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Chapter 1. Introduction

Spanning the width of the City from Market Street to the Pacific Ocean, Geary Boulevard serves much of the northern half of San Francisco and connects residents and businesses throughout the City. Geary Boulevard is among the busiest transit corridors in San Francisco, carrying approximately 50,000 riders every day. Geary also serves thousands of pedestrians and 30,000-65,000 vehicles every day on average (average daily traffic varies greatly depending on location).

Geary Boulevard has the potential to be a “great street” like Chicago’s State Street, the Portland Transit Mall, Paris’ boulevards, or Barcelona’s Passeig de Gràcia. A great street balances transit, pedestrian, bicycle and vehicular movements through thoughtful design and allows convenient access for a variety of users including residents, employees, shoppers, and other visitors. These streets also contribute landscaping and open space to neighborhoods which enhance livability and contribute to the community’s sense of place. This Study seeks to make Geary a great street.

Geary Boulevard Prioritized for Investment

Because Geary Boulevard serves such an important transportation function, the 2003 voter-approved transportation sales tax measure, Prop K, identified Geary as one of the key links in its rapid transit network, and allocated funding for major improvements to Geary including a potential bus rapid transit project. Bus rapid transit, or BRT, is an excellent tool for creating a “great street” because it is a flexible mode that can be designed to meet the specific needs of a community, contributing to the overall mobility of the community while creating a place where people want to live, work, and shop.

The San Francisco County Transportation Authority (Transportation Authority) and the San Francisco Municipal Transportation Agency (SFMTA) launched this feasibility study of bus rapid transit on Geary Boulevard in late 2004 as a tool to identify ways to improve transit service while enhancing the pedestrian environment and maintaining the convenience of auto travel. Overall, this Study has found that BRT would provide significant benefits to the 50,000 transit riders who rely on Geary bus service each day and would benefit the neighborhoods it travels through, while minimizing the negative impacts to those who choose to drive.

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1 75% of San Francisco voters approved Proposition K, the renewal of San Francisco’s ½-cent local sales tax for transportation.
1.1 Why Bus Rapid Transit?

**BENEFITS OF BRT**

- **Fast and Reliable**—offering passengers a quicker trip with more dependability
- **Cutting-Edge**—maximizing passenger comfort by utilizing state-of-the-art technology
- **Cost-Effective**—moving people as effectively as light rail at a lower capital cost
- **Quick Solution**—with community support and sufficient funding, a typical BRT project can be designed and built in 5 to 7 years
- **Flexible**—maximizing operating flexibility by allowing multiple operators and multiple types of service (e.g., local, BRT, and express bus routes).
- **Incremental**—may be deployed in phases based on funding availability and demand

**San Francisco’s Policy Framework**

The New Expenditure Plan (NEP) for Proposition K articulates the vision for transit system development in San Francisco over a 30-year timeframe. The NEP called for an integrated citywide network of rapid bus and rail transit, including the “creation of fast, frequent, and reliable bus rapid transit service,” on Van Ness Avenue, Geary Boulevard, and Potrero Avenue. The 2004 Countywide Transportation Plan (CWTP) also established BRT network development as San Francisco’s preferred policy for transportation investment.

Bus rapid transit (BRT) was chosen as the City’s transit expansion strategy because it can deliver substantial transportation benefits quickly and cost-effectively. BRT achieves many of the benefits of rail transit, but at only a fraction of the cost and is therefore able to address mobility needs on Geary while still leaving resources to invest in other San Francisco transit projects. The Geary Corridor has been considered for light rail in the past, but rather than focusing limited resources in a single corridor, San Francisco opted to distribute funding and resources to many corridors. The BRT alternatives devised during this feasibility study would not prohibit future light rail development, and the Study evaluated the costs/benefits of investment in some light rail infrastructure (fully discussed in Chapter 4 of this report) to place the potential BRT project in full context.

Bus rapid transit uses a combination of street design and technology to better manage traffic and transit in order to improve transit speeds and make service more reliable and comfortable. Characteristics of BRT can vary, but most full-featured BRT systems include the following:

- Dedicated bus lanes;

---

2 The NEP is expected to provide $2.82 billion in sales tax revenues for the transportation system — approximately 65% of which is dedicated to transit consistent with the City’s Transit First policy.
• Transit signal priority that reduces the amount of time buses spend at red lights;
• Faster boarding by using ticket vending machines, all-door boarding, and low floor buses;
• Distinctive stations and boarding areas with a high level of amenities including:
  o High quality shelters and
  o Real-time information notifying transit riders when the next bus will arrive; and
• Streetscape and pedestrian access improvements.

Upon its completion, a BRT project on Geary would become part of a network of highly recognizable transit routes. It would reduce transit travel time, increase transit reliability, and improve walking conditions. Auto impacts would be minor and could be managed by maximizing the performance and efficiency of the remaining mixed-traffic lanes through technological and design tools such as signal timing and traffic engineering. Faster and more reliable transit service would result in more people traveling to the Geary corridor for shopping, restaurants, and other commercial activities. Pedestrian improvements and landscaping would also make Geary a more pleasant and desirable place to be.
Successful Models and Proven Strategies

Currently, BRT systems have been implemented successfully in over 25 cities around the world, including cities in North America, South America, Europe, and Australia. North American cities such as Vancouver, Boston, Los Angeles, Las Vegas, and Eugene have shown that BRT can reduce travel times, increase reliability, and attract new riders, all in a short period of time with modest investment. Several other US cities are examining the feasibility of instituting BRT, including New York and Oakland.

BRT in San Francisco would be uniquely defined to fit local priorities, the features of our existing transit system, and the characteristics of the corridors BRT would serve. However, San Francisco’s BRT system can also benefit from lessons learned both nationally and internationally.

BRT systems in Los Angeles, California and Las Vegas, Nevada illustrate examples of high-quality BRT vehicles.

BRT systems in Eugene, Oregon and Vancouver, British Colombia illustrate examples of lane treatments and stop amenities.
San Francisco’s Transit Priority Network

The importance of our City’s transit system cannot be understated. High quality, frequent, reliable transit service is crucial to the quality of life and economic vitality of San Francisco. It improves air quality, reduces auto congestion and maximizes the existing street network’s ability to move people. The importance of transit and its primary role in the health and well-being of San Francisco is codified in the City Charter’s Transit-First Policy.³ The policy states:

“Public transit, including taxis and vanpools, is an economically and environmentally sound alternative to transportation by individual automobiles. Within San Francisco, travel by public transit, by bicycle and on foot must be an attractive alternative to travel by private automobile… ”

The 2004 Countywide Transportation Plan (CWTP) predicts that the share of trips made by transit will decline in the future unless measures are taken to increase the competitiveness of transit relative to driving. The CWTP analysis found that only a network of fast, reliable, and comfortable transit citywide, shown in Figure 1-1 below, can cost-effectively reverse the trend toward declining transit mode share by retaining and expanding transit ridership citywide. A BRT project on Geary Boulevard is a key step in making this network a reality.

³ San Francisco City Charter, Section 16.102, added November 1999.
1.2 Study Area

The Geary Corridor Study Area can generally be defined as bounded by California Street on the north, Balboa and Turk Street on the south, the Pacific Ocean on the west and Market
Street on the east, as shown in Figure 1-2. These boundaries roughly represent the walking catchment area for bus services that operate on Geary (approximately ¼ mile buffer). They also incorporate the parallel streets most likely to be affected by changes on Geary Boulevard. Within these boundaries, the greatest emphasis is placed on Geary itself.

Although the entire length of the corridor is included and analyzed in this study, the area between Van Ness and 33rd Avenue received particular attention. The BRT alternatives consider a dedicated transit lane between Van Ness and 33rd Avenue, building on the dedicated lane currently in place on the Geary Street/O’Farrell Street one-way couplet east of Van Ness. Improvements such as landscaping, improved shelters, and better sidewalk conditions would be applied to the whole length of the street from Market Street to 48th Avenue. No further reallocation of roadway space was considered on the Geary/O’Farrell one-way couplet since they were recently redesigned for enhanced transit service as part of the Inner Geary Transit Preferential Streets (TPS) Project, described below. This Geary BRT feasibility study utilized much of the work done in the Inner Geary TPS Project, such as conceptual designs for local and BRT transit stops, in order to create the appearance of one integrated system for the length of Geary.

Figure 1-2 The Geary Corridor Study Area

Inner Geary Transit Preferential Streets Project

The Inner Geary Transit Preferential Streets (TPS) Project was completed by the SFMTA in January 2005 and funded by Proposition K sales tax dollars. It can be considered an initial phase of the potential Geary BRT project. This was a low-cost, short-term project to improve reliability and passenger comfort through a very congested part of the corridor.
This section of the corridor already had a dedicated transit right-of-way, but it was too narrow to function effectively, and was plagued by double-parked cars and other operational problems.

The Inner Geary TPS Project improved the existing transit lane to provide a more comfortable and quicker ride by making the lane wider, creating turn pockets, and adding yellow zones to eliminate conflicts between cars and delivery vehicles in the transit lane. The project also eliminated three local stops to improve reliability and shorten transit travel times. Prior to these changes, local buses stopped almost every block, resulting in closer stop spacing than SFMTA’s standard of 800-1000 ft. At Limited stops, bus bulbs were added to improve boarding speeds and comfort. For most of the day there is one lane of automobile traffic in each direction in this area; however, during the peak periods the parking lane is converted to a through lane, doubling auto capacity. Project benefits include: greater transit reliability, calmed traffic, increased safety, enhanced streetscape, improved business deliveries, and increased parking availability through systematic parking management.

Features such as prototypical bus stop designs, landscaping, and pedestrian improvements that were developed in concept during the Inner Geary TPS Project are utilized in this feasibility study.

1.3 Study Objectives

This conceptual study assesses the feasibility of implementing bus rapid transit on Geary Boulevard as a way to improve transit service while also improving the neighborhoods that it passes through. Though quite detailed, the findings presented here are preliminary, and can be evaluated more extensively should analysis progress to the next phase of study—an environmental impact analysis. The primary purpose of the effort described in this report was to create and refine preferred BRT conceptual designs through both technical analysis and an extensive community outreach process. Community members have had many opportunities to provide input on the development of conceptual designs, and how well designs respond to key objectives such as raising transit service levels, improving pedestrian safety and access, meeting neighborhood business and residential needs, and enhancing urban design. This Study sought to answer four primary questions, described below.

Key Study Questions

- How would BRT be defined on Geary?
- Is BRT feasible on Geary?
- Is BRT justified (benefits vs. impacts)?
- Which alternatives are most promising? Are there any alternatives that should be eliminated?
1.4 Study Process

This Study has been conducted as a collaborative inter-agency and community process, involving close coordination between the San Francisco County Transportation Authority, the San Francisco Municipal Transportation Agency (SFMTA), and other city and regional agencies, as well as various community groups leading extensive public involvement.

The San Francisco County Transportation Authority was created in 1989 to administer and oversee San Francisco’s half-cent local transportation sales tax program (originally Proposition B, now Proposition K). It is also the designated Congestion Management Agency (CMA) for San Francisco and is responsible for developing and administering the City’s Congestion Management Program (CMP).

The San Francisco Municipal Transportation Agency is comprised of the San Francisco Municipal Railway (Muni) and the Department of Parking and Traffic (DPT) and is responsible for all the daily operations of transit service offered by the City and County of San Francisco and the daily operation of streets in San Francisco.

The study process consisted primarily of the following steps:

- Development of goals for the corridor and the project (described in Chapter 3),
- Analysis of existing conditions, including substantial data collection and public input, characterized in a Needs Assessment Report (summarized in Chapter 2),
- Development of “Design Principles and Guidelines” for Geary to provide a framework for the creation of conceptual design alternatives (described in Chapter 3),
- Development of five conceptual alternatives for the potential future of transportation service on Geary Boulevard (described in Chapter 4),
- Development of an evaluation framework to assess the success of the conceptual design alternatives in meeting the goals for the corridor and compare performance between alternatives (described in Chapter 5),
- Evaluation of all alternatives (summarized in Chapter 5), and
- Development of a potential implementation strategy, including phasing and funding, as well as identification of fast track projects that could be carried out while the project undergoes further analysis (Chapter 6).

Study Partners

Led by the Transportation Authority, Study partners include:
Agency Partners

- San Francisco Municipal Transportation Agency: Muni & the Department of Parking and Traffic
- San Francisco Planning Department
- San Francisco Department of Public Works
- Golden Gate Bridge, Highway and Transportation District (Golden Gate Transit)

Consultant Team

- DKS Associates w/The Robert Group and IBI Group
- ROMA Design Group
- Pittman & Associates
- David Vasquez

Throughout this document, “Study Team” will be used to refer to this collection of agency staff and consultants who conducted the Geary Corridor BRT Study.

Geary Citizen’s Advisory Committee

The Study Team was guided by the Geary Citizens Advisory Committee (GCAC), a diverse group of seventeen stakeholders representing communities along the corridor and city-wide interests. The GCAC served as a critical liaison between the Study’s technical team and local stakeholders. The GCAC enabled the Study Team to involve the community early in the planning process. In addition to numerous community and stakeholder meetings, the Study Team also hosted three rounds of public workshops held in various locations along the corridor focusing on understanding community needs and collecting input on the conceptual design alternatives along with their benefits and impacts.

The purpose of this extensive outreach was to involve the varied communities and stakeholders in refining the technical analysis, and to gauge public support for the conceptual BRT designs. If the project moves forward, this should simplify the environmental review process and lead to faster and more cost effective implementation. Outreach was conducted in six additional languages (Spanish, Chinese, Russian, Japanese, Korean, and Vietnamese) in an effort to bring ethnic and minority communities to the table who often do not have a strong voice in the transportation planning process. This multilingual outreach effort was supported in large part by an award from Caltrans’ Planning Grant program.

Community-Based Partners

Outreach efforts were supported by several other community-based partners who offered broader and deeper reach into communities that might not traditionally participate actively in transportation planning processes. These community-based partners are:

- Chinatown Community Development Center
- Ella Hill Hutch Community Center
1.5 Report Organization

This report documents the complete process and findings of the Geary Corridor Bus Rapid Transit Study, organized in the following sections:

Chapter 2: Existing Conditions and Transportation Needs

This Chapter summarizes the key findings on needs, opportunities, and constraints from the Needs Assessment Report completed in 2005, including transit, auto, bicycle, pedestrian, and urban design conditions. It also summarizes the top priority needs for transportation on Geary Boulevard as identified by the community.

Chapter 3: Project Guidelines

This Chapter lists the project goals and the “Design Principles and Guidelines” that were developed in collaboration between the Study Team and the Geary Citizen’s Advisory Committee to guide the alternatives design process.

Chapter 4: Alternatives Development

This Chapter describes the five alternative design concepts that were developed by this study of Geary Boulevard. They include a baseline “Basic Transit Priority” alternative, an additional non-BRT alternative, “Basic Plus Transit Priority,” and three full-featured BRT alternatives, one side-running design and two center-running designs. It also describes alternatives developed for two unique Geary intersections that required special attention: Fillmore Street and Masonic Avenue.

Chapter 5: Evaluation Methodology and Results

This Chapter documents the criteria and methodology used to evaluate the impacts and benefits of each alternative on Geary Boulevard and describes the outcome of the alternatives evaluation. Evaluation criteria are correlated to the project goals described in Chapter 3 and vary from transit performance and passenger comfort to traffic impacts and cost.

Chapter 6: Next Steps

This Chapter outlines the potential next steps in the process of implementing a BRT project on Geary Boulevard, including phasing and funding.
Chapter 2. Existing Conditions and Transportation Needs

This Chapter summarizes key existing conditions, needs, and opportunities for transportation improvements in the Geary Corridor. The information included in this chapter is drawn from the full Needs Assessment Report which can be found in Appendix X. The full report includes the complete set of findings, including needs, constraints, and other issues, organized into chapters that address:

- Street Layout
- Demographics And Land Use
- Transit Supply
- Transit Demand
- Transit Origin-Destination Analysis
- Transit Conditions
- Auto Conditions
- Parking Conditions
- Bicycle Conditions
- Pedestrian Conditions
- Urban Design Conditions

Each Chapter also includes a summary of the relevant public input received during the initial outreach process which culminated in the first series of public workshops in April 2005. Understanding existing conditions and needs provided an important input to the development of corridor alternatives, allowing each alternative to be designed to best address the deficiencies and take advantage of key opportunities in the corridor.

2.1 Methodology

A variety of techniques were used to document existing conditions on Geary Boulevard. Previously collected data from SFMTA and other city agencies was complemented with new data and in some instances, data estimated using transportation models. The data collection included: recording, transit, auto, bicycle, and pedestrian volumes at various locations in the corridor; collecting quantitative information on transit and auto travel times and delay; and collecting qualitative information on transit, auto, bicycle, and pedestrian
facilities, as well as urban design conditions. In addition, the Study Team sponsored a public workshop series in multiple locations along the corridor in April 2005 to learn about public perceptions of travel conditions on Geary. The Study Team also collected information on public perceptions through smaller meetings and discussions with individual stakeholders and community groups. A full description of the data collected and the methodologies used is included in Appendix X.

2.2 Overview of the Geary Corridor

Geary Boulevard: Reflecting the Diversity of San Francisco

Geary Boulevard is one of the City's most important and complex east-west streets. It is both a major transit trunk route and a major vehicle thoroughfare that facilitates travel both within the corridor and to other citywide/regional locations. Over its 6-mile length, the corridor passes through a cross-section of San Francisco, serving neighborhoods that represent a wide range of the city’s social, ethnic and cultural diversity. The street traverses a wide range of land uses, densities, and building heights.

Traveling east to west, Geary Boulevard can be characterized with the dense offices, high-rise residences, and hotels in the Tenderloin and Union Square areas, larger-scale residential and cultural buildings in Japantown and the Western Addition, and a blend of multi-unit residences with local shops at street level in the Richmond. While this is truly a corridor of multiple uses in the east, most of the rest of the length of the street is lined with businesses and institutional uses, including some of the most vibrant commercial districts in the city. One of the key challenges of this Study was to design improvements that serve and enhance this wide variety of neighborhoods, each with distinct needs, while simultaneously promoting a unified identity.

Travel on Geary: The Need to Balance All Modes

As stated previously, Geary serves as a major thoroughfare for many regional and local trips, whether users are destined for work in downtown, school at an educational institution in the corridor, shopping at the regional or local commercial districts, or eating at a local restaurant. Geary carries between 30,000 and 65,000 drivers daily, depending on location along the route, combined with more than 50,000 daily transit riders, thousands of pedestrians and bicycle riders. The street functions well for autos and other private vehicles, but conditions for other modes need significant improvement to approach the same quality of service enjoyed by private vehicles.

Muni’s 38-Geary bus route, including local, limited and express services represents one of the most heavily used bus corridors in San Francisco, and in the western United States. Transit on Geary Boulevard serves more than 50,000 boardings every weekday. If parallel routes on California, Clement, and Balboa/Turk are included, it brings ridership up to about 100,000 daily boardings. Unlike many transit routes that primarily serve commuters, transit ridership on Geary is consistently high throughout the day, on weekends as well as weekdays, and in both the eastbound and westbound direction. On Saturday and Sunday, Geary buses serve approximately 40,000 and 28,000 boardings respectively. The peak
hour on weekdays is between 3 pm and 4 pm when Geary buses are carrying approximately 2,000 passengers in the non-peak direction and over 2,000 passengers in the peak direction.

**Figure 2-1  High-ridership Bus Lines**

<table>
<thead>
<tr>
<th>Muni Route</th>
<th>Average Weekday Ridership</th>
</tr>
</thead>
<tbody>
<tr>
<td>38-Geary (including 38L, 38AX, and 38BX)</td>
<td>49,268</td>
</tr>
<tr>
<td>14-Mission (including 14L and 14X)</td>
<td>47,241</td>
</tr>
<tr>
<td>30-Stockton</td>
<td>28,997</td>
</tr>
<tr>
<td>49-Van Ness</td>
<td>28,928</td>
</tr>
<tr>
<td>1-California (including 1AX and 1BX)</td>
<td>27,797</td>
</tr>
<tr>
<td>15-Third</td>
<td>25,321</td>
</tr>
<tr>
<td>22-Fillmore</td>
<td>19,576</td>
</tr>
</tbody>
</table>

Buses serve as much as 25% of the trips made in the Geary corridor at the PM peak hour, with the highest passenger loads between Fillmore Street and Van Ness Avenue. For all neighborhoods, walking also accounts for a large percentage of trips. The non-auto mode share in the Tenderloin is over 50%, in Western Addition/Japantown is 40%, and in the Richmond is just over 30%.

In spite of high transit ridership and high pedestrian use, much of the current roadway layout and traffic signal infrastructure on Geary benefit motorists at the expense of transit riders and pedestrians. For example, the Geary expressway allows motorists to travel at relatively high speeds, while buses are channeled onto narrow and ineffectual service roads. As a result, traveling by bus on the Geary corridor takes significantly longer than traveling by automobile and is less reliable:

- Traveling from Van Ness to 33rd Avenue on a 38-Local bus takes about twice as long as driving, *excluding* the time required for a transit rider to get to the stop and wait for the bus and/or to transfer to or from another route. The effective travel speed of the 38-Local is less than 8 mph; the 38L-Limited averages approximately 10 mph; auto traffic travels at speeds averaging between 17 and 21 mph.
- Transit wait times and in-vehicle travel times are unreliable, which forces many passengers to increase the overall time they allot for their trip to account for these

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1 Municipal Transportation Agency, Short Range Transit Plan
fluctuating travel times. For many parts of the corridor, during both midday and the evening rush hour, over half the buses come “in bunches” which subsequently results in large gaps in service where no buses come at all.

- These reliability problems on Geary contribute to crowding problems, which was a major community concern. More comments were received on bus overcrowding than any other issue during the public workshops. When there are “bunches and gaps” in transit service, the bunched buses are too close together and can’t develop full and even loads, and the buses that arrive after a gap become overcrowded because they have more passengers to pick up.

One of the primary goals of this Study is to address the need to rebalance the street to better serve transit riders, pedestrians, and bicyclists, without causing a major deterioration in conditions for auto travelers. Improving transit service on Geary Boulevard would not only serve current riders, it would dramatically strengthen the citywide transit network. It would also improve mobility for local residents, benefit neighborhood conditions, and improve access to local businesses, by attracting more riders and making it easier for people to get to local restaurants, shops, and services.

Geary: Poor Pedestrian Conditions and Urban Design

Between Van Ness Avenue and Park Presidio, the design of Geary Boulevard favors cars – there are few public spaces with aesthetic qualities that enhance the surrounding neighborhood. In the Inner Richmond, Geary’s six traffic lanes effectively keep traffic moving, but the wide street also hinders pedestrian travel. The very wide, fast-moving eastern portion of the Boulevard is a major barrier to pedestrian circulation that effectively bisects Japantown and Western Addition. In addition to providing significant improvements to transit, a BRT project on Geary should also seek to (a) transform Geary Boulevard from a barrier that divides neighborhoods to a “bridge” that enhances livability and “knits together” neighborhoods on either side of the Boulevard, and to (b) significantly enhance urban design and pedestrian conditions throughout the Corridor.

2.3 Summary of Key Findings, Issues and Opportunities

Design of the BRT alternatives was greatly influenced by key issues, opportunities, and constraints that were established in the needs assessment. Key findings from the Needs Assessment Report are summarized here:

Street Layout

Existing Conditions

Geary Boulevard is generally very wide, with 125 feet of right-of-way (property line to property line) through most of the corridor and up to 168 feet at the widest point. The layout of the corridor has evolved differently in different areas, based upon factors such as traffic conditions and intensity of commercial activity. The entire street has a median divider and
the corridor generally has parking on every block. Diagrams showing the overall street layout are shown in Figures 2-1 and 2-2.
Figure 2-2  Geary Right-of-Way Layout, 48th Avenue to 14th Avenue
Figure 2-3    Geary Right-of-Way Layout, 14th Avenue to Van Ness Avenue
The traffic signals on Geary Boulevard are coordinated through a master controller system, and have recently been upgraded. In addition, select intersections have been equipped with technology that offers transit signal priority, which allows the signal to detect an approaching bus and determine if it should receive priority, by extending the green phase or potentially skipping a left-turn phase if appropriate.

Needs and Opportunities

- The wide right-of-way is both an opportunity and a constraint. The width of the road (especially around Fillmore and Masonic) affords decision-makers many opportunities to “redesign” the street configuration to better serve transit riders and pedestrians with minimal impacts to autos. In particular, reconfiguring the existing median and introducing or reallocating turn restrictions could enhance transit travel time and reliability.

Transit Supply

Existing Conditions

Geary Boulevard has some of the highest levels of scheduled transit service in the City. It is served by four variations of the 38-Geary line, which combine to provide as much as one bus every 3-5 minutes during peak periods, and some type of service 24 hours a day, 7 days a week. However, it is important to note that transit service on Geary Boulevard suffers from poor reliability, as discussed later in this Chapter, which decreases the efficacy of this high quantity of service. The four services are described below, with service hours and headways (the time between sequential transit vehicles) based on the 2005 schedules:

- **38-Local Service**: The 38-Local operates 24 hours a day, at 7-10 minute scheduled headways during the day, 6 minute headways during evening commute hours, and 30 minute headways for late evening and owl service. A total of 345 trips are offered on the Local each weekday. The 38-Local service serves 26 stops in each direction along Geary Boulevard between Van Ness Avenue and 33rd Avenue. Stops are generally less than 0.15 miles apart (about 800-1000 feet, or 2-3 blocks).

