

# **Re-Stitching the Fabric: Urban Highway Removal as an Opportunity for Equitable, Sustainable Transformation**

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## ABSTRACT

The detrimental effects of a century of highway construction and use in U.S. cities are clear. From polluting the air, contributing to climate change, encouraging urban sprawl, and entrenching racial and economic injustice in the built environment, urban highways urgently need reimagining as we aim to build a more just and sustainable society. As a result, cities across the country have slowly begun to remove their highways and undo past harms by reclaiming public space, promoting sustainable modes of transportation, and redeveloping newly available land. While past removal projects have undoubtedly improved their urban public realms, they have often missed opportunities to encourage sustainable mode shift and resist community displacement. Given recent calls for highway removal by communities, local leaders, and the federal government, now is the time to ensure the benefits of these projects are shared by all.

This thesis aims to outline a justice-oriented framework which can encourage more holistic highway removal processes. It first uses a case study approach to evaluate past projects through the lenses of sustainable mobility, public realm, and anti-displacement. Through analyses of the removal of part of the Central Freeway in San Francisco, CA and the Cypress Freeway in Oakland, CA, it identifies best practices to adopt and failures to avoid. It then specifies a set of analytical and procedural dimensions necessary for ensuring more equitable and sustainable outcomes. Finally, this framework is illustrated and tested using a proposed highway removal project: the rest of San Francisco's Central Freeway.

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An aerial view of a city with a highlighted highway route in a light brown color. The text is overlaid on this image.

# Re-Stitching the Fabric:

**Urban Highway Removal as  
an Opportunity for Equitable,  
Sustainable Transformation**

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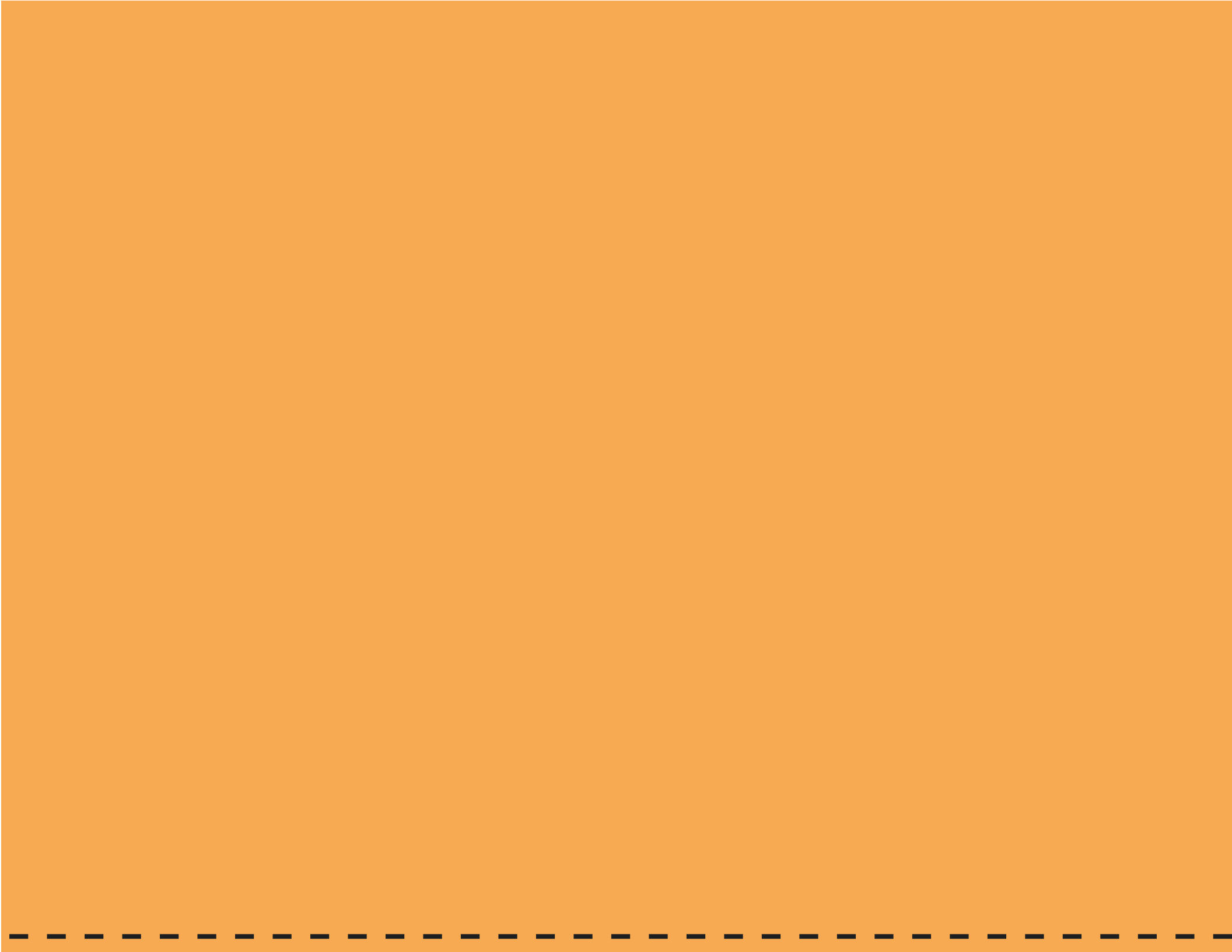
The Future of Urban Highway Removal

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# Introduction:

**The Destructive Rise and  
Slow, Contested Fall of the  
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# Background

The removal of highways has gained popularity as a means to combat the negative effects of car-centric development in U.S. cities. While highways were built in the name of progress, they have divided communities, stifled downtowns, and entrenched racial, environmental, and economic inequalities. As a result, cities across the country have slowly begun to remove highways and undo past harms by reclaiming public space, promoting sustainable modes of transportation, and encouraging development. The environmental and public realm benefits of highway removal, such as reduced air pollution and increased walkability, are evident. However, the development these projects attract has often accelerated the displacement of vulnerable residents, thereby furthering inequalities.

This thesis proposes a different approach to highway removal, treating it not as a reactive measure to only address aging or damaged infrastructure and spur private development but as a transformative opportunity to address the urgent crises of climate change and social inequity. By leveraging the unique characteristics of highway removal, these projects can reconnect and revitalize neighborhoods while preventing—or at least mitigating—community displacement. If planned in a collaborative way across jurisdictional boundaries and with communities, highway removal can be a catalyst for equitable, sustainable, and livable city-building. The proposed approach centers on developing ambitious projects that address the most pressing issues facing cities today.

Through a case study approach, this thesis aims to illustrate how highway removal can be used as a transformative opportunity to promote equitable and sustainable development. The case studies demonstrate different strategies for highway removal and are evaluated based on their ability to encourage sustainable mode shift, create a vibrant public realm, and resist community displacement. The goal is to provide a framework for planners, policymakers, and community members to use highway removal as a tool for equitable and sustainable planning.





Figure 1: Highway removal in progress in Portland, OR  
(Reclaiming Old West Broad Street)



Figure 2: Patricia's Green in San Francisco, CA, on the site of the former Central Freeway (Scott Beale / Laughing Squid)

# Highway Removal Efforts

## Highways in the U.S.

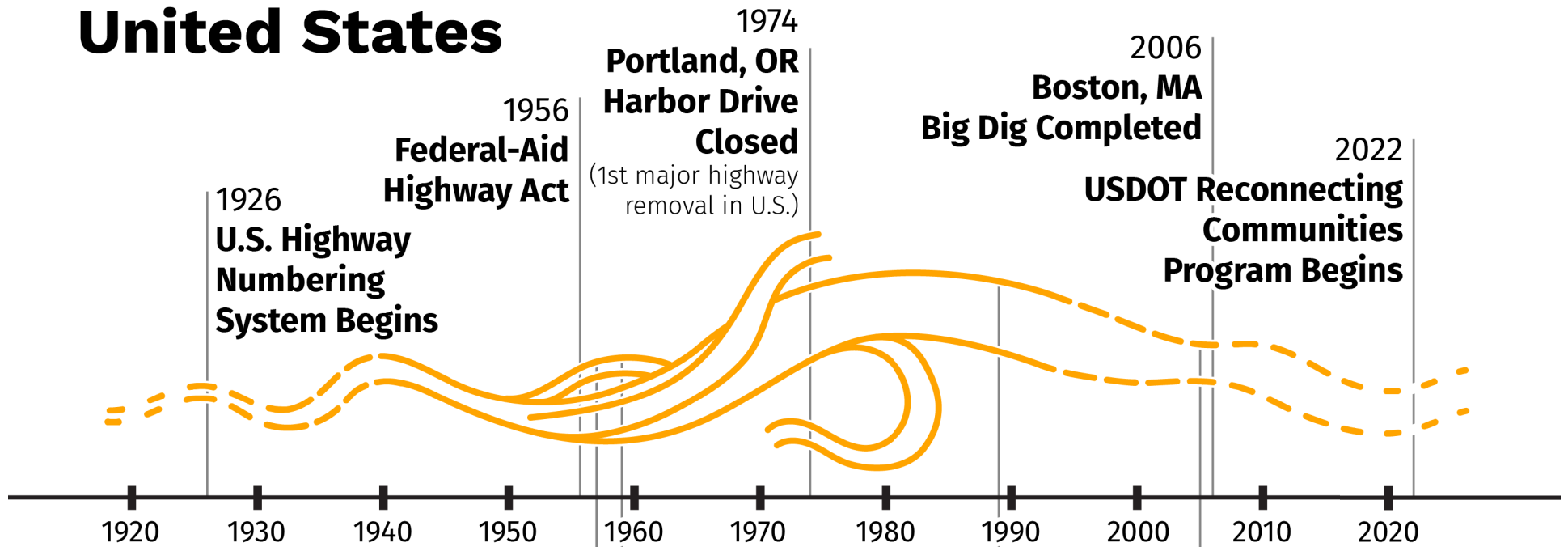
As automobility in the U.S. grew in the beginning of the 20th century, so did the political consensus for building a network of high-capacity limited-access roads. In the 1920s and 1930s, engineers and planners embraced the parkway as a road typology. Originally, these four-lane, landscaped roads were built to serve only residential and recreational traffic (DiMento and Ellis 2013). Parkways and other interwar highways often followed natural features and were narrower and more winding than their postwar counterparts (Avila 2014). While less destructive than the future interstate highways, these early highways laid the groundwork for the primacy of the automobile and a shift towards disregarding the urban fabric.

The postwar years saw a boom in the development of an interstate highway system. President Eisenhower's inspiration by Germany's autobahns during World War II and desire for easy military access to the entire country in the event of an attack culminated in the passage of the Federal-Aid Highway Act in 1956. With 90% of costs covered by the federal government, highway construction became an easy decision for most cities (Weingroff 1996). Though the interstate highway system was originally intended to only be built between cities, thus avoiding urban cores, priorities shifted to carving out rights-of-way through dense neighborhoods and downtowns. These highways were much straighter, wider, and destroyed more of the urban fabric than their predecessors (Avila 2014). A technocratic process characterized by planners and engineers invoking science and progress prioritized traffic flow over all other concerns such as local community wellbeing. From 1956 to 1966, highway construction in U.S. cities accounted for the destruction of 37,000 housing units per year and hundreds

of thousands of displaced people (Avila 2014). The frequent accompaniment of urban highway construction with urban renewal also further contributed to resident displacement. Furthermore, highway routes systematically created or reinforced racial divides by breaking up thriving communities of color or separating them from white communities. From Nashville to Birmingham to Los Angeles, redlined neighborhoods of color were cleared for highway rights-of-way (Dillon and Poston 2021).

Successful opposition to urban highway construction occurred where the local population had the most political capital for organizing, most notably in whiter, more affluent neighborhoods in San Francisco, Washington D.C., and New York. These campaigns are often referred to as the "Freeway Revolt" (Henderson 2013). While San Francisco is especially known for preventing significant freeway construction thanks to these revolts in the 1960s, it was also the site of the removal of two highways—the Central and Embarcadero Freeways—which were stubs of an unfinished cross-city highway network. While the San Francisco Bay Area's 1989 Loma Prieta earthquake—a magnitude 6.9 earthquake which destabilized much of the region's infrastructure—created favorable political circumstances for the removal of these two highways as well as the Cypress Freeway across the bay in Oakland, activism supporting tearing down already-built freeways began in 1970, nearly 20 years earlier (Cervero, Kang, and Shively 2009). This thesis examines the removals of the Central and Cypress Freeways as case studies.

# United States



# SF Bay Area

Case Study Region for Highway Removal

1957  
Oakland Cypress  
Freeway Completed

1959  
San Francisco Central  
Freeway Completed

1989  
Loma Prieta  
Earthquake

2005  
Octavia Blvd and  
Mandela Pkwy Open,  
replacing Central and  
Cypress Freeways

Figure 3: Timeline of highway construction and removal in the U.S. and in the San Francisco Bay Area

# Reasons for Removal

The impetus for highway removal projects so far has almost universally been rooted in structural defects caused by earthquakes (San Francisco’s Embarcadero and Central Freeways, Oakland’s Cypress Freeway), the risk of such defects (Seattle’s Alaskan Way Viaduct) or defects caused by other forces (New York’s West Side Highway). This trend somewhat reflects the technocratic process that led to these highways’ construction.

Only recently have there been prominent calls for highway removal in the name of justice, especially environmental and racial justice. This is exemplified in proposals for the removal of Syracuse’s I-81, New Orleans’ Claiborne Expressway, and St. Paul’s I-94 which all abut African-American communities. Moreover, President Biden’s Bipartisan Infrastructure Law allocated \$1B in grants over 5 years for a Reconnecting Communities Pilot Program which aims to “[reconnect] communities that were previously cut off from economic opportunities by transportation infrastructure” (“Reconnecting Communities Pilot Program” 2023). Though originally intended to allocate \$10 billion (Wilson 2021), this program represents a major shift in political priorities as the federal government begins to recognize and redress harms it directly produced.

# Neighborhood Benefits

Highway removal projects have a unique potential to re-stitch and improve both the physical and social fabric of their surrounding neighborhoods and cities. Local public health benefits, largely from air pollution reduction, remain a key argument used by proponents of highway removal (Patterson and Harley 2019). Even as the accelerating adoption of electric vehicles nationwide will likely reduce local air pollution, a significant portion of pollutants come from tires and brake pads (Environmental Protection Agency 2014). Furthermore, recent research suggests electric vehicles are,

on average, 24% heavier than conventional vehicles because of battery weight and that there is a positive relationship between vehicle weight and non-exhaust particulate matter emissions. This reality suggests an imperative reduction in urban automobile use to improve air quality, regardless of fuel source.

While critics of highway removal cite concerns about traffic disruption, decades of evidence point to the potential of highway removal to improve local traffic. Research on these projects demonstrates an overall minimal impact or even reduction in traffic congestion in the areas around highway removal projects (Garrick and Billings 2013). Though the exact effect is difficult to measure, research suggests these reductions result from a combination of traffic dispersal onto other streets, the elimination of low-value trips, and a shift to other modes of transportation (Cervero, Kang, and Shively 2009). Of course, this congestion mitigation and reduction potential is only increased when combined with other efforts to discourage car use, such as the reduction or elimination of parking minimums and the expansion of transit and bike networks.

