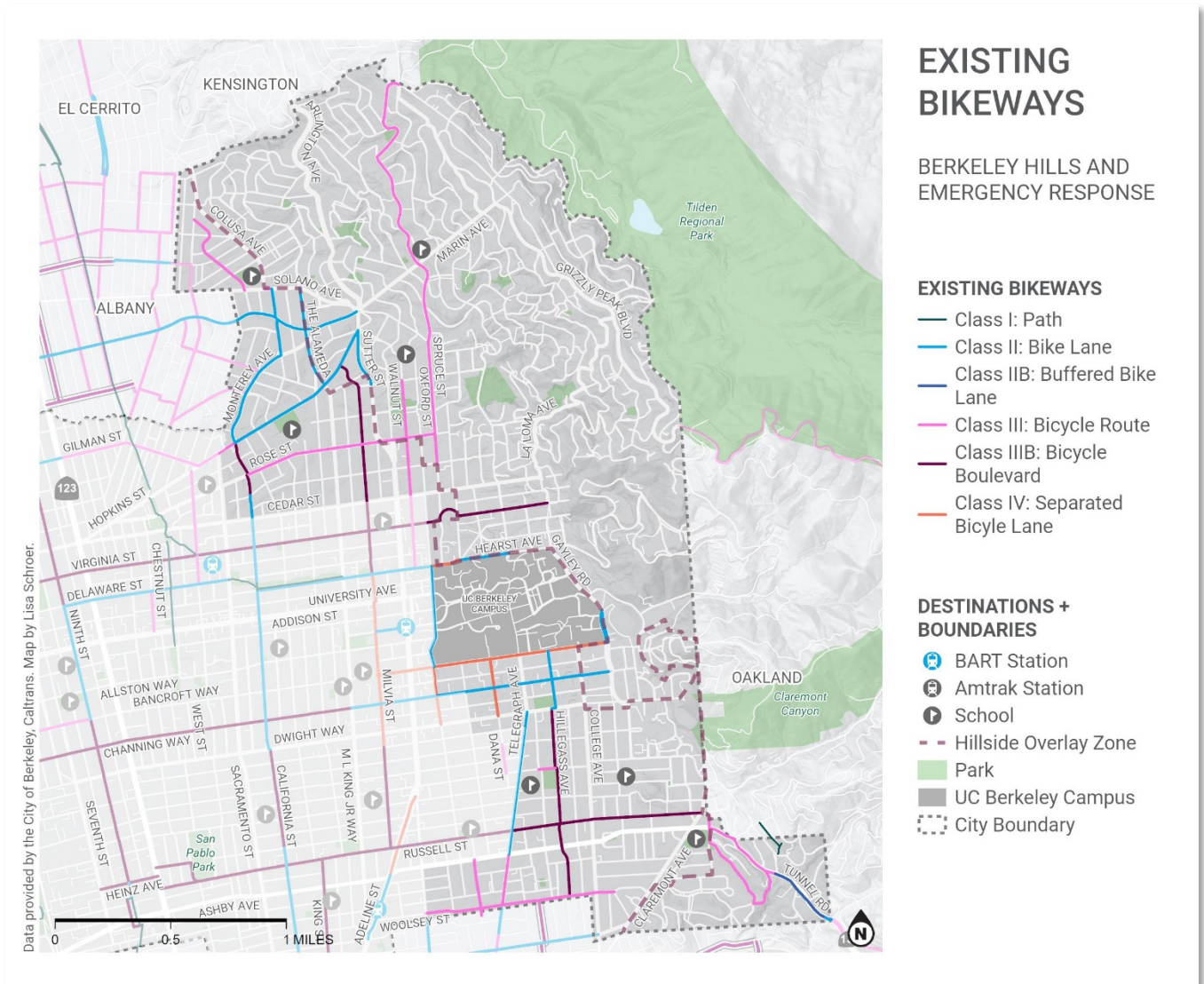
¹ Berkeley Disaster and Fire Safety Commission, "Parking Enforcement of Existing Parking Code in Fire Zones 2 & 3."

Figure 6 Existing AC Transit Bus Stops Map



Due to the steep nature of terrain in the Berkeley hills, designated bike facilities are less abundant in the hillside overlay zone than they are throughout other areas within the City. Within the study area there are existing bike facilities on Spruce Street (Class III Bike Route), Virginia Street (Class IIIB Bicycle Boulevard), and Tunnel Road (Class II Bike Lane). Of the City’s 36 Bay Wheels bikeshare stations, only three are located within the hillside overlay zone. These stations are concentrated along the western boundary of the study area close to the downtown core. Bikeshare and non-electric bike modes of travel are therefore more difficult for hillside overlay residents and likely used less frequently than in other parts of Berkeley.

Figure 7 Existing Bike Facilities Map



Fire Safety and Evacuation Routes

The Berkeley and Oakland Hills experienced a total of sixteen major fires in recent history. Often characterized by dry brush, excessive winds, and recurring locations, the East Bay Hills are prone to wildland fires. The 1923 and 1991 fires in the hillside overlay zone continue to influence perceptions of safety and drive planning and emergency response decisions today (Table 2).

Table 2 Fire History in the City of Berkeley

Historical Fire	Location	Environmental Factors	Impact
1923 Berkeley Hills Fire	North of UC Berkeley Campus	Strong winds, dry shingle roofs, vegetation/foliage	2 deaths, 584 homes destroyed, 130 acres of land

Historical Fire	Location	Environmental Factors	Impact
1991 Tunnel Road Fire	Claremont neighborhood	Strong winds	25 deaths, 3,554 homes and 456 apartments destroyed, \$1.5 million in damages, 1,600 acres burned

Housing units in the hillside overlay zone are uniquely susceptible to fire hazards. Many units are 50-100 years old. Built with wood siding, older units lack fireproof exteriors that modern fire-resistant new homes are often built with, leaving residents vulnerable to flames.² In addition to an older housing stock, the hillside overlay zone is home to non-native blue-gum eucalyptus trees that produce flammable thick peeling bark and oily firebrands when ignited. Efforts by various jurisdictional bodies including the City of Berkeley, East Bay Regional Parks District, and UC Berkeley to improve vegetation management have had limited success. The university's plan to remove non-native eucalyptus trees as part of several proposed fire hazard reduction projects were met with multiple lawsuits blocking progress for decades. Only recently, in 2023, was the university allowed to pursue vegetation management in the hills.

The 1991 Tunnel Fire led to significant changes in emergency response protocols for Alameda County, including the study area. Following the fire, the 1992-1993 Alameda County Grand Jury investigated the local government response to the emergency. The jury made four recommendations in their Final Report that continue to remain in effect today.³

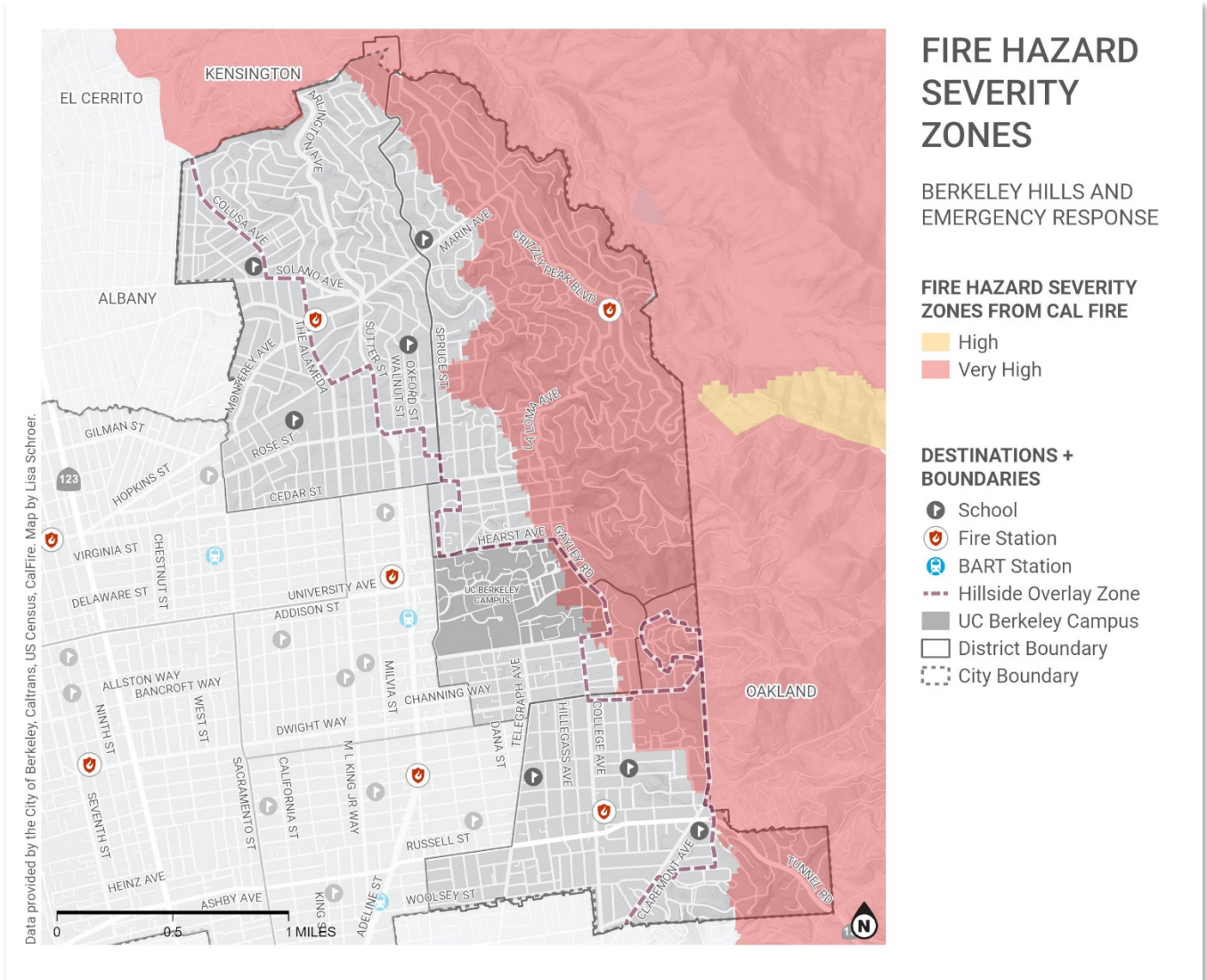
1. Recommendation #93-5: That all local jurisdictions within Alameda County allocate and commit sufficient resources to ensure that the necessary personnel, equipment, and training are in place and ready to respond to future disasters
2. Recommendation #93-6: That Oakland hire twenty-four additional firefighters and Berkeley hire thirteen additional firefighters
3. Recommendation #93-7: That all offices of Emergency Services suggest and require emergency plan updates and regularly scheduled training for all Government employees
4. Recommendation #93-8: That training all personnel in the newly established 800MHZ system be given priority, and that all jurisdictions establish regular training exercises in communicating with all agencies involved in an emergency response

Today, fire safety in the hillside overlay zone is a key priority for both residents and the City. Recent plans including the 2024 draft Local Hazard Mitigation Plan and Community Wildfire Protection Plan are reviewed and synthesized in the Plan Review section below. Figure 8 shows the extent of the State Department of Forestry and Fire Protection's (Cal Fire) designated fire hazard severity zones. The study area's eastern edge, at Berkeley's highest elevations, contains a significant acreage of very high fire severity. Just over half of the hillside overlay zone is considered to have "Very High" risk. Residents of the Berkeley Hills, Cragmont, La Loma Park, Panoramic Hill, and Claremont neighborhoods are particularly vulnerable to fire hazards.

² Gecan, "100 Years after Berkeley's 1923 Fire, Another Tragedy Could Be Even Likelier."

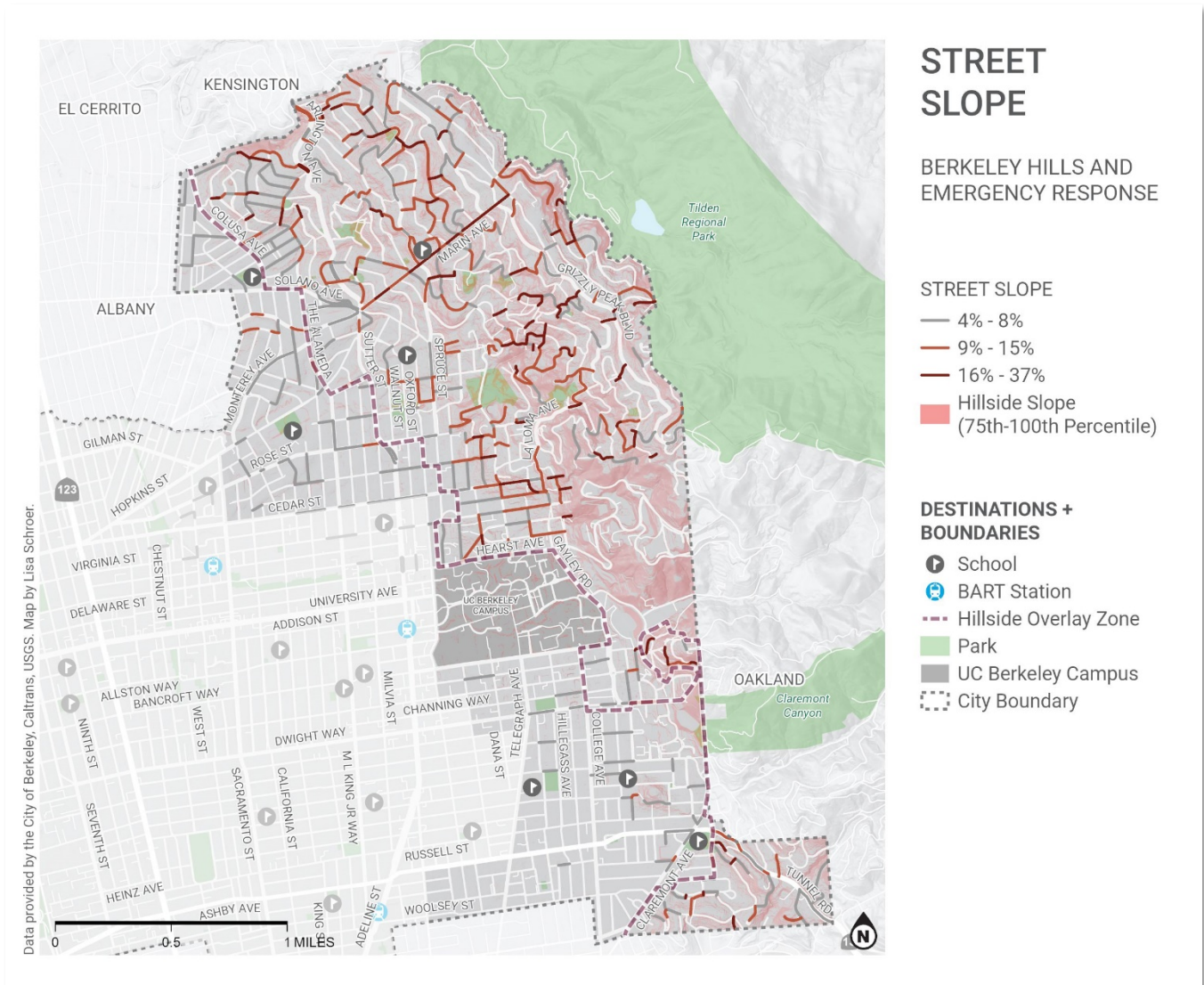
³ Alameda County Grand Jury, "1992-93 Alameda County Grand Jury Final Report."

