North Oakland Community Analysis

University of California, Berkeley

Department of City and Regional Planning

Transportation Studio, Fall 2014

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ABOUT THIS REPORT

We treated this as a collection of studies conducted in parallel, but joined together by our overall conclusions and recommendations found in the Executive Summary. Each section of this report represents an independent study carried out by a team or individual member of CP 218.

ABOUT CP 218: TRANSPORTATION STUDIO

We are a transportation studio class in the Department of City and Regional Planning at the University of California, Berkeley. The studio is a requirement for the transportation planning degree. The members of the studio are all enrolled in the Master of City Planning program, and a number of members of the studio are also pursuing dual degrees with transportation engineering, public health, or law.

ACKNOWLEDGEMENTS

We owe our inspiration for this project to Jamie Parks and Robert Raburn. Both David Campbell and Ray Lifchez provided very helpful background information at critical points in this study process. Thank you as well to Temescal Business Improvement District and the Longfellow Community Association.

Finally, we would like to thank Professor Betty Deakin and Andrea Broaddus for their guidance throughout this project. We would not have completed this without your insight and feedback. Thank you.

In September 2014, representatives from the City of Oakland ("the City") and the Bay Area Rapid Transit District ("BART") approached the CP 218 Transportation Studio with questions about travel behavior and the transportation network in and around the MacArthur BART Station in Oakland, California (Figure 1). In search of data to support the proposed Complete Streets Plan for Telegraph Avenue, the City was particularly interested in travel patterns generated by commercial activity in the Temescal Commercial District ("Temescal"). Meanwhile, BART was broadly interested in promoting urban densities that would support transit, in addition to the impacts of a new transit-oriented development adjacent to the MacArthur BART Station.

With these prompts, our studio team quickly concluded that these concerns were interesting, but ultimately too narrow in scope given the magnitude of changes coming to the MacArthur area. After some exploratory analysis, we found that market and regulatory forces at regional and local levels have converged in the MacArthur area to create the conflicts and opportunities l presented by urban infill growth:

- The MacArthur BART area has been promoted by regional authorities as an ideal location for new growth based on its ability b to serve new residents by transit. This designation is formalized as a Priority Development Area ("PDA") in the region's state-mandated plan for growth through 2040, "Plan Bay Area."
- A new transit-oriented development, MacArthur Station, adjacent to the MacArthur BART Station, is expected to bring more than 1,000 new residents to the area over the next decade (a 17% increase).
- The real estate market in this area has recovered from the recession and begun to appreciate significantly, driving up rents and threatening potential displacement of existing residents.
- In 2015, the City of Oakland will repave and reconfigure a stretch of Telegraph Avenue that runs adjacent to the MacArthur BART Station. The City's Complete Streets Plan will reduce travel lanes to make room for new bike lanes, which merchants in Temescal have opposed, fearing adverse impacts on auto travel and shoppers' accessibility to the district.

Considering this context, we found ourselves wondering, how do we improve the transportation network a) to serve existing and anticipated residents and businesses and b) to create a pleasant, efficient, and safe multimodal neighborhood and corridor? Implicit in these guiding questions about the role of a transportation network were the narrower questions about travel patterns, population density, and potential impacts of the proposed Complete Streets Plan.

We also recognized that the MacArthur case was not the City's first attempt to develop the area around a BART station to take advantage of the proximity to transit. A decade earlier, the City had partnered with local developers and BART to build Fruitvale Village adjacent to the Fruitvale BART Station in the southeastern part of Oakland. Although there are some key differences regarding the timing of each development, we wondered what we could learn from the Fruitvale case that may apply to the MacArthur area.

METHODOLOGY

This report summarizes insights and conclusions drawn from two research phases. The preliminary phase consisted of background research and site visits to both the Fruitvale and MacArthur areas as well as a case study analysis of the development in the Fruitvale neighborhood. For the MacArthur area, we conducted a policy review of key documents such as the Complete Streets Plan, the PDA map, and growth projections for Alameda County, as well as pertinent sections of Plan Bay Area. To understand the changing demographics of the area, we

Figure 1 Map of study areas

examined census and American Community Survey data over the past 15 years.

In addition to data analysis, the Fruitvale work consisted of field observations and expert interviews from which we extracted lessons learned to apply to the analysis of the MacArthur area. See Section 1 for more details about the methods used in the Fruitvale case study.

The second research phase consisted of in-depth studies of the MacArthur BART area and Telegraph Avenue corridor. We focused our studies around four elements that shape the role of transportation in the MacArthur area: the built environment, community travel patterns, parking, and the street network. For three of four elements, we collected original data to supplement sourced data. See Table 1 for a summary of the scope of analysis for each element as well as a list of data collection methods. More information on each of these methods as well as sourced data can be found in the methodology sections of Sections 2-10.

Studies were bounded by specific geographies. The Fruitvale case study examined both the planning boundary for the transit-oriented development (TOD) adjacent to Fruitvale BART, and

Table 1 Study data collection methods and scope by study element

Element	Scope of Analysis	Original Data Collection Methods
Built Environment	- Existing, planned and projected residential and commercial development in the MacArthur PDA	---
Community Travel Patterns	- Existing travel patterns of residents within walking distance of MacArthur BART - Existing travel patterns of shoppers and employees in Temescal and near MacArthur BART station	- Mail-back surveys of residents - Intercept surveys with shoppers - Interviews as well as online and paper surveys with merchants - Paper and online surveys with employees
Parking	- Existing parking supply and utilization in Temescal and within walking distance of MacArthur BART Station	- Parking census - Parking occupancy study of streets near MacArthur BART
Street Network	- Existing, planned and projected utilization of the street network for all modes	- Traffic, bicycle, and pedestrian counts along Telegraph Avenue and Martin Luther King, Jr. Way - Noise study of underpasses - Field observations of underpasses

the PDA that encompasses the station. The critical geographies for MacArthur included the 0.5 mile walk-shed of MacArthur BART Station, the main north-south corridor of the PDA, which includes Telegraph Avenue and Martin Luther King Jr. Way from 34th Street to 52nd Street, and the PDA boundary itself (see these boundaries in Figure 2). In each section, read more about the geography chosen for that aspect of analysis.

Based on TOD, healthy neighborhoods, and anti-displacement literature, we developed five goals for how the area immediately around a transit station should function. These goals are informed by the City's own policies, plans outlined in Plan Bay Area, and theory surrounding the role of transit-oriented development. Specifically, we propose that the transportation network and development in the MacArthur BART area should:

1. Enable a multimodal lifestyle (Mobility);
2. Accommodate new residents and promote planned growth (Growth);
3. Foster inter- and intra-neighborhood connections (Connectivity);
4. Promote local-serving businesses (Commerce); and
5. Support existing residents while developing without displacement (Residents).

We recognize that the ultimate goal of this project is to determine how the transportation network should function in this area. However, because the region projects considerable population and housing growth for this area through 2040 (See Section 2), we considered an evaluation of the development policies and housing policies to be worthy of transportation study.

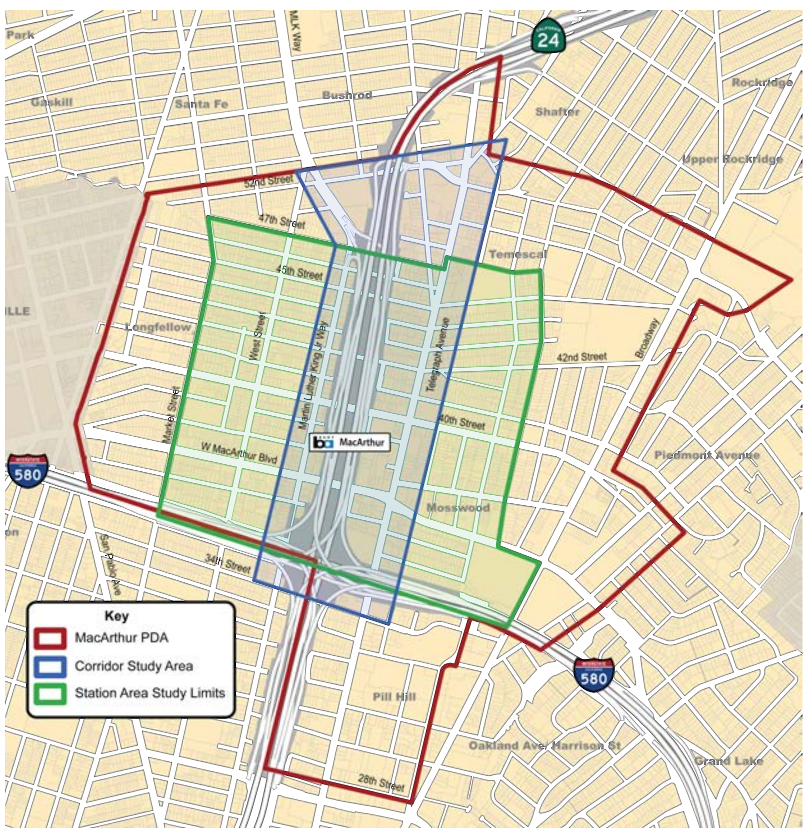


Figure 2 Boundaries for MacArthur area studies

FINDINGS AND LESSONS LEARNED

Fruitvale Case Study

We identified successes and challenges with Oakland's experience developing a TOD in the Fruitvale neighborhood. While some of the stated goals of the development were realized, other goals were not. Accordingly, we identified four lessons from the Fruitvale TOD experience to apply to planning efforts in the MacArthur Area:

1. **The City should encourage local involvement in the planning process to promote development without displacement**: Community input changed the location of a BART parking structure, and retail in the new development was chosen to complement existing businesses in the area instead of directly competing with them.
2. **The City should work with developers to acknowledge existing and anticipate new travel patterns beyond project planning boundaries**: Rigid planning boundaries failed to acknowledge or improve upon pedestrian travel conditions between the TOD and a nearby regional shopping center.
3. **The City should broadly implement pedestrian and transit focused design**s: Pedestrian streets in Fruitvale host farmers markets and permanent retail; road diets prioritize walking to connect new developments with existing neighborhoods. Unfortunately, only one travel corridor received pedestrian and transit focused designs, leaving other areas neglected.
4. **The City should ensure adequate residential growth to support new commercial space**: Strategic construction of commercial before residential space did not catalyze new, market-rate development in Fruitvale; area merchants eagerly await population increases from the stalled Phase 2 residential development to grow the customer base.

MacArthur Area Studies

After examining each element with respect to the five goals mentioned above, we identified the following takeaways:

Built Environment

- **MacArthur BART Station is not a destination:** People do not linger at the station; they hurriedly try to get through it as quickly as they can. The station's location inside a freeway underpass and next adjacent to a four-lane road (40th Street), do not encourage people to linger there.
- **There is a division between the east and west sides of the area**: We quickly observed a stark divide between the neighborhoods on the east side and the west side of the 24 Freeway. Most new planned developments, such as MacArthur Station, are located on the east whereas most foreclosures and vacancies are found on the west side.
- **There is demand for grocery stores**: Residents, shoppers, and merchants all agreed that a grocery store within the MacArthur BART area or along the Telegraph corridor would be a considerable asset for the neighborhood. Residents would prefer a grocery store to which they can walk or ride bicycles.

- **Historic growth doesn't match projected growth**: Plan Bay Area projects low population growth for the MacArthur PDA, but a high number of dwelling units with respect to historic trends. However, we project that the current housing development will not add enough dwelling units and population for a healthy and vital multimodal transportation network.

Community Travel Patterns

- **Residents are multimodal**: For common trips like going to school or going to work, residents within walking distance (1/2 mile) of MacArthur BART tend to rely on alternative modes to make trips.
- **Merchants think the majority of shoppers drive to stores, but shoppers mostly use alternative modes:** 87% of merchants thought the majority of their shoppers came to the area by car, however we found that over half of shoppers arrive by walking, bicycle, bus, and BART.
- **Shoppers are mostly local:** Near MacArthur BART and in Temescal, shoppers consist mostly of locals, who tend to walk to access the retail along Telegraph.
- **Bus riders spend the most per month:** Based on how often they usually visit the area per month and how much they usually spend, shoppers who ride the bus spend $393 per month along the Telegraph Avenue corridor from MacArthur BART to Temescal, compared to $170 spent by those who drive alone.
- **Temescal and MacArthur BART shopping areas are disconnected**: Shoppers who we intercepted near MacArthur BART had very different travel patterns than those who we intercepted near the heart of the Temescal.
- **Employees drive to work**: Unlike shoppers and residents, employees in the MacArthur area were much more likely to drive alone or to carpool.
- **BART riders primarily access MacArthur BART Station via non-auto modes**: About 75% of BART riders who access MacArthur Station walk, ride a bicycle, or take a bus or shuttle to access BART.

Parking

- **Parking is plentiful, but poorly managed**: Most blocks never hit more than 60% occupancy, but there are a few that regularly hit nearly 100%.
- **Regulations are disjointed**: The existing residential permit parking program does not manage the peak demand effectively, and zoning for new development does not align with the area's TOD goals.

Street Network

- **The Complete Streets Plan for Telegraph Avenue supports biking and walking, but not enough to avoid congestion from population growth**: In the 2032 projection, we found that bicycle delay is reduced 25%, and that auto speeds are decreased 10%. However, we also found that the Complete Streets Plan can only handle 92% of projected TOD-generated vehicular traffic in 2032.
- **The Complete Streets Plan results in increased delay for buses**: The 2032 traffic projection revealed a 2-minute increase in average bus delay from current delay.

- **Bicycle travel patterns at the intersection of Telegraph Avenue and 46th Street are not considered in the Complete Streets Plan**: At least half of through-cyclists in the corridor take Shattuck northbound instead of Telegraph Avenue, but the design treatment on Telegraph Avenue neglects their needs. The current proposal would force these cyclists to make an unprotected left turn to access Shattuck.
- **Underpasses make residents feel uncomfortable**: Residents generally feel less comfortable in the underpasses than they do in the rest of the neighborhood. Residents on the west side of the freeway (the Longfellow neighborhood) therefore tend to drive rather than walk to the Temescal retail district, even though it is within walking distance.
- **Poor wayfinding signs decrease walkability in the network**: Though there are wayfinding signs, but they are too high for pedestrians and the font is too small for cars.

DESIGN AND POLICY SOLUTIONS

In light of our findings, we propose the following design and policy solutions to the City of Oakland and BART. They are grouped by the goal that best justifies the solution, though many solutions serve multiple goals.

Mobility: Enable a multimodal lifestyle
We found that current residents are multimodal, but visitors to the neighborhood are more car-dependent; thus parking arrangements, like shared parking, should be made to make the best use of existing resources to serve the demands of visitors. Visitors, like employees, are strong targets for mode-shift incentives like transit passes.

The Complete Streets Plan narrowly supports bicycle and pedestrian activity on Telegraph Avenue, but the plan does not support transit. Given the spending power of bus riders, the City should consider modifying the plan to create transit-friendly infrastructure on Telegraph Avenue. The City should also plan for more bicycle networks, such as addressing the intersection at Shattuck and 46th Street or adding more east-west bicycle connections.

Mobility solutions:
- Actively promote mode shift by developing transportation demand management incentives and parking management techniques, such as the goBerkeley campaign (see http://www.goberkeley.info/).
- Change parking minimums to maximums along the major corridors.
- Consider relocating metered parking on Telegraph to shared off-street lots, in the underpasses, and on side streets.
- Introduce shared parking for visitors (shoppers and/or employees), such as partnership with churches with large lots to provide long-term off-street parking.
- Explore transit improvements, such as dedicated bus lanes, combined bus and bike lanes, queue jump lanes, transit signal priority, and bulb outs.
- Actively promote a mode shift by investing in bicycle facilities.

Growth: Accommodate and promote planned growth and new residents

We found that existing policies and public investments are insufficient to spur development at the level called for by Plan Bay Area in the MacArthur Area. Furthermore, a continuation of historical growth trends is not significant enough to catalyze transformative change in mode shift.

Growth solutions:

- Invest in making MacArthur BART a destination, i.e. pedestrianize 40th Street, develop a park, and develop new space for retail; such public investment will signal to private developers that this area is prime for more development (see designs in Section 10).
- Explore market incentives to develop housing at densities similar to that of MacArthur Station around MacArthur BART and along the Telegraph corridor

Connectivity: Foster inter- and intra-neighborhood connections
The design of the street network is fragmented for bicycles and pedestrians, which indicates that high levels of walking and cycling in the area occur in spite of the street network instead of because of it. Furthermore, the Complete Streets Plan does not address most of the significant barriers to a connected street network.

There are strong patterns of disconnection in the area, especially those between the east and west sides of the freeway, which are separated by the underpasses.

Connectivity solutions:

- Redesign the freeway underpasses, including new amenities like lighting, sidewalks, planter boxes, and recreation opportunities. (See designs in Section 10.)

Commerce: Promote local-serving businesses
Most businesses are located in the north and east, but we observe distinct travel habits for shoppers in Temescal versus the MacArthur BART area. Effective pedestrian wayfinding signs could help direct shoppers on foot to different parts of the area. We also suggest that businesses on the west side of the freeway either join with the Temescal Business Improvement District (BID) or start their own district to brand and market themselves as a shopping destination for local shoppers.

Essential services, like grocery stores, are missing from the area. This means that residents generally drive out of the area to buy groceries when they might prefer to travel via an alternative mode. Considering the necessity and ubiquity of the grocery trip, we strongly suggest that the area try to attract a neighborhood-serving grocery store.

There is an opportunity for future business development near MacArthur BART. We encourage the City and the BID to work with the property managers of the new commercial space to find businesses that will serve local needs.

Commerce solutions:

- Invest in new pedestrian wayfinding to point to existing business types between MacArthur BART and Temescal, e.g. sidewalk signs or a neighborhood map at MacArthur Station.
- Explore expanding the existing Temescal BID or creating a new BID on the west side of the freeway.

Residents: Support existing residents while developing without displacement
There is evidence that residents in this area, especially those on the west side, are particularly vulnerable to displacement. In light of the considerable number of foreclosures and new market-rate units coming to the MacArthur area, we recommend the City explore policies to protect established residents in this and similar PDAs.

Residents' solutions:
- Study anti-displacement housing policies, such as foreclosure assistance programs and financial literacy programs.

Section 1

Fruitvale Case Study

Justin D Bigelow

I. INTRODUCTION

Review of the Fruitvale Transit Village north of the Fruitvale BART Station in Oakland, California evokes the most important questions planners face, questions of equity, displacement, and gentrification. For whom do we plan? For whom do we pursue development? Analysis of the history of the Fruitvale Transit Village, in conjunction with site visits, personal interviews, and critical review of existing literature offers the ability to form one set of answers to these crucial questions.

The Fruitvale Transit Village, and characterizations of it, has two faces. The first, as viewed by much of the urban planning literature and BART patrons exiting from Fruitvale Station, highlights an excruciatingly deliberate attempt to connect the mass transit station with International Boulevard, which is the historic commercial heart of the neighborhood just two blocks to the north (see Figure 1.1).

Figure 1.1 Fruitvale Pedestrian Mall

The second characterization of the Transit Village is the theme park-esque backside of the structure (see Figure 1.2). That is, the Transit Village appears isolated from the neighborhood, with little-to-no activity along its perimeter. The main pedestrian mall connecting BART and International Boulevard is located within the core of the development, implying an inward looking development that neglects its context. This apparent disconnection between the Transit Village and existing neighborhood is oft repeated but seldom written in the planning literature.

Figure 1.2 Backside of Fruitvale Transit Village

With these two faces of the Fruitvale Transit Village in mind, this analysis focuses on the Fruitvale experience in order to identify lessons learned that can be applied to the MacArthur Station Transit Village currently under construction, as well as the broader MacArthur Station area and Telegraph Avenue Corridor.

Planners should look to the Fruitvale experience as they pursue the goals for the MacArthur Transit Village Priority Development Area, which include increased residential and business densities with a focus on non-auto travel patterns. As with the MacArthur Transit Village currently under construction, the Fruitvale Transit Village abuts the first BART station outside of downtown Oakland, and was built atop BART surface parking lots. There are many geographic similarities between the two locations. Each area includes station-adjacent neighborhood commercial corridors on International Boulevard and Telegraph Avenue. Predominantly medium-to-low density residential areas surround each BART Station and commercial corridor, with some mixed business-and-residential zoning near Fruitvale. Likewise, both areas are proximate to freeways (Interstate 880 in Fruitvale and Highway 24 as well as Interstate 580 in MacArthur/Telegraph study areas), and short distances from regional commercial nodes (Fruitvale Station and Emeryville). Accordingly, analysis of the Fruitvale Transit Village and its implied answers to fundamental planning questions concerning gentrification are all the more instructive for the MacArthur Transit Village area in light of the geographic similarities.

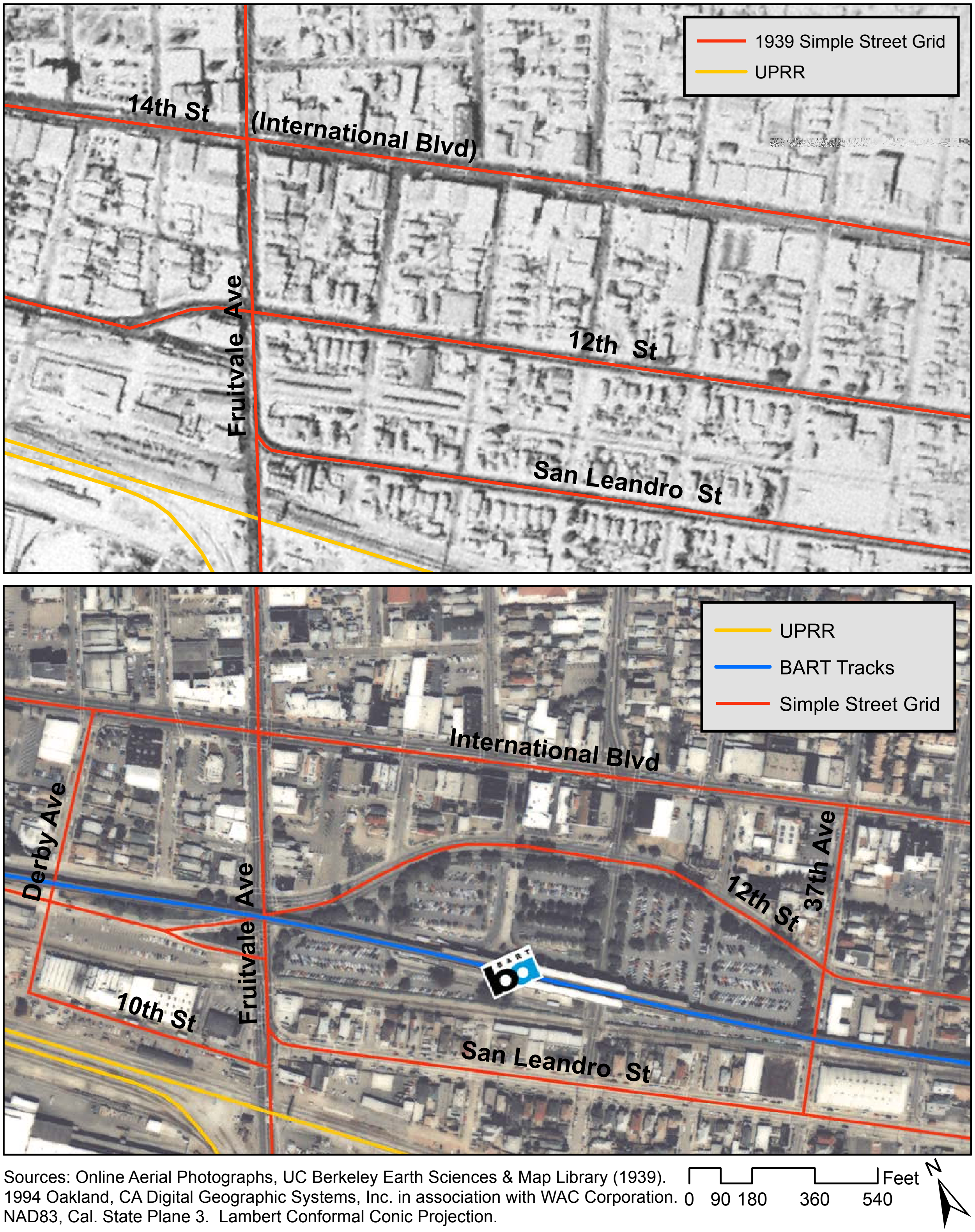
II. THE FRUITVALE NEIGHBORHOOD

The following discussion provides historical context as well as a brief review of the planning process that resulted in the Fruitvale Transit Village.

1. Historical Context

The Fruitvale neighborhood, named after the orchards planted by predominantly German migrants, was once considered Oakland's "second downtown." Prior to World War II, Fruitvale hosted canning and manufacturing industries due to its proximity to orchards and Southern Pacific rail transportation (later acquired by Union Pacific Railroad, "UPRR"). Manufacturing thrived during the war, drawing many new African American and Latino residents. However, Oakland's post-war economic decline as well as the introduction of freeways hastened the relocation of industry and fueled the suburbanization of many white residents (Scully, 2005).

Furthermore, the construction of the elevated BART tracks and accompanying Fruitvale station in the late 1960s leveled numerous buildings, leaving a re-aligned 12th street and plentiful commuter parking in its wake (see Figure 1.3). The thriving commercial corridor on 14th Street fell into disrepair. During the late 1980s and early 1990s, the commercial vacancy rate on 14th Street ranged from forty to fifty percent (Bruner Foundation, n.d.).

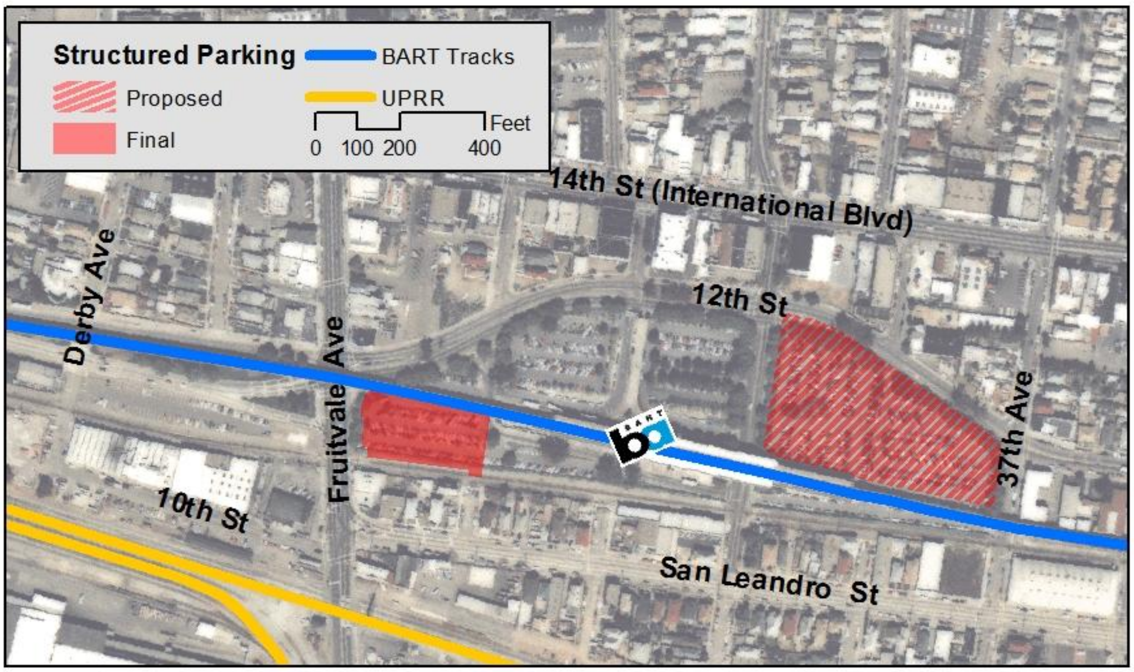


Sources: Online Aerial Photographs, UC Berkeley Earth Sciences & Map Library (1939).
1994 Oakland, CA Digital Geographic Systems, Inc. in association with WAC Corporation.
NAD83, Cal. State Plane 3. Lambert Conformal Conic Projection.

Figure 1.3 Fruitvale Streets 1939 & 1994 (Before and After BART)

2. TOD and Area Plan

In 1991, BART proposed to build a four-to-five-story parking garage on its surface parking lot just north of the Fruitvale BART Station entrance (see Figure 1.4). Notably, many area merchants agreed that increased parking would help businesses struggling on East 14th Street. However, recent work by graduate students and faculty in the City and Regional Planning Department of the University of California, Berkeley, suggested that businesses would be better served by improved pedestrian connections between the BART station and the commercial corridor (Chew, 1991; Blakely, 1990). Thus, Fruitvale neighborhood residents and business owners, organized by the long-standing local nonprofit Unity Council, strongly opposed the proposed placement of the parking structure (Bruner, 2005).



Sources: 1994 Oakland, CA Digital Geographic Systems, Inc. in association with WAC Corporation. NAD83, Cal. State Plane 3. Lambert Conformal Conic Projection.

Figure 1.4 BART parking structure proposed and final locations

The Unity Council argued that the proposed parking structure would further isolate the commercial corridor on 14th Street from the BART station. Exiting from Fruitvale station, BART riders were immediately surrounded by expansive parking lots with inadequate lighting. Additionally, BART patrons could only see the backsides of the commercial buildings fronting 14th Street because BART construction and the realigned 12th Street demolished those buildings that would have faced the station. Furthermore, the Fruitvale BART station was plagued by crime, with the second highest overall crime rate of all stations in the system (Bruner Foundation, n.d.).

In the face of neighborhood displeasure with the parking structure proposal, BART agreed to engage the community in a planning process for the station area. In light of the U.C. Berkeley studies a primary goal of the planning process was to better utilize the proximity of the BART station to benefit the challenged commercial area by improving walking conditions. The Unity Council led the community to prioritize pedestrian access between the commercial corridor and Fruitvale Station. Both BART and the City of Oakland accepted the community input, formalizing a power-sharing agreement in 1994, when the government agencies and the Unity Council signed a memorandum of understanding to create the Fruitvale Policy Committee. The Policy Committee fulfilled community wishes for improved pedestrian conditions and increased parking availability by relocating the parking structure away from 14th Street, which itself was renamed International Boulevard in 1996 (U.S. Department of Transportation, 2000).

The Unity Council created the Fruitvale Development Corporation (FDC) in order to implement the policies and planning principles created by the Fruitvale Policy Committee. The FDC held community meetings and hired architects to visualize the neighborhood and Fruitvale Policy Committee goals. The FDC defined its redevelopment area to lie between International Boulevard and San Leandro Street to the North and South, with 37th and Derby Avenues defining the East and West boundaries, respectively (see Figure 1.5) (Scully, 2005).

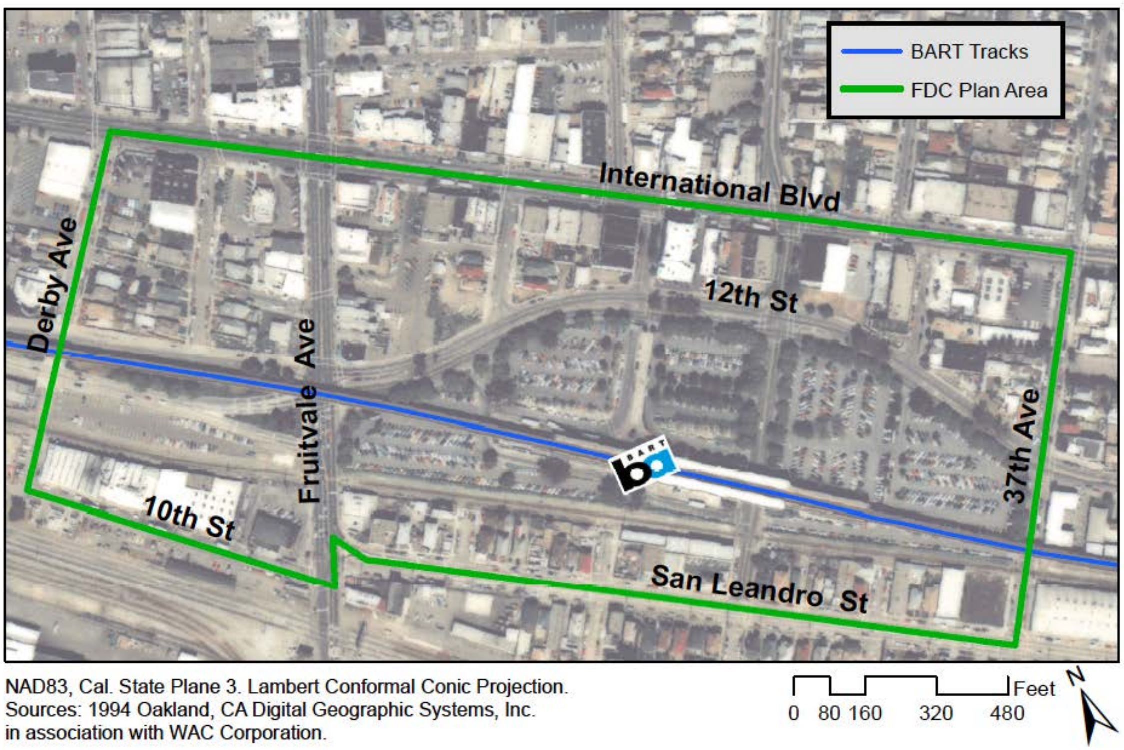


Figure 1.5 Fruitvale Development Corporation Planning Area

Despite the study area, the FDC primarily focused on implementing the Fruitvale Transit Village, the mixed-use TOD directly north of the Fruitvale BART station. The Transit Village would replace the BART parking lots that acted as a barrier between the station and International Boulevard. The FDC incorporated community input, BART parking requirements, and the Unity Council vision, defining the following policy goals for the development:

1. Relocate the proposed BART parking structure
2. Improve the neighborhood via economic development without displacing existing residents or businesses
    a. Create physical and visual connections between BART and International Boulevard
    b. Reduce traffic by offering improved pedestrian access to retail goods and services to supplant vehicle trips
    c. Reduce pollution
    d. Address crime around the Fruitvale BART station
    e. Prove that TOD works in low-income communities
3. Increase BART Ridership

Fruitvale neighborhood residents and merchants worked with the FDC and architects to visualize a design that could achieve these goals. Figure 1.6 offers one early architectural rendering of the planned development, which remains remarkably similar to the final design (U.S. Department of Transportation, 2000)

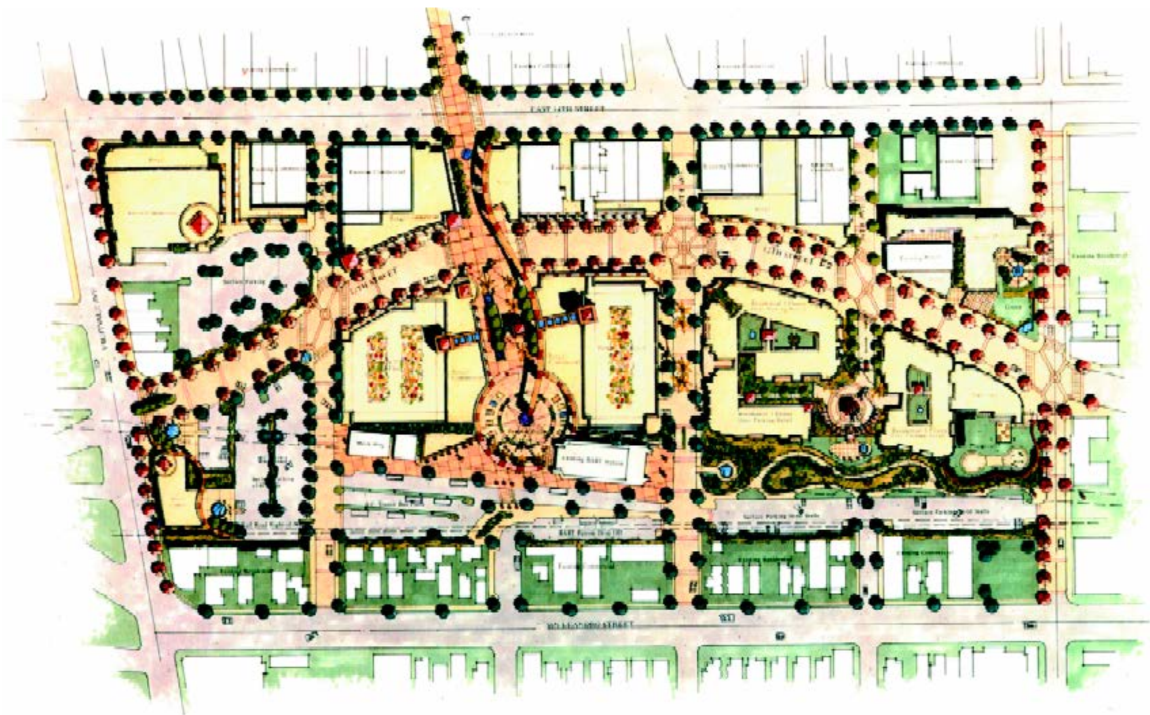


Figure 1.6 Early Fruitvale TOD Plans

3. Fruitvale Transit Village TOD

In order to implement community plans in difficult economic conditions, the FDC elected to split the Fruitvale Transit Village into two phases. Phase 1 would include the enhanced pedestrian connection between BART and commerce on International Boulevard via a plaza between two new, mixed-use structures, while Phase 2 structures would focus on new housing units and additional vehicle parking. Despite a longstanding policy of holding an open request for proposals to develop its property, BART honored the community planning efforts by awarding exclusive development rights of its northern parking lots to the FDC (U.S. Department of Transportation, 2000). With support from BART, numerous federal, state, and local government grants, and philanthropic contributors, the FDC broke ground on Phase 1 in 1999 after nearly a decade of planning, and completed the project in 2003 (Bruner Foundation, n.d.). The FDC still maintains the exclusive right to develop Phase 2, for which the EIR was certified in 2010. Details for the Phase 1 structures and Phase 2 plans are summarized in Table 1.

Table 1.1 Fruitvale Transit Village Phases 1 & 2

Amenity	**Phase 1**	**Phase 2**
Parking Structure (BART)	558 spaces	277 spaces 6 stories (1 below ground)
Ground Floor /Surface Parking	150 spaces	138 spaces below BART tracks
Residential Units	47 units (37 market rate, 10 affordable)	275 units (181 market rate, 94 affordable)
Retail	40,000 sq. ft.	n/a
Commercial/Office	114,000 sq. ft.	n/a

(Bruner Foundation, n.d.)(Environmental Science Associates, 2010)

4. Fruitvale after Construction of Transit Village Phase 1

The FDC completed Phase 1 of the Fruitvale Transit Village in 2003 with great critical acclaim as an exemplar of Transit Oriented Development in an urban, low-income setting (Bruner, 2005). Regardless of opinions from academics and critics, the development was built with significant community involvement that lead to significant community expectations. The following section describes the Fruitvale station area after the implementation of Phase 1 of the Transit Village with respect to the project goals identified by Fruitvale residents through the Unity Council and FDC-led planning efforts.

A. Relocate BART Parking Structure

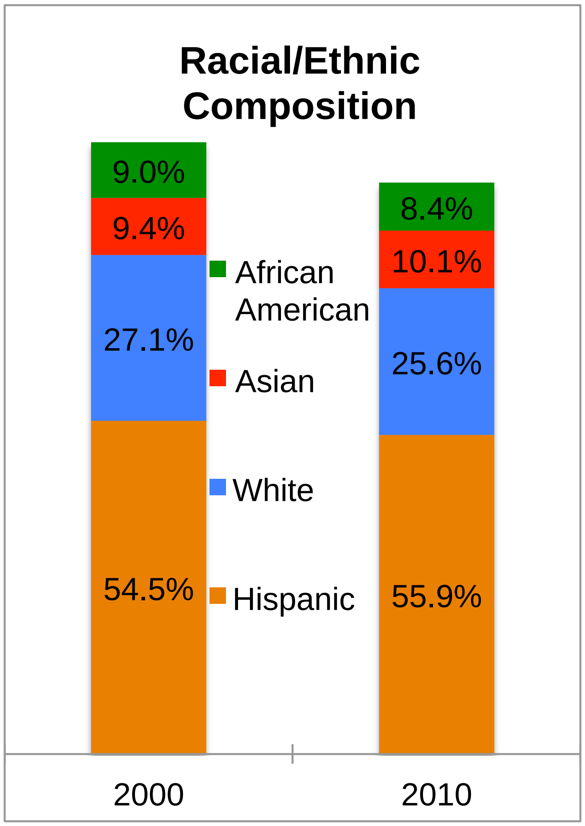
Construction of the Transit Village Phase 1 successfully changed BART's 1991 proposal to locate a four-to-five-story parking structure on its parking lots north of the Fruitvale BART Station. The implemented FDC area development plan relocated the structure south of the elevated BART tracks on Fruitvale Avenue, with access via San Leandro and 12th Streets. While this community goal was unequivocally achieved, problems remain with the current location of the parking structure. Merchants believe it is too far from the commercial corridor on International Boulevard to adequately serve nighttime parking needs in the area; real and perceived crime in the area allegedly hinder use of the structure after dark (Sanchez, 2014). Notably, Phase 2 of the Transit Village includes additional structured vehicle parking, which would exceed the 0.5 parking ratio allowed for residential units in the transit oriented development zoning district but would abide the requirement to replace existing BART surface parking spaces.

B. Provide Benefits without Displacement

Prior to analyzing the specific benefits offered by Phase 1, analysis of Census data indicates that the residential composition of the area within one-half mile of the BART station has not changed drastically after occupancy of the TOD. This finding can be interpreted in two ways. First, Phase 1 included only 47 residential units, which would not be expected to greatly impact Census figures. However, both residents and merchants were wary of the potential for new development to cause widespread gentrification, as had occurred during the economic boom of the late 1990s in San Francisco (Sanchez, 2014). Thus, a second interpretation of the Census data indicates that Phase 1 did not instigate mass gentrification. Phase 1 represented significant financial investment in a low-income neighborhood, which could be expected to increase market interest and private investment in the neighborhood. Any investments that followed Phase 1 did not alter residential Census figures.

Accordingly, a review of Census data provides meaningful insights into the changes that took place in Fruitvale between 2000 and 2010. Specifically, Figure 1.7 shows that residents of the three Census tracts within a half-mile of the BART station remained majority Latino from 2000 to 2010 while Figure 1.8 illustrates that the population decreased despite an increase in housing units. The population change may be explained by the aging population and corresponding decrease in number of children in the area.

It appears that the changes brought on by planning and construction of Phase 1 did not cause gentrification or significant displacement. This conclusion makes sense as the development was built on existing surface parking lots. Likewise, the Transit Village was touted as development without displacement in local news reports (Scully, 2005). Thus, the lack of significant residential change after Phase 1 can be interpreted both as a success of investing in a low-income neighborhood without changing the residential composition and as a failure of significant investment to catalyze private residential investments that could alternatively benefit or displace existing residents.



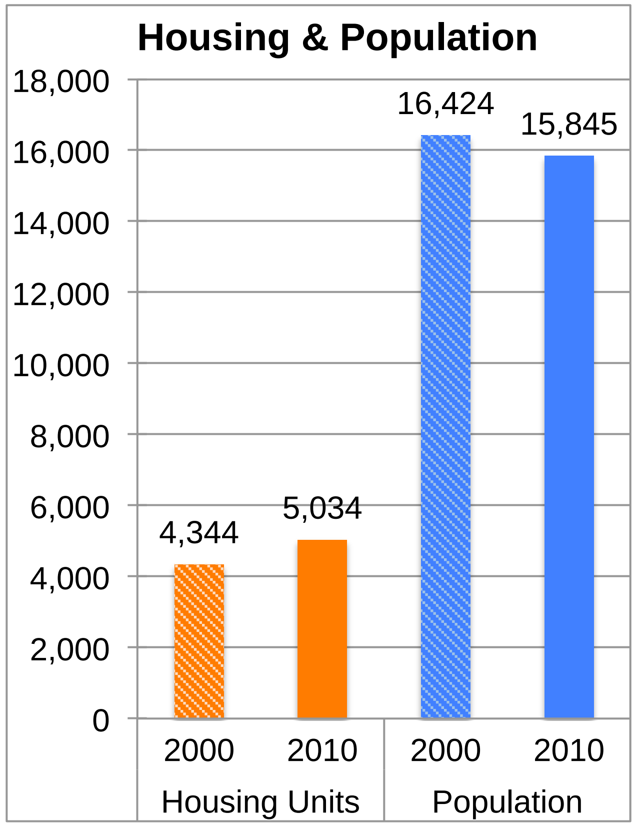
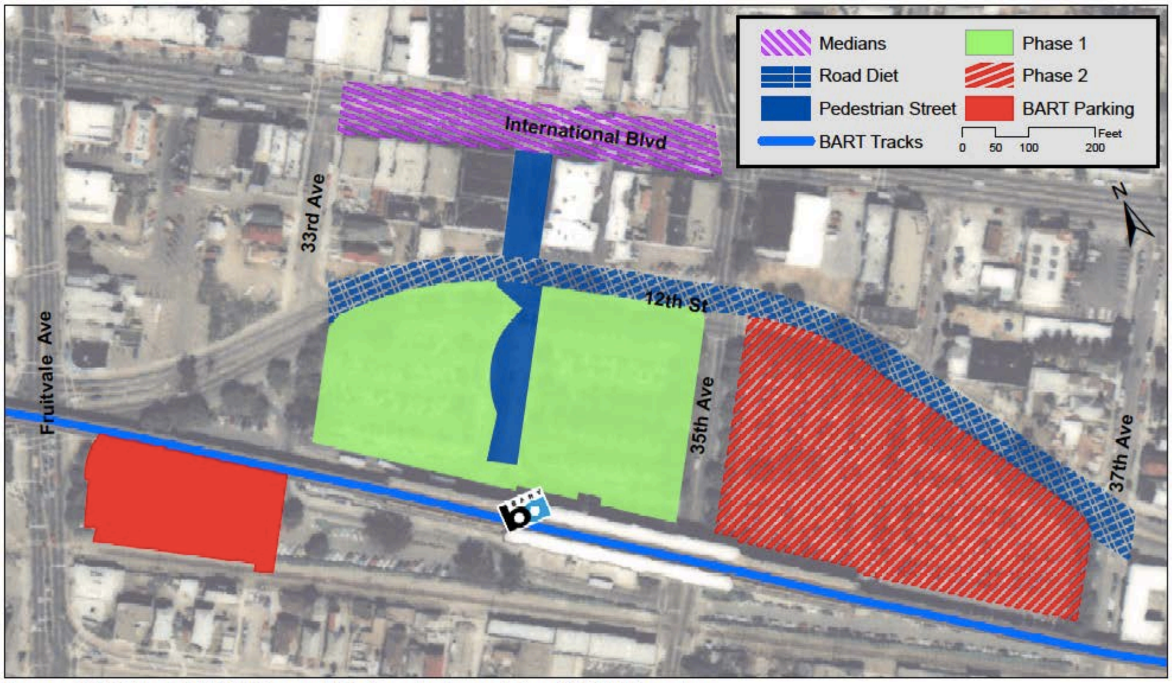


Figure 1.7 Racial/Ethnic Composition **Figure 1.8 Housing Units & Population**

(Fruitvale Census Tracts 4061, 4062.02, & 4072)

C. Connect BART with International Boulevard & Reduce Traffic

Phase 1 construction included extensive work to draw BART patrons toward International Boulevard as shown in Figure 1.9. The improvements include a pedestrian walkway lined with trees, retail spaces, and restaurants. Likewise, the project included wayfinding signs featuring mosaic tiles as well as public art amidst a water feature (see Figure 1.1). The City of Oakland also focused on the pedestrian connection by closing vehicle access on 34th Avenue between 12th Street and International Boulevard. The city further implemented a road diet on 12th Street starting at 33rd Avenue and eastward, narrowing the roadway from four travel lanes with a center turn lane and curbside parking to two travel lanes with curbside parking. It appears the vacated auto space was reallocated as sidewalks to allow Phase 1 to build out to the property line. Finally, the city placed trees and a raised platform for community events and concerts in the pedestrianized 34th Avenue, and a raised median with trees and benches were installed on International Boulevard between 33rd and 35th Avenues.



Sources: 1994 Oakland, CA Digital Geographic Systems, Inc. in association with WAC Corporation.
NAD83, Cal. State Plane 3; Lambert Conformal Conic Projection.

Figure 1.9 Fruitvale Pedestrian Infrastructure

The attention to redesigning the pedestrian realm around the Fruitvale BART station in conjunction with Phase 1 of the Transit Village greatly improved the connection between the station and International Boulevard. Where BART patrons once saw sprawling parking lots and the backs of commercial buildings that front International Boulevard, the Transit Village offers a complex environment with rich colors and imagery, increasing the enclosure of the path to a more human scale (Forsyth, Jacobson, & Thering, 2010). Figure 1.10 shows a farmers market located in the pedestrianized 34th Avenue.

Figure 1.10 Farmers Market in the Pedestrianized 34th Avenue

While some argue that the Transit Village is disconnected from the existing neighborhood, the pedestrian-focused designs implemented with Phase 1 present clear improvements over previously existing conditions between the BART station and International Boulevard. Rather, the primary criticism of the pedestrian oriented designs should be the lack of widespread use. As shown in Figure 1.9, improvements to walking conditions were not broadly deployed, but were solely focused on a two-block corridor extending north from the BART station. Applying pedestrian-focused designs beyond one corridor may have better connected the development with the existing neighborhood.

Furthermore, many critics have vocalized dissatisfaction with the aesthetics of Phase 1, arguing it separates the development from the neighborhood. Indeed the building materials and color palette of Phase 1 construction evoke images of a theme park and do not mimic the surrounding, aged building stock. Still, some reviewers of the project have generally praised its aesthetics (Forsyth, et al, 2010). More important, the architecture of the Transit Village was informed by community voices during the nearly decade-long planning process, with color choices and textures closely vetted in neighborhood meetings.