- **38L-Limited Service**: The 38L-Limited operates eastbound from about 6 am to 6 pm and westbound from about 8 am to 7 pm at 7 minute scheduled headways except westbound during the PM peak, when it operates at 5 minute scheduled headways. A total of 196 trips are offered on the Limited every weekday. It stops only at major points on Geary, serving fifteen of the twenty six 38-Local stops between 33rd Avenue and Powell Street. Stops for the 38L-Limited bus stops are generally between one third and one half mile apart (about 1500-2500 feet, or 4-7 blocks).

- **38AX and 38BX Service**: Geary has two express buses; both operate eastbound-only in the morning and westbound-only in the evening. The 38AX travels between the Outer Richmond and downtown, with 10-20 minute scheduled headways. The 38BX travels between the Inner Richmond and downtown with 9-20 minute headways. A total of 23 trips are offered every weekday on the 38AX, and a total of 25 trips are offered every weekday on the 38BX.
In addition to the routes on Geary Boulevard, routes that operate within a few blocks of Geary are considered part of the broader Geary Corridor. They include:

- 1 – California (and California Express buses 1AX and 1BX)
- 2 – Clement
- 3 – Jackson
- 4 – Sutter
- 31 – Balboa (and Balboa Express buses 31AX and 31BX)

Golden Gate Transit operates one route (Route 10) on Geary Boulevard between Park Presidio and Webster Street providing direct access from Marin County to the Richmond and Downtown. Route 10 runs approximately once per hour from 7 am to 8 pm on weekdays. However, Golden Gate Transit cannot pick up passengers traveling within San Francisco per its current agreement with the City of San Francisco.

Since Geary spans almost the entire length of northern San Francisco from east to west, several north-south transit lines provide transfer opportunities to expand access to many destinations beyond the Geary corridor. Major transfer opportunities on the corridor are:

- 18 – 46th Avenue
- 19 – Polk
- 22 – Fillmore
- 24 – Divisadero
- 28/28L – 19th Avenue
- 29 – Sunset
- 33 – Stanyan
- 43 – Masonic
- 44 – O’Shaughnessy
- 47 – Van Ness
- 49 – Van Ness/Mission

In addition, Geary buses connection to Market Street and their eastern terminus at the Transbay Transit Terminal offer broader connections to destinations throughout San Francisco and the region as a whole. The Transbay Terminal is served by over 30 bus routes from the East Bay and the Peninsula and Market Street hosts the Muni light rail lines, numerous Muni bus lines, and the BART system to the East Bay and the Peninsula.

The 47 and 49 Van Ness buses are the transit spine of another BRT corridor study recently approved by the Board and Citizens Advisory Committee of the Transportation Authority. The Van Ness Corridor BRT Study will soon begin its environmental impact analysis. Together these potential BRT projects provide an opportunity to expand high-quality, reliable transit service in the City and strengthen San Francisco’s transit priority network.

**Needs and Opportunities**

- The hours of service should be re-examined for the limited and express buses. Analysis of the 2004 Muni Customer Survey and data on cumulative passenger loads throughout the day indicate a need for expanded service hours for the 38L. This data was further supported by feedback during the public outreach events, including the 2005 public workshops on needs. These comments should be evaluated against the current demand/travel patterns in the corridor to determine to what extent the hours of service should be expanded. Limited service was analyzed
and evaluated in-depth, while analysis of express buses should be addressed in the next phase of study.

- Transit improvements on Geary should be mindful of ridership on parallel routes within the corridor. Geary serves as a trunk line in the northern part of the city, and should be attractive to potential riders on other lines within the corridor.
- Any transit improvements and/or BRT designs will need to consider Golden Gate Transit service.

**Transit Operating Conditions**

**Existing Conditions**

Though transit supply on Geary is somewhat dense compared to other parts of the city, the quality of service is considered poor by many riders and this impression is supported by data. To evaluate the current operating performance of Geary buses, the existing conditions analysis evaluated on-time performance (adherence to published time schedules and to scheduled headways), travel time and travel time variability. When bad these conditions frustrate transit riders while waiting for buses that should arrive at equal intervals, and while sitting or standing for long periods of time on crowded buses moving relatively slowly across the city. Muni customer surveys consistently list transit reliability as the biggest complaint with service.

While private vehicles experience a high level of service along Geary for the most part, transit operates in difficult conditions and congested “pinch points” at key locations along the route. Geary buses move relatively slowly, with average travel speeds often lower than 10 or 12 miles per hour—less than half that of cars. On average local buses take almost 1-hour (50 minutes) to complete the almost 6-mile route between 33rd Avenue and Transbay Terminal. Travel times for limited service hover around 39 minutes. Depending upon the time of day, travel times can vary by as little as two minutes and as much as fifteen. In most instances, the average travel time did not match the scheduled travel time, increasing the possibility of carrying delays encountered during one bus trip into the next bus trip.

Geary buses operate at high frequencies, e.g., the 38L-Limited has 7-minute scheduled headways most of the day. Therefore most riders simply “show up” at the bus stop, rather than looking at published schedules to see when the next bus is expected to arrive. Geary buses experience significant variations in reliability over the course of the day and bus travel is a good deal less predictable than automobile travel. Reliability problems are slightly more acute on the 38-L Limited than on the Local. With the exception of the westbound evening service, on the 38L-Limited only about half of the buses arrive “on-time” (defined by Muni as arriving between one minute early and four minutes late) during both mid-day and evening peak hours.

Geary buses experienced significant variability in headways, however sometimes variability increased as the bus traveled through the corridor, while in other instances, reliability problems were observed at specific locations (e.g. Van Ness Avenue) and then recovered later down the line. Sample headway variability for the 38L is shown in Figure 2-4.
Figure 2-4  Headway Variability for the 38L-Limited, Westbound PM Peak

![Bar chart showing headway variability for the 38L-Limited, Westbound PM Peak.

Figure 2-5  Headway Variability for the 38L-Limited, Westbound Midday

![Bar chart showing headway variability for the 38L-Limited, Westbound Midday.]
Needs and Opportunities

- Improvements in transit travel time and reliability are needed throughout the day because:
  - Operational problems, such as bus bunching and slow travel times, are as pronounced in the midday period as in the PM Peak.
  - Public feedback supported the need for an all day treatment.
  - Transit demand on Geary is high throughout the weekday and on weekends. Only 20-25% of Geary transit riders use Geary to commute during peak hours.
- Transit riders are especially sensitive to variability in wait time and travel time. While travel speed is important, reliability of service is even more important. Fluctuations in travel time and wait time cause riders to pad or increase their estimated trip times to reduce the potential of arriving late at their destination.
- Currently, the bus is in motion less than half of its total travel time. When in motion, the bus is traveling slower than autos, often half of auto speeds.

Improving transit travel times requires understanding the sources of delay that most commonly impact transit service. The most common sources of delay for the 38L-Limited and their respective contributions to the total transit travel time, are shown in Figure 2-5. To be successful, any transit improvements in the corridor will need to address on-time performance and travel time by impacting all of these key sources of delay, including time spent loading and unloading passengers, time spent at traffic lights, and time spent weaving in and out of the travel lane.

Figure 2-6  Travel Time Components for the 38L-Limited, Eastbound Midday

2 San Francisco County Transportation Authority, 2005 Geary BRT Needs Assessment
Description of Travel Time Components

<table>
<thead>
<tr>
<th>Time in Traffic</th>
<th>Time in motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loading and Unloading</td>
<td>Time spent at stop for the boarding and de-boarding of passengers</td>
</tr>
<tr>
<td>Signal Time Delay</td>
<td>Time spent waiting at traffic signals</td>
</tr>
<tr>
<td>Turn-out Time</td>
<td>Time spent weaving in and out of the travel lane to access the bus stop</td>
</tr>
<tr>
<td>Other Delays</td>
<td>All other sources of delay</td>
</tr>
</tbody>
</table>

Transit Demand and Crowding

Existing Conditions

Muni’s service standards establish that the peak period passenger load should be “no greater than 85% of combined seating and standing capacity,” when averaged over the two-hour peak period. (Total capacity of an articulated bus is 94 passengers, 85% of the full load is 80 passengers.) By this measure, Muni ridership counts actually indicate that Geary buses are below this maximum load standard. However, more comments were received on bus overcrowding than any other issue during the first series of public workshops. Limited buses are more crowded than local buses. One in three 38L-Limited buses traveling westbound during the evening commute did not exceed 80 passengers and 8% of these buses have more passengers than the maximum capacity of the bus as shown in Figure 2-7.

There are several reasons that riders perceive the buses as crowded. First, buses on Geary are highly loaded for long distances on both the Route 38-Local and 38L-Limited. While the average number of passengers on board rarely exceeds the maximum capacity of 94 seated and standing passengers, it commonly exceeds the bus seating capacity of 57 and sometimes exceeds Muni’s maximum load standard of 80 passengers (shown in Figure 2-6). This causes many riders to stand, often for long periods of time. Riders also tend to cluster near the front door, due to the difficulty of boarding or exiting a full bus. Multi-door boarding, proof-of-payment, and other strategies to improve the boarding and exiting process would help to reduce passenger reluctance to distribute themselves more evenly within the vehicle.

Second, reliability problems and bus bunching contribute to these crowding problems. As buses bunch together, the first (and potentially the second) bus to arrive after a significant gap in service is likely to be crowded. Buses immediately following that bus, often by less than the scheduled headway, may be far less crowded. Reducing bunching by smoothing the flow of buses will not only increase reliability, it should also even out the number of passengers on each bus and reduce the perception of crowding.

Figure 2-7  Bus Loads on Most Crowded Route, Westbound 38L-Limited, PM Peak

<table>
<thead>
<tr>
<th>Load</th>
<th>Riders</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;57</td>
<td>riders</td>
<td>2%</td>
</tr>
<tr>
<td>&gt;57</td>
<td>riders</td>
<td>67%</td>
</tr>
<tr>
<td>&gt;80</td>
<td>riders</td>
<td>23%</td>
</tr>
<tr>
<td>&gt;94</td>
<td>riders</td>
<td>8%</td>
</tr>
</tbody>
</table>

Needs and Opportunities

- Transit improvements on Geary should aim to alleviate the perception of crowding. For example, faster travel times would reduce the amount of time that someone has to stand, improved reliability would prevent one bus from becoming very crowded while the bus behind it stays relatively empty, and a more comfortable bus with multi-door boarding (such as a low floor bus with larger windows and higher ceilings) would better distribute passengers through the bus and increase passenger comfort, even on a relatively full bus.

- Higher loads on the 38L-Limited than the 38-Local suggests that some reallocation of service would more appropriately reflect demand. More data to support this approach is presented below in Transportation Ridership Demographics.

- Some Geary riders also find it difficult to distinguish between the local and limited service. Analysis shows that up to 20% of passengers use the Local bus for a trip that could be served by the Limited, i.e. they get on a local bus at a limited stop and get off that local bus at a limited stop. This indicates that there is more demand for the Limited service, as well as a need for real-time information and other strategies to differentiate the limited service.

Transit Ridership Demographics

Existing Conditions

Geary transit riders come from all socioeconomic groups, consistent with the great number and range of neighborhoods served by the Geary corridor. Geary riders include those who are transit-dependent (have no cars in the household) as well as those who own cars but choose to ride transit as the occasion warrants. The proportion of transit dependent households decreases from east to west across the Geary corridor, from up to 82% in the Tenderloin to 31% in the Outer Richmond. Limited bus riders are slightly more likely to own cars than local riders, while riders on Geary express routes (38AX, 38BX) were more likely...
to have higher incomes and higher auto ownership than those on both the local and limited routes.\textsuperscript{4}

**Needs and Opportunities**

- Improvements to Geary service must address the needs of a diverse set of transit users. Existing Geary riders represent many of the diverse cultural, economic and social groups within San Francisco. While some riders are transit-dependent, many car-owners still choose to use Geary transit services.

- Enhancing and distinguishing transit services on Geary could draw additional riders to Geary transit, as evidenced by the proportions of existing transit riders with higher incomes and car ownership on the limited and express services in the Geary corridor. Therefore, enhancing these two services in the Geary corridor would not only benefit all current riders, but could also represent an opportunity to expand ridership.

**General Traffic Conditions**

**Existing Conditions**

Motor vehicle travel times on Geary between Van Ness and 33\textsuperscript{rd} Avenue are highly predictable and typically range from 13 to 16 minutes in both the midday and PM peak. Intersections were generally able to be cleared in one cycle. This suggests that there are no “choke points” for autos west of Van Ness Avenue and that motor vehicle conditions on Geary are relatively good. At most locations traffic operations are near optimal, with average intersection delays well under 20 seconds (LOS A or B), with the rare intersection with delays of 30 seconds (LOS C). The one exception is the intersection of Geary and Masonic, which becomes quite congested during the PM peak hour when delays hover around 60 seconds, or LOS E.\textsuperscript{5}

The far-right travel lane, which serves both cars and buses, is not currently functioning effectively for either mode. Most bus stop zones are not long enough to accommodate two articulated vehicles (such as a limited and a local), so buses are often unable to fully pull over to the curb at bus stops, partially blocking the right-most traffic lane at times. Bus operators often face obstructions from double parked vehicles, and often struggle to go around vehicles or merge back into traffic after pulling over to the curb. Separating transit movement from auto movement by dedicating a lane exclusively to buses should benefit auto users and transit riders alike.

**Needs and Opportunities**

- It is a primary goal of this study to improve transit operating conditions, bringing them closer to the high quality of auto conditions.

\textsuperscript{4} Data derived from the 2004 Muni Onboard Survey.
\textsuperscript{5} This measure only applies to the frontage roads leading up to the intersection, and does not apply to through traffic traveling underneath the intersection.
Though auto traffic flows smoothly along Geary for the most part, some locations prove more challenging, such as Geary at Masonic. Special care should be taken at these locations.

Efforts should be made to maximize throughput in remaining auto lanes using technology and urban design to efficiently manage auto traffic while balancing the needs of other users in the corridor.

Parking

Existing Conditions
Parallel parking is provided along most of Geary, however most blocks between 14th Avenue and 19th Avenue offer angled parking. Parallel parking can also be found on several blocks west of 33rd Avenue. Most of Geary has meters set for a maximum of one hour or less, particularly in the commercial cores of the Richmond and downtown areas. There are several city-owned and private parking lots scattered throughout the corridor. These lots offer significant off-street parking opportunities, in the areas such as Fillmore and Masonic, where several institutions maintain surface parking lots or structured garages. Parking is in high demand in the Outer Richmond commercial core. Parking occupancy, turnover, and double parking were found to be highest between 17th and 21st Avenues.

Parking conditions have large impacts on transit delay. Crowded buses must often wait while vehicles make parking movements, or attempt to pass double-parked vehicles by trying to merge into traffic. This not only increases travel time, the unpredictability also increases travel time variability. Double parking is most common near land uses that generate a high number of short duration trips with little available parking. Such activity is likely to occur at post offices, banks with ATMs, convenience retail, and food establishments (such as coffee shops). Double parking is also problematic on Geary where diagonal parking is more prevalent because spaces are not often long enough to accommodate delivery vehicles.

Needs and Opportunities
While parking strategies and parking management are corridor-wide issues, solutions need to be tailored to the conditions on each block face. Impacts on parking cannot be summarized for the entire corridor, but must be analyzed in smaller districts or blocks.

Areas with particular parking availability and impacts on other roadway users include the blocks between 17th and 21st Avenue, as well as other locations where parking is in high demand.

Transit improvements should focus on strategies that best maintain or improve comparable availability of on-street parking because it serves local businesses and provides a valuable buffer between pedestrians and moving vehicles.

Improvements should aim to increase the utilization of spaces. For example, pricing all parking and prioritizing short-term meters should increase the availability of spaces while also alleviating double parking problems.
Pedestrian and Urban Design Conditions

Existing Conditions

Geary Boulevard is typified by relatively long crossing distances with limited refuge and standard two-stripe crosswalks that are in need of maintenance at some locations. Some locations stand out as examples of strong pedestrian-friendly locations, such as some of the commercial areas along the corridor. Conditions in these areas were used to guide design in the rest of the corridor, in order to both improve pedestrian or urban design conditions and to knit the corridor together with consistent standards, treatments or themes.

Crossing opportunities are too infrequent in many locations. The pedestrian bridges at Steiner and Webster Streets require long, circuitous walks on the ramps, with many neighborhood residents commenting that they are not as safe or secure as they would like. At Fillmore, the width of the expressway, speed of traffic, and pedestrian crossing restrictions all combine to form a barrier to pedestrian circulation.

Existing landscaping and lighting do not create a pedestrian-friendly environment for the most part. As stated above, there are areas that stand apart from general conditions on the corridor. Large mature trees can be found near Divisadero and Masonic. For the most part, however, street trees in the sidewalk are sparse, stunted and show evidence of abuse. Tree pits often have compacted and littered soil with no apparent irrigation or drainage. Branches are broken where they overhang the traffic lanes. Medians are overgrown with ivy and weeds. Community members expressed concern about ivy harboring rodents.

Currently, most lighting takes the form of cobra-head fixtures with high-pressure sodium lamps. Where there is a median, the lighting is typically double cobra-head. All lighting is directed at the street, with poor coverage of the sidewalk. Future improvements should provide pedestrian-scale lighting, potentially using fixtures in the median that light sidewalks as well.

Needs and Opportunities

Pedestrian improvements and other urban design treatments will benefit transit and neighborhood livability. Most people who access the transit system do so by walking, making the quality of the pedestrian experience an important element in attracting riders to transit. A high-quality pedestrian environment also supports neighborhood livability and commercial vitality. The urban design and pedestrian conditions analysis identified the following key opportunities:

- **Identity.** The Geary BRT project offers an opportunity to develop a unified identity for Geary and enhance neighborhood appearances and livability.
- **High-quality shelters.** Adequate, attractive and comfortable bus stops should be provided with amenities such as clear signage, real-time information about bus arrivals, and bus shelters. At high volume bus stops, additional sidewalk space is needed at key locations where the shelter, waiting passengers, and other amenities like newspaper boxes compete for space.
• **Safer crossings.** Enhanced pedestrian crossings are needed, especially at intersections with transferring routes and/or high pedestrian volumes. Redesigning the median to extend into the crosswalk, providing more visible crosswalks, and installing curb extensions/bus bulbs will help improve the quality of the pedestrian environment.

• **Landscaping.** Landscaping should be provided that enhances the appearance of the street and addresses the functional needs of the street’s users. Species that enhance water management in this relatively low-lying area should be pursued, in order to reduce the burden on active maintenance.

• **Livability.** Leverage transit improvements to enhance neighborhood appearance and livability by supporting land uses that activate the sidewalks along Geary.

• **Lighting.** Provide appropriate and attractive lighting that extends to pedestrian areas.

### Bicycle Conditions

While no bicycle lanes are currently in existence on Geary Boulevard, parallel east-west bicycle routes exist. In addition, there are several north-south bicycle routes that cross Geary Boulevard. Current bicycle activity on Geary Boulevard is very low relative to other modes of transportation, including walking and transit, possibly due to the availability of alternate facilities (e.g. Post Street) in most locations or due to the lack of facilities on Geary and volume of auto traffic. Parallel streets have more activity, particularly at Masonic Avenue, Fillmore Street and 17th Avenue.

The San Francisco Bicycle Plan & Policy Framework recommends that Geary Boulevard be studied to see if bicycle accommodation is feasible between 25th Avenue and Divisadero Street. Community feedback and stakeholder discussions describe Arguello Street to Divisadero Street as the most strategic segment of this connection because the parallel streets in this area tend to be hilly.6

There is some bicycle garage parking in the corridor and a small number of bike racks on Geary. Clement Street has dozens of bike racks and there are plans to install more racks on commercial streets throughout the Richmond district.

### Needs and Opportunities

• While Geary is not the primary bicycle route in the corridor, it is critical that bicyclists can safely and easily access transit on Geary. Strategies should be developed that facilitate access through methods such as increasing bicycle parking opportunities.

• Coordinate a bicycle study to identify ways to evaluate the potential for bicycle infrastructure within the corridor, whether on Geary or parallel streets. This study should include determining design opportunities within the overall corridor and evaluating demand on parallel streets. The study should be coordinated closely with

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6 SFMTA will begin a review of bicycle conditions in summer 2007 to better understand the best location to accommodate safe, convenient bicycle travel within the Geary corridor. Efforts will focus on planning activities until conclusion of the Bike Plan Environmental Impact Report. More detail on this effort can be found in Chapter 5.
SFMTA's city-wide bicycle planning effort to address issues such as bicycle parking and how bicyclists access transit from parallel streets.
Chapter 3. Project Guidelines

The “Project Goals” and “Design Principles and Guidelines,” developed collaboratively by the Geary Citizen’s Advisory Committee (GCAC) and the Study Team, were created to guide the development of design alternatives. They attempt to combine community input with best practices and common features of BRT systems nation-wide to ensure design of the best possible project for the Geary Corridor and its setting in San Francisco. Inputs into the design process are described below.

3.1 Bus Rapid Transit Features

Full-featured bus rapid transit (BRT) is a high quality, state-of-the-art bus service that reduces travel time, increases reliability, and improves passenger comfort. BRT combines the flexibility of buses and the quality of light rail at a fraction of the cost of rail infrastructure. Key features of a full-featured BRT system are listed below and illustrated by Figure 3-1.

Figure 3-1  Bus Rapid Transit Features
Full-Featured Bus Rapid Transit System Features

- **Dedicated Bus Lanes** remove conflicts between cars and buses. This provides a BRT vehicle with its own travel lane free of conflicting traffic, double-parked or stopped vehicles. Removing these causes of delay can significantly increase the speed, efficiency, and reliability of transit service, which in turn can improve rider experience and increase transit ridership. Auto drivers also benefit by removing conflicts with buses. For example, on Geary currently the third lane is not functioning optimally because of conflicts between buses and cars. Giving transit its own lane ensures that traffic flows efficiently in all traffic lanes.

- **Transit Signal Priority** allows buses to spend less time stopped at red lights, enabling faster trips and more reliable overall service.

- **Faster Boarding through Improved Fare Collection** is a key element of BRT. Passengers pay before boarding the vehicle at easy-to-use, convenient paystations on the station platform and then are able to board through any door. Once on the bus, tickets or monthly passes serve as proof of payment when requested by inspectors. This multi-door boarding, proof-of-payment system eliminates the need for buses to wait while all passengers pay at the front door, removing a significant factor in vehicle delay. It also improves the rider experience by allowing for a wider variety of payment choices including multi-use universal transit cards, monthly passes, and credit cards.

- **Modern, Low-Floor, High-Capacity Buses** with multiple doors allow for more convenient and faster boarding/exiting, and provide passengers with a more comfortable and quieter ride. Through the use of clean fuels and alternative vehicles, BRT helps to achieve air quality and other environmental goals.

- **Distinctive Stations and Boarding Areas**, ranging from protected shelters to large transit centers, are designed to serve as both traveler amenities and neighborhood enhancements. Improved bus stops aim to enhance safety and comfort for waiting passengers and strengthen neighborhood identity by including better signage and maps, high-quality shelters, and lighting.

- **Real-Time Information** tells riders when the next bus will arrive, allowing users more control over time.

- **Streetscape and Pedestrian Access Improvements**—such as landscaping, countdown signals, bicycle racks, and well-designed crosswalks—enhance the adjacent neighborhoods and make the street safer and more comfortable for pedestrians and bicyclists accessing the bus stops. Good street design enhances safety and comfort for residents, shoppers, and other users, and gives the street a cohesive sense of identity.
3.2 Project Goals

In order to ensure that this Study results in the development of the best possible improvement in transit service in the Geary Corridor, project goals were developed by the Study Team in close coordination with the Geary Citizens Advisory Committee. These goals informed the development of the alternative designs, the framework used to evaluate alternatives, and the framework that would be used to measure the success of the potential project upon implementation. The project goals recognize that a major transit investment should not only improve transit operations, but also improve the quality, accessibility, and attractiveness of the neighborhoods that the transit route serves. The project goals were approved by the Geary Citizen’s Advisory Committee on June 24, 2004.

<table>
<thead>
<tr>
<th>Goal 1 - Robust and Stable Transit Ridership. Decrease transit travel times; improve service reliability; improve in-vehicle comfort; improve passenger waiting experience; improve the quality and safety of transit access for all modes including pedestrians and bicyclists; and increase accessibility for Geary neighborhoods.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal 2 - Efficient, Effective, and Equitable Transit Service. Increase service efficiency and effectiveness through cost effective improvements; reduce operator stress; support demand generated by existing and planned development; and distribute passenger benefits across all users and trip purposes.</td>
</tr>
<tr>
<td>Goal 3 - Neighborhood Livability and Commercial Vitality. Support existing and planned land use; enhance safety and security for all travelers and others in the community; establish attractive transit stations that serve activity nodes; link transit routes to the community through design treatments; reduce emissions relative to no-project conditions; minimize negative impacts of the project on local residents and businesses.</td>
</tr>
<tr>
<td>Goal 4 - Transit Priority Network System Development. Establish an identity that enhances the image of transit on Geary; integrate the Geary Corridor into the citywide rapid transit system; provide clear, understandable, and accessible passenger information; apply and advance BRT technology; improve connectivity between the Geary Corridor and the local and regional transit network; create a sense of permanence that inspires confidence in long-term investment; and serve as a model for BRT applications in other urban areas.</td>
</tr>
</tbody>
</table>

3.3 Design Principles and Guidelines

The Study Team developed a series of principles and related guidelines to help shape the conceptual designs and service plans that were evaluated in this Study. The Geary “Design Principles and Guidelines” are consistent with the project goals and are intended to articulate the design priorities that should be addressed by all alternatives. In some cases, the guidelines also articulate minimum design standards (e.g., minimum lane width). The Geary Citizen’s Advisory Committee reviewed and modified the design principles and guidelines before approving them in December 2005.
The BRT principles and guidelines also build on existing policies and standards (e.g., minimum platform width); however, there were several instances where new principles and guidelines needed to be developed. These BRT design principles and guidelines will likely evolve over time, as the City works to codify city-wide, multi-modal design standards. For example, the City is currently developing a Streetscape Master Plan and Pedestrian Master Plan, which will establish standards for elements like street design, landscaping, and pedestrian amenities.