Figure 8 Fire Hazard Severity Zones Map



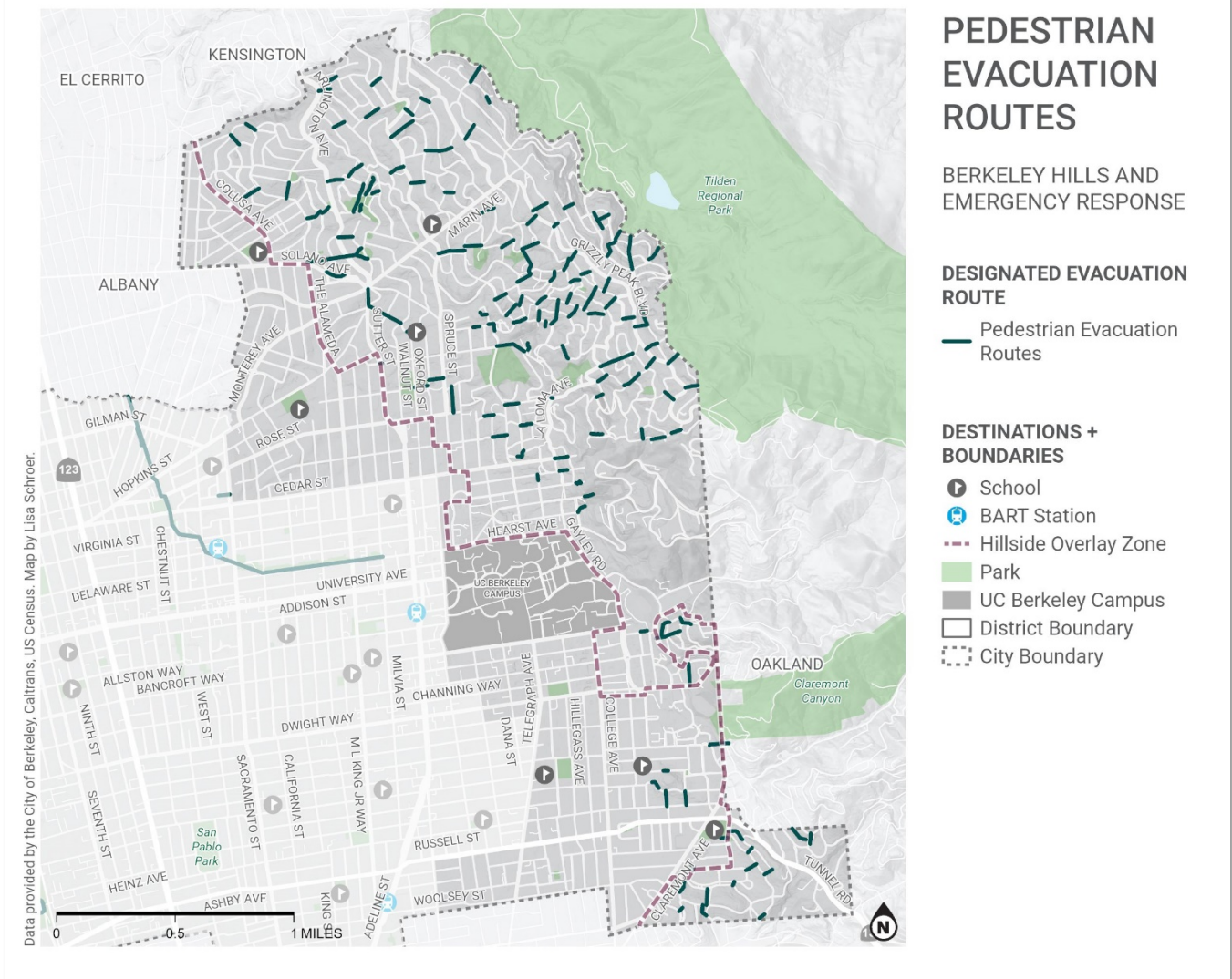
The underlying street network plays an important role in understanding fire hazards in the study area. In the event of a fire hazard emergency, the street network in the study area serves two purposes: 1) enabling residents to quickly and efficiently evacuate by car, and 2) allowing fire trucks and emergency vehicles to access the hazard. Figure 9 below shows streets with steep slopes in the study area, as well as a shaded red area where the hillside slope is in the upper 25th percentile of all of Berkeley’s terrain. Residents located at higher elevations (near the eastern edge of the study area), along steep and windy streets, and those who are far from direct arterial roadways such as Marin Avenue, Spruce Street, or Euclid Avenue, are more likely to be vulnerable in an emergency than other residents within the study area.

Figure 9 Street Slope Map



In the event of an emergency such as a fire, residents are encouraged to evacuate as quickly as possible. Many residents rely on their own cars for transportation in these circumstances. The project area's arterial roadways such as Arlington Avenue, Marin Avenue, Grizzly Peak Boulevard, La Loma Avenue, and Tunnel Road can hold higher volumes of car traffic than other local streets. These streets will likely see increased car traffic in the event of an evacuation. For residents of the hillside overlay zone without access to a car, the City has designated pedestrian evacuation routes. Figure 10 shows the extent of these pathways. Many of the designated paths are steep staircases and present accessibility issues for those using wheeled devices. Outlined in more detail in the recommendations chapter of this report, the City should consider improving crossings and adding signage where pedestrian evacuation routes intersect an arterial roadway.

Figure 10 Pedestrian Evacuation Route Map



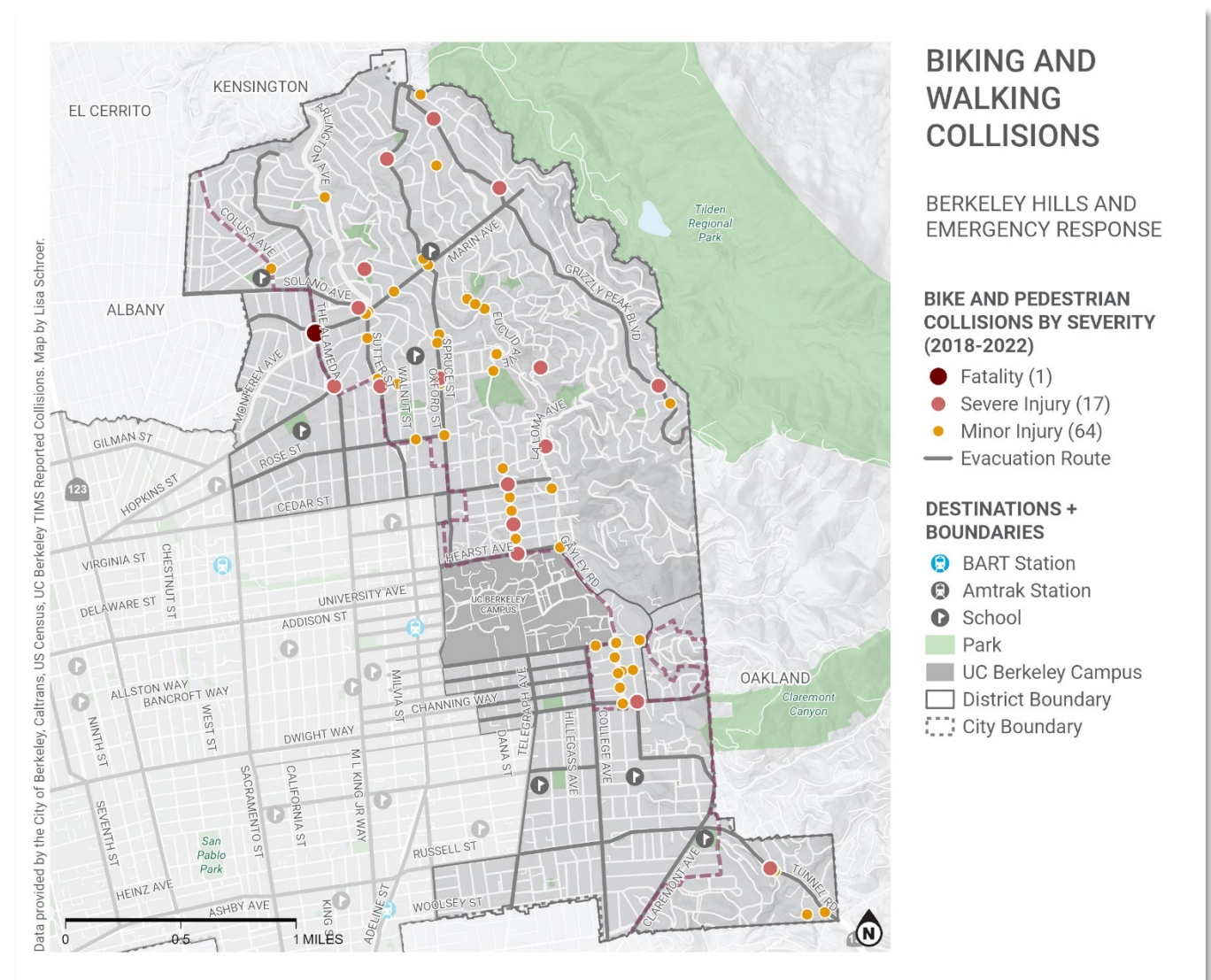
Traffic Safety in the Berkeley Hills

Between 2018 to 2022, the study area experienced 24 pedestrian- and 59 bike-related collisions where a car collided with a person walking or biking. Of the 82 total collisions, one collision resulted in a fatality and 17 collisions resulted in severe injuries. A severe injury is determined based on injury factors such as broken bones, suspected head trauma, potential for significant blood loss, paralysis, and loss of consciousness. Table 3 outlines the number of bike and pedestrian collisions that occurred along an arterial roadway in the hillside overlay zone and Figure 11 shows the geographic distribution of reported biking and walking collisions.

Table 3 Reported Biking and Walking Collisions in the Berkeley Hills from 2018 to 2022

Street	Number of Collisions
Euclid Avenue	23
Marin Avenue	9
Spruce Street	8
Piedmont Avenue	7
Sutter Street / Arlington Avenue	6
Grizzly Peak Boulevard	4
Tunnel Road	4
Rose Street	3
La Loma Avenue	2
Cedar Street	1