D. Reduce Pollution & Crime

The impacts of the Transit Village Phase 1 on pollution and crime in the area are difficult to discern. First, inadequate data exists to fully examine the impacts of the Transit Village on the pollution and air quality surrounding the Fruitvale BART station. The nearest air quality monitoring station is located 3.5 miles away, on International Boulevard. Review of California Air Resources Board air quality data between 2004 and 2008 show mixed trends with respect to criteria pollutants including somewhat increased levels of particulate matter (both PM10 and PM2.5) but generally decreased concentrations of carbon monoxide and ozone (Environmental Science Associates, 2010). However, due to the lack of data collection points closer to the Transit Village, it remains unclear what impacts Phase 1 had on pollution and air quality in the area, if any.

Second, Oakland crime data for the Fruitvale area do not provide a clear indication of Phase 1 impacts. Notably, crime on BART property at the Fruitvale station declined dramatically between the 1990s and 2005; where the station previously had the second highest crime rate, it now has one of the lowest crime rates of any BART station (Bruner Foundation, n.d.). Still, real and perceived crime continues to be a problem for the areas around the Fruitvale BART Station and International Boulevard (Sanchez, 2014). Merchants have expressed hope that an increase in population anticipated with new housing units in Phase 2 of the Transit Village will further reduce crime.

E. Prove TOD Works in Low-Income Communities

The Unity Council characterized the Fruitvale Transit Village development as *need, not demand-based development* (Scully, 2005). Analysis of the area prior to Phase 1 construction indicated the absence of a market for market-rate commercial development. In this context, the FDC utilized creative financing, including upfront payment of a 20 year lease by the Oakland Public Library, as well as commitments from nonprofit social service agencies in order to build the initial phase in order to centralize social services in the area (Bruner Foundation, n.d.). Accordingly, the Phase 1 development hosts a public library, nonprofit healthcare provider, senior center, childcare center, public charter high school, and offices for the Unity Council, in addition to retail spaces in order to meet the needs of the community. As of 2005, the Transit Village boasted an 88% occupancy rate for its retail locations while the retail vacancy rate on International Boulevard was approximately one percent, a significant improvement over the 40-50% vacancy rate of the same area two decades prior (Bruner Foundation, n.d.).

The greater vacancy rate in Phase 1 as compared to nearby, older commercial spaces makes sense in the lower-income area. Notably, many retail spaces on International Boulevard appear to be informally subdivided by various independent retailers, presumably to lower operating costs. Setting aside retail space, some say that the Phase 1 merely relocated existing social services from nearby spaces to the new development. Unfortunately, we were unable to ascertain all of the prior locations of current social services providers presently located in Phase 1. Identifying prior locations and the current occupancy would allow for more thorough analysis of the decision to emphasize commercial development in Phase 1. Still, the concept of real estate filtering, in which new, more expensive spaces are filled by economically stable entities while vacating older and cheaper spaces, logically applies in the Fruitvale area. As noted above, it appears retail filtering is present as the retail vacancy rate in older buildings along International Boulevard maintain a lower vacancy rate than the new spaces in Phase 1.

The principal question of whether Phase 1 works in the Fruitvale area should not be answered by filtering theories or simple vacancy rates. Rather, the fact Phase 1 was constructed at all begins to answer the question in the affirmative. Furthermore, the project appears to be solvent one decade after completion. Still, as noted above the Phase 2 residential component of the Fruitvale Transit Village appears stalled indefinitely. These instructive anecdotes demonstrate that TOD success in low-income neighborhoods is complex, and evokes existential planning questions regarding gentrification, displacement, and service to existing residents and businesses. Such questions are further discussed below.

F. Increase BART Ridership

Completion of Phase 1 of the Transit Village did not increase BART ridership. The literature is mixed regarding the goals and achievements of any impact the development would have on BART use. For instance, the Bruner report on the Transit Village states that BART estimated ridership increased by “300 to 600 new daily trips” since the project opened (Bruner Foundation, n.d.). Meanwhile, the Federal Highway Administration’s review of the development states that BART anticipated increased ridership of between 300 and 600 new daily passengers. Analysis of BART ridership data at the Fruitvale station reveals that daily exits at the station increased during construction and decreased after occupancy of the Transit Village (see Figure 1.11). This likely indicates that other factors had a greater influence on ridership beyond that of the Transit Village.

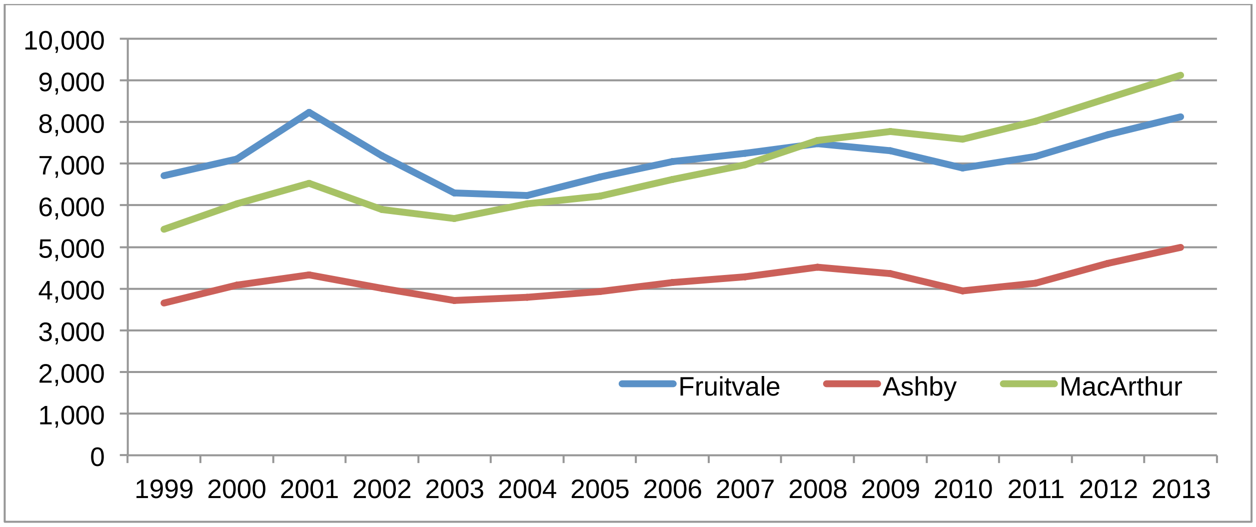


Figure 1.11 BART Ridership by Select Stations 1999-2013

Still, the City of Oakland and its consultant, The Planning Center | DC&E, evaluated the driving patterns and mode preferences of residents of two multi-family housing developments within a quarter mile radius of the Fruitvale BART station in 2013 (The Planning Center | DC&E, 2013). Residents of the Transit Village Phase 1 and Fruitvale Villas, a 30-unit market rate development completed in 1987, reported significantly greater use of public transit as the primary mode for commuting to work or school as compared to the city at large (see Figure 1.12).

Furthermore, completion of the Transit Village included a 200-space, attended bike station adjacent to the BART stop. Survey results after the bike station began operations showed a large increase in the bicycle mode share to the Fruitvale BART station, from four to ten percent of the mode share (Corey, Canapary & Galanis for San Francisco Bay Area Rapid Transit District, 2008). The ten percent bicycle mode share at Fruitvale BART station tied with Downtown Berkeley for the second highest percentage system-wide, behind Ashby station at twelve percent (Corey et al., 2008). While the bicycle and pedestrian mode shares increased, access to the Fruitvale BART station via public transit and private vehicles declined. Figure 1.13 shows the distribution of modes used to access the Fruitvale BART station in 1998 and 2008.

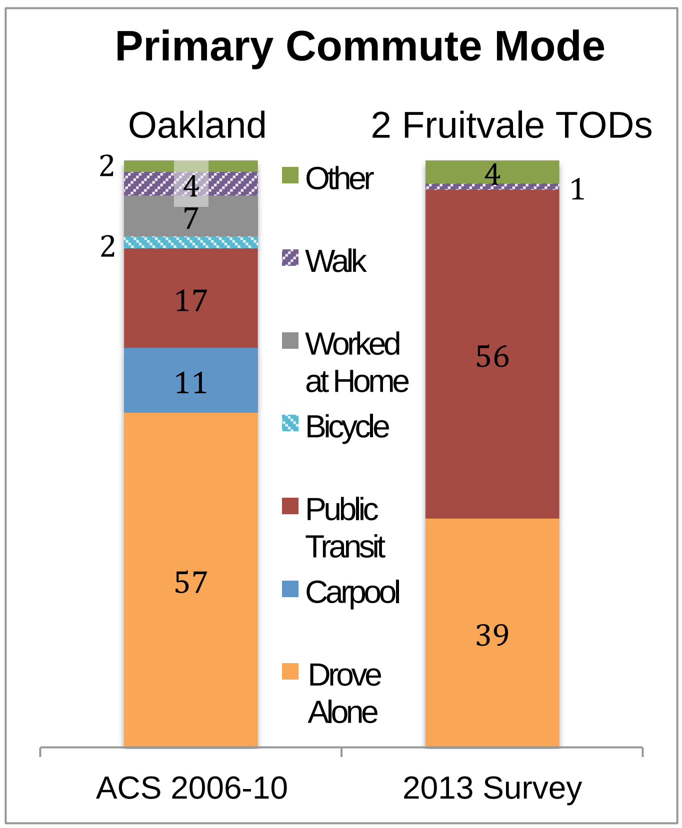


Figure 1.12 Resident's Primary Commute Modes

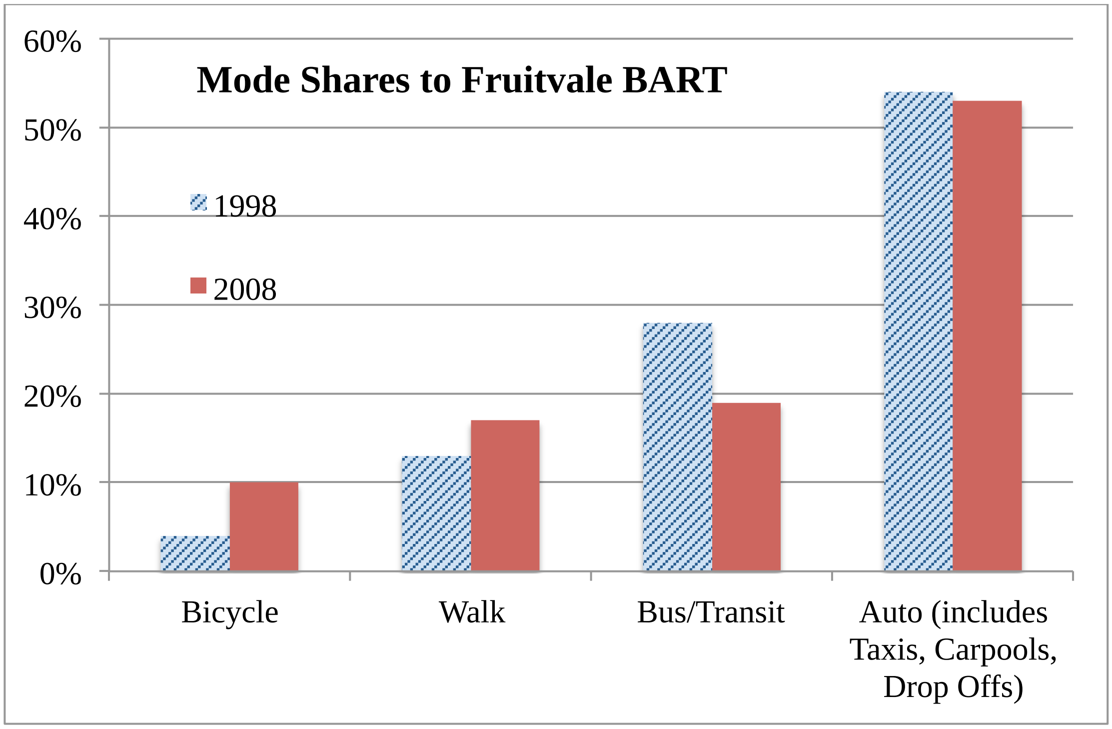


Figure 1.13 Fruitvale BART Station Arrival Mode shares in 1998 & 2008

5. Summary of Findings

Figure 1.14 offers a snapshot of the findings presented above. Specifically, the matrix identifies goals as expressed by community members during the extensive planning process, which neighbors hoped would be achieved via the development of the Fruitvale Transit Village.

Goal	Outcome
1. Relocate BART Parking Structure	☑ Achieved
2. Provide Benefits without Displacement	☐ Unclear
3. Connect BART with International Blvd	☑ Achieved
4. Reduce Crime & Pollution	☐ Unclear
5. Demonstrate TOD Works in Low-Income Communities	☐ Unclear
6. Increase BART Ridership	☒ Failed

Figure 1.14 Findings Matrix

III. LESSONS LEARNED

Based on the findings and review of the Fruitvale Transit Village development experience, there are various lessons that should be kept in mind in the context of new TOD plans and developments in Oakland. Section A offers six preliminary lessons, which were then discussed and winnowed to four more specific lessons to apply to the MacArthur BART Station study area, which are further discussed in Section B.

1. Preliminary Lessons Learned

- Create a broad planning area scope to accommodate and/or capitalize on existing uses even if not necessarily complimentary of transit oriented development. The exclusion of the regional commercial node, Fruitvale Station that opened 1997, on the edge of the quarter-mile walking radius from the BART station lessened the positive effects and potential synergies with the Transit Village and adjacent BART parking structure.
- The successes of community involvement in the planning process, including formal organization of area businesses via a business improvement district should be emulated where possible.
- The pedestrian-focused design, where implemented, successfully connected the BART station and the existing commercial corridor on International Boulevard via pedestrian plazas, road diets, and traffic calming measures.
- Further critical analysis is warranted of BART's 1-for-1 parking replacement requirement within urban infill station areas.
- Comprehensive parking regulation may better utilize existing assets in the Fruitvale neighborhood.
- Strategic sequencing of commercial versus residential developments in the context of limited development capacity may have limited the impact of Phase 1.

2. Four Lessons for the MacArthur BART Station Area

A. Local Involvement Improves Outcomes

The Fruitvale Transit Village emerged from a proposal to locate a large parking structure in the area to the dissatisfaction of area residents and merchants. To its credit, BART worked with the community and ultimately built a parking structure with community approval in a different location (see Figure 1.4). Likewise, anecdotal evidence indicates that the extensive community planning process created a sense of community ownership of Phase 1; Maria Sanchez attributes the community acceptance of the project as an explanation why there has been little vandalism of the buildings and public spaces (Sanchez, 2014).

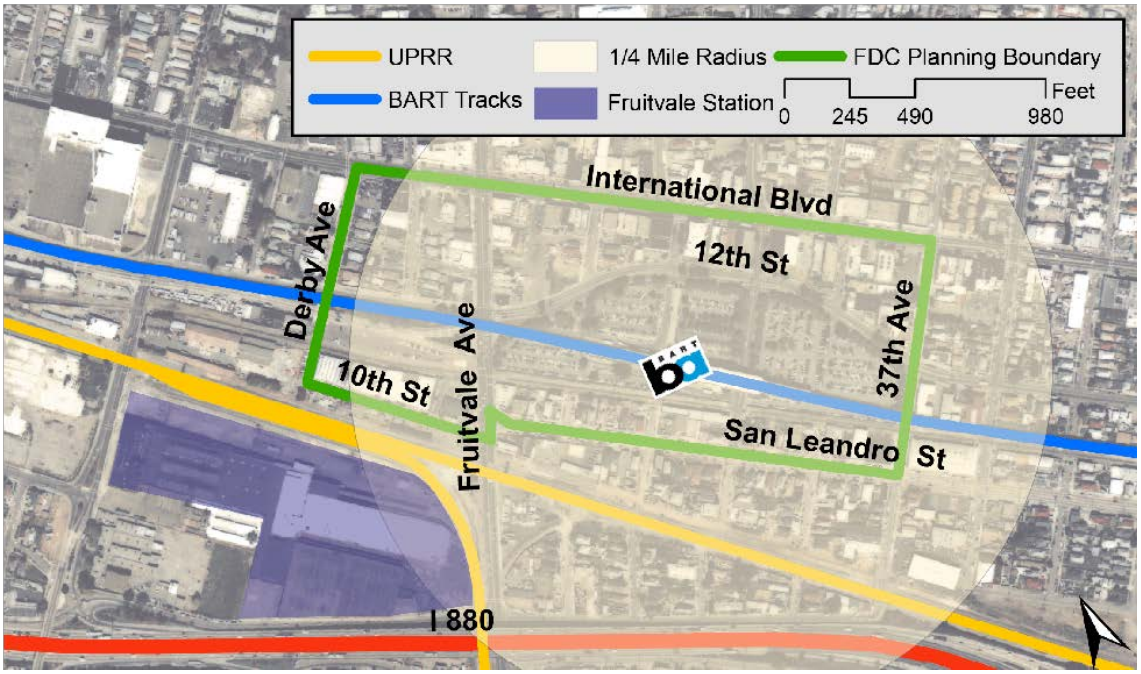


Figure 1.15 FDC Planning Boundary and Fruitvale Station Commercial Development

B. Rigid Area Plans May Neglect Existing Travel Patterns

The planning boundary defined by the FDC excluded the Fruitvale Station regional shopping center that opened in 1997 and did not reflect existing boundaries afflicting the area including the Union Pacific Railroad tracks and Interstate 880 (see Figure 1.15). Most notably, the regional shopping center includes the largest grocery store in the area. Although the Fruitvale Station commercial development has an auto-centered design, it appears many Fruitvale residents frequent its stores by foot, including by breaking a fence running the length of the commercial development separating it from the railroad (see Figure 1.16). The lack of pedestrian infrastructure between the Fruitvale Transit Village and the regional commercial node, in conjunction with the significant barriers presented by the railroad and a fence running along the tracks, is a notable error that should be avoided in future planning efforts.

Figure 1.16 Barriers to Walking Patterns between Transit Village & Regional Commerce

C. Pedestrian & Transit Oriented Designs Work
The Fruitvale Transit Village Phase 1 offers an immense improvement to the pedestrian connection between the Fruitvale BART Station and International Boulevard. In conjunction with the Phase 1 development of a pedestrian mall, the City of Oakland pedestrianized 34th Avenue and implemented a road diet on 12th Street and planted medians along International Boulevard to calm traffic and encourage individuals to walk in the area. Regardless of superficial debates around aesthetics, the walking experience in this specific corridor was greatly improved over prior, unsafe and unappealing conditions. Likewise, the residents of the Transit Village, however few, report significantly greater use of public transit as their primary commute mode.

Figure 1.17 Faint Fruitvale Crosswalk

However, Phase 1 included only 47 residential units and only prioritized pedestrian travel between the BART station and International Boulevard. That is, pedestrian and transit oriented designs only work where deployed. As noted above, the pedestrian experience appears to have been largely ignored outside of the pedestrian mall and pedestrianized 34th Avenue. While the City installed decorative crosswalks outside the prioritized corridor, the streets prioritize auto traffic over pedestrians and bikers (see Figure 1.17). Regardless of faint crosswalks, the Transit Village development failed to drastically change the pedestrian environment outside of the prioritized BART corridor. Accordingly, transit and pedestrian oriented designs should be incorporated throughout the MacArthur BART Station area plans.

D. Population Growth Propels Development
As noted above, the transit oriented design of Phase 1 bears fruit in the residents of its 47 dwelling units, who have largely adopted public transit as their primary commute mode. However, the minimal number of dwelling units in Phase 1 offers one reason why the development failed to increase BART ridership. Phase 1 prioritized commercial and retail space at the expense of residential units based on the theory that Phase 2 would house hundreds of new residents. Sadly, Phase 2 has stalled in spite of the generally booming Bay Area economy. We can never know whether prioritizing residential growth in Phase 1 would have facilitated more expeditious construction of Phase 2. Regardless, retailers in the Transit Village and along International Boulevard remain hopeful that housing new residents in the area will improve business. One important lesson from the Fruitvale experience requires planners to anticipate the amount of retail and commercial space that can be supported by existing residents, without relying on future developments that may or may not come to fruition. The builders of the MacArthur Transit Village appear to have heeded this call, as the first phases of construction include residential buildings prior to the introduction of new retail spaces. Still, planners should look beyond the MacArthur Transit Village to ensure an appropriate balance between residential and mixed-use developments to ensure adequate potential patronage for new retail spaces.

IV. CONCLUSION

Analysis of the Fruitvale Transit Village necessarily raises questions regarding the purposes of planning and development. Who and what are we planning and developing for? Even judging the Transit Village against the goals community members identified through the planning process, Phase 1 offers a mixed-experience. The project achieved the immediate community goals of relocating the proposed BART parking structure and creating a pleasant pedestrian corridor connecting the BART station with the International Boulevard commercial corridor. Still, the project failed to increase BART ridership. Furthermore, it may be improper to attribute reductions in the BART station crime rate to the development, especially in light of continued concerns regarding safety throughout the neighborhood.

Whether the project provided benefits without displacing existing residents and businesses, or whether it demonstrated that TOD works in low-income communities are difficult questions to answer. On one hand, the development increased or at least expanded the offerings of social services to residents in the area without dramatically changing the dynamics of the neighborhood. On the other hand, Phase 1 did not act as a catalyst to alter economic conditions or spark market-rate development in the Fruitvale area. By reflecting on these outcomes in light of expressed community goals, we conclude: Yes – Phase 1 provides some benefits to and did not displace the existing community. Still, the development required numerous grants from all levels of government as well as private philanthropy, and the goals of such donations are also valid and worthy of analysis. In that vein, No –Phase 1 did not provide as many benefits as a project that would have truly revitalized the neighborhood by inducing market development for new housing and employment opportunities. Whether such an ideal project is possible in any circumstance is debatable, and certainly beyond the scope of this analysis. Likewise, whether such an ideal development would have served or supplanted existing residents and businesses is equally worthy of debate. Again, these evocative questions are those that planners should continually revisit in every endeavor. Reviewing the history and analyzing the outcomes from the Fruitvale Transit Village offer numerous insights that should be considered in new TOD developments in Oakland, especially near the MacArthur BART Station.

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Section 2

Demographics and Land Uses

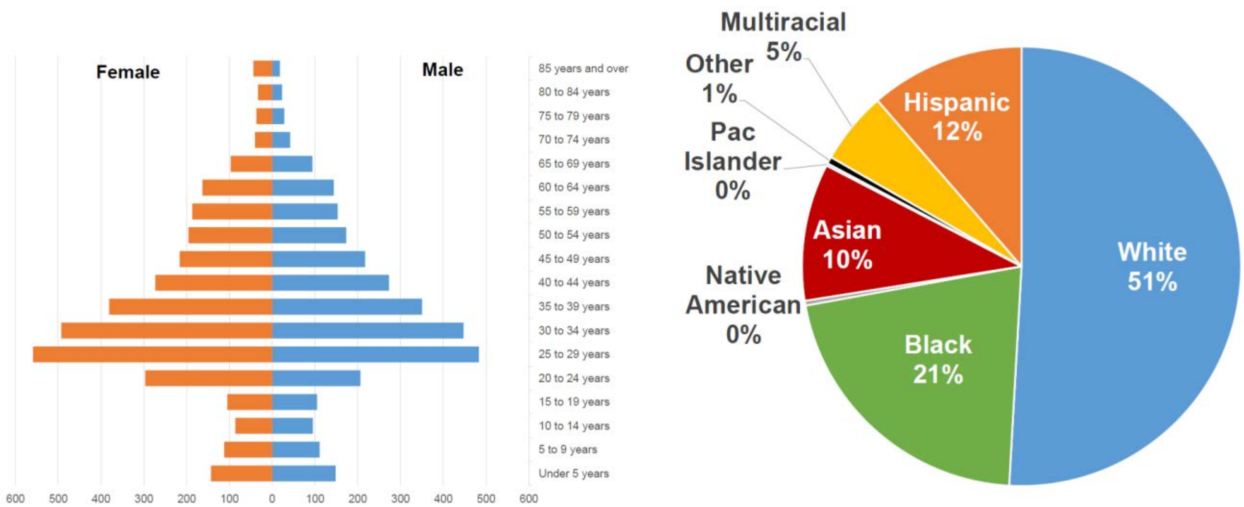
Daniel Howard

I MACARTHUR DEMOGRAPHICS

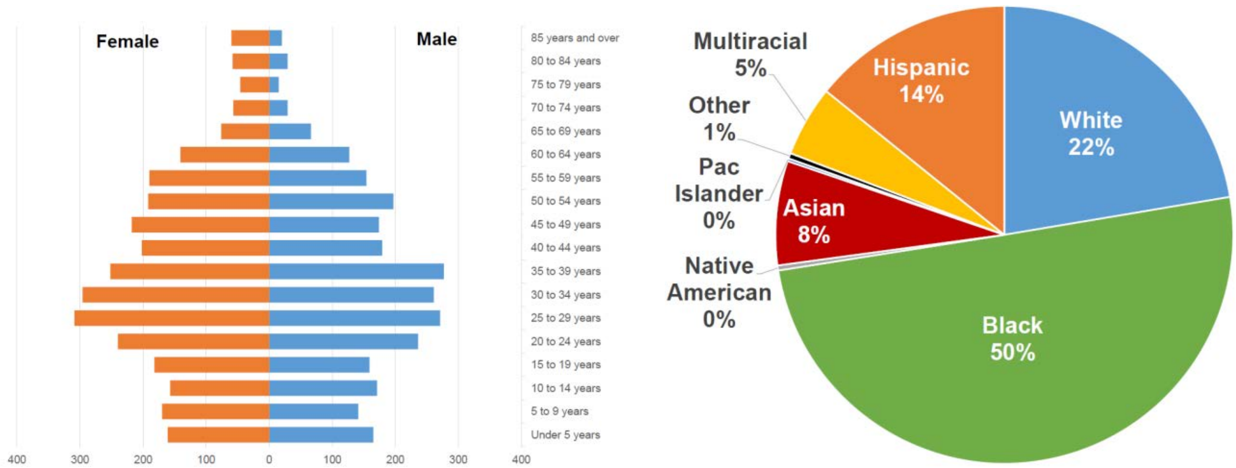
1 East and West of the Freeway

The CA-24 freeway that cuts through the heart of the PDA serves as a barrier between the neighborhoods on its eastern and western sides. This study analyzed this connectivity by examining pedestrian and bicycle flows, but to establish a baseline, we examined demographic and economic indicators that highlight such a divide.

A. Demographics
Studying the demographics of the areas east and west of the freeway provides insights into how the neighborhood's social, economic, and cultural fabric is affected by the presence of the freeway. This analysis adds depth to the results of the land use study and can reveal trends in travel behaviors and connectivity issues in the PDA. Data from the 1990, 2000, and 2010 Census and 2012 American Communities Survey (ACS) were used in this analysis. Census tract 4010 represents the community in the PDA west of the freeway, and the tracts 4011 and 4012 represent the communities on the east side of the freeway.



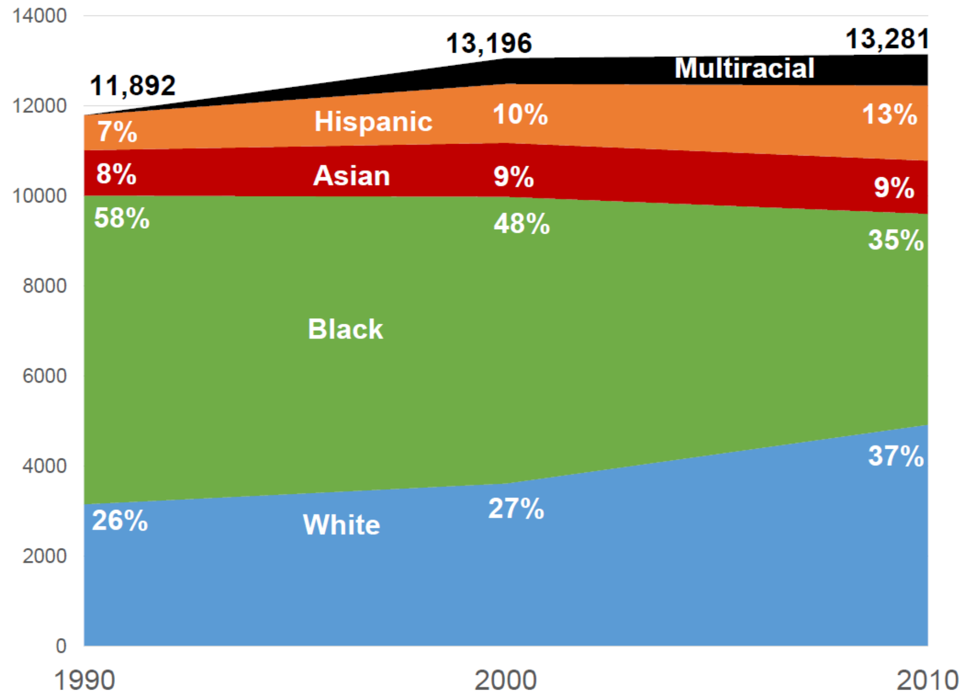
(U.S. Census Bureau; American Community Survey, 2014)
Figure 2.1 Ages and races of east-side residents



(U.S. Census Bureau; American Community Survey, 2014)
Figure 2.2 Ages and races of west-side residents

The neighborhoods on the east and west sides of the freeway are very different, as these statistics show (Figure 2.1and Figure 2.2). From this data, we can see that people living in the neighborhoods on the east side of the freeway are predominantly White and in their late 20s or 30s. Data from the 2010 ACS also suggests that the population is largely unmarried, which correlates with the low number of children and older adults in the area. In contrast, the west side of the freeway is mostly African American families. The area is host to people with a wide range of ages, including many children and older adults.

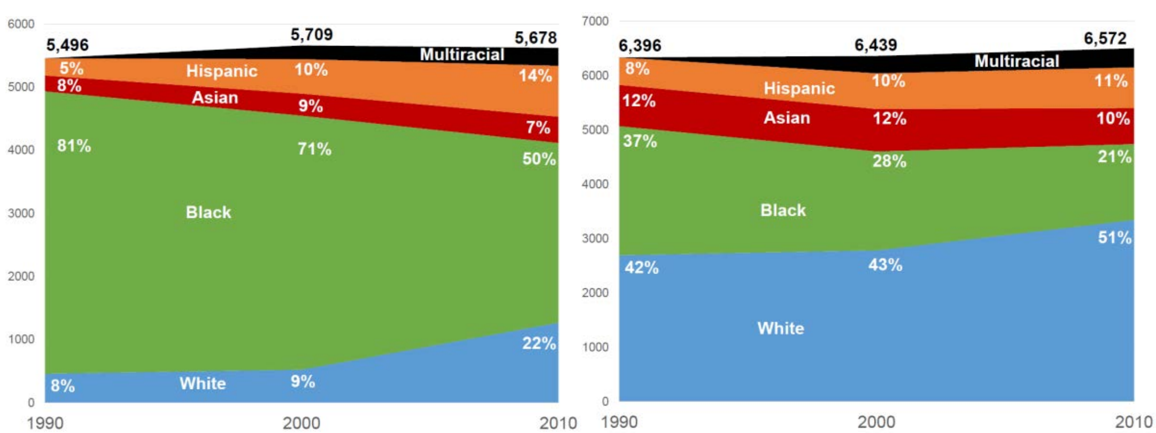
This distinction becomes more interesting when considering the demographic history of the area. Figure 2.3 shows that the entire PDA used to be predominantly African-American as recently as 2000, with Whites mostly settling on the eastern edge of the area near Broadway and Piedmont. As previously discussed, the area hardly added any units between 2000 and 2010 and the population stayed fairly constant over the course of those years. However, the population did not stagnate, rather the share of African-Americans in the area declined from 48% to 35% as the share of Whites increased from 27% to 37%. Thus this area can be considered to be undergoing significant displacement.



(U.S. Census Bureau, n.d.)

Figure 2.3 Racial component of PDA population

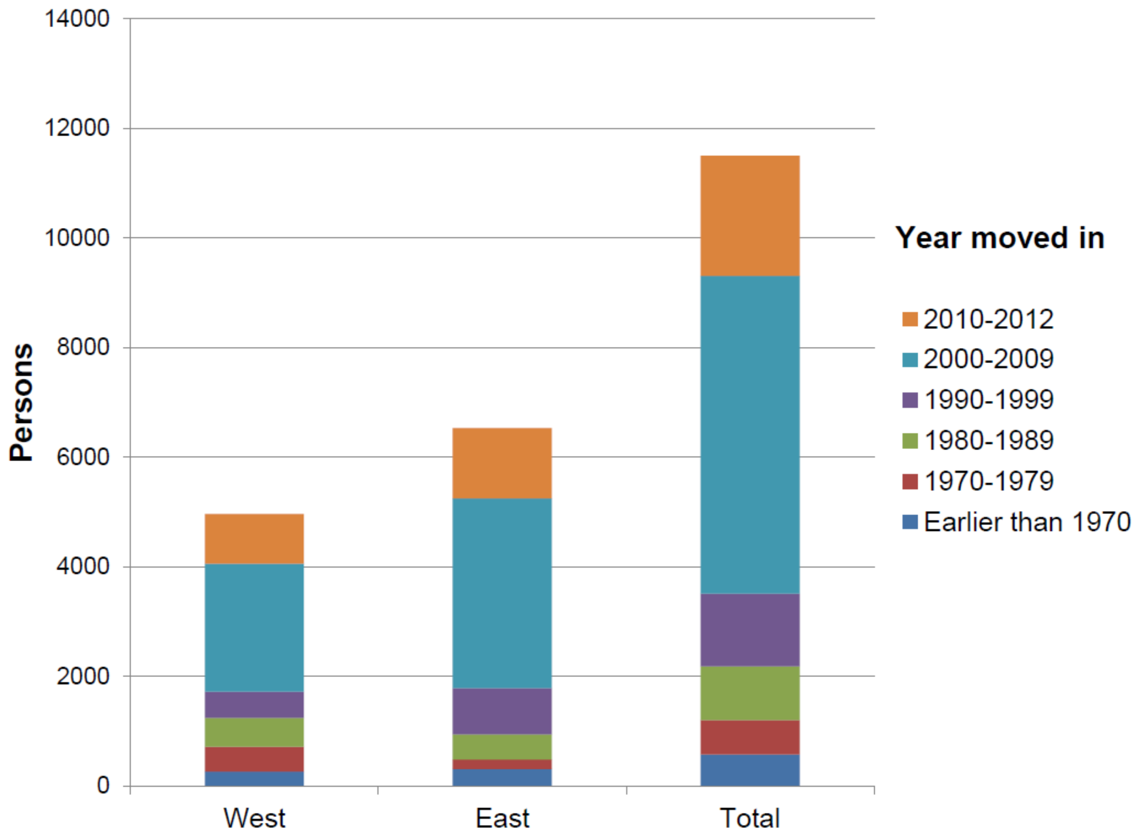
This story plays out even more starkly when considering the east and west sides of the freeway separately. Figure 2.4 shows the west side was 81% African-American in 1990, and 71% in 2000. In ten years, the African-American population dropped to 50% of the total as the white population increased from 9% to 22%. On the east side, the 42% of the population that was white in 1990 largely lived in the eastern tract, and the African-American segment of the population lived near Telegraph Avenue and the freeway. This has begun to change as the African-American population dwindled to 21% of the total in 2010 while the white population increased to 51%.



(U.S. Census Bureau, n.d.)

Figure 2.4 Demographic change on west-side (left) and east-side (right)

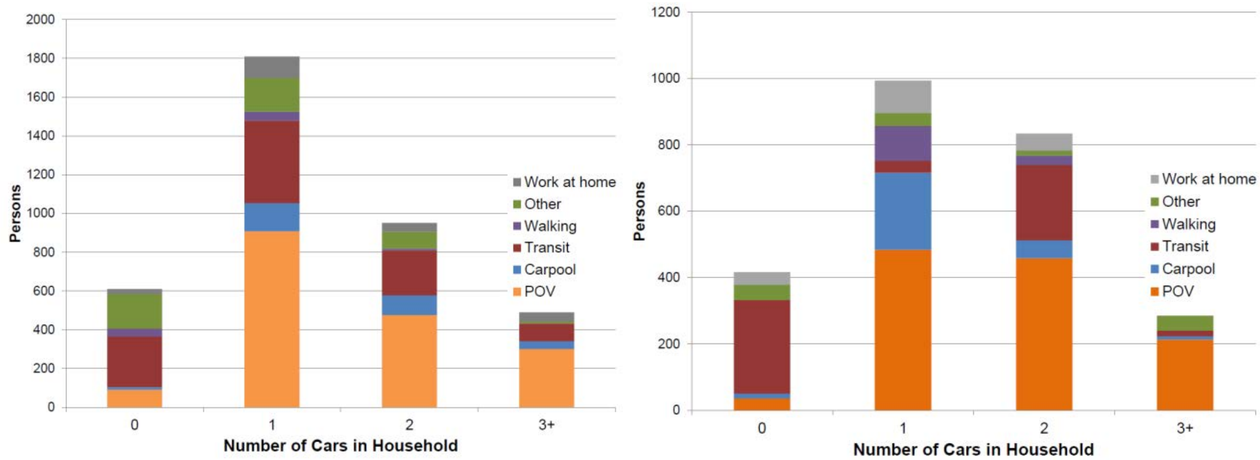
A look at housing tenures from 2012 (Figure 2.5) shows that the majority of people living in the PDA have moved there in roughly the past decade. This data leads us to conclude that the MacArthur PDA is under significant gentrification pressure and any long-term plan involving the area's housing, land uses, or transportation must consider any potential impacts on this pressure. Despite these demographic shifts, a look at median incomes suggests that the process of gentrification is not complete. The 2012 median income in the western neighborhoods was $24,570, while along Telegraph Avenue it was $29,673. This contrasts with the easternmost tract near Broadway, where the median income was $47,283. However, the observed trends will likely continue when the MacArthur Station development is completed, adding 516 market rate units and 108 affordable units to the area, and when the planned developments in the northern Temescal area add the remaining 400 units over the next five years. As argued earlier in this section, providing mechanisms to encourage longtime homeowners to add another dwelling unit to their property can help add density to the area while protecting against displacement.



(U.S. Census Bureau; American Community Survey, 2014)
Figure 2.5 Housing tenure

B. Travel Behavior
Differences in demographics between the east and west sides of the freeway perhaps explain the different approaches to travel. Of note is that no household with more than two people on either side of the freeway was carless, according to 2012 ACS data. The west side, which has a higher proportion of families, necessarily generates a higher proportion of auto trips compared to its population. This is an expected correlation given that families with children tend to require more

daily trips overall than other households and given the prevalent notion in the U.S. that childrearing necessitates car-ownership. Reducing these auto-oriented trips requires two things to change. First, activities demanded by families with children (education, daycare) must be within a reasonable walking or biking time for most residents. Secondly, the infrastructure must be improved so that paths of travel from the neighborhood to these activities are safe and accessible for people of all ages and the network is complete so that it is not overly arduous to access it.



(U.S. Census Bureau; American Community Survey, 2014)

Figure 2.6 Commute mode for residents on west-side (left) and east-side (right) sides of the freeway

Figure 2.6 displays the work commute mode by the number of cars per household, highlighting the differences in travel behaviors between residents on either side of the freeway, especially when considering that these residents have similar access to BART. Besides the more obvious conclusion that car owners tend to use them for their trips, the graphs also reveal different attitudes towards transportation between these majority White and majority African-American communities. (Note: The ACS counts commute by bicycle as “other,” so we assume that most of the persons represented by the “Other” category as commuting by bicycle). The more family oriented, African-American west side has a larger percentage of carpools than the more single east side; we infer that west side carpools are largely composed of family members and not strangers. Overall this data supports the view that people in the western neighborhoods commute to work by a mode other than the private auto because they lack access to a vehicle rather than as the result of a choice. We hold this view despite the larger number of car-free households on the east as we view the majority of these households to be car-free as a lifestyle decision. The eastern neighborhoods actually have a lower percentage of auto (carpool plus SOV) work trips among households with one or more cars, so we can infer that those not driving have largely chosen to avoid auto trips. This was supported with income data from the ACS; generally transit riders from the tracts east of the freeway had higher median incomes than auto drivers in those tracts.

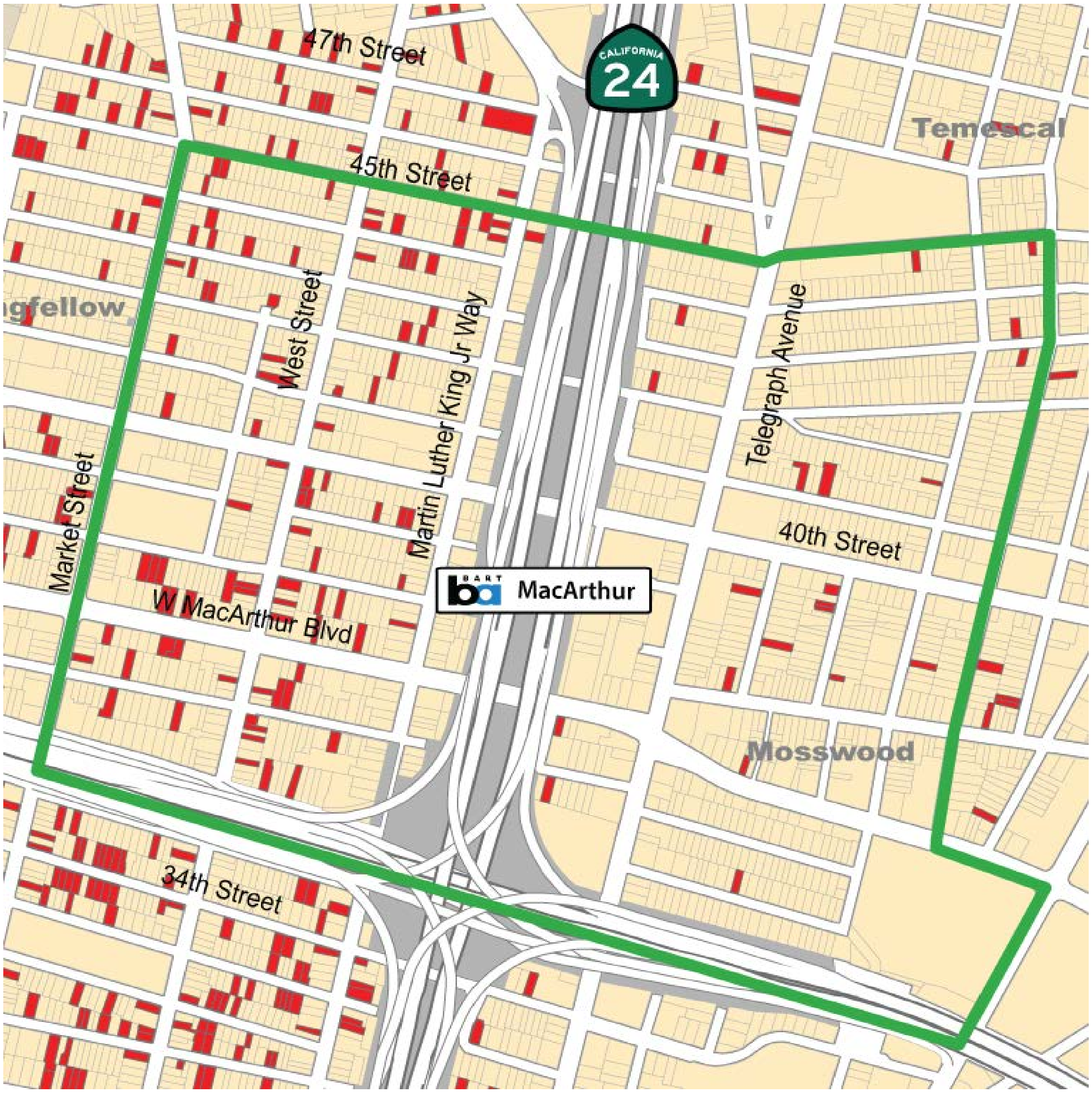
Our conclusions are also supported by average commute time by mode data available for the area from the 2012 ACS. On both sides of the freeway, the average commute time was about 29 minutes. For the private auto, the commute times on both sides of the freeway were roughly 25 minutes. For carpoolers, residents on the west side of the freeway had an average commute of 26 minutes while those on the east side had an average commute of 36 minutes. The average commute time for carpoolers on the west did not differ significantly from solo drivers, while on the east side carpooling increased the average commute time by about 10 minutes. This supports our earlier assumption that on the west side carpools are more likely to occur between members of the same family sharing a car.

The disparity between east and west commute times continues when looking at public transportation. The average commute time by bus was 22 minutes for residents of the west side and 38 minutes for residents on the east side. For BART trips, the difference was 38 minutes for residents on the west side and 44 minutes for residents on the east side. For walking and biking trips, the disparity between eastern and western residents is not statistically significant but in both cases the western average was higher (11 minutes vs 13 minutes for walking, 18 minutes vs 19 minutes for other, which includes taxi, motorcycle and bicycle). Despite the imperfections in the data, we still believe it is reasonable to conclude that residents of the east side have a greater affinity for non-auto modes and that the longer commute times for these people support that they tolerate the greater travel times associated with these modes because of their preference.

We conclude that residents of the east side are more likely to choose non-auto modes when they are a reasonable substitute for the car. Analysis of the data shown here suggests that a non-auto trip could be substituted if it took less than roughly 125% to 150% of the auto travel time. Bicycle use is higher in the eastern neighborhoods despite the roughly equal amount of bike infrastructure available on the east and west sides of the freeway.

C. Foreclosures

The MacArthur station area is roughly split in half by the freeway; they study areas on east and west sides of the freeway both have roughly 750 parcels. Of these parcels, 90 on the west side (or 27% of the total number of parcels) were foreclosed on between 2007 and 2011. In contrast, only 21 parcels on the east side (or 12% of the total) were foreclosed on during the same period. Figure 2.7 show the location of the foreclosures. This stark difference highlights the differences in demographics and opportunities between the communities on either side. We hypothesize that a lack of connectivity between the different sides contributes to this economic disparity.



(Open Oakland, n.d.)
Figure 2.7 Foreclosures in the station area

II MACARTHUR PDA LAND USES

The MacArthur priority development area (PDA) is majority residential, primarily comprised of single-family homes. Most of the commercial uses exist in the Temescal business district centered on Telegraph Avenue in the northern part of the PDA. Temescal is a collection of eclectic shops and restaurants anchored by the Temescal Plaza shopping center, which contains a national chain drug store. Many of the area shops are niche boutiques and ethnic eateries that appear to depend on customers from outside the immediate area given the specific focus of their goods. Other nonresidential land uses outside Temescal include a significant portion of auto-oriented businesses, meaning they either cater directly to motorists (e.g. gas stations) or would likely require an automobile to access goods (e.g. furniture stores). Given that the PDA is intended to focus development around transit, we analyzed area land uses to aid in trip generation estimates and to evaluate the ability of residents to complete daily activities without relying on a vehicle. Additionally, we assessed the extent to which the freeway acts as a barrier between the neighborhoods on the east and west sides of it.

We focused our data collection on three key areas. We first looked at businesses in the Temescal district to determine if these businesses are locally owned, a proxy indicator of owner involvement in the neighborhood. We then geocoded the area's grocery and convenience stores in order to understand where residents would shop for one of their consistent needs and how they would likely get there. Our goals were to determine the overall health of area businesses and to determine how well businesses in the MacArthur PDA capture the needs of residents living in the station area. We also estimated the number of dwellings in the area and projected the future number of dwellings in the PDA to provide trip generation data to inform our traffic models (see Section 8). The MacArthur PDA has been selected by Alameda County to direct the region's growth pursuant to the region's SB375-mandated goals.

(City of Oakland, 1998)

Figure 2.8 Area general plan designations

The Alameda County Transportation Commission (ACTC) plan designates the MacArthur BART station area as the center of the MacArthur PDA, shown in Figure 2.8. The site was selected because it aligns with land use priorities promoting residential and commercial densification around existing transit hubs. The county plan calls for several types of transit-oriented development (TOD), and classifies this PDA as an “Urban Neighborhood” which is described as “Residential areas with strong regional connections, moderate to-high densities, and local-serving retail mixed with housing,” (Alameda County Transportation Commission, n.d.). This designation permits 130 dwelling units per acre.

This is not the first time the MacArthur BART station area has been singled out for increased development and densification. The 1998 Oakland General Plan (City of Oakland, 1998) also sought to focus community development around the station area, however this has remained an unmet goal. Other corridors have been given the high-density “Urban Residential” designation, which also permits 130 dwelling units per acre. The remainder of the PDA is classified as “Mixed Housing Type” which permits a lower density of 30 dwelling units per acre. However, even in the “Mixed Use Housing Type” these designations all allow for a significant increase in housing density over what is provided today.

1 Commercial Land Uses

A. Property Ownership

Locally owned businesses are a defining aspect of the Temescal area. Based on 2013 Alameda County tax roll data, only ten properties in the Temescal BID are owned by entities with addresses outside the Bay Area. These commercial properties are highlighted in purple Figure 2.9. The vast majority (89%) of Temescal BID parcels are owned by persons or entities with addresses in the Bay Area, and roughly 50% of Temescal BID parcels have owners with Oakland addresses. We interpret this data to mean that Temescal businesses desire to serve their community, have more of a stake in the success of the priority development area and are perhaps more in tune with the climate and needs of the neighborhood.