The design principles and guidelines address a wide variety of issues and have been organized into seven overall categories. A brief summary of the principles and guidelines is provided below. The full set of principles and guidelines follows.

- **Busway and station design.** The busway and stations of the BRT system must maximize transit efficiency for both boarding and operations. Passenger safety, convenience, and comfort must be prioritized in designing bus stop access, transfers with other lines, and station platforms. Stations must enhance and not disadvantage local businesses and the design of the busway and stations must not preclude future development of light rail.

- **Identity.** The design features on Geary should be consistent along the entire corridor while also capturing opportunities to highlight unique neighborhoods on the corridor. Design of features on Geary must be distinctive to highlight the prominence of both Geary’s significant role in the City’s transportation network, and the higher service provided by BRT.

- **Service planning.** Service standards must be developed for this new mode, which are consistent overall with Muni light rail service standards, e.g. passenger loads of no more than 80, and stop spacing of about ½ mile for BRT and 800-1000 feet for local. Travel time savings must be re-invested into improved service for BRT while a minimum level of local service is also maintained.

- **Signals.** Traffic signals must both minimize delay for transit and accommodate safe pedestrian access, and transit stops should be on the farside of the intersection when possible. Any left turn consolidation must balance transit and pedestrian benefits with motorist needs.

- **Sustainability.** Storm water management, e.g. permeable surfaces and low water landscaping, is of particular importance in the design of Geary because it is low-lying relative to surrounding streets. BRT design should also favor procurement of solar powered equipment, new cleaner and quieter vehicles, and recycled roadway materials. These principles may need to be updated based on the San Francisco Better Streets Plan currently underway.

- **Neighborhood access.** BRT designs must maximize integration with surrounding land uses and access to adjacent properties, as well as maintain total on-street parking supply, and accommodate safe auto and bicycle circulation.

- **Pedestrian environment.** BRT designs must include features to maximize efficiency, ease, and safety for pedestrians in terms of pedestrian circulation,
access to transit stops, and street crossings. Sidewalk design, street furniture, landscaping, and lighting must enhance the pedestrian experience. These principles will need to be updated based on the San Francisco Better Streets Plan currently underway.

These capture the full range of concerns and priorities of the GCAC and Study Team and can continue to inform the design process, however they will likely be further refined and developed as future stages of this project take shape.

The “Design Principles and Guidelines,” adopted by the Geary Citizen’s Advisory Committee in December 2005, are:

**Busway and Station Designs**

- Facilitate efficient transit loading and unloading
- Include proof of payment, BRT vehicles (low floor, multi-door, wide door), ticket vending machines
- Separate transit and motor vehicle traffic
  - Design dedicated bus lane to be self enforcing (e.g., colored pavement, island separation, rumble strips, etc)
  - Accommodate rapid transit services, including Muni and GGT, in the dedicated bus lane
- Platform designs should accommodate safe access and efficient operations, and accommodate current and future demand
  - Minimum platform width = 8ft
  - Platform length based on expected vehicles (e.g., 150 ft to edge of crosswalk for two articulated buses or 2 car LRT train)
- Facilitate convenient transfers
  - Minimize walking distances and street crossings between connecting transit routes (including BART/Muni Metro station entrances)
  - Provide wayfinding information
  - Serve all transfer points
- Physical designs and supporting infrastructure should be easily maintainable
- Center busway designs must accommodate LRT operations (rail-ready), as well as Muni and GGT vehicles
  - Preferred minimum lane width is 12 ft; 11.5 ft is acceptable where right-of-way is constrained
  - Accommodate minimum turning radii of 80 ft, exceptions can be made at terminals
  - Maximum grade 6 percent
Site bus stations in locations that could expand to a three car platform (240 ft)

- Curbside bus stops should leave adequate room for businesses and pedestrian shoppers
- BRT stations and Local bus stops should:
  - Support the patrons’ sense of security with appropriate visibility (e.g., clear sightlines to approaching buses) and lighting
  - Provide adequate weather protection and comfortable seating, include space for wheelchair users in the protected area
  - Provide clear signs, maps and real-time information systems that estimate when the next bus will arrive
  - Consider the needs of people with low vision and wheelchair users in design and placement of passenger information
  - Provide culturally and linguistically specific signage (e.g., information in Japanese in Japantown)
  - Provide secure storage and facilities for bicycle access to key bus stops (BRT stops only)

Identity

- Provide an urban design treatment that is appropriate to the scale and prominence of Geary (and O'Farrell) as one of the city’s great streets
- The most visible elements – streetlights, street trees, traffic signal mast-arms and signs – should have a consistent character, design and scale that distinguish the corridor while leaving opportunities to reflect neighborhoods through which the corridor passes
- Design themes west of Van Ness should be carried through on Geary/O'Farrell east of Van Ness
- BRT stops should have an upgraded design, as compared to standard Muni stops, appropriate to the higher level of service provided
  - BRT system should be easily recognizable as premium service and be integrated into Muni Rapid System
  - Integrate maps with Muni Metro and BART, design high quality stations, use colored pavement, distinguish vehicles, etc

Service Planning

- BRT span of service and maximum headway should be consistent with Muni light rail service (e.g., L-Taraval)
- Maintain a minimum level of local service
- Average passenger loads at the maximum load point should not exceed 80 passengers
• Reinvest travel time savings back into transit service
• Stop spacing
  ○ Preferred BRT stop spacing is ½ mile; however, stop placement should also consider transfer points, key land uses, and grades
  ○ Local stop spacing on average should be between 800 and 1000 feet. Stop placement should also consider transfer points, key land uses, grade and accessibility for wheelchair users and seniors

Signals
• Minimize signal delay for transit subject to constraints
  ○ Baseline should allow transit to receive green at least 50 percent of the time
• Accommodate safe pedestrian access
  ○ Maintain or improve the pedestrian crossing speed
  ○ Transit signal priority shall not cut off pedestrian phases
  ○ Avoid manually actuated pedestrian cycles, except at intersections with low pedestrian volumes
  ○ Include pedestrian count down signals as part of signal upgrades
• Consolidate left turns to promote safety and comfort for pedestrians and transit riders
  ○ Maintain sufficient turning opportunities for motorists
  ○ Avoid left turns at BRT stops
  ○ Center running alternatives require protected lefts
• Farside stops preferred at signalized intersections

Sustainable Design
• Maximize permeable surfaces
• Invest in low-water landscaping
• Purchase solar-powered equipment (if cost effective)
• Invest in new vehicles that minimize air and noise pollution
• Identify opportunities to incorporate recycled roadway materials into final designs

Neighborhood Access
• Design BRT system to easily integrate with future potential land uses at major activity nodes
• Accommodate access to adjacent properties by residents, customers and deliveries
Provide for commercial loading/unloading
Maintain access to curb cuts

Maintain on-street parking
- Parking lane minimum of 8 ft
- Seek opportunities to replace parking on side streets and off-street

Accommodate safe auto circulation
- Minimum auto width – 10 ft
- Minimum left turn pocket – 9.5 ft
- Minimum right turn pocket – 9.5 ft

Accommodate safe bicycle access

Pedestrian Environment

Provide for efficient pedestrian circulation
- Avoid overpasses as the only crossing alternative
- Do not restrict pedestrian crossings at one leg of an intersection
- Paths of travel should be the same for the able-bodied as for those with mobility impairments

Provide safe and efficient pedestrian access to transit stops
- Highly visible crosswalks at all BRT stops, stop bars, countdown signals, accessible curb ramps
- Buffer pedestrians from motor vehicle and bus traffic with parallel parking, landscaping or other buffer treatments
- Consider pedestrian conditions on cross streets

Minimize crossing distances with curb extensions, islands, medians
- Allow a maximum of four lanes between pedestrian refuges
- Pedestrian islands should be a minimum of 6 ft wide and extend through the crosswalk
- To allow needed space for bicyclists at intersections, curb extensions should not extend across the full parking lane (6 ft preferred for 8 ft parking lane)

Coordinate the placement and design of newspaper racks, utility boxes, signage and other street furniture to provide adequate pedestrian space and reduce visual clutter

Provide landscaping that enhances the pedestrian experience without reducing the visibility of storefronts. Provide planting conditions that allow plant materials to thrive and for ease of maintenance
Tree canopy should be above store fronts and should not block traffic signals or sightlines

- Provide pedestrian-scale lighting
  - Provide appropriate intensities and coverage of lighting, but avoid wasteful over-lighting and glare
- Discourage jaywalking through design treatments
Chapter 4. Alternatives Development

4.1 Introduction

Bus rapid transit (BRT) has been implemented in a number of cities in North America. In each implementation, the configuration of the bus rapid transit line and the allocation of street right of way to transit, other vehicular traffic and parking, are unique.

This Chapter describes the features of five alternative designs developed for Geary. Three alternative BRT configurations were developed as well as two non-BRT options for future transit improvements on Geary. This Chapter simply describes the alternatives; evaluation of how the alternatives would perform is presented in Chapter 5.

The three BRT alternative designs would not only include lane and median configurations, but would also include a set of comprehensive street treatments that commonly accompany full-featured BRT systems\(^1\) including: pedestrian and streetscape improvements and bus stop enhancements. These pedestrian, streetscape, and bus stop enhancements would be common to all BRT alternatives and would be applied along the entire length of Geary (from Market St. to 48\(^{th}\) Ave.). New lane and median configurations for BRT vary for each alternative and would only be built between 33\(^{rd}\) Avenue and Van Ness Avenue.

This Chapter primarily focuses on the lane and median configurations of each alternative because the prototypical designs for Local stops/stations, as well as the streetscape and pedestrian improvements, were developed as part of the Inner Geary TPS Project. These improvements are described and illustrated below (see the discussion of features common to all BRT alternatives, Section 4.5).

Methodology

The alternatives have been refined based on extensive public involvement. Implementation of major improvements in the Geary Corridor depends, in part, on community support. Over the course of two years, the Study Team worked iteratively with the GCAC to develop the series of conceptual physical designs for the alternatives and appropriate service plans for each. To begin to build consensus, the Study Team worked with multiple communities along the Geary corridor through extensive outreach and with the help of the Geary Citizen’s Advisory Committee (GCAC). Broader community input into the designs was provided at numerous community meetings, at the second round of public workshops in December 2005, and through an on-line survey focused on the design and evaluation of alternatives. Finally each alternative was evaluated by the Study Team and results were presented to the public during the third round of public workshops in November 2006 and multiple community meetings (evaluation methodology and results are presented in Chapter 5).

\(^1\) The features common to BRT systems worldwide are described in Chapter 3. The features that would be implemented if a Geary BRT project were built are described in this Chapter.
At this stage these designs are conceptual. Further analysis and evaluation, along with more detailed design and engineering of the preferred alternative(s) would be completed in conjunction with the Environmental Impact Report (EIR) that is expected to follow this study.

4.2 Summary of Alternatives

There were five conceptual design alternatives developed by the Study Team for Geary Boulevard between Van Ness Avenue and 33rd Avenue. There are two non-BRT alternatives: a baseline “Basic Transit Priority” alternative and a “Basic Plus Transit Priority.” There are three full-featured BRT alternatives: two center-running designs and one side-running design. In the three BRT alternatives, the new enhanced BRT service would replace current 38L-Limited service, and 38-Local service would continue to operate. In the two Basic alternatives, the 38-Local and the 38L-Limited would continue to operate.

The distinguishing features of each of these five alternatives is described immediately below and a chart summarizing all the features of each alternative is provided in Figure 4-1. Each alternative is fully described later in this Chapter.
Summary of Alternatives

**Alternative 1: Basic Transit Priority** is the baseline against which all other alternatives were evaluated. It describes conditions in 2015 with no BRT improvements. It retains service as-is, but would include basic improvements that are currently planned for the Geary corridor (and much of the system) even if BRT is not built on Geary, including transit signal priority at many existing signals, low-floor buses, and some real-time information. Alternatives 2-5 incorporate all features in Alternative 1, and provide additional features to increase benefits or manage impacts.

**Alternative 2: Basic Plus Transit Priority** would include the “Basic Transit Priority” treatments described in Alternative 1, plus a dedicated transit lane in the peak direction during the peak period (eastbound 7am-9am and westbound 4pm-7pm) with increased enforcement of the bus lanes. It would include possible stop removal, bus management strategies, and enhanced on-street line management, longer bus stops where needed, and bus bulbs at the busiest stops.

**Alternative 3: Side BRT** would convert the existing outside traffic lane in each direction into a dedicated transit lane. The dedicated BRT lanes would operate between the parking lane and the two remaining traffic lanes in each direction. Both Local and BRT vehicles would operate in the dedicated lane. Non-transit vehicles would be able to cross the bus lane to park or make right turns. BRT station platforms would be located on new bus bulb-outs created by extending the sidewalk into the parking lane. Local buses would continue to pull-in to the curb for stops, allowing BRT vehicles to pass Local buses at Local stops.

**Alternative 4: Center Lane BRT with 2 Medians** would convert the center traffic lane in each direction and the existing median into dedicated transit lanes separated from traffic by two side islands. These islands would serve as bus platforms at bus stops, and landscaped medians along the whole corridor. This landscaped buffer would physically separate all bus and auto movements, minimizing bus and auto conflicts. Local buses could either operate in the center transit lane or at the curb. In the service plan where Local and BRT buses both operate in the center busway, BRT buses could pass Local buses at Local stops by narrowing islands at these locations.

**Alternative 5: Center Lane BRT with 1 Median** would also convert the center traffic lane in both directions to a dedicated transit lane, but buses would run on either side of a single, shared, wide center island. Like Alt 3, this alternative would essentially preserve the existing landscaped median along the corridor. The island would serve as a transit platform at bus stops, and waiting passengers would be buffered from auto traffic by transit lanes. The transit lanes would be physically separated from auto movements through a street treatment (e.g. raised curb), minimizing bus and auto conflicts. Depending on the service plan, this alternative would be operated using new left/right door buses because the center station platform is located on the left side of the bus. An option for BRT buses to pass Local buses if both ran in the center busway has yet to be developed for this alternative. Design of such an option could be explored in the next stage of study, the environmental impact analysis.
### Figure 4-1 Summary of Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Alt. 1 Basic Transit Priority</th>
<th>Alt. 2 Basic Plus</th>
<th>Alt. 3 Side BRT</th>
<th>Alt. 4 &amp; 5 Center BRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit Signal Priority</td>
<td>Some signals</td>
<td>Some signals</td>
<td>Most signals</td>
<td>Most signals</td>
</tr>
<tr>
<td>Low floor buses</td>
<td>X</td>
<td>X</td>
<td>Full BRT buses</td>
<td>Full BRT buses</td>
</tr>
<tr>
<td>Real-time information</td>
<td>Some stops</td>
<td>Some stops</td>
<td>All stops</td>
<td>All stops</td>
</tr>
<tr>
<td>Increased enforcement of bus lanes</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Longer bus stops (where needed)</td>
<td>X</td>
<td>X</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Bus bulbs at Limited stops</td>
<td>Some stops</td>
<td>X</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Potential Local stop consolidation</td>
<td>X</td>
<td>Few</td>
<td>Few</td>
<td></td>
</tr>
<tr>
<td>Dedicated bus lane</td>
<td>Peak hour &amp; direction</td>
<td>All day</td>
<td>All day</td>
<td></td>
</tr>
<tr>
<td>Proof of payment/ multi-door boarding</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ticket vending machines at BRT stops</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level boarding</td>
<td>At BRT stops</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>High quality bus stations</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pedestrian safety &amp; amenities</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Landscaping enhancements</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Expanded hours of BRT service</td>
<td>X</td>
<td>X</td>
<td></td>
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</tbody>
</table>

#### 4.3 Features Common to All Alternatives

The features described below would be common to at least some degree in all five alternatives as currently conceived and evaluated in this Study. These are improvements that Muni plans to implement to some extent throughout its system over time. The three BRT alternatives (Alts. 3-5) would accelerate and fully implement all of these improvements (and in some cases would utilize a more sophisticated version of technology). The two Basic alternatives (Alts. 1 & 2) would implement them selectively and gradually. This is primarily because the comprehensive features of a BRT system, and the equitable
distribution of benefits it brings, would have greater potential to leverage significant regional, state, and federal funding for transit improvements, while other alternatives may not be as competitive for the same breadth or amount of funding.

**Transit-Signal Priority** (TSP) is designed to address delays at signals, which was identified as one of the top three sources of bus delay in the Needs Assessment. TSP would essentially permit buses and traffic signals to communicate so that buses would spend less time idle at red lights. Buses would be equipped with transponders which would send signals to traffic lights allowing for extended green lights to allow buses to pass through or triggering a change from red to green for approaching buses if it does not significantly impact crossing traffic. To make optimal use of TSP, transit stops/stations should be located at the far side of intersections so that buses do not have to stop to pick up passengers until after they pass through the signal. BRT alternatives, and possibly Basic Plus, could allow for a more sophisticated TSP system (this is described in section 4.5 below on BRT alternatives).

![A bus communicating with traffic lights through a transit signal priority system](image)

**Low-floor buses** would eliminate the need for passengers to walk up steps to enter vehicles, and would also eliminate the need to deploy wheelchair lifts for disabled passengers as the bus floor would be at the same height as the boarding platform. Low-floor buses thereby would provide enhanced accessibility for all riders and would speed the boarding process. These new buses would also be cleaner and quieter than Muni’s existing fleet which would further improve the rider experience and impacts on neighborhoods. An example of low-floor buses, used in the Las Vegas BRT system, is shown below.

Muni is planning on gradually replacing their entire fleet with low floor buses. The two Basic alternatives (Alts. 1 & 2) would utilize standard low floor buses. The BRT alternatives (Alts.
3-5) could use standard low-floor buses, but are more likely to use full-featured BRT buses which have low-floors and a series of other features described in the BRT section below (Section 4.5).

![Low floor buses from BRT system in Las Vegas, Nevada](image)

**Real-time information** at bus stops is usually provided through electronic signs that are continuously updated to display when the next bus is arriving, such as the NextBus signs that Muni currently operates on a few lines, illustrated below. This is one of the most direct ways to improve the passenger waiting experience; it eliminates one of the biggest frustrations for transit riders and allows them to have more control over their time. Time spent waiting for the bus often feels longer than time spent on the bus. With no information about how long a wait might be, passengers become anxious about how long they might be at the stop, and how this will impact their trip. Accurate, reliable information on when the bus will arrive at bus stops was one of the three highest priority transit improvements identified in the recent transit-rider survey on Geary.
4.4 Basic Transit Priority and Basic Plus Alternatives

Alternative 1: Basic Transit Priority

In order to evaluate alternatives effectively, it is important to measure the alternatives against a “baseline” that represents the quality of service that is expected to operate in the corridor in the event the project is not implemented. It reflects conditions that are expected in the corridor by the year of implementation. This “baseline” functions somewhat like the “control” group in a scientific experiment.\(^2\)

Geary BRT, if implemented, is expected to be operational by 2015 at the latest. Within this timeframe, even if the City decides not to implement BRT, the three improvements described above: transit signal priority at some signals, low floor buses, and real-time information at some bus stops, are planned for implementation on Geary.

The Basic Transit Priority alternative (Alt. 1) includes the recently completed improvements downtown and in the Tenderloin that were implemented as part of the Inner Geary TPS Project including reallocating and re-striping existing dedicated transit lanes, bus bulbs at

\(^2\) This is often called the “no project” alternative, however this technical term was not well received by the community and the Study Team determined that it was not appropriate for the high level of community outreach or high level of investment that this project entails. Therefore, the name “basic transit priority” was adopted to better describe the alternative.
Limited stops, and some Local bus stop consolidation. This alternative assumes the existing placement of standard Muni bus stops outside of downtown.

The baseline alternative (Alt. 1) isolates the incremental benefits of the improvements that Muni has already planned for the corridor from any potential BRT investment, allowing the evaluation to show the true benefits and impacts of BRT.

**Alternative 2: Basic Plus Transit Priority**

Alternative 2 was added to the analysis at the request of community stakeholders who were interested in analyzing additional transit priority treatments short of a full-featured BRT system. Basic Plus would include the common elements described above, plus the following:

- **A dedicated lane in the peak period, peak direction** (eastbound 7 am - 9 am; westbound 4 pm - 7 pm) would provide faster and more reliable service in one direction operating only in the morning and evening commute times. The lane would be identified with signage, but would not have pavement markings, since it would not be an all-day treatment. While this lane would provide some travel time improvements for commuters traveling in the peak direction during the peak period, it is important to note that the recent survey of transit riders on Geary found that only 20-25% of riders take the bus during peak commute times. There is high demand for service on Geary throughout the weekday and on weekends which would be unaffected by this lane designation.

- **Increased enforcement of bus lanes** which is intended to improve the functionality of this peak-period, bus-only lane. Such enforcement might include additional parking control officers (PCOs) and other strategic methods of keeping bus lanes clear of obstructions or delays.

- **Possible bus stop removal or consolidation** which would improve transit times by limiting the number of stops a bus has to make. Specific stops have not been identified for elimination. Despite an open letter that the Study Team received calling for stop consolidation, this Study’s analysis of stops along Geary identified few Local stops and no Limited stops that would be candidates for removal. Opportunities for consolidation are limited by Muni’s stop spacing guidelines, the Geary BRT design principles and guidelines, and numerous transfer points along the route.

- **Bus management strategies** such as:
  - **AVL** (automated vehicle locators) using GPS (global positioning satellite), which would allow Muni’s Central Control to know where all buses are located on the line, provide enhanced opportunities for line management, and improve reliability.\(^3\)

\(^3\) Muni is developing a number of technological enhancements that should aid in line management (managing how buses operate on the street). A new radio system would enable Central Control and Line Managers to be able to communicate with vehicle operators in real-time. Until this technology is fully available, the NextBus system will provide a level of information that should improve Muni’s ability to manage the system.
- **Increased street supervisors** who would work to improve reliability through on-street line management. Street supervisors actually work on the street to observe bus operations and they can “re-space” buses to reduce bunching and keep the line operating effectively in the case of a service disruption. They are especially important in helping service recover from unusual incidents such as vehicle breakdowns, traffic accidents, or other incidents that impact the flow of buses on the line.

- **Longer bus stops** (where needed) would give buses more room to maneuver, allow 2 buses (e.g. a local and limited bus or buses from multiple lines) to service the same stop concurrently, and provide a more comfortable waiting area for passengers. Lengthening bus stops would require some parking removal.

- **Bus bulbs** (at busy stops) would extend the sidewalk into the parking lane at bus stops, as illustrated below. This would eliminate the need for buses to pull into the parking lane to reach the curb and then re-enter traffic which is currently a cause of bus delay. Bus bulb-outs would also improve the passenger riding experience by eliminating the motion caused by buses weaving into and out of the parking lane.

The more sophisticated form of Transit Signal Priority used for the BRT alternatives, described below in Section 4.5, would also be a possibility for this alternative.
4.5 BRT Alternatives

As mentioned above, the three BRT alternatives would include full implementation of the common elements with a more sophisticated version of the technology in some cases, described below. They would also include some of the improvements of the Basic Plus alternative, like increased enforcement of bus lanes. However they would go far beyond the features of the Basic alternatives (Alts. 1 & 2) to provide a significantly faster, more reliable, and more comfortable transit service than what exists on any of Muni’s routes today. Additional features would include: an all-day, dedicated transit lane for both directions of travel; high quality bus “stations” with substantial additional stop amenities; and implementation of other techniques that are designed to reduce travel times and improve bus speeds. In the BRT alternatives, current 38L-Limited service would be replaced by the new, enhanced BRT service. 38-Local buses would continue to operate.

The BRT alternatives (Alts. 3-5) would provide a unique opportunity to enhance service levels in the corridor without increasing operating costs. BRT would reduce travel times and these savings could be reinvested in the service to allow for extended hours and/or greater frequencies. The “cycle time,” is the time it takes to complete one full route loop (inbound and outbound) including time for the driver to take a break. If a bus “cycle time” is one hour, and the bus is scheduled to operate every 15 minutes, then 4 buses are needed to meet this scheduled headway. If bus “cycle time” is reduced by 15 minutes then only 3 buses are needed to run at the same frequency, which frees up one bus that can be reallocated to provide more frequent service, or service at different times of day. At Study workshops, more frequent service and extended hours of service for the 38L-Limited were commonly requested by the community.

Features Common to all BRT Alternatives

Features Developed during the Inner Geary TPS Project

High quality bus stations with real-time information

The environment in which passengers must wait for the bus is as important as the experience on the bus, often more so, and has real impacts on attracting and retaining riders. Because the BRT line would have fewer stops than the Local route (similar to current Muni limited service), the investment in infrastructure could be concentrated to offer high quality “stations” that would be similar in experience to light rail stations. Stations would be designed to convey a uniform image and unique brand for the BRT system while also highlighting distinctive features of the surrounding neighborhood.

All BRT alternatives would have high quality bus stations at BRT stops on the whole corridor from Market to 48th Avenue. Local stops would also be improved, but would have fewer amenities. The prototypical stop designs for both Local and BRT bus stops were developed as part of the Inner Geary TPS Project, and are illustrated below. The BRT stops would include all the following features:

- Full shelters
- Bicycle racks
Pedestrian safety and landscaping improvements

Bus rapid transit in San Francisco would not only be a cost effective way to improve transit conditions on Geary, but would also enhance the corridor for all users, making Geary Boulevard a place where people want to live, work and shop. Each full-featured BRT alternative would include an equal level of investment in the streetscape as well as amenities for pedestrians and cyclists to provide a safer and more pleasant walking environment over the whole corridor. The prototypical pedestrian and streetscape improvements were also developed as part of the Inner Geary TPS Project. Proposed pedestrian improvements for all three BRT alternatives include:

- Wider sidewalks in some locations
- Median caps
- Pedestrian countdown signals
- Landscaping on sidewalks and medians
- Way-finding signage
- Corner curb extensions
- More prominent crosswalks

Curb extensions would extend the sidewalk into the parking lane at intersections to reduce total crossing distances for pedestrians and median caps would extend medians through crosswalks to provide a mid-street refuge for pedestrians in the event they do not make it across the entire street. These improvements would also increase pedestrian visibility. Corner curb extensions would not be possible at curbside Local bus stops or where right-turn pockets would be created.