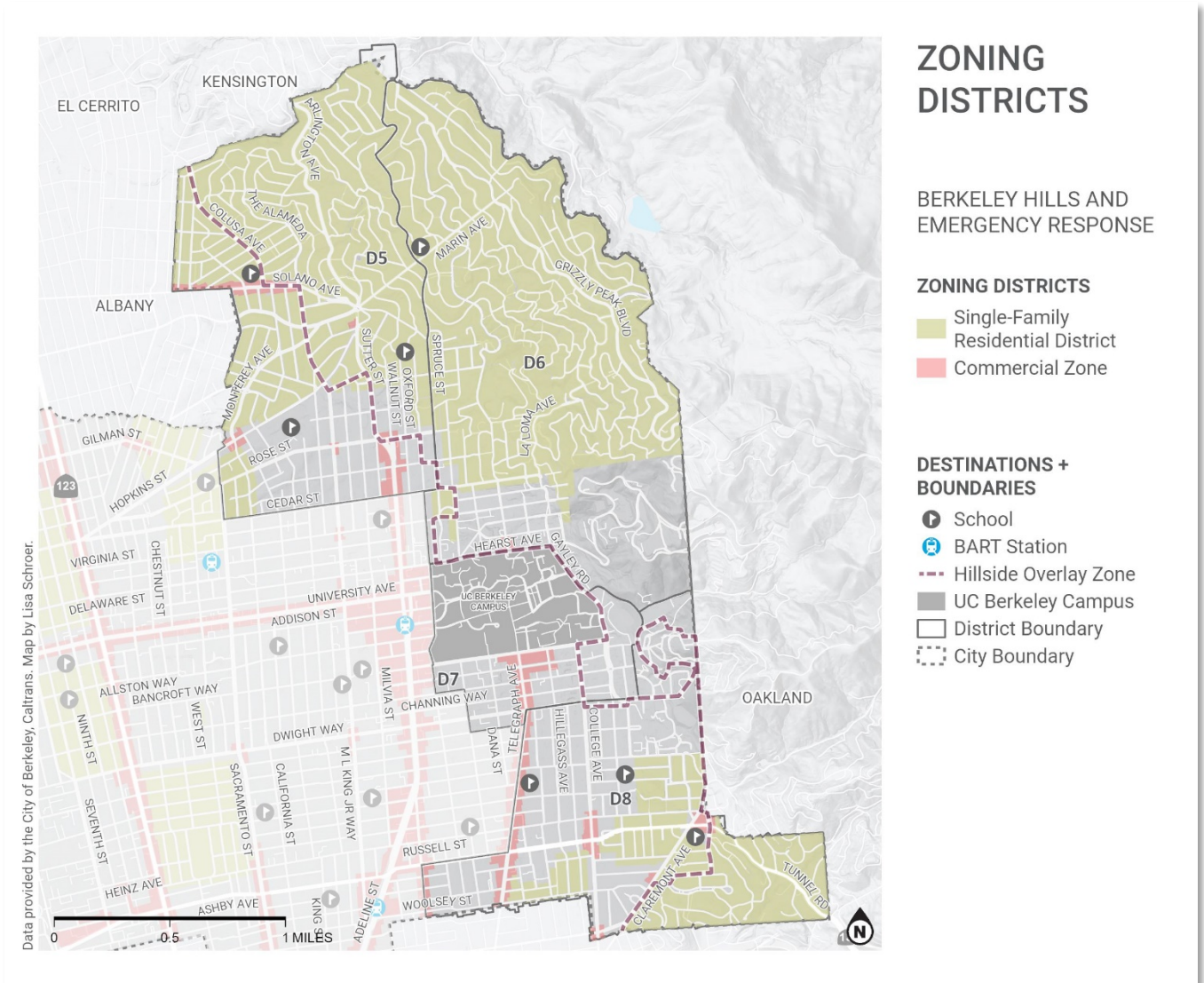
Figure 11 Biking and Walking Collisions Map



Upzoning in the Berkeley Hills

The findings in this report are increasingly important as the City of Berkeley makes steps towards upzoning single-family residential areas to allow the construction of denser multi-unit housing. Proponents of zoning code change note that denser housing is more affordable and will help address the City’s gap in middle-housing options. Opponents fear that increased density in the hillside overlay zone will exacerbate the challenges already faced by Berkeley’s most fire-prone neighborhoods. To address these concerns, the City is conducting an evacuation study that models upzoning scenarios throughout Berkeley. The report is expected to be published in early 2025. Yellow areas on Figure 12 show the single-family residential districts with potential to be rezoned in the future.

Figure 12 City of Berkeley Zoning Districts Map



Summary of Transportation Challenges in the Berkeley Hills

The following section outlines the four key transportation challenges faced by all mode types in the study area and informs the recommendation section of this report.

Fire Risk

The study area is located in a Very High Fire Hazard Severity Zone increasing the risk of catastrophic fire to the community. The Berkeley Hills sloped terrain reaches about 1,000 feet in elevation which can contribute to fire spread.⁴ This is because wildland fires usually burn more intensely and spread faster when burning uphill or through a canyon. What makes the Berkeley Hills unique, however, are the strong Diablo winds coming from the northeast during the spring and fall which can cause fire to spread downhill. These were responsible for the 1923 and 1991 fires discussed above.

The Berkeley Hills are highly vegetated, contributing to the high fire risk.⁵ Many trees planted in this area are non-native species like Eucalyptus which are more flammable than many native tree species. Fire can spread quickly jumping from treetop to treetop, setting houses aflame in the process.

In addition to the dual challenges of topography and vegetation, many structures in the Berkeley Hills are separated by less than 25 feet, which is characterized as high density according to fire industry practice.⁶ Structures that are closer together have a higher risk of contributing to structure-to-structure fire spread.

Evacuation Routes

The Berkeley Hills have limited evacuation routes compared to other neighborhoods in Berkeley. Additionally, the narrow width of many streets can constrain large scale evacuation of residents and the ability of emergency response to access a fire.⁷ Delayed or slowed evacuation can threaten people's lives, which was illustrated in the 1991 fire where 25 people perished, many of whom died when attempting to evacuate through the few, narrow roads out of the Berkeley Hills.

⁴ Sprague, "Wildfire Risk Associated with Additional Density in the Very High Fire Danger Severity Zone," July 16, 2024.

⁵ Sprague.

⁶ Sprague.

⁷ Sprague.

Higher Density Housing Leading to Increased Fire Danger

Berkeley was the first city in the United States to enact single-family zoning in Elmwood in 1916.⁸ This, along with racially-restrictive covenants, redlining, and the Berkeley Neighborhood Preservation Ordinance of 1973 created segregated neighborhoods.⁹ Please see footnote 9 for more information about these concepts. The study area in question is almost exclusively single-family zoned. The Berkeley City Council has made it a priority to make amends with this sordid past through many different policy changes; upzoning single-family neighborhoods is one such policy.¹⁰ Berkeley Fire Chief Sprague came out against the inclusion of the study area in 2024 in the initial staff recommendation to upzone all Berkeley neighborhoods, due to the existing increased fire risk, which is discussed in more detail above.¹¹ He argued that adding density in the Berkeley Hills would increase the fire risk even more and endanger life and property. In response the City Council instructed staff to design an upzoning ordinance excluding the study area.¹² The City Council will revisit the possibility of upzoning the study area once the wildfire evacuation study is complete, most likely by January 2025.

Underlying this discussion is the state's mandate that the City plan for 9,000 more units by 2031 per the Regional Housing Needs Assessment (RHNA).¹³ Because the City is fairly built up, one of the only ways to reach the RHNA number is to upzone the City's single-family residential neighborhoods to allow for increased density, including in the Berkeley Hills. The fire danger in the hills is high and increased density could increase the fire risk in the study area. This conflict, between the study area's fire risk and the need to build more housing, will prove to be a challenge in the Berkeley Hills. If the City Council chooses to upzone the study area after evaluating the evacuation study, much work will need to be done to make the study area more fire resilient.

Traffic Calming

Many of the study area's roads are narrow, with tight turns, and no sidewalks. These conditions make it difficult for people biking and walking to navigate safely, however they are conducive to slowing vehicles down. Because of the study area's unique conditions, prescribing traffic calming interventions is more complicated than in other areas of Berkeley. The roads already make it more difficult for the Fire Department to access the study area in the event of a fire, so adding traffic calming interventions such as speed humps and bulbouts may increase emergency response times while having little impact on vehicle speeds because the roads are already quite narrow. Therefore, traffic calming infrastructure should be added strategically, sparingly, and with the Fire Department's needs front of mind. For example, when the Boulder Fire Department had concerns that adding a protected bike lane would not allow traffic to move out of the way for an emergency vehicle, the design was changed to widen the protected bike lane so emergency vehicles could use it as a lane when necessary. Thoughtful and precise placement of any traffic calming measures is imperative to not increase the already high fire danger experienced in the Berkeley Hills.

⁸ Yelimeli, "Berkeley Denounces Racist History of Single-Family Zoning, Begins 2-Year Process to Change General Plan."

⁹ Racial restrictive covenants added to the deeds of homes barred certain groups, usually Asians and African Americans, from purchasing or leasing property in areas of Berkeley. Redlining was a practice whereby certain areas of Berkeley were designated as being high-risk for investment. The designations were typically applied to areas with large non-white and/or economically disadvantaged populations, and resulted in people who lived in or wanted to move to these areas being denied loans. The Neighborhood Preservation Ordinance was intended to protect neighborhood character but severely reduced multi-family dwelling units being built in Berkeley between 1970 and 2000.

¹⁰ Gecan, "100 Years after Berkeley's 1923 Fire, Another Tragedy Could Be Even Likelier."

¹¹ Sprague, "Wildfire Risk Associated with Additional Density in the Very High Fire Danger Severity Zone," July 16, 2024.

¹² Gecan, "Berkeley Council Tasks Redraft of 'missing Middle' Zoning Changes."

¹³ "Housing Element Update | City of Berkeley."

Methodology

Over the course of the semester we conducted ten interviews with City staff, advocates, planning professionals, and academics in California, Oregon, and Colorado. These interviews provided invaluable insights which helped inform this report and its recommendations. We are grateful for their time and their willingness to share their knowledge with us. Without them this report would not have been possible. Additionally, some of these interviews assisted us in choosing and compiling our case studies on Portland, Los Angeles, and Boulder. We chose these case studies for various reasons: Portland because it is well known for prioritizing bold and innovative traffic calming techniques; Los Angeles because many communities are located in the Wildland-Urban Interface which have similar geographic features to the Berkeley Hills; and Boulder because it is a college town of similar size to Berkeley, has similar geographic features, and is at risk of wildfires.

To supplement our interviews, we conducted an in-depth document review. This included reviewing all relevant City of Berkeley plans which are expanded upon in the following section. Additionally, we conducted an academic literature review to understand what peer-reviewed journal articles say about this subject area. Finally, we reviewed gray literature from organizations such as NACTO to ensure we understood and included lessons learned around traffic calming, emergency response management, and the inclusion of fire departments in transportation planning.

Existing Plan Review

The City of Berkeley is taking steps towards addressing the unique transportation challenges of the study area. To ensure synergy with ongoing planning efforts, the project team conducted an extensive review of the City's recent planning documents related to safe streets, including emergency response, evacuation planning, and traffic calming initiatives. The following table provides a foundation for the recommendations developed in this report.

Table 4 Planning Documents Related to Street Safety in the Berkeley Hills

Document Name	Relevant Vision, Goals, Policies, or Recommendations in the Document
General Plan (2001)	<ul style="list-style-type: none"> • Policy T-28: Provide for emergency access to all parts of the City and safe evacuation routes <ul style="list-style-type: none"> ○ Actions: maintain and improve pedestrian pathways as alternative evacuation routes, consider parking restrictions to ensure access for emergency vehicles and evacuation on narrow streets in the Berkeley Hills • Policy S-22: Reduce fire hazard risks in existing developed areas <ul style="list-style-type: none"> ○ Actions: develop proposals to make developed areas more accessible to emergency vehicles and reliable for evacuation. Consider restricting on-street parking and increasing parking fines in hazardous areas
Complete Streets Policy (2012)	<ul style="list-style-type: none"> • The City of Berkeley is committed to complete street design that provides safe, comfortable, and convenient travel along and across streets through an integrated network that serves all categories of users including emergency vehicles

Document Name	Relevant Vision, Goals, Policies, or Recommendations in the Document
Berkeley Bicycle Plan (2017)	<ul style="list-style-type: none"> • Policy PL-1: Integrate bicycle network and facility needs into all City planning documents and capital improvement projects: <ul style="list-style-type: none"> ○ Incorporate the needs of all modes and stakeholders; the design process should include emergency response • Chapter 6.7 Project Recommendations: Design guidelines for bollard alternatives, bike boulevards, traffic calming, traffic circles, traffic diverters, and grade separated crossings include specifications for maintaining/improving emergency vehicle access
Vision Zero Action Plan (2019)	<ul style="list-style-type: none"> • Action items <ul style="list-style-type: none"> ○ Undertake a Standards of Coverage/Response Time Study to provide a data-driven understanding of how safety improvements impact emergency response times ○ Continue to deliver traffic calming projects
Berkeley Pedestrian Plan (2020)	<ul style="list-style-type: none"> • Recommendation: explore opportunities for better aligning street design for reduced traffic speeds with emergency response equipment and service standards • Intersections should be designed to facilitate safe passage by pedestrians, and allow emergency vehicles to use full intersection to make turns
Community Wildfire Protection Plan (2023)	<ul style="list-style-type: none"> • Goal 2.1 Evaluate the Berkeley roadway network's ability to support evacuation and response. Identify and implement network improvements to reduce response times and speed evacuation times. • Goal 2.3 Use roadway network evacuation/response analysis to inform fire evacuation plans for responders and the community.

Document Name	Relevant Vision, Goals, Policies, or Recommendations in the Document
Local Hazard Mitigation Plan (2024)	<ul style="list-style-type: none"> • Proposed Actions <ul style="list-style-type: none"> ○ Coordinate regional wildfire mitigation strategies with key partners and stakeholders ○ Continue to implement the traffic safety capital construction projects identified and prioritized in the Berkeley Pedestrian Plan (2021), Berkeley Bicycle Plan (2017), Berkeley Vision Zero Action Plan (2020), and Berkeley Transit-First Implementation Plan; these projects are intended to encourage non-driving modes ○ Develop process to increase parking enforcement in fire-vulnerable areas during fire weather. ○ Maintain and improve roadways in Fire Zones 2 and 3. ○ Maintain signage for public pathways to identify safe and accessible pedestrian evacuation routes from the hill areas. ○ Public Works Staff will maintain paths on an as needed basis, and will coordinate with the Berkeley Path Wanderers to maintain public pathways to provide safe pedestrian evacuation routes from the hill areas. ○ Urge PG&E to perform utility undergrounding in Berkeley's Very High Fire Hazard Severity Zone (VHFHSZ) to mitigate wildfire risk and limit evacuation and ingress obstruction. Coordinate efforts with the State of CA Public Utilities Commission, and elected officials. ○ Complete implementation of the Evacuation and Response Time Study to identify necessary roadway safety improvements, along with prioritized roadways, to facilitate safe evacuation during emergency scenarios. ○ Complete evacuation analysis required by new State evacuation laws under SB99, AB747, and AB1409. Incorporate findings into the updated Safety Element of the General Plan.