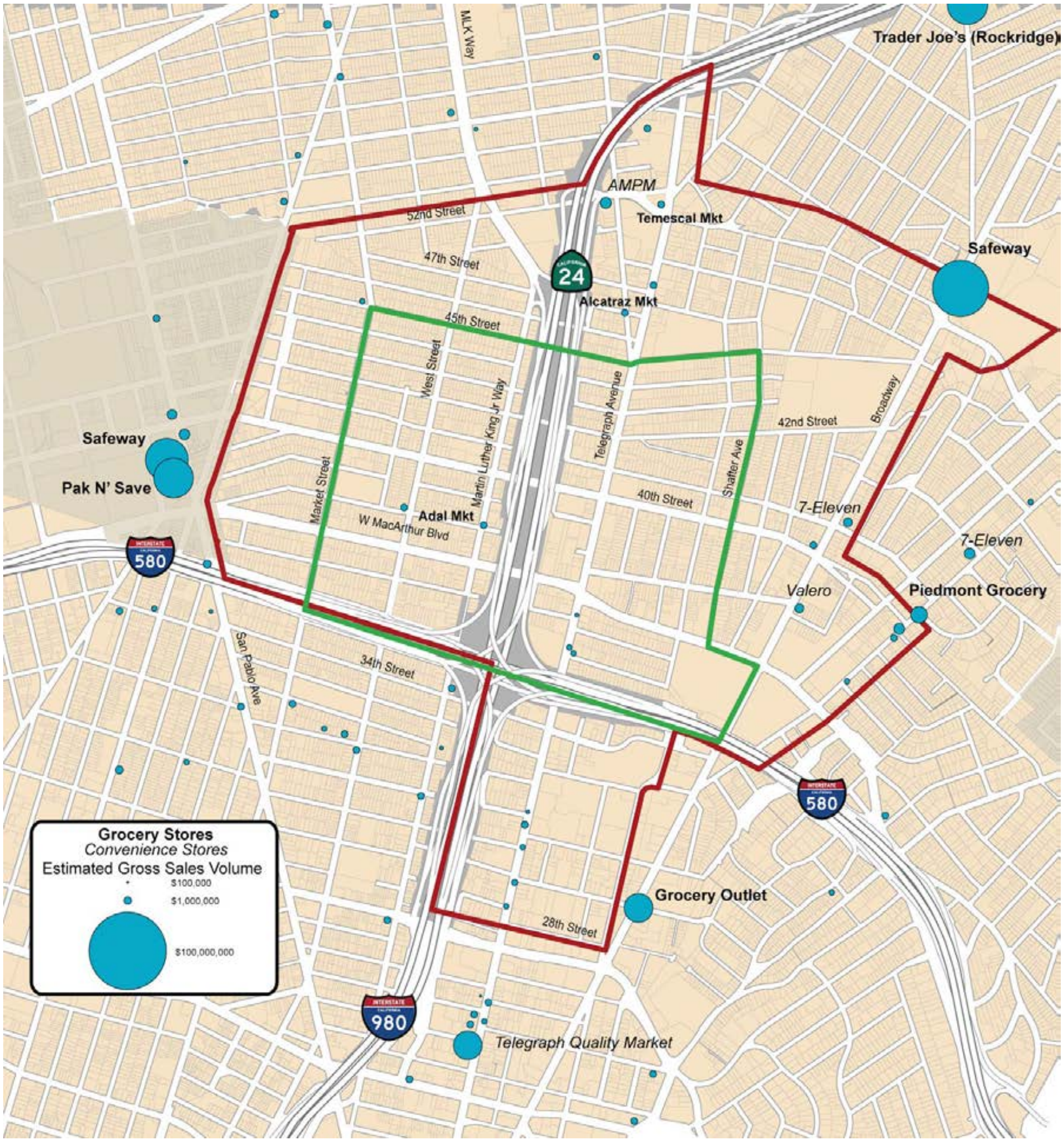
(ReferenceUSA, n.d.)
Figure 2.9 Commercial property ownership

Notably, the large Temescal Plaza is owned by an LLC incorporated in Kansas and populated mostly by national chains, along with other parcels in the BID that are outright owned by national companies. It is difficult to determine the positions of these businesses towards changes to the BID, as local branches of national businesses may have policies restricting them from taking positions on local issues for fear of damaging the national brand. However, many of these businesses may be assets to the community if they are the only providers of services needed by residents. Lastly, three parcels at the southern end of the BID are owned by individuals residing in Southern California. These properties must be monitored closely for signs of landlord absenteeism; properties with absentee landlords may be a source of blight to the area if the owner has no incentive to develop.

B. Amenity Access

We focus on residents' access to grocery stores as a significant topic for study because much public data exists on commute trips but little data is available on non-work trips, despite the fact that these trips make up about 60% of vehicular trips (AASHTO, 2013). Grocery trips are among the most frequently made non-work trips and we hoped that by studying residents' means of access to grocery stores, we could better understand if the PDA is functioning as a TOD, and if not, what elements need to be introduced to allow the area to capture more non-work trips using modes other than the private auto.

Despite the designation of the MacArthur station area as a neighborhood center and the desire for the development to be oriented around transit, the area lacks a full-service grocery store within walking distance of the BART station (Figure 2.10). Two Safeways, Pak N' Save, a Grocery Outlet, and a Trader Joe's, all large volume grocery stores, all lie outside of the study area. Ethnic markets and niche grocery stores make up the grocery options within the BART station area; from sales volume data we infer these stores are likely not a large draw for residents, a notion we confirmed with resident behavior surveys (see Section 3).

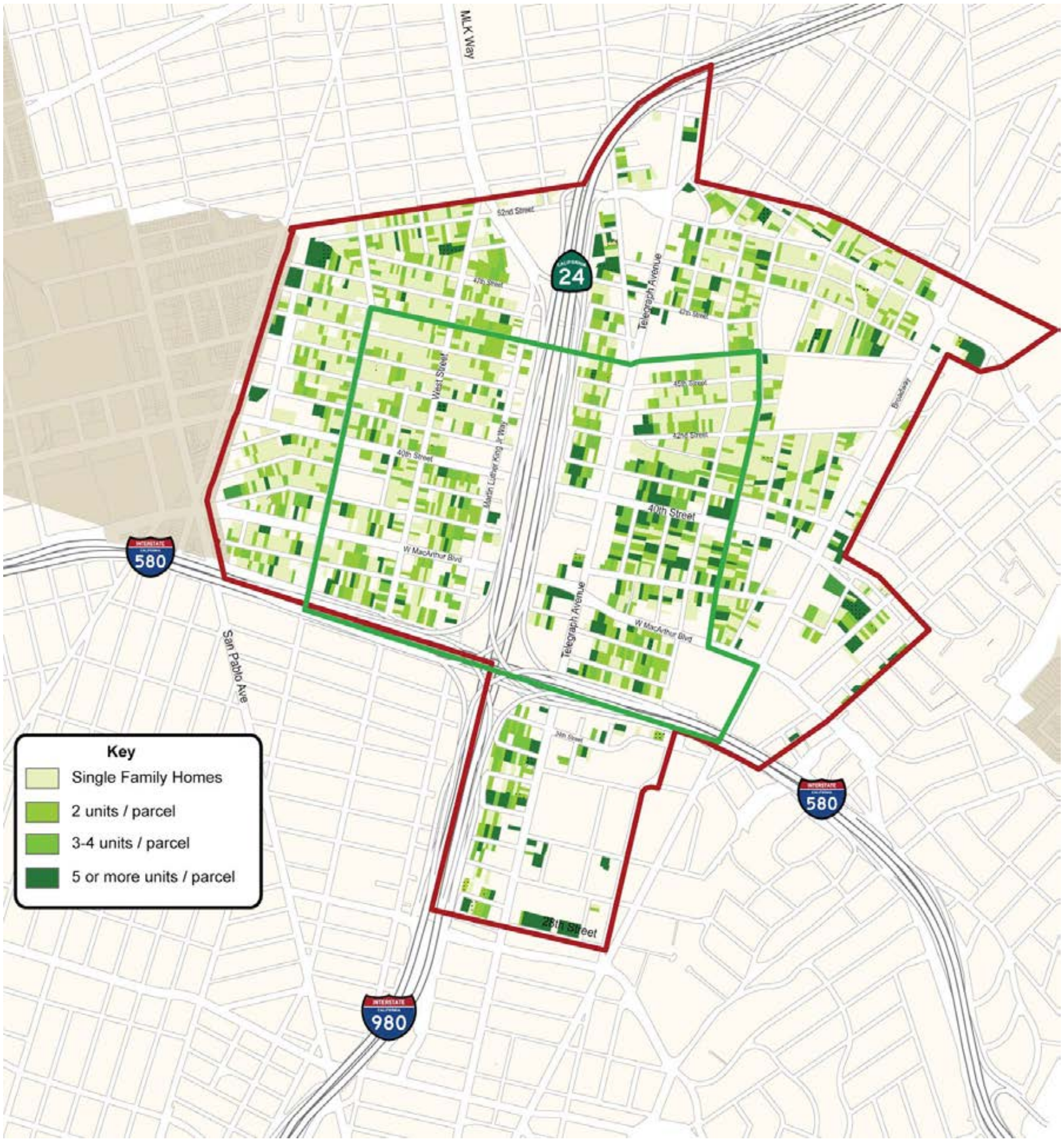


(ReferenceUSA, n.d.)

Figure 2.10 Grocery stores near the MacArthur PDA

2 Residential Land Uses

Understanding residential uses in the PDA is important in assessing how the PDA can meet the goals outlined in Plan Bay Area. As shown in Figure 2.11, the current residential stock is predominantly low-density housing. Most parcels contain a single family home, although some host two to four units either in accessory units or as duplexes or quadruplexes. There are relatively few multifamily buildings, with most concentrated around 40th Street or on the periphery of the PDA.



(Alameda County Tax Assessor, 2013)

Figure 2.11 Residential densities in the MacArthur PDA

A. Current Dwelling Unit Estimate

2010 Census data was used to estimate the number of dwelling units within the MacArthur PDA. Because the census geometry does not exactly match the boundaries of the PDA or study area, we used the census block groups, outlined in red in Figure 2.11 for the analysis. These block boundaries are about ¼ mile from the MacArthur station study area boundaries and taken together they are roughly equivalent to the PDA. These boundaries were used to model trip generation in the area over the planning time horizons shown (see Section 8). From this data, we found there were 13,281 people living in 6,625 dwelling units.

B. Short-Term Growth

In order to develop a growth projection for the next five years, we analyzed Oakland Planning Department records detailing projects that have been built since 2010, are under construction, or are in the permitting process. Currently, the MacArthur Station TOD is the only project under construction and the first one to be built in the area since 2009. This project will add 624 units to the area when completed. Other developments planned or permitted in the area will bring this total to just over 1,000 units. These developments are concentrated near 51st and Telegraph, in the Temescal district. The exact unit breakdown is shown in Table 2.1. Higher density development is coming to the area with the MacArthur Station development immediately adjacent to the BART station, and other mixed-use development near the junction of Telegraph and 51st St.

Table 1.1 Developments planned and under construction

Name	Location	Dwelling Units	Retail (sqft)	Type
MacArthur Station	MacArthur BART & 40th St	624	42,500	Mixed Use
Civiq	5110 Telegraph	68-100	3,000	Mixed Use
Creekside Mixed Use (Nautilus)	5132 Telegraph	120	7,700	Mixed Use
Courthouse Condominiums	2935 Telegraph	142	3,000	Mixed Use
4801 Shattuck	4801 Shattuck	44	--	Residential
3884 MLK Jr Way	3884 MLK Jr Way	40	--	Residential

(City of Oakland Planning and Zoning Department, 2014)

If these projects are completed in the next 5 years, this indicates a 15% growth rate over 5 years. This data was integrated into the transportation demand analysis along Telegraph Avenue, and used to generate transportation and commercial growth into the future.

C. Dwelling Unit Estimate at Build-Out

The 1998 General Plan provides significant room for growth; there are two different maximum densities in the PDA, 130 DU/acre and 30 DU/acre (City of Oakland, 1998).This plan will expire in 2015, however by applying these densities to the residential parcels in the PDA, we obtained an estimate for the number of dwelling units that can be provided in the PDA. Though the densities will likely be kept when the plan is renewed, it is important to note that designations were put into place assuming the population would grow, when in reality it did not. We excluded any parcel with an existing use other than residential, but included vacant lots. Based on this methodology, we estimated nearly 12,000 dwelling units can be built in the area, which is roughly double today's housing density. Coincidentally, this number coincides with the rough number of units allocated to the area by 2040 in Plan Bay Area. If existing non-residential uses are allowed to convert to residential (or residential mixed-use) then the existing General Plan provides for as many as 24,500 units.

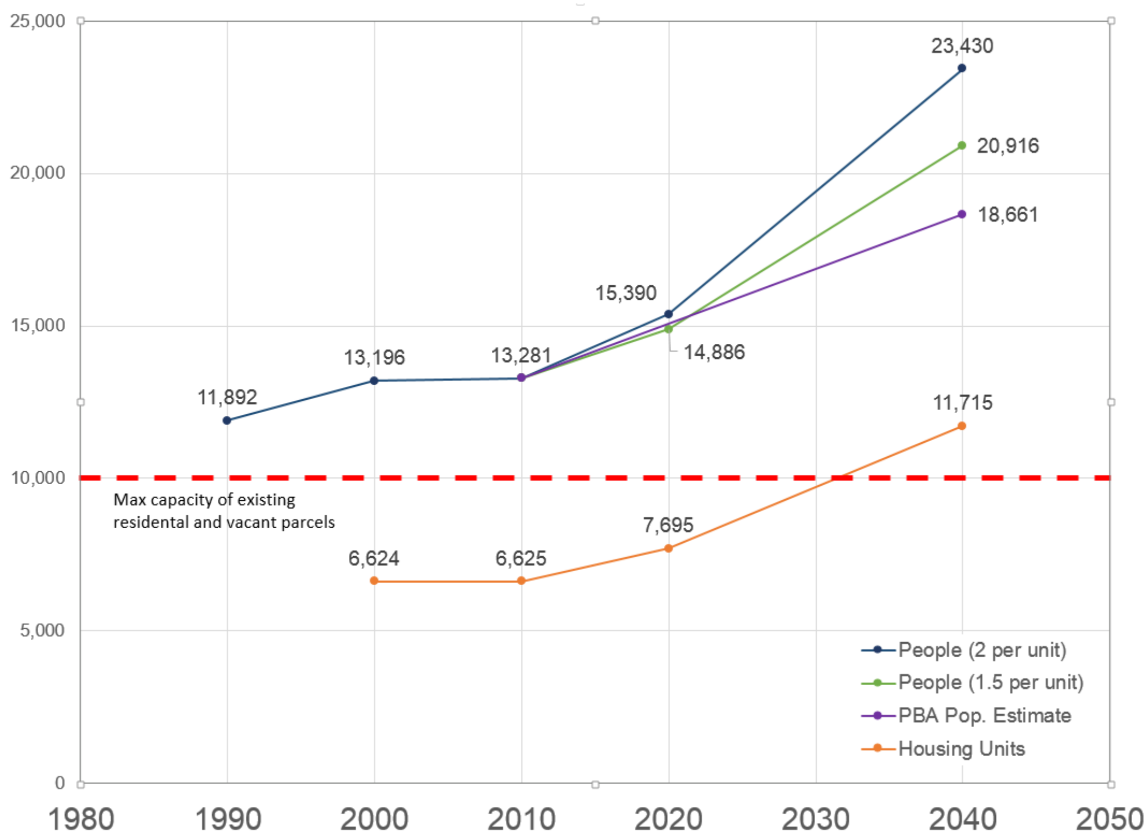


Figure 2.12 Population and housing growth projections

However, given the previous amount of growth seen in the area we do not expect that the "full buildout" scenario is likely. Figure 2.12 demonstrates different growth projections for the PDA: population projections employs the historic rate (2 per unit), moderate rate (1.5 per unit), and regionally projected (PBA Pop. Estimate) population numbers and plots them alongside planned/projected Housing Units in orange.

Our analysis of the area's current land uses show that the MacArthur PDA contains several small, disconnected neighborhoods characterized by low density housing. There is a significant gulf between the density provided for in the General Plan and the existing built environment. Despite the policies allowing for this densification, the area has not seen a significant amount of growth over the past decade and a half. The slow growth in the area around a regional transit hub is striking considering the high demand for housing in the Bay Area in general, and along rapid transit lines in particular. Adjustments to the market are likely needed to bring about this planned growth.

Figure 2.12 compares the historic population growth in the area with growth projections. The 2020 estimates are based on the completion of the projects listed in Table 1.1. The 2040 estimates are based on the number of units allocated to the MacArthur PDA by Plan Bay Area. The current and historic occupancy per dwelling unit is about 2.0; however Plan Bay Area uses a much lower rate when calculating its population projections, shown in purple. We calculated a middle scenario where new residents occupy the additional units at a rate of 1.5:1, which produces the green estimate. This graph is useful to compare population growth rates which in turn will affect all our projections in the PDA from demand for commercial activities to trip generation. From 1990 to 2000, the population growth rate was about 1% annually, and between 2000 and 2010, this rate slowed to 0.1% annually. Our 2020 projections predict the growth rate will return to between 1.2 and 1.5%, and the various 2040 projects predict between a 1% growth rate (the Plan Bay Area estimate assuming about 1 person per dwelling unit) and a 5.2% growth rate (using Plan Bay Area unit predictions with the historic occupancy rate). From this analysis, we conclude the Plan Bay Area estimates seem to be somewhat inaccurate when considering historical data. We will therefore use two growth scenarios: a 1% annual growth rate based on the area's history, and an optimistic 3% growth rate (see Section 8).

Figure 2.13 Projected densities after buildout of General Plan

Figure 2.13 shows where the density would be added. Much of the density increase could come from existing single-family homes adding a second or third unit to their parcel. This option increases density without eliminating existing housing stock, and in an area with a high number of foreclosures, it could improve the financial circumstances of homeowners by enabling them to retain their property. Oakland zoning regulations allow this behavior and some homeowners in the area have already taken advantage of the policy, however many more have not. Our analysis of residential parcels in the area shows that there are no regulatory barriers to density doubling in the PDA, and suggests that market factors need to be addressed if the goal is indeed to increase density in the MacArthur PDA.

There are three primary issues that must be addressed: first, the immediate station area suffers from a lack of place, improved site design and better integration with the surrounding community is required. Second, there are a high number of property owners in distress. To reduce the likelihood of displacement, policy measures should also address the needs of existing residents and property owners. And, finally, most of the planned development is to the east of the freeway. The negative outcomes of this type of lack of connectivity have been demonstrated by the Fruitvale Station analysis, and should be directly addressed. Disconnected development may lead to further inequality between these communities.

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Section 3

Residents

David Weinzimmer

Various survey instruments were developed by the transportation studio class to understand travel patterns, needs, and perceptions of people in neighborhood. Subsequent sections of this report detail the findings for shoppers, merchants, and employees. This section describes the methodologies of a survey that was distributed to residents in the MacArthur Station Area.

I SURVEY CONTENT AND MOTIVATION

The survey asked respondents about the types of destinations they visit and how they get there, the kinds of development they would like to see in their neighborhood, and perception issues while traveling in their neighborhood (on the street as well as under freeway overpasses). It also asked limited questions on household characteristics to understand how closely our survey respondents match Census data for the area. The purpose of the survey was to understand existing conditions and the extent to which residents are or are not able to meet their day-to-day needs for shopping, work, school, and other trips inside their own neighborhood. The survey included a raffle for a $50 gift card as an incentive to encourage participation.

The resident survey is important for addressing some of the lessons learned from the example of the Fruitvale TOD (see Section 1). The plans for the station area around Fruitvale did not have a sufficient scope when examining the connections between the BART station and nearby destinations. This is evident particularly with the burdensome pedestrian connections to the Fruitvale Station commercial center just west of the BART station. The MacArthur Station Area Resident Survey asked where existing residents travel in and outside the neighborhood on a day-to-day basis for various types of trips. It also solicited their input on what types of new businesses are necessary or desired in the neighborhood.

II SURVEY INSTRUMENT AND DISTRIBUTION

The survey instrument is in Appendix 4 of this report. The survey starts with a matrix asking whether the respondent had gone to a variety of types of destinations in the past week either within or outside the MacArthur Station Area, and then asks more detailed questions about trips for groceries, school, and work. The survey then asks what types of new businesses the respondent would like to see within walking distance, perceptions of safety and comfort while walking in the neighborhood, and how often the respondent walks through the freeway underpasses. Lastly, the survey asks about demographic questions and transit usage.

A sample of 1,000 households (about 15% of households in the station area) received an envelope containing information about the study and the MacArthur Station Area map, a double-sided, one-page survey with 16 questions, and a postage-paid return envelope. The MacArthur Station Area is shown in Figure 3.1 below, as well as the blocks that were selected for survey distribution, highlighted in blue. The sampling strategy ensured that roughly half of the surveys went to the east and west sides of the station area as defined by the dividing line of Highway 24. This distribution allows us to draw strong conclusions on any differences in travel patterns that result from the physical barrier of the freeway itself.

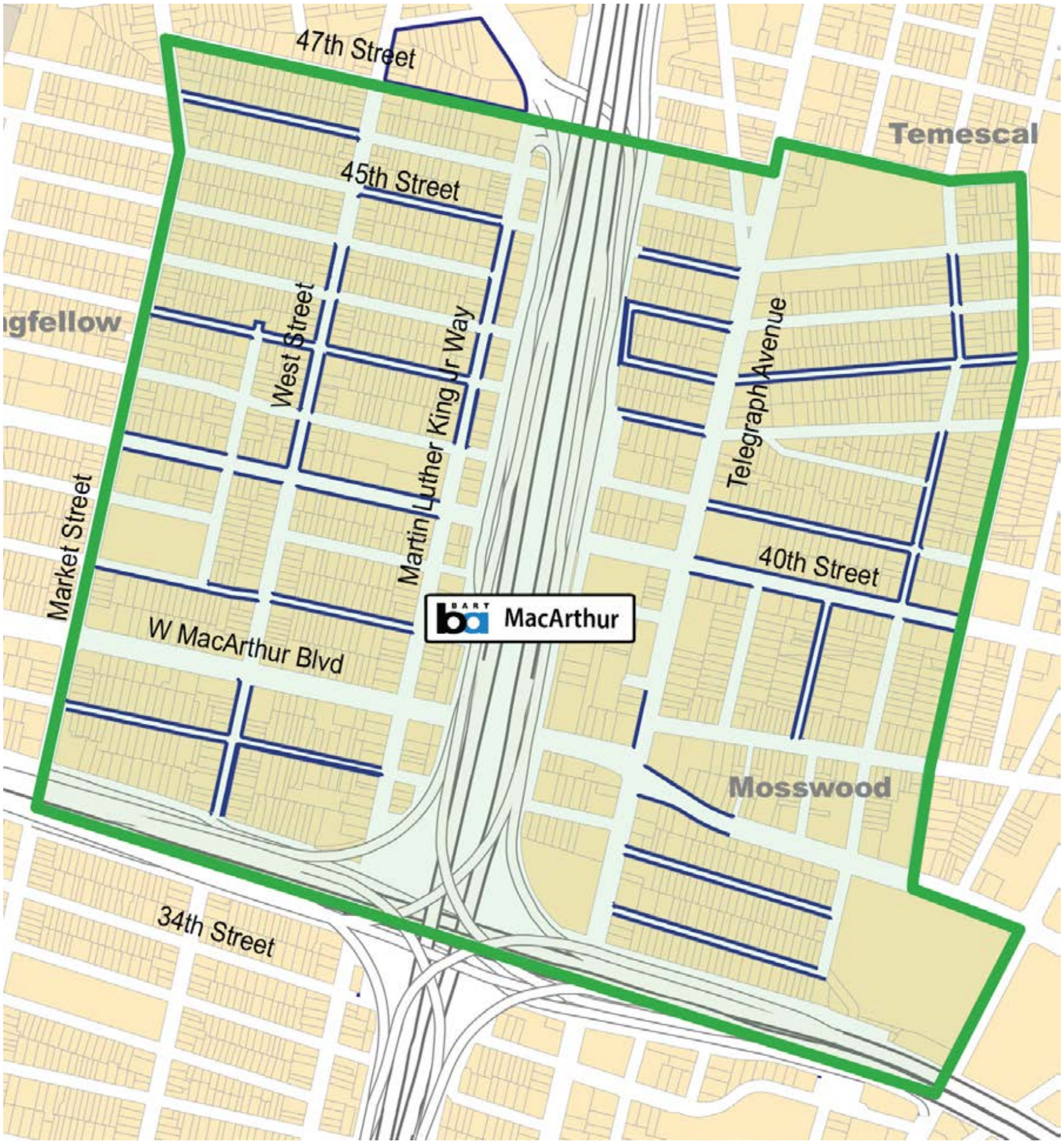

Figure 3.1 MacArthur Station Area and Residential Survey Distribution

In addition, the block faces designated for survey distribution are chosen to accurately represent the mix of housing types within the area. There is a relatively representative mix of multi-family housing, attached multi-unit homes, and detached single family homes in the block faces chosen for survey distribution.

The primary method of survey distribution was delivering surveys door-to-door in person, delivering 400 surveys in person to each side of the freeway (800 surveys total delivered in person). While delivering surveys in person, survey distributors made note of the addresses for which mailboxes were inaccessible, which included a disproportionate number of apartment buildings. To avoid under-sampling residents of these buildings, 200 surveys were mailed to the addresses collected in person.

III SURVEY RESULTS

1 Sample Summary and Response Rate

Out of 1,000 surveys distributed, 195 were returned, yielding a 20% response rate. The survey sample is not perfectly representative of the neighborhood, but does seem to be a very reasonable approximation. Among respondents, 52% were renters (and 48% owners), compared to 73% from the American Community Survey of the US Census. However, there was a good response rate across income brackets (see Table 3.1 below), and while there was a higher response rate on the east side of the neighborhood compared to the west, the samples from both sides are large enough to be able to draw strong conclusions. Among responses, 64% (n=125) were from the east side of the neighborhood, and 36% (n=70) from the west.

Table 3.1 Household Income Brackets of Survey Respondents

Income Bracket	Number	Percentage	Cumulative Percentage
<$25,000	20	11%	11%
$25,000 - $49,999	27	15%	25%
$50,000 - $74,999	41	22%	47%
$75,000 - $99,999	26	14%	61%
$100,000+	72	39%	100%

2 Neighborhood Trip Capture

Residents were asked what types of activities they had done in the past week inside the MacArthur station area and outside it. The full results are reported below in Table 3.2, but the most common types of trips that were made within the station area were to:

- Restaurants (56%)
- Coffee shops (54%)
- A friend's house (42%)
- Pharmacies or drugstores (38%)

The most common trips to destinations outside the neighborhood were to:

- Groceries (90%)
- Work (69%)
- Bank (57%)

Table 3.2 Residents' Trips Inside and Outside Neighborhood in Past Week

Trip Type	In	Out	Out:In
Restaurant	56%	44%	0.8
Coffee shop	54%	34%	0.6
A friend's house	42%	49%	1.2
Pharmacy/Drugstore	38%	45%	1.2
Bar	23%	28%	1.2
Bank	17%	57%	3.4
Work	15%	69%	4.6
Doctor's office	15%	41%	2.8
Groceries	15%	90%	5.9
Clothing shopping	5%	36%	7.7
School	3%	27%	10.2

It is deceptive to look only at the absolute percentage of residents who went to each type of activity though without also comparing the ratio of respondents who went outside to the those who stayed inside the neighborhood for each trip type. This ratio tells us how much more likely residents were to leave the neighborhood for a particular type of trip. Table 3.2 shows that residents were:

- 10 times more likely to go outside the neighborhood for school than to go to school in the neighborhood,
- 8 times more likely to go outside the neighborhood for clothing shopping, and
- 6 times more likely to go outside the neighborhood for work.

Restaurants and coffee shops where the only activities that residents were more likely to engage in inside than outside the neighborhood.

Respondents took a median of 3 trip types within the neighborhood and 5 trip types outside the neighborhood in the past week. Among respondents, 16% reported some trips outside the neighborhood and no trips inside the neighborhood. This was one figure that did vary significantly between the east and west sides of the freeway: 11% of respondents on the east side went to no destinations inside the neighborhood, whereas 25% of respondents on the west side reported the same (statistically significant, $p=0.008$). This is likely because there are more businesses to walk to on the east side of the freeway on the Telegraph Avenue commercial corridor, and as demonstrated later in this section the freeway underpasses between the east and west sides are perceived as a substantial barrier.

3 Mode Shares and Accessibility for Grocery, School, and Work Trips

Residents were asked about location, frequency, trip duration, and mode for three key trips: grocery, school, and work trips. The most striking result is that residents are remarkably multimodal, particularly for non-grocery trips, as shown in Table 3.3 below.

Table 3.3 Mode Shares for Grocery, School, and Work Trips

Mode	Grocery (n=190)	School (n=58)	Work (n=150)
Bike	13%	21%	15%
BART	1%	26%	38%
Drive alone	52%	14%	31%
Drive with someone	19%	22%	2%
Walk	13%	5%	7%
Bus	3%	9%	3%
Other	0%	3%	4%
Active (Walk + Bike)	25%	26%	22%
Transit (BART + Bus)	4%	34%	41%

Across all three trip types, active transportation modes (walking and biking) accounted for roughly a quarter of all trips. Furthermore, school and work trips had transit mode shares of 34% and 41%, respectively (and only 36% and 33% driving mode shares, respectively). As is shown in Section 5 of this report about shopper surveys in the Temescal area, the residents whose mode shares are described here are also the largest share of shoppers in the Temescal area. The results of the resident survey thus give many key insights into the travel patterns and preferences of many of the shoppers in the area.

With grocery trips, residents shopped for groceries an average of 1.5 times per week, with 60% going once or less per week. It took residents on average 10.2 minutes to get to groceries from home, with 71% driving. Among those who did not drive, it took an average of 14.1 minutes to get to groceries, compared to 8.7 minutes among those who did drive (statistically significant difference, *p=0.000*). The most common grocery destinations were Berkeley Bowl, Trader Joe's, Pak 'n Save, and Whole Foods; 52% shopped in Oakland, whereas 32% shopped in Berkeley and 15% in Emeryville.

With school trips, only 31% of households had someone who was a student. However, only half of these student households were full-time students attending school 5 days a week. A quarter (23%) of the student households were students at UC Berkeley; a third of student households (30%) were K-12 students. Students took on average 24.2 minutes to get to school.

With work trips, 80% of respondents said they were employed. Among employed respondents, 31% worked in Oakland, 29% in San Francisco, and 15% in Berkeley; 71% worked five or more days a week. Respondents took on average 26.0 minutes to get to work. The commute was only 22.5 minutes for those who drove versus 27.9 minutes for those who did not (statistically significant difference, *p=0.052*), but this difference was largely due to extended BART commutes to San Francisco. Among those not working in San Francisco, drivers took on average 22.5 minutes and those who did not drive took 19.8 minutes, less than drivers, although this difference was not statistically significant. This neighborhood is accessible to major employment centers in Oakland, Berkeley, and San Francisco, and allows residents the opportunity to commute in a time-efficient manner using alternative modes.

4 Availability of Cars and Bikes

To understand what types of transportation improvements would serve existing residents, it is important to understand availability of cars and bikes. Car ownership is high in the MacArthur Station area: 88% of residents reported having access to a vehicle (which varied by only 4% between the east and west sides of the neighborhood). However, bike ownership is also high, with 77% of respondents having access to a bike (varying insignificantly by only 6% between the east and west sides of the neighborhood).

The high bike ownership and already relatively high bike mode shares observed throughout the neighborhood indicate that bike facility improvements serve a wide band of current residents. In addition, bike usage within each income bracket was examined, shown below in Table 3.4. “Use Bikes” indicates that the respondent reported biking for either a grocery, school, or work trip.

Table 3.4 Percentage of Residents Using Bikes, Within Each Income Bracket

Income Bracket	Use Bikes
<$25,000	30%
$25,000 - $49,999	30%
$50,000 - $74,999	27%
$75,000 - $99,999	15%
$100,000+	26%

These data indicate that biking is an important mode of transportation within all income categories in the MacArthur BART station area, and indeed that rates of biking are highest among the lowest income brackets.

5 Transit Usage

Respondents were asked how frequently they ride BART and the bus (AC Transit). The results are shown in Table 3.5 below.

Table 3.5 Frequency of BART and Bus Usage

Frequency	BART	Bus
5+ times per week	26%	9%
A few times per week	23%	7%
Once per week	9%	4%
A few times per month	21%	10%
Once a month or less	18%	23%
Never	3%	47%

Both BART and the bus are clearly valued by residents. Aside from BART’s substantial mode share for school and work trips (26% and 38% respectively, from Table 3.3), 58% of residents report that they use BART at least once per week. While the bus is less widely utilized than BART, it still provides useful service to residents: 20% of respondents reported using the bus at least once per week.

6 Perceptions of Safety and Comfort on the Street and under Freeway Overpasses

Respondents were asked to rate how safe they feel when walking around their neighborhood, and also to rate how comfortable they felt when walking under the freeway overpasses. The ratings were on a 5-point Likert scale, with 1 being "very unsafe/uncomfortable," 3 being neutral, and 5 being "very safe/comfortable."

On average, perceptions of safety while walking in the neighborhood were 3.0, or neutral, though this varied between the east and west sides of the neighborhood, with the east side feeling slightly safer than the west side (3.1 versus 2.9, difference statistically significant, $p=0.050$).

Consistently, respondents rated comfort while walking under the freeway overpasses lower. Overall, respondents rated comfort under overpasses 2.2 ("uncomfortable"), with respondents from the east side of the neighborhood rating it lower (2.0 versus 2.3, difference statistically significant, $p=0.030$). As shown in Table 3.6 below, respondents from the west side of the neighborhood were much more likely to walk under the freeway overpasses than residents of the east side of the neighborhood: 75% of residents of the west side reported walking under the overpasses at least "occasionally," compared to 30% of those on the east side of the neighborhood, and almost half of residents on the west side did so "frequently."

Table 3.6 Frequency of Walking Under Freeway Overpasses

Frequency	East	West
Frequently	6%	45%
Occasionally	24%	30%
Rarely	48%	22%
Never	22%	3%

Among those who walk under the overpasses frequently, the average rating of comfort was a 2.5 compared to a 2.1 for all others (difference statistically significant, $p=0.009$). While both these ratings indicate discomfort walking under the freeway, the lower rating for those who do not walk under the freeway frequently indicates that the overpasses are perceived as a particularly deterring barrier to this group of residents. This is corroborated by the comment of one survey respondent: "Maybe it's just that there are fewer businesses immediately to the west of the highway, but I do perceive it as a border of some kind and don't often cross it (on foot at least)."

Few residents feel at ease walking under the freeway overpasses. On average, respondents felt 0.9 Likert points less comfortable in the overpasses than while walking around the neighborhood in general. These results suggest that residents perceive a need for design improvements that would increase comfort and safety, particularly under the freeway overpasses.

7 Businesses and Other Destinations Desired by Residents

Residents were also directly asked to indicate in a free response what types of businesses and other destinations they would like to see within walking distance in the neighborhood. Among 180 respondents who commented, the following were requested:

- Grocery store (58%)
- Restaurants (30%)
- Cafés (18%)
- Bookstores (11%)
- Hardware and gardening store (10%)
- Bank (7%)
- Drycleaner (5%)
- Bakery (4%)

Comments by residents made it clear that the businesses were desired not only for the sake of having businesses located conveniently for residents, but also for the safety benefits of having more eyes on the street and people on the sidewalks. Some respondents explicitly stated that they wanted to see more businesses so there would be more people ("more bars and things that have people out on the street at night"). Others requested businesses not on the basis of what type of business they were, but on the basis of locations that they'd like to see more activity: one respondent asked for "restaurants on Telegraph south of 40th," while another said, "I would love to see an increase in safety via more retail/commercial spaces, especially in MLK between 40th and 52nd." Another respondent said that they "hope the MacArthur BART station redevelopment increases the commercial development of my neighborhood west of Telegraph to San Pablo."

Many residents voiced strong support for having locally owned, small-scale businesses: residents wrote "small, locally-owned grocery," or, "local shops and restaurants, no chains!"

Residents also voiced concerns about gentrification. When asked what businesses they would like to see, one resident wrote, "None, honestly. I'm getting priced out of this neighborhood, and development isn't helping." Others had less negative views about development, but thought it was very important that development maintain and increase affordability in the neighborhood. It was common for respondents to specifically request "an affordable grocery store" or "affordable restaurants." Another respondent said, "I would like to see many new businesses come to MLK between 40-47th but not trendy stores... more every day businesses." One respondent said they would like to see "places that attract and honor a diverse crowd," while another asked: "The current development is catering to a younger, wealthier population while old-standing residents are losing housing -- how can we develop and protect long term Oakland residents?"

Most resident did express opinions in support of new businesses they would like to see in the neighborhood, but there is clearly a widespread desire to develop and expand business in the MacArthur station area while avoiding a breakdown in the affordability and inclusiveness of the neighborhood, and to keep a local character to the development that does come in.

Section 4

Merchant Perceptions

Jessica Nguyen

I PURPOSE

The goal of the interviews was to gauge merchants' perceptions on the importance of parking, their customers' and employees' travel modes, delivery patterns, and the impacts of proposed changes on Telegraph Avenue and MacArthur BART station area to their businesses.

II METHODOLOGY

1 Interview Guide Development

We conducted exploratory interviews with a subset of businesses and board members of the Temescal Business Improvement District (BID) to refine our interview guide (Appendix 4) and determine effective methods for engaging with merchants. We found that the afternoon, between 2:00-4:00 p.m., seemed to be a favorable time when merchants were available to talk due to a lull in business. The findings of the exploratory interviews were also used to inform the development of the shopper and employee surveys.

2 Sampling Plan

We constructed the study sample by obtaining a list of the businesses located within the study area. We filtered out businesses that were not related to our study objectives based on North American Industry Classification System (NAICS) categories, such as offices, since we were primarily interested in businesses that provide services to the community. After filtering, we found 266 business within the study area that represent types of businesses applicable to our study goals. Our goal was to interview 27 relevant businesses (10%) from our study area. We divided the study area into three sections based on the Temescal BID boundary (40th St-66th St on Telegraph Ave.) and density of businesses: South of 40th Street, 40th-46th Street, and North of 46th Street.

3 Data Collection

The data was then collected through in-person semi-structured interviews. We approached the businesses in the study area door-to-door. If they were unavailable at that time, we asked about an alternative time to come back or proposed to follow up by email or phone if appropriate. An online survey was also distributed through the Temescal BID and Longfellow Community Association to their listservs. Some surveys were also completed in paper form at one of the Temescal BID's monthly Merchants Association meetings.

For the data analysis, we categorized businesses as Retail, Service, or Restaurant/Bar. Businesses and activities that might require customers to carry items to or from the location, such as a clothing store, laundromat, post office, and visiting the library, were categorized as Retail. Businesses and activities that do not require customers to carry items to or from the location, such as hair salons, were categorized as a Service. Businesses where customers go to eat or drink were categorized as Restaurant/Bar. We did not include responses from businesses located outside of our study area in the data analysis. Figure 4.1 shows the location and types of businesses in the study area.

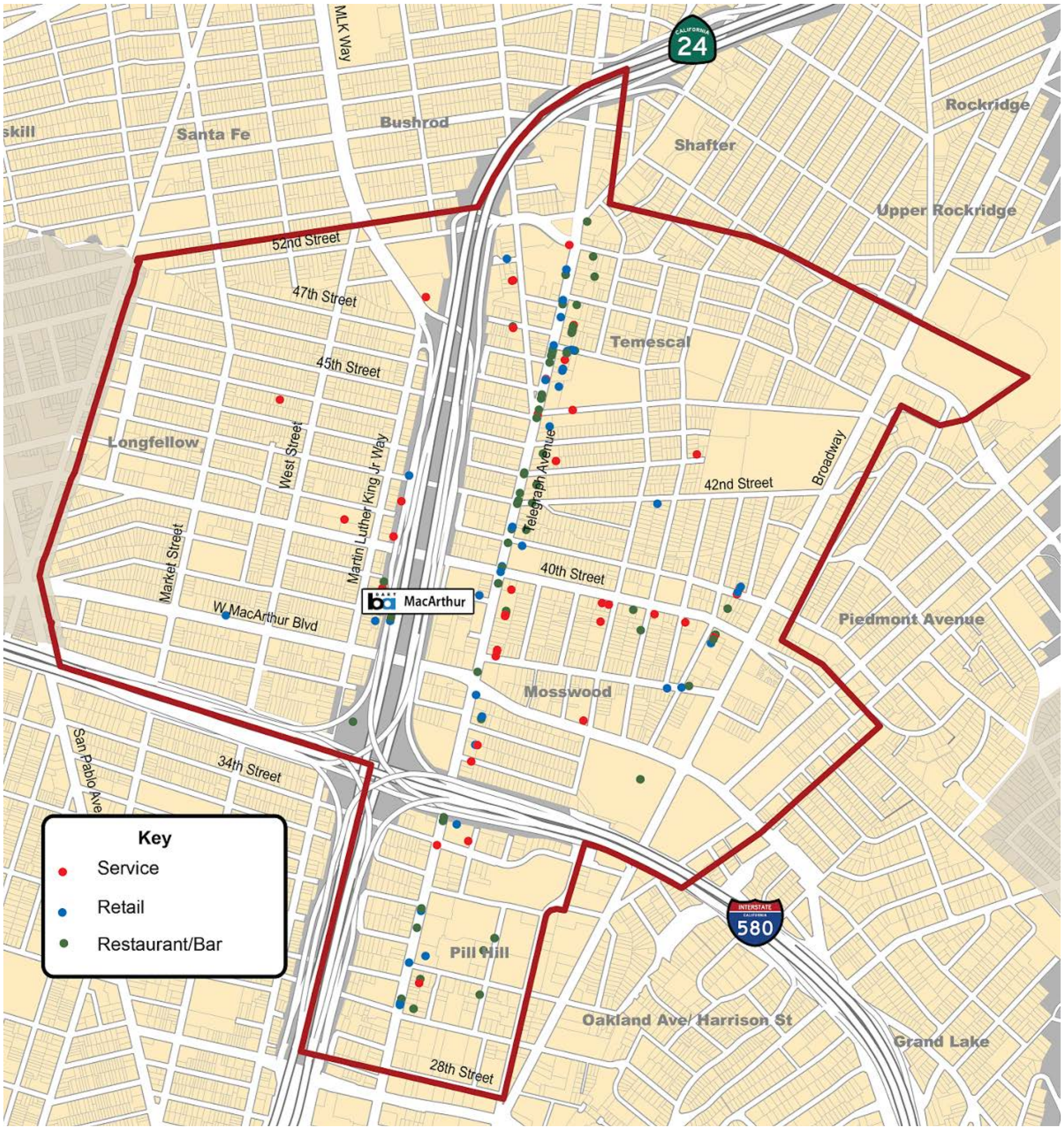

Figure 4.1 Businesses in study area

III FINDINGS

1 Responses

In total, we received 34 responses through the interviews and online survey from businesses located in the study area. Of the 34 responses, 44% were retail, 36% were services, and 20% were restaurants/bars. The businesses interviewed had been at their current location for an average of 12.5 years. Of the merchants who responded to the interview or survey questions, 50% were the owner of the business, 29% were employees, and 21% were managers. The map below (Figure 4.2) shows the businesses that were interviewed or responded to the online survey. None of the merchants indicated that they had surveyed their customers before.

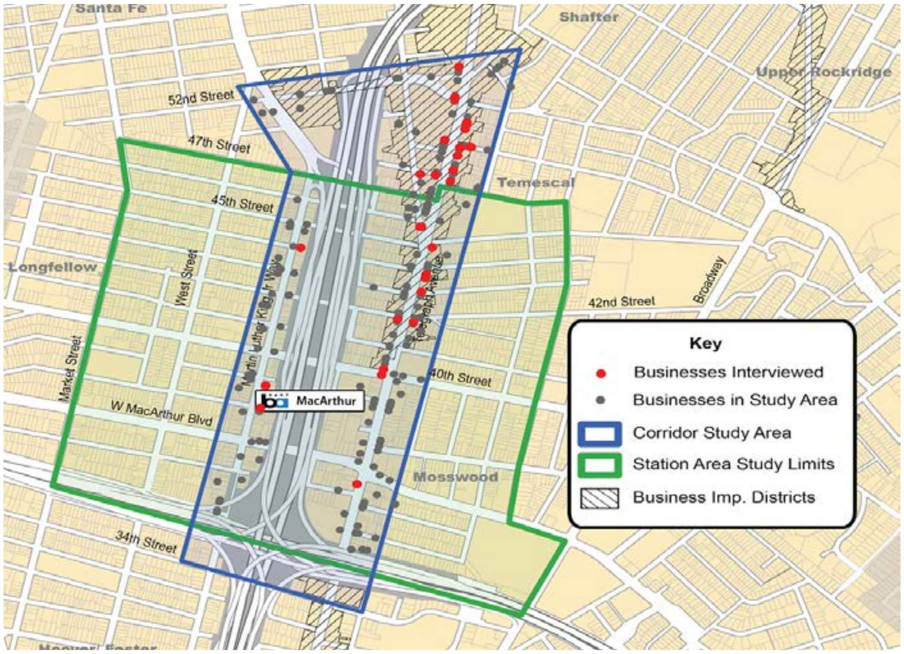

Figure 4.2 Merchants interviewed

2 Merchant Perceptions of Customer and Employee Modes

When asked how they think that their customers arrive at their business, 87% of the merchants interviewed thought that the majority (50% or more) of their customers drive. A significantly smaller proportion of merchants thought that their customers come by alternative modes, with 10% perceiving that the majority of their customers walk, and 3% perceiving that the majority of their customers bike. Figure 4.3 shows the distribution of merchant perceptions of customer modes. With regards to employee modes, 75% of the merchants interviewed perceived that the majority of their employees drive, 11% perceived that the majority of their employees walk, 7% perceived that the majority of their employees bike, 4% perceived that the majority of their employees use BART, and 3% perceived that the majority of their employees take the bus.

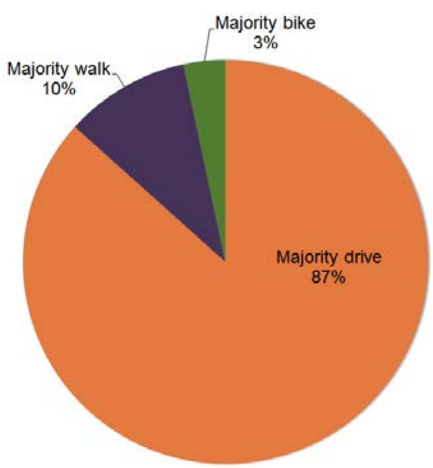

Figure 4.3 Merchant perceptions of customer modes

3 Satisfaction with Parking

Merchants are generally dissatisfied with the current parking facilities for their customers, as shown in Figure 4.4. Almost 60% of merchants interviewed ranked the current parking facilities as Fair or Poor, while 21% ranked them as Excellent or Very Good, and 6% ranked them as Good.

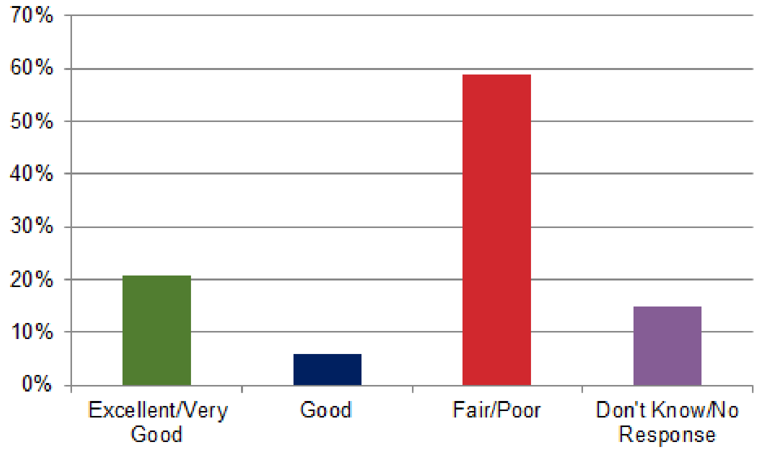

Figure 4.4 Merchant satisfaction with customer parking

Merchants had mixed views with regards to parking for their employees. Almost 30% of merchants interviewed ranked parking facilities for their employees as Excellent or Very Good, while 35% ranked them as Fair or Poor. The majority (82%) of those who ranked parking as Fair or Poor reported that their employees use free on-street parking.

4 Impact of MacArthur Station Development

Merchants are generally optimistic about the new MacArthur Station development. The distribution of responses are shown in Figure 4.5. Half of the merchants interviewed thought that the new development would help their business, 12% thought it would both help and hurt, and 6% thought it would neither help nor hurt. No merchants though that it would only hurt their business. Those who were in support shared that the development will bring more people into the neighborhood, which will translate to more clients or customers for their businesses. Some merchants who are located in the north part of the study area felt that even though the new residents and shoppers may not visit their business specifically, it would help the neighborhood become more vibrant, and thus help their business. Some merchants expressed concern about traffic and parking management, but saw other benefits of the development.

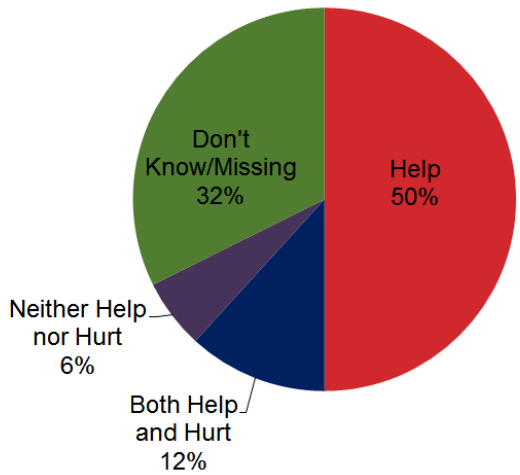

Figure 4.5 Impact of MacArthur Station

5 Views on proposed Telegraph Ave. Complete Streets Plan

Forty-seven percent of the merchants interviewed reported that they were familiar with the City of Oakland's proposed complete streets plan. Of those who were aware, 47% supported the proposed changes to bicycle facilities because they felt it would improve traffic safety. Those opposed to the proposed changes felt that there would not be enough space to accommodate a bicycle lane or that the bicycle lane should be on a different street. Only 20% supported the proposed changes to parking. Those in support noted that people park on the side streets, so changes to parking on Telegraph Ave. would not greatly impact their business. Those who were opposed thought that it would negatively impact businesses or that parking is needed in order to accommodate growth of the area.

6 Public Safety

Merchants shared experiences with theft and car break-ins near their businesses, and expressed a general concern about public safety. However, others commented that the area is improving. Public safety is also a concern among employees, as discussed in Section 6, with less than half indicating that they feel safe on their commute to work.

IV CONCLUSION

The merchant interviews revealed that most merchants think that the majority of customers and employees drive to their business. This perception was confirmed by the Employee Survey (see Section 6), but contradicted by the Shopper Survey (see Section 5). Merchants are dissatisfied with parking for their customers, and have varied levels of satisfaction with parking for their employees. Merchants are generally optimistic that the MacArthur Station development will help their business, however, there is mixed support for the proposed changes to bicycle and parking facilities in the Telegraph Ave. Complete Streets plan. Merchants also have mixed views about public safety in the area.