These significant investments in the pedestrian and streetscape realms are linked most strongly to the BRT alternatives because implementation of a BRT system specifically,
rather than general transit improvements, would be far more competitive for current and foreseeable local, state and federal funding opportunities.

This significant investment in landscaping and pedestrian safety dovetails with other major citywide efforts which all aim to make San Francisco a place characterized by “great streets”: the Mayor’s greening program, the Better Streets Plan (includes the Pedestrian Master Plan and the Streetscape Master Plan). Synergies between these projects should enhance resources available for pedestrian and streetscape improvements in the BRT alternatives.

Prototypical streetscape and pedestrian improvements, developed as part of Inner Geary TPS Project

All-Day Dedicated Transit Lane

All BRT alternatives would include an all-day dedicated lane for buses. A transit only lane is one of the most effective ways to improve bus speeds, reduce travel times, and improve service reliability, because it removes the uncertainty and delay resulting from operating in mixed traffic. In addition, this was one of the three highest priority transit improvements requested in a recent survey of transit riders on Geary.

All BRT alternatives would result in two mixed-traffic lanes and one dedicated transit-lane in each direction on Geary within the Study Area. East of Park Presidio, all three BRT alternatives would convert one mixed-traffic lane into a dedicated transit lane. West of Park Presidio, areas that currently have diagonal parking would be replaced with parallel parking, providing enough space to create a transit lane without reducing the number of mixed traffic lanes. The transit-only lane is proposed to have both “Bus-Only” markings and signage, as well as colored pavement to provide distinctive branding for the BRT system. In the Side BRT alternative (Alt. 3), these distinctive lane markings would also serve to discourage mixed traffic from entering the bus lane as described more fully below. An example of lane treatments, from a BRT system in Rouen, France, is shown below.
Proof of payment with multi-door boarding

The time required for boarding and alighting is the second largest source of transit delay on the Geary corridor today. In addition to the advantages of new low-floor buses discussed above, a “proof-of-payment” fare collection system could significantly speed up transit service by making the boarding process more efficient. This system would allow passengers to board at all doors provided they have “proof” that they have paid a fare. Once on the bus, tickets or monthly passes could be shown when proof of payment is requested by inspectors who would randomly check BRT vehicles. Allowing passengers to use all doors to enter and exit the vehicle would substantially reduce the time required for boarding and alighting at transit stops.

Ticket vending machines at station platforms

Allowing passengers to pay before boarding the vehicle at easy-to-use, convenient paystations on the station platform would both speed up boarding and improve passenger convenience. This, combined with multi-door boarding and a proof-of-payment system, would eliminate the need for the bus to wait while all passengers pay at the front door, removing a significant factor in vehicle delay. It would also improve the rider experience by allowing for a wider variety of payment options including cash, Translink cards, and possibly credit or debit card as well, depending on the technology.

4 Translink card stores “electronic cash” that can be used to pay the fare on many different transit
More Sophisticated Transit Signal Priority

The funding available to bus rapid transit would allow for an incremental investment in transit signal priority (TSP), including interconnecting the signals so that a group of intersections could function as part of a continuous system. Whereas basic TSP just enables a bus to communicate with the next signal, this enhanced TSP would allow a traffic signal up to four intersections ahead of an approaching bus to acknowledge an approaching bus and make adjustments to speed transit flow without creating additional delay for other users. This interconnected system would allow adjustments like skipping a left turn phase to hold a green light for an approaching bus depending on volumes and recovery time. While these systems are very sophisticated, they are also designed for safety. In no case would the signal priority be set to preempt a red light, and pedestrians would always be allowed sufficient time to safely complete their crossing. More detailed study can be pursued in a subsequent phase of work to determine opportunities for more advanced transit signal priority for Alternative 2 as well.

Reinvestment of Travel Time Savings into More BRT Service

By reducing travel times, this package of BRT improvements could provide enough operating cost savings to enable Muni to increase service and expand the service hours for the BRT service into the night to match the light rail system. Expanding the BRT service to include evenings and Sundays was among the three highest priority improvements identified during the recent rider survey. Furthermore, it is expected that just in order to maintain current ridership levels and levels of service in future years will require higher operating costs. The operating efficiencies inherent to BRT service could allow for increased service and increased ridership for the same investment in operating costs, a much more sustainable service in the long run.

BRT Vehicles

The BRT alternatives (Alternatives 3-5) would likely not use standard low-floor buses, but full-featured BRT vehicles which could also have wider doors; more doors; doors for boarding on both the left and right side of the bus; and higher quality passenger amenities within the bus, as well as unique branding to distinguish the higher level of service.
Left Turns
All BRT alternatives would consolidate left turns for the 4 miles between Van Ness Avenue and 33rd Avenue in order to reduce conflicts with pedestrians. There are 61 total intersections in the corridor. BRT alternatives would reduce the number of intersections where left turns are permitted from 24 in both directions (Alt. 1 baseline conditions) to 13-16 in each direction depending on the alternative. For example, between Arguello Street and 4th Avenue there are 2 opportunities to turn left in the baseline, whereas under the BRT alternatives there would only be one opportunity to make a left turn. All left turns would have a dedicated left turn signal phase and left turn pocket to maximize the effectiveness of left turn locations.

Number and Location of Station Stops
All three BRT alternatives were assumed to share the same number and location of transit station platforms. The BRT stops were generally assumed to be at the locations of current 38-L Limited stops. This is in line with most BRT systems in North America which typically have stops that are at least 1,200 feet apart. For the most part, current Local stops between Van Ness and 33rd are within Muni standards and would therefore be maintained. Possible stop consolidation could be analyzed in the next stage of study to bring all Local stops within Muni stop guidelines.

Other Transit Operators
Golden Gate Transit (GGT) operates service along Geary Boulevard, averaging approximately one bus per hour during the day (GGT route #10). All of the BRT alternatives are designed to accommodate GGT service in the dedicated transit lanes. Side BRT and Center BRT with 2 medians (Alts. 3 & 4) would not require Golden Gate Transit to acquire any new vehicles, whereas Center BRT with 1 median (Alt. 5) would require both Muni and GGT services to operate with new buses that have doors on both sides.
Alternative 3: Side BRT

Side BRT (Alt. 3), would convert the outside traffic lane in each direction to a dedicated transit lane. The bus would operate between the parallel parking lane and the two remaining mixed-flow traffic lanes. Figure 4-2 shows a plan view drawing (from above) and a typical cross section of Side BRT.

Figure 4-2 Alternative 3: Side BRT

The element that most distinguishes Side BRT from the other two BRT alternatives is the fact that a right-side transit lane cannot be physically separated from other traffic because mixed traffic must continue to be able to cross the lane in order to park and make right turns. Bus operations would be slowed by parking and turning movements, as well as double-parking in the bus lane, reducing the benefits of the dedicated transit lane. In addition, because there is no physical separation between transit vehicles and private vehicles, it would be easier (than Alts 4 and 5) for autos to drive in the transit-only lane in violation of the “BUS ONLY” designation (when the lane is physically separated violations of
this sort are difficult to impossible). Side BRT would essentially maintain the existing median.

**Stations**

All BRT transit station platforms would be located on bus bulbs that would be created by extending the sidewalk into the bus zone/parking lane. This would allow for an enhanced passenger waiting area, more pedestrian amenities, and shorter pedestrian crossing distances. It would also eliminate the need for the bus to pull into and out of the curb lane for its stops (one of the sources of bus delay).

**Service Plan**

In this alternative both the 38-Local and BRT buses would operate in the side-lane. BRT vehicles would be able to pass 38-Local buses at Local-only stops because Local stops would not have bus bulb-outs: when Local buses pull into the bus zone to pick up passengers, the BRT buses would be able to pass in the bus lane.
**Alternative 4, Center BRT with 2 Medians**

Center BRT with 2 medians (Alt. 4), would convert the existing center traffic lane in each direction and the existing center median into dedicated transit lanes separated from traffic by two side islands. Figure 4-3 shows a plan view drawing (from above) and a typical cross section of Center BRT with 2 medians.

**Figure 4-3  Alternative 4: Center BRT with 2 Medians**

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**Stations**

Transit stations would be located on the side islands, which would also serve as landscaped medians between bus stops. These islands would physically separate the buses running in the middle lanes from auto traffic. Medians would be narrowed to allow for left turn pockets.
Service Plan

There were two service plans considered for this alternative, each of which would have different impacts on the roadway and parking supply. In the first alternative both Local and BRT buses would operate in the center busway. By narrowing the islands at Local stops only, there would be room for an additional lane which would allow BRT buses to pass Local buses. In this service alternative existing curbside bus stops could be replaced with on-street parking.

The second service plan that was considered was one where the Local bus would remain at the curb and only the BRT buses would run in the center busway. This would eliminate the need for a passing lane, but would also eliminate any parking gains. It would also re-introduce the disadvantages to both autos and Local buses resulting from operating in mixed-traffic; with this service plan alternative the travel time savings gained by operating in the center transit lane would accrue only to BRT buses. The extent of these impacts would depend on the frequency of Local service and is further discussed in Chapter 5.
Alternative 5: Center BRT with 1 Median

Center BRT with 1 median (Alt. 5), would convert the center traffic lane in each direction to a dedicated transit lane which would run on either side of a shared center island. Figure 4-4 shows a plan view drawing (from above) and a typical cross section of Alternative 5.

Figure 4-4 Alternative 5: Center BRT with 1 Median

In this configuration bus and auto movements would be completely separated, offering maximum transit travel time savings and also eliminating bus conflicts for autos. However unlike Center BRT with 2 medians (Alt. 4), the lack of side islands to “buffer” the transit lane from auto traffic would necessitate some type of special treatment to keep drivers out of the bus lane. This treatment could be a raised curb between the busway and auto lanes or raised pavement that discourages cars from entering the busway, similar to the design of...
the N-Judah in the Inner Sunset between 9th and 19th Avenues. This alternative would require use of new left/right door buses in order to accommodate left-side boarding between 33rd Avenue and Gough and right-side boarding in the Tenderloin/Downtown and towards the Ocean.\footnote{After evaluation of BRT plans for Geary, Van Ness, and Potrero (the three corridors currently under consideration for BRT implementation) and selection of preferred alternatives is complete, it would be determined if Muni should acquire a BRT-specific fleet of left/right door buses, or if right door-only buses would suffice.}

This design would maintain existing parking supply except at intersections with left turns. As illustrated in Figure 4-4, accommodating a left turn pocket would require shifting through-traffic lanes to the right and removing some parking near the intersection.

**Station**

The existing median would basically be maintained in this alternative, serving as a center boarding platform shared by passengers in both directions at bus stops, and as a landscaped median for the rest of the street. This 14-foot center median would provide a wide passenger waiting area and ample space for passenger amenities. Passengers would be buffered from traffic by the bus-only lanes which would enhance passenger safety.

**Service Plan**

There were only two service plans considered for Alternative 5 because a passing lane option for BRT buses to pass Local buses has not yet been developed. As mentioned previously, a passing lane concept for Alternative 5 could be developed in the next phase of study, the environmental analysis and preliminary engineering review.\footnote{If a passing lane option is developed allowing both the Local and BRT buses to run in the center transit-only lane, this alternative would require the purchase of left / right door buses for local service as well as for BRT since both services would serve center median stations, which require the use of left door boarding vehicles.}

The first service plan option is a “skip stop” service. This would eliminate the distinction between Local and BRT services and instead every bus would stop at every other stop, alternating with the bus behind it. A simplified diagram of typical skip-stop service is shown below in Figure 4-5. Buses would overlap on some stops to allow for transfers. This would mean that every stop would be covered by at least one of the two buses, but no single bus would need to stop at every stop, allowing for faster service for all buses. This eliminates the need for a passing lane since buses travel at approximately the same speed. However, when implemented in other cities this operation system has proven difficult for passengers to understand and to use. In most cases it has been discontinued.\footnote{This service plan could also be considered for Alternative 4 if it emerges as a preference in future stages of study, but was not considered in this phase of work.}
The second service plan is providing Local bus service at the curb with only the BRT bus in the center busway, similar to the second service plan for Alternative 4. This plan would result in a reduction of parking spaces because local buses remain at the curb, therefore parking spaces cannot be replaced at bus bulbs as in Alternative 4. During an environmental analysis, the Study Team will seek to design a passing lane option to accommodate Local buses in the center busway.

4.6 Special Locations: Fillmore and Masonic

There are two intersections on Geary which required development of special design alternatives: Fillmore Street and Masonic Avenue. Both intersections have an underpass that allows auto through traffic on Geary in both directions to avoid conflicts with cross traffic. Their complexity and width present both great opportunities and significant challenges.

In the course of this feasibility study the Study Team was only able to do initial design work for these locations; a more thorough examination would be needed if the project is advanced to the preliminary engineering/environmental analysis phase. As described more completely in Chapter 5, “Evaluation Methodology and Results,” it is quite clear that there are feasible designs that address the challenges that these locations present. However it is also clear that some alternatives need further development and that more detailed study is required to identify the best physical design for each location.

Fillmore Street

Currently at this intersection, three lanes of through traffic in each direction on Geary enter an underpass, allowing cars to bypass cross traffic at Fillmore. Buses stay on street-level service roads to the right and left of this expressway to facilitate transfers with the 22-Fillmore. Service roads have one lane of mixed-flow traffic and one parking lane. This causes significant delays for buses due to conflicts with pedestrians, service vehicles, and cross traffic as shown below. Land uses like the post office and Fillmore Auditorium cause frequent double parking here. In addition, though this is one of the most frequent transfer points on the Geary corridor, this intersection has some of the poorest pedestrian and passenger waiting conditions, shown in the photo below.

Geary Boulevard is at its widest here. This intersection offers an opportunity to provide buses with some of the efficiencies that autos currently enjoy, while still preserving

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11 Fillmore is actually a relatively narrow street which makes the underpass less crucial for preserving smooth traffic operations because the width of Fillmore would not allow for enough cross traffic to cause a large amount of delay for traffic on Geary.
adequate auto levels of service. It also presents an opportunity to better utilize the ample wide right-of-way to balance pedestrian space with wide streets for autos and other vehicles.

Buses operating in the Fillmore area must use congested service roads, where passengers and pedestrians must often compete for inadequate sidewalk space

The most important community priority for the Fillmore intersection was to better use this space to enhance the surrounding neighborhood and to facilitate connections between neighborhoods to the north and south of Geary. The wide road here creates a freeway-like atmosphere and feels like an insurmountable rift between Japantown to the north and the Western Addition to the south. Converting this barrier into a bridge between neighborhoods was a major priority in the design of BRT alternatives here.

To address these issues, the Fillmore alternatives were designed not only to improve bus performance, but also to improve the pedestrian environment and to knit neighborhoods together. Four alternatives were considered for this intersection. Two would maintain the underpass and two would fill in the underpass, bringing all traffic to the surface. All of these designs for Fillmore would require some additional engineering analysis in the environmental impact analysis.

**Fillmore Side Boulevard BRT**

In the Fillmore Side Boulevard BRT design the underpass would be filled in and all traffic would operate at street level, as pictured in Figure 4-5. The overall design of the Fillmore Side BRT alternative would be similar to the standard Side BRT alternative (Alt. 3), except the Fillmore version would maintain the service roads on both sides of Geary. The BRT and 38-Local buses would operate in a dedicated transit-only lane located between the service road on the edge and two lanes of through traffic in the center. This would require conversion of one lane of through traffic in each direction. The service roads would be maintained to reduce conflicts between buses and local traffic, particularly parking and turning cars.

Station platforms would be located on 10.5-foot medians between the service roads and the bus lane. The service roads would follow a boulevard-style design with ample pedestrian-friendly features, curb extensions at cross-walks, and prominent landscaping, including an additional median in the center of Geary. This multiple-median design would provide
opportunities for landscaping and beautification as well as help achieve the goals of connecting neighborhoods, rather than serving as a barrier.

**Figure 4-6 Fillmore Side Boulevard BRT**

![Fillmore Side Boulevard BRT Diagram](image)

**Fillmore Center Boulevard BRT**

The Center Boulevard BRT is the second design alternative in which the underpass would be filled and all traffic would operate at street level, pictured in Figure 4-6. This design would be quite similar to the standard Center BRT alternative with 2 medians. Buses would operate in a dedicated busway in the center of the street, separated from auto traffic by 16-foot medians on both sides. These medians would provide pedestrian refuge, opportunities for significant landscaping and a more pleasant walking environment. As with some of the other Fillmore options, the wide sidewalks and medians would also serve a place-making function to connect neighborhoods rather than separate them.

One lane of traffic in each direction would be removed to accommodate these transit lanes and the service roads would be eliminated. That would leave two lanes of mixed-flow through traffic and a lane of parallel parking in each direction. This alternative would allow for significantly wider sidewalks (18-35 feet depending on the location). Wider sidewalks in front of Japantown addresses a top priority identified in the Japantown Preservation Plan.
The third option for the Fillmore intersection, Underground BRT, would maintain the underpass. Both BRT and 38-Local buses would operate in the center of the underpass, a bus station would be underground and passengers would change levels to transfer between Geary and Fillmore buses, as illustrated in Figure 4-7. One lane of through traffic in the underpass in each direction would be converted to accommodate these dedicated transit-only lanes, leaving two lanes of through traffic in each direction. The existing tunnel would need to be widened to accommodate BRT platforms and sound walls would be installed on both sides of the platforms to buffer pedestrians from noise and fumes of auto traffic.

On the surface, service roads and parking would be maintained as they are today. A street level plaza would be created to provide space for escalators and/or elevators descending to the underground transit plaza. Passengers could reduce underground waiting time by relying on real-time transit arrival information displayed in the surface-level transit plazas. Also, this is the only design alternative for Fillmore that would allow Fillmore buses to stay where they are and not move to the corners.

Though this option would not bridge the neighborhood as successfully as the Side and Center Fillmore alternatives, it would leave Fillmore and Geary very accessible and pedestrian friendly, and could possibly encourage more north-south movement on Fillmore.
Fillmore Viaduct BRT

The fourth option, “Viaduct BRT,” would maintain part of the underpass, as illustrated in Figure 4-8. In this design, BRT and 38-Local buses would run in the center of the road at street level. This would be achieved by filling the center lane of the underpass in each direction, leaving two through traffic lanes in each direction. Service roads and parking would be maintained as they are today. Stations would be located on street-level plazas that increase public open space, buffer pedestrians from auto traffic, and maintain street-level transfers to between Geary buses and the 22-Fillmore. Pleasant, simple pedestrian crossings with bulb-outs would connect the center platforms and the sidewalk.

Plaza design is one element that would definitely need further analysis during the preliminary engineering stage of the Study to ensure the dimensions allow for safe use by all types of vehicles. For example, future stages of the Study would analyze the length of the platform to ensure safe vertical clearance for trucks at the entrance and exit of the underpass.
Masonic Avenue

The intersection of Masonic and Geary is very complex and presents unique design challenges and opportunities for improvements. Like the Fillmore intersection, Masonic requires special attention because lanes of traffic on Geary enter an underpass. Also like Fillmore, there are side service roads at the surface for local traffic and right turns. At Masonic, however, there are also lanes that allow for westbound traffic on Geary to turn left onto Masonic. The Masonic intersection has the highest left-turn volume on the corridor at the PM peak hour. In addition, the wide roadways here necessitate long pedestrian crossing times.

Unlike Fillmore, the underpass at Masonic provides crucial operational benefits to through traffic on Geary. Masonic allows cars to bypass two signals, one of which has large traffic volumes. This larger underpass restricts cross traffic for four blocks. In addition, the current design allows cars to transition from Geary to Masonic with relative ease. However, buses on Geary currently operate on steep side service roads and often get caught in local traffic congestion. The alternatives developed for this intersection sought to offer buses the same efficiencies that auto traffic currently enjoys, while still maintaining acceptable levels of service for all users.

Two alternatives were developed to address these goals: an underground and a surface design. Both of these options have flaws that would require additional thought to meet the needs of all users. Additional engineering work could be completed during the EIR phase of this project, building on the initial analysis of this Study. The following sections describe the two options included in the initial analysis.
**Masonic Surface BRT**

In the Surface BRT design alternative for Masonic, pictured in Figure 4-9, buses would operate at the surface in a semi-exclusive lane, local traffic would remain at street level, and auto through-traffic would be maintained in the tunnel. Eastbound buses would travel in the mixed-traffic service road west of Masonic. After crossing Masonic, they would travel in a dedicated lane on the service road. The additional lane would come from removing non-metered parking, which should not make a significant impact on the overall parking supply because the adjacent mall has a large off-street parking lot and because un-metered parking does not tend to have much turnover. At Baker, the service road ends and the bus would enter a more typical side-lane busway. A joint platform for both Geary buses and 43-Masonic buses would be located at a large bus bulb immediately after Masonic.

Westbound buses would travel in a dedicated lane on the existing service road east of Presidio that would be made available by converting un-metered parking spaces, as above. A bus-only signal at the Presidio intersection would allow buses to enter the intersection first in order to reduce conflicts with left-turning autos. Between Presidio and Masonic, buses would travel in a bus only lane in the center of the roadway. After crossing Masonic, buses would travel down the service road in a mixed-traffic lane before entering a more typical dedicated side-lane west of Collins. Station platforms would be accommodated on a wide landscaped median between the bus lane and the service road immediately east of Masonic.

This alternative would allow for integrated, street-level transfers between Geary and Masonic and would reduce potential auto-pedestrian conflicts by maintaining through traffic underground.

**Figure 4-10  Masonic Surface BRT**
Masonic Underground BRT

In the Underground BRT design, pictured in Figure 4-10, the existing underpass would be dedicated exclusively to Geary buses. All current tunnel dimensions would remain the same, with one underpass lane in each direction dedicated to the bus and the second lane used for the platform. Passengers would have to change levels to access the bus and/or transfer to Masonic buses. At the surface, Masonic buses would operate in the centermost lanes, which would be dedicated to transit. Stops would be located directly above the underground station in a surface transit plaza between Masonic and Presidio. This plaza would provide additional space for pedestrians and waiting transit riders.

In this alternative, all auto traffic would be brought from the underpass to the surface. To accommodate this significant increase in surface through traffic, the service roads would be widened to two lanes to carry the additional auto traffic that previously used the underpass.

Figure 4-11 Masonic Underground BRT

4.7 Rail-Readiness

In response to a request by the Geary CAC, the Study included analyses to determine the most appropriate range and level of rail-ready investments in a bus rapid transit line on Geary given the possibility of converting the BRT facility to light rail at some future date. This section discusses the approach of this analysis, the components analyzed, potential benefits and conceptual cost estimates for the each of the components. Rail-ready analysis focused on the portion of Geary between Van Ness and 33rd Avenue; costs and impacts for a light rail line east of Van Ness would be more significant and were not developed as part of this analysis. Basic rail-ready costs for the Fillmore and Masonic intersections are included conceptually in estimates developed for these intersections, but need additional analysis due to the conceptual nature of the estimates as well as the need for subsequent redesign of alternatives at each location. Further detail should be developed during a subsequent stage of study, and as such these costs were not evaluated in detail as part of the analysis presented below.
The Geary corridor was considered for light rail improvements in the past during the crafting of the New Expenditure Plan for Prop K. The Expenditure Plan Advisory Committee (EPAC) determined that while transit improvements on Geary Boulevard were of high importance, a light rail line on Geary was not viable within the financial constraints of the 30-year plan. Instead, the EPAC developed a plan that mandates that any further improvements on Geary be “rail-ready”. Alternatives must be designed in a way that does not preclude the possibility of future development of light rail. The mandate is intended neither to support nor preclude light rail on Geary, rather to anticipate the possibility of expanding the light rail network and minimize potential impacts of conversion by building on any existing improvements.

The center-running conceptual alternatives accommodate the physical dimensions and operational requirements of a light rail vehicle—horizontal and vertical clearances, grades, and turning radii. As noted above, the Study Team were later asked by the GCAC to conduct a more detailed analysis to determine which, if any, other components of a light rail line might be cost-effective and worthwhile to install during BRT implementation as a way to reduce impacts if the transit line on Geary is converted to light rail in the future. A summary of the rail-readiness analysis is provided below, with the full report in Appendix XX.

Methodology

The Study Team began by incorporating standards for the physical dimensions and operational requirements for light rail vehicles into the design principles for the alternatives. Following the alternatives design, the Study Team developed a list of potential light rail components that could be installed during BRT construction. Each component was evaluated in context, with detailed estimates developed based on the conceptual engineering drawings to determine the cost of each component. The Study Team then analyzed the impacts and benefits of installation during potential BRT construction weighed against those of installation, or rather conversion, during possible light rail construction.

This analysis was also accompanied by a review of predominantly North American cities that had considered BRT-to-rail conversions, along with a review of cities that had already converted to rail from BRT. Reviews identified the benefits, impacts, and risks faced during BRT construction as well as those experienced and observed during conversion to light rail. The goal of both the technical analysis and the brief case studies is to determine whether the benefits of installing more extensive rail infrastructure during BRT construction outweigh the costs or risks of leaving that infrastructure unused until the time if/when light rail is built.