Literature Review in Brief

Topics

1. The unclear relationship between emergency response time and health
2. Congestion improves safety but inhibits response times
3. The many downsides of on-street parking
4. Types, uses, and limitations of residential parking permits
5. The importance of traffic calming that serves emergency response needs

Infrastructure and policy solutions both play roles in creating a safe and effective transportation network that can facilitate emergency response and evacuations. A growing body of research is revealing ways that emergency response and street safety needs can be aligned in Berkeley.

Emergency Response Time (ERT) and Health

The time required for responders to arrive at the scene of an emergency is a major concern for local governments. While conventional wisdom is often that faster emergency response times (ERTs) result in improved outcomes, this relationship is neither linear nor uniform. Both system-level factors (such as infrastructure, distance, and time of day/ week) and patient-level factors (health needs, age, perceived severity of emergency) compound to affect response times.¹⁴ Furthermore, ERT intervals vary for vehicles of different size, shape, and mass: longer and heavier vehicles tend to be affected more than shorter or lighter vehicles.¹⁵ An especially important area for further study is the influence of patient symptom descriptions on ERTs, as responders may prioritize time and resources differently based on the perceived acuity of the patient's condition.¹⁶

Studies of the relationship between ERTs and patient survival show mixed results: one study found that the conventional 8-minute critical treatment threshold was not an effective predictor of patient survival.¹⁷ Another study observed an improved survival rate for ERTs under 5 minutes, but little significant difference between ERTs ranging from five to twelve minutes. In other words, the study could not support the assertion that reducing response times from seven minutes to six minutes, or 12 minutes to 11 minutes would improve patient survival.¹⁸

Literature around emergency response times is limited by its focus on mortality and survival. Patient survival is the most visible outcome of emergency medical care, but there may be other time-critical medical events that are not ultimately fatal. Further study into other time-critical medical emergencies could enrich understanding of how impactful response times are on non-life threatening health outcomes. Furthermore, personal health crises are only one of the emergency types addressed by emergency responders. Similar studies focusing on rescue operations, structural fires, and other emergency types are necessary to understand the effects of ERT on a broader range of health and safety outcomes.

¹⁴ Nehme, Andrew, and Smith, "Factors Influencing the Timeliness of Emergency Medical Service Response to Time Critical Emergencies."

¹⁵ Atkins and Coleman, "The Influence of Traffic Calming on Emergency Response Times."

¹⁶ Nehme, Andrew, and Smith, "Factors Influencing the Timeliness of Emergency Medical Service Response to Time Critical Emergencies."

¹⁷ Blanchard et al., "Emergency Medical Services Response Time and Mortality in an Urban Setting."

¹⁸ Blackwell and Kaufman, "Response Time Effectiveness."

Speed and Congestion

Street congestion is an impactful determinant of emergency response time.^{19,20} ERTs fluctuate in accordance with cycles of traffic flow, commuting patterns, and demand for road space. However, tradeoffs associated with faster moving traffic include increased collision frequency and severity.²¹ People biking and walking are especially susceptible to increases in vehicle speed.^{22,23} One article cites a Los Angeles study which found that “an increase in driving speed from 20 to 40 mph decreases a pedestrian’s chance of surviving a vehicle crash from 80% to 10%”.²⁴ The dangers of high vehicle speeds should be weighed against the need for quick emergency response in the particular case of each street and neighborhood.

On-Street Parking

On-street parking is a concern for both transportation planners and emergency responders who seek to facilitate quick emergency response, improve street safety, and improve equitable access to the area. Illegal parking in particular can lead to congestion, inefficient traffic flow, disrupted public transportation, increased accidents, and lost revenue from valid parking spaces.²⁵ Enforcement of parking policies is key to their success, as is nuanced understanding of the communities they serve and affect.²⁶ Free parking is a publicly maintained land use associated with depressed land values and costly repairs. Because free parking generates no revenue, it represents a significant financial opportunity cost for cities.²⁷ In areas with sufficient demand, strategically charging for parking can reduce cruising for parking and improve land values and density.^{28,29}

Residential Parking Permits (RPPs)

Residential Parking Programs are policies that require motorists to obtain a permit to store their vehicle in the public right of way in certain areas. There are two broad categories of RPP programs: Privileging RPPs and Controlling RPPs.³⁰ Privileging RPPs are those which prioritize residents by striving to reduce through-traffic and make street parking more available. Controlling RPPs are those which manage parking for both visitors and residents, seeking to efficiently use curb space, lower minimum parking requirements, and reduce the number of vehicles entering and exiting the area. While Privileging RPPs are effective in reducing visitor parking, they can have the unintended effect of encouraging more vehicle ownership by offering low-cost parking to residents. This may lead to higher per-capita vehicle ownership and, over time, little improvement in the amount of available parking for residents. Controlling RPPs are preferable because they offer the same benefits, but also discourage or prohibit residents from purchasing more than one or two permits. Controlling RPPs can lead to lower per-capita vehicle ownership and increased availability of parking for residents. This can also mean quieter streets, fewer auto-pedestrian interactions, and less unsafe parking behavior (such as parking in front of hydrants or crosswalks).³¹

¹⁹ Brent and Beland, “Traffic Congestion, Transportation Policies, and the Performance of First Responders.”

²⁰ Nehme, Andrew, and Smith, “Factors Influencing the Timeliness of Emergency Medical Service Response to Time Critical Emergencies.”

²¹ Venegas et al., “Take the High (Volume) Road.”

²² Iacono, Krizek, and El-Geneidy, “Measuring Non-Motorized Accessibility.”

²³ Venegas et al., “Take the High (Volume) Road.”

²⁴ Venegas et al.

²⁵ Cullinane and Polak, “Illegal Parking and the Enforcement of Parking Regulations.”

²⁶ Cullinane and Polak.

²⁷ Shoup, “The Trouble with Minimum Parking Requirements.”

²⁸ Shoup, “Cruising for Parking.”

²⁹ Shoup, “The Trouble with Minimum Parking Requirements.”

³⁰ Brudner, “On the Management of Residential On-Street Parking.”

³¹ Brudner.

A study of Southside RPPs in Berkeley “found that this system worked well for residents but limited availability for nonresidents [such as repair workers, local teachers, and guests of residents] who had justifiable reasons to park on the neighborhood streets.” RPPs are highly context dependent and may not be a good fit for every neighborhood.³²

Traffic Calming

Traffic calming infrastructure can be used to control the direction, speed, or continuity of automobile traffic. Higher speed collisions inflict more severe injuries and death than lower speed collisions.^{33 34} Slowing vehicle speeds on existing roads is not as simple as lowering speed limits - drivers rarely adjust fully to decreased posted speeds. Managing vehicle speeds requires a methodical balance of infrastructure and enforcement.³⁵ Traffic calming infrastructure shares the onus of speed management with law enforcement, freeing emergency responders to focus on more urgent matters. However, slowing traffic flow can seem at odds with the need for quick and efficient emergency response times.³⁶ This conflict can often be addressed by including emergency services in other priority infrastructure, such as high-occupancy vehicle lanes, bus lanes, and bike lanes.³⁷ Because many high-injury zones in the Berkeley Hills are along evacuation and response routes, these streets stand to benefit the most from mutually supportive infrastructure improvements.

Case Studies Relevant to the Berkeley Hills

Los Angeles County, California

Los Angeles County, which has a population of over 10 million, has a diverse array of geographic features, including desert, mountains, hills, valleys, and coastal plains.³⁸ Much of Los Angeles County, including portions of the City of Los Angeles, is located in Very High Fire Hazard Severity Zones (VHFHSZ) and are characteristically hilly or mountainous. Examples include Bel Air, Glendale, Hollywood, and communities abutting the Santa Monica Mountains including Malibu, Calabasas, Topanga Canyon, and Agoura Hills. Similar to the Berkeley Hills, these communities are characterized by having a majority of single-family homes. Additionally, a subset of these communities have narrow roads running through and within them, similar to the Berkeley Hills.

³² “Residential Permit Parking: Better Off Without It? - Emily Moylan, Matthew Schabas, Elizabeth Deakin, 2014.”

³³ Amundsen, “An Evaluation of the Power Model.”

³⁴ Hussain et al., “The Relationship between Impact Speed and the Probability of Pedestrian Fatality during a Vehicle-Pedestrian Crash.”

³⁵ Hussain et al.

³⁶ Bunte, “Traffic Calming Programs & Emergency Response: A Competition of Two Public Goods.”

³⁷ Brent and Beland, “Traffic Congestion, Transportation Policies, and the Performance of First Responders.”

³⁸ Mowery, “Planning the WUI in LA County, CA.”

With a history of destructive fires in and near the Wildland-Urban Interface, in 2005 the Fire Department and the Department of Transportation for the City of Los Angeles created a parking prohibition program during Red Flag Days. Critical areas were identified in Very High Fire Hazard Severity Zones where parked vehicles could delay people from evacuating and delay the Fire Department from accessing the area during a fire.³⁹ Areas included narrow roads, tight curves, hairpin turns, and critical intersections which if not cleared of parked vehicles could create a choke point during evacuations. The Fire Department designated these as Red Flag Areas and partnered with the Department of Transportation to post no parking signs, as shown in Figure 13 below.⁴⁰ Citizens are responsible for checking if the Fire Department has called a Red Flag Day, which is defined as when winds are stronger than 25 mph and humidity is less than 15 percent, and not parking where these signs are located.⁴¹ If a vehicle is parked in a Red Flag Area during a Red Flag Day, the City will promptly tow the illegally parked vehicle to ensure clear passage of the roadway.

The City of El Cerrito in the Bay Area operated a Red Flag Parking pilot program modeled after the City of LA's from June through November 2024.⁴² Temporary No Parking signs were placed on several roads on Red Flag days. People would have to find out if a Red Flag Day had been called by searching online or signing up for a text or email alert from the Fire Department. Educational flyers were distributed to vehicles in violation and no vehicle was cited or towed. Because the pilot program ended around the time of this report's publishing, it is unclear how successful the program was.

Figure 13 City of Los Angeles No Parking on Red Flag Days Signage (Source: Laurel Canyon Association)



³⁹ "Fire Zone History | Los Angeles Fire Department."

⁴⁰ Leu and Loc, "How to Avoid Getting Towed during LA's Red Flag Parking Restrictions."

⁴¹ Leu and Loc.

⁴² "Red Flag Warning."

Small communities are scattered throughout the dense chaparral that is characteristic of Topanga Canyon, located in unincorporated Los Angeles County.⁴³ Topanga Canyon is steep, rocky, and most of its dense vegetation has not burned in the last 30 years. Santa Ana winds can blow strongly through this area and most crucially, there is only one main road in and out of the Canyon, Topanga Canyon Boulevard.⁴⁴ Fire officials have estimated that it would take seven hours for all Topanga Canyon residents to evacuate, making this community extremely high risk. The challenges during evacuations caused by the limited egress options have not dissuaded those who call Topanga Canyon home from living there. Instead, the community focuses on home fire hardening and emergency preparation, most notably through an annual emergency fair where representatives of the Forest Service, County Fire Department, and other organizations can interact with Topanga Canyon residents and encourage fire safety.⁴⁵

Located northwest of the City of Los Angeles, the City of Glendale abuts Griffiths Parks and Verdugo Mountain, both highly vegetated open spaces and both classified as being within a VHFHSZ by CalFire.⁴⁶ Additionally, the Adams Hill neighborhood within Glendale is characterized by narrow and steep roads that make it difficult to traverse if people park their vehicles on the street. To address these issues, the City of Glendale places high value on collaborating with neighboring cities to share lessons learned and ensure all jurisdictions are on the same page because fire does not respect municipal boundaries. To address the egress and ingress issues in Adams Hill, Glendale has red curbed one side of many of these roads to deter parking and increase egress and ingress in case of an emergency. A city official we spoke with emphasized that enforcement of these red curbs is paramount to adjust people's behavior. They explained that people in Glendale frequently flout the law because enforcement is inadequate. Illegal parking increases emergency response times because it forces fire apparatuses to drive on curbs and have personnel get out to move trash bins to make enough room for the vehicle to pass.

Key Findings

- A No Parking on Red Flag Days Program can improve road accessibility in the event of a fire emergency.
- Red curb parking restrictions should be enforced on windy and narrow roads to ensure compliance so emergency vehicles can drive through.

City of Portland, Oregon

Portland, a city of approximately 652,000 residents in the state of Oregon, is well known for its bikeability and strong bike culture.⁴⁷ Over the past decades, the Portland Bureau of Transportation (PBOT) has installed hundreds of miles of bike lanes and traffic diverters, and have narrowed the width of many roads.

While traffic fatalities have risen since 2020, Portland remains committed to eliminating traffic deaths through the City's Vision Zero initiative.⁴⁸ ⁴⁹ PBOT has initiated a number of innovative programs to increase the safety of pedestrians, bikers, and drivers alike. For example, they have added left turn calming which slows turning speeds and improves left turning drivers' view of the crosswalk at intersections which may result in fewer or less severe pedestrian crashes.⁵⁰

⁴³ Leu and Loc, "How to Avoid Getting Towed during LA's Red Flag Parking Restrictions."

⁴⁴ Lowe, "If You Move Out Here, You Make a Deal With Nature."

⁴⁵ Lowe.

⁴⁶ "Fire Hazard Severity Zone Viewer."

⁴⁷ "U.S. Census Bureau QuickFacts."

⁴⁸ Dole, "As Traffic Deaths Surged, Portland Transportation Bureau Fell Short of Safety Goals, Audit Says."

⁴⁹ "Portland Vision Zero Action Plan Update 2023-25 | Portland.Gov."

⁵⁰ "Left-Turn Calming | Portland.Gov."