By definition, highway removal frees up significant land for potential public realm-enhancing uses. From new housing—including affordable housing—and commercial space to open space and linear parks, highway removal can transform a major disamenity into a mosaic of attractive, public-serving amenities. Crucially, these projects distinguish themselves as opportunities to ambitiously rethink entire urban corridors, a unique opportunity for many of America’s legacy urban public realms.

# Environmental Gentrification

While highway removal has the potential to transform neighborhoods for the better, its benefits are not always shared by all. Environmental improvements undertaken in vulnerable neighborhoods run the risk of displacing the very communities the improvements were intended to better. As land values increase, so do real estate speculation and rents, thus driving out low-income residents (Anguelovski et al. 2019). This phenomenon, called “environmental gentrification”, embodies an unfortunate irony: when successful, environmental justice activism may work against itself by contributing to the displacement of the people it aims to help (Checker 2011). While the literature on this topic focuses on climate resilience infrastructure and green space, this phenomenon can be appropriately applied to highway removal projects which similarly improve the public realm, health outcomes, and drive economic growth. Because U.S. highways were often intentionally built through low-income, minority neighborhoods which had less political capital to oppose highway construction, highway removal projects must be especially sensitive to their impact on surrounding communities.

# Highway Removal Without Community Displacement

Despite their risk of displacement, highway removal projects are also well-suited to strengthen communities, ensure local residents benefit, and create more equitable cities. Crucially, highway removal frees up a large area of contiguous, centrally-located,

publicly-owned land, thus presenting a unique opportunity to create a unified, effective plan for anti-displacement.

While not all anti-displacement strategies involve explicit changes to the built environment, highway removal projects present a unique opportunity to implement those strategies that do. In research about anti-displacement strategies, the production of housing, especially affordable housing, and community control of land are among those that have the greatest potential for resisting displacement (Chapple and Loukaitou-Sideris 2021). Several public agencies and researchers have recognized the concern of highway removal-induced displacement and have called for mitigation measures such as affordable housing expansion and land trusts to be implemented alongside highway removal projects (DiGiulio 2021; Transportation for America 2020; “Reconnecting Communities - FAQs” 2023). Research about highway removal projects suggests deed-restricted affordable housing development can slow rent growth (Patterson and Harley 2019). This research illustrates the potential of affordable housing and land trusts to mitigate the negative effects of gentrification that can result from highway removal projects. The hope is that a different approach to highway removal projects can better balance redevelopment along with providing residents with long-term stability and control over their neighborhoods.

This kind of holistic, context-sensitive planning requires intentional collaboration across traditional jurisdictional, disciplinary, and scalar boundaries. For example, whereas state departments of transportation often own the land under highways, ownership might need to be transferred to a municipality before it is developed as affordable housing or given to a community land trust. Traffic engineers, housing developers, municipal planners, urban designers, community residents, and business owners need to work together to create a unified vision with actionable strategies that lead to broadly equitable and sustainable outcomes.

# Case Studies:

## **The Transformational Potential and Risks of Urban Highway Removal**

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# Methodology

Highway removal projects across the country have taken different forms, each with a wide variety of success and failures. To better understand what factors govern the performance of highway removal projects, this thesis employs a case study approach to gain generalizable insights from a systematic, site-specific qualitative and quantitative analysis. Though highway removal projects could be analyzed using a range of lenses including vehicular traffic impacts, economic development, and public health outcomes, this thesis focuses on the following three principles.

## Sustainable Mobility

First and foremost, highway removal projects represent significant changes to a city's transportation infrastructure and to key assumptions about what modes of transportation should be prioritized where. Car-orientation, especially in the U.S., has been majorly detrimental to urban life and its legacy hinders long-term goals such as environmental sustainability and social equity. Vehicular transportation consistently ranks among the top contributors to climate change and air pollution (Environmental Protection Agency 2015). Moreover, car-oriented landscapes are extremely exclusive of low-income people, children and elderly populations. Finally, cars are a space-inefficient mode of transportation compared to transit, biking, and walking, especially in urban areas where land is scarce. Reducing automobility and encouraging more use of sustainable modes is necessary for cleaner, less carbon-intensive, more inclusive, and more efficient cities.

## Public Realm

Beyond changes to transportation, highway removal projects transform the land use and public realm of their surrounding neighborhoods. Highway removal allows cities to holistically reimagine entire corridors. These projects can turn severe disamenities to amenities, attracting people and economic development. Urban quality of life, in many ways, depends on a vibrant public realm. Highway removal projects have the opportunity to reallocate public land for uses such as green space, plazas, and mixed-use development, all the while activating ground floors and street frontage. Public realm improvements often serve a multitude of goals because they are interwoven with other physical systems such as mobility and environment. For example, a highway removal project which widens sidewalks and plants trees can encourage walking, increase access to transit, activate the streetscape, and mitigate the urban heat island effect.

## Anti-Displacement

Though highway removal has the potential to create far-reaching benefits for cities, these benefits are often not shared equally. The risk of community displacement following highway removal is particularly concerning given the displacement that occurred in the 20th century as a consequence of many highway construction projects. To end these cycles of displacement, cities need to invest in creating permanently affordable housing and protections for tenants. Current residents—especially historically marginalized residents—must be prioritized in planning processes

to avoid cycles of displacement. Because highway removal frees up significant public land, cities should prioritize using this land to mitigate displacement by building affordable housing and giving land to community land trusts. Moreover, highway removal planning processes must deeply engage residents to make sure the project addresses their needs and concerns, all while prioritizing the voice of low-income communities of color historically marginalized in decision-making. Because highway removal frees up significant public land, cities should prioritize using this land to mitigate displacement by building affordable housing and giving land to community land trusts.

## Case Study Selection

While some of the most familiar examples of highway removal involve waterfront highways replaced by boulevards, such as San Francisco's Embarcadero Freeway, Portland's Harbor Drive, or New York's West Side Elevated Highway, this thesis focuses on highway removal projects that have sought to re-stitch urban neighborhoods together. Whereas waterfront highway removal projects have mostly abutted downtowns and wealthier neighborhoods, inland projects have tended to be located in more vulnerable neighborhoods and be at higher risk of community displacement. These kinds of projects require special attention to ensure their benefits to sustainability and livability are enjoyed by current residents.

The San Francisco Bay Area, in particular, has been the site of some of the highest-profile highway removal projects in the country as a result of the 1989 Loma Prieta Earthquake which damaged much of the region's infrastructure. This earthquake created the political conditions necessary for highway removal to be considered seriously by local and state elected officials and public agencies as removal became a viable alternative to costly repairs and retrofits.

To conduct a fairer comparison, I only chose case studies from the Bay Area involving neighborhood re-stitching, specifically the Central Freeway removal in San Francisco and the Cypress Freeway removal in Oakland, both resulting from the 1989 earthquake. The site chosen for illustrating the design framework is the rest of the Central Freeway in San Francisco. These similarities make my findings more applicable to my design framework as both San Francisco and Oakland face significant development pressure and have been gentrifying over the past 30 years.

I also chose these case studies because of my personal familiarity with these neighborhoods and the region at large. Having grown up in Palo Alto (a southern suburb) followed by San Francisco and having visited the two case study corridors and the proposed removal corridor, I felt comfortable analyzing them systematically while ground-truthing the results with my own lived experience.

## Case Study Evaluation

Focusing on the three principles of sustainable mobility, public realm, and anti-displacement, both case studies are introduced, contextualized, and evaluated based on their ability to:

1. Shift regional mode split to reduce automobility and encourage more people to ride public transit, bike, and walk,
2. Enhance the public realm to foster vibrant urban life, and
3. Resist displacement of vulnerable communities.

Their performance is evaluated using a combination of secondary research, analytical drawings, analysis of spatial demographic data from the U.S. Census, and my personal lived experience of these two neighborhoods. Finally, a set of key takeaways is identified from the two projects' collective advantages and drawbacks to inform a justice-oriented highway removal framework.



# Principles and Criteria



## **Sustainable Mobility**

Shift regional mode split to reduce automobility and encourage more people to ride public transit, bike, and walk

(associated strategies are inextricably linked)



## **Public Realm**

Enhance the public realm to foster vibrant urban life



## **Anti-Displacement**

Resist displacement of vulnerable communities

# Octavia Boulevard

**(Former Central Freeway)**

*San Francisco, CA*

## Introduction

Octavia Boulevard opened to the public in 2005, replacing the former Central Freeway north of Market Street in the neighborhood of Hayes Valley. While facilitated by the freeway's destabilization by the 1989 earthquake, the removal was a result of a decade-long struggle between local Hayes Valley activists, the California Department of Transportation (Caltrans), local elected officials, and residents of the city's more car-oriented west side.

The freeway north of Fell Street was removed by Caltrans in 1991 because of structural concerns, thus daylighting Hayes Street, the neighborhood's main commercial corridor, and demonstrating the potential impacts of highway removal. The future of the section between Fell Street and Mission Street remained uncertain until 1999 with the passing of a ballot initiative pushed by local activists proposing removing the highway north of Market Street and building housing on the new parcels.

Octavia Boulevard and the adjacent former freeway parcels demonstrate the transformational potential of highway removal to revitalize a neighborhood and build new housing. However, given Hayes Valley's gentrification since the removal and the displacement of many longtime residents and businesses, this project also serves as a reminder to center anti-displacement principles and local communities in landmark urban redevelopment projects.

# The Central Freeway Becomes Octavia Boulevard

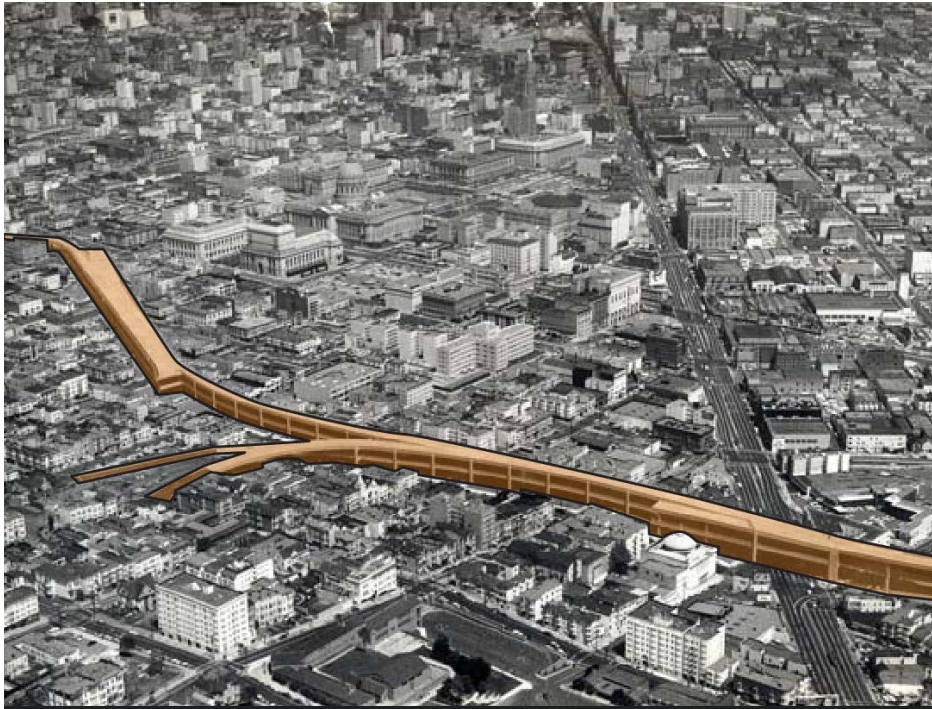


Figure 4: The recently built double-decker Central Freeway in 1965 (San Francisco Public Library)

The Central Freeway's construction significantly disrupted San Francisco's urban fabric. Residents and their homes were cleared to carve out a right-of-way. Often at least as tall as adjacent buildings, the structure towered over the neighborhood, blocking views and polluting the air.



Figure 5: Octavia Boulevard and infill development in 2023 (Google Earth)

The Central Freeway's removal restored much of the scale of the urban fabric that was destroyed for its construction. New development and open space has filled in gaps left by the main double-decker structure and its on- and off-ramps.

# Historic Images of the Central Freeway



Figure 6: Newly built freeway in 1959 (San Francisco Public Library)



Figure 7: Central Freeway over Hayes St. (San Francisco Public Library)



Figure 8: Central Freeway over Market St. (San Francisco Public Library)



Figure 9: Central Freeway blocking City Hall (San Francisco Public Library)

# Octavia Boulevard and Hayes Valley Today



Figure 10: Patricia's Green with rotating art installations (NACTO)



Figure 11: New market-rate housing (Bruce Damonte)



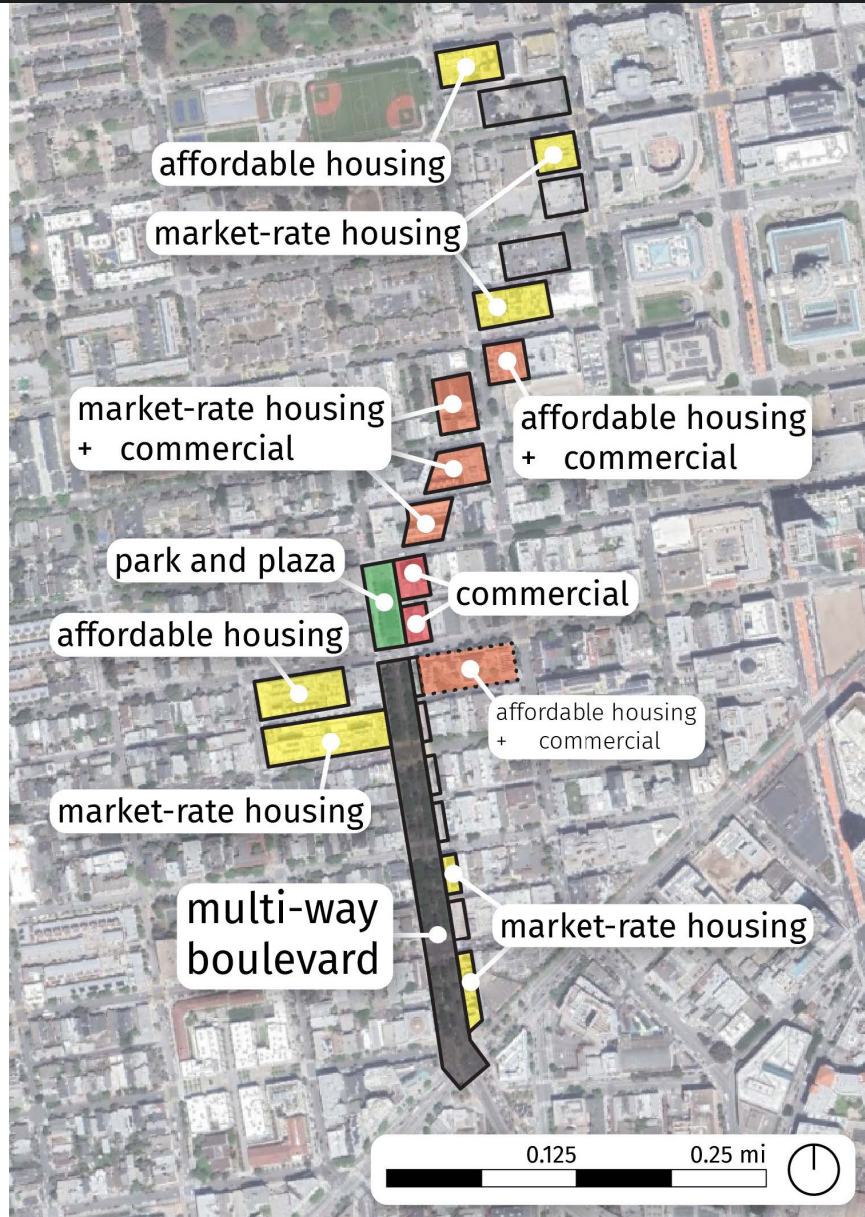
Figure 12: Traffic separation on Octavia Blvd (MIG)



Figure 13: New affordable housing for seniors (Rien van Rijnhoven)

# Octavia Boulevard New Land Uses

Figure 14: New land uses on former freeway parcels after the removal of the Central Freeway (Google Earth)



As the roughly  $\frac{3}{4}$ -mile Central Freeway corridor north of Market Street was removed, half of its land was converted to the multi-way Octavia Boulevard separating regional and local traffic with housing development on narrow parcels along the right-of-way, and half was developed as market-rate and affordable housing on larger parcels, often with retail on the ground floor. A park was created at the transition point between these two zones. Some freeway parcels have yet to be developed and are mainly used as community gardens or parking lots in the meantime. The removal also spurred adjacent housing and commercial development.