V LIMITATIONS

Our ability to collect data was limited by the availability of merchants and scheduling constraints with business hours of operation. It should also be noted that the responses were based on merchants' perceptions, and may not fully reflect actual shopper and employee travel patterns and behaviors.

Section 5

Shopper Travel Patterns

Sara Barz

The City of Oakland ("City") currently lacks information about the travel modes shoppers use to access its commercial districts. To help address that need, and to better understand how the transportation network serves visitors generated by local commerce, we conducted shopper surveys to offer the City insight on their travel modes, spending, and parking habits in the Temescal commercial district ("Temescal") and the MacArthur BART Station area (Figure 5.1).

We proposed these two areas within the study area for the following reasons:

1. In the process of redesigning Telegraph Avenue, the supply and demand of parking related to commercial activity in Temescal has become a point of contention for residents and merchants. We wanted to add data to help resolve conflicts about the need for parking;
2. We wanted to understand if Temescal and MacArthur BART draw more local or regional customers;
3. We wanted to understand if the retail the MacArthur BART area draws a different customer base from Temescal; and
4. We wanted to know how much economic value was produced by mode to guide future transportation investments in the area.
5. These two areas represent the largest concentration of existing and planned retail in the study area.

The findings of these surveys will complement our parking analysis of the study area (Section 7) as well as the results of interviews with merchants about their perspectives of travel patterns along Telegraph Avenue (Section 4).

Figure 5.1 Study areas in the regional context

Initial field observations and background research have indicated that the parking supply on the most demanded blocks of the study is severely constrained (Wilbur Smith Associates and the Planning Center | DC&E, 2012). Moreover, in exploratory interviews (Section 4) merchants and members of the Temescal Business Improvement District (BID) have said they think the primary way that shoppers access their businesses is by car.

However, the assumption that most shoppers arrive by car has not been tested. Considering the high numbers of cyclists observed along Telegraph Avenue during the peak hour as well as the number of pedestrians observed in the afternoon in Temescal, the mix of travel modes that shoppers use to access the area is unlikely strictly auto-dependent.

I WHAT WE KNOW ABOUT THE TRAVEL PATTERNS OF SHOPPERS

Historically, researchers have not investigated the modes taken for shopping or other commercial transactions. However, in the past 5-10 years, researchers and cities have become quite interested in the modes that shoppers use to access neighborhood commercial districts. A 2013 study in Portland, Ore., (Clifton, Muhs, & et al., 2013) on the travel choices and spending habits of consumers throughout the city found that drivers may spend more money on a single shopping trip, but that bicyclists, pedestrians, and transit riders are more competitive customers because they tend to frequent businesses more often than drivers. Concurrently, the San Francisco Municipal Transportation Agency conducted a study of the ways shoppers access Polk Street (San Francisco Municipal Transportation Agency, 2013), which found similar results.

Our study of the travel modes and spending habits of shoppers along Telegraph Avenue will add to this body of literature. Based on this research, we will present the City of Oakland with recommendations for how to optimize the transportation network in the Temescal and MacArthur BART area.

II METHODOLOGY

From Nov. 5 to Nov. 19, we conducted intercept surveys W seven locations (Figure 5.2) along Telegraph Avenue and Martin Luther King Jr. Way. Locations were chosen to intercept passersby in front of retail clusters, in parking lots, and near popular destinations. Locations were surveyed in two-hour intervals between 11 a.m. and 7 p.m. on at least one weekday and one Saturday (for more on the survey locations, see Table 5.1).

Two studio members conducted surveys at each location. One member would ask every three passersby to take the survey while the other would tally total passersby as well as survey rejections. Teams offered candy to passersby as an incentive to participate.

We asked respondents **13 questions** about their **travel** and **shopping behavior** in the Temescal and

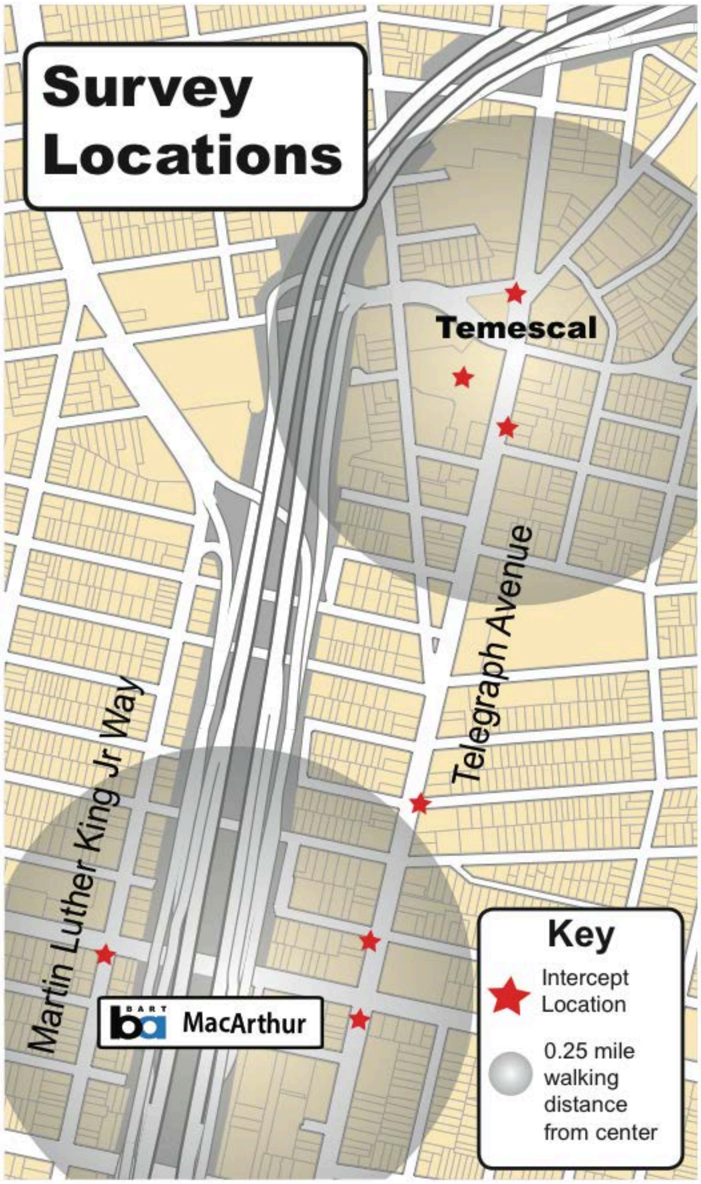

Figure 5.2 Map of shopper intercept locations within the study corridor

MacArthur BART commercial areas. We approached 838 passersby of a possible 2,506 people (sampling rate = 33%). Of those 838 individuals, 262 people took the survey (response rate = 31%). From the 262 responses, 10 responses were suppressed because the respondents were minors, did not spend money or participate in activities in the area, claimed expenditures higher than their stated income ranges, or responded to questions in such a manner that provoked the surveyors to distrust their responses. Removing the suppressed responses, the total sample size was 252, which results in a margin of error of 6% at the 95% confidence level.

1 Survey Design

The shopper survey collected data from respondents about five topics:

1. The types of shops and activities that drew the shopper to the area,
2. The frequency with which they visit the area,
3. The amount of money they spent in the area,
4. The travel mode they took to the study area, and
5. Their car or bicycle parking location, as applicable.

We also collected basic demographic data on age, gender, zip code, and household income to see if travel and shopping patterns correlate with one of the aforementioned characteristics. Respondents were asked to answer these questions by completing a paper form. If the respondent did not feel comfortable reading the questions, the surveyor would then read aloud the questions and mark down the answers (see the survey instrument in Appendix 5).

2 Limitations

There are some limitations to this sample. We constructed the sampling strategy to intersect with shoppers when pedestrian flows would be highest at the survey locations and at times that we assumed would be more likely to garner responses. Thus we chose not to conduct surveys of shoppers during the morning rush hour because we were not confident we would receive many

Table 5.1 Survey locations, dates, and times of day

Location	Date	Day of the Week	Time
Telegraph & 51st Street	11/8/2014	Saturday	2-4 p.m.
Temescal Plaza (parking lot)	11/19/2014	Wednesday	11 a.m.-1 p.m. 5-7 p.m.
Telegraph & 49th Street	11/8/2014 11/12/2014	Saturday Wednesday	2-6 p.m. 5-7 p.m.
Telegraph & 44th Street	11/8/2014	Saturday	2-6 p.m.
Telegraph & 41st Street	11/15/2014	Saturday	2-4 p.m.
Telegraph & 40th Street	11/5/2014 11/12/2014	Wednesday Wednesday	3-5 p.m. 11 a.m. -1 p.m.
Martin Luther King Jr. Way & 40th Street	11/12/2014 11/15/2014	Wednesday Saturday	11-1 p.m. 2-5 p.m.

responses even though there are coffee and bagel shops in the area that attract many customers. We also chose to end our survey period by 7 p.m. even where restaurants and bars serve patrons until 10 or 11 p.m. because a) we did not want to compromise the surveyors' safety, and b) we did not have confidence we would receive many responses well after dark. Because the survey was conducted in early November, the sun set at 5 p.m. Thus this sample does not represent the shopping patterns during the morning peak and the late evening.

Furthermore, while we did attempt to collect surveys in one popular parking lot, the public parking lot at Temescal Plaza (bordered by 51st Street, Shattuck Avenue and Telegraph Avenue), surveyors were asked to leave twice by private security guards. Therefore it is conceivable that this survey under counts shoppers who drive to a lot, shop in stores only accessible via the lot, and then leave the area. However, there are few parking lots with these characteristics in the area, and we found that shoppers tended to frequent at least two destinations, which would likely draw them onto the sidewalk where they may be intercepted.

Finally, there's no reason to believe that early November is a representative time of year to conduct such a study. We chose to conduct the study at that time because it worked best in relation to the demands of other fieldwork for the studio.

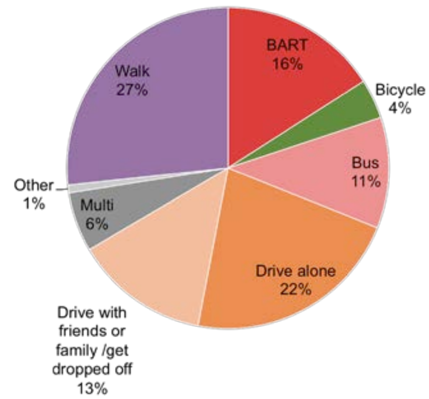

Figure 5.3 Modes of shoppers on the day of the survey

III FINDINGS

Because there were varying response rates for each question, we have noted below the total number of responses by question.

1 Modes of Shoppers

Mode Share on the Survey Day
When asked how they usually travel to the area, 58% of shoppers responded they took alternative modes (Figure 5.3) Thirty-three percent of shoppers reached the area by driving alone or with friends and family. N = 251

Mode Share on a Usual Day
When asked how they usually travel to the area, the same share (58%) of shoppers responded that they took alternatives modes (Figure 5.4). Similarly, 32% of shoppers say they usually reach the area by driving alone or with friends and family. However, more shoppers say they usually reach the area by bicycle (10%) than they did on the survey day (4%). On both the survey day and a usual day, the largest share of shoppers walked to reach the area. N = 234

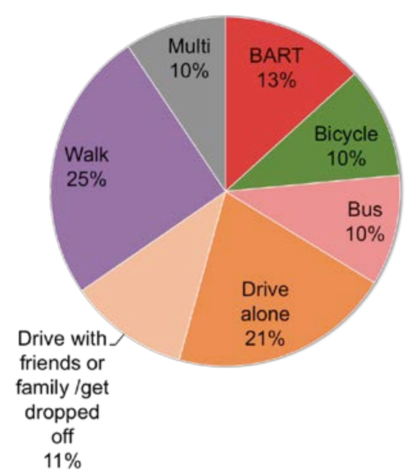

Figure 5.4 Modes of shoppers on a usual day

2 Regional vs. Local Shoppers

Most shoppers claimed their zip code of residence was either 94609, the zip code that encompasses the entire study area, or one of the six zip codes that border the study area zip code (94608, 94611, 94612, 94618, 94703, and 94705). We defined those seven zip codes as “local” and all other zip codes as “regional.” By those definitions, most shoppers in the area were local shoppers (Figure 5.5). N = 216

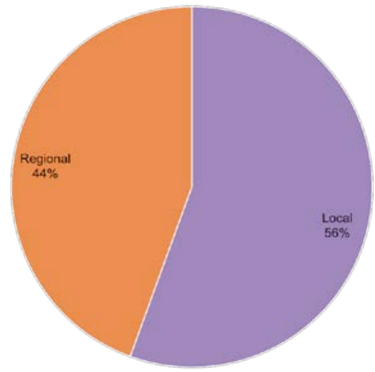

Figure 5.5 Regional vs. local split of shoppers by category of zip code

3 Travel Patterns by Regional vs. Local Distinction

When we examined the usual mode share of local and regional shoppers by zip code category, two distinct patterns emerged. First, most respondents who claimed 94609 as their zip code of residence walked to reach stores in the areas (52%); however the share of walkers decreased as zip codes of residence moved farther away from the study area. One quarter of shoppers walked from the six zip codes bordering 94609 and only 8% of shoppers from all other zip codes reached the area on foot. Second, shoppers who drive demonstrated the inverse pattern. Only 10% of shoppers who lived in the study area drove to reach shops whereas that share increased to 32% of shoppers (combining those who drive alone with those who drive with others) who live in the bordering zip codes and 46% of regional shoppers (Figure 5.6). N = 216

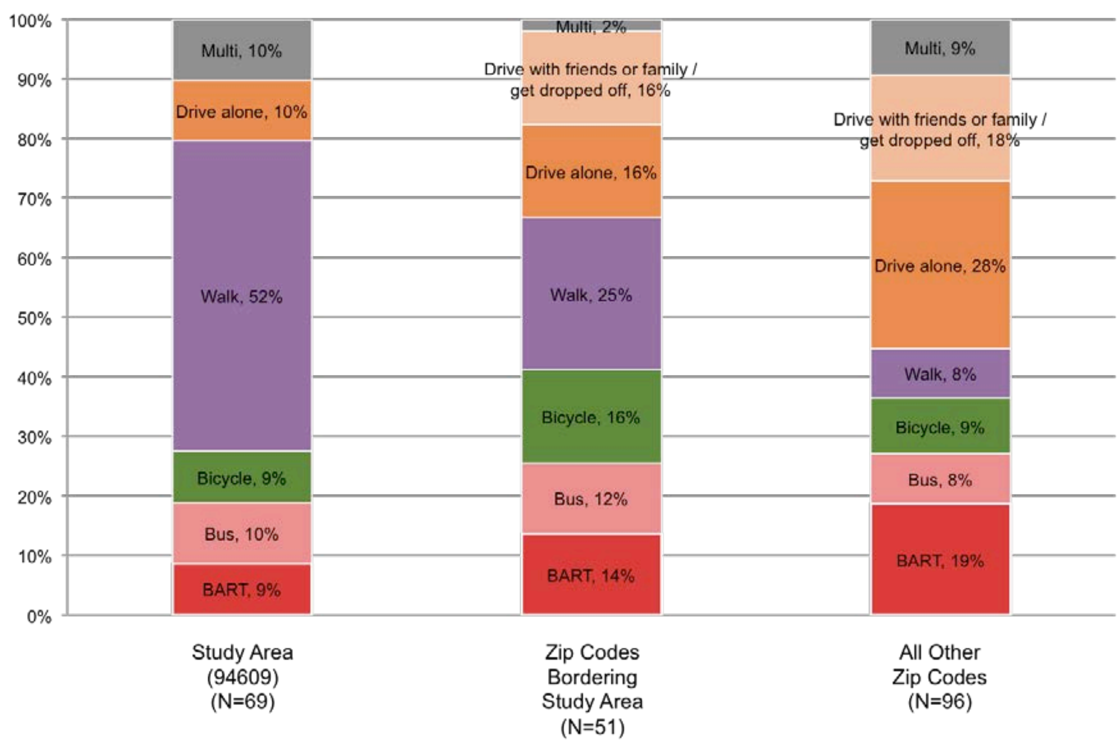

Figure 5.6 Mode shares of local and regional shoppers

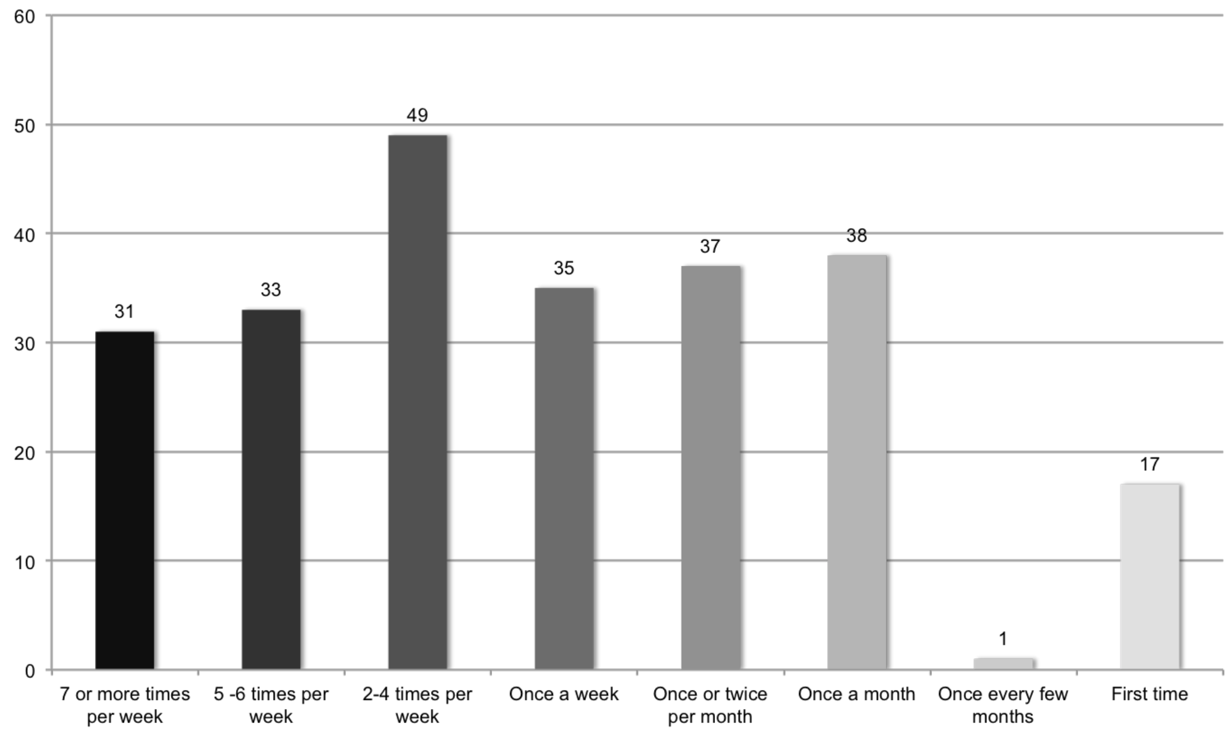

Figure 5.7 Frequency of visits to the area

4 Destinations and Trip Frequency

The largest share of shoppers (20%) stated that they visit the area 2-4 times per week (Figure 5.7) but the majority of shoppers visit the area at least once a week (61%). Of the group of shoppers who visit at least once per week (N=140), 69% of them travel to the area by alternative modes. N = 241

On average, shoppers stated they visited 2 destinations on the day of the survey. N = 244

5 Spending

We asked shoppers how much they spent (or were planning to spend) on the day of the survey as well as how much they usually spend in the study area. On average, shoppers stated they spent $40 on the day of the survey (N = 239) and $26 on a usual visit (N = 157).

Depending on how frequently shoppers visited the area, their

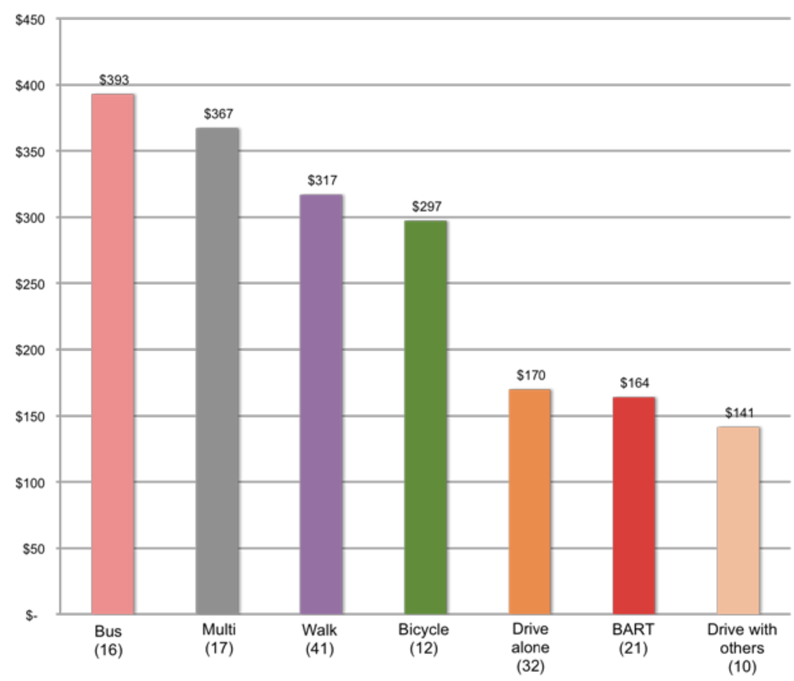

Figure 5.8 Average spending in the area per month by mode

spending levels had varying degrees on economic influence. We found that when shoppers' average usual spending per visit was multiplied by their frequency of visits per month and categorized by their usual travel mode, we saw a pattern in which alternative modes generated more economic value to the area. Of this sample the highest value per month to the area actually came from shoppers who usually access the area by bus (Figure 5.8).

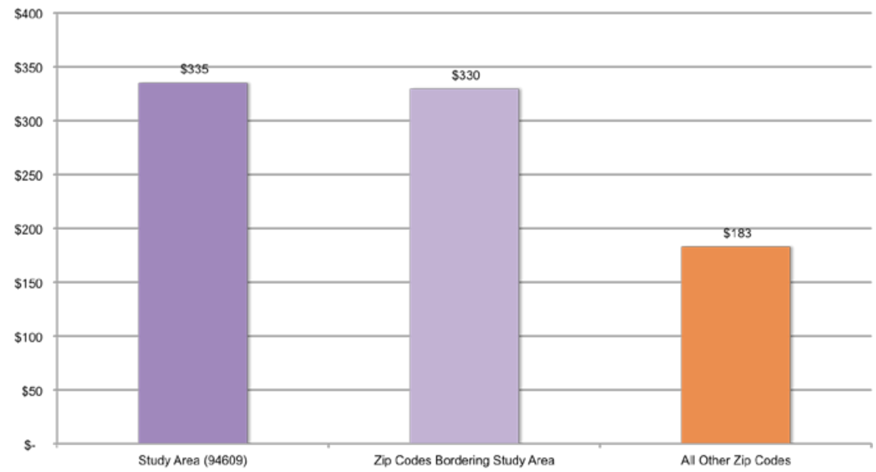

Figure 5.9 Average monthly spending by zip code category

We also examined spending habits by zip code category. Though regional shoppers had a higher average usual expenditure in the area ($30) than shoppers who live in the study area ($20), they spent less per month than local shoppers because of their lower number of visits to the area per month (6 times per month) than shoppers who live in the study area (17 times per month). Overall, shoppers who live in the study area provided the highest amount of economic value to the area (Figure 5.9). N = 143

6 Temescal vs. MacArthur BART Station Area

Beyond just a local vs. regional divide in travel and spending patterns, we observed a clear distinction in the travel patterns of shoppers who were intercepted in the heart of the Temescal versus those who were intercepted closer to MacArthur BART (For a map of survey locations, see Figure 5.2). Shoppers intercepted near MacArthur BART traveled to the area via a greater mix of modes whereas those who were intercepted in the Temescal depended more on walking and driving (Figure 5.10).

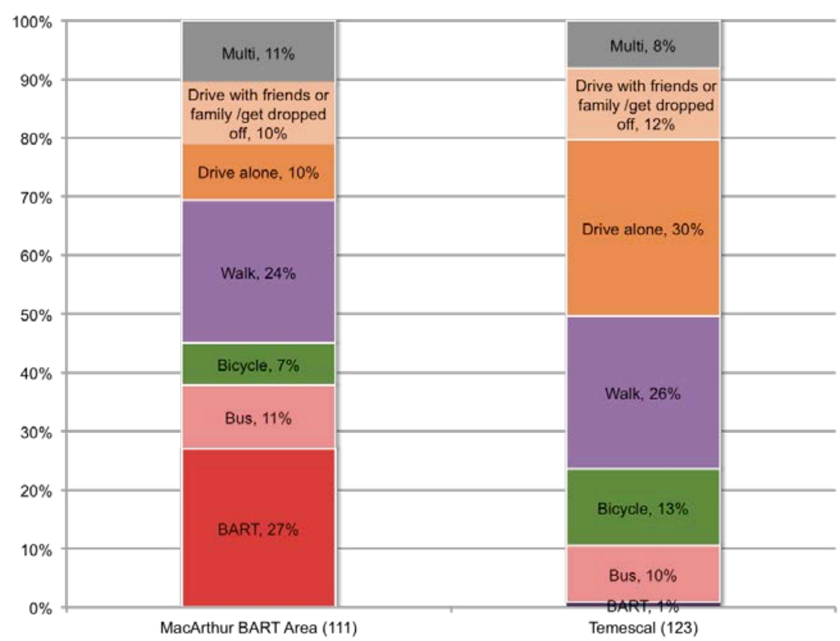

Figure 5.10 Mode share of shoppers at both nodes of study area

7 Missing Business Types

When asked to list what kinds of businesses or activities they would like to see more of in the neighborhood, shoppers noted bars (16), grocery stores (15), and restaurants (12) most frequently (Figure 5.11). N = 194

Figure 5.11 Word cloud of businesses or activities desired by shoppers

RECOMMENDATIONS

Based on findings from the shopper survey, we suggest that the City of Oakland make transportation improvements near MacArthur BART and Temescal that favor alternative modes over auto travel. While auto travel does comprise a sizable minority or trips to the area, the economic value generated per month from those trips is less valuable than the economic value generated from alternative modes. This implies that facilities like vehicular parking are less important to the area than sidewalks, bus facilities, and bicycle lanes.

Because the distribution of businesses in the area largely serves local customers, it stands to reason that shoppers primarily rely on alternative modes. But it is conceivable that the planned commercial development adjacent to MacArthur BART station will induce a population of shoppers who are more regional in origin. However, considering the City's stated policy to reduce single-occupant vehicle trips (City of Oakland, 1998) and the new commercial development's proximity to BART, we strongly recommend not building or requiring auto facilities to encourage regional mode shift away from driving and to BART.

Finally, we observed two distinct patterns of shopper mode shares in Temescal and in the MacArthur BART area. Yet, we find that the two nodes are quite close to one another. The walking distance from 51st Street and Telegraph Avenue to MacArthur BART Station is less than one mile (Google Maps, 2014). Thus we recommend that the Temescal BID, with help from the City, consider investing in wayfinding that advertises business types and retail clusters with walking times along the length of the corridor. We think this strategy could be particularly effective given that many of the shops desired by shoppers are actually present in the area. Moreover, a neighborhood map at MacArthur BART Station featuring popular destinations and walking times may also help to connect shoppers to desired destinations between the two commercial nodes of the area.

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Section 6

Employee Survey

Kagure Wamunyu

I. PURPOSE

The goal of the employee surveys was to understand employees' travel behaviors, their shopping activities, perception of safety, and how parking and existing public transit serve their needs. This information was used to analyze the overall travel patterns in the study area.

II. METHODOLOGY

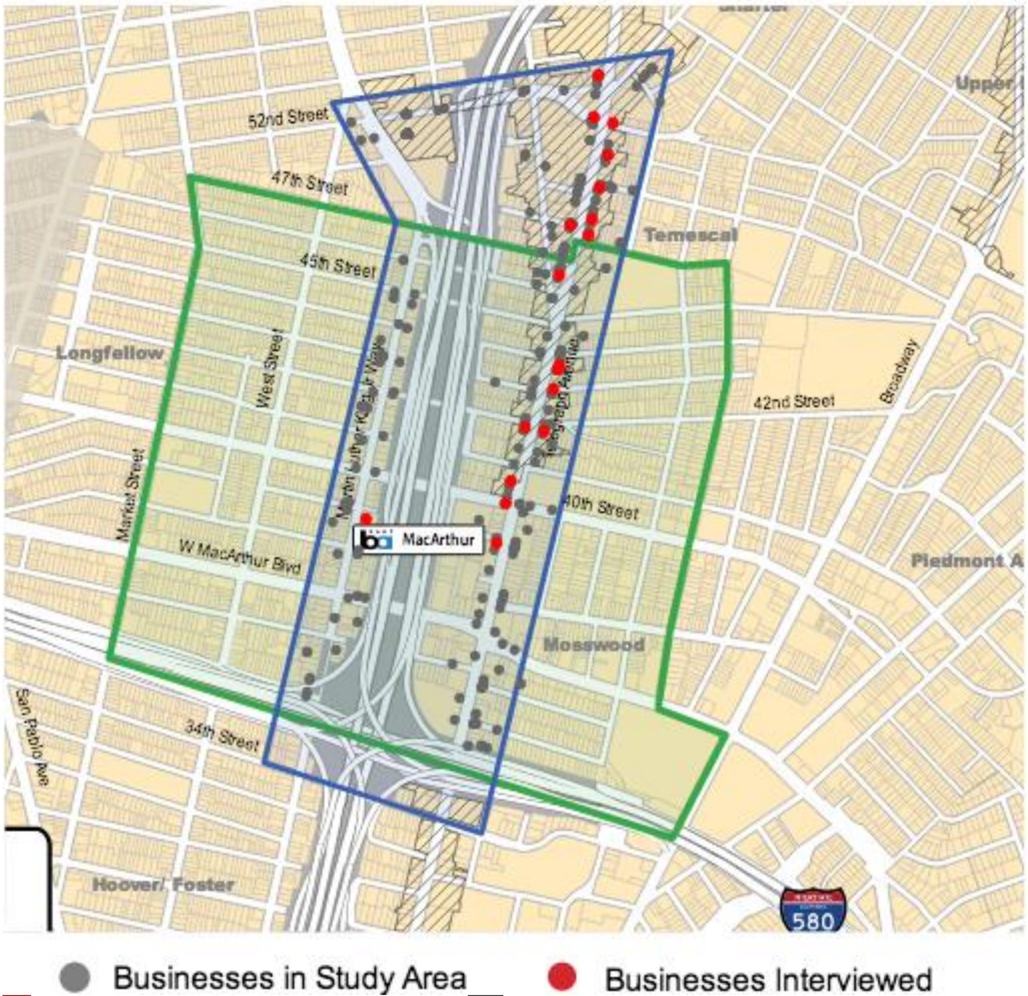
The exploratory interview findings from the merchant interviews were used to guide the times and methods for administering the employee survey. (see Section 4). We found out from the exploratory interviews that the best time to visit businesses was between 2:00pm and 4:00pm when business was slower and more employees were available. In addition, we found that dropping the employee surveys at the business and coming back another day to pick them up would give us more responses as compared to asking the employees to mail the surveys back to us. Finally, we found that offering the survey in both a paper and an online format and providing an incentive of a $50 raffle for employees that completed the survey encouraged more participation.

Our initial goal was to reach all of the employees that worked in the businesses we had interviewed for the merchant interviews. Therefore, the sampling plan used for the employee survey is similar to that used for the merchant's interviews. (See Section 4). We assumed that if a business was unwilling to respond to the merchant interview, they would be unwilling to give their employees the employee survey. In order to increase participation, we sent out a link of the online employee survey to the listservs of Temescal Business Improvement District (BID) and the Longfellow Community Association. We also provided the online survey link to merchants who agreed to administer the survey to their employees. Additionally, during the shopper surveys, if a respondent indicated that they were an employee in our study area, we asked them to fill out the employee survey. We did not include responses from businesses located outside of our study area in the data analysis. See Appendix 6 for the employee survey.

III. FINDINGS

1. Responses

In total, we received 47 responses through paper surveys administered to businesses that responded to our merchant interviews, during the shopper survey, and online surveys sent out through the Temescal BID and Longfellow Community Association. Figure 6.1 shows the business locations of the employees who completed the survey. A majority of the employees interviewed had been working at this location for 3 or more years and 77% of the respondents worked 4-8 hours a day at this location. Finally, 36% of the employees arrived to work between 6-9am and 47% arrived between 9am and 11am.



Employee Survey Response Received Businesses in the area

Figure 6.1 Sample locations and businesses where employee responses were received

2. How Employees Get to Work

A majority (51%) of employees indicated that they drive alone to work with 4.4% carpooling. Figure 6.2 below shows the different modes of commute that employees use. This is in line with findings from merchants' perceptions, who indicated that a majority of their employees drove to work. It is interesting to note that despite a BART station being located within the study area, only 11.1% of employees took BART. Also, the area is served by the 1 and 1R AC Transit bus lines along the Telegraph corridor, but no employee indicated that they took the bus to work and only 7% used multi-alternative modes. When asked whether it was convenient to take the BART or bus, only 23% of employees responded that they found it convenient to take BART to work, and 19% indicated that they found it convenient to take the bus to work. This may point to a system wide problem and a lack of bus/BART stops near their origin.

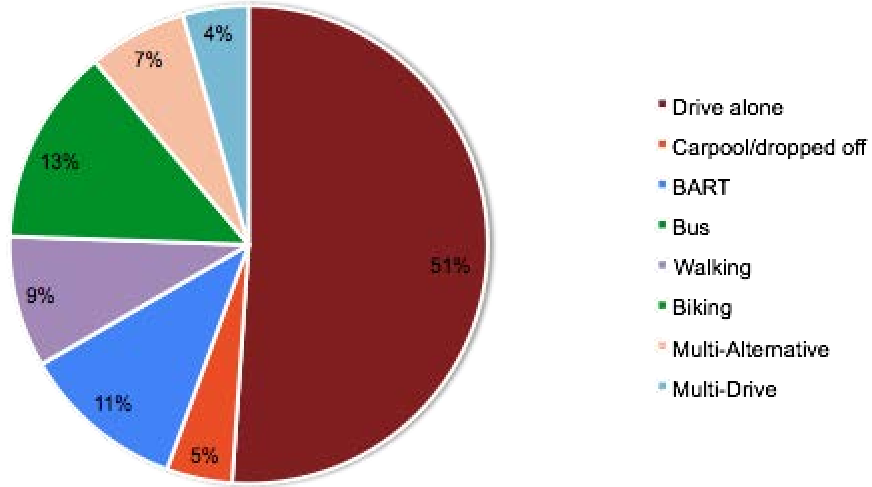


Figure 6.2 How employees get to work.

3. Finding Parking

Overall, there was no problem with employee parking. Figure 6.3 below indicates employee's response to whether they usually find parking. 80% of the respondents agreed that they usually find parking near their workplace. Further, in finding out where employees park, 52% of respondents indicated that they parked their vehicles in free employer provided parking and 39% park on free on-street parking. This is a total of 91% of employees who parked for free.

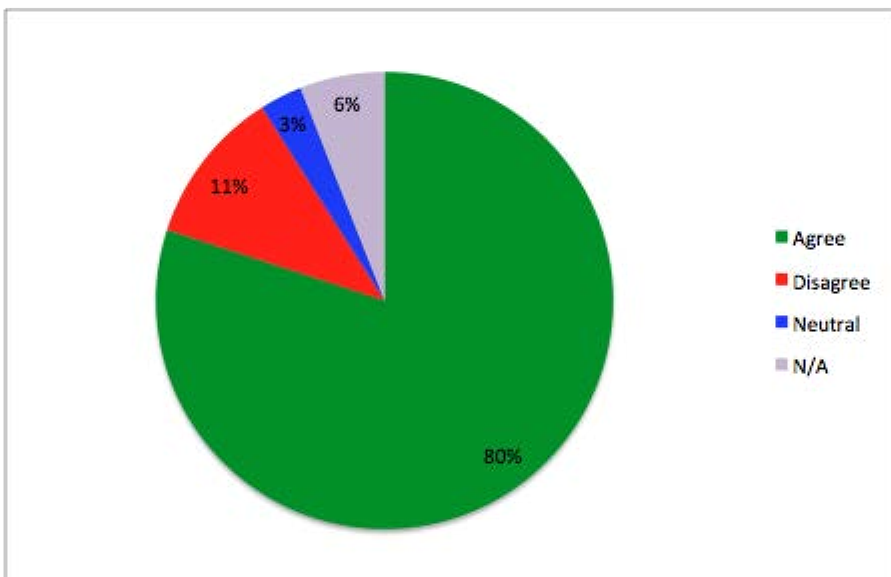


Figure 6.3 Usually find parking.

4. Perception of Public Safety

When employees were asked about public safety, almost a quarter of the employees did not feel safe shopping in the neighborhood they worked in. When asked about their commute, less than half of the employees indicated that they felt safe during their commute to or from work. Merchants had also shared experiences with theft and car break-ins near their businesses, and expressed a general concern about public safety. This indicates that there may be an issue of safety in the area that may need to be addressed. Figure 6.4 below shows employees' response to whether they feel safe during their commutes or while shopping in the neighborhood after work.

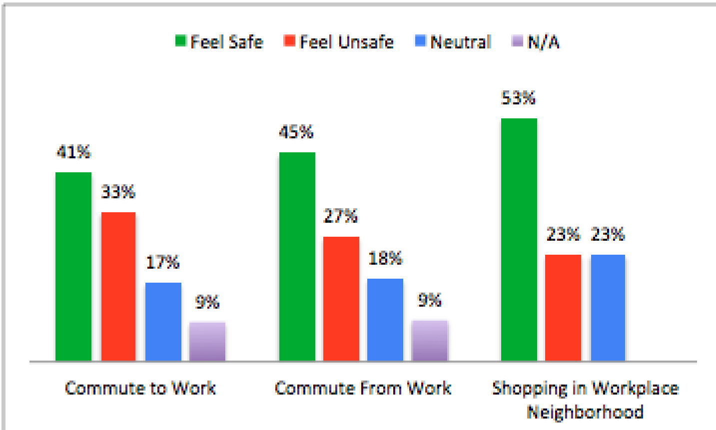


Figure 6.4 Employees' views on public safety.

5. Shopping Activities after Work

We asked employees about their shopping activities after work to learn more about whether there are businesses that are missing in the study area. Less than half of the employees responded that they buy groceries and essentials in the neighborhood, while over 50% of the employees indicated that they were able to go to bars/restaurants in the neighborhood or were able to shop in the neighborhood. Lack of a grocery store in the study area may contribute to why employees indicated that they did not buy groceries or essential in the neighborhood. FIGURE 6.5 below shows the breakdown of responses on activities that employees are able to carry out in the neighborhood.

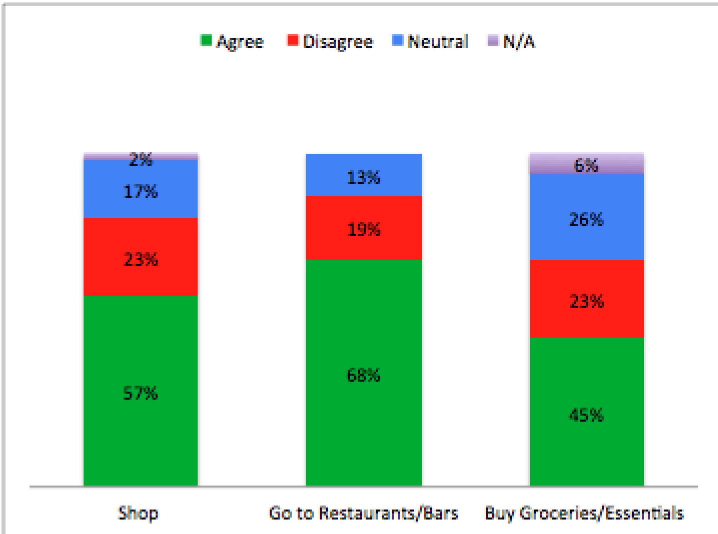


FIGURE 6.5 Able to do activities in the neighborhood near my workplace.

IV. CONCLUSION

Employees are largely auto dependent despite availability of alternative modes of transport. This supports the merchants' perceptions that a majority of their employees drive. They do not have a problem finding parking and 91% of employees park for free during their work hours. While employees are able to do activities in the neighborhood after work, safety still remains a concern to a quarter of the employees. Adding a grocery store in the neighborhood may increase the number of employees who are able to buy groceries or essentials in the neighborhood, increasing the vibrancy of the area.

V. LIMITATIONS

The employee sample size was small, and thus, may not be representative of all of the employees in our study area. This was due to difficulty in getting employees to respond to our paper or online survey. In addition, we faced a time constraint in how many weeks we would give the employees to respond to our surveys.

Section 7

Parking Analysis

Alexandra Hallowell

I. CITY AND NEIGHBORHOOD CONTEXT

As part of the evaluation of the impact projected growth in the MacArthur BART Station Area Priority Development Area (PDA) and the proposed Complete Streets realignment plan for Telegraph Avenue, a thorough understanding of existing parking within the analysis zone was required. This parking study illustrates existing conditions, analyzes current issues, identifies shortfalls, and makes recommendations to integrate thoughtful parking policy into future commercial and residential development in the area.

1. Existing Plans and Policies

At issue throughout the PDA are the numerous, often conflicting land use and transportation policies and plans. Evaluation of local parking infrastructure and policy requires the articulation of area priorities; however, it is difficult to discern priorities for the area given the multitude of documents directing zoning, policy, and growth.

The 1998 Oakland General Plan lists the MacArthur BART Station Area as a Transit-Oriented District which, "…[is] designated to take advantage of the opportunities presented by Oakland's…BART stations…Easy pedestrian and transit access to mixed use development characterize these areas." Furthermore, the document states "In a few areas of the City, such as downtown and near neighborhood activity centers, it is suggested that pedestrian traffic flow would take precedence over the traffic flow of automobiles" (City of Oakland 1998).

While the most recent regional transportation and land use plan, Plan Bay Area, has designated this area as a site eligible for special funding to promote densification and transit oriented development (TOD) (Metropolitan Transportation Commission and Association of Bay Area Governments) (Alameda County Transportation Commission), these policies have not been integrated with the General Plan. Part of this designation as a PDA requires very high population growth, however, there is little evidence this growth, at a rate of nearly 5% annually over the next 40 years, will be realized given the historical residential growth of less than 0.1% (over the last four decades) (U.S. Census Bureau 2014) (U.S. Census Bureau; American Community Survey 2014) (Alameda County Transportation Commission).

In addition to these planning documents, the newly adopted Complete Streets plan (Oakland City Council 2013) ("Telegraph Avenue Complete Streets Implementation Plan" 2014) incorporates traffic calming strategies and aims to improve the safety and connectivity of non-auto modes through the heart of the study area along Telegraph Avenue, a four-lane arterial that connects downtown Oakland and Berkeley.

Without clear consensus regarding area priorities, determining efficacy of planned future interventions are difficult to evaluate. However, these documents seem to agree on the following:

1. MacArthur BART Station Area is a community asset
2. A reduction in single occupancy vehicle (SOV) trips is a priority
3. MacArthur BART Station Area land use should develop as a TOD

While each document fails in one way or another to integrate policies seamlessly, it is clear that the MacArthur BART Station Area is intended by all guiding documents to be a dense neighborhood center, where residents can access daily necessities without the use of a vehicle, and reach the region's vast variety of jobs using public transit. And, as this area is a designated TOD, the zone should also capture a large percentage of "essential trips", or routine trips such as trips to the supermarket, pharmacy, etc.

The following parking analysis will therefore evaluate existing and proposed changes to parking by:

1. Ability to generate mode shift away from SOV for all types of trips
2. Ability to leverage existing facilities to meet community needs which will be characterized as the ability to capture a high proportion of "essential trips."

2. Parking Policies

Minimum off-street parking regulations in the MacArthur PDA are complex, a map of these requirements is found in Figure 7.1. Generally, mandates are organized by land use type: either residential or non-residential. Regardless of use, the vast majority of the PDA requires some off-street parking be included in any new development. Specifically, most residential land uses in the area require at least one off-street parking space per residential dwelling unit, with a significant portion of the PDA requiring 1.5 parking spaces per unit.

Likewise, non-residential parcels require off-street parking spaces based on square footage and are further categorized by specific use types, including but not limited to full-service restaurants, fast food restaurants, medical services provider, financial services provider, or church. For example, a fast food restaurant in a Community Commercial zone must provide one off-street parking space for every 200 square feet of restaurant space, while the same restaurant in a Neighborhood Commercial zone must provide one space for every 300 square feet. Due to the numerous zones and subcategories of land use types, the non-residential uses are visualized relative to each other. Thus, the Community Commercial zone is visualized as a "moderate" parking requirement while the Neighborhood Commercial zone reflects a "great" requirement.

The Mixed Use zone in the center of Figure 7.1 is the only area with no minimum parking requirement for non-residential uses. However, the zone mandates 0.5 parking spaces be provided for every residential dwelling unit. This relaxed requirement is somewhat thwarted by the BART parking requirement, which mandates at least one-for-one replacement of commuter parking spaces near the BART station. Notably, hourly or daily parking spaces in the zone (called "auto fee parking") must be provided in a below ground structure, or in a three or more story structure, but the structure cannot increase the auto fee parking capacity by more than 175%.

Figure 7.1 Parking requirements in MacArthur BART station area PDA

(Oakland Planning Code, 2014) (Oakland Zoning Map, 2011)

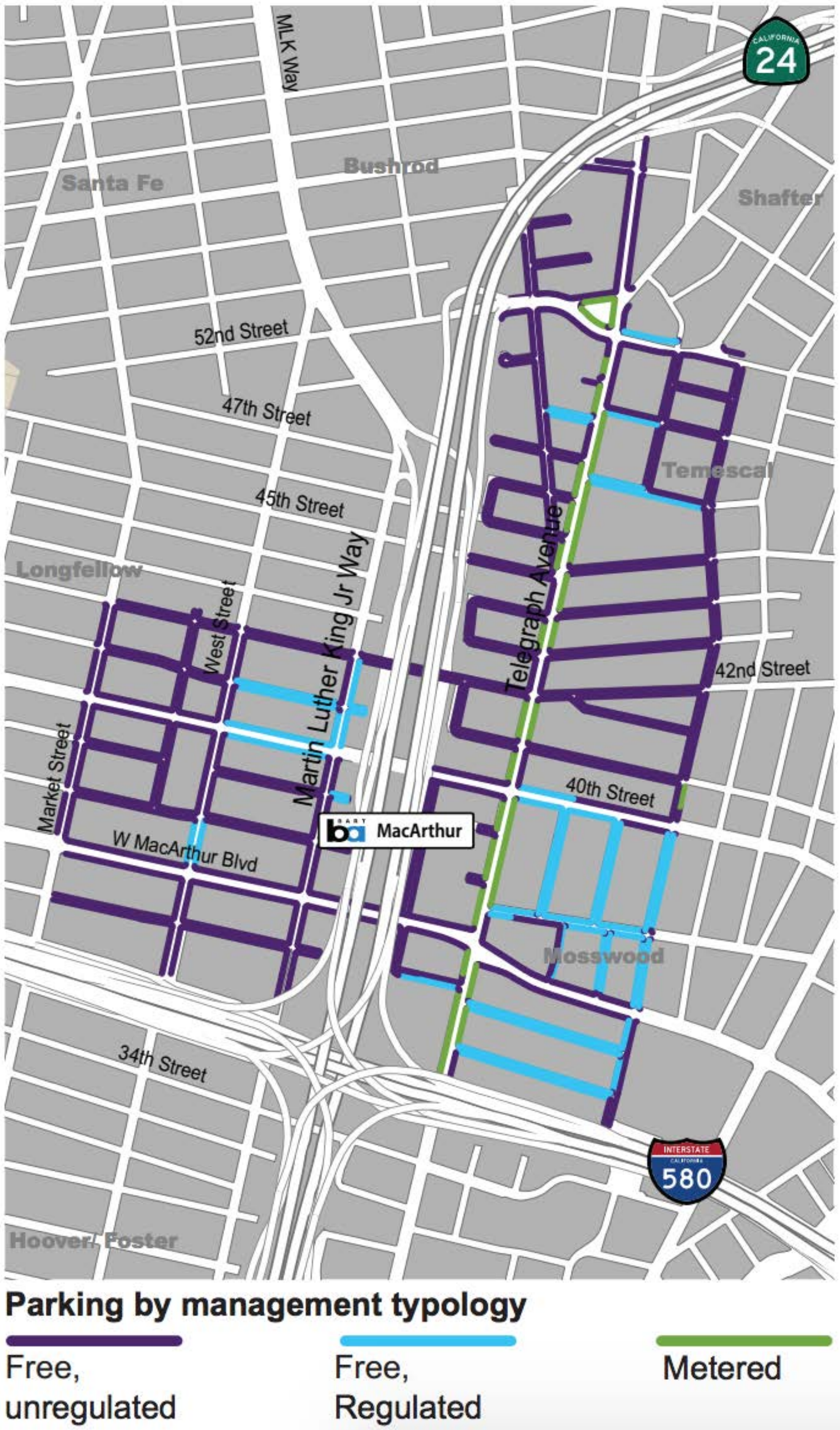
Currently under construction is MacArthur Station development, which upon completion will consist of 624 residential units, 42,500 square feet of commercial space, 5,000 square feet of community space. The site is atop BART's approximately 600-space surface parking lot, which has been relocated to a six-story, 480-space garage to the south of the development. Notably, this deviates from the standard BART parking policy requiring 1-to-1 replacements of off-street commuter parking spaces. Also important to note is that the MacArthur BART parking structure is not available to non-BART riders. Pay kiosks are located within the BART station, behind the fare gates.