The Portland Fire Department has been a willing partner in the City's initiative to make it safer to bike, walk, and roll while reducing traffic injuries and fatalities. The Fire Department collaborates with transportation planners on proposed street re-designs to ensure that both traffic calming and emergency response goals are met. Portland Fire recognizes that adding infrastructure that makes it safer to bike and walk can decrease traffic fatalities and decrease the number of calls the Fire Department must respond to, and therefore the stress responders experience from responding to traumatic traffic crashes.⁵¹

When designing major transportation infrastructure changes, PBOT staff liaise with the Fire Marshall early on to ensure the project design will not hinder the ability of emergency vehicles to traverse the area. For example, when redesigning a road to include protected bike lanes and a tree-lined center median the Fire Marshall was concerned that drivers would not be able to get out of the way for an emergency vehicle due to the barriers on either side. The solution they decided on together was to add rolled mountable curbs for the protected bike lane as well as for the center median. Additionally, trees were removed from the center median design. With this design change, emergency vehicles could drive through traffic by straddling the median or the protected bike lane divider. This compromise addressed the emergency response concerns while not sacrificing the transportation safety elements of the design.

PBOT has worked to address the Fire Department's concerns in other ways as well. When fire department officials shared their concern that they were unclear about what certain road infrastructure changes were for, PBOT created a booklet that explained what each infrastructure element was and what its purpose was. These were distributed to each fire station to help effectively communicate functionality. PBOT staff also conducted a ride along to gain a better understanding of how fire officials interact with transportation infrastructure.

In 2018, then-Portland Fire Chief Mike Meyers joined a National Association of City Transportation Officials (NACTO) webinar about Fire Trucks and Vision Zero.⁵² The main reason many fire departments oppose many safe streets projects is because they perceive them to slow down response times. However, he explained that the Fire Department had not seen a decrease in emergency response times due to the City's safe streets initiatives. This was proven when PBOT conducted an analysis of emergency response times before and after transportation projects were completed which were designed to increase the safety of people biking and walking. As an example, the addition of a protected bike lane to a street only increased emergency response time by a couple seconds.

Chief Meyers also discussed the role fire apparatuses play in Fire Departments' perception that safe street projects will increase response time.⁵³ Fire apparatuses are large vehicles which need more room to maneuver. This is especially true for ladder trucks which deploy outriggers to stabilize the truck when the ladder is extended. Chief Meyers acknowledged this difficulty but saw the path forward in sourcing smaller fire apparatuses with equivalent capabilities such as those used in Europe and Asia.⁵⁴ While he wanted to purchase smaller fire apparatuses, Chief Meyers expressed frustration with the lack of availability of smaller models and cooperation of vendors to make fire apparatuses to these smaller specifications.

Key Findings

- The Fire Department benefits from the Bureau of Transportation's efforts to reduce traffic injuries and eliminate traffic fatalities by reducing the number of non-fire calls they have to respond to.
- Traffic calming infrastructure does not significantly slow down emergency response times.
- Smaller fire apparatuses would improve maneuverability.

⁵¹ *Fire Trucks & Vision Zero.*

⁵² *Fire Trucks & Vision Zero.*

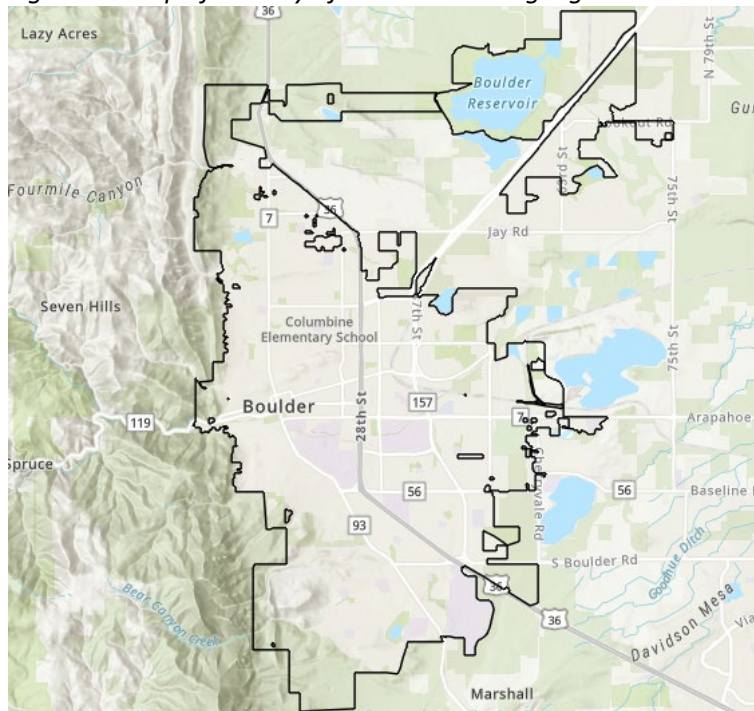
⁵³ *Fire Trucks & Vision Zero.*

⁵⁴ *Fire Trucks & Vision Zero.*

City of Boulder, Colorado

Boulder is a city of roughly 100,000 people abutting the Rocky Mountains (Figure 14). It experiences four distinct seasons, and thus experiences seasonal disaster risks including drought, wildfire, and flooding. Boulder is a college town, with nearly 40% of the population affiliated with CU Boulder. The bulk of its population resides in lower, flatter neighborhoods, with some larger, wealthier neighborhoods in the foothills. It is buffered from neighboring municipalities by agriculture and open space.

Figure 14 Map of the City of Boulder that Highlights the Hills and Mountains on the City's Western Edge



Emergency Response and Infrastructure Improvements

Boulder's grid-aligned streets are generally conducive to self-evacuation during fires. The City's primary objective for transportation infrastructure is to safely transport people under normal conditions, and secondarily to ensure safe egress from natural disasters. The City is concerned about the ability of first responders to access emergencies on congested city streets. Boulder has implemented several policy and infrastructure changes to improve road safety and first responder navigability.

Residential Parking Permits (RPP)

Boulder’s RPP program covers high demand sections of 13 neighborhoods, including the hilly Chautauqua and Mapleton neighborhoods. Permitted vehicles can park indefinitely while unpermitted vehicles are generally allowed but subject to time limits. As of November 2024, permits are issued online and associated with license plate numbers, eliminating the need for physical permits.⁵⁵ Permit parking helps lower the number of cars entering and exiting an area. The permitting structure favors residents, while still allowing non-residents some parking. A chief complaint about Berkeley’s Southside RPP program in the past was its exclusion of non-residents with legitimate reasons for parking there.⁵⁶ Boulder’s RPP program accounts for this by offering business, vendor, and commuter passes.

Table 5 Overview of Boulder's RPP Program

	Availability	Price per Permit	Period
Resident	Two Per Person (Registered Vehicles)	\$50	1 Year
Visitor	Two (Residents only)	\$5	1 Year
Residential Guest	Two, Case-By-Case	Case-By-Case	2 Weeks
Business	Three Per Business	\$75	1 Year
Mobile Vendor	Boulder-Based Businesses	\$75	1 Year
Commuter	Limited, Rolling Availability	\$115	1 Quarter

Core Arterial Network (CAN) and Neighborhood Safety Management Program (NSMP)

Until 2022, Boulder’s Neighborhood Speed Management Program allowed residents to request traffic studies on neighborhood streets, which could then lead to traffic calming installations. These would slow through traffic, including emergency response vehicles. However, review of the NSMP found that most traffic calming requests came from high-resource, relatively low-risk residential areas. According to city sources, 67% of crashes in Boulder happen on only 17% of its streets, namely arterial roads. To address this disproportionate need, Boulder decided to focus on traffic calming and pedestrian infrastructure on higher-incidence arterial streets rather than in residential areas. As a result, it discontinued the neighborhood streets program in 2022.⁵⁷

Pivoting to focus on dangerous and high-conflict streets, the City identified a network of high-priority routes called the Core Arterial Network (CAN) (Figure 15). Many of the streets identified are emergency response routes as well as congested commuter streets. The CAN is designed to continuously link high-quality infrastructure, maximizing the benefit of transportation improvements for walkers, cyclists, transit users, and drivers. It is also intended to create paths for emergency services at heavily congested locations. Infrastructure improvements are made during scheduled road resurfacing to efficiently minimize disruptions.⁵⁸

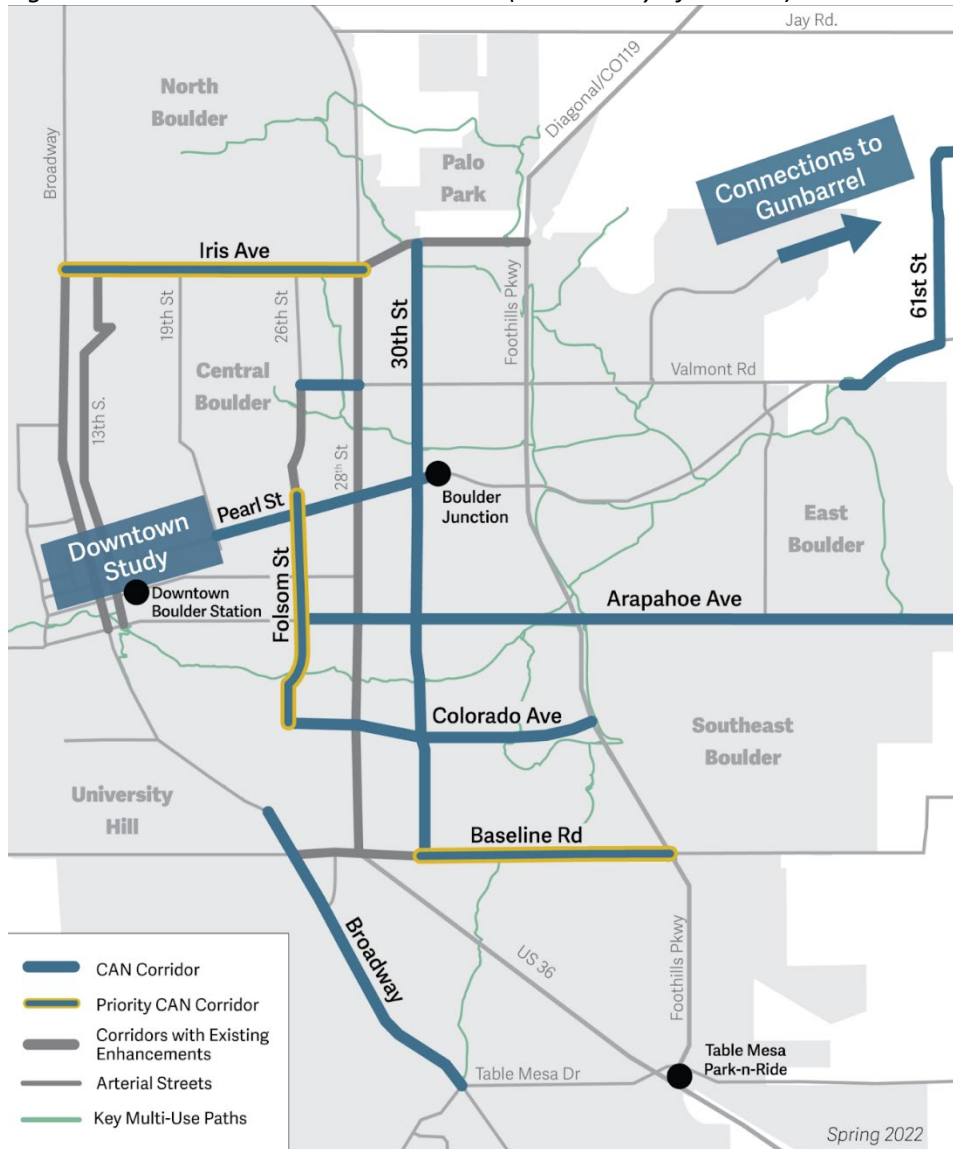
⁵⁵ “Neighborhood Parking Permits | City of Boulder.”

⁵⁶ “Residential Permit Parking: Better Off Without It? - Emily Moylan, Matthew Schabas, Elizabeth Deakin, 2014.”

⁵⁷ “Neighborhood Speed Management Program | City of Boulder.”

⁵⁸ “Boulder’s Core Arterial Network | City of Boulder.”

Figure 15 Boulder's Core Arterial Network (Source: City of Boulder)



Iris Avenue Transportation Improvement Project

The Iris Avenue project considers the needs of many users including emergency responders. As part of the CAN, the Iris Avenue Transportation Improvement Project is renovating one of Boulder's main arterial corridors by installing a center turn lane and two-way protected cycling (Figure 16 and Figure 17).⁵⁹ Figure 18 shows how the center lane and bike lane can be used by emergency services. These kinds of familiar design interventions are being used across the CAN to strategically improve safety for pedestrians and navigability for emergency services.

⁵⁹ "Iris Avenue Transportation Improvements Project | City of Boulder."