Rail-ready Options

The Study Team evaluated two alternatives for rail-readiness on Geary. The first—Option A—defines rail-readiness by ensuring that conceptual BRT designs do not preclude development of light rail in the future. This option, as described above, requires designing the horizontal and vertical clearances, grades, and turning radii for all center-running BRT alternatives to light rail standards. It further requires that stations or stops be sited in a location that can accommodate a light rail platform, which is longer than the typical 120' minimum space required for BRT.

Again, this option reduces the need for reconstruction of medians or reallocation of the street space if a conversion to light rail is made. However, there are likely to be construction impacts if conversion to light rail is pursued, as it would require laying tracks and other
related infrastructure. Option A prioritizes resources for development of a full-featured BRT system along the corridor. Because of the significantly lower cost relative to Option B, it also allows resources that would be spent on rail-ready activities to be allocated to other improvements in this corridor or others until or if the decision to convert to light rail is made.

As a result of the review of conversions or conversion decisions in other cities, the Study Team recommends adding design of a modular station or platform to Option A. Muni currently operates light rail vehicles with a higher boarding height, compared to the potential low-floor BRT vehicles that facilitate level boarding. The difference in boarding height between buses and light rail vehicles would require a change from the lower BRT platforms to much higher platforms for light rail vehicles if the line were converted to rail. However, it is possible to design and install a modular platform where the height of the platform can be easily raised with minimal disruption or impact to the operation of transit vehicles or autos. Doing so would increase BRT capital cost estimates. However it would greatly reduce the need to completely rebuild platforms if a conversion is made. Costs are described in more detail below.

Option B defines rail-readiness by reducing the need to excavate or reconstruct the street more than once in an effort to minimize construction impacts. This option includes all components of Option A, and then expands the definition to analyze a potential package of more extensive investments. In addition to the physical dimensions of light rail, the Study Team analyzed the costs, benefits and impacts of installing the following components:

- structural elements
- utility relocation
- underground electrical elements
- rail investments
- station foundations
- platform modifications
- overhead contact system
- electrical substations

Of these components, the Study Team eliminated installation of the overhead contact system (OCS) and of the electrical substations, since these elements offered little to no savings in construction impacts and would be used only if the BRT line were converted to a light rail line. Other components of this option should greatly reduce the need for substantial additional construction if conversion to light rail is pursued. Option B includes laying the tracks and covering them with the busway, relocating utilities currently located in the center median to the curb, installing grounding and corrosion protection for the covered tracks, electrical elements beneath the running-way, changes to elevations or grades of the cross streets, and other structural elements of the running-way.

**Lessons from Other Cities**

Only one other US city has made the conversion to light rail after installing a rail-ready dedicated bus line—Seattle, Washington. The Downtown Seattle Transit Tunnel (DSTT) was installed in the late 1980s and converted to light rail in 2007. Seattle pursued a rail-ready option similar to Option B described above, with the hope that the only significant
components of conversion would be uncovering the rails and purchasing light rail vehicles. However, at the time of conversion it was discovered that the rails needed substantial re-installation to address grounding and corrosion problems. In addition, platform reconstruction was required to accommodate their change to low-floor light-rail vehicles, which were neither available nor anticipated at the time of construction. Additional and unexpected costs for conversion of the DSTT exceeded $160 million dollars, almost half of the $400 million already expended on construction of the 1 - 2 mile dedicated busway.

Most of the other cities reviewed and consulted decided to incorporate rail-readiness in BRT designs by pursuing avenues similar to Option A described above. One other city, Houston, Texas, is still analyzing the various light rail and rail-ready components to determine the benefits, impacts, risks and level of investment. Several cities outside of the US, Bogota, Colombia and Curitiba, Brazil, have analyzed BRT-to-rail conversion and rejected the idea, finding that the flexibility and capacity of BRT was adequate and, in some cases, more favorable than rail systems on their BRT corridors. More detail is offered in Appendix XX.

Comparison of the Options

Capital costs of the two options were vastly different. For the most part, costs of Option A are included in the BRT capital cost estimates given that the design principles and guidelines included the physical dimensions of light rail vehicles, and were thereby incorporated into the conceptual designs for the center-running BRT alternatives (Alts 3–5). The incremental cost of modular platforms at the stations is estimated at approximately $2.5 million, while Option B is expected to cost about $130 million above the capital costs for the typical BRT sections. These costs do not include rail-ready investments at Masonic and Fillmore, where design and construction would likely incorporate a higher level of rail-ready investment depending on the alternative chosen. More analysis of rail-ready investments at these intersections would be needed in a later stage of study.

Figure 4-12  Comparison of Rail-Ready Options

<table>
<thead>
<tr>
<th></th>
<th>Option A</th>
<th>Option B</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRT Construction Cost(^{12})</td>
<td>$172M – $212M</td>
<td></td>
</tr>
<tr>
<td>Additional Rail-Ready Cost</td>
<td>$2.5M</td>
<td>$130M</td>
</tr>
<tr>
<td>BRT Construction Time</td>
<td>1 ½ - 2 yrs</td>
<td></td>
</tr>
<tr>
<td>Incremental BRT Construction Time</td>
<td>-</td>
<td>~ 1 yr</td>
</tr>
<tr>
<td>BRT Traffic Impacts</td>
<td>MED</td>
<td>HIGH</td>
</tr>
<tr>
<td>Future LRT Conversion Time*</td>
<td>~ 3 yrs</td>
<td>~ 2 yrs</td>
</tr>
<tr>
<td>Future LRT Traffic Impacts*</td>
<td>HIGH</td>
<td>MED</td>
</tr>
<tr>
<td>Level of Risk</td>
<td>LOW</td>
<td>HIGH</td>
</tr>
</tbody>
</table>

\(^{12}\) Costs presented are in the year of construction, 2010.
Based on the rail-ready analysis by PB Americas summarized above and detailed in Appendix XX, the Study Team’s current recommendation is Option A. Though Option B should result in a benefit of reduced traffic and construction impacts in the future if the potential Geary BRT line were converted to a light rail line, Option B represents a significant sunk cost for rail-ready activities that would not benefit travelers on Geary unless or until conversion to light rail were pursued at a point quite far in the future. For Option B improvements like laying track and relocating utilities would increase BRT construction time by at least 1 year, while Option A includes the more significant impacts of conversion if or when such conversion were pursued in the future. When taken together the construction time of Option A and Option B is approximately the same for BRT with rail-ready enhancements and light rail conversion in the future—Option A would take an additional 2-3 years for conversion in the future whereas Option B would add 1 year to BRT construction along with up to 2 additional years to convert in the future.

**Key conclusions**

Rail-ready Option A is the most prudent option given the high risks and sunk costs, along with the uncertainty of light rail development and long timeframe before its construction. Activities in Option A do not preclude light rail conversion, and minimize some impacts of conversion by incorporating physical requirements of light rail operations into BRT design.

The Study Team recommend incorporating a modular station platform into BRT designs as study progresses, so that platforms can be easily raised to boarding heights of light rail vehicles as warranted if light rail conversion is pursued.
Chapter 5. Evaluation Methodology and Results

5.1 Introduction
This Chapter presents the results of the Study Team’s evaluation of expected benefits and impacts of BRT on Geary Boulevard. The evaluation analyzed the performance of each conceptual alternative (both BRT and non-BRT alternatives) with respect to transit performance and rider experience, pedestrian safety, urban and landscape design, traffic operations, capital and operating cost, and construction impacts. These criteria were measured through both qualitative and quantitative metrics (evaluation criteria are described fully in Section 5.2). The analysis is based on the standard designs not including the Fillmore and Masonic intersections (which can be integrated in the next phase of study). This Chapter also documents how well each alternative would meet project goals and address key transportation needs identified during community outreach and the Needs Assessment process. This is an initial evaluation only and has been constantly refined and developed throughout the process to date. Further analysis can be completed in future stages of work (i.e. environmental analysis and preliminary engineering).

With any transportation project, there are trade-offs between benefits and impacts. The Study Team refined each BRT alternative based on technical expertise and community feedback, in order to maximize the benefits of each alternative while devising strategies to minimize or offset impacts where possible. In future stages, the Study Team will remain committed to minimizing impacts of BRT, including maximizing the performance and efficiency of the remaining mixed-traffic lanes through tools such as signal timing and traffic engineering; developing strategies to reduce construction impacts and minimize parking loss; and determining the magnitude and direction of traffic diversions in order to better manage all modes on Geary Boulevard and on surrounding streets. The Study Team is also committed to working with the community to protect adjacent neighborhoods through strategies like traffic calming where warranted and welcome.

Summary of Evaluation Results
Overall, Geary Boulevard could accommodate BRT and several BRT designs would be feasible, which means that there are choices about how to implement BRT on Geary. In general, BRT would offer significant transit performance benefits including faster travel times, more reliable wait times, more comfortable service, and lower operating costs per passenger. At the same time, BRT impacts have been estimated to be relatively minor and could be alleviated.
The key findings of the alternatives evaluation are as follows:

Benefits

- **BRT would offer significant transit performance benefits.**
  - Transit travel times are expected to drop by up to 30%, closing the time gap between driving and riding the bus.
  - Service Reliability should improve considerably by eliminating most (Side BRT) or all (Center BRT) conflicts with mixed traffic, and by streamlining passenger loading and unloading.
  - Transit ridership is expected to increase by as much as 25% under the BRT alternatives, helping to reduce the citywide trend toward declining transit mode share.
  - Center BRT alternatives (Alts. 4 & 5) would improve transit performance the most because conflicts with mixed traffic are completely removed by the physically separated lane. As a result they would attract the most new riders and would provide the greatest share of benefits to transit-dependent households.

- **The experience of riding the bus would be considerably improved by BRT** due to new transit station platform amenities and safety improvements, including lighting, shelters, signage and wayfinding information, and real-time transit arrival information. BRT would also increase the size of transit station platforms and provide a smoother and more comfortable ride (less weaving and stopping).
  - Center BRT with 1 median (Alt. 5) would provide the best transit rider experience. It would have the widest platform, a buffer from traffic (bus lanes), and a single platform which would increase activity and therefore security.

- **Pedestrian safety and access would be greatly improved by BRT** by reducing pedestrian crossing distances, providing visible crosswalks, providing a complete set of countdown signals, and enhancing landscaping.
  - BRT alternatives would vary, primarily in the size and shape of the landscaped median(s), the design of the median pedestrian refuges, and the amount of buffer they would provide to pedestrians on the sidewalk.

- **BRT would improve accessibility to and from the Geary corridor.**
  - Job accessibility by transit from Divisadero and 20th Avenue is predicted to increase by 20-70% with BRT.
  - Center BRT alternatives would increase accessibility the most because they make it possible to travel to more destinations more quickly.

- **BRT has the potential to make Geary a great street** by providing a recognizable design theme along the whole corridor through the colored transit lane; landscaping upgrades; enhanced street furniture and paving; and potentially lighting and other urban design features. This would improve the beauty of the street, and upgrade
Geary’s character to match its size and prominence within San Francisco’s street hierarchy.

- **BRT would contribute to the City’s development of a distinctive, recognizable, and consistent network of transit priority streets.** With all BRT designs on Geary it would be clear that this is a new level of service, distinct from current Muni service.
  - Center BRT alternatives (Alts. 4 & 5) would provide the strongest opportunities for unique BRT branding and identity.
- **Center BRT alternatives (Alts. 4 & 5) would provide the greatest overall benefit** due to the physically separated transit lane prominently located in the center of the street. Side BRT (Alt. 3) would improve conditions considerably over the baseline; however the permeable transit lane, which allows conflicts with right turning and parking vehicles, would diminish benefits somewhat.
- **Basic Plus (Alt. 2) is estimated to deliver benefits similar to Side BRT when the dedicated lane is in effect** (eastbound in the AM peak period, westbound in the PM peak period), and would perform like the baseline (Alt.1) during all other times of day for criteria that is based on traffic operations. The effects of the lack of pavement definition and of the changing regulations by time of day are hard to predict, but could cause confusion for drivers, resulting in lower performance than Side BRT. For other more qualitative criteria, Basic Plus generally would perform like the baseline because it would not include substantial investments in features like station platforms, pedestrian amenities, urban design elements, or landscaping.

**Impacts**

- **BRT impacts to traffic operations and parking can be minimized.**
  - Overall traffic conditions are not expected to deteriorate significantly from conditions in the baseline (Alt.1) for any alternative during the PM peak hour.
  - Auto travel times are expected to change by less than 2 minutes (actually decreasing in some scenarios) a relatively minor change when compared to the considerable time savings for transit.
  - Average transit delays at intersections are predicted to drop by up to 50% (8 sec) while auto delays should change by less than 1 second (actually dropping in some scenarios) during the PM peak.
  - Traffic diversions from Geary to other streets are expected for all of the BRT alternatives (Alts. 3-5) and the Basic Plus Transit Priority alternative (Alt. 2). However, this initial analysis suggests that these changes in traffic patterns would be predictable and would not be severe. Traffic is expected to continue to flow smoothly on Geary Boulevard itself, and the volume of traffic diverted to parallel streets would only be 1-2 additional cars per minute (during the peak period). This magnitude of diversions would be undetectable by most travelers, and could be managed with traffic signal timing adjustments.
  - The parking supply would only be minimally impacted by BRT if strategies to off-set reductions were adopted during implementation. Center BRT with 2
Medians (Alt. 4) should actually increase the parking supply by 16% while the other alternatives should remove no more than 4% of parking spaces.

- **Construction costs of BRT on Geary** are expected to range between $172 and $212 million depending on the alternative – significantly less than a subway or light rail project.\(^1\) If new low-floor buses with left and right doors are necessary, SFMTA would work proactively to procure them through the normal vehicle replacement cycle.

- **BRT is expected to provide more service with little to no increase in operating costs** by reducing the amount of time required for a bus to complete its route.

- **BRT construction would be low-intensity and quick** relative to major transportation projects like a light-rail or subway construction.\(^2\)
  - BRT on Geary Boulevard could be constructed in a year for all BRT alternatives if staged simultaneously at 2-3 locations, in 3-6 block segments for 2-3 months apiece.
  - Roadway access to businesses could be preserved during construction for drivers, pedestrians and transit riders.
  - Several strategies to reduce any construction impacts would be feasible with all BRT alternatives.

- **Basic Plus would have minimal impacts**, although the benefits would also be substantially less than BRT. This was the direct intent of the Basic Plus alternative--to provide some basic transit benefit while minimizing all impacts.

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1. Though this cost estimate includes costs for construction at the Fillmore and Masonic intersections of Geary, these intersections would need more detailed design and analysis in the next stage of study. Project costs may increase as a result of redesign of these locations.

2. This construction assessment does not include the intersections at Fillmore and Masonic. Construction impacts at these two locations will vary in intensity and time depending upon the alternative chosen.
5.2 Evaluation Approach and Criteria

Overall Evaluation Methodology

Alternative 1, Basic Transit Priority, is treated as the baseline for the horizon year 2015, because it represents improvements that are likely to occur whether or not there is a BRT project in the corridor. All other alternatives are compared against conditions in this baseline alternative. This helps isolate the incremental benefits that would result from the BRT investments (and/or additional priority treatments) from the standard changes Muni already has planned, as well as isolating the alternatives from changed conditions in 2015, e.g. demographics and trip making. The alternatives were also compared to each other to evaluate the advantages of one design over another.

Both text descriptions and charts are used to document the results of the evaluation for each category. In the charts, up and down arrows are used to illustrate whether an alternative results in an improvement or deterioration over conditions in the baseline (Alt. 1). For the quantitative metrics, unless otherwise indicated, a horizontal line means no change, one arrow indicates a change of less than 10%, two arrows indicate a change of 10% to less than 20%, and three arrows indicate a change of 20% or greater. For the qualitative metrics, a horizontal line also means no change, one arrow indicates a relatively small change, two arrows indicate a moderate change, and three arrows indicate a substantial change.

It is important to keep in mind that an up arrow means a benefit and a down arrow means an impact because in some cases a negative number represents a benefit. For example, a decrease in travel time is a beneficial change, so it is accompanied by an up arrow.

For some of the criteria, two or more alternatives are projected to perform similarly. Therefore they are discussed together and no distinction is made between them in the charts. This is most common for the two Center BRT designs (Alt. 4, Center BRT with 2 side medians and Alt. 5, Center BRT with a 1 center median). For many criteria they would perform identically because the benefits and impacts would result from dedication of the center mixed flow traffic lane to transit, regardless of where the platforms are located.

The Side BRT (Alt. 3) and Basic Plus (Alt. 2) are also sometimes discussed together because they would both involve dedication of an outside lane for transit. However, as currently envisioned Basic Plus performs like Side BRT only 5 hours a day and only in the peak direction (i.e. eastbound from 7-9 am and westbound from 4-7 pm). In the non-peak direction during the peak hour and in all off-peak hours Basic Plus (Alt. 2) would perform like the baseline (Alt. 1), because no dedicated lane would be provided.4

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3 Typically this is called the "no project," however this technical term was not well received by the community and the Study Team determined that it was not appropriate for the high level of community outreach that this project entails. Therefore, the name "basic transit priority" was adopted to better describe the alternative.
4 In addition, it is hard to quantify whether the lack of colored pavement clearly identifying the dedicated transit lane and the changing regulations by time of day in the Basic Plus alternative will impact driver compliance and thus reduce reliability improvements for this alternative when the dedicated lane is in effect.
Because many charts illustrate conditions in the westbound PM peak, the Basic Plus Alternative may appear to perform better than it would when evaluated over the course of the day, since the charts represent the time when the alternative would be delivering its maximum benefit. Readers should note that for this Alternative these charts only illustrate conditions that would be experienced by a relatively small portion of Geary riders.

**Measures of Evaluation**

The Study team developed an evaluation framework which was grounded in the project goals and approved by the Geary Citizen’s Advisory Committee in March 2006. It consists of seven categories, each of which was assigned various “sub-criteria,” which consist of both qualitative and quantitative metrics.

Four of the seven measures capture expected project benefits, while three address potential impacts or constraints as follows:

<table>
<thead>
<tr>
<th>Benefits:</th>
<th>Impacts/Constraints:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Transit Operations and Performance</td>
<td>5. Traffic and Parking Impacts</td>
</tr>
<tr>
<td>2. Transit Rider Experience</td>
<td>6. Capital and Operating Costs</td>
</tr>
<tr>
<td>4. Urban Design and Landscaping</td>
<td></td>
</tr>
</tbody>
</table>

The technical models used for the evaluation (VISSIM, SF-CHAMP, and Synchro) are described in detail in the next section. In addition to these models, there were three other primary sources of data for evaluating BRT performance:

- Conceptual engineering designs,
- Data on the performance of other BRT systems around the world, and
- Stakeholder and community outreach.

A table describing all the evaluation categories and sub-criteria is provided in Appendix X.

**Modeling Process**

Many key aspects of BRT performance are assessed using a three-step approach to modeling transportation conditions, summarized in Figure 5-1 below. The three key models used are:

- San Francisco’s Countywide Travel Demand Forecasting model (SF-CHAMP)
- Synchro traffic operations model
- VISSIM traffic and transit micro simulation model
San Francisco Countywide Travel Demand Forecasting Model (SF-CHAMP)

The San Francisco County Transportation Authority’s travel demand forecasting model (SF-CHAMP) forecasts how changes in land use, roadway networks, and transit networks are likely to affect travel demand in San Francisco. Complete documentation of SF-CHAMP methodology and findings are included as Appendix X. Key inputs to the model include:

- Expected changes in land use, i.e. number of jobs, households, and employed residents;
- Estimates of future travel demand from outside San Francisco;
- Known future roadway network modifications, taking into account major roadway projects, such as planned changes to Geary Boulevard and parallel streets;
- Planned future transit network modifications, including changes to bus routes and the addition of major projects such as the Third Street light rail line.

SF-CHAMP basically measures how many people are going from one location to another and what mode they are using to get there (i.e. transit, car, walking). An SF-CHAMP model for the year 2015 without BRT (the Basic Transit Priority alternative) was created in addition to SF-CHAMP models for the Side BRT and Center BRT alternatives. Analysis for the Basic Plus alternative (Alt. 2) was a combination of outputs from the baseline model (model for the year 2015 without BRT) and the Side BRT (Alt. 3) model because this alternative performs like Alternative 3 during the peak period in the peak direction and like the baseline at all other times of day. The SF-CHAMP modeling yields the following information:

- Changes in numbers of travelers and vehicles on Geary Boulevard and parallel streets;
Changes in the proportion of people walking or bicycling;
Changes in transit ridership on each route in the Geary corridor;
Changes in the origins and destinations of travelers in cars and on transit.

Synchro Traffic Operations Model

Once it is known how many people are going from one location to another by car, Synchro helps to understand how traffic flows on a specific street. This model focuses on intersections, since in urban areas the smoothness of travel at intersections is a key factor in congestion. Synchro assesses how well intersections serve the number of vehicles that are expected, and estimates the resulting delays caused at intersections.

MTA operates a Synchro traffic operations model that covers much of the city. For this Study, MTA and the Consultant team worked collaboratively to develop a model for the 2015 baseline on Geary, as well as models for the 2015 Side and Center BRT alternatives. Complete documentation of the Synchro model is included as Appendix XX.

Intersection operation depends on the volume of vehicles, the timing of the traffic lights and the number of right/left turn pockets (location of turn pockets is used to time actual signals). Synchro is grounded in real data; it is based on observed volumes of through and turning traffic and it uses actual signal timing. The 2005 Synchro model is populated with this observed data and then scaled up based on CHAMP outputs for 2015. Inputs to the Synchro model include:

- The roadway configuration of the corridor;
- Expected vehicle volumes, including on parallel streets;
- Number, length, and type of turn pockets;
- The signal timing plan.

The Synchro model outputs that are used for evaluation include:

- The average amount of delay to vehicles at each intersection;
- Queues of vehicles waiting at traffic lights;
- An overall metric for the performance of the intersection, called an “LOS” grade.

VISSIM Micro-Simulation Model

Results from the SF-CHAMP and Synchro models are used as inputs to this third modeling step, VISSIM. VISSIM is a program that allows us to see how cars and buses interact. The model actually simulates the number of people traveling and how they impact one another. It can assess how auto travel times and transit travel times change for different alternatives and is based on observed volumes of traffic on different streets.

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5 Municipal Transportation Authority, the agency in charge of Muni and the Department of Parking and Traffic
Unlike SF-CHAMP, VISSIM simulates the individual behavior of pedestrians, drivers, and transit riders at each intersection. Unlike Synchro, VISSIM distinguishes between people in vehicles, on transit, and on the sidewalk, and is also able to model transit signal priority – each instance that a bus triggers an extended green light as it approaches an intersection.\textsuperscript{6} Documentation of the VISSIM model is included as Appendix X. Key inputs to the VISSIM model include:

- Numbers of people on buses, walking, and driving
- Movements made by each vehicle at an intersection (e.g., turn left or right, or go through)
- Signal timing and locations where signal priority is permitted.

The outputs from the VISSIM modeling include:

- Transit and car travel times;
- Delay at intersections for people whether traveling by car, by bus, or on foot.
- Visual simulation that allows transportation planners and engineers to identify problem locations.

\textsuperscript{6} VISSIM uses the same signal controller logic as the actual signals, which could help to streamline implementation.
5.3 Transit Performance

Purpose

One of the key purposes of this Geary Corridor BRT Study is to help understand how the proposed alternatives would benefit transit operations. This analysis will help determine the degree to which the alternatives would meet three project goals: maintaining a robust and stable transit ridership, providing efficient, effective, and equitable transit service, and the development of a distinctive, recognizable, and consistent network of transit priority streets.

Figure 5-2 shows all the sub-criteria for transit performance. It provides both a brief explanation of each and the source of the data used for its evaluation (e.g. the model used to measure each criterion).

Figure 5-2 Transit Performance Criteria

<table>
<thead>
<tr>
<th>Sub-criteria</th>
<th>Methodology/Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in transit travel time</td>
<td>Measures the average total travel time along the corridor and compares to the average auto travel time.</td>
<td>VISSIM micro-simulation model</td>
</tr>
<tr>
<td>Change in service reliability</td>
<td>Measures the variation in passenger waiting times and travel times.</td>
<td>Case Studies</td>
</tr>
<tr>
<td>Ease of operation</td>
<td>Captures the difficulty of operating the transit vehicles along their route, including: how much transit mixes with other traffic, how much transit weaving occurs along the corridor, and the degree of built-in enforceability of the bus lane.</td>
<td>Operator Input, Physical Designs</td>
</tr>
<tr>
<td>Distribution of benefits/</td>
<td>Compares benefits, such as overall travel time savings, for transit-dependent groups (e.g. zero-car households and low-income households) to benefits for the general population.</td>
<td>Travel Demand Model</td>
</tr>
<tr>
<td>Transit Equity Analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attract/retain transit riders</td>
<td>Measures the change in the number of transit trips on Geary routes to determine how well transit alternative serve existing and potential new riders.</td>
<td>Travel Demand Model</td>
</tr>
</tbody>
</table>

Methodology

The travel modeling process described at the beginning of Chapter 5 provided the bulk of the transit performance results. The VISSIM modeling simulated travel times and speeds.
for both transit vehicles and autos. SF-CHAMP modeling estimated ridership for each alternative, and evaluated how changes in transit performance would benefit different groups of travelers (the equity analysis). Finally, to assess criteria not easily modeled, focus groups were used.

For the purposes of the transit performance analysis, no distinction was made between the two Center BRT designs (Alternative 4 with two side medians and Alternative 5 with a single center median) because for the most part they are expected to perform identically. The models measure the transit performance improvements that would result from an exclusive, physically-separated center transit lane, regardless of where the platforms are located.

In addition, for some criteria Basic Plus (Alt. 2) results are the same as Side BRT (Alt. 3) results because most of the analysis presented here is for the PM peak period when both alternatives would provide a dedicated outside lane for transit in the westbound direction. At most other times of day and in the eastbound direction during the PM peak, Basic Plus would perform like the baseline.