# Sustainable Mobility + Public Realm

Octavia Boulevard demonstrates several strategies to successfully transform a double-decker freeway breaking up a neighborhood into a boulevard which balances traffic throughput with a pleasant pedestrian experience.

Crucially, the boulevard serves two main purposes: connecting the west and north parts of San Francisco with regional destinations such as the East Bay, Silicon Valley, San José by funneling car traffic to and from via the current Central Freeway touchdown at Market Street as well as serving local car, bike, and pedestrian traffic around Hayes Valley. These two types of flows are separated by tree-planted medians, thus protecting pedestrians and bikers from some dangerous, fast-moving traffic. All intersections have 4-way crosswalks and left turns are mostly prohibited. While the boulevard suffers from severe congestion during peak hours and the excessive width of the local traffic lanes encourages speeding, it is generally viewed as a successful example of highway-to-boulevard conversion (King 2007).

Beyond the definitional public realm improvements resulting from increased light, air, views, and greenery previously blocked by a double-decker concrete elevated structure, the Central Freeway removal revitalized Hayes Valley by introducing ground-floor commercial space on many of the newly developed parcels. Moreover, planners created a new open space at the intersection of the local traffic extension of the boulevard—Octavia Street—and the neighborhood’s main commercial corridor—Hayes Street. This park, now named Patricia’s Green after one of the main neighborhood anti-freeway activists—Patricia Walkup, anchors the neighborhood through a mix of greenery, public seating, a play area, and rotating art installations. An adjacent lot freed up by highway removal hosts small-scale retail and programmed

open space. What was previously a noisy, polluted corridor and a “magnet for crime” was transformed into a lively, human-scaled corridor (Henderson 2013; King 2007).

While the Central Freeway’s removal clearly improved Hayes Valley’s public realm, it’s unclear if it has been a major contributor to a shift towards sustainable modes of transportation. In a post-removal survey of drivers who previously used the freeway, 66% used a different freeway, 11% used city streets, 2.8% didn’t make the trip, and only 2.2% shifted to public transit. However, 19.8% made fewer trips since closure (Cervero, Kang, and Shively 2009). Moreover, planners decreased parking minimums of 1 space per unit to 0.25-0.75 per unit for new developments along the boulevard (Cervero, Kang, and Shively 2009). The new corridor may have discouraged car use, but it didn’t do much to improve San Francisco’s transit system beyond enhancing pedestrian access to existing bus stops and light rail stations.

# Octavia Boulevard Section

Octavia Boulevard mostly successfully balances a pleasant pedestrian experience, slower local traffic flows, and faster regional traffic flows by using planted medians to separate flows by speed. However, the local traffic lanes—shared between cars and bikes—are just as wide as the regional traffic lanes, thus encouraging speeding. New infill development on narrow parcels activates the streetscape by opening onto the boulevard.

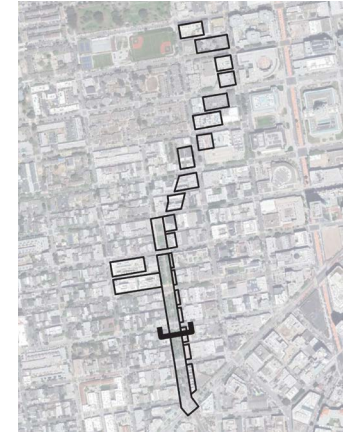
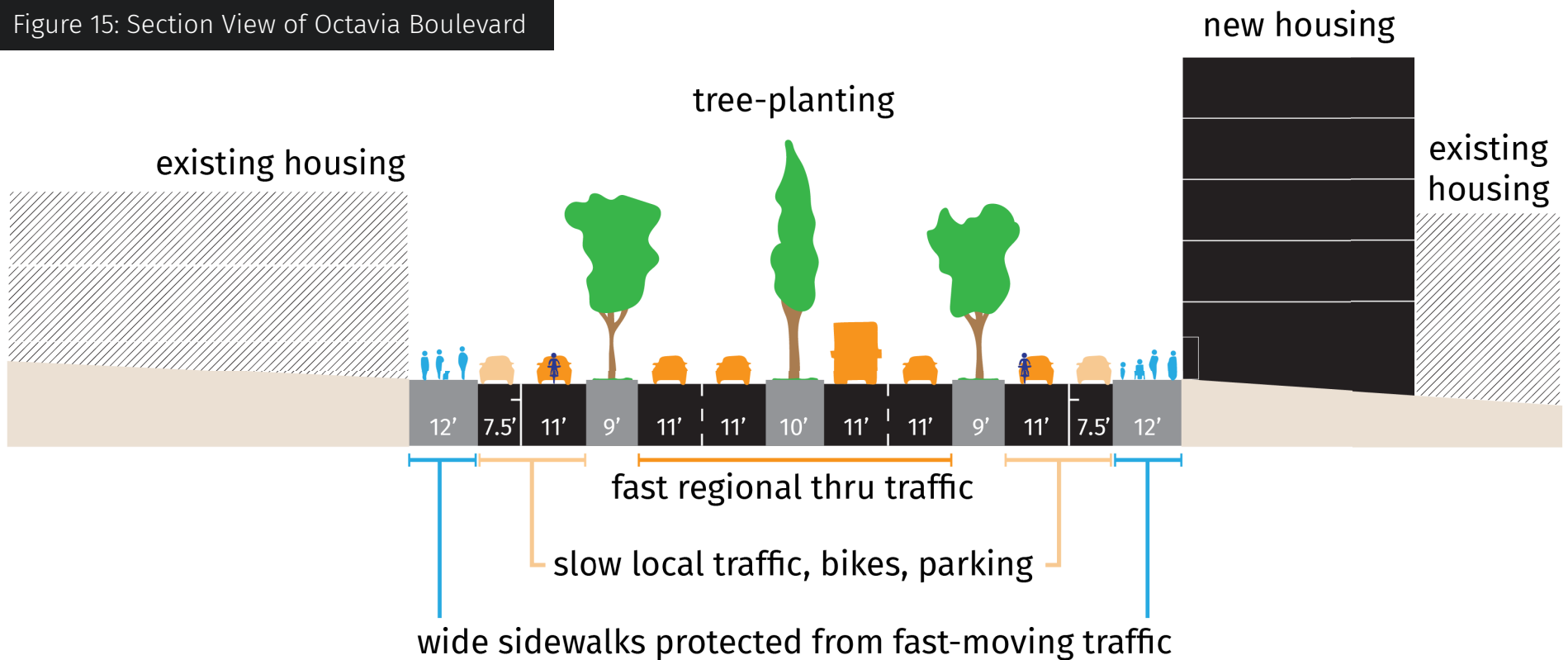


Figure 15: Section View of Octavia Boulevard



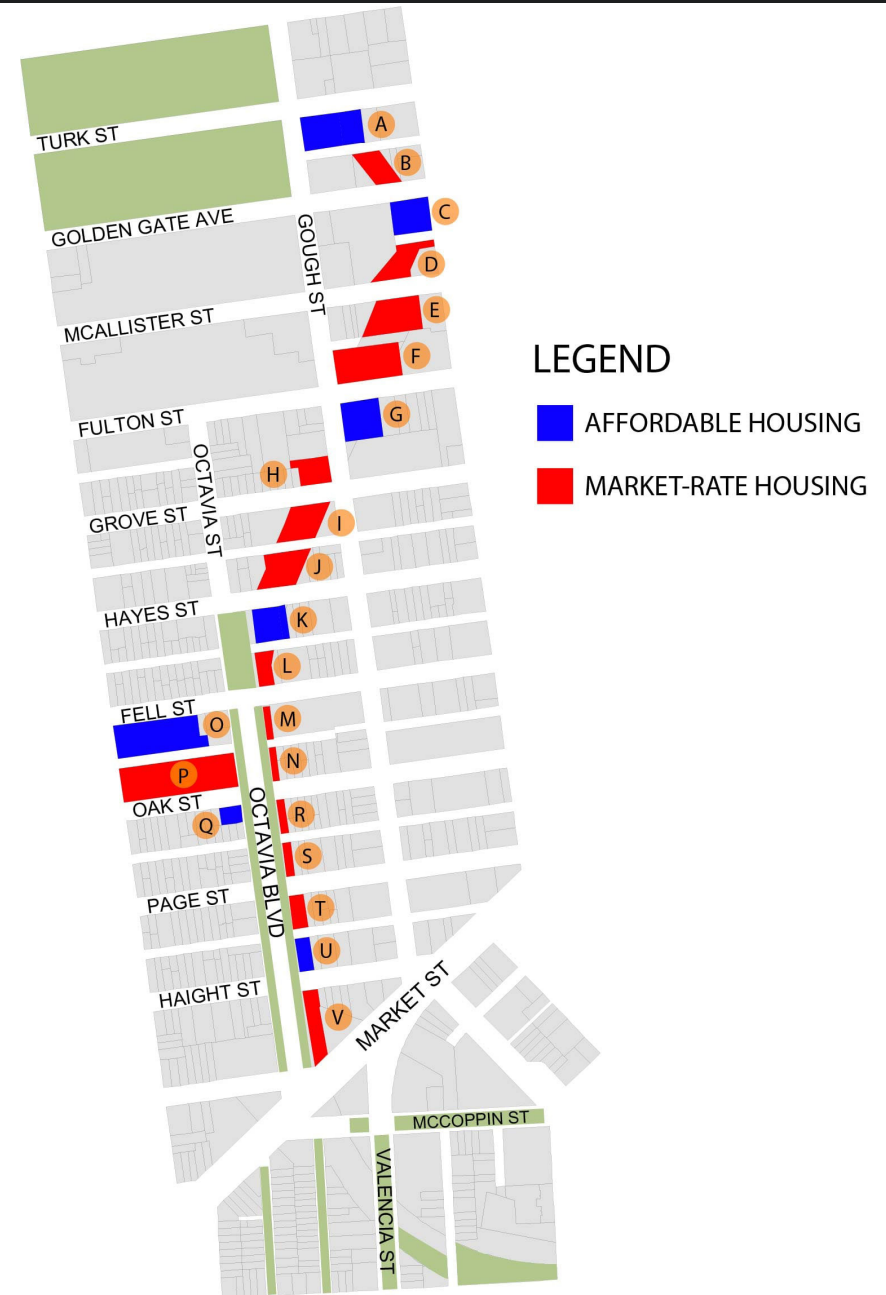


# Anti-Displacement

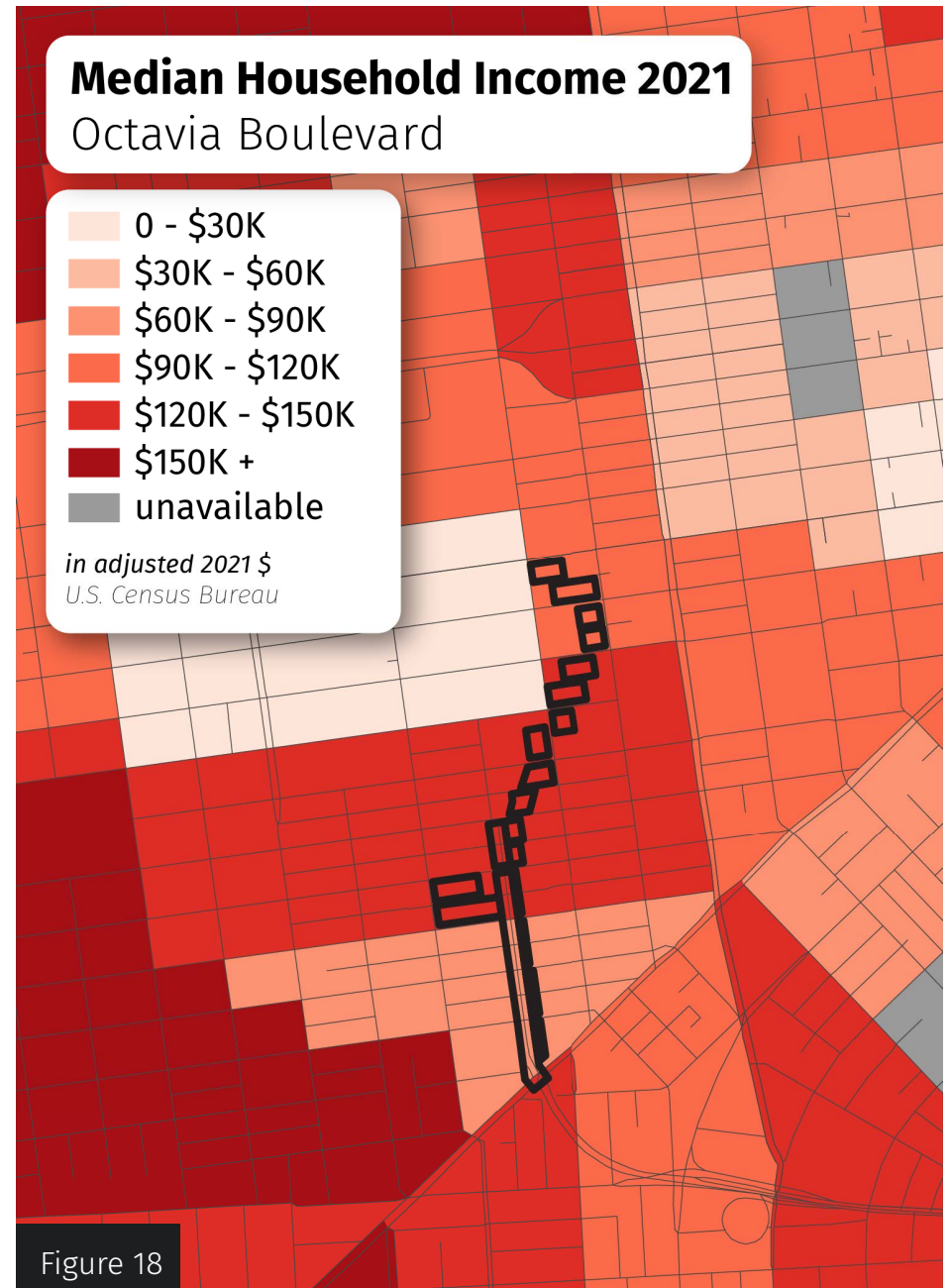
In a city facing a housing affordability crisis and development pressure, the opportunity to holistically plan for and develop multiple blocks of market-rate and affordable housing on 22 adjacent parcels in a centrally-located, transit-rich neighborhood is a rare one. Moreover, planners proactively planned to resist displacement of current residents and ensure a mixed-income neighborhood through affordable housing preservation and development (San Francisco Planning Department 2008). Once all parcels are developed, this highway removal will have directly resulted in 989 new housing units, 500 of which (51%) are designated affordable below market-rate.