Figure 16 Photo of Iris Ave and 19th Street in summer of 2024 (Source: City of Boulder)



Figure 17 Annotated Rendering of Iris Street Transportation Improvement Project (Source: City of Boulder)

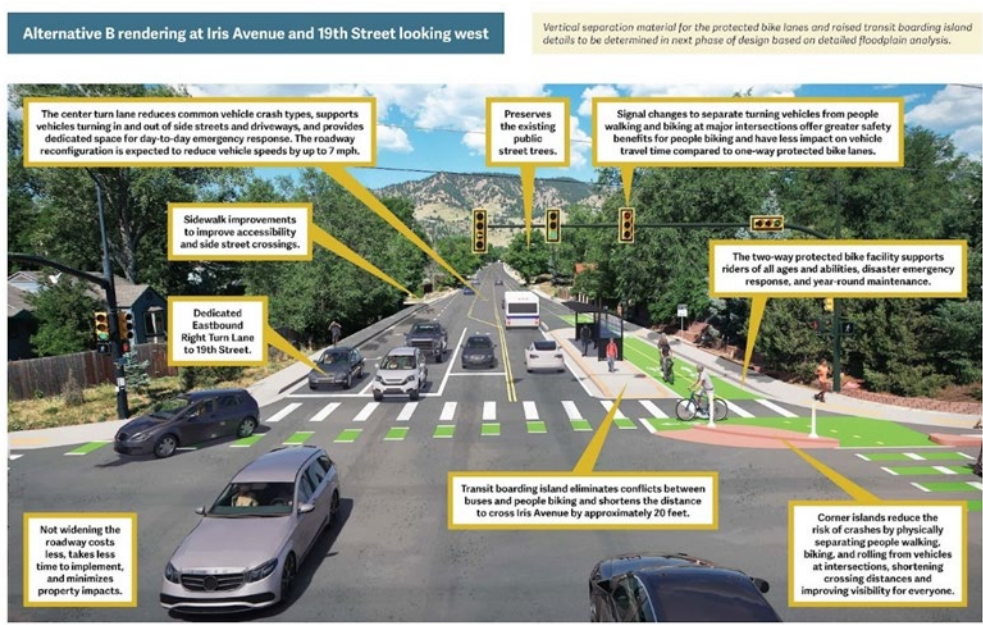
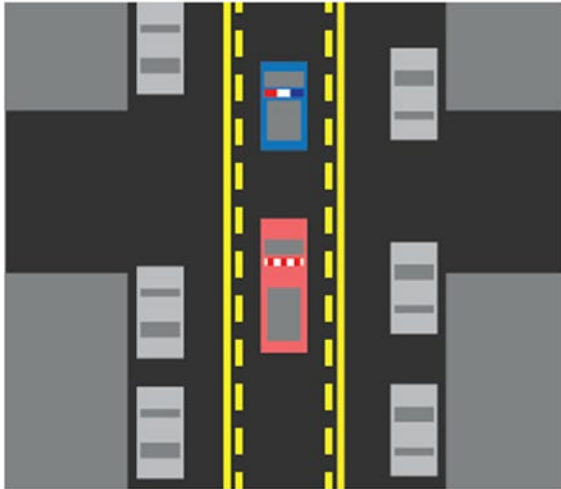


Figure 18 Graphic Demonstrating Emergency Response Vehicles Using Center Lane and Bike Lane (Source: City of Boulder), used for communicating infrastructure changes to the public

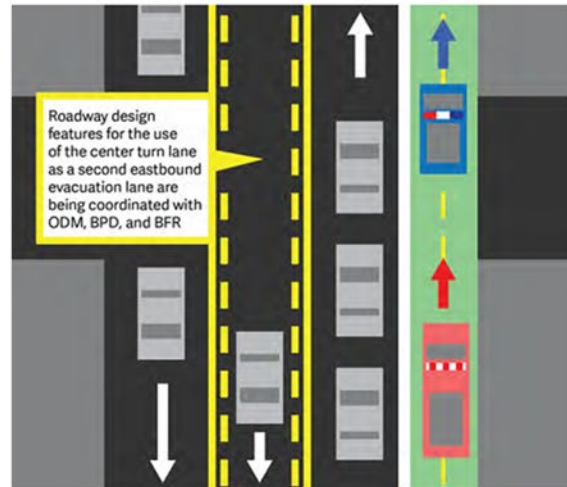
DAY-TO-DAY EMERGENCY RESPONSE

In day-to-day scenarios, the Boulder-Fire Rescue and Police departments can utilize the center turn lane for emergency operations.



DISASTER EMERGENCY RESPONSE

In a disaster scenario, the two-way protected bike lane in Alternative B is wide enough to accommodate emergency vehicles.



Key Findings

- Changes to arterial roads are designed to improve pedestrian and emergency service access
- Residential Parking Permits in hilly neighborhoods instituted to manage demand, volume, and safety
- Shift away from traffic calming in residential areas to prioritize traffic calming on high-need arterials

Recommendations

Based on our review of the literature, document analysis, case studies, and interviews, we have formulated the following recommendations, organized into two areas: policy and infrastructure. For each recommendation we provide background, as well as its advantages and disadvantages. Table 6 then follows by organizing our recommendations from high to lower need.

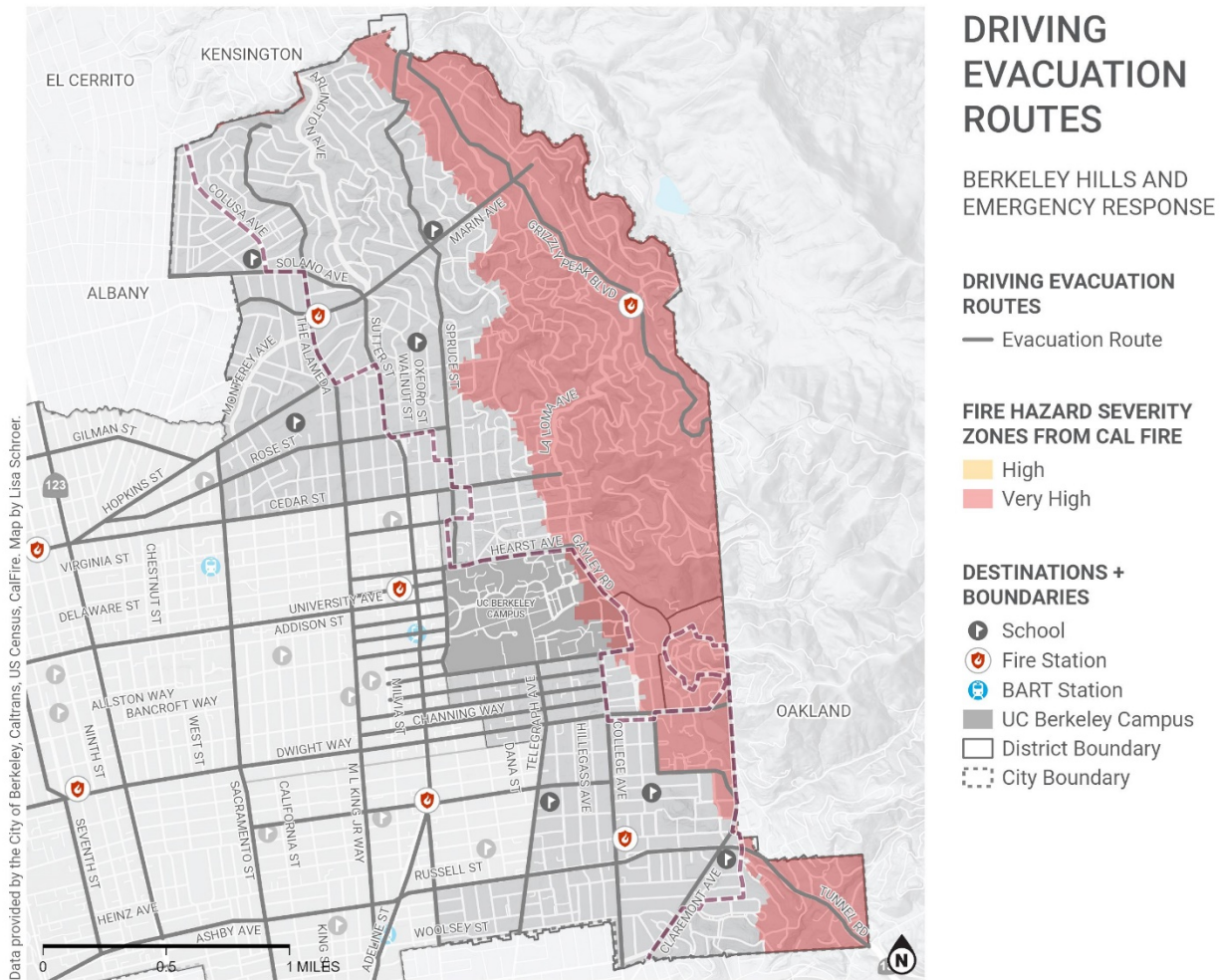
Barring the traffic calming recommendations, all recommendations are applicable to help increase the accessibility of the hills to emergency response and to facilitate efficient evacuation of residents out of the hills in event of a fire. Both have similar needs. For example, restricting street parking can make it faster for fire apparatuses to arrive at the scene of an emergency and can reduce bottlenecks for people evacuating out of the hills.

Policy Recommendations

Recommendation #1: The City of Berkeley should enforce parking regulations.

Background: In June 2022, the Berkeley Disaster and Fire Safety Commission recommended that the Berkeley Police Department enforce parking restrictions in Berkeley’s Fire Zones 2 and 3, which are illustrated in Figure 19 below.⁶⁰ This area maps onto our study area.

Figure 19 Berkeley Fire Zones and Evacuation Routes Map



The staff report contends that constant and flagrant violations of existing parking restrictions compound the twin dangers of high fire danger and narrow roads that reduce the ability of emergency response vehicles to access the Berkeley Hills and resident’s ability to evacuate.⁶¹ Illegal parking reduces the available space for vehicles on the road, making ingress and egress more difficult and creates hazards for pedestrians, especially those with mobility challenges.

⁶⁰ Berkeley Disaster and Fire Safety Commission, “Parking Enforcement of Existing Parking Code in Fire Zones 2 & 3.”

⁶¹ Berkeley Disaster and Fire Safety Commission.

Parking Enforcement Officers (PEOs), who are part of the Berkeley Police Department, provide parking enforcement throughout the City and focus on enforcing parking meters and residential parking permit areas. Berkeley employs 22 full-time Parking Enforcement Officers but due to staffing and funding constraints, the City does not have adequate resources to enforce parking laws in the Berkeley Hills.⁶² Instead, the Police Department offers voluntary overtime to its officers to enforce parking laws in the hillside overlay zone during Red Flag events. The Berkeley Disaster and Fire Safety Commission writes that “a consistent lack of enforcement sends the message that parking restrictions in the Hills are not important, but in truth these restrictions are crucial for life-safety in these neighborhoods.”⁶³

Recommendation: We recommend that the City enforce parking regulations in the study area to deter illegal parking and make ingress and egress easier. While we acknowledge the funding and staffing constraints that the City faces, ensuring an unimpeded right of way is crucial to ensure residents can evacuate during an emergency and emergency services can access the hills, potentially saving lives.

Acknowledging the staffing and funding constraints of the City, we recommend that the City evaluate new digital technologies that can ease ticketing. For example, Los Angeles is partnering with Hayden AI to deploy camera-based technology on the LA Metro buses to ticket vehicles blocking bus lanes and bus stops throughout the City.⁶⁴ The cameras scan the license plate of illegally parked vehicles and send this information to the Los Angeles Department of Transportation (LADOT) where a person verifies the violation and sends a ticket in the mail to the registered owner. LADOT, which contends with staffing shortages like Berkeley does, states the new program will increase enforcement efficiency and lead to lasting behavior change. Additionally, to address concerns about this technology being used to surveil people, Hayden AI destroys video images of parking violations within 60 days and video images that do not show parking violations must be destroyed within 15 days.⁶⁵

AC Transit operates six bus routes through the study area.⁶⁶ The City of Berkeley should explore partnering with a company such as Hayden AI to install and operate parking enforcement cameras on these buses to deter illegal parking which limits emergency vehicle access and hinders wildfire evacuation.

Advantage: Enforcing parking regulations is an effective tool to increase compliance with parking regulations. Full compliance is only reached when drivers expect that regulations will be regularly enforced.⁶⁷ For example, if drivers know they will get a ticket for parking on a sidewalk, they are far less likely to do so. If drivers know that the City does not enforce parking regulations in the Berkeley Hills, then they are more likely to flout the regulations if it benefits them.

Disadvantage: As noted above, enforcing parking regulations is expensive for the City of Berkeley due to staffing and cost constraints. Hiring more PEOs, or reassigning PEOs from other parts of the City, would require a large financial commitment from the City (employee costs and lost parking meter ticket revenue) which could mean reassessing other City priorities. Additionally, an increase in surveillance and enforcement may infringe on people’s desire for privacy. Community opposition may also arise because PEOs are employed within the Police Department which are viewed by some as mechanisms for surveillance and oppression.

⁶² City of Berkeley, “City of Berkeley Proposed Budget For Fiscal Year 2025 & 2026.”

⁶³ Berkeley Disaster and Fire Safety Commission, “Parking Enforcement of Existing Parking Code in Fire Zones 2 & 3.”

⁶⁴ Schlepp, “Metro Buses Will Soon Begin Automatically Ticketing Parking Violators on These Routes.”

⁶⁵ Moran Perez, “LA’s Metro Buses Will Use AI To Ticket Drivers Parked In Bus Lanes.”

⁶⁶ “Maps & Schedules | Alameda-Contra Costa Transit District.”

⁶⁷ McCormick, “Parking Enforcement.”

Recommendation #2: The City of Berkeley should consider implementing a No Parking on Red Flag Days Program.

Background: As discussed in the Los Angeles case study, the City of Los Angeles has a program which prohibits parking in certain locations within the Very High Fire Hazard Severity Zones (VHFHSZ).⁶⁸ During Red Flag Days, parking restrictions are in place in these identified areas (see Figure 20 below). Increased parking enforcement is deployed during Red Flag Days, and illegally parked cars are towed by the City. The City of El Cerrito conducted a Red Flag Day Parking pilot program from June through November of 2024 that was modeled after LA's.⁶⁹

Figure 20 No Parking on Red Flag Days Sign



Recommendation: If implementing more permanent no parking zones is not feasible, Berkeley should implement a program similar to the Los Angeles No Parking on Red Flag Days. The Fire Department should assess the streets in Fire Zone 2 and 3 and determine street sections where prohibiting parking during Red Flag Days would assist with ingress and egress if a fire event occurred. In these areas no parking signs, like the one depicted above, should be installed. The City should encourage residents to sign up for AC Alert via email and/or text message which provides location-specific alerts during emergencies like earthquakes, fires, severe weather, road closures, and evacuations.⁷⁰ Residents will be able to be notified if a Red Flag Day has been established and know not to park in the designated areas. This program should be paired with intensive community outreach to educate the public about why the program is being implemented and how to find out when a Red Flag Day has been called.