Findings

Transit Travel Times

Figure 5-3 shows the expected average total travel time from Gough to 33rd in the PM peak period for the 38-Local, the 38L-Limited/BRT (the BRT service would replace the 38-Limited service in the three BRT alternatives, Alts. 3-5), and autos under each of the alternatives. In all cases westbound travel would be faster for all types of vehicles because signals have been optimized for the direction of peak demand. In the morning period, these results would be reversed. Complete VISSIM travel time and speed results are included as Appendix X.

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7 This assumes that a passing lane option is developed for Center BRT with 1 median (Alt. 5). If skip stop service were to be adopted, these results could vary, as skip stop would operate differently than the service modeled.
Figure 5-3  Average Transit and Auto Travel Times (Gough to 33rd), PM Peak

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Westbound Travel Time</th>
<th>Eastbound Travel Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Auto</td>
<td>38</td>
</tr>
<tr>
<td>Alt 1: Basic Transit Priority</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 min</td>
<td>32 min</td>
</tr>
<tr>
<td>Alt 2: Basic Plus</td>
<td></td>
<td>13 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25 min</td>
</tr>
<tr>
<td>Alt 3: Side BRT</td>
<td></td>
<td>13 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25 min</td>
</tr>
<tr>
<td>Alt 4: Center BRT with 2 medians</td>
<td></td>
<td>15 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>23 min</td>
</tr>
<tr>
<td>Alt 5: Center BRT with 1 median</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the PM Peak direction, all BRT alternatives are expected to improve transit travel time, without degrading auto travel times as shown in Figure 5-3. BRT service would replace Limited service, so it is assumed that all current Limited riders would ride the BRT service. The new BRT service is also expected to attract about one third of current Local riders who would be drawn to the improved service.

The Center BRT Alternatives (Alts. 4 & 5) are expected to result in the greatest improvement in end-to-end travel time for bus riders. Under the Center BRT alternatives, former 38L-Limited riders would save 8 minutes during the PM peak traveling westbound from Gough to 33rd Avenue, a 30% time savings. Local riders would save 9 minutes if they stayed on the Local bus (28% savings), and 14 minutes if they switched to BRT (44% savings). Eastbound time savings would be slightly more modest under the Center BRT alternatives, saving Local and Limited transit riders between 5-7 minutes if they stayed on the same service, and saving Local riders 12 minutes if they switched to BRT service. All these estimates are savings over the baseline 2015 travel times, not over current transit travel times.

The Side BRT alternative (Alt. 3) should also result in significant travel time savings for transit riders, though less than those achieved by Center BRT configurations because some buses would be slowed by parking or turning cars and by double parked vehicles. Westbound, both Local and Limited riders who remain on the same service should save

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8 Alt. 2 (Basic Plus) has travel times similar to Alt 1 (Basic Transit Priority), except in the peak period, peak direction when travel times are similar to Alt. 3 (Side BRT). This can be seen in the chart: Alt. 2 performs like Alt. 3 in the westbound direction (the peak direction), and like Alt. 1 in the eastbound direction.

9 Additional westbound travel time savings come from signal timing as discussed in the introduction to this section.
about 7 minutes in total travel time, a 20-25% savings from the baseline. Riders switching from Local to BRT service would save about 13 minutes. Eastbound, the Side BRT would perform identically to the Center BRT for the BRT service, saving former Limited passengers 5 minutes in travel time, and former Local riders 12 minutes. The 38-Local would be 25% faster than Local service in the baseline, saving passengers 8 minutes.\textsuperscript{10}

The Basic Plus alternative (Alt. 2) would have travel times similar to the baseline (Alt. 1), except in the peak period, peak direction when travel times would be similar to the Side BRT alternative (Alt. 3). This assumes that a similar level of resources would be invested in traffic management (e.g., turn pockets and signal timing changes) for the Basic Plus as are planned for the Side BRT alternative. A comparison of travel time savings for both the eastbound and the westbound PM peak are illustrated in Figure 5-4 and Figure 5-5.

Beyond travel time savings for each bus, it can also be illustrative to compare total aggregate hours saved by transit riders every day on the different alternatives.\textsuperscript{11} Whereas the Basic Plus alternative (Alt. 2) is expected to save passengers 2,200 hours per day, the Side BRT alternative (Alt. 3) would save more than twice that, about 4,800 hours, and the Center BRT Alternatives (Alts. 4 & 5) would save two and a half times more, about 5500 hours.

These travel time savings are consistent with the improvements experienced by other full-featured BRT systems in the United States which have reduced travel times anywhere from 11 to 35%\textsuperscript{12}.

\textsuperscript{10} Since these models were run, the signal priority and signal timing for the side alternative have been modified to improve the travel time savings. If the project continues into the next phase of work, we will continue to refine and improve the transit travel time savings for both side and center alternatives.

\textsuperscript{11} Total aggregate hours saved by transit riders is calculated by multiplying the average trip length for riders on Geary (from the Geary on-board survey), by the travel time savings per rider, by the average number of riders in a day.

\textsuperscript{12} FTA Exhibit 3-9
Figure 5-4  Average Transit Travel Time (Gough to 33rd), 2015
Westbound PM Peak

<table>
<thead>
<tr>
<th>Alternative</th>
<th>38-Local Travel Time (Change from Alt. 1)</th>
<th>38L / BRT Travel Time (Change from Alt. 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt 1: Basic Transit Priority</td>
<td>32 min</td>
<td>26 min</td>
</tr>
<tr>
<td>Alt 2: Basic Plus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alt 3: Side BRT</td>
<td>25 min (22% less)</td>
<td>19 min (27% less)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alt 4: Center BRT with 2 medians</td>
<td>23 min (28% less)</td>
<td>18 min (31% less)</td>
</tr>
<tr>
<td>Alt 5: Center BRT with 1 median</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 5-5  Average Transit Travel Time, (Gough to 33rd), 2015
Eastbound PM Peak

<table>
<thead>
<tr>
<th>Alternative</th>
<th>38-Local Travel Time (Change from Alt. 1)</th>
<th>38L / BRT Travel Time (Change from Alt. 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt 1: Basic Transit Priority</td>
<td>32 min</td>
<td>25 min</td>
</tr>
<tr>
<td>Alt 2: Basic Plus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alt 3: Side BRT</td>
<td>24 min (25% less)</td>
<td>20 min (20% less)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alt 4: Center BRT with 2 medians</td>
<td>25 min</td>
<td>20 min</td>
</tr>
<tr>
<td>Alt 5: Center BRT 1 median</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Transit Travel Time compared to Auto Travel Time

One of the primary issues identified in the Needs Assessment was the need to better balance different modes in the Geary corridor, specifically by bringing transit operating conditions closer to the high quality of auto operating conditions. It is particularly important
to minimize the difference between auto and transit in-vehicle travel times considering the additional parts of a transit trip (walking to the station and waiting for the bus and then exiting the bus and walking to the final destination).

Figure 5-6 compares in-vehicle travel times for autos and buses for each of the alternatives. Under baseline conditions (Alt. 1), riding a bus from Gough to 33rd Avenue in the PM peak is expected to take twice as long as driving. Even Limited service is expected to take almost 75% longer than driving. While some difference between driving time and transit time is to be expected since buses need to pick up and drop off passengers, the magnitude of this difference discourages riders from taking transit. Furthermore, actual travel time for transit users can be longer than shown here when adding factors such as time spent accessing the transit stop and waiting for the bus to this comparison.

All of the BRT alternatives would reduce the difference in travel time between driving and taking transit over the full course of the day. The Center BRT alternatives (Alt. 4 & 5) would reduce the gap the most, due primarily to the higher quality separation between transit vehicles and auto movements. BRT buses traveling between Gough and 33rd Avenue in a Center BRT lane would take only 3 minutes longer than driving the same distance. Local service is also substantially improved, with travel on the local bus taking about 50% longer than driving.

**Figure 5-6 Average Auto and Transit Travel Time (Gough to 33rd), Westbound PM Peak**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Auto Travel Time</th>
<th>38-Local Travel Time (Comparison to Auto)</th>
<th>38L / BRT Travel Time (Comparison to Auto)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt 1: Basic Transit Priority</td>
<td>15 min</td>
<td>32 min (113% slower)</td>
<td>26 min (73% slower)</td>
</tr>
<tr>
<td>Alt 2: Basic Plus</td>
<td>13 min</td>
<td>25 min (92% slower)</td>
<td>19 min (46% slower)</td>
</tr>
<tr>
<td>Alt 3: Side BRT</td>
<td>13 min</td>
<td>25 min (92% slower)</td>
<td>19 min (46% slower)</td>
</tr>
<tr>
<td>Alt 4: Center BRT with 2 medians</td>
<td>15 min</td>
<td>23 min (53% slower)</td>
<td>18 min (20% slower)</td>
</tr>
<tr>
<td>Alt 5: Center BRT with 1 median</td>
<td>15 min</td>
<td>23 min (53% slower)</td>
<td>18 min (20% slower)</td>
</tr>
</tbody>
</table>

**Service Reliability**

While speeding up transit service is important, improving reliability and consistency of service can be even more important to transit riders. Passengers are often far more sensitive to wait times than to in-vehicle travel times, especially when real-time transit
arrival information is not available. In other words, time spent waiting for the bus “feels longer” to the passenger than the same amount of time spent on the vehicle. Consistency and predictability are key factors in improving the customer experience and increasing transit ridership on Geary.

All BRT designs (Alts. 3-5) are expected to improve transit reliability by reducing conflicts with mixed traffic and streamlining passenger loading and unloading. A dedicated lane would allow buses to maintain consistent headways, avoiding bunching or long gaps in service. The Center BRT alternatives (Alts. 4 & 5) would provide the most dramatic improvement because conflicts with cars would be completely eliminated by the exclusive bus lanes that are not permeable to mixed traffic. The Side BRT alternative (Alt. 3) would improve reliability slightly less because parking, turning and double-parked vehicles would continue to slow some buses down, causing gaps in service. In addition, waiting time for the BRT service in all three BRT alternatives could be reduced because the re-investment of travel time savings would allow for more frequent headways. The amount of time buses spend at platforms would also be more consistent due to multi-door boarding and a proof-of-payment system where passengers pay on the platform before boarding.

The Basic Plus alternative (Alt. 2) is expected to be subject to the same delays as the baseline most of the time, and to have similar reliability improvements as Side BRT (Alt. 3) during peak periods, when the dedicated bus lane is in effect. More research will need to be conducted to determine if the lack of clearly identifiable markings for the dedicated lane in the Basic Plus alternative along with changing regulations by time of day would impact driver compliance and thus reduce reliability improvements for this alternative.

A summary of the expected change in service reliability from Alternative 1 for each alternative is provided in Figure 5-7. It should be noted that transit service reliability under Alternative 1 is likely to be worse than current conditions, as increased auto volumes will likely increase conflicts between cars and transit vehicles on Geary.

13 For the purposes of this stage of modeling, the travel time savings were split evenly between more frequent service and longer service hours. In future stages of study, Muni will develop a more sophisticated model to determine precisely how much additional service could be offered.

14 Source: SF CHAMP Travel Demand Model, San Francisco County Transportation Authority.
Figure 5-7 Service Reliability

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Service Reliability (Comparison to Alternative 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt. 1: Basic Transit Priority</td>
<td>Potentially worse than today because of increased auto traffic</td>
</tr>
<tr>
<td>Alt. 2: Basic Plus</td>
<td>• Better than Alt. 1 in peak direction, at peak hour</td>
</tr>
<tr>
<td></td>
<td>• Like Alt. 1 at all other times</td>
</tr>
<tr>
<td>Alt. 3: Side BRT</td>
<td>• Better reliability, but some conflicts with cars remain</td>
</tr>
<tr>
<td></td>
<td>• Streamlined passenger boarding; more consistency in time spent at platform</td>
</tr>
<tr>
<td>Alt 4: Center BRT with 2 medians</td>
<td>• Best reliability, eliminates all car-bus conflicts</td>
</tr>
<tr>
<td>Alt 5: Center BRT 1 median</td>
<td>• Streamlined passenger boarding; more consistency in time spent at platform</td>
</tr>
</tbody>
</table>

Ease of Operation

All BRT designs (Alts. 3-5) would significantly improve transit operating conditions over the baseline, making the route easier and safer for Muni operators to navigate. Overall the Center BRT alternatives (Alts. 4 & 5) would provide the greatest improvements.

All three BRT designs (Alts. 3-5) would eliminate the need for BRT buses to pull into and out of traffic at bus stops due to bus bulbs, which reduces weaving. The 38-Local buses would still have to weave into and out of the bus stop at Local-only stops in both the Side BRT alternative and in the Center BRT alternatives if Local service is run at the curb. If the Local service is run in the center busway, there would be a very small degree of weaving for both services to allow Limited buses to pass Local buses at Local-only stops.

The three BRT designs would also remove buses from mixed traffic for 80% of the length of the corridor. In baseline conditions (Alt. 1) buses would travel in mixed traffic for about 5 miles whereas in the BRT alternatives (Alt. 3-5) buses would travel in mixed traffic for only 1 mile from 33rd to 48th Avenues. However, the Side BRT alternative (Alt. 3) would not remove these conflicts with traffic entirely because of parking and right-turning vehicles crossing the bus lane, double-parked cars, and other cars that illegally use the bus lane. Center BRT alternatives (Alts. 4 & 5) would remove conflicts with mixed traffic completely between Van Ness to 33rd Avenue because the bus lane would be physically separated.

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15 This combines the existing dedicated lane east of Van Ness with 3.9 miles of new dedicated lanes from Van Ness to 33rd Avenue.
from mixed traffic. (If the local services were run at the curb in either of the Center BRT alternatives, they would be running in mixed traffic.)

Alternative 2 (Basic Plus) would not have all the improvements of Alternative 3. Therefore even in the peak period, peak direction, transit operations would not be improved as much as with Side BRT (Alt. 3). There would likely be a few targeted additional bus bulbs which would aid reliability, but they would not be applied corridor-wide as with the Side BRT alternative.

**Figure 5-8 Ease of Operation**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Ease of Operation (Comparison to Alternative 1)</th>
</tr>
</thead>
</table>
| Alt. 1: Basic Transit Priority | • Mixed traffic operations between 48th Avenue and Gough Street; dedicated lanes from Gough to Transbay Terminal  
• Bus weaves frequently to access stops |
| Alt. 2: Basic Plus | • Mixed traffic operations during off-peak  
• Bus weaves frequently to access stops, except at a few locations with bus bulbs |
| Alt. 3: Side BRT | • Dedicated lane, some conflicts remain  
• Less weaving |
| Alt 4: Center BRT with 2 medians | • Dedicated lane, physically separated  
• Minimal weaving |
| Alt 5: Center BRT with 1 median | |

**Distribution of Benefits/Transit Equity Analysis**

A number of steps in the planning process are intended to advance projects with an equitable distribution of benefits and impacts. Broad community and stakeholder participation as early as possible helps to ensure that concerns about design, benefits and impacts of potential projects, as well as distribution of each, are addressed effectively in the design process.

The Geary corridor passes through a diverse set of neighborhoods ranging from very low income to high income. The proportion of households in the corridor who do not own cars also varies by location—from 81% in the Tenderloin and Downtown to 31% in the Outer Richmond. The following evaluation measure captures the degree to which low-income households and households without a car benefit from BRT on Geary relative to other households.

The SF-CHAMP model can calculate transportation outcomes for different groups of people, such as low-income and zero-car households, or transit-dependent households. To
measure the equity of BRT investment on Geary, the Study Team measured the share of project benefits that would accrue to low-income households and transit-dependent households, as well as the share of households that are not low-income and those that have access to a car. An equitable project is one that benefits these populations proportionately.

Figure 5-9 below estimates how benefits from a potential BRT project on Geary accrue to each of the populations described above.

**Figure 5-9 Share of Total Travel Time Savings for Households**¹⁶

<table>
<thead>
<tr>
<th></th>
<th>Zero-Car Households</th>
<th>Households with 1+ cars</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Citywide Proportion</strong></td>
<td>20%</td>
<td>80%</td>
</tr>
<tr>
<td>Alt 3: Side BRT</td>
<td>16%</td>
<td>84%</td>
</tr>
<tr>
<td>Alt 4: Center BRT with 2 medians</td>
<td>29%</td>
<td>71%</td>
</tr>
<tr>
<td>Alt 5: Center BRT with 1 median</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Attract and Retain Transit Riders**

The following describes expected changes in ridership on all Geary buses (i.e. all 38-line buses) for the alternatives. Transit ridership in 2015 is expected to increase over current ridership for all alternatives (Alts. 1-5). In the baseline 2015 conditions (Alt. 1), transit ridership in the Geary corridor is estimated to increase by about 4% over today’s ridership.¹⁷ All the BRT Alternatives (Alts. 3-5) are expected to increase ridership significantly over these baseline projections (Alt. 1) with the Center BRT designs (Alts. 4 & 5) attracting the most riders, nearly doubling ridership in some scenarios. This is because a faster, more reliable and more comfortable service is quite desirable. The BRT services are expected to not only improve service for those who currently ride the 38L-Limited, but also attract 38-Local riders and riders from other routes who are willing to walk a bit farther to access better service.

On average, within the peak periods, the Basic Plus alternative (Alt. 2) is expected to attract about 5% more riders than the baseline in 2015 (Alt. 1). The Side BRT alternative is expected to attract 15% more riders than the baseline, and the Center BRT alternatives (Alts. 4 & 5) should attract 25% more riders than the baseline.

¹⁶ The Study Team could not complete a full equity analysis for the Basic Plus alternative (Alt. 2) due to the timing of this Study. More detail could be developed in a later phase of analysis.

¹⁷ This is slightly lower than the system-wide increase of 5%. This increase does not keep pace with the growing number of trips in the corridor.
Though BRT alternatives are expected to increase overall ridership, the increase does not come from equal increases in ridership for Local and Limited service. BRT is expected to shift ridership significantly from the slower local service to the faster BRT service. Under the Center BRT alternatives (Alts. 4 & 5), ridership on the BRT bus is expected to nearly double current limited ridership (96% more riders), while the 38-Local is expected to lose riders. Similarly, under the Side BRT alternatives, the BRT service is expected to increase ridership by about 80% compared to current limited ridership. As travel time savings attracts more riders to the BRT service, the balance between local and BRT services should be revised to better match ridership. In addition, re-investment of travel time savings could allow for increases in BRT service.

The ridership gains for the Center BRT alternatives assume that both the Local and the BRT buses operate in the center busway. However, currently there is only a viable passing lane design for the Center BRT alternative with 2 medians (Alt. 4), not for the Center BRT with 1 median (Alt. 5), as described in Chapter 4. In the event that another service plan is adopted for these Center alternatives, transit ridership gains are likely to be somewhat diminished, but to still be higher than for any other alternative. If the local bus remains at the curb or if a skip stop service is adopted, transit ridership gains are only 20%, rather than 25%.
Figure 5-10  2015 Transit Ridership

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Estimated Average Daily Transit Ridership (all Geary services) Growth from Alternative 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt. 1: Basic Transit Priority</td>
<td>51,200 riders (4% increase from today)</td>
</tr>
<tr>
<td>Alt. 2: Basic Plus</td>
<td>5% more</td>
</tr>
<tr>
<td>Alt. 3: Side BRT</td>
<td>15% more</td>
</tr>
<tr>
<td>Alt 4: Center BRT with 2 medians</td>
<td></td>
</tr>
<tr>
<td>Alt 5: Center BRT with 1 median</td>
<td>25% more</td>
</tr>
</tbody>
</table>

According to the model, between 2,000 and 3,400 new transit riders would ride the Geary buses every weekday under the BRT alternatives (Alts. 3-5). These new riders would primarily be existing Muni riders who are seeking better service, e.g. riders on other routes who choose BRT services instead of their current route. This is because those existing riders perceive a benefit from BRT service and are willing to walk farther to receive shorter travel times and more reliable service. It could also include some people who were previously walking or driving. Increased ridership means more potential customers for local businesses.

Ridership estimates for the BRT alternatives may be conservative, because other BRT implementations in the U.S. have found that more people shift from driving.

Community Feedback

At public workshops hosted by the Authority in November 2006, participants were asked to express their views on Geary BRT. A wide range of comments were received—from those expressing support of BRT, to those concerned with the magnitude of impacts from the dedicated lane, to those seeking additional analysis to understand both benefits and impacts. A complete summary of workshop results is included in Appendix XX.

For the most part public comments supported improvements that resulted in more reliable service on Geary. In a survey of approximately 1200 transit riders along Geary, the highest priority transit investments included real-time information, expanded hours of

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18 The Authority conducted a survey of transit riders at bus stops along the length of Geary over a three-week period in summer 2006. More details can be found in Appendix XX.
service, and the dedicated lane. The increased speed, reliability and comfort offered by BRT were attractive to community members and stakeholders.

Some members of the public feel that estimates of reduced travel time may not be significant enough to warrant the impacts to auto operations, changes to parking availability, and diversions from Geary to parallel streets. Some members of the public support Basic Plus (Alt 2) because its impacts are limited to commuting trips during the peak hour and in peak direction. Others indicated that more permanent transit improvements would encourage them to use BRT for non-work travel. While some respondents and workshop participants felt that BRT would be more efficient and offer an improvement on current conditions, others look for more detailed analysis of impacts in an environmental analysis.

**Key Conclusions**

BRT would improve transit performance for every sub-criteria in this category, with the Center BRT alternatives (Alts. 4 & 5) offering the greatest improvement over the baseline. The physically separated transit-only lane of the Center BRT designs would offer the greatest transit travel time savings, reliability improvements, and ease of operations, which in turn would lead to the highest ridership gains because people are willing to walk farther to receive shorter travel times and more reliable service. Side BRT (Alt. 3) would also improve transit conditions considerably over the baseline, but the improvements would be somewhat diminished because the transit lane is permeable to mixed traffic and thus some conflicts would still occur which effect reliability, travel time, and rider satisfaction. The Basic Plus Alternative (Alt. 2), would deliver benefits similar to Side BRT when the dedicated lane is in effect (eastbound in the AM peak period, westbound in the PM peak period).
Figure 5-11  Summary of Transit Performance Results

<table>
<thead>
<tr>
<th></th>
<th>Transit Travel Times Westbound PM Peak (Limited to BRT service)</th>
<th>Service Reliability</th>
<th>Ease of Operation</th>
<th>Attract and Retain Transit Riders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt 1: Basic Transit Priority</td>
<td>26 min</td>
<td>Potentially worse than today</td>
<td>Potentially worse than today</td>
<td>51,200 riders</td>
</tr>
<tr>
<td>Alt 2: Basic Plus</td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
</tr>
<tr>
<td>Alt 3: Side BRT</td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
</tr>
<tr>
<td>Alt 4: Center BRT with 2 medians</td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
</tr>
<tr>
<td>Alt 5: Center BRT with 1 median</td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
</tr>
</tbody>
</table>
5.4 Transit Rider Experience

Purpose

Maintaining robust and stable transit ridership is the first goal of the Geary BRT project. Ensuring a positive experience for users of the system is critical, both for retaining existing riders, as well as attracting new ones. Transit rider experience is measured by quality of the waiting and boarding experience; quality of the in-vehicle experience; wayfinding ability; and safety and security of waiting riders.

Another goal of the Geary BRT project is system development of a transit priority network. Achieving this goal involves enhancing transit on Geary, while simultaneously helping achieve citywide goals of developing a high-quality, rapid transit system with a sense of permanence. The ability of each alternative to provide a unique “brand” or identity for this crucial, highly-used transit route is also measured in this section as it will be integral to how transit riders experience riding the bus on Geary.

Figure 5-12 shows all the sub-criteria that measure transit rider experience. It provides a brief explanation/definition of each sub-criteria and the source of the data used for its evaluation.
Figure 5-12 Transit Rider Experience Criteria

**GOALS:**
* Robust and Stable Ridership
* Transit Priority Network System Development

<table>
<thead>
<tr>
<th>Sub-criteria</th>
<th>Methodology/Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of waiting and boarding experience</td>
<td>Captures how the different designs affect waiting time and waiting variability, platform width, and buffers between waiting passengers and auto traffic.</td>
<td>Physical Designs and Qualitative</td>
</tr>
<tr>
<td>Quality of in-vehicle experience</td>
<td>Captures the quality of the ride on transit from the passenger’s perspective, including how much buses weave and the distance buses travel in mixed traffic. The travel demand model forecasts average bus loads, which will help to predict crowding on buses.19</td>
<td>Physical Designs and Travel Demand Model</td>
</tr>
<tr>
<td>Wayfinding ability</td>
<td>Captures how visible and legible transit routes and information would be to riders by assessing passenger comprehension of the system, e.g. can passengers easily find bus stops and transfer between bus stops, and the ease of transferring from Geary to other routes (including vertical circulation).</td>
<td>Physical Designs and Qualitative</td>
</tr>
<tr>
<td>Security of waiting riders</td>
<td>Captures level of perceived safety and security for waiting riders, including visibility of waiting passengers to other passengers and to people in nearby buildings.</td>
<td>Qualitative</td>
</tr>
<tr>
<td>BRT transit route branding / identity</td>
<td>Measures the ability of a design to be recognized by the general public as a high-quality and rapid service, includes opportunities for distinctive design treatments, establishment of consistent design themes, and raising the visibility of transit service.</td>
<td>Qualitative</td>
</tr>
</tbody>
</table>

**Methodology**

Unlike a number of other evaluation criteria, transit rider experience is measured both qualitatively and quantitatively, because it is measuring, in part, the way the environment would make riders “feel”.

Branding, marketing, the quality of the station platform amenities, and security are qualitatively assessed. The systematic qualitative analysis and ranking system required coordination across a multi-agency team and was continually refined as the Study progressed. It will continue to be enhanced and further refined in future stages of the Study.