The MacArthur Station development falls within the S-15 mixed-use zone, and while required to contain only 0.5 spaces per unit, the planned residential units will have one parking space per unit, or 624 total spaces. While this is well below the maximum allowable, an approximate 1,050 spaces, this also represents a missed opportunity to capture non-auto mode share, granting free and easy access to a private vehicle for a residence only several hundred feet from BART.

3. Parking Restrictions

Existing parking restrictions throughout the study area are limited and disjointed. The length of Telegraph Avenue contains metered on-street spaces, most with a 2-hour limit between 8am and 6pm. There are two different Residential Permitted Parking (RPP) zones—A and N, where non-permitted vehicles may park for free two hours between 8am and 6pm Monday through Friday. However, the vast majority of the area has no parking management.

Figure 7.2 Type of on-street parking



Signage is also a key issue; in the northern Temescal district parking signs remain from a brief period when parking enforcement was extended from 6pm to 8pm. This extension was quickly rescinded due to public backlash but the signs remain (Wilbur Smith Associates and the Planning Center | DC&E 2012). In the MLK Jr. analysis zone west of the BART Station, vandalism has rendered numerous parking signs illegible and in some locations the signs have been ripped down entirely. Additionally, the colored curbs have not been properly maintained, leaving visitors (and researchers) to question the location of restricted parking zones.

4. Loading

Loading along the Telegraph Avenue commercial corridor was one other feature we considered alongside the parking study. The city of Oakland has policies on loading but the guidelines are sparse. The Oakland Municipal Code lists double parking as a fineable offense in Section 10.08.150 (Oakland Municipal Code, 2014). (City of Oakland 2014) The code does not make exception for commercial delivery vehicles. Chapter 10.40 in the code focuses on stopping for loading and unloading. The code allows traffic engineers to create yellow curbed loading zones in any commercial district or central business district. The only limitation is that yellow curbs must be less than one half the block length. The California Vehicle Code provides further guidance on commercial vehicle loading and unloading. Section 22502 states that commercial vehicles are exempt from the rule that a vehicle must be parked within 18 inches of a curb as long as it is necessary to accomplish the loading or unloading of merchandise or passengers (State of California). This however does not permit a delivery vehicle to park opposite to the flow of traffic.

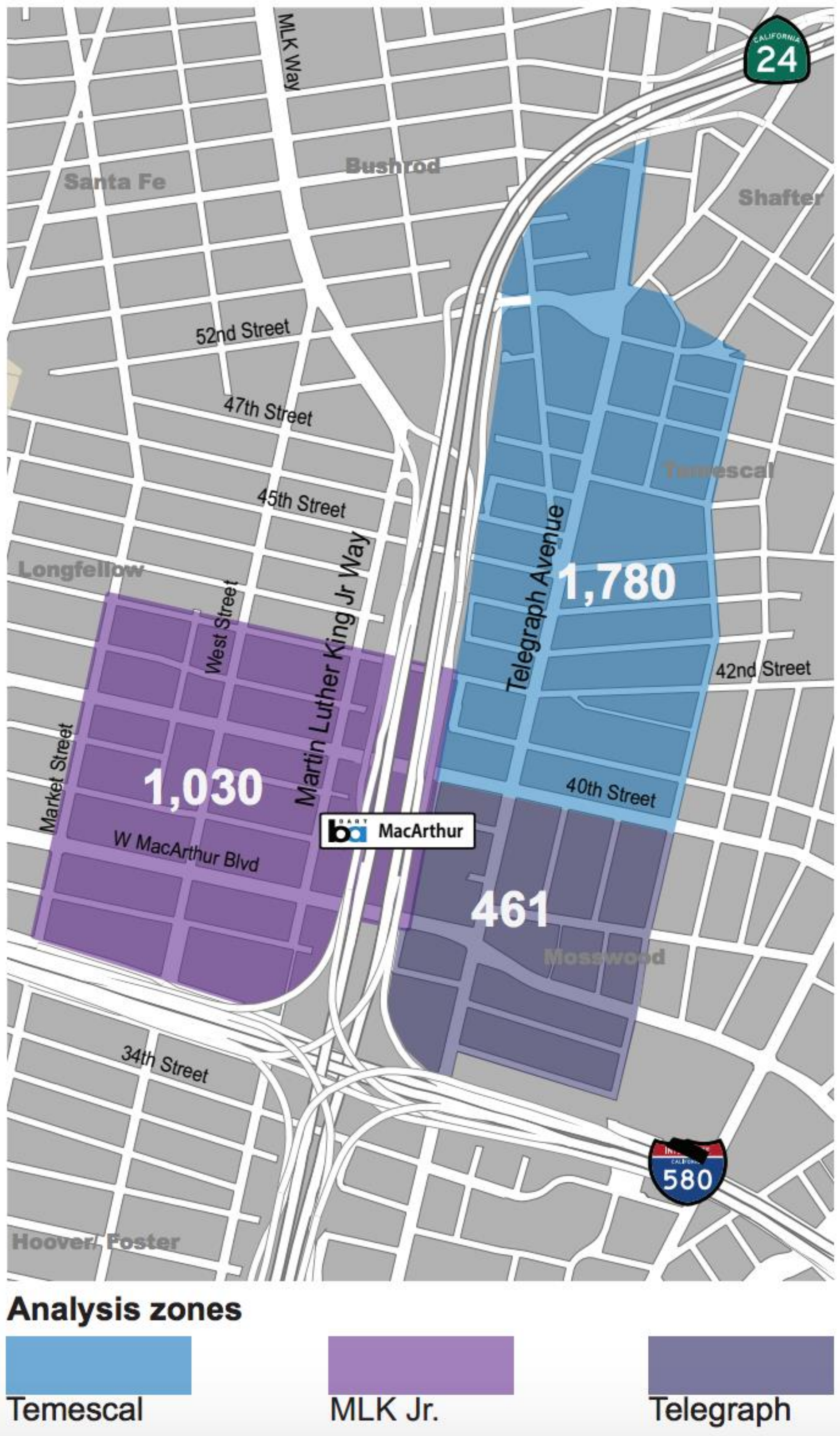
Merchant concerns regarding availability of curb-side loading space had been highlighted as a key issue in previous Complete Streets discussions. Inadequate loading can create dangerous limited sightlines and disrupt the flow of traffic. An analysis was performed to identify potential problems and make recommendations moving forward.

II. PARKING AND LOADING

1. Parking Inventory

The parking analysis zones have been broken into three geographical categories depicted in Figure 7.3 Map of parking analysis zones: Temescal Commercial Zone, Martin Luther King Jr. (MLK) Way Corridor and Telegraph Commercial Corridor. In the three zones combined, here are 3,271 on-street parking spaces. Temescal has 2,498 public parking spaces with 1,780 on-street spaces, 718 off-street spaces, and 32 parking lots (Wilbur Smith Associates and the Planning Center | DC&E 2012). Telegraph Commercial Corridor has 461 on-street spaces and 211 curb cuts. The MLK Commercial Corridor has 1,030 on-street spaces, no public lots, and 375 curb cuts. Figure 7.5 Map of on-street parking below demonstrates the number of spaces divided by block face length to show which blocks have a higher intensity of on-street availability.

Figure 7.3 Map of parking analysis zones



A. Methodology

Original data was collected for the Telegraph Commercial Corridor and the MLK Commercial Corridor. The data for the Temescal Commercial Zone are taken from the 2012 inventory performed by Wilbur Smith Associates and the Planning Center for the City of Oakland. Because many on-street spaces are unmetered and un-marked, an approximate number of spaces per block face was derived using the typical length of a space, 18 feet (State of California Department of Transportation (CalTrans) 2004). Curb cuts were observed, and where they broke the block face into segments smaller than the length of a typical vehicle, these spaces were excluded from the inventory. Abandoned lots with fencing along curb cuts were frequently used as parking spaces, and were therefore included in the inventory. Redevelopment of these parcels may therefore diminish the number of spaces in the public realm.

B. Neighborhood Parking Overview

There is currently an abundance of on-street parking spaces for both residents and visitors alike. Zoning has long required off-street parking for both single-family and multi-family dwellings, and this appears to have been effectively enforced; most single-family homes have private driveways and most multi-family structures have an on-site multi-vehicle lot, presumably for residents.

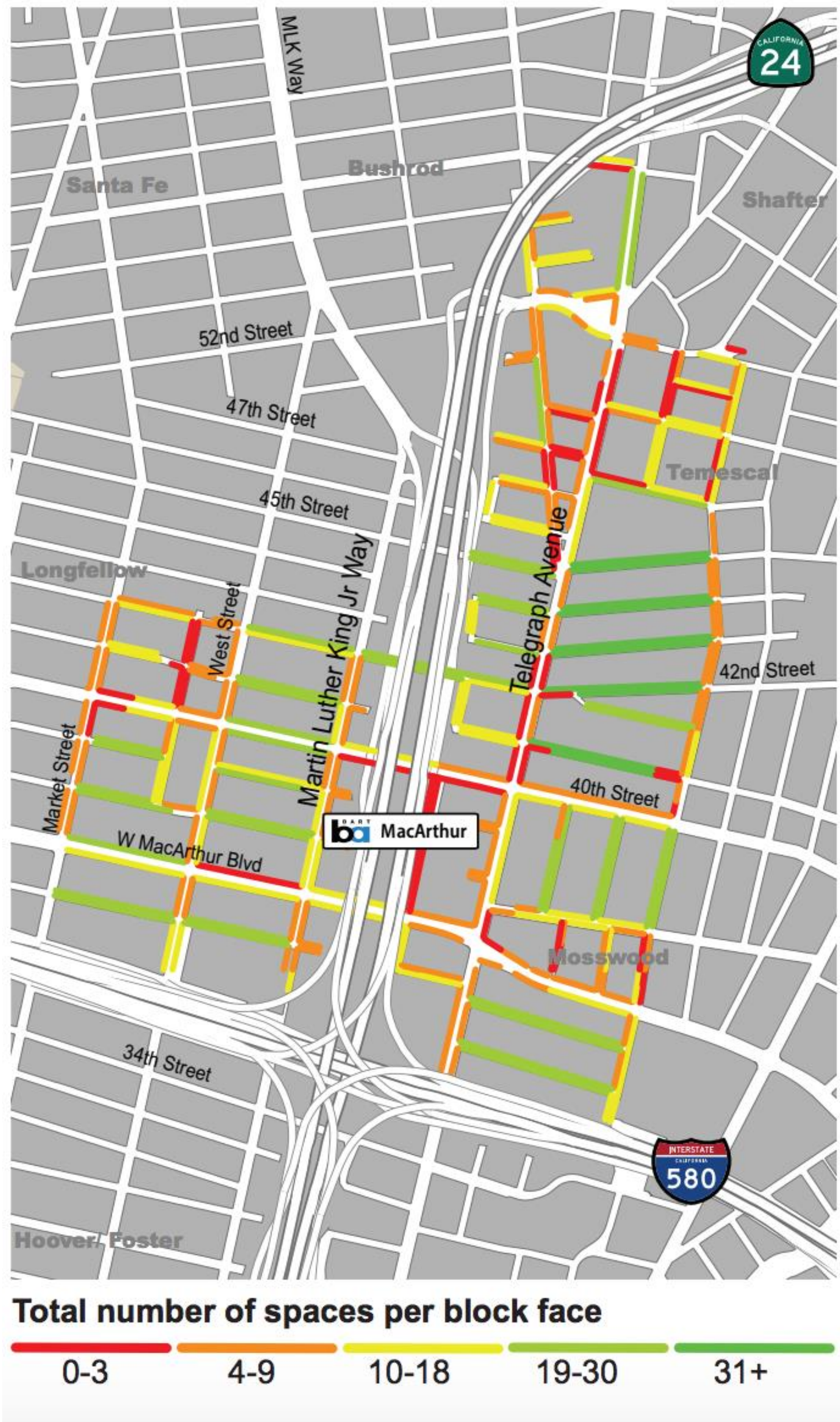
Very few streets in the analysis zones have any on-street regulation as was noted above. However, there are a large number of large off-street lots for local businesses and community centers. The area has a very high number of churches; nearly all have sizeable off-street lots available for parishioners. In discussions with church leaders, there were varying reports of adequacy of these facilities at peak occupancy periods (usually Sunday mornings) with some leaders stating parishioners must frequently seek on-street parking when the lots fill. Observation periods did not coincide with these peak periods, and researchers noted almost entirely empty lots on multiple occasions.

Many parking lots observed along the MLK Commercial Corridor appear unmanaged, as demonstrated in Figure 7.4. It is unclear if these lots are *de facto* community property, with long-time residents able to use lots freely and with outsiders risking a tow or vandalism, or if they are free and available to all.

Figure 7.4: Possibly unregulated parking

The lot has no attendant, no signage, and is only partially paved, however, the parking within the lot appears organized.

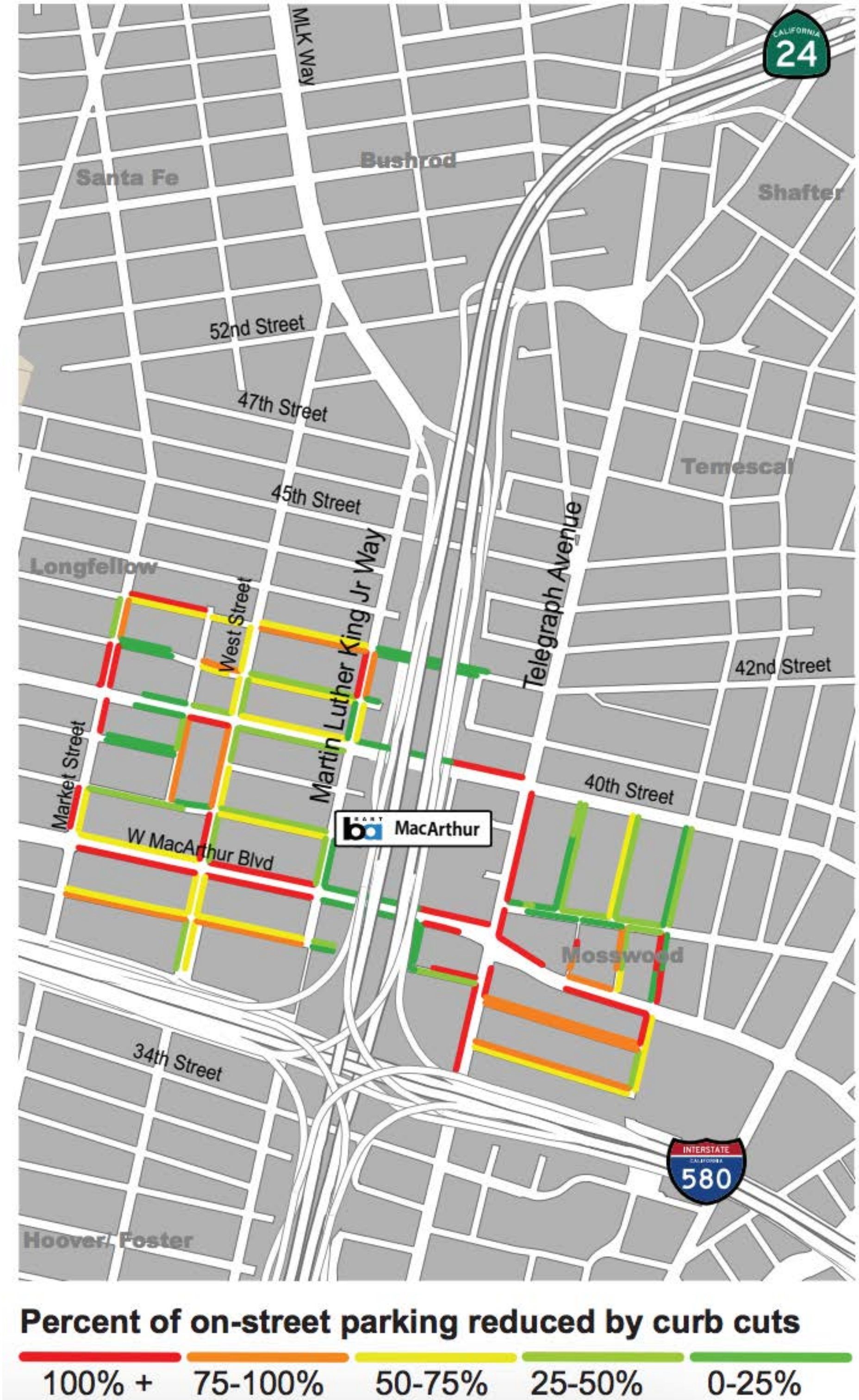
Figure 7.5 Map of on-street parking



C. Curb Cuts

Several neighborhoods have a high prevalence of curb cuts, with some blocks having more curb cuts than on-street spaces. For instance, Webster Street, between 40th Street and 38th Street has more curb cuts that parking spaces. While curb cuts are not always equal to the length of an on-street parking space, the haphazard spacing used in residential areas often means that more spaces are removed from the public realm than are being replaced by a driveway. Additionally, the location and prevalence of cuts are important factors for street realignment proposals, as cuts complicate or prevent improved pedestrian and cycling facilities.

Figure 7.6 Prevalence of curb cuts



2. Parking Utilization

In discussions with area residents and merchants, parking was frequently cited as a major concern; indeed 59% of area merchants interviewed rated parking for shoppers as Fair or Poor (see Section 4). Beyond capacity, we wanted to understand how facilities were being used: with what frequency are spaces turning over, what times of day is occupancy very high or very low? And finally, how valid are merchant concerns?

A. Methodology

To supplement the Temescal Parking Study, researchers measured parking utilization and turnover in proximity to the BART station area on Thursday, October 30 and Saturday November 1, 2014. Researchers monitored four block faces in the two analysis zones on an hourly basis from 6am until 6pm on Thursday and from 10am until 6pm on Saturday. The researchers noted license plates of vehicles parked or idling along the block face; they also noted street- and time-specific parking restrictions.

The first of the two zones is Telegraph Avenue, which is comprised of Telegraph Avenue between 40th Street and 38th Street, 38th Street east to Clarke Street, and Clarke Street north to 40th Street. The second zone was the Martin Luther King Jr. Area, from 40th Street west to West Street, West Street north to 41st Street, 41st Street east to MLK Jr. Way, and MLK Jr. Way south to 40th Street.

The following zones were selected for the variety of street and parking typologies they possess as well as their general proximity to the MacArthur BART Station Area, which was used to indicate a worst-case occupancy scenario:

Parking regulation typologies

1. Metered parking: Telegraph Avenue
2. Resident permit parking: 38th Street 40th Street, 41st Street, Clarke Street
3. Unregulated parking: West Street

Street typologies

1. Commercial: MLK Jr. Way, Telegraph Avenue
2. Mixed commercial residential: 38th Street, 40th Street
3. Residential: Clarke Street, West Street
4. Proximity to workplace (school and commercial): 38th Street, 40th Street, Telegraph Avenue, 41st Street

The data collected from these street types were then applied to streets within the analysis zone to characterize the parking behavior in the neighborhood.

Two unforeseen issues arose during data collection: first, six metered parking spaces were closed due to construction along Telegraph Ave. The length of this construction prohibited rescheduling data collection. Second, police activity on Clarke Street closed the area to residents and visitors on Saturday. This prevented data collection between 10am and 12pm, and as the street was opened as collection of data was underway at 12pm, the turnover rate between 12pm and 1pm may be higher than typical. However, it is important to note that both of these issues likely overestimate rather than underestimate occupancy, and the conclusions presented here demonstrate what could be considered a worst-case scenario.

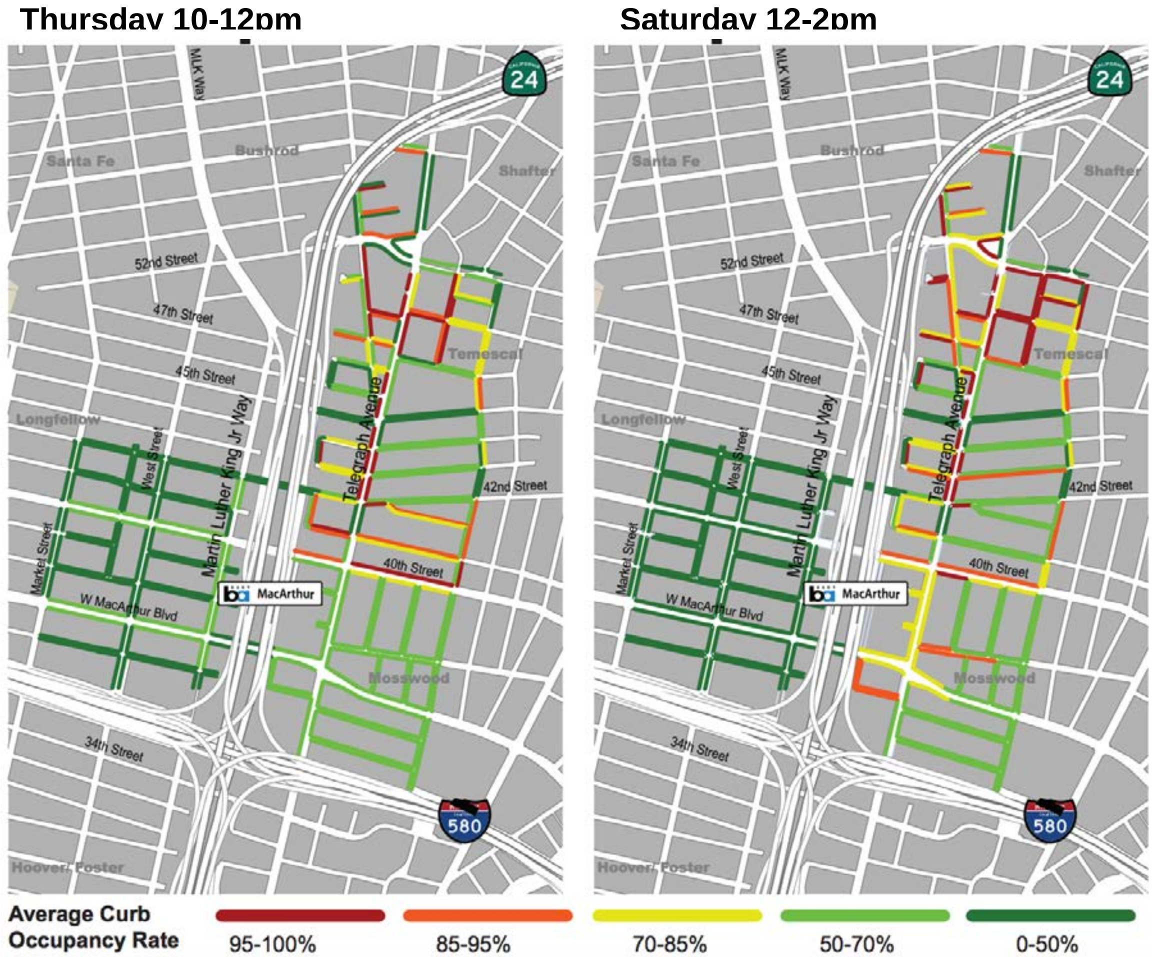
B. Results: Hours at or above practical capacity

The only hours during which any of the block faces in the two MacArthur Station Area zones were at or above the 80% threshold typically cited as the "optimum" occupancy rate (San Francisco Metropolitan Transportation Agency 2014) were early morning (before 8am) on Thursday in the residential areas with required residential permits. No block monitored in this area had a median occupancy rate above 60% at any other time.

Vehicles on Clarke Street, an east-side residential street where a resident parking permit is required the Thursday survey found that residents indeed remain more than twice as long as visitors, with a median stay of 300 minutes versus 120 minutes. The west side of the freeway experiences a similar magnitude in discrepancies between the behavior of locals and visitors: the median length of stay for a permitted vehicle on 40th Street was 210 minutes where visitors remained for 90 minutes.

Half of visitors parking along Clarke Street are remaining longer than the permitted maximum of two-hours. Incidentally, parking enforcement passed through the area during observations, and several vehicles were ticketed. Despite this, the average length of stay as well as discussions with area residents and visitors indicates that visitors may feel the risk of ticketing is low enough in exchange for free parking. This is likely compounded by the fact that there are no long-term parking facilities available in the study area; it is functionally impossible to park legally for more than two hours in the analysis zone as a visitor.

Figure 7.7 Curb occupancy rates



C. Temescal

Using data from the 2012 parking study for the City of Oakland, it is clear that Temescal, unlike the MLK Jr. and Telegraph Avenue areas, does experience frequent shortage of parking. Merchant fears south of 46th Street vis à vis parking shortages seem confirmed when witnessing the Temescal experience.

According to the 2012 parking study, numerous blocks in the heart of the Temescal are at or above practical capacity (80% occupancy) seven or more hours per day. However, as this same study points out, there is haphazard parking management and little paid parking. Therefore, the capacity studies are only identifying a shortage of a free commodity. Before any changes to infrastructure are considered to improve capacity, changes to parking management must occur.

3. Occupancy and Demand Conclusions

Parking policies through the Telegraph corridor have been a political lightening rod in recent years. The proposed Telegraph BRT was unsuccessful for many reasons, however fears regarding removal of parking along this commercial corridor were one of many controversial issues that doomed the project ("Advocates Rebuff Merchant's Absurd Argument Against East Bay BRT | Streetsblog San Francisco" 2014). Similarly, the June 2012 Complete Streets plan has backed away from buffered bicycle lanes and improved transit for the same reason. As Section 4 shows however, merchants benefit most from transit riders. This is in addition to the fact that the plurality of shoppers in the Temescal arrives by walking. Preserving free or very-low cost parking at the expense of the areas' most valuable and reliable visitors is illogical, even harmful.

4. Loading

A. Existing Situation

Telegraph is a commercial corridor and as a result, businesses have on street and off street loading zones. The city of Oakland designates the various types of loading/parking zones using painted curb colors. Yellow curbs are for loading and unloading of goods and passengers from 7 a.m. and 6 p.m. Vehicles unloading goods are allowed to park for 30 minutes and vehicles unloading passengers are allowed to park for 3 minutes. White curbs are passenger loading and unloading zones only. Finally, green zones are 12 minutes maximum parking zones.

Telegraph between 34th and 52nd has several yellow, white, and green zones and they are listed below.

1) Yellow Zones
   a) In front of Aunt Mary's Café (44th/43rd)
   b) In front of Discount Store (40th/41st)
   c) In front of Portofino and Metro PCS (40th/39th)
2) Green Zones
   a) In front of Sahn Maru Korean BBQ (44th/43rd)
   b) In front of Barkade (44th/34th)
3) White Zones
   a) In front of Beebe Memorial Cathedral (39th/Apgar)
   b) In front of McNary, Morgan, Greene, and Jackson Mortuary (37th/36th)
   c) In front of Fouche's Hudson Funeral Home (37th/36th)
   d) In front of First African Methodist Episcopal Church (37th/MacArthur)

In general, the yellow and green zones are located closer to the Temescal area where there are more retail businesses and restaurants. The white zones are closer to the MacArthur BART area where there are many churches and funeral homes.

B. Loading Issues

Because Telegraph Avenue is a commercial corridor, it is important to consider commercial loading issues along the street. The two areas of particular focus are Temescal and the MacArthur BART area. Temescal is already a bustling business district with several businesses that require delivery of goods. The MacArthur Transit Village area is slated to add 42,500 sq feet of commercial space over the next five years (ACTC, 2013), loading issues are expected to become an important consideration. Loading can create severe traffic conflicts because generally delivery vehicles are large and do not have space to park. Oftentimes vehicles perform illegal movements such as double parking. This can pose a problem for through traffic, which is obstructed and also can impact parked vehicles who may be blocked into a parking spot. Designing a street to accommodate loading movements would improve street performance by reducing traffic conflicts.

C. Loading Zone Configurations

Using both California and Oakland legal framework, there are several possible loading configurations and designs that could be proposed, such as alley loading, yellow zones, center lane loading, and side street loading. *Alley Loading* is preferred because it moves all loading off of the main thoroughfare. This eliminates conflicts between delivery vehicles and normal road users such as cars and bicyclists. However, while alley loading is preferred, there must be an alley on the back of building for this to occur. *Yellow Zones* provide loading area by removing normal parking spots with yellow painted curb areas. Yellow zones allow for loading close to business, but often results in empty/underutilized parking spots when loading is not occurring. Furthermore, because there is limitation on the amount of yellow zones, care must be taken in deciding which businesses get yellow zones in front of their building. *Center Lane Loading* is ideal when there is a bicycle facility on the street. This type of loading eliminates conflicts between bicyclists and delivery vehicles by forcing delivery vehicle to not obstruct bicycle lanes. However, center lane loading impacts vehicular turn movements and may cause an unnecessary visual barrier in the middle of the street. Finally, *Side Street Loading* moves loading movements to side streets. This helps to eliminate conflicts in loading on the main street but it is not preferred by businesses because of the distance that goods must be transported by foot.

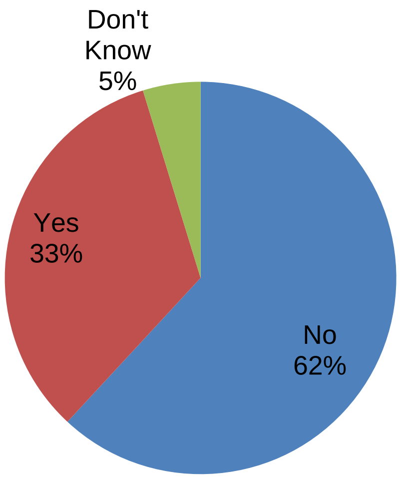
1. Study Methodology To study commercial loading and unloading issues and to determine the best loading design strategy for Telegraph Avenue, a two pronged qualitative study was executed. The first is the merchant survey discussed in Section 4 to understand travel behavior, and will indicate how deliveries are received by businesses.

The second part of the loading study is to observe morning deliveries on the Telegraph corridor. The study location was on Telegraph Avenue from 51st to 40th street. This includes the stretch of Telegraph through Temescal to MacArthur BART. Much of the street has a urban character with store fronts not set back from the sidewalk Observers recorded every loading or unloading situation on a Wednesday from 7:00 to 8:30 AM and 3:00 to 4:30 PM. The study noted loading location, business delivered to, vehicle type, loading start and end times, and illegal loading movements.

D. Results

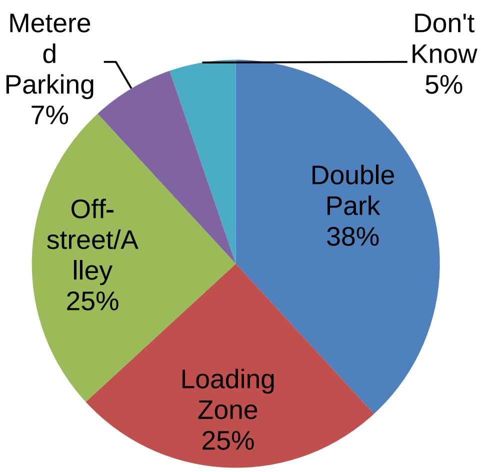
21 businesses located in the loading study location were surveyed on their experiences with deliveries. Figure 7.8 shows that 62% of respondents found that they had no delivery issues and 33% did.

Figure 7.8 Merchant response to the question of if they have issues with delivery parking



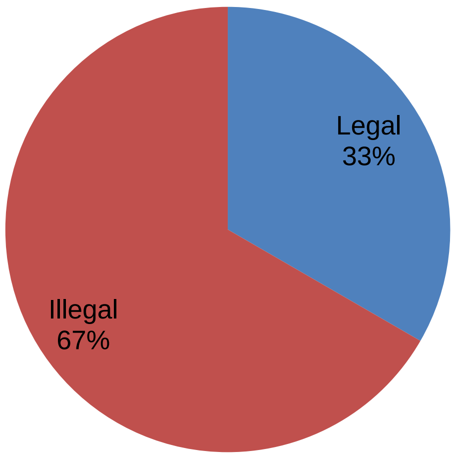
When asked to indicate where delivery vehicles stop, about 45% indicate that their delivery vehicle made an illegal movement by either double parking or parking in metered spaces. Figure 7.9 depicts the locations of deliveries

Figure 7.9 Merchant response to the question of where delivery vehicles park



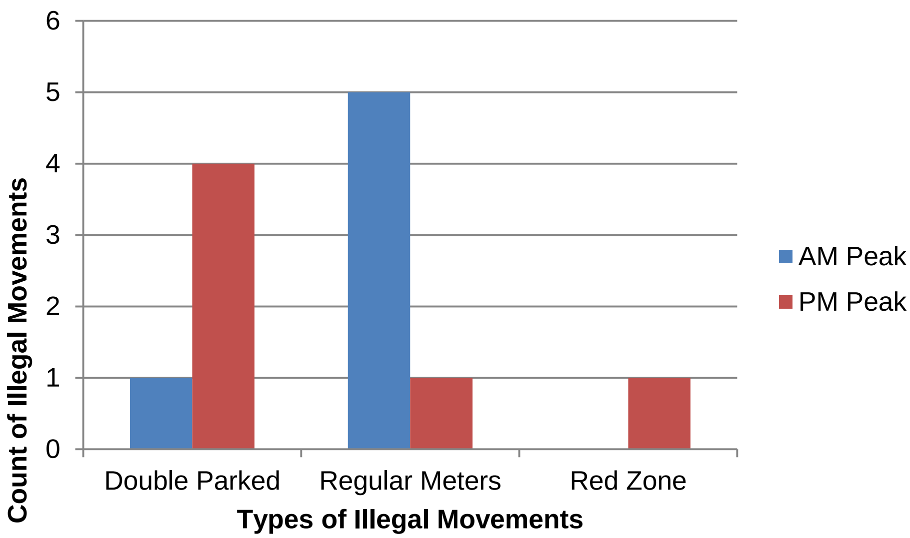
The loading field study took place over one AM and one PM peak. A total of 18 loading/unloading observations were taken with 9 in each people. Overall, 12 of 18 loading/unloading movements were illegal movements classified as double parking, parking in general metered spaces, or parking in a red zone. Figure 7.10 shows the percentage of illegal and legal loading/unloading movements.

Figure 7.10 Percentage of legal/illegal loading movements



Although there were similar numbers of illegal movements for both the AM and PM peaks, the main type of illegal movement differed between the peaks. In the AM peak because there were less cars in general metered spaces, the predominant illegal movement was to park in those empty metered spaces. In the PM peak, the main type of illegal movement was double parking. Figure 7.11 shows the distribution of illegal parking movements for each peak period.

Figure 7.11 Types of illegal movement in peak periods



E. Conclusions
Surveyed merchants indicate that they consider loading to be a problem. Field studies verified that many delivery vehicles do make illegal movements to deliver goods to commercial businesses. However, because the number of loading occurrences was small, the illegal movements did not impact other street users significantly. Therefore, we can conclude that loading is not a major concern on this corridor currently. However, the Telegraph Avenue Complete Streets Plan, puts the street on a road diet removing one travel lane from each direction. If this plan were to be put in place, vehicle would not be able to double park because they would be blocking the only travel lane.

Because loading/unloading is important to businesses on Telegraph Avenue, loading alternatives should be developed before the implementation of the Complete Streets plan. Some possible alternatives to consider include constructing more yellow zones, developing building with alleys, and allowing for side street loading.

III. RECOMMENDATIONS

1. Strategies & Precedents

The proposed Complete Streets plan for Telegraph Avenue from June 2014 has so far backed away from treatments to improve cyclist safety and transit efficiency through Temescal largely due to concerns stemming from potential problems generated by the reduction of parking along the already stressed Telegraph Avenue corridor. However, as this corridor currently only sparsely applies parking management and pricing strategies, we believe these concerns to be overwrought.

A. Parking in New Development

The 2015-2023 City of Oakland Housing Element calls for changes to the parking code to facilitate the construction of new, especially low-income housing and promote adaptive reuse (The City of Oakland). Minimum parking requirements are known to increase the costs of residential housing (Jia and Wachs 1998) and reduce the financial viability of adaptive reuse of long-vacant buildings, which are particularly prevalent throughout the MLK Jr. analysis zone (Manville and Shoup 2010).

Managing increased parking for new residential units is especially important if this area is indeed to fulfill its proposed purpose under Plan Bay Area as a transit oriented development (TOD). Research has shown that on-site parking availability reduces non-auto mode share for commute trips (Weinberger, Seaman, and Johnson 2009). In effect, the existing web of requirements and limitations governing parking complicates the densification projected by Plan Bay Area, and poses potential hazards for the proposed Complete Streets realignment of Telegraph Avenue.

Plan Bay Area's population projections indicate a growth of up to 11,715 units by 2040. If we assume a 1:1 parking ratio for these new units, this indicates 11,715 new vehicles within the PDA. This would indicate several potential negative outcomes: In order to achieve this residential density, subterranean garages would be required to fulfill the required number of parking spaces as ground-level lots would take up too much square footage. A study of single-family houses and condominiums in San Francisco indicated a 20-30% increase in home value, pricing out many residents looking to purchase (Jia and Wachs 1998). A similar, small-scale study of rental housing in Portland, OR found a similar 20% increase in rental price in buildings with paid subterranean parking (Hallowell and Stoy 2014).

The City of Oakland should embrace a flexible policy structure for future redevelopment that enables tenants to address parking concerns by employing a series of facility enhancements aimed at all visitors, and not only those arriving by vehicle. The City of Portland, Oregon has embraced a series of parking requirement mitigation measures that enable developers to provide protected bicycle parking facilities, car sharing, and public realm enhancements to reduce the required parking. Parking is also not required for developments within walking distance of high-frequency transit (Portland Bureau of Planning and Sustainability 2013).

The City of Oakland should also investigate design guidelines regarding residential curb cuts, which our study has shown can reduce on-street capacity by more than 100%. While eliminating the effects of existing curb cuts will be exceptionally difficult if not impossible, it is important that this practice be recognized as counter-effective and be severely restricted moving forward.

Additionally, commercial parcels being redeveloped with existing numerous or large curb cuts should be encouraged to redesign these cuts to enhance both on- and off-street parking capacity and improve safety for pedestrians.

B. Shared Parking

Due to the amount of off-street parking owned by churches, they represent what could be an important partner in increasing public parking supply. We approached several church leaders asking them their interest in opening their parking lots to the public. Church leaders were asked under what circumstances they would consider sharing their spaces with the public. One respondent saw the monetary value of the parking lot, and was interested in leveraging the lot to bolster the church's financial resources. He indicated that the church would be interested in renting out spaces at a city rate, which in the area is approximately $2 per hour. However, he was hesitant to undertake this project due to fears of liability and the complexity of administration of fees. He did note that his community would be interested if the city were able to offer management of the lot.

Shared parking could be especially effective at providing the facilities required to maintain existing parking capacity while removing on-street metered parking from stretches of Telegraph Avenue to enable the continuation of the proposed bicycle and transit facilities through the entire corridor. Large existing facilities like the area Churches could be leveraged to maintain capacity, and plazas along the corridor could partner to promote shared facilities as redevelopment changes the existing tenant composition.

Figure 7.12 Potential shared parking locations

C. Parking Management District

As has been documented, the RPP program throughout the study area is ineffective at managing facilities when they are most needed. Discussions with area residents regarding failed attempts to create new RPP zones indicate many residents do not understand how they stand to benefit from the program. There are three specific ways that the RPP program currently fails residents:

1. Sparse enforcement as indicated by the high number of vehicles ignoring regulations
2. Lack of coordination between the time of day of regulations and the time of day when facilities are burdened
3. Lack of coordination between the number of permits issued and the existing on-street capacity

It is difficult to promote a paid program's benefits when they are so few. Rather than using RPP funds to maintain high levels of enforcement, they are rolled into the City's general fund. The program therefore remains underfunded and understaffed. The RPP funding structure should be altered to one in which the fee for a permit equals the amount required for effective enforcement. Funds generated from improved enforcement could be used to replace those lost by the removal of permitting fees from the General Fund. While a more in-depth analysis will be required before strong statements regarding financial benefits of such a program can be made, it is not difficult to see how increased enforcement would lead to increased income for the City.

What is more, these RPP programs were instituted during the MacArthur Station development process when MacArthur BART parking was significantly reduced in order to manage overflow. However, two things happened: many would-be RPP zones were never incorporated, thwarting this attempt at coordination, thereby diminishing the ability to actively and effectively manage on-street parking especially around the MacArthur BART station. Community members have indicated that commuters have now "discovered" areas with free parking within walking distance of the station, and avoid paying the $3.50 daily fee charged by BART by parking in unregulated zones.

It is our estimation that this issue is mitigated only by the perception among visitors and residents alike that the MacArthur BART station area is a dangerous place (see Sections 3 and 4). Broken glass is prevalent throughout the study area, as are vandalized street signs; both constitute a not-so-subtle reminder to visitors that private property may be vulnerable if left alone for too long.

Over-regulation of parking facilities can be safeguarded against by ensuring that permitting programs are employed only in areas experiencing a shortfall of capacity. Currently RPP in the analysis zone manages parking during the workday, which is when residential areas in the study zones experience the lowest capacity. This is best contrasted with the post-work period when residents return home and find on-street parking scarce. The lack of coordination with enforcement during this peak occupancy period is compounded by the fact that RPP does not limit the number of permits granted to any neighborhood. There is no link between the number of residential permits and the number of on-street spaces within an RPP zone.

While public facilities should be managed by public agencies, if the City of Oakland is unable or unwilling to overhaul the existing RPP program, neighborhoods could create their own Parking Management Zones and handle this independently using the funding structure mentioned above.

D. Demand-based Pricing

The occupancy and demand conclusions drawn from this analysis must be presented alongside two important factors:

1. The occupancy rates for the vast majority of blocks are for free parking
2. The occupancy rates for priced blocks virtually always have free parking available within a block or two.

Professor Donald Shoup has produced a large body of transportation and land use literature has documented how free parking generates greater car trips than priced parking (Shoup 2005) much of which can be simplified into the following statement: In order to reduce demand, raise the price. San Francisco's SF*Park* program, based largely on Shoup's work, has demonstrated how this can and does work (San Francisco Metropolitan Transportation Agency 2014). In 2012, San Francisco installed parking meters that collected data about occupancy. When a block consistently had an occupancy rate above 80%, the price was raised. The prices were based not only on location, but also by time of day; a space in San Francisco's financial district would be very high during the workday, and taper off as demand decreased after employees returned home.

Oakland's other neighbor, Berkeley, has also instituted a demand-based parking pilot program called GoBerkeley which creates zones based on length of stay and varies hourly rates based on the desirability of the location such that a space off the heavily traveled Shattuck Avenue has a low time limit (two hours) and a high price ($2.75/hour) and a side street several blocks away, south of Bancroft Street has a long time limit (eight hours) and a low price ($1.50/hour) (GoBerkeley 2014). GoBerkeley uses some of the program's profits to fund transportation demand management (TDM) strategies for area employees that are used to subsidize transit passes. This would be a particularly effective feature for the Telegraph Avenue commercial corridor as half of employees surveyed stated they arrived by car (see Section 6).

A pricing strategy similar to these programs should be employed in the Temescal commercial district before further discussions regarding a lack of capacity can be taken seriously.

2. Next Steps

This issue highlights the conflict between the philosophical ideals and the institutional barriers in implementing Complete Streets as a guiding planning standard. To make a street complete, vehicles will lose their priority status; however policy makers seem unwilling to recognize this reality. This will not require the removal of all parking, but it will entail a change of the *status quo.*

Parking is only one aspect of this Complete Streets plan, however, historically, parking seems to disproportionately disrupt multi-modal improvements along this corridor. Improving the coordination of parking policies will go far in promoting logic and predictability in the experience of finding parking, making way for new improvements for transit and active transportation.

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Section 8

Network Analysis

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I INTRODUCTION

The objective of the network analysis is to understand the current use of transportation infrastructure in the study area and to develop a set of recommendations for Telegraph Avenue taking into account current proposals and planned developments for the area. By identifying travel patterns in the study area across all modes, we aim to detect potential conflicts in upcoming projects and generate recommendations for improvement. This is especially important with the implementation of Complete Streets on Telegraph With knowledge of whom, how, and why people use Telegraph, paired with a firm analysis of data such as traffic counts and origin-destination pairs, a series of recommendations for Telegraph Avenue between 34th Street and 52nd Street can be generated.

Figure 8.1 Network analysis study area

II CURRENT CONDITIONS

1. Current Infrastructure

A. Current Street Design

The corridor of interest in this study, Telegraph, is a five-lane street. There are two northbound and two southbound lanes with a center running turn lane in the center. The through lanes are generally 10.5-feet wide and the center lane is 9-feet wide. This street runs parallel to State Route 24 (SR-24).

The other major corridor under analysis is Martin Luther King Jr. Way (MLK). This is a four-lane street that runs parallel to Telegraph on the west side of SR-24. There are two northbound and two southbound lanes, which are generally 10.5 feet wide.

The study area also contains a short segment (around five blocks) of Shattuck Avenue (Shattuck), which connects to Telegraph in the network study area. This segment of Shattuck consists of two lanes (one northbound and one southbound), and intersects with Telegraph at the same intersection as 45th Street.

There are several east-west streets that pass underneath the freeway linking MLK to Telegraph. Starting from the northern end of the study area, these streets are 52nd Street, 45th Street, 42nd Street, 40th Street, MacArthur Boulevard, and 34th Street. MacArthur Boulevard and 40th Street are major corridors, especially 40th Street as it contains the MacArthur BART station under SR-24.

The freeway, SR-24, presents many connectivity issues. During its construction in the late 1960s, there were numerous demolitions of well-established residential and commercial districts (Temescal). This is very apparent in the study area, as select east-west roads run underneath the freeway while many dead-end or turn into a circle and intersect with a north-south corridor twice.

B. Bicycle and Pedestrian Facilities

Though Telegraph and MLK do not offer many bicycle facilities, shared-use bike lanes, or sharrows, are located on 40th St. and 48th St. These roads offer an east-west movement through the study area, but there are no dedicated north-south facilities. The sharrows on 40th St. have even been painted green in order to increase visibility and awareness of bicyclists. There are numerous bike parking racks in the MacArthur BART station and near Temescal Plaza. Even though there are no dedicated bike facilities for north-south movements, it is possible they are needed to offer greater connectivity.

All roads within the area have wide sidewalks, which suggest that pedestrians are welcome. There are some pedestrian wayfinding signs that point to potential destinations, such as the BART station and Temescal District. However, these signs are attached to poles at great heights making them possibly better suited for cars, except for the fact that the text on these signs is quite small and thus hardly readable for drivers. Furthermore, these wayfinding signs point to many medical centers including the Kaiser Health and Alta Bates hospitals, destinations usually attained by driving as opposed to walking or bicycling. Thus, the intent of these signs remains puzzling.

The roads that run underneath the freeway also present a problem for the pedestrian and bicyclist experience. The dingy and dark underpasses are often sites for illegal dumping. Furthermore, the station area of the MacArthur BART station is often congested with buses.

C. Transit Facilities
The main transit facility of this area is the MacArthur BART station. This station is a common transfer point, as three of four BART lines run through it, and these lines are often timed to meet at the same time.

The BART station also offers many other transit connections to AC Transit lines as well as shuttles run by Emery-Go-Round, hospitals, and tech companies such as Google™. Ridership data from AC Transit has been obtained as a part of this analysis.

D. Parking
St. parking is offered throughout the study area, except for along MLK and MacArthur Blvd. Site visits reveal that these spaces are mostly occupied during peak hours close to Temescal Plaza, and these levels taper off further south.

Numerous small sites, such as Temescal Plaza, McDonald's, and VBC Animal Hospital, offer small, off-street parking lots for patrons. The largest parking lot is at the MacArthur BART station, which includes a large parking garage that opened recently. The parking within the study area has been subject to public debate in regards to the Complete Streets Plan, and is being addressed in the Section 7.

E. Loading and Unloading Zones
Telegraph is a commercial corridor and as a result, businesses have on street and off street loading zones. The city of Oakland designates the various types of loading/parking zones using painted curb colors. Yellow curbs are for loading and unloading of goods and passengers from 7 a.m. and 6 p.m. Vehicles unloading goods are allowed to park for 30 minutes and vehicles unloading passengers are allowed to park for 3 minutes. White curbs are passenger loading and unloading zones only. Finally, green zones are 12 minutes maximum parking zones. In general, the yellow and green zones are located closer to the Temescal area where there are more retail businesses and restaurants. The white zones are closer to the MacArthur BART area where there are many churches and funeral homes. Loading is being addressed in Section 7.

2. Traffic Counts Results

Traffic count information is important in assessing current conditions of congestion as well as diagnosing current issues in the network or issues that may arise in the future. Traffic counts also provide a baseline of infrastructure use. This baseline is taken into account when determining future demand.

Because this network analysis will include the use of alternative modes such as cycling and walking, counts were taken for vehicular turning movements, bicyclist turning movements, and pedestrian movements in the crosswalk of intersections in the study area along MLK and 52nd St. These quantities were obtained for Telegraphnue from the *Telegraph Complete Streets Plan* (Fehr & Peers, 2014). The other counts, which include vehicular turning movement counts, bicycle turning movement counts, and pedestrians using the crosswalk, were taken Wednesday, October 8, and Wednesday, October 15, for the AM peak hours of 7:30 to 9:00 AM and PM peak hours of 4:30 to 6:00 PM for the following intersections:

- MLK & 34th St.
- MLK & MacArthur Blvd.
- MLK & 40th St.
- MLK & 45th St.
- MLK & 47th St.
- MLK & 52nd St.
- Shattuck & 52nd St.

This section's Appendix contains the vehicular turning movement counts and bicycle turning movement counts for both the A.M. and P.M. peak periods.

For transit counts, information from Automatic Passenger Counts, provided by AC Transit, were used to characterize passenger flows and transit ridership during these hours. These passenger counts are the total boardings and alightings for various stops during various time periods.

3. Floating Survey Studies

Pairing of origin-destination data is a resource and labor intensive process. To collect this information, floating car and bike studies were performed on weekdays between November 29th and October 6th. To obtain statistics from the morning and evening peaks the studies were done between 7:00 and 9:00 AM and 4:00 and 6:00 PM. A total of 163 bicyclists and 147 cars were followed, 90 and 71 in the morning and 73 and 76 in the afternoon, respectively. Besides origins, destination, and times of each trip, the gender of the bicyclists was also recorded for the bicycle-floating study. Between the AM and PM peak observations, 64% of bicyclists were male and 36% were female.