Advantage: Restricting street parking at pinch points on Red Flag Days will improve the speed with which residents can evacuate, and emergency vehicles can access the Berkeley Hills. Additionally, it is a surgical approach with little impact to people's lives most of the year thereby potentially increasing the political feasibility of this program.

⁶⁸ "LAFD Red Flag Program Overview."

⁶⁹ "Red Flag Warning."

⁷⁰ "AC Alert."

Disadvantage: This program may impact tenants, who are less likely to have access to off-street parking, more than homeowners. Because tenants may be more likely to have a lower income than homeowners, this program may affect Berkeley Hills residents inequitably. Additionally, issues may arise if residents are not aware that a Red Flag Day has been called and do not move their vehicle out of a No Parking on Red Flag Day area. This especially could affect residents who may not have the technological knowledge or access needed to know how to look up if a Red Flag Day has been called.

Recommendation #3: The City of Berkeley should consider implementing a Residential Preferential Parking Program.

Background: The City of Berkeley has an existing Residential Preferential Parking (RPP) program which covers neighborhoods surrounding the University of California, Berkeley and downtown.⁷¹ In these areas, vehicles must have an RPP permit to park for more than two hours, allowing non-residents to park for short visits while enabling residents to park near their home. Annual parking permits cost \$66 and are digital allowing the license plate to function as the permit. Applicants must submit a photo ID, their vehicle registration, and proof of residency to qualify. Many other cities, including Boulder, Colorado, have RPP programs.

Recommendation: We propose an amended version of the RPP program to be extended to the study area to discourage legal on-street parking and encourage the use of off-street parking. This program would restrict each household to purchase one on-street vehicle parking permit which would allow them to park in legal parking areas. All other vehicles, including visitors and those owned by residents, would be limited to parking on the curb for a two-hour limit. We do not make any recommendation regarding the cost of the parking permit, but it should be expensive enough to encourage people to make use of private off-street parking instead. Extensive community outreach should be conducted to educate residents about the program and its underlying public safety purpose. Revenue that does not go towards program operation could go towards funding Recommendation #4 (Subsidized TNC Trips).

Advantage: Implementing a RPP Program could reduce the number of parked vehicles on the street, thereby making the streets more accessible for emergency response vehicles and increase the speed of evacuations. Additionally, revenue generated by parking permit fees in excess of program operation costs can help fund subsidized TNC trips for people who do not buy an RPP permit, thereby making Recommendation #4 more financially feasible. Because the RPP Program's goal is to disincentivize on-street parking, it may encourage people, especially visitors, to switch from driving to using a ride hailing company or take transit. Finally, the RPP Program prioritizes parking for residents over visitors, which could help build support for the Program because it does not prevent residents from parking long-term.

Disadvantage: The RPP Program could incentivize residents to move their cars off-street. This program may impact tenants, who are less likely to have access to off-street parking, more than homeowners. Because tenants are more likely to have a lower income than homeowners, this program may affect Berkeley Hills residents inequitably. Finally, while RPP Programs have been shown to succeed at protecting on-street spaces for residents,⁷² this particular RPP Program has not been tested and effectiveness is uncertain. It may be that every household decides to purchase a parking permit which would lead to a minimal reduction in on-street parking. In this case, Berkeley may wish to add a policy whereby residents prove they are using their garage or driveway (if they have one) to park, before getting a permit, as Pasadena does.⁷³

⁷¹ City of Berkeley, "Resident Parking Permits."

⁷² Moylan, Schabas, and Deakin, "Residential Permit Parking."

⁷³ Schleck, "Challenges of Free Residential Parking Permits and Potential Solutions."

Recommendation #4: The City of Berkeley should subsidize Transportation Network Companies rides for people living in the Berkeley Hills who do not buy an RPP pass.

Background: Transportation Network Companies (TNCs) are ride hailing companies which provide on-demand transportation services for passengers. These companies include household names such as Lyft and Uber, and autonomous vehicle companies like Waymo that operate in specific geographies. Numerous transit agencies have partnered with Uber and Lyft throughout the United States to improve mobility choices for their customers.⁷⁴ TNCs have been used when usual transit has been disrupted, to supplement in-house microtransit, and provide last-mile connectivity between transit and the rider's origin or destination. For example, residents in one of eight neighborhoods in the St. Louis region can ride Lyft to a nearby Metro Transit center or MetroBus stop for \$1. Additionally, the majority of residents living in the hillside overlay zone are within a five-minute walk of an AC transit stop, however, limitations on bus frequency and route access likely affect resident's preferred mode choice.

Recommendation: To encourage Berkeley Hills residents to park off-street, the City of Berkeley should partner with Uber and/or Lyft to provide subsidized rides to residents who do not purchase an RPP pass. Subsidized trips would have to begin or end at the resident's home in the Berkeley Hills and should be encouraged to be used as a connector to BART or other transit options. The subsidy should be larger than the cost of the RPP pass to provide residents a large enough incentive not to purchase a pass. Ideally, this program would encourage those Berkeley Hills residents who cannot park their vehicle off-street and do not use their vehicle often to sell their vehicle and use the subsidized TNC trips instead. This program could improve the mobility of sub-populations in the Berkeley Hills which have difficulty getting around such as the elderly and people with disabilities.

Advantage: This program provides residents with an economic incentive to not purchase a RPP pass and thereby not park a vehicle on the street long-term. This could help reduce the number of vehicles parked on the street more than if the RPP Program was implemented on its own. Providing subsidized TNC rides may also increase the political viability of the RPP Program as well as other parking policies proposed in this report (red curbing as an example).

Disadvantage: Providing discounted TNC rides may reduce modal shift from cars to transit as well as encourage transit riders to use TNCs instead of transit. Additionally, the program may not have the desired effect of disincentivizing people from purchasing a RPP permit. Households may decide to purchase a RPP permit because it is more convenient regardless of the cost of the permit and the financial incentive provided by the subsidized TNC rides. Finally, everyone, including wealthier people, are eligible to receive discounted TNC rides, which presents an equity issue. The optics of providing subsidies to a wealthier area may not be favorable. However, if Berkeley upzones the Berkeley Hills, subsidizing TNC trip may be helpful for middle and lower income residents who move to the area due to the construction of new multifamily housing.

Recommendation #5: The City of Berkeley should improve transit options in the Berkeley Hills.

Background: AC Transit operates six bus routes through the study area, notably the 65 and 67 routes that reach the highest elevations.⁷⁵ Bus 65 travels from Downtown Berkeley to Euclid Avenue and Grizzly Peak Boulevard. Bus 67 travels from Downtown Berkeley to Spruce Street and Grizzly Peak Boulevard. These two routes provide limited transit coverage to people living in the Berkeley Hills, increasing people's need to own a car. High car ownership in the study area helps contribute to residents parking their cars on the street which can hamper egress and ingress in the case of an emergency.

⁷⁴ "Transit and TNC Partnerships."

⁷⁵ "Maps & Schedules | Alameda-Contra Costa Transit District."

Recommendation: To increase people’s mobility in the Berkeley Hills, the City of Berkeley should work with AC Transit to expand bus coverage. Increasing the frequency of Bus 65 and 67, as well as expanding the routes to cover more streets in the Berkeley Hills would help make taking the bus more convenient. This in turn may, over time, reduce the number of cars per household and reduce the number of cars parked on the street.

Additionally, the City of Berkeley should explore offering microtransit rides for Berkeley Hills residents to supplement traditional bus service. We encourage Berkeley to look at programs such as [Richmond Moves](#) which was launched in 2022 in Richmond, California. It was created to ease connections between fixed-route transit service and destinations and was financed through a grant from the California Clean Mobility Options Voucher Pilot Program.⁷⁶ Richmond Moves charges \$2 per ride in one of program’s three plug-in hybrid vehicles.

Advantage: Improving transit availability in the Berkeley Hills could help create a modal shift in some trips from car to bus. Additionally, increasing the number and frequency of bus routes will improve equitable transportation access in the Berkeley Hills and improve access for those who do not own a vehicle by choice. AC Transit may also benefit through increased ridership.

Disadvantage: While the City of Berkeley can encourage AC Transit to increase the number and frequency of bus routes in the Berkeley Hills, it is still AC Transit’s prerogative whether or not to do so. The City cannot compel AC Transit to add or change routes. Additionally, adding or extending bus routes can be very expensive, as new equipment may need to be acquired, and bus drivers may need to be hired. Administering a microtransit program could be expensive as well. However, state grant funding may be leveraged to offset the program cost.

Recommendation #6: The City of Berkeley should foster interdepartmental cooperation between the Fire and Transportation Departments.

Background: Most government departments are significantly siloed and often criticized for having “tunnel vision”.⁷⁷ According to interviewees, Fire Departments have a singular mission of responding to public safety concerns as quickly as possible, and traditionally, firefighters develop a siloed view of their work from the onset of their careers. A key reason is that they only learn about other departments’ needs as they earn more senior ranks and are, for example, assigned to interdepartmental task forces.

Recommendation: As traffic safety becomes more of a concern and cities increasingly adopt Vision Zero initiatives, Fire Departments are drawn into issues traditionally in the purview of Transportation Departments.⁷⁸ To foster interdepartmental cooperation between the Fire and Transportation Departments, early career fire and transportation staff should learn about each other’s operational needs and duties to gain a better understanding and appreciation of the department’s work. A simple way to nurture mutual understanding is to periodically organize “ride alongs” where transportation staff can join a fire department for a day on the job and vice versa. While this could be quite an expensive program as a firefighter on a “ride along” would need to be backfilled by another firefighter on overtime, the value it could bring to fostering interdepartmental cooperation could justify such a program.

⁷⁶ “City Launches Electric Microtransit Service, Richmond, CA 2022.”

⁷⁷ Rosenbloom, O’Leary, and Chanin, *Public Administration and Law*.

⁷⁸ Gecan, “‘Street Trauma Prevention’ Role Proposed for Berkeley Fire.”

Advantage: If cooperation between departments is emphasized for transportation and fire department staff from the beginning of their employment it may smooth interdepartmental relationships long term as cooperation and collaboration becomes part of the culture of these departments. Additionally, it could reduce frustration among department staff if they understand the needs and motivations of the other department. Finally, it may benefit the City of Berkeley organization as a whole because increased cooperation may lead to increased efficiency and improve the ability to serve Berkeley residents.

Disadvantage: This kind of intentional cooperation will take a fair amount of time and effort to be effective. City departments already have a lot on their plates and additional tasks related to learning other department's charges could overtax staff capacity. Additionally, this may have overtime and staffing ramifications, especially for the Fire Department where coverage always must be assured.

Infrastructure Recommendations

Recommendation #7: The City of Berkeley should purchase smaller fire apparatuses when the opportunity arises.

Background: There is a natural conflict between the narrow roads of the study area and the large fire apparatuses operated by the Berkeley Fire Department. Smaller fire apparatuses are made which have the same or even increased capabilities.⁷⁹ Standard fire trucks ("pumpers") with a 1,500 gallon/minute fire pump capacity may have a wheelbase of 201 inches and overall length of 384 inches necessitating a turning radius of 36 feet.⁸⁰ Shorter fire trucks, such as a "Rapid Attack Apparatus" pumper with a wheelbase of 129 inches and overall length of 266 inches, can have the same fire pump capacity with a 48% shorter turning radius. Aerial ladder trucks are necessary to reach the tops of taller buildings. Aerial ladder trucks are especially necessary in the flats where an increasing number of high-rise apartment buildings are being built. While aerial ladder trucks aren't as operationally necessary as standard fire trucks in the Berkeley Hills, they could still be called upon in a fire. Just like with standard fire trucks, shorter models are made with the same or even increased capabilities.⁸¹

For example, a Seagrave AerialScope Ladder Truck with a wheelbase of 247 inches and overall length of 546 inches has a ladder height of 95 feet, ladder reach of 89 feet, and turn radius of 40.5 feet. In contrast, the much smaller Magirus M32L-AS has a wheelbase of 190 inches and overall length of 393 inches. Despite the decreased truck size, it has a taller ladder height at 105 feet (10 feet taller than the Seagrave), the same ladder reach of 89 feet, and a 45% smaller turning radius at 23 feet.

There is little existing demand for smaller fire trucks in the United States because fire departments like to purchase the same type of apparatuses they are familiar with. An additional reason why the demand for smaller fire apparatuses is low is because a perceived reduction in fire response capabilities may increase the City's insurance costs. Therefore, manufacturers have been slow to manufacture and offer a variety of these types of trucks which are common in Europe and Japan. The unavailability of these trucks is a major hurdle for widespread adoption in the United States.⁸²

⁷⁹ Epstein and Chiarenza, "Initial Findings on Downsizing Large Vehicles."

⁸⁰ Epstein and Chiarenza.

⁸¹ Epstein and Chiarenza.

⁸² Myers, "NACTO Webinar - Fire Trucks and Vision Zero."