Conceptual engineering drawings provided more quantitative information about bus weaving, platform capacity, and the buffers between cars and waiting passengers. The SF-CHAMP model provided information on bus crowding. The full matrices for Transit Rider Experience are presented in Appendix X.

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19 Travel time and reliability are also an important part of the in-vehicle passenger experience; however these are described in great detail in the prior section. Please refer to Section 5.3 for more information on these criteria.
There are some design features which are consistent across all BRT designs (Alts. 3, 4, & 5) which would improve transit rider experience and thus all BRT alternatives can be described together. However, in many cases, the unique aspects of each of the three BRT conceptual design alternatives would result in variations in the transit rider experience and are described separately. While Basic Plus (Alt. 2) and Side BRT (Alt 3) perform similarly under other evaluation criteria, they are analyzed separately for transit rider experience because the station area investments made for Side BRT (Alt. 3) would not be made for Basic Plus (Alt. 2).

Findings

Quality of Waiting and Boarding Experience

A passenger’s experience waiting for and boarding the bus is affected by multiple factors: the quality, width, safety, and cleanliness of the station platform, the separation between passengers on the platform and moving traffic, as well as how often the bus comes and whether it arrives on time. In baseline 2015 conditions (Alt. 1) Muni bus stops would not change physically from today (standard shelters and a 6-foot or smaller passenger waiting area), but passenger waiting and boarding would be improved somewhat as more real-time arrival information would be provided and low-floor buses would be introduced.

The three full-featured BRT designs (Alts. 3-5) would include all of the improvements above, plus many others that would improve passenger waiting and boarding considerably over baseline conditions. For some metrics all three BRT designs (Alts. 3-5) would perform equally, and for others, rider experience would vary between the three.

All BRT alternatives (Alts. 3-5) would include considerable investment in the station area, including amenities like increased seating, larger shelters, and comprehensive streetscape improvements, like consistent street plantings and curb extensions. (All of the features included in the Project Design Principles and Guidelines, described in Chapter 3, would be consistent through the corridor for all three BRT alternatives.) All three BRT designs (Alts. 3-5) would provide considerable improvements in transit service reliability by providing an all-day dedicated transit lane. Side BRT (Alt. 3) would improve reliability somewhat less than Center BRT alternatives (Alt. 4 & 5) due to some remaining conflicts between transit vehicles mixed traffic, as described in Section 5.3: Transit Performance. Average passenger wait times would be reduced under all three BRT alternatives both because of reliability improvements and increased service frequency resulting from re-investment of travel time savings.\(^{20}\)

Side BRT (Alt. 3) and Center BRT with 1 median (Alt. 5) would provide the best passenger waiting experience with wide BRT station platforms (Alt. 3: 20 ft. bus bulb/sidewalk, Alt. 5: 14 ft. platform) and a 13-foot bus lane that would act as a buffer between passengers and auto traffic. The Center BRT alternative with 2 medians (Alt. 4) would have 9.5-foot platforms and would provide no buffer from auto traffic because the platform would be directly adjacent to traffic lanes on one side. However, there are design treatments that could be

\(^{20}\) For the purposes of this stage of modeling, the travel time savings were reinvested to offer more frequent service and longer service hours. In future stages of study, Muni will develop a more sophisticated operating cost model to determine precisely how much additional service could be offered.
used to lessen the impact of waiting adjacent to traffic. For example, a platform-long buffer can be installed to act as a buffer or shelter design can help shield passengers from the adjacent traffic lane.

Station conditions in the Basic Plus Alternative (Alt. 2) would be similar to the baseline (standard shelters and passenger waiting area of 6-feet or less) except at a few locations with bus bulbs or longer bus zones. In the peak period, peak direction, the Basic Plus alternative is expected to experience the same reliability improvements as the Side BRT.21

A comparison of alternatives for quality of waiting and boarding experience is provided in Figure 5-13 below.

### Figure 5-13 Waiting and Boarding Experience

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Description of Waiting and Boarding Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt. 1: Basic Transit Priority</td>
<td>• Some real time information, new low-floor buses</td>
</tr>
<tr>
<td></td>
<td>• Standard Muni bus shelters</td>
</tr>
<tr>
<td>Alt. 2: Basic Plus</td>
<td>• Improved reliability (peak period &amp; direction)</td>
</tr>
<tr>
<td></td>
<td>• Some real time information, new low-floor buses</td>
</tr>
<tr>
<td></td>
<td>• Standard Muni bus shelters</td>
</tr>
<tr>
<td>Alt. 3: Side BRT</td>
<td>• 20ft. BRT bus bulb/sidewalk and 12 ft. local platforms, bus lane buffers from traffic</td>
</tr>
<tr>
<td></td>
<td>• High-quality bus shelters with full amenities</td>
</tr>
<tr>
<td></td>
<td>• Improved reliability (some conflicts remain)</td>
</tr>
<tr>
<td></td>
<td>• Real time information, new low-floor buses</td>
</tr>
<tr>
<td>Alt. 4: Center BRT with 2 medians</td>
<td>• Two 9.5 ft. station platforms, small buffer from traffic</td>
</tr>
<tr>
<td></td>
<td>• High-quality bus shelters with full amenities</td>
</tr>
<tr>
<td></td>
<td>• Improved reliability</td>
</tr>
<tr>
<td></td>
<td>• Real time information, new low-floor buses</td>
</tr>
<tr>
<td>Alt. 5: Center BRT with 1 median</td>
<td>• Single 14 ft. platform (widest), bus lanes buffer traffic</td>
</tr>
<tr>
<td></td>
<td>• High-quality bus shelters with full amenities</td>
</tr>
<tr>
<td></td>
<td>• Improved reliability</td>
</tr>
<tr>
<td></td>
<td>• Real time information, new low-floor buses</td>
</tr>
</tbody>
</table>

### Quality of In-Vehicle Experience

The quality of the in-vehicle riding experience is a function of the smoothness of the ride and crowding on the buses. Passengers are especially sensitive to the “side to side” motion required to weave buses from the traffic lane to the curb for stops and then back into traffic. While all of the BRT alternatives would perform better than the baseline, due to their dedicated transit lane, the Center BRT alternatives (Alts. 4 & 5) would provide the best in-

---

21 It is difficult to determine whether the lack of colored pavement to clearly identify the dedicated lane in the Basic Plus alternative along with changing regulations by time of day will impact driver compliance and reduce reliability improvements for this alternative.
vehicle experience because they would operate completely separate from mixed traffic and would require minimal weaving along the corridor (some weaving to accommodate passing), allowing for a smoother, straighter passenger ride. The Side BRT alternative (Alt. 3) is expected to involve some conflicts with mixed traffic and more weaving motions than the Center BRT alternatives due to parking and right-turning vehicles crossing the bus lane, and the possibility of double-parked vehicles and other bus-lane violations, all of which is less comfortable for passengers.

Basic Plus (Alt. 2) would perform about the same as the Side BRT in the peak period, peak direction, and the same as the baseline alternative at all other times. It is possible that more bus-lane violations would take place due to the lack of pavement markings and the changing regulations by time of day.

BRT improvements are expected to attract more riders; passenger loads would likely be equal to or greater than current loads. However, the elimination of “bunching” and “service gaps” gained through improved reliability as well as higher frequency from reinvestment of travel time savings, as well as all-door boarding with proof of payment (POP), should result in more evenly distributed passenger loads than in the baseline alternative. In addition, more comfortable buses should improve the experience of riding on full buses. A description of relative benefits for quality of in-vehicle experience is provided in Figure 5-14 below.
Figure 5-14  Quality of In-vehicle experience

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Description of In-vehicle Experience Comparison to Alternative 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt. 1: Basic Transit Priority</td>
<td>• Buses weave frequently to access stops</td>
</tr>
<tr>
<td></td>
<td>• Mixed traffic operations (except for bus-only lane from Van Ness Ave. to Transbay Terminal)</td>
</tr>
<tr>
<td>Alt. 2: Basic Plus</td>
<td>• Additional bus bulbs will reduce weaving somewhat during peak hour in peak direction</td>
</tr>
<tr>
<td>Alt. 3: Side BRT</td>
<td>• Much smoother ride, some mixed traffic conflicts remain</td>
</tr>
<tr>
<td>Alt. 4: Center BRT with 2 medians</td>
<td>• Much smoother ride, some weaving to allow BRT buses to pass local buses</td>
</tr>
<tr>
<td>Alt. 5: Center BRT with 1 Median</td>
<td>• Smoothest, straightest ride²²</td>
</tr>
</tbody>
</table>

Wayfinding ability

All BRT alternatives (Alts. 3-5) would provide additional signage to improve general transit wayfinding and the transfer experience in particular. Wayfinding would be simplified in Center BRT alternative with 1 median (Alt. 5) because the same platform is used for travel in both directions. In either of the Center BRT alternatives, if all services were run in the busway, BRT stops would be distinguished from local stops by longer stop zones and enhanced transit amenities.²³ If local service were run at the curb, it would be even easier to distinguish between services, but could be frustrating for some passengers who would be forced to choose whether to wait for Local buses at the curb or BRT buses on the center platform. In the Side BRT alternative (Alt. 3) BRT stops should be easy to distinguish from local stops by bus bulbs and other design treatments.

All of the side running alternatives, including the baseline, Basic Plus (Alt. 2) and the Side BRT (Alt. 3) would have the advantage of offering stop locations that could be designed to minimize the walk distance for transfers. For example, at the corner of Geary and Divisadero, the most common transfer direction would be from eastbound Geary buses to southbound Divisadero buses. Geary buses traveling eastbound currently stop on the nearside of the intersection to allow for a combined corner stop

²² Some weaving could occur once a passing lane is developed, likely the same degree of weaving as Alternative 4. More work can be done in the next phase of study to evaluate these impacts.
²³ Currently there is only a viable passing lane design for the Center BRT alternative with 2 medians (Alt. 4), not for the Center BRT with 1 median (Alt. 5). The Study Team is optimistic that a passing lane option can be developed for the Center BRT alternative with 1 median (Alt. 5) in the next stage of this Study.
with the 24-Divisadero; passengers simply have to get off the Geary bus and walk a few feet around the corner to get on the Divisadero bus. Center BRT alternatives (Alts. 4 & 5) would require riders to cross from the center lane to the curb to transfer to bus routes that cross Geary.

Wayfinding is simplified when the visibility of transit services can be maximized and when passengers can be confident that the service operates the same way all day and every day of service. Alternative 2 would have the added complexity of operating differently at different times of day, which could be difficult for users of all modes to understand.
### Figure 5-15 Wayfinding Ability

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Description of Wayfinding Comparison to Alternative 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt. 1: Basic Transit Priority</td>
<td>• Minimal wayfinding information&lt;br&gt;• Can locate stops to minimize walking distance for dominant transfer</td>
</tr>
<tr>
<td>Alt. 2: Basic Plus</td>
<td>• Existing wayfinding information&lt;br&gt;• Can locate stops to minimize walking distance for dominant transfer</td>
</tr>
<tr>
<td>Alt. 3: Side BRT</td>
<td>• Additional signage&lt;br&gt;• Can locate stops to minimize walking distance for dominant transfer&lt;br&gt;• Easy to distinguish between services</td>
</tr>
<tr>
<td>Alt. 4: Center BRT with 2 medians</td>
<td>• Additional signage&lt;br&gt;• Easy to distinguish between services</td>
</tr>
<tr>
<td>Alt. 5: Center BRT with 1 median</td>
<td>• Additional signage&lt;br&gt;• Easy to distinguish between services&lt;br&gt;• Simple, consistent due to 1 platform</td>
</tr>
</tbody>
</table>

### Sense of Security for Waiting Riders

Riders in all alternatives (1-5) would benefit from informal surveillance by other riders, which could be enhanced in BRT designs (Alts. 3-5) by increased ridership and extended BRT service hours. The security of waiting riders would also be improved in all BRT designs (Alts. 3-5) by station features such as closed-caption TV monitoring, better lighting, and enforced station-area proof-of-payment zones.

Passenger activity on the platform would be highest in the Center BRT alternative with 1 median (Alt. 5) because passengers traveling in both directions would wait on the same station platform. Increased ridership and more “eyes on the platform” would naturally enhance security. However, both Center BRT alternatives (Alts. 4 & 5) would have somewhat reduced natural surveillance from adjacent land uses due to roadway and parking separation.

Passenger’s sense of safety in the Side BRT and Center BRT alternative with 1 median (Alts. 3 & 5) could be better due to the transit lane buffer from moving traffic.

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24 In the Center BRT alternative with 1 median (Alt. 5), the combined platform for both directions of travel would require service in one direction to have nearside stops which would limit the effectiveness of TSP. The inconsistency can be addressed in the next phase of study.
Figure 5-16  Passenger Sense of Security

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Passenger Sense of Security Comparison to Alternative 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt. 1: Basic Transit Priority</td>
<td>High visibility from adjacent land uses and passenger activity at the bus stop</td>
</tr>
<tr>
<td>Alt. 2: Basic Plus</td>
<td>- High visibility from adjacent land uses and passenger activity at the bus stop</td>
</tr>
<tr>
<td>Alt. 3: Side BRT</td>
<td>- Enhanced station safety (e.g. lighting)</td>
</tr>
<tr>
<td></td>
<td>- Close visibility from adjacent land uses and passenger activity at the bus stop</td>
</tr>
<tr>
<td>Alt. 4: Center BRT with 2 medians</td>
<td>- Enhanced station safety (e.g. lighting)</td>
</tr>
<tr>
<td></td>
<td>- Reduced visibility from adjacent land uses</td>
</tr>
<tr>
<td></td>
<td>- Sense of security from passenger activity at the bus stop</td>
</tr>
<tr>
<td>Alt. 5: Center BRT with 1 median</td>
<td>- Enhanced station safety (e.g. lighting)</td>
</tr>
<tr>
<td></td>
<td>- Highest passenger activity</td>
</tr>
<tr>
<td></td>
<td>- Reduced surveillance from adjacent land uses</td>
</tr>
</tbody>
</table>

**BRT Transit Route Branding/Identity**

This criterion measures the ability of a design to be recognized by the general public as a high-quality and rapid service.

All three BRT alternatives (Alts. 3-5) would feature colored transit lanes to discourage mixed traffic which would also brand bus rapid transit services as something unique. However, the visual distinction of Side BRT (Alt. 3) would be less obvious than the Center BRT alternatives because cars could cross the bus lane to turn right or park. Moreover, because bus bulbs would extend the sidewalk in Side BRT, they could be identified with the sidewalk environment rather than the distinctive BRT transit service. Basic Plus would not have a colored lane and therefore would operate like the baseline in terms of BRT transit route branding.

Center BRT alternatives (Alts. 4 & 5) would provide the best branding opportunity and strongest identity for BRT because the bus lanes would be physically separated from auto lanes, reinforcing their identity as Rapid Transit. The location of station platforms in the center of the roadway would offer the opportunity to build signature stations designed to advertise the BRT service, with infrastructure dedicated exclusively to transit.
Figure 5-17  BRT Identity

<table>
<thead>
<tr>
<th>Alternative</th>
<th>BRT Identity Comparison to Alternative 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt. 1: Basic Transit Priority</td>
<td>No distinction: perceived like any other Muni route</td>
</tr>
<tr>
<td>Alt. 2: Basic Plus</td>
<td>No change</td>
</tr>
<tr>
<td>Alt. 3: Side BRT</td>
<td>• Colored pavement creates stronger identity</td>
</tr>
<tr>
<td>Alt. 4: Center BRT with 2 medians</td>
<td>• Separate rapid transit infrastructure</td>
</tr>
<tr>
<td>Alt. 5: Center BRT with 1 median</td>
<td>• Prominent, visible stations</td>
</tr>
<tr>
<td></td>
<td>• Ample branding opportunities</td>
</tr>
<tr>
<td></td>
<td>• Colored pavement</td>
</tr>
</tbody>
</table>

Community Feedback

Many community stakeholders were pleased to see that features of the potential BRT project would include real-time information, better lighting at stations, consistent signage, and more comfortable shelters that also protect from wind and rain. Implementation of real-time information, e.g. NextMuni, was a high priority improvement for transit improvements on Geary, and systemwide. Participants were also interested in the prospect of low-floor vehicles that would allow faster and easier boarding and departure. Seniors were especially supportive of the new vehicles, stating that they would allow more comfortable use of buses.

A few residents suggested that stations further incorporate security and safety features, such as security cameras, emergency call boxes, and non-slip materials on walking areas. Safety and security of the Fillmore and Masonic underpasses was also discussed, and additional comments on alternatives at these locations are described in Section 5.10.

Most community members felt that BRT would reduce crowding on buses and provide a smoother, more comfortable ride. Comments also included suggestions to incorporate education for transit riders and motorists alike in order to ensure that design is easy to use and understand.

Key Conclusions

In every measure of transit rider experience, all of the project alternatives (Alts. 2-5) would offer a better experience than the baseline (Alt. 1). Center BRT with 1 median (Alt. 5) would perform the best overall because transit riders would have the widest platform, they would be buffered from traffic by bus lanes, and riders in both directions would share one platform which increases activity and therefore security. Both Center Alternatives (Alts. 4 & 5) rank high overall because they would provide the strongest opportunity for BRT branding and identity, and they would offer the greatest reliability improvements by providing a physically separated transit-only lane in the center of the street. Side BRT ranks highly in terms of
perceived security, primarily because of the natural surveillance of sidewalk activities and the opportunities for stops to be located to minimize the walk distance for the dominant transfer direction (e.g., at Geary & Divisadero). Basic Plus (Alt. 2) would improve conditions considerably less than the full-featured BRT alternatives because there would be fewer investments made to the station environment.

**Figure 5-18  Summary of Transit Rider Experience Results**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Quality Waiting/Boarding Experience</th>
<th>Quality In-vehicle Experience</th>
<th>Wayfinding Ability</th>
<th>Sense of Security</th>
<th>BRT Branding / Identity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt. 1: Basic Transit Priority</td>
<td>Real time info, new buses, but standard shelters</td>
<td>Frequent weaving, mixed traffic operations</td>
<td>Minimal wayfinding, some stops minimize transfer walk distance</td>
<td>Natural surveillance-adjacent land uses, no enhanced stations</td>
<td>Perceived like any other Muni route</td>
</tr>
<tr>
<td>Alt. 2: Basic Plus</td>
<td><img src="image1" alt="Graph" /></td>
<td><img src="image2" alt="Graph" /></td>
<td><img src="image3" alt="Graph" /></td>
<td><img src="image4" alt="Graph" /></td>
<td><img src="image5" alt="Graph" /></td>
</tr>
<tr>
<td>Alt. 3: Side BRT</td>
<td><img src="image6" alt="Graph" /></td>
<td><img src="image7" alt="Graph" /></td>
<td><img src="image8" alt="Graph" /></td>
<td><img src="image9" alt="Graph" /></td>
<td><img src="image10" alt="Graph" /></td>
</tr>
<tr>
<td>Alt. 4: Center BRT with 2 medians</td>
<td><img src="image11" alt="Graph" /></td>
<td><img src="image12" alt="Graph" /></td>
<td><img src="image13" alt="Graph" /></td>
<td><img src="image14" alt="Graph" /></td>
<td><img src="image15" alt="Graph" /></td>
</tr>
<tr>
<td>Alt. 5: Center BRT with 1 median</td>
<td><img src="image16" alt="Graph" /></td>
<td><img src="image17" alt="Graph" /></td>
<td><img src="image18" alt="Graph" /></td>
<td><img src="image19" alt="Graph" /></td>
<td><img src="image20" alt="Graph" /></td>
</tr>
</tbody>
</table>
5.5 Access and Pedestrian Amenities

Purpose

Improving pedestrian conditions and maximizing access and mobility throughout the corridor are among the top priorities for the BRT project; responding directly to the Needs Assessment and to community feedback. This category measures the benefits of each alternative to pedestrians, both when walking along the street (sidewalk conditions) and when crossing the street (crossing experience). It also measures the quality of bicycle access on Geary, including safety and comfort for bicyclists. Finally, it measures the increase in transit accessibility to jobs (i.e. how many more jobs opportunities are available to transit riders within 30 minutes from neighborhoods in the corridor). Figure 5-19 shows all the criteria for access and pedestrian amenities. It provides a brief explanation/definition of each and the source of the data used for its evaluation.

Figure 5-19  Access and Pedestrian Amenities Criteria

<table>
<thead>
<tr>
<th>GOALS:</th>
<th>Methodology/Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robust and</td>
<td>Measures safety and comfort for pedestrians crossing Geary</td>
<td>Physical Designs</td>
</tr>
<tr>
<td>Stable Ridership</td>
<td>Boulevard, e.g. average crossing distances, how many</td>
<td></td>
</tr>
<tr>
<td>Neighborhood</td>
<td>traffic lanes pedestrians must cross, and the width of</td>
<td></td>
</tr>
<tr>
<td>Livability</td>
<td>pedestrian islands.</td>
<td></td>
</tr>
<tr>
<td>and Commercial Vitality</td>
<td>Measures safety and comfort for pedestrians on the sidewalks, including sidewalk width and whether there are buffers between the sidewalk and moving traffic.</td>
<td>Physical Designs</td>
</tr>
<tr>
<td>Quality of bicycle access</td>
<td>Measures safety and comfort for bicyclists riding in the corridor, including the space available for bicyclists to navigate, i.e. average width of dedicated space for bicyclists, and whether curb extensions “pinch” this right travel lane.</td>
<td>Physical Designs</td>
</tr>
<tr>
<td>Increased employment and retail accessibility for neighborhoods</td>
<td>Captures the change in work opportunities accessible by transit for each alternative, measured by the change in the number of jobs reachable within a 30-minute transit trip.</td>
<td>Travel Demand Model</td>
</tr>
</tbody>
</table>

Methodology

The evaluation results for this category were primarily assessed through review of the conceptual physical design drawings prepared for each alternative. SF-CHAMP was used to estimate changes in accessibility to economic opportunities.
Findings

Crossing Experience

The crossing experience in both the baseline alternative (Alt. 1) and the Basic Plus alternative (Alt. 2) would be equivalent to current conditions, which are good in some areas, but poor in many other areas. The area from 15th Avenue to 28th Avenue is relatively pedestrian-friendly due to a vibrant commercial zone and diagonal parking; traffic is relatively calmed and pedestrians only have to cross 2 lanes of traffic in either direction. In other sections of the corridor however, crossing distances are very long, making it difficult for many pedestrians to safely get across the intersection in the time allotted. For example, east of Park Presidio pedestrians must cross 3 lanes of traffic plus a parking lane before reaching a refuge, and where there are left turn pockets pedestrians are forced to cross all 5-7 lanes of traffic plus 2 lanes of parking before reaching a refuge. In these locations the medians are so narrow that they hardly provide any refuge.

Pedestrians sometimes have to cross seven lanes of traffic between Arguello and Park Presidio and there is no usable median in many locations.

The design of BRT alternatives sought to bring more balance to the corridor, to replicate the features of the more pedestrian-friendly areas in the areas that are less pedestrian-friendly. The BRT alternatives would improve the pedestrian crossing experience by installing highly visible crosswalks, landscaped medians, a complete set of pedestrian countdown signals, corner curb extensions, and median caps (which provide a raised, mid-crosswalk pedestrian refuge), all illustrated below. The three BRT designs on average would reduce pedestrian crossing distances by 12 feet, more than the width of a travel lane, primarily through the addition of corner curb extensions into the parking lane (crossing distances would be reduced by 6 feet at intersections with local bus stops, at the few intersections with right turn pockets, and at intersections with left turns in Alternative 5).

25 Pedestrian crossing times will meet the City standard for crosswalks with medians, which is 3 feet per second.
The three BRT alternatives (Alts. 3-5) are designed to ensure that the majority of pedestrians could cross Geary in one signal cycle, through a combination of reduced crossing distances and improved signal timing for all travel modes. Pedestrian refuges are incorporated into all BRT designs so that those pedestrians who were unable to cross in one signal phase would have a safe refuge. Even in Side BRT (Alt. 3), which for the most part would leave medians as they are currently, features like median caps would be added to improve the pedestrian crossing experience.

Aside from these improvements common to all BRT alternatives, there are also ways in which the pedestrian crossing experience would vary by alternative. Foremost, the nature of the mid-street pedestrian islands provided in each alternative varies. The differences in median designs are illustrated in Figure 5-12 below.

Overall, the crossing experience is most improved in Center BRT with 2 platforms (Alt. 4), because the wide street would be broken into three manageable sections with safe refuges provided after crossing only two lanes of traffic (three lanes at the few intersections with right turn pockets). However, in this design the two 9.5-foot medians would be narrowed to 5 and 8 feet at local stops to allow BRT buses to pass local buses,\(^\text{26}\) and one median would be completely eliminated at the 12-13 intersections with left turn pockets. This would require that pedestrians cross five lanes of traffic between refuges at these locations. However, the Study Team offset left turns so that they would not occur for both directions of travel at one intersection. Therefore, at every intersection, the crosswalk on one side would

\(^{26}\) In the service plan where both BRT and Local services are run in the center busway.
always have full width medians and pedestrians would have the option to cross on the side with no left turn pocket.

In Center BRT with 1 median (Alt. 5), pedestrians would consistently have to cross 3 lanes of traffic to reach refuge (four lanes at the few right and left turn pockets), however, the ample 15-foot center median would be consistent at all intersections throughout the corridor. In the Side BRT (Alt. 3), pedestrians typically would have to cross three lanes of traffic (four at the few right and left turn pockets) to reach a refuge, and medians would typically be 15 feet wide, but would be reduced to 5 feet at the 27 intersections with left turns. As in Alternative 4, left turns would be offset so pedestrians would always have at least one side of the intersection where the wide median would be intact.