The floating vehicle studies involve following a motorist or bicyclist chosen at random as he/she/they traverse through the network study area. The subjects are followed from the moment they enter the study area until they leave these boundaries. The origin, the destination, the route and the travel time of each subject are noted. Subjects starting their trip inside the study area are also accounted for and their initial location is recorded as the origin of the trip. If the subject ends a trip within the study area (they park or get off their bike), that location is recorded as their destination.

This section's Appendix contains the vehicular and bicycle origins and destinations data obtained for both the A.M. and P.M. peak periods.

4. Issues and Conflicts

One of the main characteristics observed during the field surveys was to characterize the time of the day that presented more critical traffic conditions. Comparing the AM and PM peak periods, it was observed that there was more traffic volume in the afternoons, both for cars and bicycles. Due to this finding, only the PM period was considered for modeling purposes for the rest of this study.

From the information collected from field surveys, we identified some issues and conflicts present with the current street design and operations. With regards to car traffic, we observed that vehicles use the network for local trip purposes, as few vehicles where followed from north to south across the entire network. The intersections of 52nd St with MLK, Shattuck, and Telegraph present considerable queue and waiting times, particularly during the afternoon peak period. The intersection of Telegraph with 52nd and 51st also presents as the distance between these intersection is only of 200 feet, making it easy to grow a queue from transversal vehicle inputs in the 51st intersection (like Claremont Ave. or 52nd St.) to block the Telegraph through movement from the 52nd intersection.

Analyzing bicycle flows and conditions, we identified that bicycles use the network for long distances, as approximately 60% of the vehicles entering the network at Telegraph or Shattuck southbound, travel across the network towards downtown Oakland. A big destination in the morning (and origin in the afternoon) is the MacArthur BART station, which has a large number of facilities for users to park their bikes and access BART. An important corridor is also 40th St, which has the only bike lane in the area, for westbound bicycle traffic to BART, but it does not continue once it reaches the BART station.

There are certainly safety issues to support a new street design, particularly one that protects cyclists from vehicular traffic. During the floating survey studies, an accident between a car and bicycle was observed on 40th St and Telegraph. This supports the idea of considering a Complete Street Design that promotes a better interaction between bicycles and cars.

III ANALYSIS

1. Network Model

A. Introduction

The objective of the network model is to model future travel scenarios to evaluate the ability of the street network to handle increased trips. The base model is established in 2017 and accounts for trips generated by PDA projects in the pipeline based on ITE trip generation rates for residential dwelling units and general retail stores. Two future scenarios are evaluated for the year 2032. The first future scenario is the no action scenario. This model accounts for population growth consistent with Association of Bay Area Governments (ABAG) projections. The second future scenario is the transit oriented development scenario. In this scenario, a low and high mode shift are tested on three different street infrastructure alternatives; current infrastructure, Complete Streets on Telegraph, and 40th St. Pedestrianization with Telegraph Complete Streets.

B. Trip Generation

The developments planned for the MacArthur PDA have already been approved and are expected to be completed by 2017. The map shows the location of each of the developments and Table 8.1 specifies the type of development, size, and the number of trips generated based on ITE trip generation manual (ITE, 2012). For residential types of development the trip generation rate is 0.72 per dwelling unit, as specified by ITE for “Residential Planned Unit Development” (code 270), while for retail development the trip generation rate is 5.02 per 1,000 squared feet, as specified by ITE for “General Retail Center” (code 826).

Figure 8.2 Map of the planned developments around the immediate network

Table 8.1 Trips generated by planned developments in the MacArthur PDA

Development Name	Location	Development Type	Development Size	ITE Trip Generation Rate	Trips Generated		
					Total trips	Trips Entering	Trips Exiting
MacArthut Station	MacArthur BART & 40th St	Residential	624 dwelling units	0.72 / dwelling unit	449	288	162
MacArthut Station	MacArthur BART & 40th St	Retail	42,500 sq ft	5.02 / 1,000 sq ft	213	119	94
Civiq	5119 Telegraph Ave (by 51st St)	Residential	68 dwelling units	0.72 / dwelling unit	49	31	18
Civiq	5119 Telegraph Ave (by 51st St)	Retail	3,000 sq ft	5.02 / 1,000 sq ft	15	8	7
Creekside Mixed Use (Nautilus)	5231 Telegraph Ave (by Claremont Ave)	Residential	120 dwelling units	0.72 / dwelling unit	86	55	31
Creekside Mixed Use (Nautilus)	5231 Telegraph Ave (by Claremont Ave)	Retail	7,700 sq ft	5.02 / 1,000 sq ft	39	22	17
Courthouse Condominums	2935 Telegraph Ave (by 30th St)	Residential	142 dwelling units	0.72 / dwelling unit	102	65	37
Courthouse Condominums	2935 Telegraph Ave (by 30th St)	Retail	3,000 sq ft	5.02 / 1,000 sq ft	15	8	7
N/A	4801 Shattuck (by 48th St)	Residential	44 dwelling units	0.72 / dwelling unit	32	20	11
N/A	3884 MLK Way (by 39th St)	Residential	40 dwelling units	0.72 / dwelling unit	29	18	10
Total					**1,029**		

The trips generated by each development are added to the network at the corresponding locations. For trips exiting the development, routing follows the current travel patterns as identified by the traffic counts. For trips entering the new developments, routing follows the observed OD patterns of the floating survey studies. Thus, trips are added to the 2014 volumes as shown in the table below to obtain the volumes expected for 2017. These new trips are assigned to different modes as explained later in this section of the report.

Table 8.2 Trips generated by planned developments by origin

Origin	Destination	Trips
Martin Luther King Jr. Way & 40th St.	MacArthur BART & 40th St	**136**
Martin Luther King Jr. Way & 52nd St.	**ALL**	**152**
Martin Luther King Jr. Way & 52nd St.	MacArthur BART & 40th St	136
Martin Luther King Jr. Way & 52nd St.	5110 Telegraph (51st and Telegraph)	6
Martin Luther King Jr. Way & 52nd St.	5132 Telegraph (Claremont and Telegraph)	11

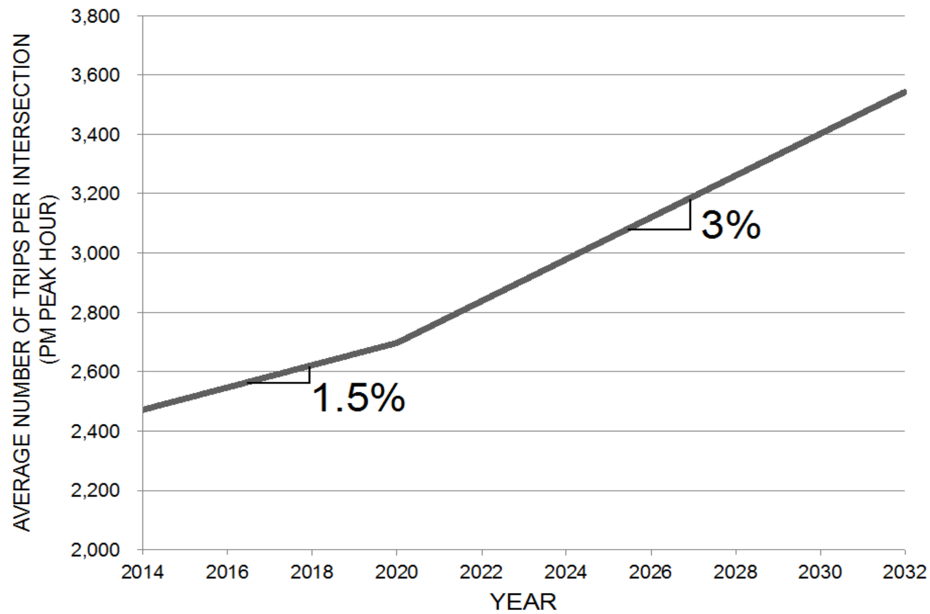
Origin	Destination	Trips
Martin Luther King Jr. Way & MacArthur Blvd.	**ALL**	**150**
Martin Luther King Jr. Way & MacArthur Blvd.	MacArthur BART & 40th St	136
Martin Luther King Jr. Way & MacArthur Blvd.	2935 Telegraph (by 30th)	12
Martin Luther King Jr. Way & MacArthur Blvd.	3884 MLK Way (by 39th)	2
Telegraph Ave. & 34th St.	**ALL**	**124**
Telegraph Ave. & 34th St.	5110 Telegraph (51st and Telegraph)	23
Telegraph Ave. & 34th St.	5132 Telegraph (Claremont and Telegraph)	45
Telegraph Ave. & 34th St.	4801 Shattuck (by 48th)	10
Telegraph Ave. & 34th St.	3884 MLK Way (by 39th)	2
	Network[1]	43
Telegraph Ave. & 42nd St.	**ALL**	**29**
Telegraph Ave. & 42nd St.	5110 Telegraph (51st and Telegraph)	6
Telegraph Ave. & 42nd St.	5132 Telegraph (Claremont and Telegraph)	11
Telegraph Ave. & 42nd St.	2935 Telegraph (by 30th)	12
Telegraph Ave. & 49th St.	**ALL**	**21**
Telegraph Ave. & 49th St.	5110 Telegraph (51st and Telegraph)	6
Telegraph Ave. & 49th St.	5132 Telegraph (Claremont and Telegraph)	11
Telegraph Ave. & 49th St.	4801 Shattuck (by 48th)	5
Telegraph Ave. & 52nd St.	2935 Telegraph (by 30th)	**25**
Shattuck Ave. & 51st St.	2935 Telegraph (by 30th)	**12**
Telegraph Ave. & 51st St.	2935 Telegraph (by 30th)	**12**
Telegraph Ave. & 40th St.	**ALL**	**14**
Telegraph Ave. & 40th St.	4801 Shattuck (by 48th)	5
Telegraph Ave. & 40th St.	3884 MLK Way (by 39th)	9
Martin Luther King Jr. Way & 34th St.	3884 MLK Way (by 39th)	**5**
MacArthur BART & 40th St.	**Network[1]**	**256**
Telegraph Ave. & 51st St. from East	**Network[1]**	**24**
Telegraph Ave. & Claremont Ave.	**Network[1]**	**48**
Shattuck Ave. & 48th St.	**Network[1]**	**11**
Martin Luther King Jr. Way & 39th St. (from East)	**Network[1]**	**10** [1]

[1] Trips with destination "Network" originate at the specified location but then follow the current network's routing (based on traffic counts).

C. Future Volumes

Population growth estimates developed by the Association of Bay Area Governments (ABAG) are used to project the volumes obtained for the year 2017 to expected volumes for the year 2032, the build-out year. Trips volumes for all movements and modes at all intersections are assumed to increase at the same rate as the population. Figure 8.3 shows this increase based on the average number of trips per intersection in years 2017 through 2032.

Figure 8.3 Trip volume increase from 2017 to 2032



D. Mode Shares

The MacArthur station area is slated as a transit-oriented development (TOD), so future trips are expected to be more multimodal. To account for the uncertainty of these future scenarios, three different mode shares are used: one assuming no mode shift from the current situation; a second one assuming a low shift from cars to alternative modes; and a third one assuming a high shift from cars to alternative modes.

For the initial scenario where it is assumed that there is no mode shift from the current scenario, the generated trips (from planned development until 2017 and population growth thereafter) are assigned to each mode based on the 2014 mode share: 82% for cars, 4% for bikes, 6% for pedestrians, and 8% for bus. To obtain these percentages, the car, bicycle, and pedestrian counts as well as bus ridership are used to obtain the mode share at each intersection. These are then averaged across all intersections to obtain the current (2014) network mode shares.

In order to come up with the ranges of low and high mode shift, several sources were consulted: the latest Bay Area Travel Survey (2000); the mode shares published by the Transit Cooperative Research Program (TCRP) in the 17th chapter of their report number 95, which focuses on TOD effects on mode shares; the mode shares of the Fruitvale TOD (2008, presented in Section 1 of this report); and the mode shares resulting from the residents' survey (presented in Section 3 of this report). Table 8.3 presents the mode shares for each of these sources.

Table 8.3 – Mode shares based on different sources

	Current Observed	BATS 2000 data	TCRP Report 95	Fruitvale 2008	Residents Survey 2014
Car	83.2%	78.4%	89.1%	61.2%	56.9%
Bus	8.0%	6.3%	7.4%	7.7%	11.4%
Bikes	3.4%	6.0%	1.4%	12.2%	12.4%
Pedestrians	5.4%	9.3%	2.1%	19.0%	19.3%
TOTAL	100%	100%	100%	100%	100%

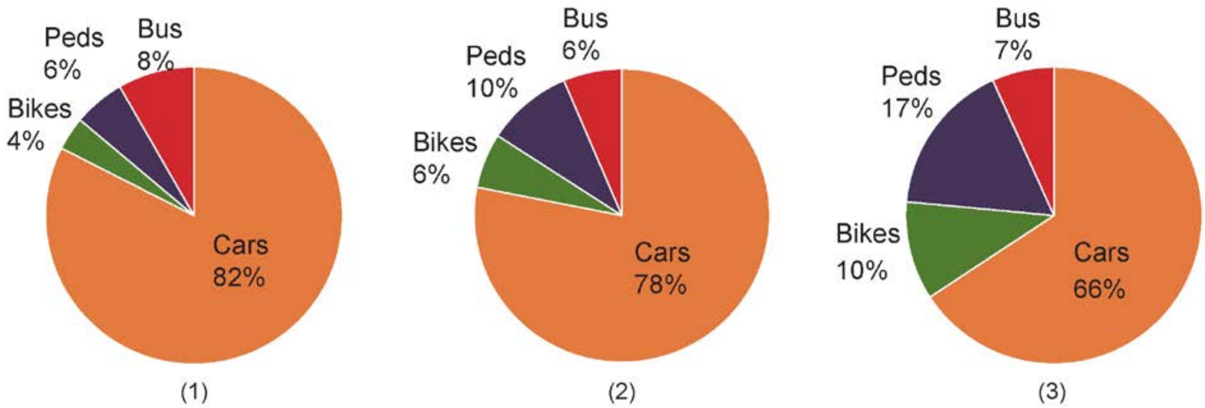
While the data from the residents' survey shows a much higher share of alternative modes than the other sources, these only account for trips ending in the immediate network area (for the PM peak) and does not take into account the trips going through or originating in the immediate network area. Thus, these data is used to validate the data obtained from other sources. The BATS 2000 data show the lowest shift from cars to alternative modes when compared to the current mode shares, while the Fruitvale mode shares shows the highest shift. Thus, these two are used to create the two levels of mode shift, low and high, respectively. These two new mode shares are applied only the future trips, i.e. the added trips from 2014 to 2017 based on trips generated by the planned development, and the added trips from 2017 to 2032 based on the estimated population growth. Thus, the three different mode shares applied to these future trips are as shown in Table 8.4.

Table 8.4 – Three mode shares applied to future trips

	Current Mode Share	Low Shift to Alternative Modes	High Shift to Alternative Modes
Cars	83.2%	78.4%	61.2%
Bus	8.0%	6.3%	7.7%
Bikes	3.4%	6.0%	12.2%
Pedestrians	5.4%	9.3%	19.0%

Finally, after the future trips (generated by the planned development, for 2017 volumes, and estimated through population growth, for 2032 volumes) are assigned the different mode shares and are added to the 2014 volumes (whose mode shares are not altered), the final overall mode shares are as presented in Figure 8.4.

Figure 8.4 – Overall network mode shares resulting from (1) current mode split, (2) low shift to alternative modes, and (3) high shift to alternative modes



E. VISSIM Model

To evaluate the network, a traffic simulation model in VISSIM was developed. VISSIM, by PTV, is a traffic simulation tool that allows the simulation of individual vehicles in a network. Furthermore, it allows the interaction of different modes of transportation, like cycling, public transportation, and pedestrian activity. Given this flexibility to interact with different modes of transportation, this tool was selected to evaluate the network considered and the different design alterations targeted at different modes of transportation.

The development of a traffic simulation model in VISSIM can be defined in three steps. The first step is to develop a network of links and connectors, following the current infrastructure design. The network was characterized, from site visits and aerial photographs, to report on the number of lanes, their length, and their use, to develop a network for analysis.

The second step to develop a model is to define the traffic characteristics. The vehicle input was obtained from directly from the traffic counts. Once inside the model, the vehicles were assigned a route to take for the immediate intersection according to the traffic counts. Once a vehicle passed the intersection, it was assigned a new route to take for the following intersection according to the traffic counts of the next intersection. This way, each vehicle was assigned a route across the network following the data collected from field traffic count surveys.

The last step consists of solving traffic conflicts at intersections to avoid collisions. Most intersections solve these conflicts through traffic signals. Traffic signal timings were obtained from the City of Oakland. The traffic signals on Telegraph were obtained from signal optimization software called Synchro and from signal timing cards for the intersections on Shattuck and Martin Luther King Jr. Further analysis was required to solve traffic conflicts in certain intersections. For each intersection, the traffic movements were observed and in case the conflicts were not resolved with the signal operations (like unprotected left turns) priority rules were defined.

Finally, to avoid biased results from the evaluation of an empty network, a pre-heating initial time of 45 minutes was defined before running an hour of evaluation.

2. Validating the Model

Once the modeled was developed from current field information, the model was tested to see if the traffic conditions observed on field were being modeled appropriately. The main criteria to calibrate the model was to observe the differences between the cars and bicycles counted on field, for every intersection, and compare them with the cars and bicycles volumes simulated. For this comparison the GEH statistic was used. The GEH statistic is a commonly used formula to compare traffic volumes in transportation models, practitioners around the world, like Transport for London (TfL, 2013), encourage its use given that it is easy to compute, and takes in consideration not only the differences between volumes, but their magnitudes too. Therefore, the GEH statistic would be higher for a 10 to 100 volume comparison, than a 1 to 10 volume comparison, although the difference in percentage is the same. The following formula is used to calculate the GEH statistic, where *M* is the traffic volume modeled and *C* is the traffic volume counted:

$$GEH = \sqrt{\frac{2(M-C)^2}{M+C}}$$

According to commonly used modeling guidelines, a GEH statistic below 5 is considered acceptable for model calibration processes (TfL, 2014). Table 8.5 shows the results obtained from the model validation process for three sample intersections in the network, presenting the traffic counts and the modeled volumes.

Table 8.5 – Model validation results

Intersection	Car Counts	Car Model	GEH Cars
Martin Luther King Jr. Way & MacArthur Blvd.	24	21	0.63
	50	53	0.42
	134	140	0.51
	505	494	0.49
	128	136	0.70
	33	36	0.51
	782	653	4.82
	104	82	2.28
	53	34	2.88
	51	45	0.87
	74	67	0.83
	246	268	1.37
Telegraph Ave. & 51st St.	611	626	0.60
	95	93	0.21
	334	329	0.27
	479	487	0.36
	11	9	0.63
	208	184	1.71
	41	31	1.67
	275	211	4.11
	539	429	5.00
	84	68	1.84
	91	87	0.42
	512	461	2.31
Telegraph Ave. & 40th St.	541	517	1.04
	89	66	2.61
	171	177	0.45
	143	115	2.47
	102	65	4.05
	488	418	3.29
	131	127	0.35
	91	65	2.94
	689	671	0.69
	341	349	0.43
	76	67	1.06
	25	25	0.00

3. Scenarios Modeled

To capture the effects of population growth, different mode shares, and the implementation of Complete Streets on the network, it is important to lay out the different scenarios modeled carefully. We ran 7 models for the PM peak as well as a model to represent current conditions.

2.1 2017 No Action
The first model forecasts traffic to the year 2017 by taking account Priority Development Area (PDA) projects in the pipeline. Trips are estimated with ITE Trip Generation rates for residential dwelling units and general retail stores. For the PM peak, 1,029 trips are forecasted, and current mode shares calculated from traffic counts are applied.

2.2 Year 2032, No Action
The second model takes into the population growth into the year 2032. ABAG estimates that population for this year will be a 30% increase from that of the year 2020. The model also applies current mode shares, so it assumes that no action is taken to promote mode shift. This represents an extreme scenario, and we expect a lot of delay for cars.

2.3 Transit Oriented Development
The area around the MacArthur BART station is slated for transit-oriented development, modelling current mode shares is likely unrealistic. There is a good probability that users of the network will travel with alternative modes, especially as travelling by car becomes more inconvenient. However, it is important to note that these TOD mode shares are only applied to the trips added onto the existing traffic counts. This assumes that current users of the network do not shift modes, which is the worst-case scenario.

For robustness, we modeled two different mode shares to represent high and low mode shifts from the current mode splits (obtained as previously explained). These mode shares were applied to the current infrastructure, the network with Complete Streets implemented on Telegraph Avenue, and the network with Complete Streets implemented on Telegraph Avenue and 40th St. Pedestrianization.

IV CONCLUSION

1. Results

A. Model Metrics
The objective of developing a simulation model was to use it as a tool to evaluate the different scenarios considered. VISSIM allows its users to do a number of evaluations, from individual vehicle information to network performance metrics. For this study, two different sets of criteria were considered, intersection metrics and network performance measures.

2. Intersection Metrics

To evaluate the performance of the model, five different metrics were used.

1. Car delay (Level of service, or LOS)
2. Queue length
3. Bus delay
4. Bike delay
5. Person delay

With information at this level of detail, we are able to analyze how the different scenarios modeled affect each mode of transportation individually.

3. Network Performance Metrics

To have a macroscopic evaluation of the model, we also considered the following aggregate metrics:

1. Network efficiency measure (vehicles entering the network divided by vehicles attempting to enter the network)
2. Total delay average per mode of transportation

With this information, we are able to analyze how efficient is the network operating, how many vehicles are not entering to the network due to congestion and queue spillback, and how metrics are changing to observe differences across scenarios.

4. Effect of Current Infrastructure

Comparing the 2017 and 2032 No Action models shows the effects of population growth in the network. Three intersections are in a "failure" state in 2014, and with the additional trips from the PDA projects, there are more failing intersections in 2017. This is especially true for intersections along Telegraph In total, two intersections operate at LOS F, one intersection operates at LOS E, and two intersections operate at LOS D in the network.

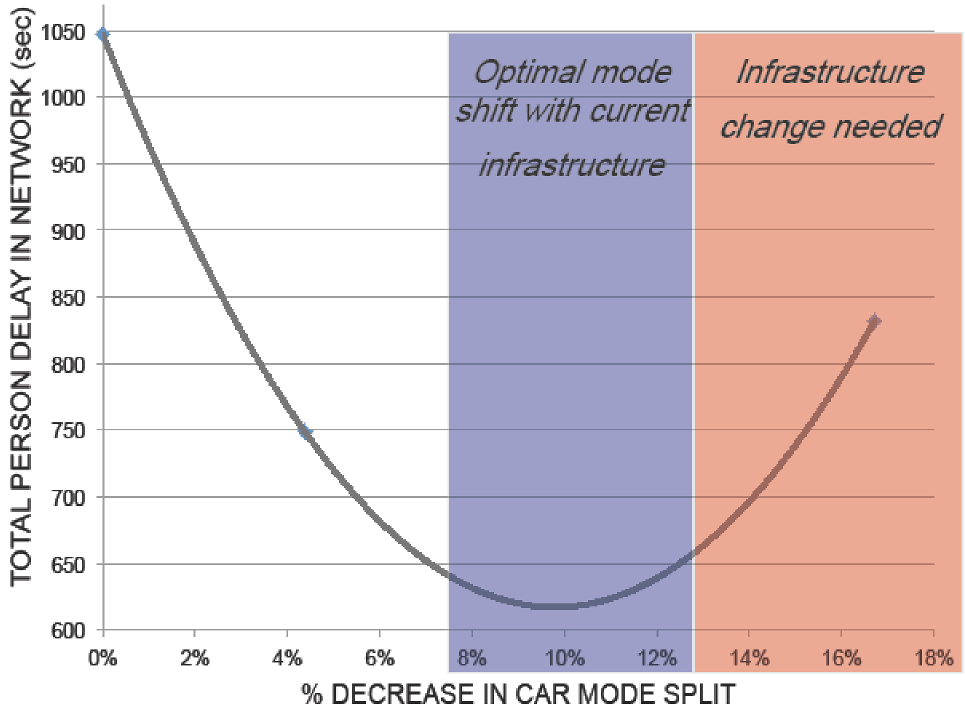
For the 2032 No Action model, conditions worsen as expected. All intersections along Telegraph as well as Shattuck & 52nd St. and MLK & 40th St. are in a failure state. Furthermore, 30% of vehicles cannot enter the network, and there is an 80% increase in overall bike delay. This means that the network is performing poorly, and measures must be taken to ensure that the network still runs efficiently. Since the MacArthur Station area will be a transit-oriented development, new residents will be encouraged to use alternative modes, meaning that mode shift will occur.

5. Effects of Mode Shift on Current Infrastructure

Comparing the 2032 No Action model to the 2032 Transit-Oriented Development on Current Infrastructure Models shows the effects of mode shift on the network. It is likely that the implementation of Complete Streets on Telegraph will encourage mode shift, and new users of the network are more likely to use alternative modes since the MacArthur Station area will be a transit-oriented development.

The graph below shows the person-delay versus percent reduction in car mode share for the 2032 No Action Model and the 2032 TOD models on current infrastructure. This displays how person delay is reduced when car trips are shifted to cycling and walking. However, there is a point where shifting trips from cars to active modes increases the overall person delay if bike lanes are not installed.

Figure 8.5 – Effect of car mode split changes on person delay with current infrastructure



6. Effect of Complete Street Design

The purpose of this study is to understand what benefits can be expected from the implementation of Complete Streets on Telegraph. A critical scenario comparison is the 2032 TOD mode shares on current infrastructure versus that on the Complete Streets network.

Given that there is a significant amount of vehicles entering Telegraph in both directions, and since Complete Street Design reduces its capacity from two lanes to one lane as a traffic calming measure, we assumed that a fraction of through traffic not take Telegraph but it would shift to MLK instead. From this assumption, 20% of the vehicle inputs in Telegraph were shifted to the new corridor. We obtained this number through the floating car survey.

Analyzing the individual intersection metrics, we can observe that the Complete Street Design has an important effect compared with current infrastructure design. Table 8.6 shows the differences between these scenarios at the intersection level.

Table 8.6 – Current infrastructure versus Complete Streets intersection results

Intersection	High Modal Shift on Current Infrastructure					High Modal Shift on Complete Streets				
	Car LOS	Average queue length (ft)	Person Delay	Bus delay	Bike delay	Car LOS	Average queue length (ft)	Person Delay (s)	Bus delay (s)	Bike delay (s)
MLK & 52nd	E	318	69.43	111.5	93.2	E	308	63	87	72.2
MLK & 47th	A	1	9.95	19.2	0.5	B	1	10.98	28.4	0.4
MLK & 45th	B	10	12.63	20.7	7.8	B	7	12.37	23.4	7.3
MLK & 42nd	B	16	21.68	40.7	18.1	A	4	7.58	21.4	1.6
MLK & 40th	E	261	77.50	84.2	73.8	C	27	23.32	29.7	17.6
MLK & MacArthur	D	101	44.60	125.6	48.1	F	410	95.46	106.3	57.6
MLK & 34th	C	22	22.99	44.1	15.6	F	107	108.14	158.5	50.6
Shattuck & 52nd	F	530	93.42	0.0	113.0	E	519	75.01	0.0	97.4
Telegraph & 52nd	E	125	75.04	238.5	54.3	E	104	79.42	114.1	82.5
Telegraph & 51st	F	619	81.13	21.9	53.2	F	626	88.07	82.5	64.8
Telegraph $ 46th	C	25	28.00	31.1	8.8	C	78	26.03	21.4	7.0
Telegraph & 42nd	C	27	23.90	18.2	12.9	C	63	19.84	13.7	8.7
Telegraph & 40th	F	611	94.70	111.3	73.7	D	268	51.86	55.5	26.6
Telegraph & MacArthur	E	419	80.74	91.6	47.7	F	393	88.33	64.5	43.6
Telegraph & 34th	F	224	96.12	163.4	52.8	E	251	83.47	84.8	27.4

From Table 8.6, we can observe that most intersections on the Telegraph corridor do not suffer significant impacts, as the LOS remain at similar levels (improving in most intersections except MacArthur Blvd.). Bicycle delay is also reduce through the network, except on the sections of the new design where the bike lane ends and bicycle and cars share a lane (between 46th S. .and 52nd St.). However, the performance of Martin Luther King Jr. deteriorates significantly, particularly in the south between 34th St. and MacArthur Blvd. where delays for every mode increase significantly.

It is also important to look at outputs on an aggregate level, especially since service on Telegraph improves as that of MLK gets worse. Table 8.7 shows the results of this comparison according to the network performance metrics analyzed.

Table 8.7 – Current infrastructure versus Complete Streets network results

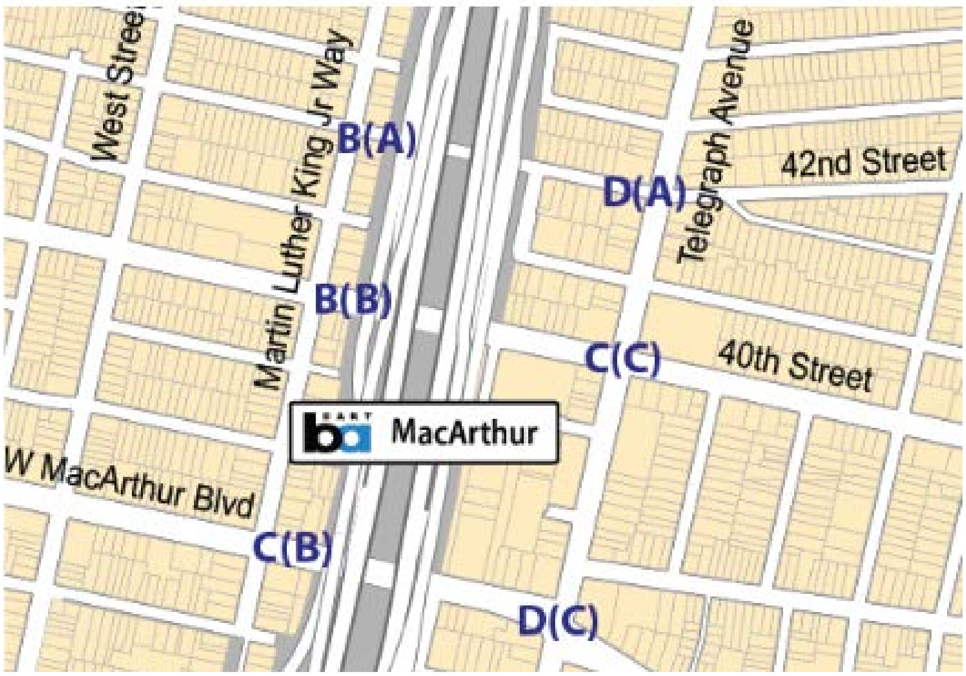
	Delay Total (s)					Total number of vehicles served by the model				
	Total	Cars	Trucks	Buses	Bikes	Total	Cars	Trucks	Buses	Bikes
Current Infrastructure	3,306,109	2,721,805	61,697	24,189	498,418	12,474	10,515	225	38	1,696
Complete Streets	3,358,857	2,893,307	67,073	26,135	372,344	11,475	9,575	206	39	1,655
Percentage change	2%	6%	9%	8%	-25%	-8%	-9%	-8%	3%	-2%

From Table 8.7, we observe that the changes presented by the complete street design show significant results comparing with the performance of the current design. All motor-vehicle modes suffer an increase in delay; in particular, buses increase their delay by 8% or in a two minute delay increase per average bus. Though, bicycles decrease their delay with the Complete Street Design by 25the efficiency of the network is reduced with the new design, as 8% of vehicles are not being entered to the model, most of them being cars.

7. Effect of Pedestrianizing 40th St.

To support the design solution of pedestrianizing 40th St. in Section 10, the solution was evaluated in VISSIM. Based off current conditions, we determine that 40th St. could be pedestrianized because there is enough capacity on parallel streets (42nd St. and MacArthur Blvd.) to support the car traffic diverted of 40th St. Figure 8.6 depicts the level of service at each intersection after the 40th St. Pedestrianization. The LOS before the pedestrianization is shown in parenthesis. Most intersections perform slightly worse than before, but the only dramatic change is seen at Telegraph & 42nd St. Minor signal changes and addition of turn pockets would help to reduce the delays at each intersection.

Figure 8.6 Effect on LOS from pedestrianizing 40th St.



In 2032, when combining the Telegraph Complete Streets Design with the 40th St. Pedestrianization, congestion becomes a more significant problem. Traffic on MacArthur Blvd. becomes very heavy. A macro-simulation model is needed to determine if a larger network could support the pedestrianization of 40th St.

8. Recommendations

This study focuses on characterizing the current network infrastructure and how it is being used to identify problems and propose recommendations for future scenarios. Through the data collected, we observed that the network is performing under capacity except for the intersections on 52nd St. for Martin Luther King Jr. Way, Shattuck, and Telegraph. Current signal timings optimize green times for Telegraph but have no effect on the parallel corridor, MLK, or important cross streets such as 40th St. and MacArthur Blvd. Given that the car traffic in this area presents characteristics of local trips and cyclists use the network for long trips (observed in the floating survey study), we recommend that the network provide better signal timings for cycle traffic to improve bicycling conditions and promote shift towards this mode.

Although current infrastructure presents low delays for users in general, this is not the case for the future scenarios considered. The 2032 No Action scenario shows that trips associated with future developments and population growth add significant stress on the network, increasing delays across modes. Looking at the current street design and evaluating a reduction in car trips by increasing bicycle trips does present an initial improvement in total person delay; however, if mode shares continue to increase, delays would also increase across all modes. This is from friction between active and motorized modes. We recommend that modal shift from cars should be promoted for future developments, but there should also be an infrastructure change, such as Complete Streets, to accommodate these shifts.

Finally, from the Complete Streets model, we observe that although there are better conditions for bicycle trips, it seems to allow additional delays for other modes. The Complete Streets Design that is implemented on Telegraph should provide benefits for everyone. Furthermore, there are important design conflicts that are not addressed yet should be taken into consideration in the Complete Street Design, particularly the bicycle left turns on 40th St. and 46th St. The northbound cycle traffic on Telegraph is not being addressed adequately, as currently approximately 50% diverts to Shattuck instead of continuing north Telegraph Additionally, the Complete Street Design does little to improve transit operations. We recommend that future work on this project explore taking away more parking along or prohibiting left turns and taking away the center turn lane on Telegraph for queue jumps or a bus-only lane. Transit-signal priority should also be evaluated as well in comparison to optimizing signals for cycle traffic.

Conclusively, we recommend that the Complete Streets Design be revisited to address future traffic in the best possible way. The network design should be able to accommodate new trips associated with alternative modes and future developments if this is the course of action the City of Oakland and surrounding community is willing to take. Although the Complete Street Design evaluated does improve bicycle travel on Telegraph, it does it in a narrow way by maintaining sharrow lanes near the heavy traffic intersections (51st St. and 52nd St.) and not addressing current bicycle trip patterns adequately (particularly on the intersection between Telegraph & 46th St.). Travel through the network could present significant improvements if the Complete Street Design is edited to accommodate these issues, as well as increased bus delays and promotion of modal shift.

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Section 9

Citywide Bicycle Demand Model

Timothy Brathwaite

When assessing the benefits of the Complete Streets plan, it is important that benefits are accounted for at the level of the entire city in addition to those benefits seen at the corridor level. Given that the Complete Streets Plan has an objective to "design a street that supports healthy living and sustainability, with a focus on creating a better balance of travel mode choices for all users," one expected benefit is that the bicycling, walking, and transit riding mode shares of travelers should increase as a result of the project (City of Oakland, 2014). Moreover, because Telegraph Avenue is important to travel both within Oakland and between Oakland and more distant locations such as UC Berkeley, one might expect the increased use of sustainable modes of travel by not only people living next to or along Telegraph Avenue but by people who live further away but travel on Telegraph Avenue as they journey to their final destinations. To help quantify changes in sustainable modes of travel, this portion of the studio project focuses on assessing the changes in citywide bicycle mode share that is expected as a result of the two design options in the Telegraph Avenue Complete Streets Plan.

I APPROACH

To forecast changes in mode share in response to a change in part of the transportation system, the typical procedure would be to model a traveler's mode choices using a discrete choice model, inputs to the model, and then observe the changes in modeled mode shares. Unfortunately, most mode choice models are insensitive to the policy options that local jurisdictions have for encouraging bicycle use. An example of this is the fact the Complete Streets Plan lists the "combination of cycle track, buffered bike lanes, and standard bike lanes" as its first key design element with respect to bicycles (City of Oakland, 2014), yet characteristics such as the presence of bicycle infrastructure are typically not present in mode choice models and will therefore appear to have no affect on the likelihood that a person travels by bicycle. Additionally, variables such vehicle speeds, traffic volumes on roadways and topography are usually not present in mode choice models even though they are known to impact the probability of a person bicycling. Because of these deficiencies, we decided to create a new mode choice model that, in particular, would be sensitive to the infrastructure and other spatial variables mentioned above.

At a high level, our basic idea was to build off of four bodies of literature. First, we drew upon GPS studies of cyclists, which observed how far cyclists would deviate from the shortest path between their origin and destination. The results of these studies was used to generate a "zone of likely travel" within which we could be reasonably confident that an individual would travel, if they chose to travel by bicycle. Secondly, we built upon the efforts of prior researchers who used "built environment factors" to capture the effect of the physical environment on one's mode choice behavior. Once we had the zone of likely travel for each cyclist, information on each street (i.e. the type of bicycle infrastructure present on the street, the posted speed limit on the street, and the slope of the street) was collected and numerous summary statistics were calculated for the zone. These summary statistics were used to characterize the distribution of the each of the relevant variables instead of merely using point estimates as was often done with other built environment factors. Traffic volumes were ignored because of a lack of comprehensive and accurate data. Thirdly, we drew upon techniques used in computer science and machine learning to determine which of the many variables collected were most related to people's decision to travel by bicycle. We used the summary statistics to create a decision tree that identified which of the summary statistics (alone or in combination with each other) were most useful in predicting whether or not a person would bicycle. Lastly, we connected these efforts to traditional mode choice modeling by entering the output of the decision trees into a multinomial logit model (MNL) of individual mode choices. The resulting hybrid model was used to forecast the expected increase in cycling mode share due to the design options in the Complete Streets Plan.

The final hybrid model we used was based on the specification of the home-to-work tour mode choice model used by the San Francisco Metropolitan Transportation Commission (MTC) which is based in Oakland. We chose to base our model on an already existing, local model to demonstrate how such a model could be easily adapted to evaluate the effects of the Complete Streets Plan. Hopefully, our efforts will be replicated on a larger scale to include the assessment of changes in the walking and transit mode shares throughout Oakland, in addition to the bicycle focused work done in this studio.

II DATA

The data used to estimate the models used in this project came from a variety of sources. The source of the travel diary data, which provided demographics, origin and destination information, trip purposes, and time of day for each trip was the California Household Travel Survey (CHTS). This is a stratified random sample of households in California who were asked to fill out a one day travel diary along with a suite of descriptive demographic information about themselves and their households. From the complete data set, the tours of individuals who both lived and worked or went to school in either Oakland, Berkeley, or San Francisco and were retained for model estimation. The set of included tours was expanded beyond just those of people who lived and worked or attended school in Oakland because the number of tours meeting this criteria was too low to support the estimation of a cycling sensitive model. In total, the final data set included 1,016 tours, 87 of which had bicycling as the primary travel mode used on the tour.

Along with the CHTS data, we drew upon a suite of spatial data from each city and from MTC. Specific data sources for streets, bicycle infrastructure, speed limits, topography, traffic analysis zones, and city boundaries came from:

1. *Streets*: Shapefiles of city streets were acquired from the City of Berkeley's Data Download Catalog , from the City of Oakland's internal resources, and from the City of San Francisco through DataSF.
2. *Bicycle Infrastructure*: For Oakland and San Francisco, shapefiles of bicycle infrastructure were retrieved from the internal city resources and DataSF respectively. For the City of Berkeley, bike infrastructure information was acquired from MTC.
3. *Speed Limits*: For the City of Berkeley, speed limit information was obtained from the City's website. As before, the information for Oakland and San Francisco was retrieved from internal city resources and DataSF.
4. *Topography (elevation information):* For Oakland, Berkeley, and San Francisco, all elevation data was obtained from the National Elevation Dataset (NED) of the United States Geological Survey, using their 1/3 arc-second dataset.
5. *Traffic Analysis Zones (TAZ):* For the entire nine-county Bay Area, the TAZ geographies were gathered from MTC.

6. *City Boundaries*: All city boundaries were gathered from 2013 United States Census TigerLine shapefiles.

In addition to the CHTS and geographic data, "level-of-service" information was gathered from MTC's travel model "skims." The skims are lookup tables that provide the cost, time, and distance for traveling between each origin-destination pair of TAZs. The skims are differentiated by time of day and by travel mode. Specifically, the times of day are grouped according to "early AM" (3AM - 6AM), "AM peak" (6AM - 10AM), "midday" (10AM - 3PM), "PM peak" (3PM - 7PM), and "evening" (7PM - 3AM).

III METHODOLOGY AND ESTIMATION RESULTS

Overall, the methodology of this project consisted of four main phases. First, the geographic data was cleaned and combined. Secondly, the travel diary data from the CHTS was combined with the travel skims from MTC and processed into a form that could be used for modeling. Thirdly, the hybrid model described above was built, and lastly, the citywide mode shares were forecasted using the model and the proposed redesigns of Telegraph Avenue. These steps are detailed below.

1 Clean and combine geographic data

1. **General Cleaning**: To support network analysis, we had to convert multi-linestrings to linestrings and connect endpoints of lines which were near each other but fail to touch.
2. **Map Matching**: For each city (Oakland, Berkeley, and San Francisco), we had to spatially join the linestring records in the speed limit and bikeways shapefiles to their respective streets. If a linestring did not exist in the streets shapefile, it was created if necessary.
3. **Filtering**: We excluded all highways or private roads from the various shapefiles of streets. We also excluded data from jurisdictions outside of Oakland, Berkeley, and San Francisco.
4. **Feature Creation**: We created point features to represent intersections of linestrings in the shapefiles of streets and to act as nodes when doing network analysis such as shortest path calculations.
5. **Raster Data Extraction**: We extracted elevation data from the Arc/Info Binary Grid files obtained from the NED and associated the elevations with each point created in step 1c).

2 Process the CHTS Data

6. **Tour Creation**: We created tours from the raw person, place, and activity files. The tours were stored in "long format" where each row of the data file represents a particular person and an alternative that they could use as their travel mode and all the attributes of that mode for that person. Each tour was a series of trips from a person's home to their work or school and back to their home. The primary tour mode was taken to be the mode which was used for the greatest distance on the trip.

7. **Data Augmentation**: We used the CHTS activity files to determine the time of the tour and MTC skims to determine the level-of-service for each travel mode for each tour.
8. **Spatial Indexing**: We created spatial indices which defined the relationships between nodes (street intersections), places, and TAZs and city boundaries. These indices aided the creation of many of the variables used in the model.
   i. Places were indexed to their closest nodes.
   ii. Places were indexed to their surrounding TAZs.
   iii. Nodes were indexed to their surrounding TAZs.
   iv. TAZ centroids were indexed to their closest node.
   v. TAZs were indexed to their surrounding cities.

3 Build hybrid decision tree-logit models.

1. **Zone Creation**: We built off of the research of Dill and Gliebe (2008), which quantifies how far cyclists will deviate from the shortest path between their origin and destination, conditional upon the length of that shortest path. Dill and Gliebe's findings were used to construct a zone for each traveler, within which the person was likely to bike—if they chose to travel by bicycle. The straight-line distance between the centroid of each person's origin and destination TAZ was first calculated and then subtracted from the mean distance that each person was likely to deviate from their shortest path. The remaining distance was then divided by two and taken to be how far the person could deviate in a perpendicular direction from the straight line between the centroids of their origin and destination TAZs. With the corners of the zone established, the shortest paths were found, in each direction, along the street network from the origin to each corner and then finally to the destination. The tracing of this path along the street network was used to define the zone.
2. **Zone Characterization**: From these zones, numerous values were calculated in order to characterize the distribution of bicycle infrastructure, speed limits, and roadway slopes. The variables calculated include
   i. The percentage of road miles within the zone which have class 1 (off-road bicycle paths or cycle tracks), class 2 (bicycle lanes), and class 3 (sharrows) bikeways on them
   ii. The various deciles (in terms of roadway miles) of speed limits and slopes
   iii. The absolute value of elevation change between a person's origin and destination
   iv. The length of the shortest path between a person's origin and destination
   v. The percentage of roadway miles in a zone which are 25miles per hour (mph) and below, which are 30 mph, which are 35mph, and which are 40mph and above
   vi. The percentage of roadway miles along the shortest path from a person's origin to their destination, which are 25 mph, 30 mph, 35 mph, and 40 mph and above.
3. **Tree Induction**: Given all of the spatial variables calculated for each person's zone of travel, a decision tree was induced using the zonal variables as

explanatory variables and the decision to bike or not bike as the dependent variable. The tree was induced on a stratified sample of 80% of the data and pruned using reduced-error pruning on the rest of the data. Regarding other options that an analyst sets when building a decision tree, one determines

i. the splitting criteria used to measure the “purity” of a given partition of the data
ii. the type of split made (binary or multiway and “axis-parallel” or oblique)
iii. the stopping rule used to decide when a node will not be split any further
iv. The pruning method used to decide which nodes should be retained.

For this project, we used entropy as the splitting criteria, made binary axis-parallel splits, stopped splitting when the “information-gain” from splitting was zero or when less than 7 individuals would be in a node resulting from the split, and used reduced-error pruning. The tree that resulted from this procedure and a description of the variables present in it are shown below. To read the tree, note that to the right of each arrow/branch is the criteria that must be met for an observation to proceed down that branch. For instance, Node 0 characterizes observations where shortest_path_35 is greater than or equal to 0.01. The {Not Bike: xx, Bike: xx} frequencies in the output nodes denote how many of the observations used to train the tree fell into that node and did not or did bike.

Variable	Descriptions
shortest_path_35	The ratio of roadway miles along the shortest path from one's origin to destination which have speed limits of 35 mph to total roadway miles along the shortest path
slope_xx	The xx-percentile of the slopes in the zone of likely travel between one's origin and destination.
min_distance	The length, in miles, of the shortest path between one's origin and destination.
bike_class_2	The ratio of roadway miles in one's zone of likely travel which have a bike lane on them to the total roadway miles in one's zone.
forward_elevation_change	The absolute value of the change in elevation (in feet) between one’s origin and destination.

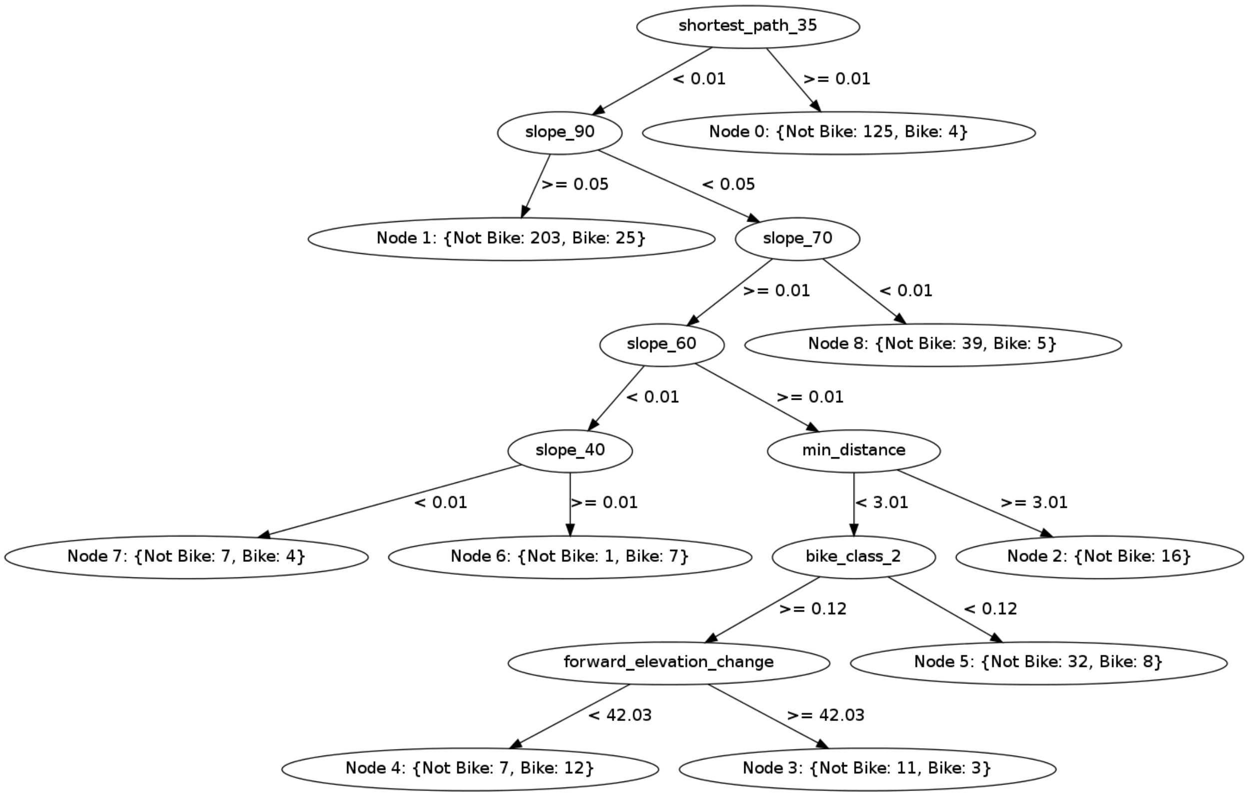

Figure 9.1 The decision tree used in our hybrid model

4. **Logit Model Estimation**: The home-to-work tour mode choice model from the MTC travel demand model was used as the basis for our model. Since the travel skims only contained information on the drive alone, shared-ride (2 people), shared-ride (3+ passengers), walk-transit-walk, walk-transit-drive, drive-transit-walk, walk, and bike modes, those were the modes that we modeled. Regarding the model specification, aside from the added spatial variables, the main difference between the MTC model and our project's model is that our travel distance variables for walking and biking do not have a piecewise specification. We tried to recreate MTC's piecewise specification but it led to illogical signs on one of the distance variables for walking. Besides this point, all variables that were actually estimated and described in MTC's model were estimated here.