However, gentrification and displacement have nonetheless occurred in Hayes Valley since the Central Freeway's removal. The neighborhood has grown wealthier and whiter. Between 1990 and 2000, the amount of White residents increased 32.9% while the amount of Black residents decreased 35.9% (Cervero, Kang, and Shively 2009). Figures 17 and 18 show a significant increase in inflation-adjusted median household income in Hayes Valley from 1990 to 2021. Figures 19 and 20 show that Hayes Valley lost Black residents and gained White residents, especially in areas close to Octavia Boulevard. Because San Francisco experienced gentrification citywide during this period, it is difficult to isolate the Central Freeway's removal's impact on displacement. Nonetheless, it is clear the project could have done more to ensure more equitable outcomes.

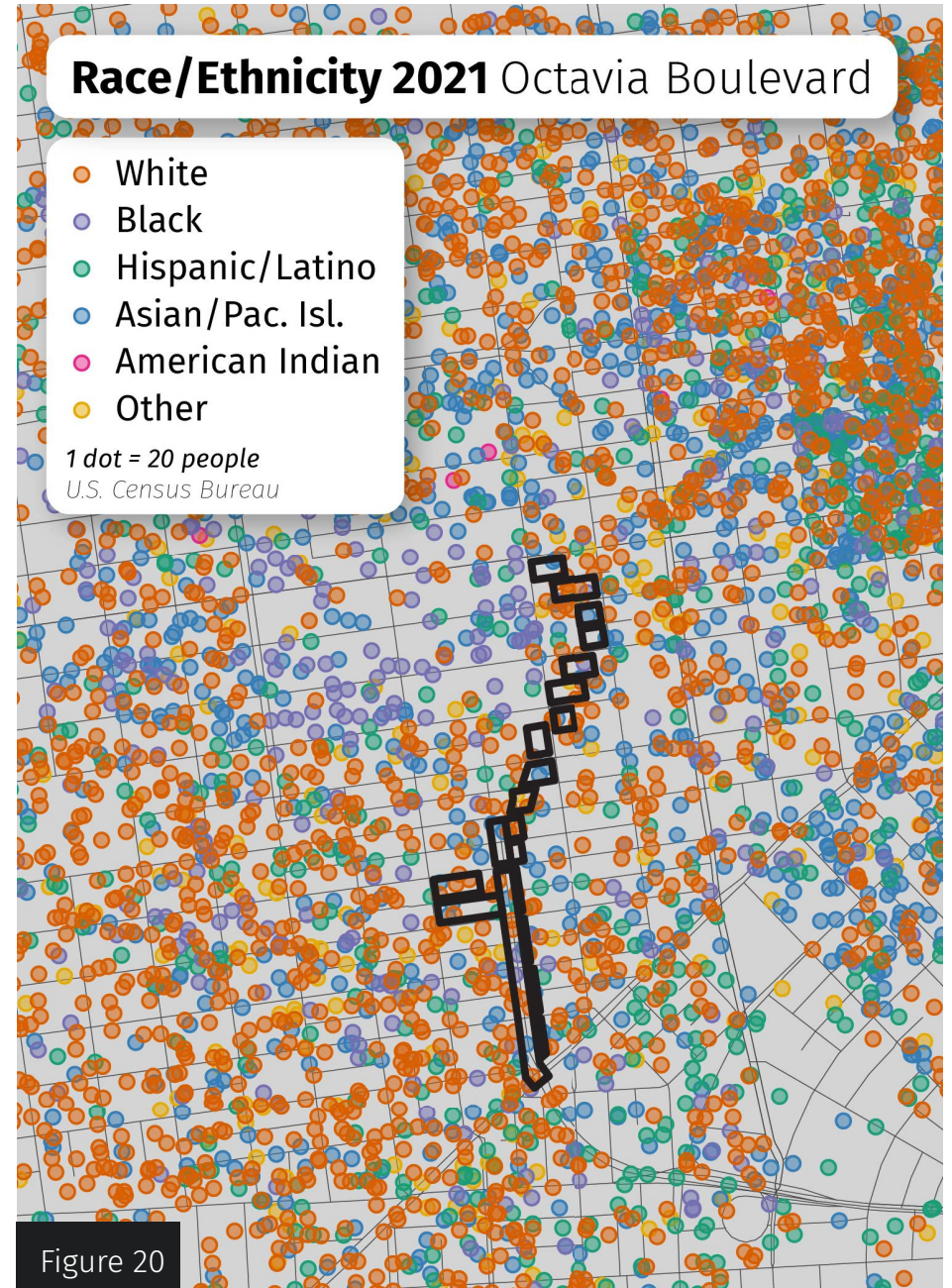
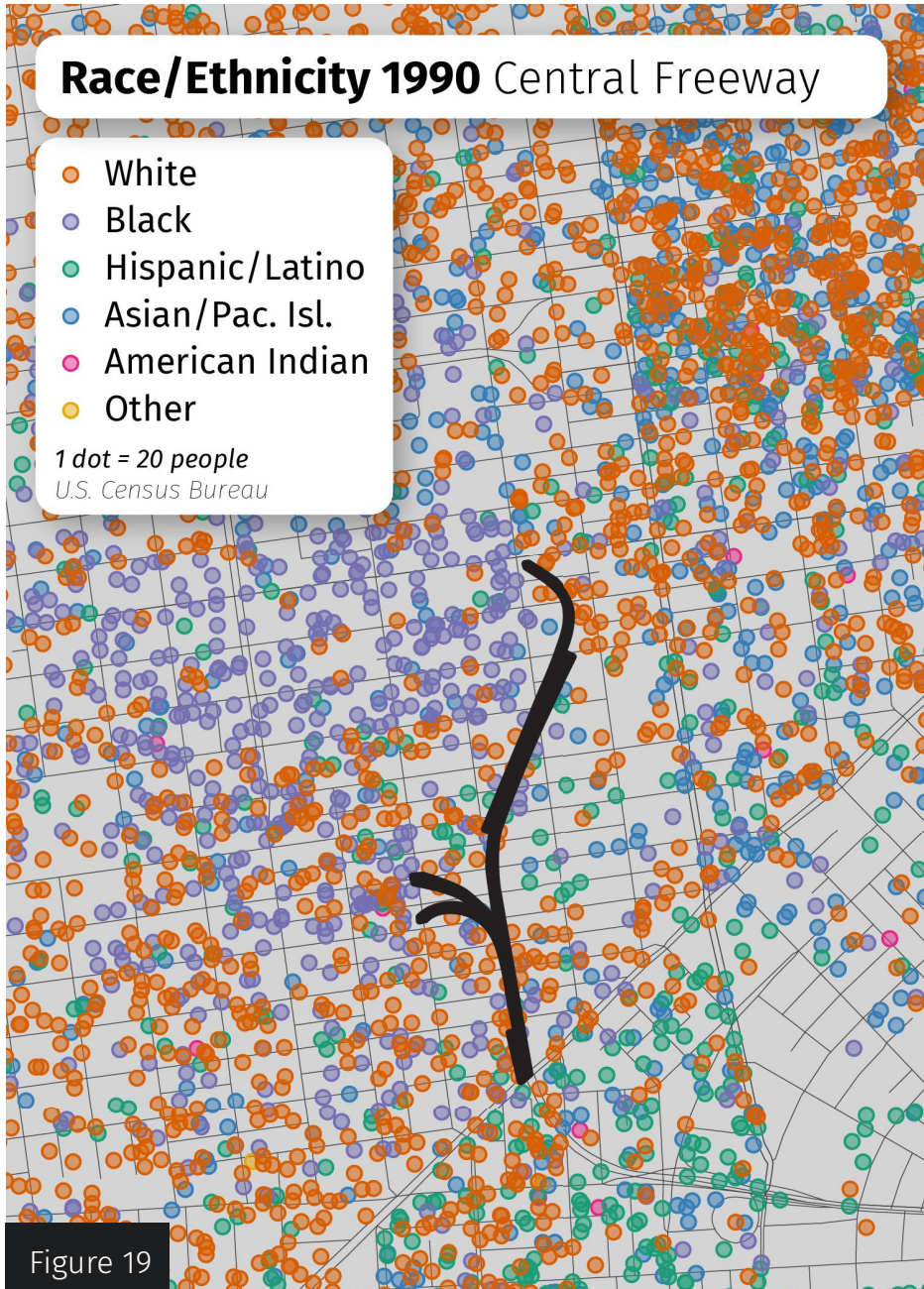
Figure 16: Affordable and market-rate housing development along the former Central Freeway corridor (San Francisco Planning Department)



# Demographic Shifts: Income



# Demographic Shifts: Race



# Mandela Parkway

**(Former Cypress Freeway)**

*Oakland, CA*

## Introduction

Mandela Parkway opened in 2005, replacing the double-decker Cypress Freeway (I-880) from 5th Street to I-580 through West Oakland. Unlike the Central Freeway, the Cypress Freeway collapsed during the 1989 earthquake, tragically claiming 42 lives. A decade-long process involving Caltrans and community groups resulted in a rerouted freeway around the half-residential, half-industrial neighborhood and the conversion of the former right-of-way into a parkway named after South Africa's anti-apartheid leader and first Black president, Nelson Mandela.

Initially, Caltrans proposed rebuilding the highway along the same corridor. However, the 1969 National Environmental Policy Act required public involvement on the project, thus empowering local residents to contribute to the planning process (Praetzellis, Praetzellis, and Van Bueren 2007). Community groups organized in the name of environmental justice and revitalization to move the highway out of West Oakland, citing air and noise pollution concerns. While the final proposal to reroute I-880 along the edge of West Oakland adjacent to the Port of Oakland did not meet all of the community's demands, mitigation measures were enacted such as local hiring programs for the rerouting project, toxic waste cleanup, and, crucially, a landscaped boulevard along the former freeway alignment (Praetzellis, Praetzellis, and Van Bueren 2007).

Mandela Parkway and the transformation of West Oakland demonstrate the possibility of highway removal through residential and industrial areas and the use of state transportation resources for community improvements. This project also tells a cautionary tale about community displacement and the long-term commitment needed for highway removal-spurred development.

# The Cypress Freeway Becomes Mandela Parkway

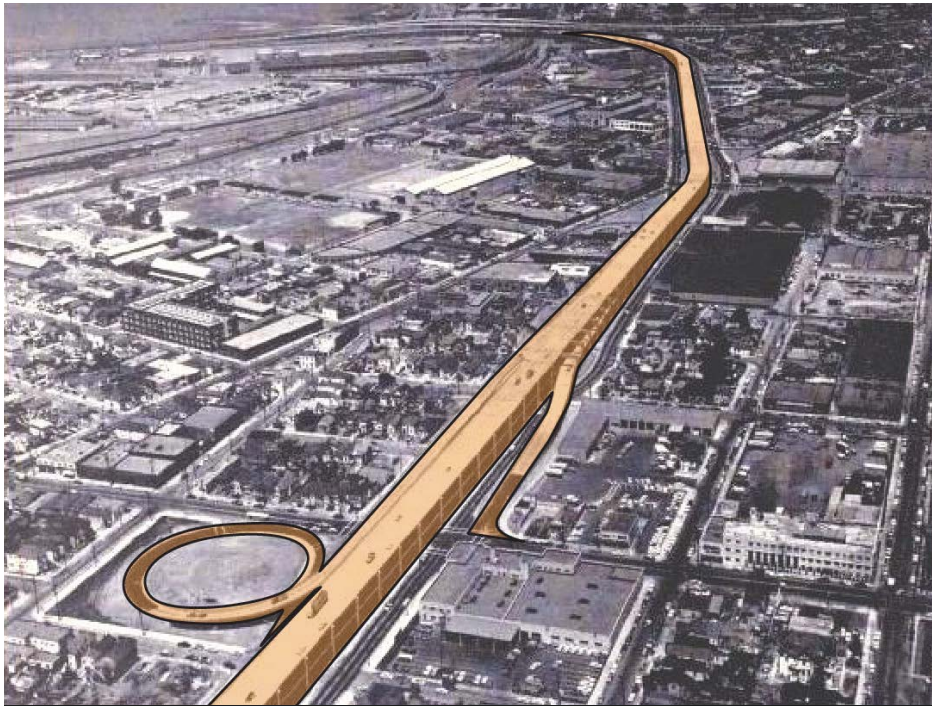


Figure 21: The recently built Cypress Freeway in 1958 (California Highways and Public Works)

The Cypress Freeway's construction divided West Oakland. Taller than most surrounding buildings, the double-decker freeway was an imposing, disruptive force on the neighborhood. It was lined by frontage roads and often separated residential and industrial uses.



Figure 22: Mandela Parkway in 2023 (Google Earth)

The Cypress Freeway's removal and replacement by Mandela Parkway transformed the corridor from a divider to a . Mandela Parkway features a wide median park along its entire length. Not much freed up land was devoted to infill development. The land formerly occupied by a looping off-ramp was converted to a memorial park for the victims of the earthquake.