Recommendation: Smaller fire apparatuses exist that are as capable as their larger counterparts. While Berkeley in recent years has bought a fire apparatus with a smaller wheelbase for use in the study area, we recommend that more fire trucks be converted to smaller models at end-of-life. In the eventuality of a large fire in the study area, all Fire Department capacity will be needed and one singular smaller fire truck will not be adequate. Most of the Berkeley Fire Department's fire truck fleet should be capable of quickly and efficiently responding to fires in the Hills. Some cities such as San Francisco have made efforts to decrease the size of their fleet to be able to maneuver better through narrow roads.⁸³

Advantage: Smaller fire apparatuses can improve the speed at which the Fire Department responds to calls for service in the Berkeley Hills. Additionally, smaller fire apparatuses are more nimble which could improve the Fire Department's effectiveness to respond to calls throughout the City, not just in the Berkeley Hills.

Disadvantage: As noted above, there are fewer manufacturers that offer smaller fire apparatuses within the United States which may delay or reduce the City's ability to purchase them. Additionally, fire apparatuses have long life spans. According to the National Fire Protection Association recommends that fire apparatuses should be retired after 25 years of service.⁸⁴ This means that the benefits of this recommendation would take a long time to be made apparent. Finally, through our interviews we learned that a perceived reduction in fire response capabilities due to the procurement of smaller fire apparatuses may increase the City's insurance costs.

Recommendation #8: The City of Berkeley should designate additional no parking zones in the study area.

Background: Currently there are no parking zones, denoted by a red curb, in the study area. However, red curbing should be expanded due to the amount of illegal parking that occurs. The Disaster and Fire Safety Commission has alerted the City Council multiple times to the issue of illegal parking in the Berkeley Hills showing evidence of cars parked on sidewalks restricting access to pedestrians and those with mobility challenges.⁸⁵ A consistent lack of enforcement sends the message that parking restrictions in the study area are not important, but in truth these restrictions are crucial for life-safety in these neighborhoods. These vehicles are most likely parked on the sidewalk because there is not enough room on the road to park. Places where people park on the sidewalk are clear places where a no parking zone should be added.

Red curbs should be added to roads with widths less than 26-feet and where residents have access to off-street parking.⁸⁶ By limiting red curbing to narrow roads where residents have an alternative place to park, it may reduce the amount of opposition. If deemed necessary, blue curbs could be painted in conjunction with red curbs to allow mobility-limited residents to park.

Advantage: When paired with parking enforcement, designated no parking zones will be effective in removing parked vehicles from street segments which will help increase the amount of street space available to emergency response vehicles. Additionally, it can increase the speed of evacuation out of the Berkeley Hills.

Disadvantage: Reducing the supply of street parking is politically fraught and the City should expect some residents to voice their displeasure. The Berkeley Hills have a contentious history around street parking and the City would benefit from acting strategically to minimize resident protest.⁸⁷

⁸³ Petrillo, "Eight Streamlined and Compact Pumpers Delivered to the San Francisco (CA) Fire Department - Fire Apparatus."

⁸⁴ Shand and Wilbur, "The Apparatus Architect."

⁸⁵ Berkeley Disaster and Fire Safety Commission, "Parking Enforcement of Existing Parking Code in Fire Zones 2 & 3."

⁸⁶ Berkeley Disaster and Fire Safety Commission.

⁸⁷ Rauch, "No Changes yet to Parking in Berkeley Hills despite City's Bright-Red Curb-Painting Mixup."

Recommendation #9: The City of Berkeley should add pedestrian safety improvements and wayfinding to existing pedestrian evacuation paths.

Background: The study area hosts an extensive network of pedestrian pathways which were built during the early parts of the 1900s to provide shortcuts through the long blocks to reach street cars lines.⁸⁸ These steep, narrow paths vary in quality from those with concrete steps and railings to overgrown dirt paths and are maintained by the Berkeley Path Wanderers, a volunteer organization dedicated to preserving and maintaining the paths.

City staff have identified these paths as a crucial evacuation route for pedestrians out of the Berkeley Hills. The 2024 Local Hazard Mitigation Plan Update proposes to a) publicize up-to-date maps of all emergency access and evacuation routes; b) maintain signage for public pathways to identify safe and accessible pedestrian evacuation routes from the hill areas; c) have Public Works Staff maintain paths on an as-needed basis, and coordinate with the Berkeley Path Wanderers to maintain public pathways to provide safe pedestrian evacuation routes from the hill areas; and d) install handrails on all public pathways, prioritizing areas with high usage and steep inclines to increase pedestrian safety and accessibility.⁸⁹

Recommendation: The above proposed actions are labeled “high priority” and are included in the 2024 Local Hazard Mitigation Plan.⁹⁰ In addition to the above actions, pedestrian infrastructure such as crosswalks and pedestrian flashing lights should be installed where paths intersect with a major arterial.

Advantage: These pedestrian safety measures will improve pedestrians' ability to safely travel out of the Berkeley Hills in the event of an evacuation. While these pedestrian improvements are recommended to improve pedestrian evacuation, these improvements will increase pedestrian safety regardless of an evacuation impetus. Finally, this recommendation builds on the City of Berkeley's 2024 Local Hazard Mitigation Plan Update which identifies pedestrian safety in the Berkeley Hills as an important issue to address.

Disadvantage: The pedestrian paths in the Berkeley Hills are not used as extensively because of the car centric nature of the Berkeley Hills. Therefore, planning for pedestrian access and safety improvements will not affect a large number of people. In the case of an evacuation, we expect the vast majority of residents to evacuate via vehicle. Additionally, many of the paths are not ADA accessible.

Recommendation #10: The City of Berkeley should assess the existing high needs/high benefits areas for traffic calming.

Background: The study area is a diverse area in terms of household income and demographics. The northern area is made up of higher income households living in single-family residential homes, whereas the areas near the University are lower income where many students live. Traffic calming interventions are not appropriate in all parts of the study area due to the varied geography. For example, adding a bulb out to a narrow road where vehicles park on one side may further exacerbate ingress and egress concerns.

⁸⁸ “OUR HISTORY.”

⁸⁹ “2024 Mitigation Strategy Actions Spreadsheet.”

⁹⁰ “2024 Mitigation Strategy Actions Spreadsheet.”

Recommendation: If the City wishes to expand the use of traffic calming measures, it should assess the study area and place traffic calming infrastructure at high conflict points. These points may include schools where children may be walking or biking to and from school and on Spruce Street which is a designated Class III bike route with “sharrows”. Numerous serious and fatal bike collisions have occurred on Spruce Street, most recently in May 2024.⁹¹ Because of its designation as a bike route and the high incidence of bike crashes, Spruce Street should be prioritized for traffic interventions.

Crucially, the City should install traffic calming infrastructure only where the highest need and highest benefit for traffic calming would be found. This is necessary to properly allocate scarce City resources as well as provide a cost-benefit rationale to those who may be skeptical of traffic calming measures. Showing the systematic decision making behind a project proposal is imperative to fostering public support for traffic calming interventions which is important to the success of the project. Additionally, all traffic calming interventions should take into account the needs of the Fire Department to not significantly impede the movement of fire apparatuses.

Advantage: Adding traffic calming interventions to high need and high benefit areas will help improve safety for all users, but especially people who walk or bike. Traffic calming increases pedestrian and cyclist comfort, which could help increase the number of walking and biking trips. These interventions are especially beneficial to vulnerable road users such as the elderly who are at greater risk of becoming a crash victim.⁹²

Disadvantage: When comparing the high needs/high benefits areas in the Berkeley Hills to those in other portions of the City, the study area’s traffic calming needs may not be as urgent as those in the other areas. Because the City has only limited resources to make and maintain traffic calming improvements, implementing specific traffic calming measures in the Berkeley Hills may not be the most impactful use of funds. Additionally, the construction of traffic calming projects may be disruptive for a short time period to the surrounding neighborhood.

Recommendation #11: The City of Berkeley should conduct a traffic study to determine if, where, and what traffic calming is needed if the Berkeley Hills are upzoned.

Background: The City of Berkeley has been undergoing an effort to amend the zoning ordinance and General Plan to make it easier to build denser housing throughout the City.⁹³ The aim is to incentivize “missing middle” housing such as townhouses and condominiums. The initial staff recommendation was to upzone all Berkeley neighborhoods, however the City Council instructed staff to design an upzoning ordinance excluding the study area due to its high fire risk at the recommendation of the Fire Department. The City Council will revisit potentially upzoning the study area once the wildfire evacuation study is complete, most likely by January 2025.

⁹¹ Raguso, “Cyclist Taken to Highland after Colliding with Bus in Berkeley.”

⁹² “Pedestrian Safety.”

⁹³ Gecan, “Berkeley Council Tasks Redraft of ‘missing Middle’ Zoning Changes.”

Recommendation: As of this writing it is not known if the study area will see increased housing density due to upzoning. If the Berkeley City Council decides to upzone the study area and increased density is added, more traffic calming measures may be needed in certain areas because more vehicles and pedestrians will be traversing the study area. A traffic study should then be conducted to determine if traffic calming measures are needed due to the increase in vehicles and pedestrians, where the traffic calming measures should be placed, and what traffic measures would be most appropriate for the location. More vehicles and pedestrians can lead to more conflict between the two user groups. Adding appropriate traffic calming measures to protect vulnerable road users may be necessary. However, if the City Council decides not to upzone the study area adding traffic calming measures should not be a high priority considering the narrow road widths and the lower population density which create less of a need for traffic calming interventions.

Advantage: The above recommendation is an analytical approach to determine if and where traffic calming measures are needed, contingent on the upzoning of the study area. Conducting a traffic study can provide clear justifications for funding specific traffic calming projects. Additionally, this approach is in line with Berkeley's Vision Zero commitment and their Bike and Pedestrian Plans.

Disadvantage: Traffic studies are time-consuming and costly, which could delay needed interventions and make projects less financially feasible.⁹⁴

Prioritization and Implementation of Recommendations

Collectively, these recommendations could be quite expensive for the City of Berkeley to implement. For example, increasing parking enforcement in the Berkeley Hills could cost hundreds of thousands of dollars annually if additional Parking Enforcement Officers were hired and additional vehicles were purchased. These recommendations can only be operationalized if the necessary funding is available. Future research should focus on creating a financial feasibility study to understand the financial tradeoffs of each recommendation.

While the Berkeley Hills are not a socio-economic monolith, many people who live in the study area are highly resourced. Many of our recommendations, such as subsidized TNC trips, would benefit wealthy people. This presents an equity concern which our report does not delve into. We would urge future research to study this issue.

Additionally, political feasibility is an important consideration to take into account when making decisions about which recommendations to implement. Residents of the Berkeley Hills are very politically engaged and may strongly oppose some of these recommendations and put political pressure on the City Council and related commissions and departments to not implement them. While we urge the City of Berkeley to implement these recommendations, we realize that city government does act at the behest of its residents. Therefore, we have prioritized the recommendations below by need and political feasibility which were determined based on our analysis of the mobility challenges in the Berkeley Hills (see Table 6).

We also included a timeframe component to indicate when each recommendation should be implemented (short-term, medium-term, and long-term). The recommendations are sorted from High Need to Lower Need and the numbers correspond to their ordering in the recommendations section above.

⁹⁴ "How Much Does a Traffic Study Cost?"

Table 6 Prioritizing Recommendations

Recommendation	Need	Political Feasibility	Timeframe	Source(s)
#1 Enforce Existing Parking Regulations	High	High	Medium-term	2024 Local Hazard Mitigation Plan, June 2022 Berkeley Disaster and Fire Safety Commission Staff Report, Culinane and Polak 1992, Hussain et al. 2019
#2 No Parking on Red Flag Days Program	High	Medium	Short-term	2024 Local Hazard Mitigation Plan, City of Los Angeles, City of El Cerrito
#7 Smaller Fire Apparatuses	High	Medium	Long-term	NACTO, Atkins and Coleman 1997, Kakuchi et al. 2007
#8 Increase No Parking Zones	High	Low	Short-term	Interview
#3 RPP Program	Medium	Low	Long-term	City of Berkeley, Moylan et al. 2014, Shoup 1999 and 2006
#5 Improve Transit Options	Medium	High	Long-term	Interview
#9 Pedestrian Safety Improvements	Medium	High	Medium-term	2024 Local Hazard Mitigation Plan, Kensington Evacuation Research Report,
#10 Traffic Calming in High Needs/Benefits Areas	Medium	Medium	Short-term	2024 Local Hazard Mitigation Plan, Boulder Case Study, Amundsen 2024, Hussain et al. 2019, Iacono et al. 2010
#11 If Upzoned, conduct Traffic Study to determine traffic calming needs	Medium	Medium	Long-term	Project team
#6 Interdepartmental Cooperation between Fire and Transportation Depts.	Lower	High	Long-term	Interview
#4 Subsidize Transportation Network Company Trips (Uber/Lyft etc.)	Lower	Medium	Medium-term	2024 Local Hazard Mitigation Plan, Interview

Short-term= 1-2 years; Medium-term=2-5 years; Long-term=5+ years

Conclusion

The Berkeley Hills is a heterogeneous region of people with diverse lifestyles, mobility needs, and priorities. Wildfire looms large in residents' collective memory, while street trauma presents a daily threat to public safety. Risk distribution in the Berkeley Hills differs street-by-street and block-by-block: the greatest fire susceptibility is in the east of the study area, and the greatest number of road-user injuries are in the west of the study area where steeper terrain meets flat terrain. The City of Berkeley has committed to protecting residents from both environmental and roadway hazards: a safe city requires pedestrian-safe streets, reliable evacuation routes, and navigable emergency corridors. Emergency services and transportation planners can address these risks using the strategic policy and infrastructure adjustments outlined in this report. Past opposition to change by residents underscores the importance of interdepartmental collaboration and the ability to convincingly communicate risk management strategies to the public. Aligning the goals of emergency responders and transportation planners reveals opportunities for collaboration, equitable risk mitigation, and improved quality of life in the Berkeley Hills.

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