We have also added a few variables such as placing the output nodes of the decision tree into the utility equation for bicycles as explanatory variables (Bicycle Node x). The travel time variable has also been split into two separate variables because its coefficient was seen to be quite different between auto modes and transit modes. Lastly, a "Cross-Bay Tour" dummy variable was added to indicate whether an individual has to cross the San Francisco Bay to reach his or her tour destination. This was done to correct an illogical sign on the travel cost coefficient for transit modes. The estimation results and specification of the final model are shown below. Note that ASC stands for "alternative specific constant" and that drive-alone is the reference mode.

Log-likelihood at zero: -1950.2698

Estimation Results

Parameter	Est	SE	t-stat
ASC Shared Ride: 2	-2.7172	0.2206	-12.3153
ASC Shared Ride: 3+	-2.8319	0.2197	-12.8923
ASC Walk-Transit-Walk	-0.1690	0.3604	-0.4688
ASC Drive-Transit-Walk	-3.3721	0.4598	-7.3332
ASC Walk-Transit-Drive	-3.9091	0.4639	-8.4270
ASC Walk	1.4042	0.2672	5.2554
Travel Time, units:min (All Auto Modes)	-0.1116	0.0135	-8.2629
Travel Time, units:min (All Transit Modes)	-0.0291	0.0039	-7.4680
Travel Cost, units:$ (All Transit Modes)	-0.1236	0.0831	-1.4876
Travel Distance, units:mi (Walk)	-1.0957	0.0836	-13.0996
Travel Distance, units:mi (Bike)	-0.2182	0.0514	-4.2422
Household Size (Shared Ride 2 & 3+)	0.5849	0.0577	10.1383
Cross-Bay Tour (All Transit Modes)	1.0544	0.4954	2.1284
Bicycle Node 0	-3.3049	0.5802	-5.6958
Bicycle Node 1	-1.8926	0.3474	-5.4479
Bicycle Node 2	-2.3690	0.8454	-2.8021
Bicycle Node 3	-1.3636	0.6840	-1.9934
Bicycle Node 4	0.9469	0.4827	1.9615
Bicycle Node 5	-0.9221	0.3772	-2.4447
Bicycle Node 6	1.2950	0.8304	1.5594
Bicycle Node 7	-0.6809	0.6387	-1.0662
Bicycle Node 8	-1.8099	0.5199	-3.4815

Log-Likelihood of final model: -1372.2089

Table 9.1 Estimation results for the hybrid MNL model

4 Forecast Bicycle Mode Share

1. To forecast the bicycle mode shares under each of the design options in the Telegraph Avenue Complete Streets Plan, we created two new street network files, one with the combination of bicycle lanes and sharrows along Telegraph Avenue from “design option 1” and one with the combination of cycle tracks and bicycle lanes along Telegraph Avenue from “design option 2.” For design option 2, the network was coded as simply having bike lanes running continuously along Telegraph Avenue from 20th street to 57th street. This was done because cycle tracks never showed up in our hybrid model as being an important driver of an individual's decision to bike. This is likely due to the fact that there were not enough cycle tracks in existence in 2012 in Oakland, Berkeley, or San Francisco to permit the estimation of any effect from them. Given that cycle tracks are not expected to induce fewer new people to bike than bicycle lanes, the portions of Telegraph which were supposed to be cycle tracks were coded as bicycle lanes. This provides a lower bound on the expected effect of design option 2.
2. For forecasting, we filtered the dataset to only those tours where the individual's home was in Oakland.
3. We then computed the expected probabilities for each person in the filtered dataset using the new street networks and the hybrid model shown above.
4. For each tour, we multiplied the sample weight for the person from the CHTS to the predicted probability of traveling by bicycle to get a new expected number of home-based work or school tours whose primary mode is the bicycle. These values were then divided by the sum of all the person weights for each tour to get the expected mode share under each of the design options. The forecast results, both in terms of the change in the absolute numbers of cycling tours and in terms of mode share percentages are shown below in Figures 9.1 and 9.2.

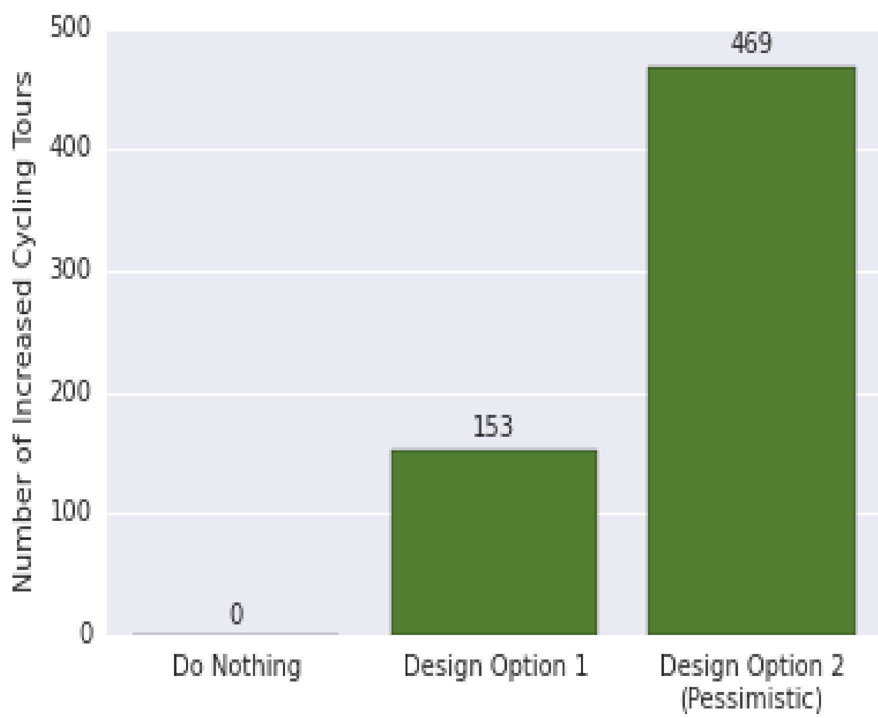

Figure 9.2 Number of increased bicycle tours resulting from the Complete Streets Plan

IV DISCUSSION

Given that the pessimistic version of design option 2 only differs from design option 1 by keeping the bicycle lanes on Telegraph Avenue from 46th St. to 52nd St., it is clear that maintaining the bicycle network all the way up Telegraph promotes cycling to much greater degree than having a mixed network of shared lane markings and bike lanes. Under the pessimistic version of design option 2, more than three times as many new cycling tours from home to work or school are added in comparison to design option 1. Given that there are currently about 1,200 cyclists per day traveling on Telegraph Avenue (City of Oakland, 2014), this represents a large increase in the number of cyclists, and even more cyclists can be expected if one installs a combination of cycle tracks and bicycle lanes up and down the corridor.

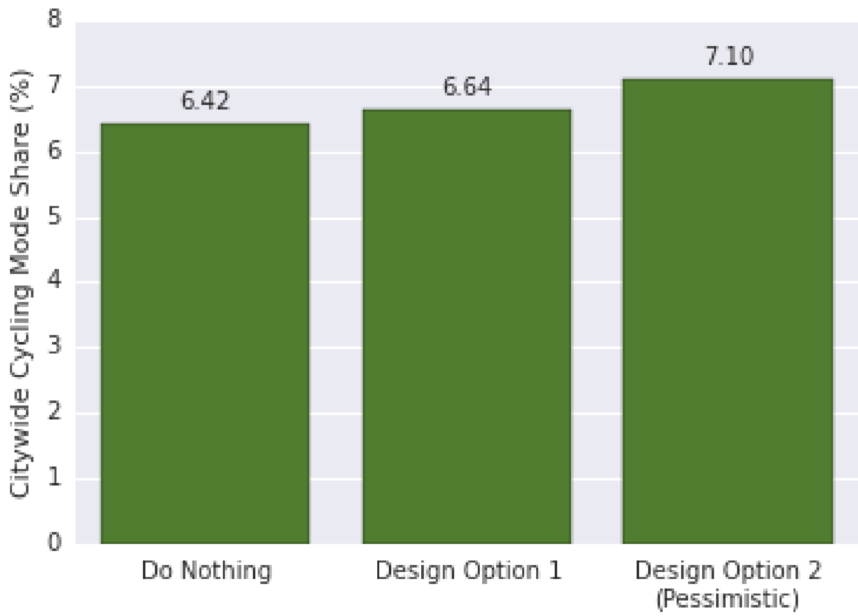

Figure 9.3 Citywide bicycle mode shares due to the Complete Streets Plan

REFERENCES

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Dill, Jennifer, and John Gliebe (2008). "Understanding and Measuring Bicycling Behavior: A Focus on Travel Time and Route Choice." *Urban Studies and Planning Faculty Publications and Presentations*. Web.

Section 10

Underpasses and 40th Street

Christina Blackston
Daniel Howard

Our first site visits involved walking in the neighborhood along Telegraph Avenue, the neighborhood along Martin Luther King Jr. Way, and the MacArthur BART station area. We used the underpasses at 45th Street, 42nd Street, 40th Street, and MacArthur Boulevard to cross between the neighborhoods and were struck by their poor conditions. We hypothesized that the state of the underpasses deterred people from walking and biking under them, inciting people to drive on trips within walking distance because of safety, comfort, and aesthetic concerns. To test this, we gathered data on travel patterns and analyzed it to see whether it supports this hypothesis, and attempted to understand how residents' attitudes towards the underpasses affected their travel behavior by soliciting their input at a community meeting, in email responses, and by conducting a randomized mail survey.

I OBSERVATIONS

We categorized our observations into several key areas: noise, light, sanitation, traffic speeds and other users, which we then broke down into overall safety and comfort scores. We assigned scores from 1 to 5, with 1 representing a very poor condition and 5 representing a very good condition. For neutral conditions, we gave the underpass a score of 3. A description of each of the criteria follows.

1. Noise

We conducted a noise survey, quantifying noise in decibels (dBA) with readings from a noise meter. The results of the noise survey will be further discussed later in this chapter. We also took qualitative observations of noise that included the major source of the noise, the pitch of the sound (low rumble versus high-pitched sounds), and whether the sound was continuous or sporadic. We combined these results into the single score.

MacArthur Blvd was assigned a noise score of 1 because it was the second loudest area we measured. The low-pitched, continuous noise primarily comes from the freeway; the multilevel nature of the underpasses trap noise and direct it down to the surface streets nearby. Noise from BART is also distinguishable near the tracks.

The loudest component of noise for 40th St was the traffic on the street itself. Freeway noise cannot be distinguished over the traffic inside the underpass and there is no noise from BART owing to the more enclosed nature of the underpass.

The 42nd St underpass was the quietest we observed, owing to its very enclosed nature and low traffic volumes. BART and highway noise were indistinguishable from background noise and the occasional car driving by did not affect overall noise levels.

In contrast, the 45th St underpass was the loudest because of the squeal of BART rails. Similar to MacArthur Blvd, the multi-level nature of the freeway and BART crossings tends to amplify sound in the underpass, contributing to the unpleasant environment.

2. Light

We also observed varying light levels in the different underpasses. The MacArthur Blvd and 45th St underpasses have the greatest natural lighting since the various viaducts over these streets are at different levels, allowing light to shine through. Even allowing for natural light, MacArthur Blvd is still fairly dark because of the wide highway bridges at its center. 40th St and 42nd St are both very enclosed spaces with little sunlight. All underpasses have poor electric lighting, making them uncomfortable spaces at night. Therefore, none of the underpasses received a satisfactory review in this category.

3. Sanitation

All of the underpasses suffer from a lack of cleanliness, making them unpleasant places and signifying their state of neglect. 40th St benefits from trashcans associated with the BART station, but these were often overflowing when we observed them. 42nd St and 45th St are the sites of illegal dumping, as well as refuse from homeless encampments, which created the least sanitary conditions.

4. Traffic Speed

Traffic moves very quickly on MacArthur Blvd, and although there is a parking lane alongside the six-lane roadway, it is unused, leaving pedestrians feeling exposed to the high-speed vehicles. We also saw fast-moving traffic on 45th St, which we attributed to the fact that the street is very wide and lightly used. We observed the slowest traffic speeds on 42nd St, which supported our observation that cyclists prefer this street for crossings between the east and west sides of the freeway. The large amount of multimodal activity and conflicts between bikes, people, buses, and cars keeps traffic speeds lower on 40th St, but the high traffic volumes alongside the sidewalk make it less comfortable for non-motorized users than 42nd St.

5. Other Users

Another important factor that influences feelings of safety and comfort for pedestrians and cyclists using the underpasses are the people who share the environment with them. With respect to this consideration, the contrast between the different underpasses is stark. On MacArthur Blvd, a pedestrian feels somewhat isolated because there are very few other pedestrians on that street. On 40th St, people walk or wait for shuttles but do not otherwise linger in the area, so depending on the time of day there could be very few other people or the sidewalk could be overflowing. Both 45th St and 42nd St have a homeless population, which tends to make some other users of the street very uncomfortable. At 45th St this feeling is aggravated by the fact that the encampments are at the top of a sloped support structure, so people using the sidewalks have the unnerving feeling of being watched from the shadows above them.

6. Summary

We took all of these considerations and summarized them into our overall impression of safety and comfort for each underpass (Table 10.1).

Table 10.1: Underpass Observation Criteria

	Noise	Light	Sanitation	Traffic Speed	Other Users	Safety	Comfort
MacArthur Blvd	1	2	2	1	2	3	2
40th St	2	1	2	2	3	3	2
42nd St	5	1	1	4	1	1	1
45th St	1	3	1	1	1	1	1

In the MacArthur Blvd underpass (Figure 10.1), we felt neutral on safety and slightly uncomfortable. The high traffic speeds and lack of pedestrian activity were an issue, but the fact that the sidewalk was buffered from moving vehicles by extra space set aside for parking helped, even if there were few parked cars in the parking lane. The fact that this street is noisy, poorly lit and isolated lead to feelings of discomfort while walking.

Figure 10.1 MacArthur Blvd Underpass.

The underpass at 40th Street (Figure 10.2) benefits from having significant activity associated with the BART station but is likewise plagued with traffic noise and poor lighting. The higher number of people using the underpass to access the station puts more eyes on the street and aids in the perception of safety. However, the narrow sidewalks alongside a busy street coupled with the poor lighting and noise makes the underpass uncomfortable for most.

Figure 10.2 40th St Underpass.

The underpass at 42nd Street (Figure 10.3) did have reduced traffic speeds, volumes, and noise, but it is the darkest and most enclosed. Vagrants, litter and encampments make this underpass feel both unsafe and uncomfortable.

Figure 10.3 42nd St Underpass.

The underpass at 45th Street (Figure 10.4) appeared to represent the worst of each of the categories. It is the noisiest underpass and the one least trafficked by people passing through.

There are a large number of homeless people camped above the sidewalk, causing concerns for safety. A lot of illegal dumping occurs here and this trash adds to the piles of waste and belongings from the encampments, making this underpass very uncomfortable. The only asset the 45th St underpass has is the abundance of natural light that makes its way under the various levels of bridges.

Figure 10.4 45th St Underpass.

II COMMUNITY CONCERNS

In addition to our own observations, we solicited input from residents of the Temescal and Longfellow neighborhoods regarding their perceptions of the underpasses. We attended a meeting of the Longfellow Community Association (LCA) Transportation and Land Use Committee, received additional comments from LCA members via email, and heard feedback from residents of Longfellow and Temescal via the randomized mail survey discussed in Section 3 of this report.

Of note is the fact that attempting to make the underpasses more hospitable is not a new issue for Longfellow residents. At the meeting, we heard of their repeated efforts to get the City of Oakland to respond to their concerns about dumping and safety in the underpasses (LCA, 2014). In addition, residents spoke about the need for better lighting at all of the underpasses. Residents desire to access attractive neighborhood destinations on the east side, especially on Telegraph Ave, while the west side lacked such destinations and carried with it significant safety concerns.

We also heard that many residents like their neighborhood because it was close to transit, but would like to see it become more walkable and bikeable.

1. MacArthur Blvd

Community members noted that MacArthur Blvd may become a desirable cycling street once plans to include a bike lane come to fruition, and that cyclists often used MacArthur Blvd to get from Longfellow to downtown. However, some of these cyclists had found new routes due to the recent construction of the BART garage and MacArthur Station transit village, which has impacted the street for several years. Residents expressed hope that the new retail at this development would attract more pedestrians and cyclists to the area, but noted even though Kaiser Hospital and the Mosswood neighborhood are considered within walking distance, people normally did not walk there. Residents were dismayed that the current plan for improvements for MacArthur Blvd failed to include better lighting for the area, and they did not like the current art. Finally, car break-ins for those who parked in the underpass used to pose a problem, but these have diminished somewhat with the opening of the new BART parking garage (LCA, 2014).

2. 40th St

Residents noted that pedestrians normally used the south side of the sidewalk on this street because the north side was less inviting, which negatively impacted businesses located there. It was also noted that previously residents did not want residential parking passes implemented in the neighborhood, but now were feeling the effects of commuters parking in the neighborhood due to construction (LCA, 2014). Residents commented that 40th Street has numerous daily conflicts between cyclists and buses, shuttles, taxis and cars and that the sidewalk was also very crowded at times. Around the BART station there was also the demand for well-lit areas and more “eyes on the street” to deter crime.

3. 42nd St

Homeless encampments were noted as a major issue in this underpass, sometimes blocking the way for pedestrians. Residents articulated that they did not feel as threatened passing through on bike in this underpass due to their increased travel speed through the area, though did note that sometimes glass is on the ground as cars parked in the underpass get broken into (LCA, 2014). Finally, some residents expressed that users of the underpass could benefit from increased lighting in this tunnel-like section of 42nd Street.

4. 45th St

The Longfellow community members noted that 45th Str is frequently used out of necessity by parents walking their children to school, since it is the most direct route. However, they said that it was not even inviting to bike in the underpass due to debris on the sidewalk and street. It was hypothesized that people dump in that underpass because it seems that no one is responsible for it, and noted that the condition of the underpass makes visitors see the neighborhood in a negative way. The homeless encampments in the underpass were also noted, and there was concern that the needs of these individuals must be addressed before changes to the underpass take place. It was also suggested that 45th St could benefit from the addition of greenery. One resident shared her opinion that 45th St was the least hospitable underpass (LCA, 2014).

III COMMUNITY DATA

In addition to soliciting qualitative opinions from residents, we conducted quantitative measurements of the area through resident surveys, counts of different modes, and sound surveys.

1. Resident Surveys

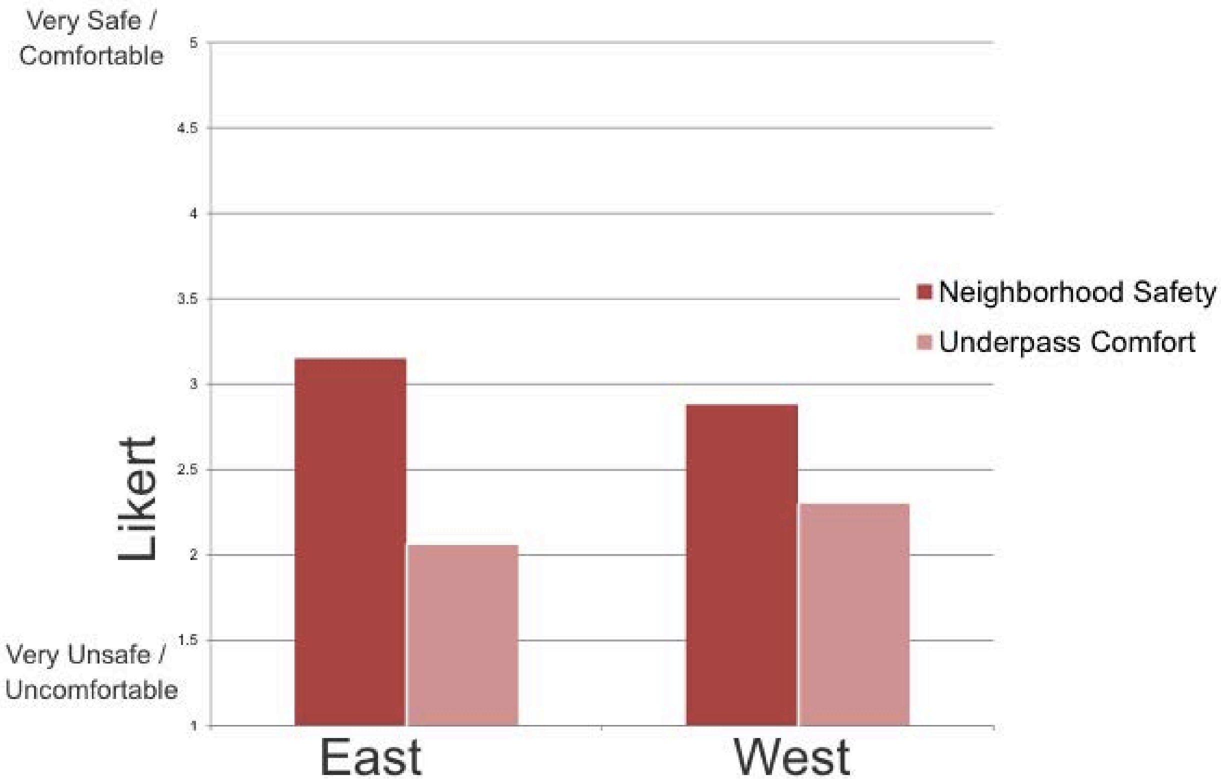

Figure 10.5 Resident perceptions of the underpasses.

Residents on the east and west sides of the highway were asked to assess how safe they feel when walking around their neighborhood as well as how comfortable they feel in the underpasses. They responded on a scale from 1 to 5 with 1 being very unsafe/uncomfortable, 3 corresponding to neutral, and 5 as very safe/comfortable (Figure 10.5). Residents on the east side had an average score of 3.15 on safety perception while the residents on the west side had an average score of 2.88, statistically significant at the 5% level ($p=0.0263$). Residents on the east side had an average score of 2.06 on comfort walking in the underpasses while the residents on the west side had an average score of 2.30, statistically significant at the 10% level ($p=0.0546$). Residents on the east side generally feel more comfortable in their neighborhood and less comfortable in the underpasses than those on the west side.

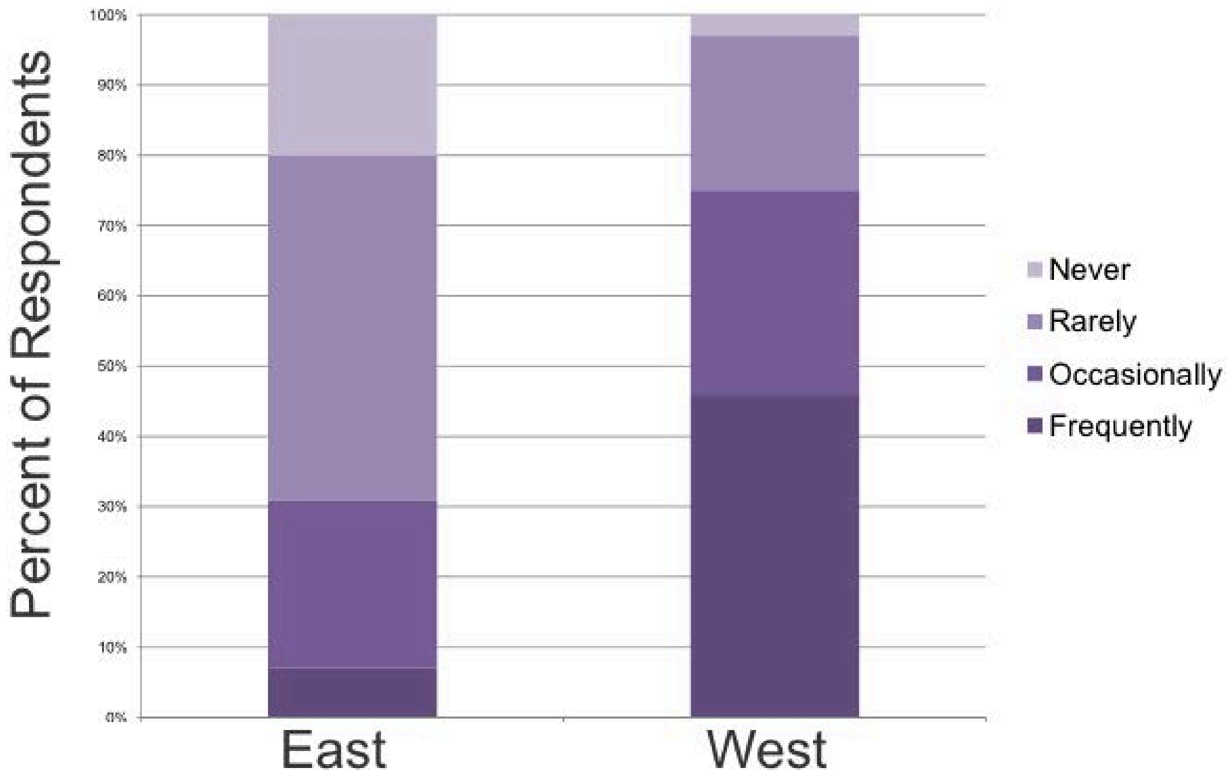

Figure 10.6 Frequency of underpass use.

When asked how frequently they used the underpasses, only 7% of residents on the east side responded they used the underpasses frequently, compared to 46% of respondents on the west side (Figure 10.6). The difference in frequency distribution between east and west is highly statistically significant with a chi-squared test (p=0.0000). Those who use the underpasses "frequently" rated their comfort as 2.49, meaning they are less averse than others, but still less-than-neutral on comfort. Since residents on the west side use the underpasses more frequently but still feel less-than-comfortable, there are equity concerns as those on the west side must interact with the underpasses more often.

2. Traffic flows

In understanding travel behavior within and between these two neighborhoods, we observed people walking, biking and driving at eight key intersections along Martin Luther King Jr Way and Telegraph Ave. Bicycle and automobile counts at Telegraph Ave were taken from the Telegraph Avenue Complete Streets Plan (City of Oakland, 2014). All other counts were taken between the hours of 5pm – 6pm (PM peak) on various weekdays from October 2014 to November 2014. We found that pedestrians and cyclists tend to avoid using the underpasses at 45th St, 42nd St, and MacArthur Blvd (Figure 10.7). We observed high numbers of pedestrians and cyclists on 40th St and high numbers of bikes using Telegraph Ave during the PM peak period. Despite many people making the decision to walk and bike in the area, we found the network is designed primarily for cars, the counts of which are shown for comparison. For instance, people at 40th St and Telegraph Ave often cross the intersection twice, forcing them to wait for two signals and causing them unnecessary delay. Cyclists on 40th St do not have a continuous bike lane to help them reach the BART station. Overall, we found that the network contains many barriers which discourage walking and biking in the area, especially between the east and west sides of the freeway. This disconnectivity motivates our recommended designs for the area. Finally, most people are accessing BART through non-auto modes (Figure 10.8) showing the need to better accommodate those arriving to the station via alternative modes.

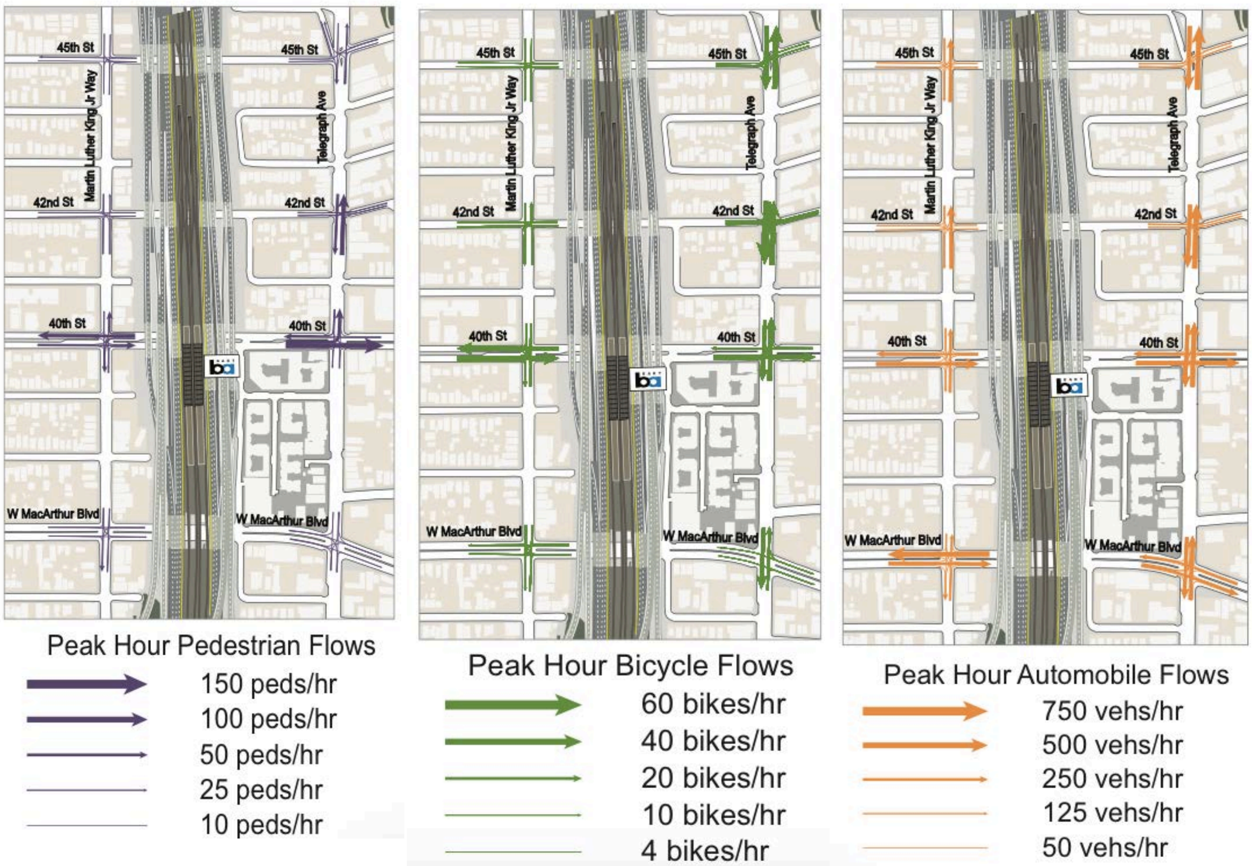

Figure 10.7 Pedestrian, bicycle, and auto flows.

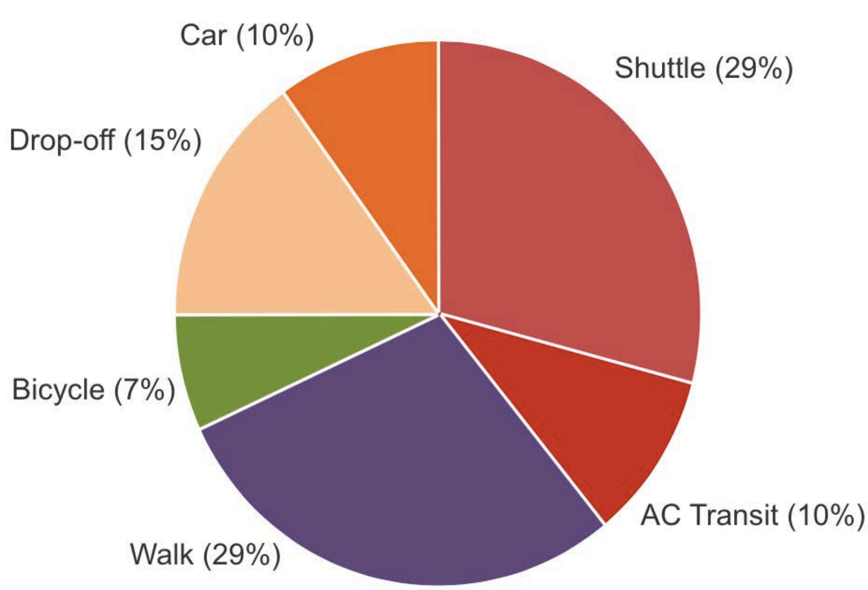

Figure 10.8 BART access mode.

3. Sound Surveys

Sound measurements were taken around and within each of the freeway underpasses. Generally, it is permissible to listen to sounds at 85 dBA for 8 hours without causing hearing loss, but for every 3 additional dBA the acceptable exposure time is cut in half (Centers for Disease Control, n.d.)

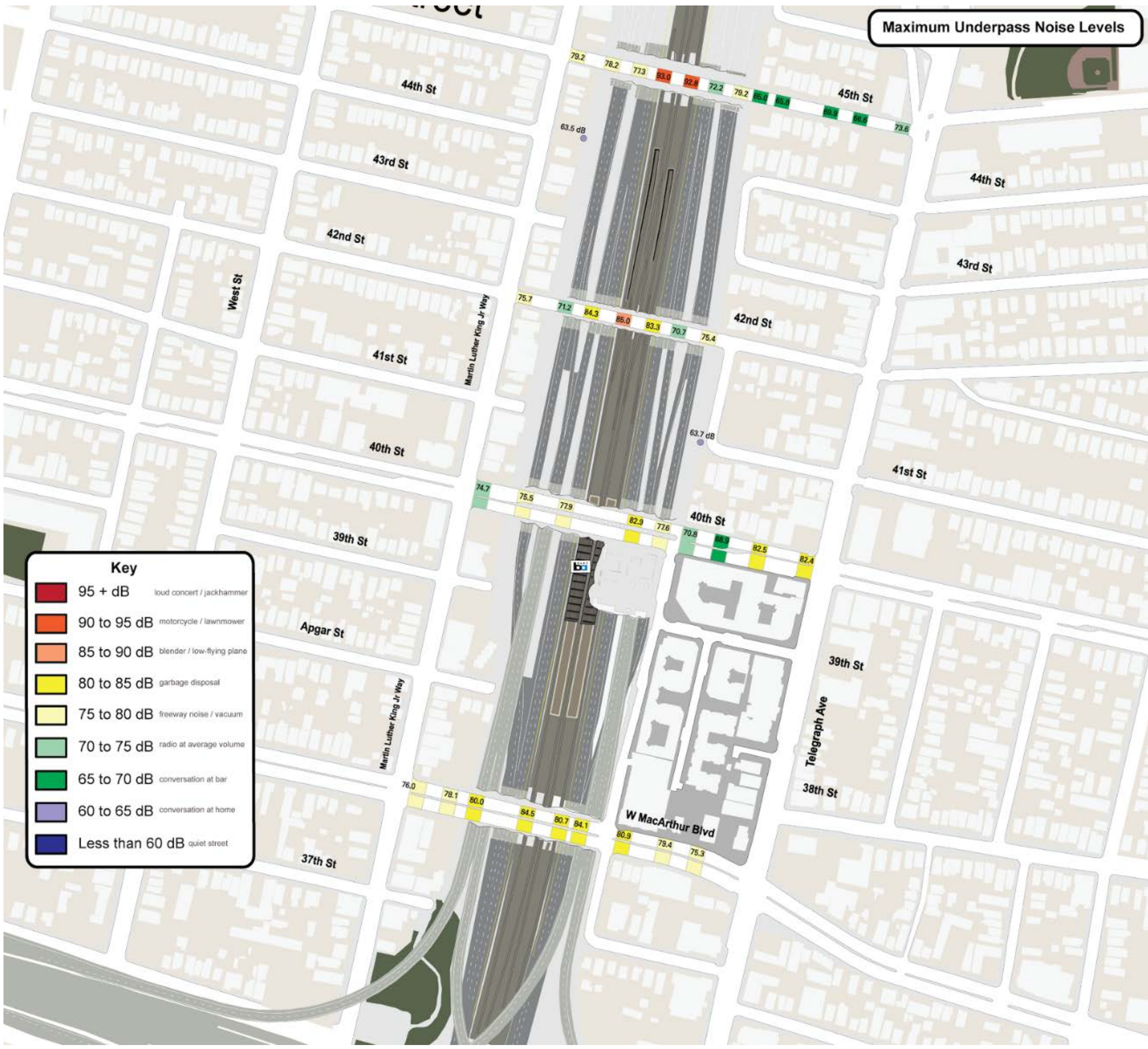

Figure 10.9 Overall noise levels.

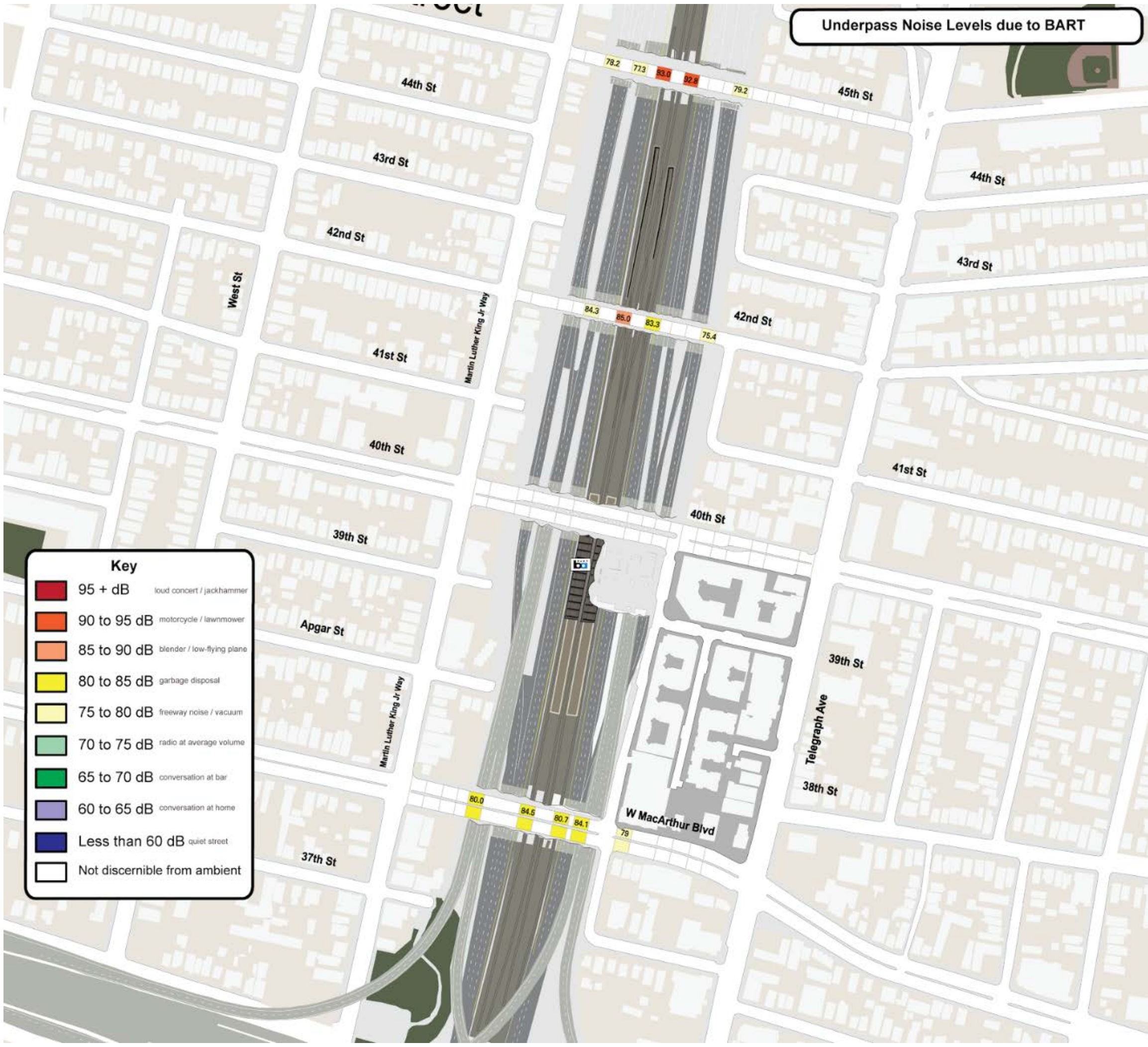

Figure 10.10 Underpass noise levels from BART.

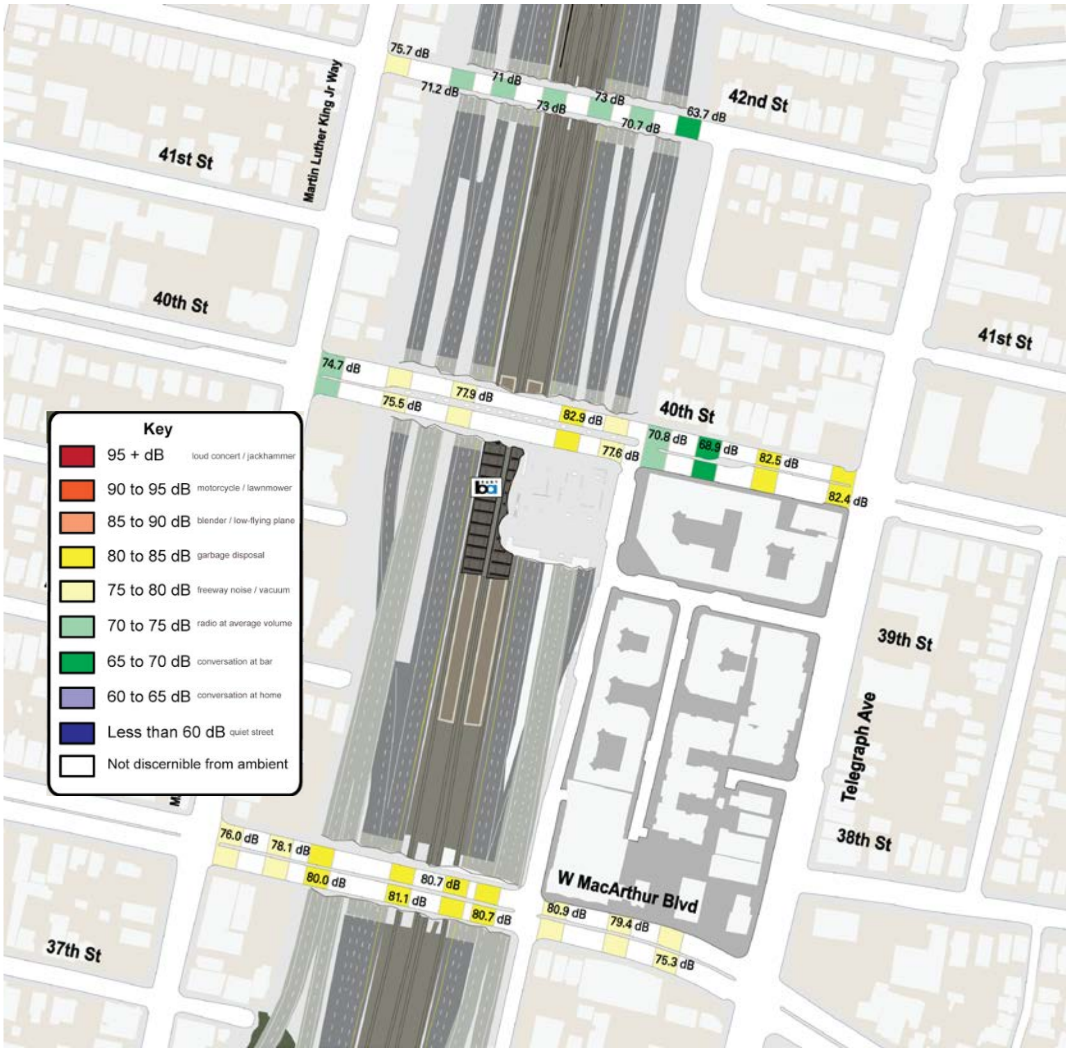

Figure 10.11 Underpass noise levels from street.

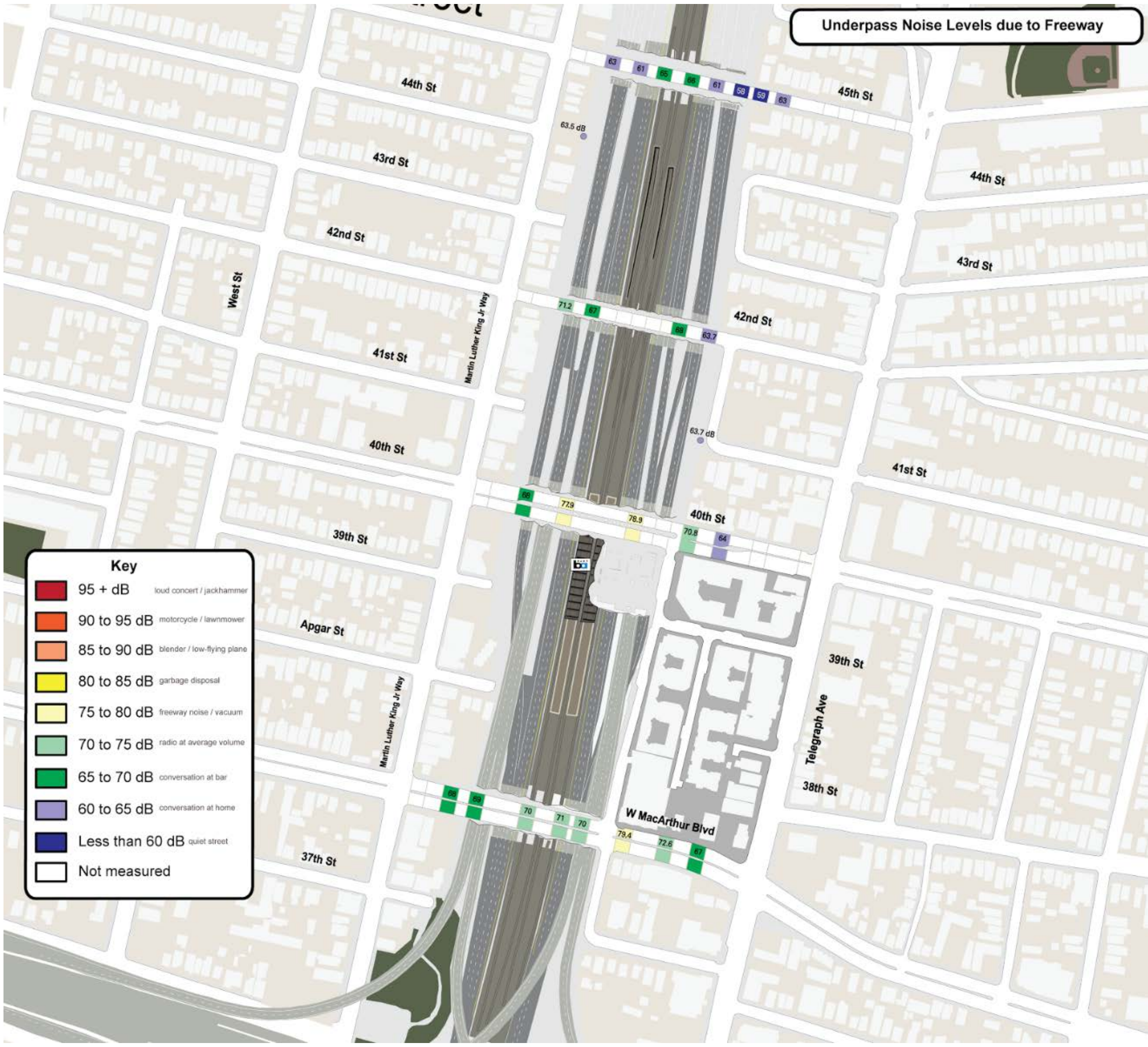

Figure 10.12 Underpass noise levels from freeway.

The loudest overall volume, 93 dBA, a noise level comparable to that of a motorcycle or lawnmower, was recorded at 45th St due to the noise from BART (Figure 10.9; Figure 10.10) A reading of 85 dBA was recorded at 42nd St, also from BART, which is comparable to a blender or low-flying plane. The loudest noise readings at MacArthur Blvd and 40th St, in the high 70 dBA and low 80 dBA, both resulted from the heavy amounts of through traffic (Figure 10.11). This range is comparable to a garbage disposal or vacuum. The freeway did not significantly contribute to the noise in the study area (Figure 10.12) The loudest freeway readings, taken at MacArthur and 40th Street, were comparable to noise generated by a vacuum cleaner and the measurements taken at 42nd Street and 45th Street ranged from the volume of a radio to a quiet street or conversation at home.

These observations yield a few conclusions. In order to facilitate the use of 45th St as a community-serving underpasses BART will need to be encased in sound-absorbing material in order to lessen the noise. The freeway did not contribute to significant amounts of noise at any of the four underpasses, so no mitigation of the freeway will need to occur in order to develop the underpasses into community spaces.

IV DESIGN INSPIRATIONS/PRECEDENTS

Our observations, data collection, and community input led us to seek inspirations from other cities to help inform our designs for the underpasses in the study area. We studied a range of treatments from purely aesthetic treatments designed to make the space more desirable and indicate investment in the neighborhood, to re-imaginings of the space in the underpasses that create new, innovative uses.

A simple but effective technique is the use of lighting to enhance the desirability of the underpass. LED lighting is cheap, bright, and energy efficient. LEDs also come in a variety of colors and can be programmed to create animation effects. Bill FitzGibbons, a Texas artist, has installed LED treatments to underpasses in San Antonio, Texas and in Birmingham, Alabama with the intent of encouraging pedestrians to use the otherwise undesirable underpasses to cross between two sections of the downtown (Figure 10.13). According to the local paper, “using two underpasses at Commerce and Houston streets, [FitzGibbons’ installation] ‘Light Channels’ illuminates a visual barrier between San Antonio’s Convention Center and a shopping center that had minimal foot traffic” (Browning, 2013). The lighting cost approximately $200,000 to install (Fitz, 2014).

Figure 10.13 "Light Channels" LED installation in San Antonio, Texas (Browning, 2013).

Murals and sculpture are other obvious choices to improve the aesthetics of the sculpture. Oakland has a strong artistic tradition and the neighborhoods around the freeway are no exception. Washington, DC recently held an art competition soliciting proposals from artists and designers to improve the condition of the underpasses in the rapidly improving NoMa district. Project goals were similar to the goals we had for the MacArthur area underpasses, namely:

1. Transform the underpasses into spaces that create positive sensory experiences for pedestrians, cyclists and drivers.
2. Create a significant neighborhood attraction.
3. Create a destination — not just a link to travel from one place to the other.
4. Provide a visual connection between the east and west sides of the neighborhood.
5. Enhance the underpasses after dark.
6. Preferred consideration will be given to interactive solutions that encourage visitors to linger in the underpasses (Cook, 2014, n.p.).