# Historic Images of the Cypress Freeway



Figure 23: Land cleared to build Cypress Freeway (Oakland Tribune Collection)



Figure 24: Cypress Freeway ramps (Remembering 7th Street)



Figure 25: The double-decker Cypress Freeway (California Highway and Public Works)



Figure 26: Cypress Freeway collapse during the 1989 Loma Prieta Earthquake (Jim Sugar/Corbis Historical)

# Mandela Parkway Today

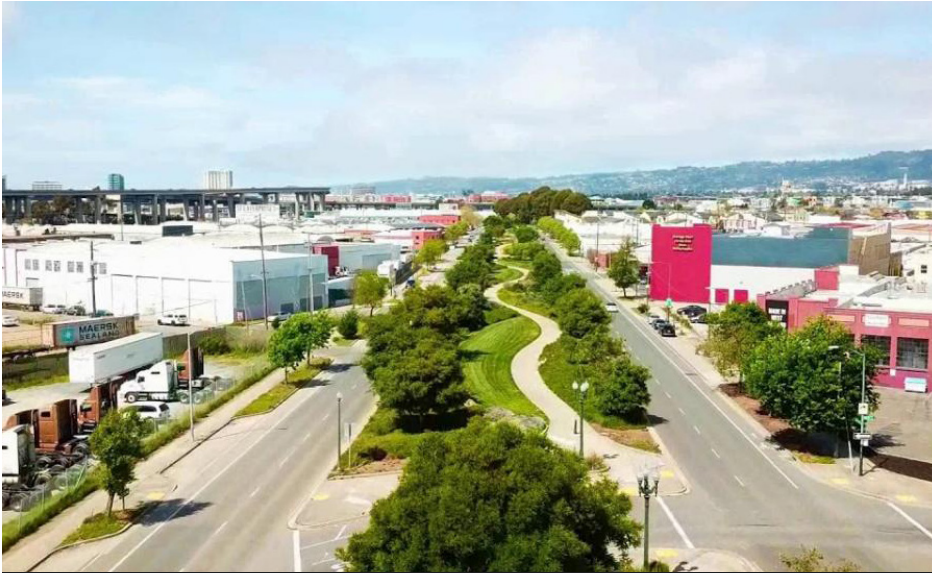


Figure 27: Mandela Parkway with park in median (fscotthumphrey)



Figure 28: New affordable housing, street facing (Bridge Housing)



Figure 29: Interior of new affordable housing (Bridge Housing)



Figure 30: Industrial building converted to art studios (AMSteel)

# Mandela Parkway New Land Uses

Figure 31: New land uses on former freeway parcels after the removal of the Cypress Freeway (Google Earth)



As the roughly 1¾-mile Cypress Freeway was removed, most of it was replaced by Mandela Parkway, a four-lane road with a linear park in its median—a unique amenity in Oakland. The removal did not free up as many developable parcels compared to Octavia Boulevard. What was freed up has been developed as affordable housing, parks, and a fire station. The removal also spurred adjacent development and conversions of industrial space into other uses.



# Sustainable Mobility + Public Realm

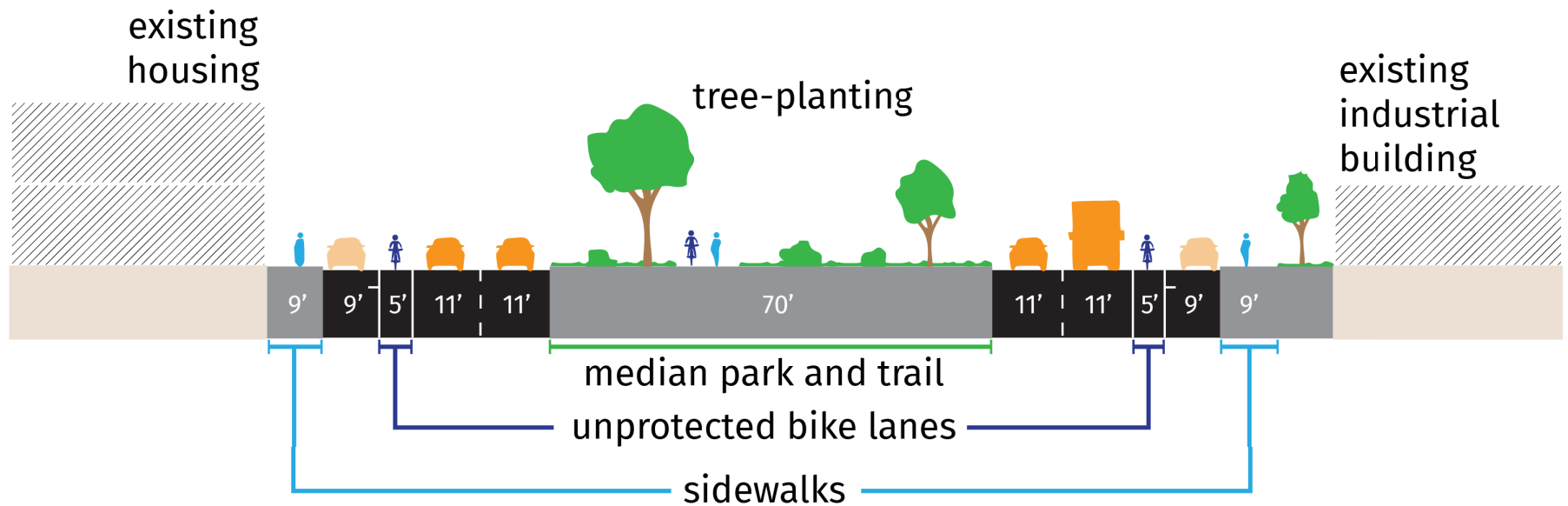
It's fair to say that I-880's rerouting and the creation of Mandela Parkway have completely transformed the experience of public life and mobility in West Oakland. The parkway features a linear park and trail in its 70-foot median which connects to the regional waterfront Bay Trail at both ends. This pedestrian- and bike-friendly design promotes active transportation and encourages residents to engage in outdoor activities. Mandela Parkway represents a unique kind of amenity in Oakland, especially in a significantly industrial area such as West Oakland. A new park built on the former site of a looping freeway ramp memorializes the victims of the earthquake (Brown 2005). Moreover, studies indicate a reduction in air pollution in the form of nitrous oxide (-38%) and black carbon (-25%) resulting from the project (Patterson and Harley, 2019). However, it is worth noting that other than pedestrian improvements around West Oakland BART station, this project did not include any improvements to the transit system, making it less effective in contributing to mode shift. Additionally, the portion of the parkway abutting industrial uses largely lacks frontage, resulting in low foot traffic.

# Street Section

Mandela Parkway boasts a wide linear park in its median, significantly adding to West Oakland's green space. The highway removal improved the pedestrian experience both by enhancing the sidewalks and by creating a dedicated trail in the median park. Bikers can also use the median trail or the bike lanes on either side, though the lanes are unprotected from car traffic. Buildings on either side were mostly left untouched and no infill development opportunities were opened up along Mandela Parkway. Combined with many backs and sides of industrial buildings facing the parkway, the streetscape is left somewhat unwelcoming.



Figure 32: Section View of Mandela Parkway



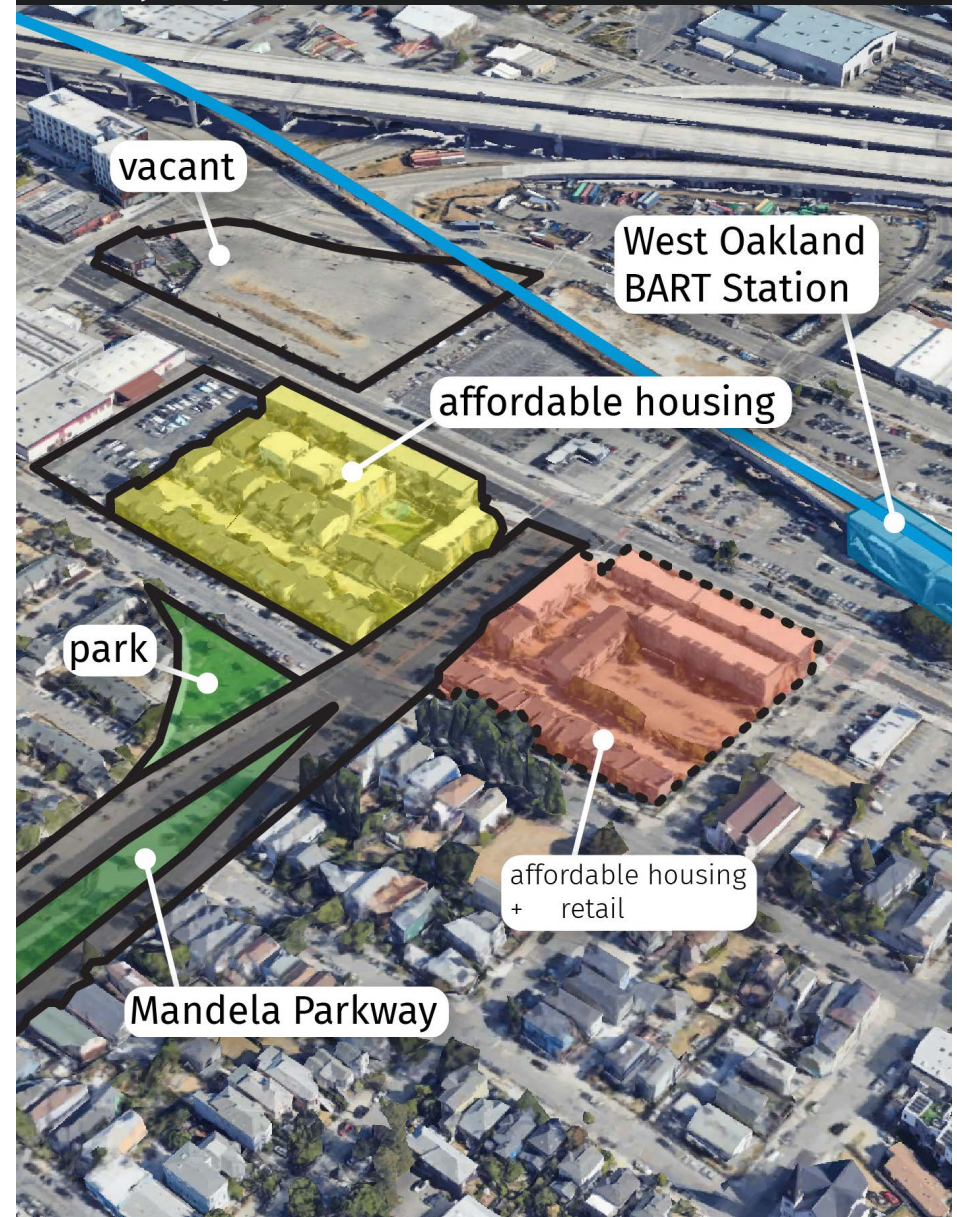
# Anti-Displacement

The Cypress Freeway's rerouting and reimagining of the Mandela Parkway corridor has had mixed results in terms of ensuring neighborhood improvements are shared equitably. The construction of a 100% affordable, 168-unit development called Mandela Gateway on a newly available parcel at the south end of the corridor provided much-needed affordable housing options (Buttenwieser 2020). However, a large former freeway parcel just south of Mandela Gateway has yet to be developed, leaving the large parcel vacant for over 20 years.

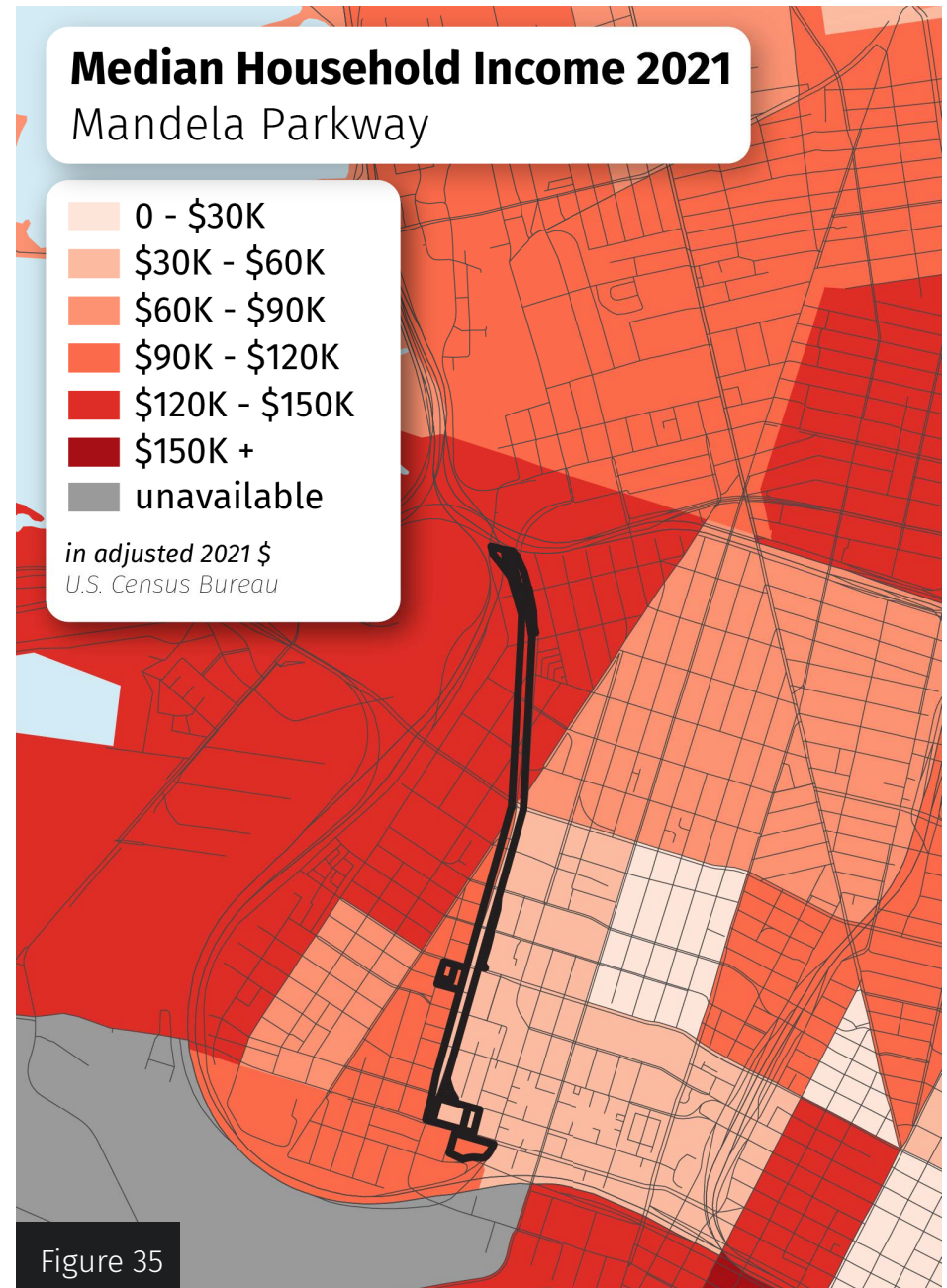
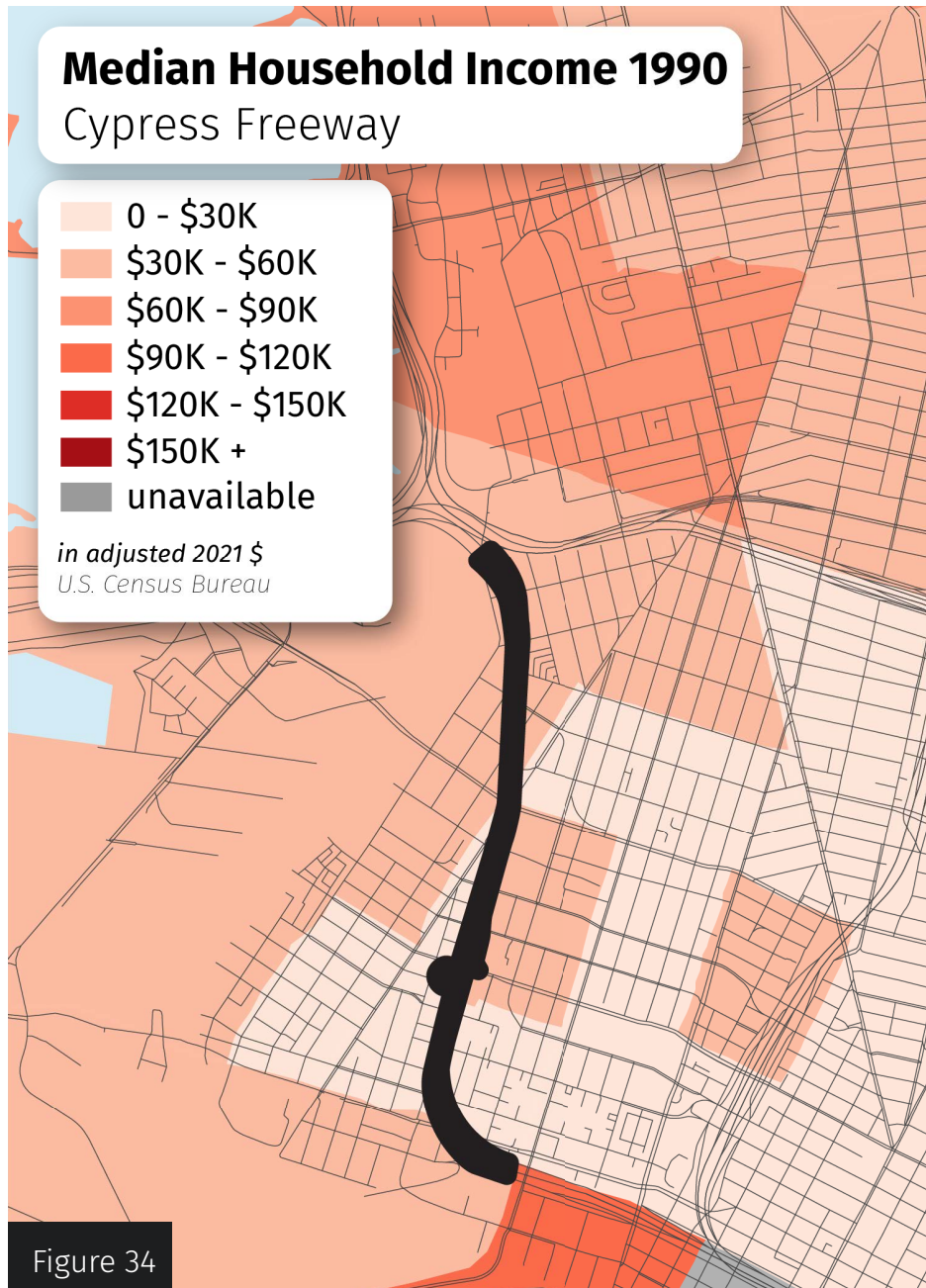
West Oakland, a predominantly low-income African-American neighborhood in the 1990s, also experienced gentrification and displacement, with a rise in higher-income and predominantly White and Hispanic/Latino residents (DelVecchio 2000), accompanied by a decrease in the Black population by 28% (Patterson and Harley 2019). Figures 34 and 35 show a significant increase in inflation-adjusted median household income in West Oakland from 1990 to 2021. Figures 36 and 37 show that West Oakland lost Black residents and gained White and Hispanic/Latino residents in the same period. Because Oakland experienced gentrification citywide during this period, it is difficult to isolate this removal's impact on displacement.

While rents in the entire neighborhood rose significantly, recent research shows rents closer to Mandela Parkway rose slower, possibly because of deed-restricted affordable housing developments such as Mandela Gateway (Patterson and Harley, 2019). However, overall housing development in the area, affordable or not, has been limited, indicating a missed opportunity to address the housing shortage and mitigate displacement pressures effectively.

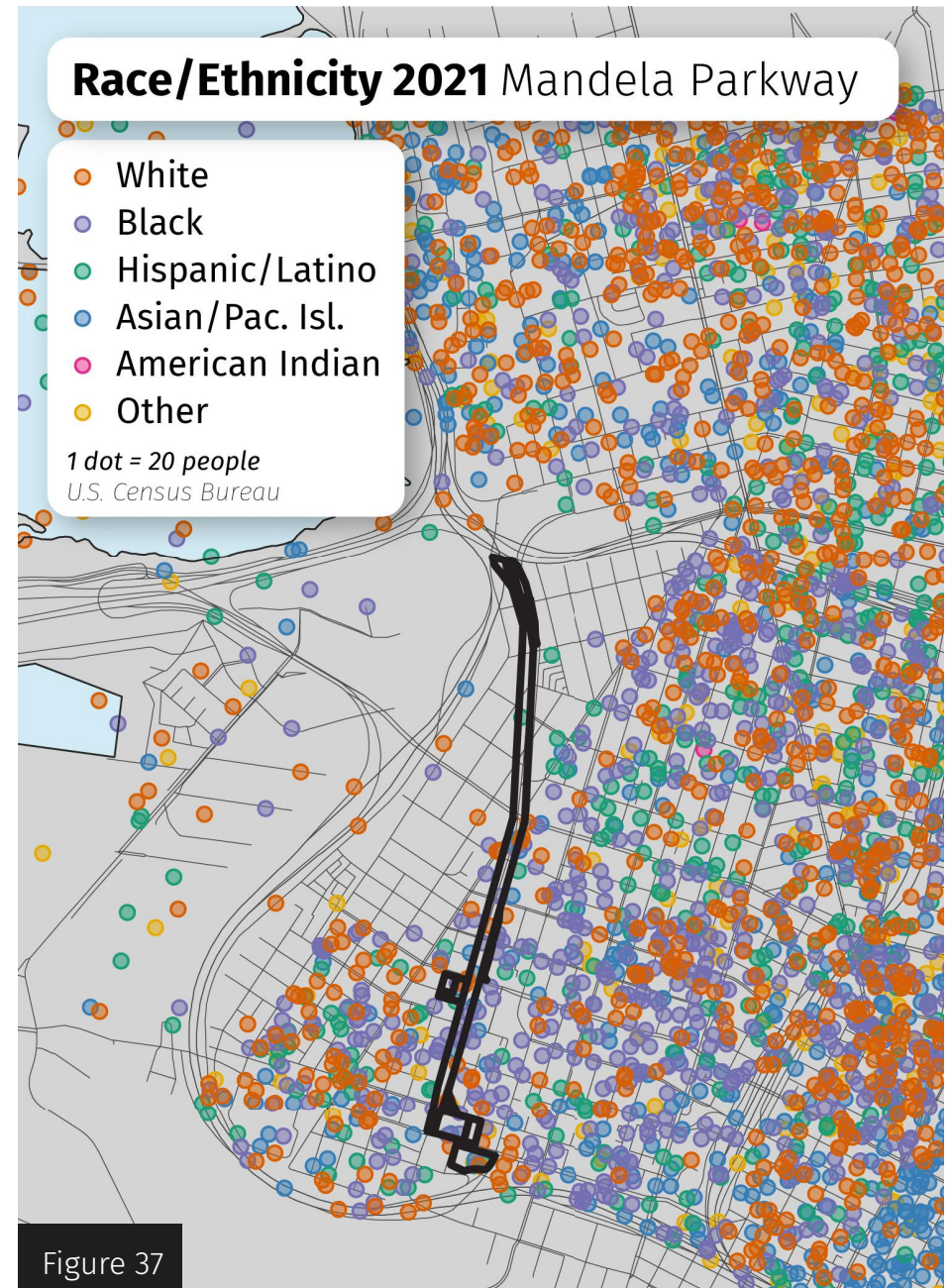
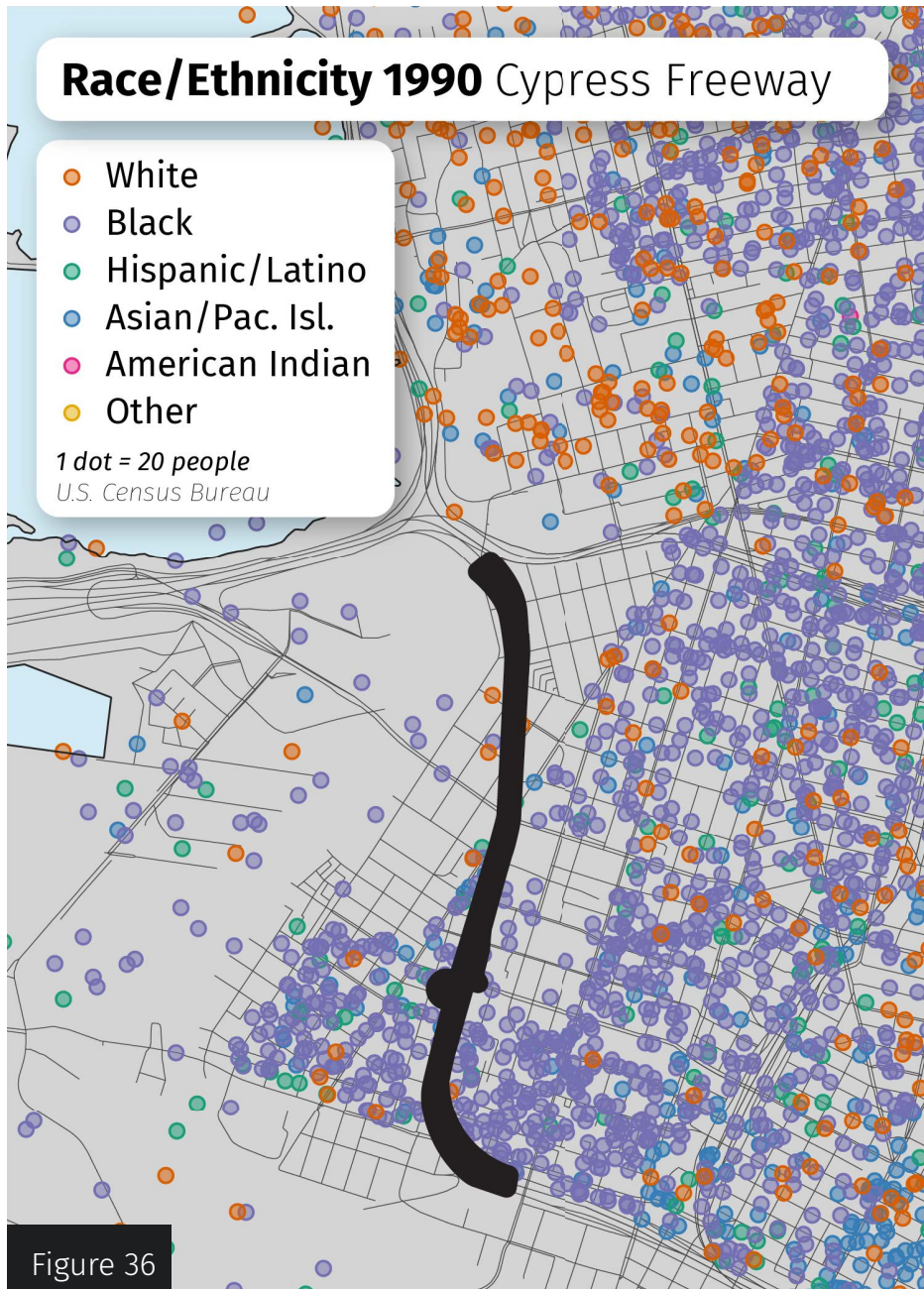
Figure 33: Affordable housing development along Mandela Parkway (Google Earth)



# Demographic Shifts: Income



# Demographic Shifts: Race



# Key Takeaways

Octavia Boulevard and Mandela Parkway are rich examples of both the transformational potential and risks of highway removal projects.

Overall, the public realms of Hayes Valley and West Oakland were significantly improved as a result of highway removal. The pedestrian experience was enhanced through wide sidewalks, traffic separation, and a trail. New public green spaces were created on former freeway parcels. In Hayes Valley, infill development was designed to activate the ground floor with retail and ensure a vibrant streetscape by creating frontage along Octavia Boulevard. However, the uneven pace of development means that parcels freed up by highway removal may remain vacant for decades.

Both Octavia Boulevard and Mandela Parkway somewhat improved sustainable mobility. Octavia Boulevard shows how regional traffic can be retained while lessening the negative impacts of automobility through traffic separation. Basic bike improvements on both corridors expanded the local bike network. However, neither project directly expanded public transit despite the unique opportunity to reimagine a new corridor. Likely as a result, directly measured mode shift was low.

These case studies also had mixed outcomes for their ability to resist and mitigate community displacement. In both cases, freeway parcels were used to build affordable housing, with notably many cases of 100% affordable housing. However, it seems no other anti-displacement strategies were employed. To avoid displacement, highway removal planning needs to be more multi-jurisdictional, multi-disciplinary, and multi-scalar. We need to think of highway removal not as just transportation projects, but as holistic redesigns of corridors that integrate mobility, housing, and environmental systems.

# Advantages

# Drawbacks

## Sustainable Mobility



- Boulevards can balance regional traffic and local sustainable mobility
- Traffic is surprisingly adaptive post-removal
- Bike improvements are relatively easy and high impact

- New rights-of-way weren't used to expand transit
- Directly measured mode shift was low

## Public Realm



- Opportunity to create new green spaces and activate public space
- Removal can be effective in both mixed-use residential and industrial areas

- Uneven development leaves some parcels vacant for a long time

## Anti-Displacement



- Opportunity for significant affordable housing development
- Opportunity for high percentage of affordable housing units

- Need for more displacement mitigation
- Only relying on affordable housing is not enough

# Planning//Design

## Framework:

**Sustainable, Livable  
Development without  
Displacement through  
Highway Removal**

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# Highway Removal Framework

## Introduction

How can key lessons from Octavia Boulevard and Mandela Parkway be applied to future highway removal projects, both in the Bay Area and across the country? How can successes be replicated and failures be corrected? What does a highway removal project that encourages sustainable mobility, enhances the public realm, and resists displacement look like?

The following justice-oriented framework aims to address these questions by identifying key dimensions of inquiry, planning, and design needed for more equitable, sustainable outcomes. Later, some of these dimensions are explored through a design exercise: the removal of the rest of San Francisco's Central Freeway from Market Street to I-80.

This framework aims to distill key approaches to equitable, sustainable highway removal planning gleaned from the case studies and previous research. While emerging from the specific context of the Bay Area, the hope is that this framework can inform and improve highway removal projects across the country. These tools can be used by planners, policymakers, and activists to more holistically understand and frame the opportunities and challenges these kinds of projects face. This framework assumes a single urban highway removal project in a context of government will to address mistakes and harms of the past and work with communities to envision a better future.

# History

Situate this project in the city's transportation, urban design, and political history.