After reviewing the contest description and submissions, we determined that a similar design and art competition would be a good element to include in any underpass improvement package. The goals for any set of improvements to underpasses will be similar to the points mentioned above by Cook, and a design contest will encourage locals to take ownership of the space and draw the underpasses into the community identity.

Drawing on the last point mentioned by Cook, we sought solutions, both temporary and permanent, that attract people to the underpasses and cause them to linger there. We noted many cities around the world host farmer's markets, food trucks and other temporary events underneath viaducts and that those events do draw people to the space, perhaps for the first time. However to create lasting patterns it is necessary to show permanent investment in the underpasses so that users feel comfortable and safe. To these ends we looked at permanent treatments designed to draw people to the space below the underpasses.

A successful example of underpass redevelopment is the "Bajo Puentes" project in Mexico City (Figure 10.14; Figure 10.15). The project locates retail, restaurants and play spaces in a set of neglected underpasses. These uses draw regular users to the area, deterring crime and creating a positive cycle in which more people are attracted to use the underpasses, whether staying or passing through, because they feel comfortable and safe. Another important feature of the Bajo Puentes project is the use of reflective white paint to enhance the effect of any natural or artificial light that makes it under the viaduct (Miroff, 2013). The success of the underpass revitalization program is well recognized:

> Eduardo Aguilar, an urban planner for the Mexico City government who helped design the program, said: 'These were spaces that generated no benefit and had been illegally appropriated as dumping grounds for trash or as homeless campsites. They were spaces that cost the city to maintain and were a drain on resources.' He also told Azure magazine, that these place are 'well-lit at night' and 'they attract a lot of people.' With the addition of pedestrian walkways, these are actually safe place to be in (Green, 2013, n.p.).

The project is successful in part because of the innovative method by which the cash-strapped city government financed it. Recognizing that revenue will be brought in by businesses which locate underneath the bridges, and that the land itself is public (and therefore lower cost), the city recognized that a public-private partnership was the best way to bring about development. "The city government's department of housing and urban development (SEDUVI) asks business owners and developers to take on leases for these places at below-market rates, but also asks them to pay for the clean-up, construction, and upkeep of the sites. Local businesses have to leave 50 percent of the area as public space, but 30 percent can be used for commercial purposes, and 20 percent for new parking" (Green, 2013). This model could be followed in an American context, with the ratios tweaked to reflect the demands of the neighborhood for particular uses, such as retail, recreation, or parking.

Figure 10.14 Bajo Puentes Playground in Mexico City (Green, 2013).

Figure 10.15 Bajo Puentes Restaurant in Mexico City (Miroff, 2013).

Aside from a revenue-generating public-private partnership like Bajo Puentes, there are many examples of state and local governments repurposing space under freeway bridges for recreation. Skate parks in particular have been a popular use to locate under bridges. The freeway provides a buffer between these noisy and somewhat undesirable uses and neighbors who might raise concerns. San Francisco recently completed a skate park in SOMA under the Central Freeway for about $3.3 million and the park has consistently drawn activity to the area (Garreton, 2014). Toronto reclaimed the space under a series of underpasses in a project aptly named "Underpass Park" (Figure 10.16). The 2.5-acre park, which cost roughly $6 million to build and was funded by the Canadian government, features play structures, a skate park, and basketball courts (Alcoba, 2012).

Figure 10.16 Underpass Park, Toronto (Alcoba, 2012).

A final inspiration comes from Patricia's Green in Hayes Valley, San Francisco (Figure 10.17). Hayes Valley is well known for its complete transformation following the removal of the Central Freeway. However, when considering 40th St and the MacArthur BART station, we wondered if these effects could be achieved even with the freeway left in place. Until the completion of Patricia's Green, Hayes Valley lacked a neighborhood center. The green area, complete with art and play structures, catalyzed development around it and enabled a formerly divided neighborhood to come together. However, with these improvements and without the freeway, the neighborhood has since succumbed to significant market pressure and has become largely unaffordable. With the freeway in place, we hope that similar improvements on 40th Street will deliver the same benefits and catalyze development while the freeway shields residents from displacement. We believe the pedestrian-oriented approach and placemaking elements of Patricia's Green can be leveraged to aid the area around the MacArthur BART station become a destination in its own right.


Figure 10.17 Patricia's Green, San Francisco (IFHP, 2013).

V UNDERPASS TREATMENTS

The underpasses at MacArthur Blvd, 42nd St, and 45th St are given different treatments due to their different natures. MacArthur Blvd and 42nd St are given lighter treatments; while we recommended that 45th St have a heavier treatment given that more severe issues were identified by our fieldwork and by the community. It also serves as the connection to the Temescal shopping district, an important community asset.

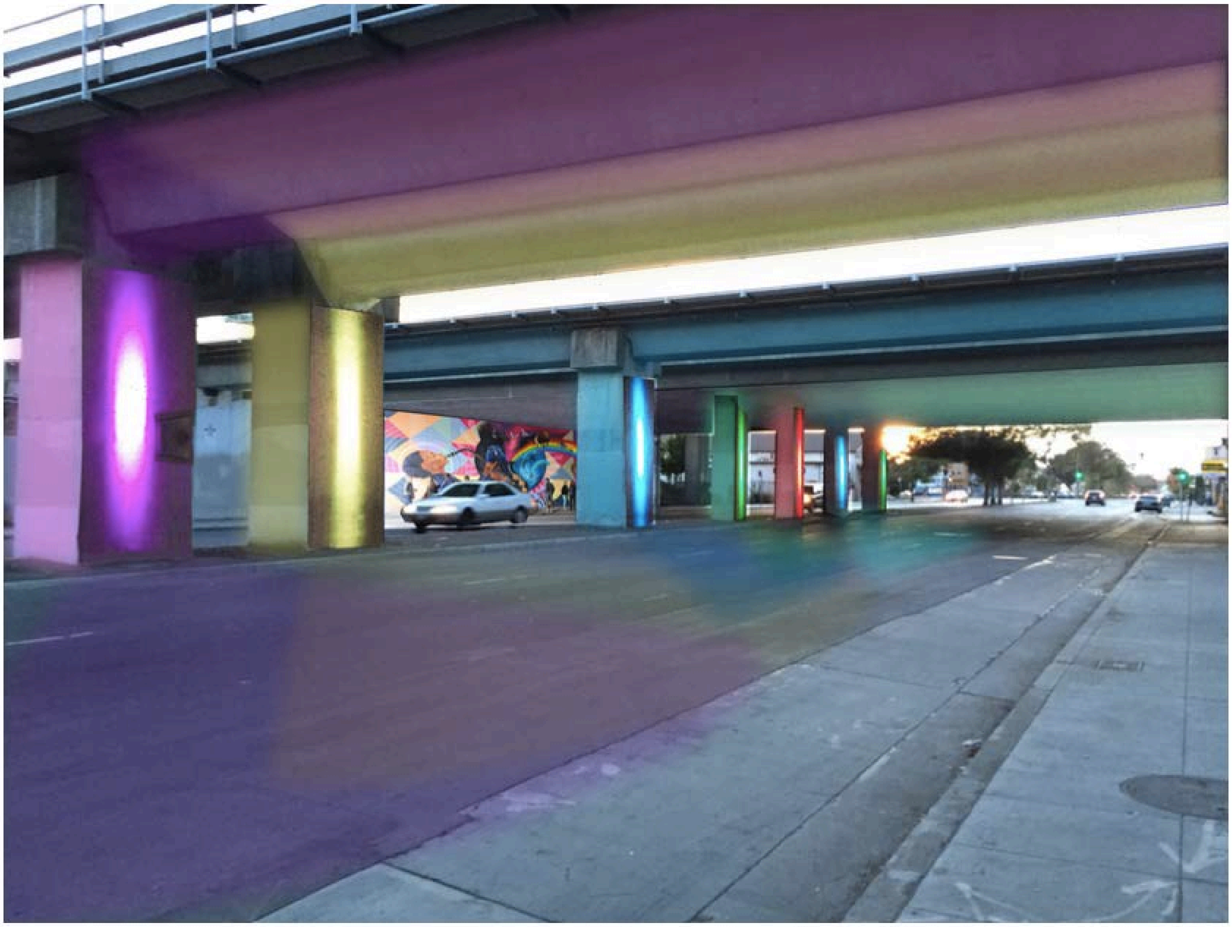

Figure 10.18 Redesigned MacArthur Blvd underpass.

At MacArthur Blvd, we responded to residents' concern for increased lighting and a celebration of local artists. We recommend that LED lighting be used to illuminate the underpass and an art competition, similar to the one in Washington, DC's NoMa district, be held to choose an installation representative of the community (Figure 10.18).

Figure 10.19 Redesigned 42nd St underpass.

At 42nd St, it had been noted that the space is enclosed, dark and neglected. We responded by suggesting LED lights be added to the underpass. Since cars were already parked in the underpass, we suggest angled parking to accommodate additional vehicles while narrowing the street to slow traffic speeds for pedestrians and cyclists (Figure 10.19).

Figure 10.20 Redesigned 45th St underpass.

At 45th St we had observed litter, cars travelling at high-speeds on wide streets with narrow sidewalks and significant noise from BART. We envisioned the underpass at 45th Street as a neighborhood-serving amenity that draws users from both sides of the freeway. At 45th St, we widened the sidewalk on the south side of the street to slow cars and make the underpass more hospitable to pedestrians and cyclists. We made use of the light that we saw shining through the underpass to install greenery. Finally, a climbing wall or similar playspace could take advantage of the verticality of the underpass while providing a community gathering place that serves families (Figure 10.20). As described earlier, an innovative public-private partnership financing method could be used to facilitate a business locating in the underpass. Since the land is owned by the City of Oakland, and air rights are owned by Caltrans, the space could be rented to the business at below-market rate. The business would then be responsible for cleanup and upkeep of their sites. Additionally, the lower costs to the business would allow them to keep prices lower, making the climbing wall more accessible to those at a range of income levels.

VI 40th STREET RESDESIGN

40th Street is treated differently than the other underpasses because we recognize that the influence of the MacArthur BART station's only entrance, and the multimodal traffic it draws, makes this street unique, giving it both local and regional importance. Many people, (approximately 19,000 daily entries and exits to the station) pass along some portion of this street as part of their regular travel patterns (BART, 2014). As noted earlier in this report, these people do not currently stay for long, and use the station area only as a transfer point. We believe that

40th St represents an opportunity to establish a focus point for the community, leveraging these flows of people as a way to invigorate the community in the immediate area. If the street were redesigned in a way that encouraged commuters to stay, it could catalyze activity on the street through additional retail and recreational traffic, which in turn would promote walking and biking through the underpass, connecting neighborhoods on the east and west. In addition, the street could be designed to incorporate placemaking elements that establish a center for the communities in the station area, draw foot traffic and shoppers to the Telegraph Ave and Martin Luther King Jr. Way commercial corridors, and stretch the BART station's "front doors" to Telegraph Ave and Martin Luther King Jr. Way. To this end, our conceptual design kept in mind the following goals, derived from our observations, resident and merchant feedback, and design examples from other cities:

1. The design should first and foremost celebrate the pedestrian, promoting walking since walking is the dominant mode of access to this area.
2. The design to should seek to improve the experience for transit riders transferring between shuttles, BART and bus transportation and encourage them to stay a little longer than their next departure.
3. The design should provide a safe environment for cycling and enhance the connectivity of the bike network in the area.
4. The design should complement the MacArthur Station transit-oriented development plans.
5. The design should preserve access for commercial vehicles, taxis, and people being picked up or dropped off at BART.
6. The design should seek to establish MacArthur BART station as a desirable destination and to provide a gateway and focal point for the community.
7. The design should attempt to provide activities, goods, or services that are needed in the community, encouraging people to walk to the station area to fulfill these needs.

Figure 10.21 Redesigned 40th Street (at Telegraph, facing west).

Figure 10.21 shows a rendering of a possible design that fits the above seven criteria. Primarily, our design recommendation is to pedestrianize 40th Street between Martin Luther King Jr. Way and Telegraph Avenue. This concept is built around promoting the pedestrian experience by providing open space, reduced noise, fewer traffic conflicts, and scenery to observe while walking. The design enhances pedestrian and bike safety, accommodates the heavy pedestrian and bike traffic and complements the existing retail at the corners and the new retail space in the MacArthur Station development. The open green addresses residents' need for a proper park to serve as a community gathering place; a park surrounded by retail will be a high trafficked and well-loved asset to residents and visitors alike.

Under the freeway, a pedestrianized 40th Street (Figure 10.22) provides more space for an enhanced transit plaza for people waiting for BART, AC Transit, or a shuttle. This space also gives enough room to locate retail under the freeway. This retail can draw more activity into the underpass and encourage people to linger in the area, deterring crime and litter. Shops can cater to the needs of commuters and residents; these retail uses could include a café or biergarten, a newsstand, a food court, a grocery store, or a drycleaners. Bright, artistic lighting improves both safety and desirability. This design overall elevates the walking and transit experience and invites people to stay in the area.

Figure 10.22 Redesigned 40th Street (BART Station entrance, facing southwest).

There are many benefits to this design; we seek to highlight them by indexing them to the following categories:

1. Walking benefits
2. Cycling benefits

3. Transit benefits
4. Neighborhood benefits
5. BART Agency benefits

1. Walking benefits

Our conceptual design confers the most benefits to pedestrians because our observations revealed that most people walk for some portion of their journey to access MacArthur BART, because our surveys revealed latent demand for walking from residents and visitors to the area, and because many people are already choosing to walk on this section of 40th Street. Most obviously, pedestrianizing the street confers large benefits to walkers in terms of noise, air quality, aesthetics, comfort, and traffic safety. More subtly, our design concept would reduce pedestrian delay at the intersections with Telegraph Avenue and Martin Luther King Jr. Way. When conducting pedestrian counts we noticed many pedestrians cross both 40th Street and Telegraph Avenue when proceeding through the intersection, regardless of their final direction of travel. This means that people must wait for two crossing phases before proceeding along their way, resulting in additional pedestrian delay. If the intersection were designed so that a car had to wait for two signal phases before making a turning movement, the design and level of service would be considered unsatisfactory. The pedestrianization of the west side of 40th Street at this intersection would prioritize walking by minimizing this crossing delay, while not significantly impacting the phasing on Telegraph Avenue, because crossing 40th Street would become a free movement for people walking on the west side of Telegraph. Figure 10.25 highlights other benefits to pedestrians from the design, specifically the increased activity under 40th St resulting from locating retail along the south side, improved lighting, and a pathway connecting 41st Street to MacArthur BART. In addition to creating another pedestrian connection within the neighborhood, this path, which would be located on a currently fenced-off portion of Caltrans right-of-way for the adjacent freeway, would connect the new retail center to parking under the 42nd Street underpass, introducing more activity to that location and relieving parking stress on nearby residential streets.

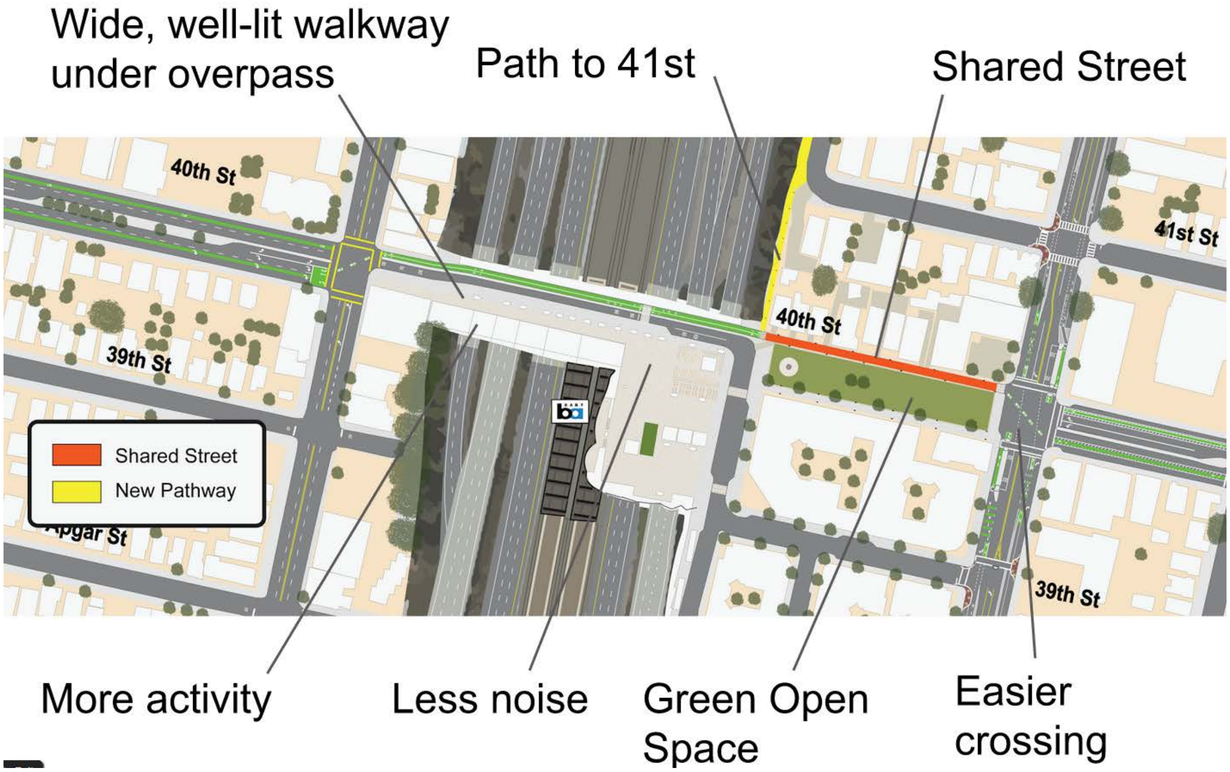

Figure 10.23 Design features enhancing walking.

2. Cycling benefits

Today, cyclists travelling between the east and west sides of the freeway have few options, most of which are not particularly desirable. From our observations and from discussions with residents, we found that many cyclists use the 42nd Street underpass, because it is flat and car traffic is calmer that at the other crossings. Cyclists accessing BART are forced to use 40th Street, and the current design does not take cyclists' travel patterns into account. Today there is no direct way for cyclists to access the station from the westbound lanes of 40th Street, requiring them to stop, dismount and wait for a pedestrian crossing phase at the signal. Many cyclists don't wish to do this, so they make a left at the pedestrian crossing and bike onto the sidewalk, getting into conflicts with eastbound vehicles, pedestrians in the crosswalk, shuttles and buses. At the least, cyclists are inconvenienced by this design, and more often the design has shown to create hazardous conditions.

Pedestrianizing 40th Street reduces many of those conflicts and creates a more ordered cycling environment. As part of the design concept, a two-way cycle track would be created along the north side of the underpass, protected from the eastbound transit lane by a raised median. A raised crosswalk between the cycle track and the rest of the pedestrian plaza would provide access to the BART station. This crosswalk would be uncontrolled, because cyclists would only have to look in one direction (west) for oncoming traffic, and because the transit lane would be restricted to buses, taxis, delivery vehicles and shuttles traveling at low speeds. The raised crosswalk would also serve as a speed control device for these vehicles and remind them of their obligation to yield to those in the crosswalk.

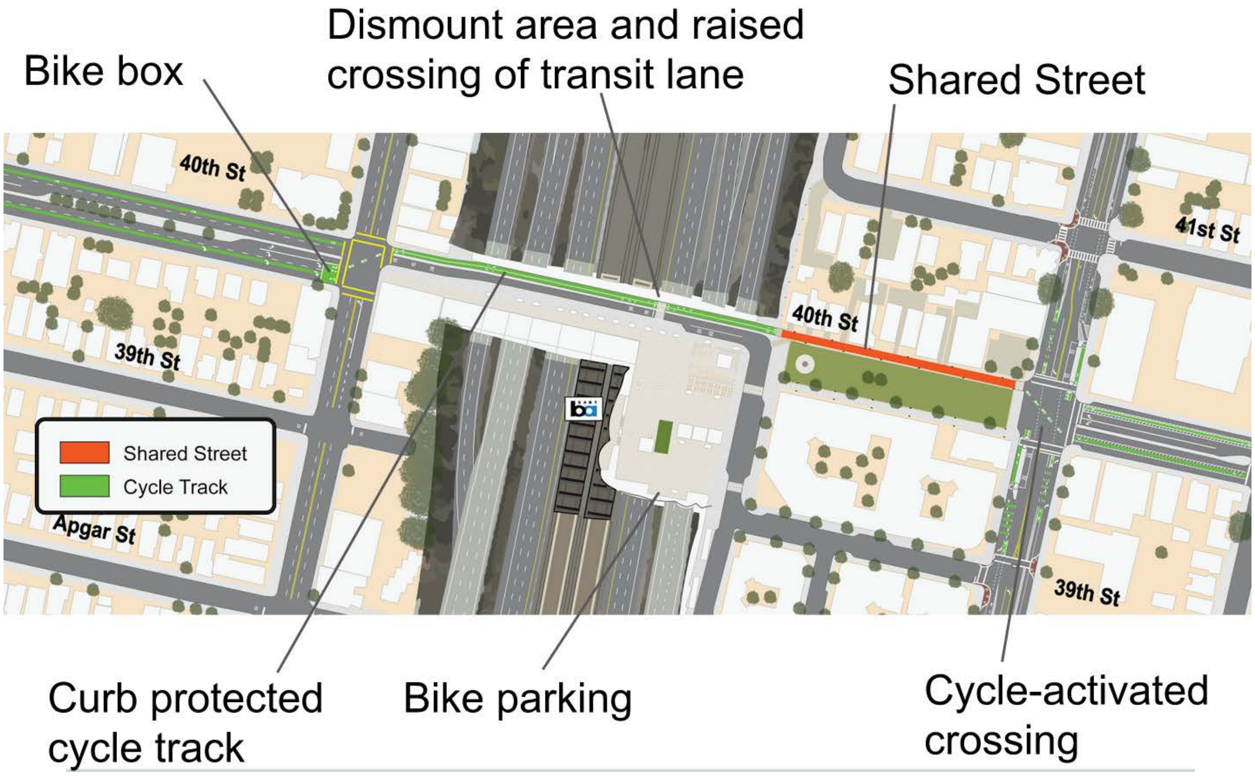

Figure 10.24 Design features enhancing cycling.

The cycle track connects to a shared street, or woonerf on the east side of the freeway that provides a dedicated right of way for bicyclists while providing motor vehicle access to residents living on the north side of the 40th St (Figure 10.24). There are three single-family homes and three multi-family (approximately 6 to 8 unit) apartments on the north side of 40th St, with a maximum of 24 vehicles that could need to access the street, assuming 2 cars per household. Even if these vehicles made multiple trips per day, auto volumes on this street would be well below even the most lightly trafficked residential street in the area, leaving the space open for bicyclists and pedestrians most of the time. Design elements, such as a narrow right of way that does not permit for vehicles to easily turn around, and signage at the Telegraph Ave intersections, would discourage people attempting to use the shared street to drop off BART passengers. Combined with improved signage and station area maps showing the location of dedicated pick-up/drop-off locations, these elements should ensure a safe, comfortable space for bicyclists of all ages.

Finally, since the shared street and cycle track run along the north side of 40th Street, they must transition back to the regular traffic lanes on the east and west ends. This can be accomplished through cycle-only signals on the west side and a signal for the shared street on the east side. The signals would be concurrent with the pedestrian crossing phases for the north and crosswalks at these intersections, enabling bikes to access the street while pedestrians cross on either side. Signals would be activated either by bikes or pedestrians waiting to cross MLK Jr. Way or Telegraph Ave.

3. Transit Benefits

Recognizing MacArthur BART as a transfer point between BART, AC Transit, the Emery Go-Round, and corporate shuttles, we sought to repurpose the space under the freeway as an a grand station waiting area to make transfers more pleasant. This repurposing involved creating additional space to the existing BART plaza through pedestrianizing 40th St, adding better lighting, and introducing amenities that will serve transit riders waiting for their next ride.

Figure 10.25 Design features enhancing transit.

During our visits to the station, we counted five separate AC Transit stops within a block in either direction of the BART station entrance. For instance, the eastbound 57 line stops in front of MacArthur BART station and then stops again at Telegraph Ave. We proposed consolidating those stops into two stops that serve MacArthur BART, an eastbound stop under the freeway in front of the BART station plaza, and a westbound stop at 40th and MLK Way. Such a redesign will improve the legibility of the bus system to riders and make transfers simpler.

A dedicated eastbound transit lane passing directly in front of the BART station entrance would reduce delays caused by buses operating in mixed traffic (Figure 10.25). This eastbound lane would turn buses, taxis, and shuttles onto the frontage road linking to MacArthur Blvd. Taxis would pick up and drop off passengers at a taxi stand on the frontage road, and shuttles would board and alight passengers at the existing shuttle stop on the frontage road. For lines terminating at the MacArthur BART station, this solution links the vehicles to a layover area under the underpass on westbound MacArthur Blvd, which is being used today.

While waiting for their transfer in the station plaza, transit riders could grab a coffee at the café, and buy a newspaper or other essentials at the newsstand located under the freeway. This design is similar to that of many European rail stations, which connect station platforms via an undercroft lined by retail, while the rails pass over the tunnel. Transit information screens placed throughout the area would show BART arrival times alongside shuttle and AC Transit arrivals so that transit customers could wait outside the faregates comfortably while ensuring they make their connections. The additional space, legibility, and amenities afforded by an enhanced BART station plaza would significantly improve transit riders' experience at the MacArthur BART station.

4. Neighborhood benefits

In addition to being a transportation improvement, the 40th Street redesign confers specific non-transportation benefits to residents and merchants in the surrounding community. While benefiting from the improved transit, bike, and pedestrian experiences afforded by the design, residents and merchants also receive new retail space and placemaking elements in the design that address community needs identified in our study.

Figure 10.26 Retail elements in design.

As shown in Figure 10.26, pedestrianizing 40th Street provides more room under the freeway to locate a string of small shops. When visiting MacArthur BART station, we observed two small business already located in the BART station plaza, a florist kiosk and a mobile café / food stand. These businesses could be given leases in the row of shops along with other neighborhood-serving businesses such as dry cleaners, food stands, a grocery store, or a newsstand. Similar to the Bajo Puentes project, these leases could be made below market rate in exchange for obligations to provide community benefit since the property itself would be publicly owned. The businesses' loading needs could be met via the transit lane and the frontage road, and the city could place restrictions on when loading is allowed to occur so as not to interfere with transit service at peak times. Since merchants are not yet located in these spaces, establishing a cohesive loading policy at the outset will reduce the possibility of conflicts between delivery vehicles and transit in the future.

This additional retail will complement the existing business on Telegraph Avenue and the new retail coming at the MacArthur Station development. One possibility is that the retail in the MacArthur Station development could be regional business that serves an attractor to the station area, while locally serving, low-margin businesses could locate in the retail space under the freeway while paying lower rents. This ensures the commercial development builds on itself and creates a commercial hub around the station. A grocery store, sought after by many residents but up to now not provided by the market, must be located somewhere in this commercial hub. Locating the grocery store near the BART station encourages trip chaining, where people pick up some groceries along their commute trip, which is both convenient for residents and reduces the number of trips generated by the station area. Our design locates this grocery store on a parcel of BART-owned property at the corner of 40th Street and MLK Jr. Way. Locating the store on this parcel allows BART to provide incentives to grocery chains seeking to lease the space, which may help the business 'pencil out' in its initial stages when residential density is not yet sufficient to generate enough grocery customers to make a store profitable. This location also will draw residents of the east side to MLK Jr. Way where they can discover some of the existing businesses on the street and catalyze the development of MLK Jr. Way as a second commercial corridor serving the communities on both sides of the freeway.

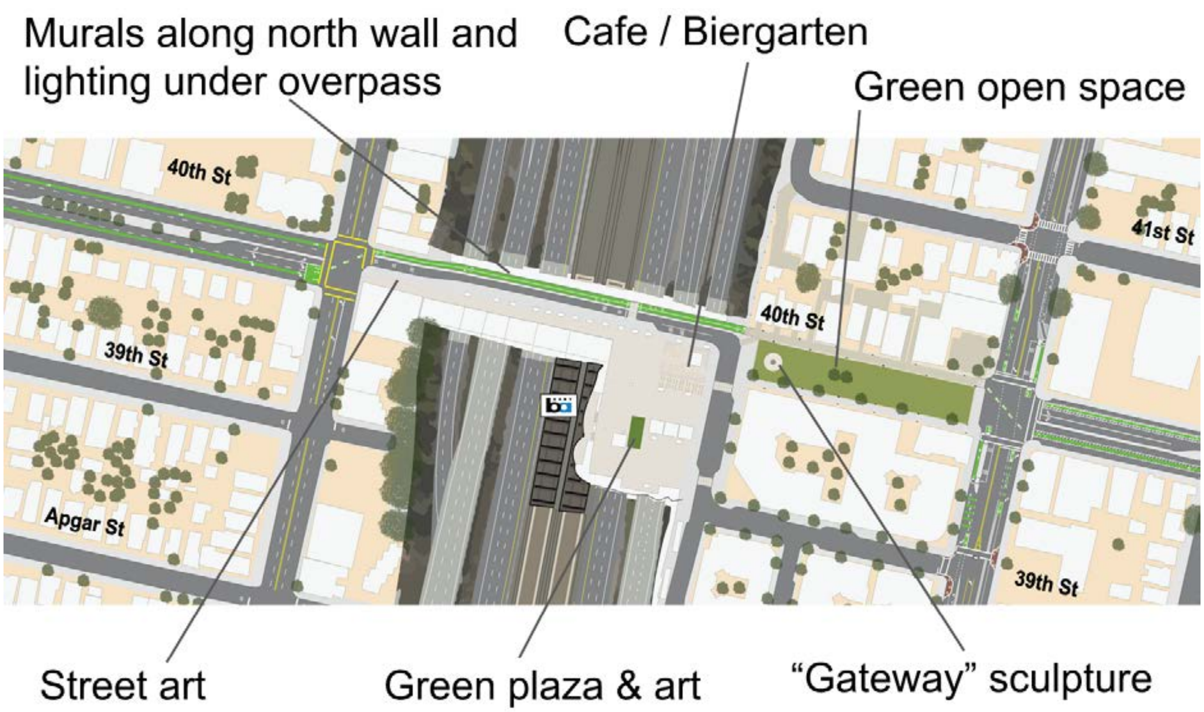

Figure 10.27 Placemaking elements of 40th Street redesign.

Finally, the communities around MacArthur BART lack a focus point and adequate parks, and the 40th St redesign would repurpose some of the space currently given to drivers passing through the area into assets for the community that provide recreation and definition (Figure 10.27). The green open space between Telegraph Ave and the freeway will provide a place for kids to play and for people to sit, picnic and watch passersby in this heavily trafficked area. This design recognizes that the 40th St corridor is close to becoming a vibrant place because it has enough foot traffic to catalyze and support vibrancy, but it lacks reasons for people to stay and engage with the space. A public open space, along with the additional retail mentioned earlier, would provide those reasons and draw people towards the Temescal-Telegraph corridor. Space at both the MLK and Telegraph gateways could incorporate public sculptures designed by local residents and the north wall of the underpass could include murals. A café or biergarten located at the corner of 40th St and the frontage road, the most heavily used pedestrian space, provides opportunities for people-watching and views of the green space. These placemaking elements establish 40th Street as the center of the neighborhood and encourage people to stay, to see, and be seen, which in addition to providing neighborhood benefits, provides improved comfort and safety to those passing through.

5. BART agency benefits

BART itself can also benefit from the conceptual design outlined in this report. Pedestrianizing 40th Street will promote walking, biking and transit as means to access the station, which furthers BART's strategic goals and reduces the demand for parking in the area. The redesign effectively extends BART's station entrances from underneath the freeway to 40th Street's intersections with Martin Luther King Jr. Way and Telegraph Avenue, providing the station with an improved presence in the community. The enhanced plaza, retail, and open space provide BART riders with additional amenities that make riding BART a more desirable choice than other modes of transportation, and improve the status of the BART station in the community.

Financially, BART can benefit from retail leases on its property, as many other transit systems throughout the world already do. Many Asian and European transit agencies, and the Washington Metropolitan Area Transportation Authority in Washington, DC combine retail with their stations and generate significant revenue from real estate operations. In this station, BART could use its real-estate assets to generate revenue and provide a model for other station areas in its system, which could influence the design of yet unbuilt stations as BART expands. BART can also partner with beneficiaries of the placemaking elements in this design, such as the Temescal BID, to provide funding for art and sculpture in the station area as well as construction and maintenance of the green open space on 40th St. Through these partnerships and leveraging agency assets, BART could meet agency goals and raise revenue by promoting the MacArthur BART station as a desirable, vibrant place.

6. Impacts

Implicit in the goals of any redesign of 40th Street is the need to mitigate any impacts of the design to existing users of the area and ensure that the current activities and travel patterns can still take place. Pedestrianizing 40th St carries with it immediate impacts to auto travel, specifically impacts to mobility and accessibility caused by the removal of this street from the auto network.

We modeled the impacts of this removal on mobility through the area under worst-case scenarios using both current traffic levels and projected traffic levels following buildout of the area prescribed by the General Plan. A more detailed discussion of this model and its assumptions is available in Section 8 of the report. Essentially, the model used ITE trip generation estimates, assumed conservative levels of mode shift from auto to walking, biking and transit, and also assumed that people currently using 40th St as an east-west connector would not divert until they were forced to, i.e. at either the MLK Jr. Way or Telegraph Ave intersections, rather than at a prior intersection. Under current conditions, and even with these pessimistic assumptions, the model showed that no intersections in the network were significantly impacted by the change. But, in the future model, all intersections were severely impacted, going to LOS E or F, assuming that the Telegraph Complete Streets Plan is implemented at the same time as pedestrianizing 40th St. However, the model also showed these same impacts to LOS for scenarios where 40th St remains open to auto traffic. Thus, we conclude that in any scenario, significant mode shift from auto to non-auto modes is the only way to reduce traffic congestion in the long term. The model showed most drivers would divert from 40th St to the wider MacArthur Blvd, which today is lightly used relative to its design capacity.

Impacts to auto accessibility are likewise addressed in the redesign. The shared street located along the frontage of the residences along the north side of 40th St addresses their need for auto access. We project that these residences generate a low number of trips because they are relatively low density and adjacent to many forms of transit. The other improvements, such as the addition of retail, would cause trip generation for these six buildings to decrease from today. A shared street can safely handle a small amount of low-speed automobile traffic alongside bicyclists and pedestrians; this condition can be achieved this as long as the shared street is not used for pick-ups and drop-offs.

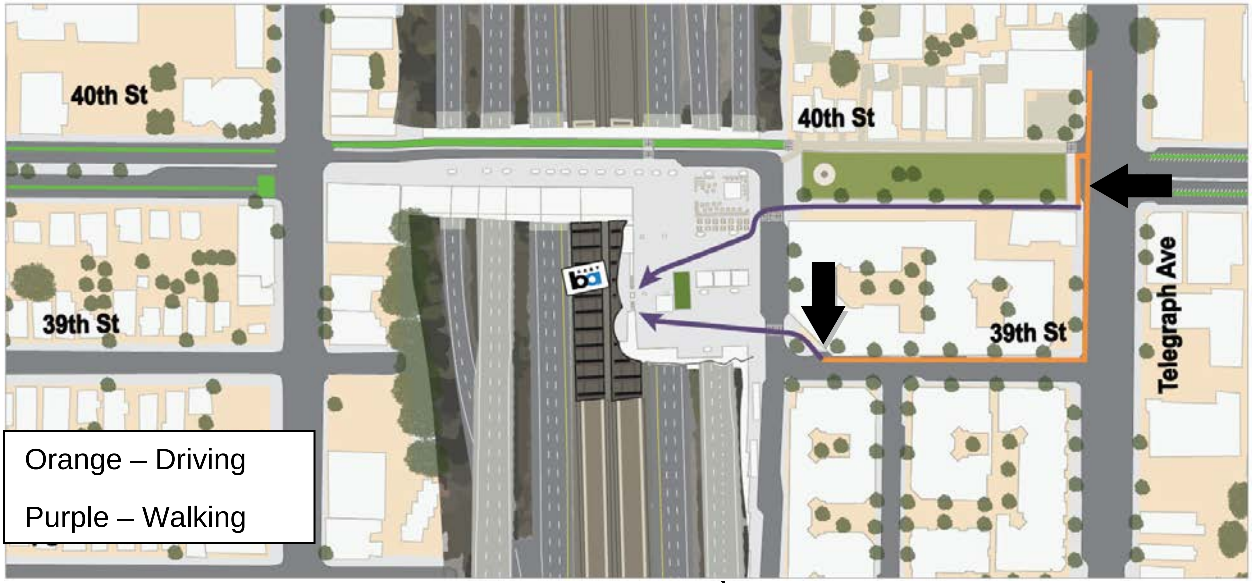

Figure 10.28 Pick-up and drop-off locations after 40th Street redesign.

BART station access for cars is also minimally impacted by this design as BART garage access is provided by the frontage road which can be reached from MacArthur Blvd. Primary access for pick-ups and drop offs is provided along Telegraph Ave. Secondary access (intended for use by elderly persons or those with a disability who may have difficulty walking the distance from Telegraph Ave to the station) is provided on the internal street (39th St) near the frontage road and the station plaza (Figure 10.28). Pick-ups and drop-offs would be prohibited on the shared street, which could carry signed restrictions such as "Auto Access for Residents Only" and would be further deterred by the narrow right of way making it impossible to turn around. Access for large vehicles such as moving trucks, garbage trucks, or emergency vehicles would be permitted by a set of removable bollards permitting these vehicles to connect from the shared street to the frontage road. Emergency vehicles could also drive on the grass open space and bypass the bollards as well.

Figure 10.29 AC Transit lines using 40th Street.

In addition to auto impacts, the redesign does carry impacts to the 57 and C lines that currently run eastbound and westbound on 40th Street (Figure 10.29). Pedestrianizing 40th Street would restrict these movements and force these lines to use MacArthur Blvd between Martin Luther King Jr. Way and Telegraph. After reviewing AC Transit routing and ridership data for these lines, we recommend rerouting the 57 and C to use MacArthur Blvd between Martin Luther King Jr. Way and Broadway (Figure 10.30).

Figure 10.30 AC Transit line rerouting accommodating 40th Street redesign.

We project that the reroutes would not increase bus delay as it does not increase the number of turns the bus must make along the route and traffic speeds along MacArthur Blvd are faster than on 40th St. Our conclusion is also supported by the traffic model mentioned earlier in this report. Although in-vehicle speeds would likely not be impacted, we do recognize that there are significant impacts to access times caused by people having to walk further to access transit. By their nature these impacts are unavoidable, however we do project that relatively few people would be impacted. By looking at Figure 10.29 and Figure 10.30, we can see that people living north of the halfway point between MacArthur and 40th Street would be negatively impacted and people living south of that line would be positively impacted by the change. AC Transit ridership shows few people board or alight on the 57 and C between Telegraph and Broadway, which is supported by Figure 10.31, a map produced by Fehr and Peers showing the origins of those taking transit to the MacArthur BART station.

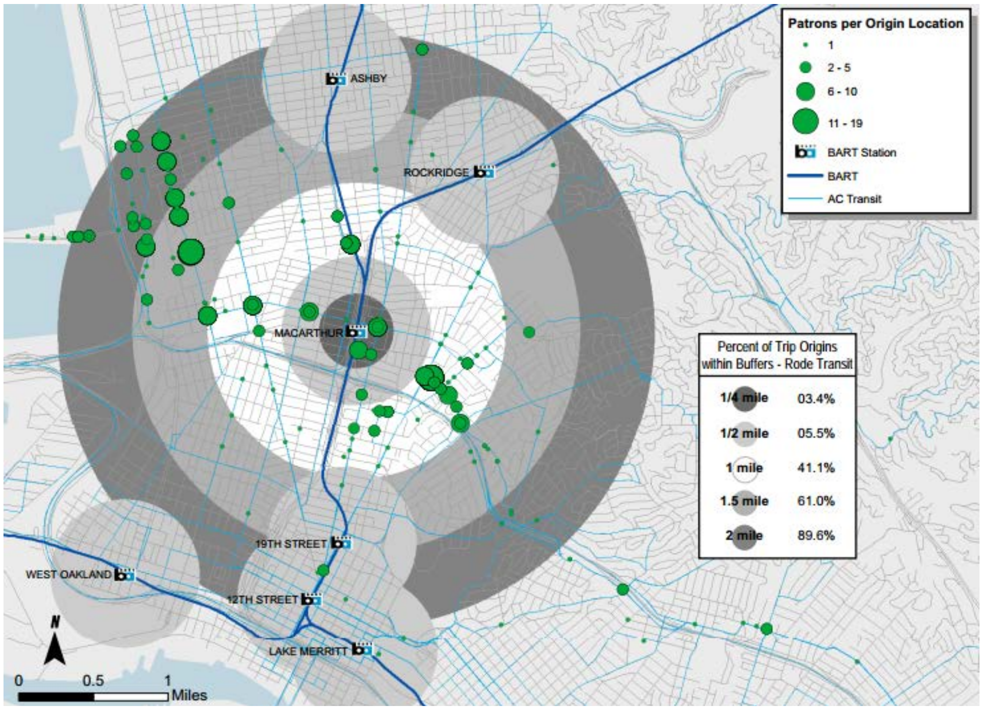

Figure 10.31 Origins of transit riders accessing MacArthur BART (Fehr & Peers, 2008).

This map also reveals many people originating along MacArthur Blvd past Broadway, who would benefit from the more direct route identified above. Contrasting Figure 10.31 and Figure 10.32 we can conclude that most people within a ½ mile radius of BART prefer to walk and would not be impacted by a re-route of bus service away from 40th Street.

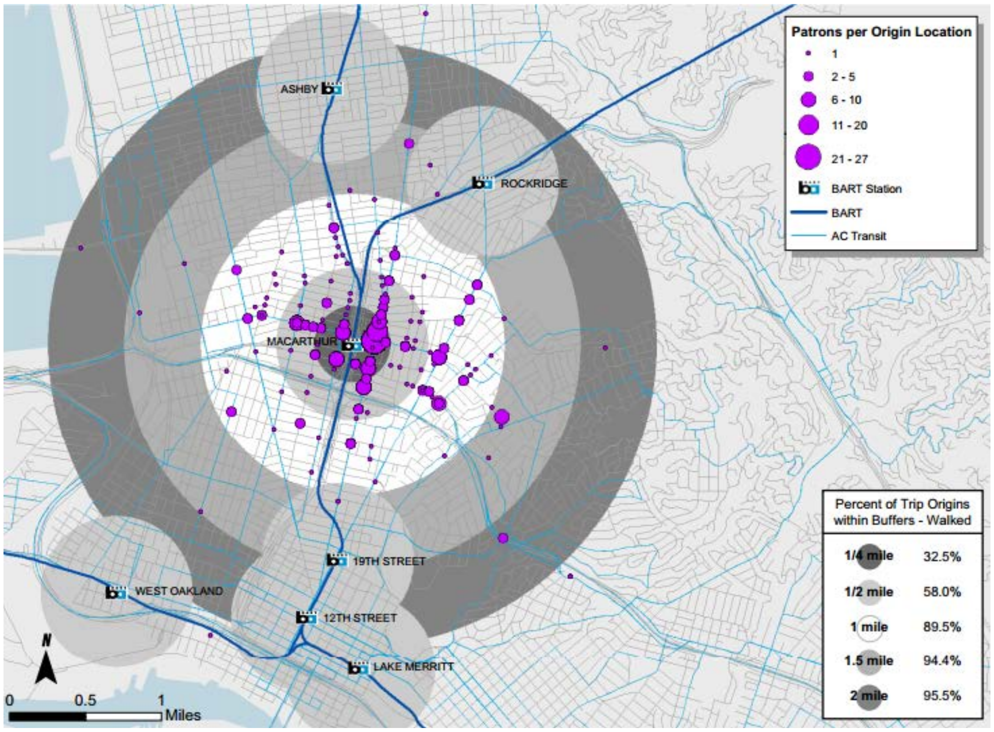

Figure 10.32 Origins of BART riders accessing MacArthur BART on foot (Fehr & Peers, 2008).

From our data and observations, as well as resident and stakeholder opinions we can conclude that a redesign of 40th St to refocus around the pedestrian, bike and transit experience would provide many benefits to the community, BART, and those who use the street every day, while resulting in minimal disruption to existing travel patterns and minimal impacts to existing users. In addition to being a tangible investment in the community, a 40th St redesign would help shape travel behavior, promote the shift of trips to non-auto modes, and aid the neighborhood in capturing more non-work trips internally. All of these features of the redesign work to create a more livable, vibrant and sustainable community and support regional and statewide targets for greenhouse gas emission reduction found in Plan Bay Area and SB 375, while complementing existing and future uses in the area. We recommend the City of Oakland, BART and Caltrans adopt the conceptual plan for 40th St presented here and develop it into a detailed redesign of the station area.

VII IMPLEMENTATION/SMALL STEPS

Reimagining spaces under freeways is a fairly new idea, so the costs of implementation are difficult to estimate. However, some relevant projects have been proposed or completed that can be used to approximate costs. In November 2013, a Kickstarter was funded to create newly painted highway columns at 54th Street and Shattuck Avenue as an expansion of the Temescal Flows Public Art Mural Project. The total expense to create artwork on the 14 rounded concrete columns that are between 15' to 19' in height and 8'-10' in length is estimated at $31,000 (“Shattuck Avenue Gateway,” n.d.). Additionally, the completion of the previous portion of the mural project suggests the possibility that Caltrans will work with innovative design ideas with regard to the underpasses. In the NoMa neighborhood of Washington, DC Mayor Vincent Gray signed a measure to allow the Business Improvement District to spend $25 million for the improvement of public space and construction of three to four parks. The first is planned for construction under the overpass at the tracks approaching Union Station (Russell, 2014).

In order to understand the feasibility of information from a legal standpoint, we examined the ownership of the underpasses and the pertinent laws. Any changes to the public right of way ("ROW") under the Highway 24 and BART overpasses will likely require approvals from the City of Oakland, Caltrans, and BART, potentially including changes of use from an auto-throughway to an open public plaza.

First, the ownership of the surface land remains ambiguous. BART began service between Fremont and MacArthur Stations in September 1972, which indicates that construction took place between 1966 and 1972. Meanwhile the current Highway 24 ROW was acquired by Caltrans just before the freeway overpasses in the area were constructed between 1969 and 1970.[1] This indicates that both BART and the new Highway 24 alignment were designed and constructed concurrently. Photographs of the construction confirm this theory, and also demonstrate that access was generally maintained between the east and west sides of the Highway 24/BART ROW via MacArthur Boulevard, and 40th, 42nd, and 45th Streets. The maintenance of these cross streets during construction, despite the immense ROW acquisition for the elevated freeway and rapid transit structures, indicates that Oakland likely maintains ownership of at least the surface streets below the Highway 24/BART ROW. In place of "splitting" the surface and air rights, it is likely that BART and Caltrans obtained aerial easements over Oakland's cross streets. This theory has not yet been confirmed, but appears likely given Caltrans's current policy in favor of obtaining aerial easements for highways where surface uses continue. (ROW Manual, Sec. 08.01.30.00).

Accordingly, it is unclear what, if any, conditions the aerial easements impose upon Oakland's use of the surface land. That is, it is possible that the Caltrans and/or BART could have some limited authority to define whether the public ROW under the overpasses is used for auto-traffic or a plaza.

Regardless of surface rights, it is clear that Caltrans and BART own the infrastructure above the ROW. Caltrans has existing policies and procedures to install art, including lighting, on its infrastructure, which must be officially sponsored by a relevant local government (here, the City of Oakland). Caltrans does not allow private entities to install art on its infrastructure. A Caltrans employee stated that BART would need to concur in any art installations as well. Those who appear to be the primary points of contact to implement changes to the streetscape under the Freeway and BART overpasses are listed below:

Steven Huss, Interim Manager
City of Oakland, Cultural Arts & Marketing
510-238-4949 / shuss@oaklandnet.com

[1] Prior to construction of the Grove-Shafter Highway 24 freeway alignment between Highway 980 and the Caldecott Tunnel, Ashby Avenue was officially designated state Highway 24, it has since been renamed Highway 13.

David Eng, Landscape Architecture
Caltrans, District 4
510-286-5920 / david.eng@dot.ca.gov

Gary Anderson, BART Senior Real Estate Engineer
510-464-6676

We have suggested a range of redesign options to reflect both lower-cost improvements that can be made within a shorter timeframe, and those that are longer-term investments. The smallest and most obvious step is that trash and refuse in the underpasses must be cleaned up on a regular basis, sending the message that these spaces are cared for by the city. Lighting and art are simple ways to improve safety and comfort for pedestrians and cyclists, as well as signal investment in the neighborhoods, for a relatively low cost. The pedestrianization of 40th Street is a major infrastructure investment; therefore before undertaking a project of such scale it would be wise to acclimate people to the change through smaller pilot projects. Such pilot projects could be simply hosting temporary events on 40th Street that pedestrianize the street for a few hours or days. Food truck culture is well established in the Bay Area in temporary events like Off the Grid. The Streatfood Park in SOMA (Figure 10.33) demonstrates the possibility of using the underpasses to host food trucks on a permanent basis, owing to the popularity of the temporary events. Other mobile services such as a library bookmobile, or mobile health services like blood pressure and cholesterol screenings, could draw a variety of different users to the space and provide missing neighborhood amenities.

Figure 10.33 SOMA Streatfood event (Kennedy, 2012).

VIII CONCLUSION

The underpasses currently function as barriers to connectivity that must be addressed in order create a more vibrant, functional neighborhood. Despite the large presence of pedestrians and cyclists in the area, the infrastructure prioritizes the automobile. Our designs incorporate our own observations, community input, and design precedents to provide suggestions for the creation of more welcoming underpasses and the establishment of 40th St as a destination in its own right.

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