- How did this highway come to be? Why was it built? Who was it built for?
- What did it replace? Who was displaced to build the new right-of-way?

# Extent of Removal

Identify exactly which corridor you are examining and how radically it should be transformed. This decision will have ripple effects on the other factors.

- What kind of highway is it currently? At-grade? Elevated? Sunken?
- How much of it should be removed? Is there a key vehicular link that should be kept limited-access?
  - What is the structural status of the highway? Is it in good condition? Is it in disrepair?
  - Is there a portion of the current structure that could be adaptively reused? Could it become a transit right-of-way? Or a linear park?

# Parcels

Identify which parcels will be freed up by the highway removal. These are the bounds of the direct impact the highway removal project can have. These will likely be:

- Small, narrow parcels on the sides of the right-of-way
- Larger parcels where major on- and off-ramps are currently located
- Infill parcels not to be replaced by an at-grade right-of-way

These parcels are likely owned by a state department of transportation who will need to transfer ownership to the municipality for appropriate land use allocation.

# Sustainable Mobility

Identify opportunities to leverage this highway removal project to improve and expand the city's transit, bike, and pedestrian networks.

Analyze how the corridor fits into the city and region's transit system.

- How is the corridor served by transit now? Is this service well-placed to absorb former freeway trips and encourage more transit ridership?
- Could an existing line be extended? Or should a new line be created? What anchors can it connect?
- If the new right-of-way carries freeway-bound traffic, how will conflicts between this traffic and a new transit service be managed?

Analyze how the corridor fits into the city and region's bike system.

- How is the corridor served by bike facilities now? Are there gaps in the bike network it can strategically fill?

Analyze how the corridor fits into the city's pedestrian infrastructure system.

- Does the corridor hinder pedestrian movement? Across the corridor? Along the corridor?

# Land Use

Analyze the surrounding land uses. These will determine the starting point of the corridor's character.

- What land uses line the corridor?
- Are there opportunities for indirectly influencing development on privately owned land? Are there vacant parcels and buildings? Are there any underused surface parking lots?

# Public Realm

Analyze the surrounding public realm. It has an immense potential for transformation as a result of highway removal.

- What is the current pedestrian experience at the ground level? How can it be improved?
- How do buildings interact with the corridor? Do their entrances face it? Or are their backs and sides turned towards it?
- What are current generators of activity and foot traffic?
- What green and open space exists along the corridor? Is it enough?

# Community Engagement

Engage those who would be most affected by the highway removal.

- Who currently lives along the corridor?
- What challenges do they face and what opportunities do they have?
- What priorities do they have in terms of land uses? Housing? Open space? Economic opportunities? Arts and culture?

# Anti-Displacement

Identify the most appropriate strategies for mitigating and resisting community displacement all the while prioritizing the most vulnerable communities.

- Where can affordable housing be developed?
- What parcels could the city give to a community land trust for stewardship?
- Is there existing affordable housing that needs preservation?

# Governance

Identify key stakeholders needed to accomplish a sustainable, equitable highway removal project.

- Who owns the land under the highway?
- Who are the most relevant institutional stakeholders? The state department of transportation? The planning department? The housing authority? The parks department?
- How can these stakeholders collaborate across jurisdictions, disciplines, and scales?

# A Sustainable, Equitable Vision for San Francisco's Central Freeway

As an illustration of this framework on a real project, I propose removing the rest of the Central Freeway, from Market Street to I-80. The public realm success of Octavia Boulevard is clear. This project would ideally physically extend Octavia Boulevard south of Market Street, proactively address its drawbacks in terms of sustainable mobility and displacement, all the while responding to the unique mixed-use/industrial neighborhood conditions present at the border between the Mission District and South of Market. Both local residents (Mullaney 2022a) and State Senator Scott Weiner (Mullaney 2022b) have called for this highway's removal. It seems this project is gaining some political momentum. In fact, San Francisco's General Plan calls for a study of the impacts of removing the rest of the Central Freeway:

*"A comprehensive study of benefits and impacts of removal of the Central Freeway south of Market Street should be conducted. This study should include analysis of the impacts and benefits on surrounding neighborhood livability, local and regional transportation, especially Muni and regional transit services, and economic impacts. (San Francisco Planning Department n.d.)"*

This proposed removal project lies in the context of a city whose Regional Housing Needs Allocation (RHNA), developed in 2021, calls for the construction of 82,069 new housing units in the next 8 years, of which 40% need to be affordable to low income (50-80% area median income) and very low income (<50% area median income) households (ABAG 2021). This represents a 22% increase in housing units. San Francisco has also designated itself as "transit-first" with a policy, last amended in 2007, stating:

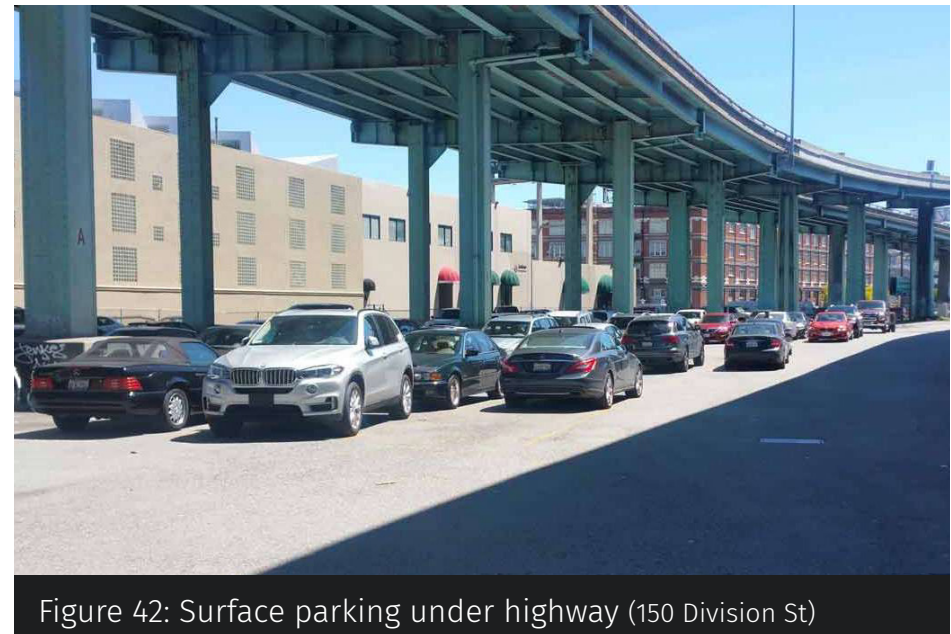
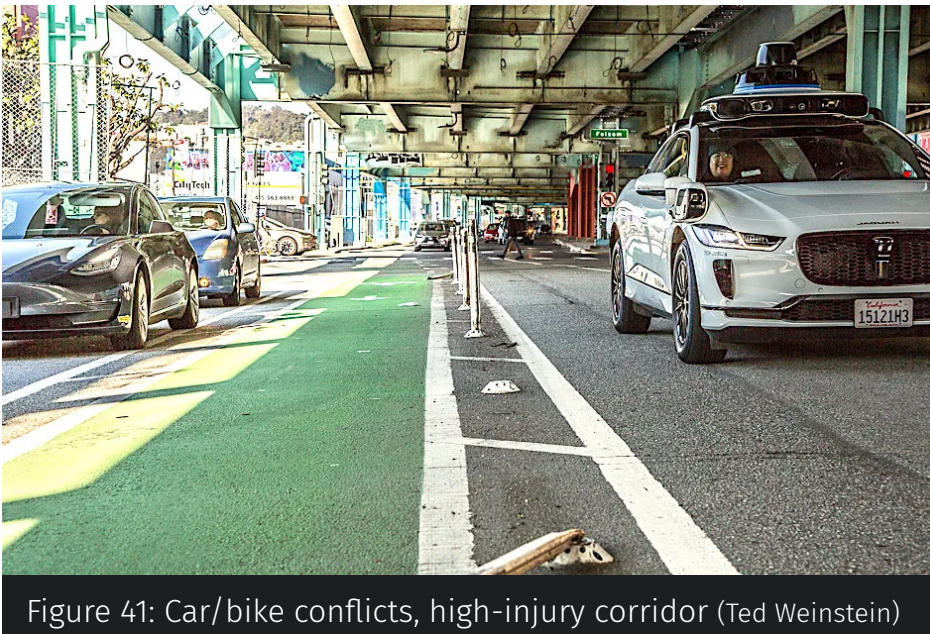
*"Decisions regarding the use of limited public street and sidewalk space shall encourage the use of public rights of way by pedestrians, bicyclists, and public transit, and shall strive to reduce traffic and improve public health and safety" ("Transit-First Policy" 2007).*

# The Central Freeway Today



Figure 38: Aerial view of the Central Freeway (Google Earth)

# The Central Freeway Today



# History

The construction of the Central Freeway in 1959 involved the destruction of a dense urban fabric to carve out a wide right-of-way for an elevated highway. While a portion of the freeway in Hayes Valley north of Market Street was removed after the 1989 Loma Prieta Earthquake, the portion south of Market Street remains. The removal of this portion would aim to restore some of the original fabric while maintaining the existing surface-level road.



Figure 43: Central Freeway in 1938 (Google Earth)



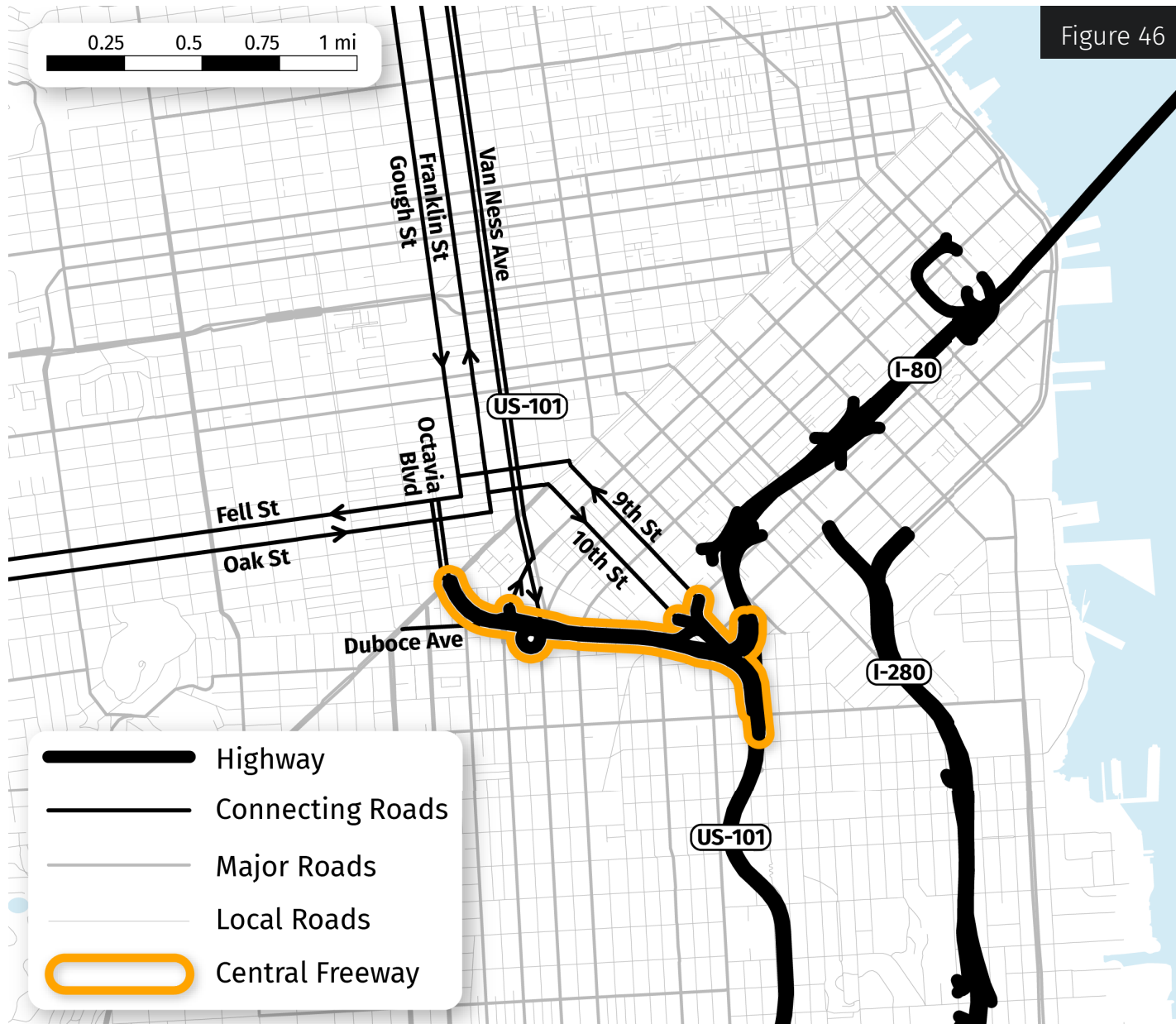
Figure 44: Central Freeway in 1987 (Google Earth)



Figure 45: Central Freeway in 2022 (Google Earth)

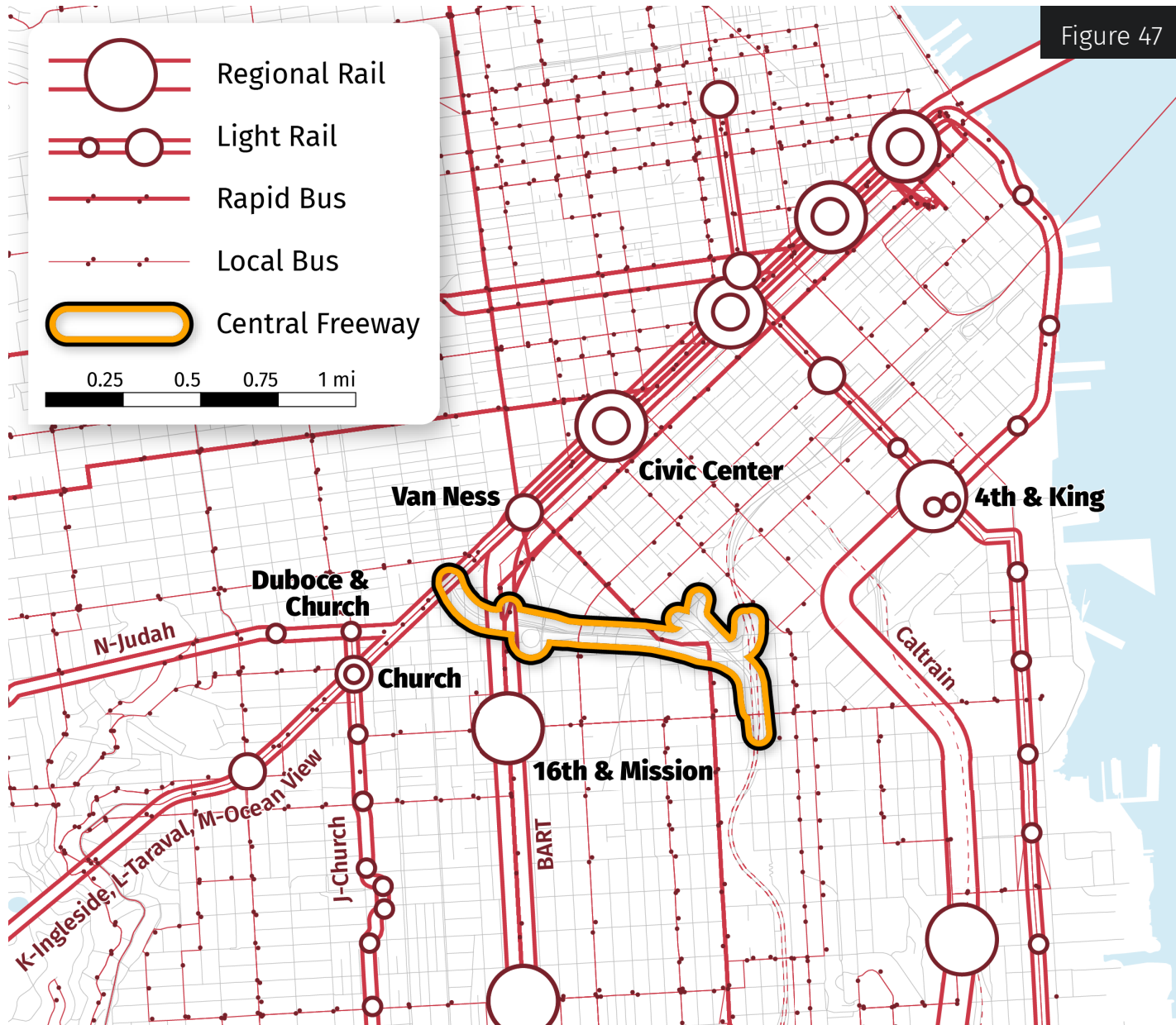


# Regional Vehicular Network



The Central Freeway is a stub highway which funnels traffic from I-80 and I-101 to surface-level arterial roads leading to northern and western parts of the city. Since it does not function as a key regional link, its traffic could likely be well-accommodated by a boulevard the same way Octavia Boulevard replaced the Central Freeway north of Market Street.

# Public Transit Network



The Central Freeway corridor is relatively well-served by public transit. It is served by two rapid bus lines and a local bus line. Crucially, if used for transit expansion, the corridor could fill a gap in San Francisco's transit network between 4th & King Caltrain (regional rail) station and the central and western neighborhoods of the city. Current light rail service to 4th & King from the west requires first going downtown, leading to long travel times.

# Bicycle Network



The street under the Central Freeway, called 13th Street on the western side and Division Street on the eastern side, currently has protected bike lanes for about half its length. However its removal could allow for these to be extended to its entire length, thus filling a gap in the city bike network and creating a path which avoids the city's hills.

# Design Exercise

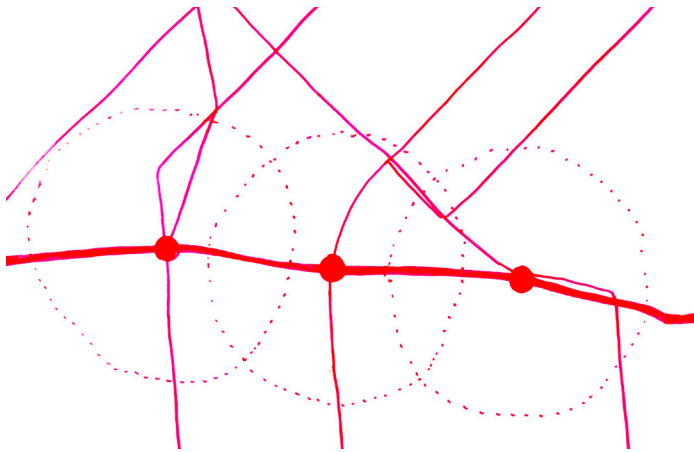
## Design Vision

The following design strategies serve as illustrations of some of the framework's themes. They represent only a few options for how to think about the future of San Francisco's Central Freeway corridor. I propose the partial removal of San Francisco's Central Freeway and the conversion of 13th and Division Streets currently beneath the elevated highway to a landscaped boulevard similar to Hayes Valley's Octavia Boulevard. Displacement would be mitigated by gifting parcels freed up by the removal to a community land trust for stewardship and encouraging affordable housing development on vacant and underutilized surface parking lots along the corridor.

# Sustainable Mobility Strategies

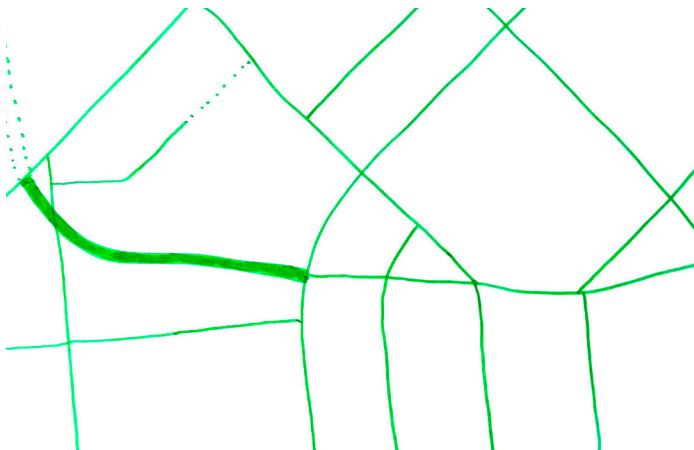


## Transit Network Expansion



With the goal of expanding San Francisco's transit network and encouraging mode shift, I propose removing only half of the width of the elevated Central Freeway to reuse it as a right-of-way for light rail. Three elevated stations would be built to serve the corridor and connect to existing bus routes at street level.

## Bicycle Network Expansion



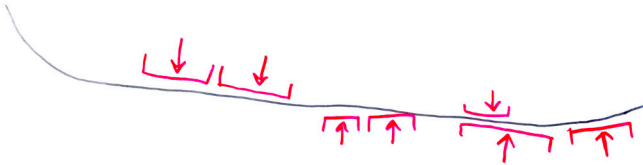
The current protected bike lanes can be extended to Market Street to make the corridor easily bikeable.

# Public Realm Strategies



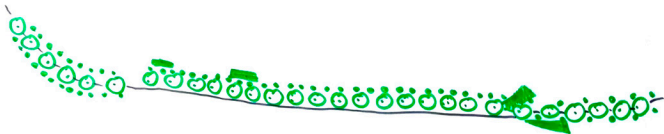
## Frontage Reorientation

In order to activate the boulevard's streetscape, newly freed up narrow parcels can be developed wherever the current building entrances do not face the boulevard.



## Tree Canopy + Green Space

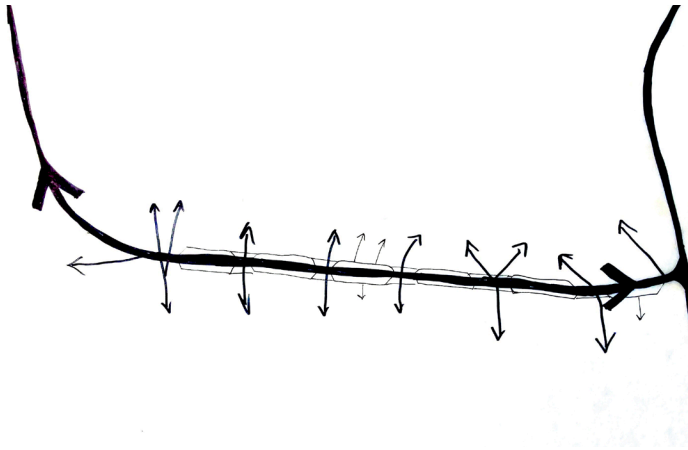
Trees can be planted in the boulevard's medians. Irregularly shaped parcels can be converted into green space. Together, these interventions can enhance the public realm, provide shade, and reduce the urban heat island effect.



# Public Realm Strategies



## Traffic Separation

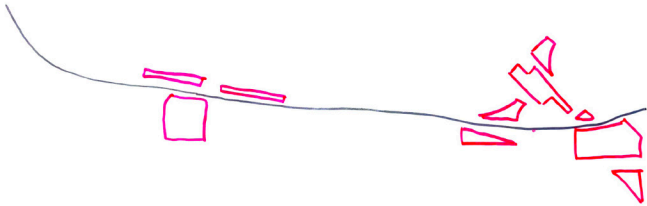


Similar to Octavia Boulevard, this boulevard should separate regional traffic and local traffic. This can improve safety and comfort for pedestrians and bikers.

# Anti-Displacement Strategies

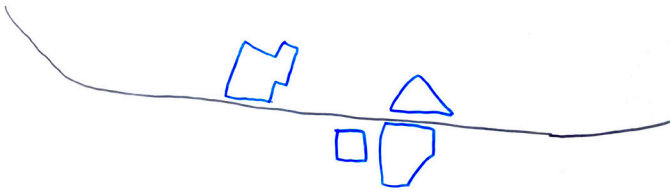


## Community Land Trust Ownership



Ownership of parcels freed up by highway removal should be transferred from Caltrans (the California Department of Transportation) to a community land trust with the goal of stewardship and development of affordable housing. This measure can ensure permanent affordability in a way that many temporarily affordable housing developments cannot. Moreover, existing residential, commercial, or industrial buildings can be acquired by the community land trust as a way to deepen a commitment to anti-displacement.

## Affordable Housing Development



While private development will be attracted to vacant parcels and underutilized surface parking lots, affordable housing development should be prioritized and encouraged through supportive policies.



# Proposed Section

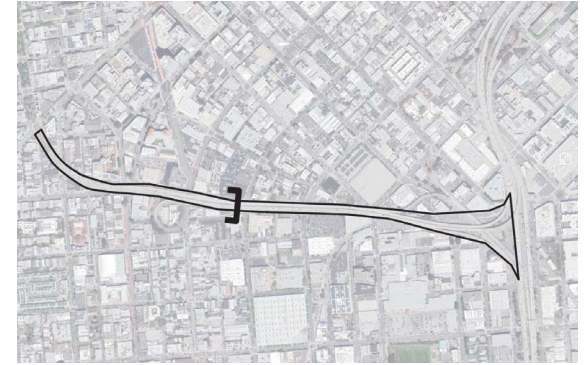
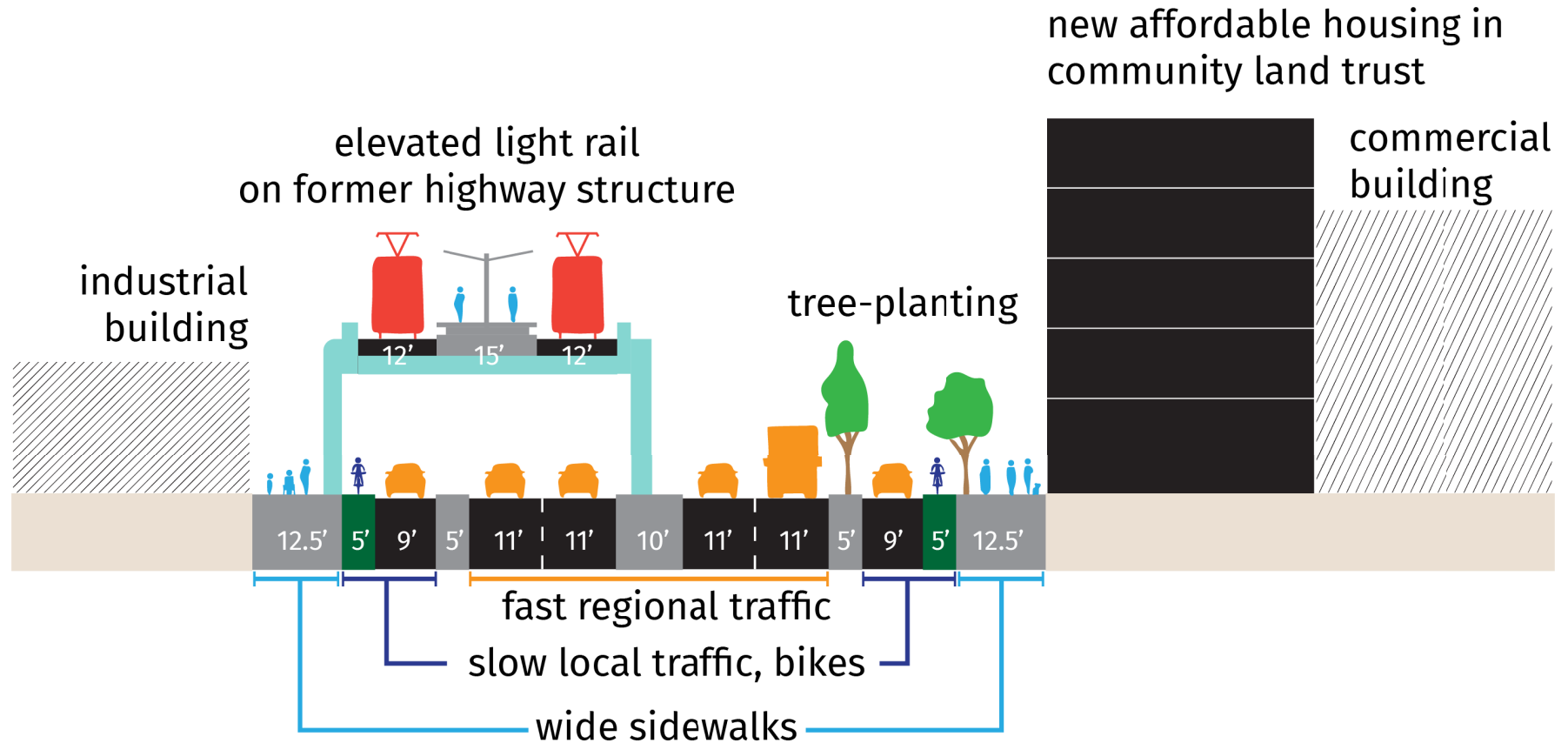


Figure 49: Proposed section view of the corridor



# Conclusion:

## **The Future of Urban Highway Removal**

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# Conclusion

Highway removal projects are unique in their catalytic power to redefine how we plan our cities and who we plan them for. Done well, they can embed sustainability and equity into the built environment. Done poorly, they can reproduce cycles of displacement and deepen social inequalities.

While Octavia Boulevard and Mandela Parkway successfully improved their adjacent public realms, they fell short on their ability to encourage mode shift and resist community displacement. Thus, they demonstrate an excessively narrow view of what highway removal projects can do.

Learning from the case studies' successes and failures, the proposed highway removal framework aims to reduce the negative unintended consequences of these projects by highlighting key dimensions of inquiry, planning, and design. The design exercise centered on the Central Freeway demonstrates what this framework could look like when implemented on a current project. While this exercise is not a comprehensive corridor plan and doesn't attempt to directly engage community priorities, it broadens the conversation about the future of this corridor and ones like it.

Future research on highway removal can aim to refine this framework and evaluate its application. The proposed framework represents a first step towards a brighter future where urban corridors are redesigned in more systematically sustainable and equitable ways.

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