**Figure 5-20  Physical Designs for BRT Alternatives**

**Side BRT (Alternative 3)**

**Center BRT with 2 medians (Alternative 4)**
Center BRT with 1 median (Alternative 5)

Even considering these variations, all of the BRT designs would offer significant improvement over the baseline because the number of left turn pockets, which deteriorate crossing conditions, would be reduced. In this feasibility study, the Study Team proposed reducing the number of intersections that allow left turns between 33rd and Van Ness from 24 in either direction in the baseline (22-23 of which have left turn pockets) to 13-16 in each direction in the BRT alternatives (12-14 of which have left turn pockets). More detailed analysis is needed in the next phase of work to finalize these assumptions.

A comparison of crossing experience and sidewalk conditions (described below) in Alternatives 2-5 with crossing experience and sidewalk conditions in Alternative 1 is provided in Figure 5-21 below.

Sidewalk Conditions

All the BRT designs (Alts. 3-5) would improve sidewalk conditions on Geary Boulevard through pedestrian-scale street lighting and improved landscaping. Side BRT would also offer a wider sidewalk (20.5 feet) at bus bulbs (14 locations), and the bus lane would offer an increased buffer between pedestrians and moving auto traffic. Basic Plus (Alt. 2) would not offer the landscaping improvements provided with Side BRT, but it would offer some increased buffer to pedestrians at the peak hour in the peak direction. A comparison of the change in both sidewalk conditions and crossing experience (described above) from Alternative 1 is provided in Figure 5-21 below. The Center BRT alternatives (Alts. 4 & 5) would offer some additional pedestrian room on the sidewalks by moving bus stops/shelters to the Center stations, if both local and BRT services were operated in the Center busway.27

27 A passing lane option has not yet been developed for Alternative 5, but is expected in the next stage of the Study.
### Figure 5-21 Quality of Crossing Experience and Sidewalk Conditions

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Crossing Experience &amp; Sidewalk Conditions</th>
</tr>
</thead>
</table>
| Alt. 1: Basic Transit Priority | • Long crossing distances (avg. 100 feet)  
• Inadequate pedestrian refuge at left turn locations.  
• 48 left turns (33rd to Van Ness) |
| Alt. 2: Basic Plus | • No change (minimal additional buffer when dedicated lane is in effect.).  
• Some additional bus bulbs |
| Alt. 3: Side BRT | • Wider sidewalks in some locations (20.5 feet)  
• Bus lane provides additional buffer from moving traffic  
• Reduced crossing distance (avg. 88 feet)  
• Countdown signals  
• Landscaping improvements  
• Fewer left turns (30) |
| Alt. 4: Center BRT with 2 medians | • Reduced crossing distance (avg. 88 feet)  
• Countdown signals  
• Landscaping improvements  
• Fewer left turns (28)  
• Additional pedestrian space on sidewalk by moving bus shelters to the center. |
| Alt. 5: Center BRT with 1 median |                                                                                                           |

**Quality of Bicycle Access**

The quality of bicycle access would be slightly improved in all the BRT designs (Alt. 3-5). All of the BRT stations would have bicycle parking and, consistent with current policy, all buses will be equipped with bike racks. Overall, traffic would be somewhat calmed because there would be only two lanes of through auto traffic rather than three. Lastly, in the Center BRT alternatives (Alts. 4 & 5), if both local and BRT buses were run in the center busway, bicycles would not have to interact with buses in the right lane, which can be challenging.

Some of these benefits would be offset by narrower auto lanes. Side BRT (Alt. 3) would present a drawback to cyclists by requiring them to cross the bus lane to make a right turn, just as regular mixed traffic would.

The Study team is currently working to refine the alternatives to determine how best to accommodate bicycles within the Geary Corridor. The Study team is making every effort to accommodate a dedicated bicycle lane of adequate width (no less 5.5 feet) in the corridor, in order to enable safe bicycling in neighborhoods throughout the corridor. A review of

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28 The alternatives do not vary enough from the baseline or from each other to warrant a separate comparison chart for this criteria. The slight changes are reflected in the summary chart at the end of this section.
potential configurations of bicycle lanes on Geary and parallel streets will begin in Spring 2007 and findings will be incorporated into SFMTA’s bicycle plan and/or the next phase of work on Geary as appropriate.

Increased Employment and retail accessibility for neighborhoods

The SF-CHAMP model can predict how improvements in transit travel time translate into improved access to jobs. This is a key economic benefit to people who choose not to drive a car and/or cannot afford to own a car. In addition, when jobs can be easily accessed by transit, it is more likely that people who have access to a car will choose transit to get to work, reducing auto congestion and improving air quality. The model estimated the number of jobs within a 30-minute transit trip from four representative locations: downtown (2nd Street at Market), Japantown Center, Divisadero at Geary, and 20th Avenue at Geary.

BRT alternatives would all increase the numbers of jobs and shopping opportunities that could be accessed by transit, and would help to close the gap between job accessibility by transit and job accessibility by auto. As transit travel time improves, it would approach auto travel time, helping to equalize how many jobs would be accessible within a 30 minute transit trip.

The largest improvement in total job accessibility by transit would occur in the Center BRT designs (Alts. 4 & 5) at 20th Avenue (+73%) and at Divisadero (+27%). In Side BRT, approximately 20% more jobs would be accessible from both these locations. For Downtown and the Tenderloin, which are closest to the highest employment density in the City and therefore already have high job accessibility, improvements would range from 1-6% for all alternatives. These gains in job accessibility for the Center BRT alternatives assume that all services would be run in the busway. If another service plan were adopted (local at the curb or skip stop) the gains would drop somewhat. More access to jobs would also mean more access to commercial and retail opportunities for Geary neighborhoods.

Due to the timing of this Study, the Study Team could not complete a full analysis of job accessibility for the Basic Plus alternative (Alt. 2). Like many other metrics, Basic Plus would likely perform like the baseline (Alt. 1) in the non-peak direction/hours and like Side BRT (Alt. 3) in the peak hour, peak direction.
Figure 5-22  Job Accessibility in 2015\textsuperscript{29}

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Job Accessibility in 2015</th>
<th>Change from Alternative 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Downtown</td>
<td>Japantown</td>
</tr>
<tr>
<td>Alt. 1: Basic Transit Priority</td>
<td>553,900</td>
<td>459,200</td>
</tr>
<tr>
<td>Alt. 3: Side BRT</td>
<td>+ 1%</td>
<td>+ 4%</td>
</tr>
<tr>
<td>Alt. 4: Center BRT with 2 medians</td>
<td>+ 2%</td>
<td>+ 6%</td>
</tr>
<tr>
<td>Alt. 5: Center BRT with 1 median</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Community Feedback

Participants in the 2\textsuperscript{nd} workshop series hosted by the Authority in December 2005, commented on the strong relationship between BRT features and increased accessibility to Geary for a wide range of users. Many participants felt that BRT would make Geary safer for pedestrians, with the additional countdown signals, more-visible crosswalks, and reduced crossing distances. Some were concerned that the center median designs might result in increased jaywalking in areas with lower traffic volumes, and encouraged more detail on potential design of buffers.

Though sidewalk widths were not increased in the typical sections in order to minimize impacts on access to businesses and other active land uses during construction, many noted the opportunity for improved streetscape amenities. In some areas, for example in Japantown, community stakeholders called for alternatives that did include sidewalk widening to provide more comfortable pedestrian space and greater opportunities for streetscape amenities. More detail on this location can be found in Section 5.10.

There was substantial support for incorporating bicycle access to Geary as part of BRT study, though many community members and stakeholders are concerned that Geary’s constrained right of way may not easily accommodate auto lanes, transit lanes and bike lanes safely. Cyclists are very interested in initial bike planning to begin in summer 2007 to understand where best to incorporate safe and convenient bike travel within the Geary corridor, particularly between Arguello and Divisadero.

\textsuperscript{29} The Study Team could not complete a full analysis of job accessibility for the Basic Plus alternative (Alt. 2) due to the timing of this Study. Like many other metrics, Basic Plus will likely perform like the baseline (Alt. 1) in the non-peak direction/hours and like Side BRT (Alt. 3) in the peak hour, peak direction.
Key Conclusions

All BRT designs (Alts. 3-5) would improve pedestrian safety and amenities and the overall attractiveness of Geary considerably, through features such as corner bulbs, countdown signals, and enhanced landscaping. These and other BRT improvements are also expected to make Geary more accessible, improving the livability for neighbors, as well as appeal for visitors. BRT is expected to encourage more people to walk to restaurants, do their shopping, and meet with friends or family on Geary.

Figure 5-23 Summary of Access and Pedestrian Amenities Results

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Crossing experience and Sidewalk Conditions</th>
<th>Quality of Bicycle Access</th>
<th>Increased employment and retail accessibility (at 20th Ave.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt. 1: Basic Transit Priority</td>
<td>Long crossing distances, Inadequate pedestrian refuge, 32 left turns</td>
<td>Poor</td>
<td>54,600</td>
</tr>
<tr>
<td>Alt. 2: Basic Plus</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Alt. 3: Side BRT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alt. 4: Center BRT with 2 medians</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alt. 5: Center BRT with 1 median</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.6 Urban and Landscape Design

Purpose

The right-of-way given to streets and sidewalks represents the city's largest public space. The many diverse features of a street all contribute to the overall ambience, how a street "feels," and in turn, how residents and visitors feel about the surrounding neighborhood. The size and prominence of Geary Boulevard merit a high quality streetscape with a consistent and distinctive design and prominent, beautiful landscaping. Creating a pleasant environment for everyone who uses Geary involves attention to both subtle details and larger features, including character and quantity of green space and integration between the right-of-way and the surrounding land uses. The urban and landscape design evaluation criteria are intended to assess how the project would improve neighborhood livability and commercial vitality, one of the project's four main goals.

Measuring each alternative's contribution to urban and landscape design also helps determine the degree to which each alternative would help move San Francisco towards another study goal and community priority: the development of a distinctive, recognizable, and consistent network of transit priority streets.

Figure 5-24 shows all the sub-criteria for urban and landscape design with a brief explanation of each and the source of the data used for its evaluation.
Figure 5-24  Urban and Landscape Design Criteria

<table>
<thead>
<tr>
<th>GOALS:</th>
<th>Methodology/Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Neighborhood Livability and Commercial Vitality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Transit Priority Network System Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-criteria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Street identity</td>
<td>Captures the ability of an alternative to support a distinctive, recognizable design for Geary Boulevard, through the BRT platforms, street furniture, and landscaping.</td>
<td>Qualitative</td>
</tr>
<tr>
<td>Integration with adjacent land uses</td>
<td>Considers the ease of accessing transit from adjacent land uses.</td>
<td>Qualitative</td>
</tr>
<tr>
<td>Ability to create useable public open space</td>
<td>Evaluates the quantity and quality of any new open space established by the design alternatives.</td>
<td>Physical Designs</td>
</tr>
<tr>
<td>Quality, quantity, and character of landscaping</td>
<td>Evaluates the amount, quality, and consistency of green space throughout the corridor.</td>
<td>Qualitative</td>
</tr>
<tr>
<td>Quality of sustainable storm water management</td>
<td>Assesses the contribution of the BRT alternatives toward sustainable storm water management, through the number of mature trees and permeable ground surface area.</td>
<td>Physical Designs</td>
</tr>
</tbody>
</table>

**Methodology**

The analysis of urban design criteria was derived from conceptual drawings of each alternative that include the dimensions of the landscaped median. The Study team assessed urban design considerations through a qualitative review led by the San Francisco Planning Department.

Detailed analysis of the quality, quantity, and character of landscaping, as well as the quality of sustainable storm water management treatments, which are key features of urban and landscape design, was beyond the scope of this initial conceptual Study. There is a brief preliminary discussion of landscaping included below. More detailed analysis of both criteria can be done in the environmental analysis stage of the project.

**Findings**

**Street Identity**

Overall, the only existing unifying, recognizable identity for Geary Boulevard is an expressway for cars. The overall impression it makes on visitors is not one of multi-

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30 This metric was not evaluated in this Study, but can be analyzed in the next phase of work. Because of the unique topography of Geary being lower than most of the surrounding area, this evaluation will be a critical component of the analysis to ensure success of the project.
modalism, neighborhood beauty, or rich urban design. Existing trees in the median along much of the corridor are small and inconsistent and the other plantings are minimal and haphazard. There are areas which have higher quality landscaping including healthy, large trees, such as the stretch surrounding Divisadero and the vibrant commercial corridor between 15th and 25th Avenues. However the quality of these sections is not carried through for the length of the Boulevard, therefore it does not affect the experience of Geary as a corridor, or its importance to San Francisco.

All of the BRT designs (Alts. 3-5) would include comprehensive streetscape improvements for the entire corridor. These would include distinctive paving, consistent and prominent tree plantings, and uniform landscaping. These would create a recognizable design theme along the whole corridor, and would upgrade Geary’s character to match its size and prominence. These median and landscaping improvements, combined with a colored transit-only lane (a prominent, highly visible feature distinguishing Geary from other streets), would provide a strong, consistent linear axis and would create a unique, recognizable identity for Geary Boulevard. Neither the baseline alternative (Alt. 1) nor the Basic Plus alternative (Alt. 2) would include any corridor-wide or localized streetscape improvements and thus would perform like current conditions in terms of street identity.

Center BRT with 1 median would provide the most prominent identity for Geary due to the consistency and width of the center median, undiminished for left turns or other traffic movements. Additionally, the unified, wide center platform presents an ideal opportunity for “signature” stations that would reflect the surrounding neighborhood. The Center BRT alternative with 2 medians (Alt. 4) would also create a strong identity with central bus lanes separated from traffic lanes by parallel landscaped medians and waiting platforms, however medians would be narrowed for both local stops and left turns which would weaken its design impact. Both Center BRT alternatives would strongly distinguish the BRT service from standard bus service.

Side BRT (Alt. 3) would not create as distinct an identity for Geary or for the BRT service compared to the Center BRT options because locating the BRT infrastructure on the sidewalk would not be as strong a defining element as the highly visible center median. In addition, bus lanes would not be as distinct because they would be used by autos accessing on-street parking, loading, and right turns. The Side BRT alternatives would, however, retain a 15-foot median (except at locations with left turn pockets) and provide new landscaping to enhance the presence of the median, which would provide a degree of the linear axis in the Center alternatives.

A comparison of the change in street identity from Alternative 1 is provided in Figure 5-25 below.
### Figure 5-25 Street Identity

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Description of Street Identity</th>
<th>Comparison to Alternative 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt. 1: Basic Transit Priority</td>
<td>No change from today: • Inconsistent, haphazard landscaping • No unifying, memorable corridor elements</td>
<td></td>
</tr>
<tr>
<td>Alt. 2: Basic Plus</td>
<td></td>
<td>• No change</td>
</tr>
<tr>
<td>Alt. 3: Side BRT</td>
<td></td>
<td>• Median, landscaping improvements • Colored transit-only lane</td>
</tr>
<tr>
<td>Alt. 4: Center BRT with 2 medians</td>
<td></td>
<td>• Median, landscaping improvements • Colored transit-only lane • Strong linear axis</td>
</tr>
<tr>
<td>Alt. 5: Center BRT with 1 median</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Integration with Adjacent Land Uses

Baseline (Alt. 1), Basic Plus (Alt. 2), and Side BRT (Alt. 3) alternatives are anticipated to be most directly integrated with adjacent land uses because pedestrians walking along the sidewalk could easily stop and wait for a bus without crossing any travel lanes. Center BRT alternatives (Alt. 4 & 5) would not be as directly integrated with adjacent land uses because waiting platforms would be located in the center of the road; however, the dual medians of Alternative 4 and the uninterrupted medians of Alternative 5 would help to break down the scale of the street, improving the overall sense of an integrated environment on Geary Boulevard.

#### Ability to Create Useable Public Open Space

None of the alternatives would contribute substantively to new open space. The Side BRT alternative (Alt. 3) performs slightly better than the others because the wide bus bulbs would add to the existing sidewalk space, creating an ample 20.5 foot pedestrian space that could be used for additional sidewalk activities.

This criterion is most applicable to the designs at Fillmore and Masonic, where more space is available, and thus there would be more opportunities for open space. This is discussed in Section 5.10.

---

31 The alternatives do not vary enough from the baseline or from each other to warrant a separate comparison chart. The slight changes are reflected in the summary chart at the end of this section.

32 The alternatives do not vary enough from the baseline or from each other to warrant a separate comparison chart. The slight changes are reflected in the summary chart at the end of this section.
Quality, Quantity, and Character of Landscaping

At present, the quality of landscaping on Geary is quite varied. In some areas, there are many prominent, healthy trees and other landscaping that contributes to the character and quality of Geary and enhances the surrounding neighborhoods. In others, trees on sidewalks are sparse and stunted and medians are overgrown with ivy and weeds.

All BRT alternatives (Alts. 3-5) aim to build on the high-quality sections of Geary and completely refurbish the poor quality sections of the street. The alternatives would provide landscaping that both enhances the appearance of the street and addresses the functional needs of the street’s users.

A more quantitative landscaping analysis can be done in the next stage of the Study. It would likely include a review of street and transit station platform layout and geometry in order to calculate the number of trees that can be supported, the square footage of landscaped area, and the size and shape of landscaped sections of the street.

Community Feedback

Community members commented on the varying quality of existing streetscape amenities, including landscaping, along with the lack of such amenities in many locations. Most comments called for improvements to streetscape amenities and pedestrian access on Geary. A few community members were more interested in transit improvements, stating that waiting environment was not necessarily as important as a comfortable and reliable transit ride. Some merchants, particularly in the Richmond, are concerned with the characteristics of streetscape elements, indicating that existing landscaping and transit improvements obstruct storefront signage at some locations. They encourage selection of plantings and other amenities that are either low enough or high enough to allow clear views of storefronts.

Many community members and stakeholders liked the idea of a strong, consistent look for Geary and the potential BRT line, while others preferred common elements with some variety and change through the corridor to reflect different neighborhoods. The center alternatives were thought to provide the best opportunity for a prominent unified streetscape. Community members support including neighborhood maps and wayfinding materials for neighborhood attractions in shelters, and some further suggested retail kiosks and other activities where space allows.

Key Conclusions

Urban design improvements that are provided by the BRT alternatives (Alts. 3-5) have the potential to make Geary a great street. Through median and landscaping upgrades and a colored transit-only lane, all of the BRT alternatives (Alts. 3-5) would create a recognizable design theme, establish a distinct visible linear axis, and considerably improve the beauty of the street along the whole corridor.

The Center BRT alternative with 1 median (Alt. 5) performs slightly better than the others because it would have the most regular presence throughout the corridor, a consistent wide
median that would not be reduced for left turns or other traffic movements. The side alternative offers the most potential for increased public open space because the wide bus bulbs would add to the existing sidewalk space to create a large pedestrian space for additional sidewalk activities.

**Figure 5-26   Summary of Urban and Landscape Design Results**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Street Identity</th>
<th>Integration with Existing Land Uses</th>
<th>Creation of Open Space</th>
<th>Quality, Quantity, and Character of Landscaping</th>
<th>Quality of Sustainable Storm water Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt. 1: Basic Transit Priority</td>
<td>Inconsistent haphazard landscaping; no unifying corridor elements</td>
<td>No change from today</td>
<td>No change from today</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alt. 2: Basic Plus</td>
<td></td>
<td></td>
<td></td>
<td>TBD in the next phase of work</td>
<td>TBD in the next phase of work</td>
</tr>
<tr>
<td>Alt. 3: Side BRT</td>
<td>![Upward Arrow]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alt. 4: Center BRT with 2 medians</td>
<td>![Upward Arrow]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alt. 5: Center BRT with 1 median</td>
<td>![Upward Arrow]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.7 Traffic Operations and Parking

Purpose

For a bus rapid transit project to be successful on Geary, it must not only benefit transit riders, but also improve neighborhood livability and commercial vitality, the third of the project’s four primary goals. This goal not only promotes an investment in pedestrian safety, streetscape, and urban design as discussed in previous sections, but also seeks to minimize impacts on neighborhoods, such as traffic congestion.

This section evaluates how each alternative would affect traffic conditions and overall use of the corridor by automobile drivers. The analysis includes the estimated delay autos experience at intersections, the overall flow of traffic, average changes in auto travel times, and the degree to which traffic would be diverted to other streets. Parking impacts are measured by the change in the number of spaces available. Figure 5-27 shows the sub-criteria for Traffic Operations and Parking and provides both an explanation/definition of each and the source of the data used for its evaluation (i.e. the model used to estimate each criterion).

Traffic operations are assessed in the PM peak period, when overall demands on the system would be greatest, so the results here should represent the worse case for auto operations. In addition, though only two lanes of auto traffic in each direction would remain in the three BRT alternative designs (Alts. 3-5), many tools and strategies exist to maximize the efficiency of those remaining lanes, e.g. left/right turn pockets and enhanced signal timing. While the Study Team has used these strategies to a certain extent in this conceptual design study, even more traffic engineering can be done in the environmental analysis stage of the Study, so all these results should be considered preliminary and worst case.

Figure 5-27 shows all the sub-criteria for traffic operations and parking. It provides both a brief explanation of each criteria and the source of the data used for its evaluation (e.g. the model used to measure each criterion).
Figure 5-27 Traffic Operations and Parking Criteria

<table>
<thead>
<tr>
<th>GOAL: Neighborhood Livability and Commercial Vitality</th>
<th>Sub-criteria</th>
<th>Methodology/Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accommodate traffic circulation and access</td>
<td>Provides a direct measure of impacts specifically to drivers, expressed through overall intersection performance, delays to vehicles (expressed as Level of Service, or LOS), average auto travel time on Geary, and change in the number of turn restrictions. Also assesses the change in turn restrictions which impact overall traffic flow.</td>
<td>VISSIM micro-simulation model, Physical Designs, Synchro traffic model</td>
<td></td>
</tr>
<tr>
<td>Change in intersection delay</td>
<td>Measures how intersections accommodate the through movement of people. VISSIM measures how many seconds a person must wait to get through the intersection and can produce three measures of delay: the average delay for drivers in cars; and the average delay for bus riders; and the average delay for all people using an intersection, regardless of how they get there (car, bus or walking).</td>
<td>VISSIM micro-simulation model</td>
<td></td>
</tr>
<tr>
<td>Change in traffic volumes on parallel streets</td>
<td>Measures the amount of traffic diverted from Geary Boulevard to other streets and the likely locations of those diversions.</td>
<td>Synchro traffic model, SF-CHAMP</td>
<td></td>
</tr>
<tr>
<td>Presence of on-street parking</td>
<td>Measures the net change in on-street parking spaces by street segment.</td>
<td>Physical Designs</td>
<td></td>
</tr>
</tbody>
</table>

**Methodology**

Measuring traffic impacts requires extensive use of the three computer models described in the beginning of Chapter 5 (Section 5.2): VISSIM, Synchro, and SF-CHAMP. SF-CHAMP was used to quantify the extent of traffic diversions. The VISSIM micro-simulation model was used to assess delay not only for autos, but for all modes traveling on Geary Boulevard. Both VISSIM and Synchro models were used to assess intersection and roadway performance. Parking impacts were tallied based on engineering drawings.

**Findings**

**Overview of Intersection Performance**

In an urban setting like the Geary corridor, the time it takes to move traffic through intersections is the key determinant of how smoothly traffic flows. One of the most basic ways to gauge the “performance” of an intersection, is to measure the average amount of time that a person or vehicle spends delayed at an intersection (i.e., are signals timed such that drivers rarely have to stop? Can drivers get through each signal in one cycle? Does it take multiple signal cycles to get through a single intersection?).
The traffic models allow the Study Team to measure both how long, on average, vehicles have to wait at Geary intersections over the whole corridor (average intersection delay), and the amount of congestion at each individual intersection (intersection “level of service”). The models also enable the Study Team to capture the relative efficiencies of buses versus cars by measuring “person delay.”

Traffic Circulation and Access

Traffic conditions vary considerably at individual intersections throughout the corridor due to roadway layout, traffic volumes, etc. The Synchro model describes the overall performance of an intersection by using a common measure called “level of service,” or LOS. “Level of service” captures the level of congestion at an intersection by measuring vehicle delay and is expressed through “grades” of A through F. A grade of “A” means that an intersection is free-flowing without any delay, while a grade of “F” represents an intersection that is experiencing near “gridlock” conditions. From the perspective of an individual driver, these grades mean the difference between getting through an intersection in a single signal phase (LOS A-D) versus waiting for multiple cycles (a “failing” intersection LOS E-F). Cities usually aim for a LOS of “C” or “D” depending on the intersection and the context. That is because, though no one enjoys an intersection performing at LOS F, an intersection performing at LOS A for autos may not be optimally utilized by all users and is not necessarily the most efficient use of public investment.

At the PM peak hour, overall traffic conditions would not significantly deteriorate from conditions in the baseline (Alt. 1) for any alternative. Traffic conditions at some intersections are predicted to be at level E regardless of a BRT project, (in the baseline, Alt. 1), due to increases in overall traffic volumes in the future. So in order to evaluate the traffic impacts of the BRT design alternatives, it is particularly important to compare all LOS figures to traffic conditions in the 2015 baseline (Alt. 1).

At some intersections, the BRT designs would improve conditions from the baseline. For example, in both the Side and Center BRT alternatives conditions would improve from a level of service D to a C at the intersection of Geary and Franklin Street. At other intersections, problems with traffic flow at intersections would persist (LOS D or E) in all alternatives. For example, level of service at Stanyan and Fulton would be a “D” in the baseline (Alt. 1), the Side BRT (Alt. 3), and the Center BRT alternatives (Alt. 4 & 5). Overall, no intersection would approach breakdown conditions in the baseline or any of the alternatives, with the exception of Geary and Masonic under the Center BRT designs (Alts. 4 & 5), where the vehicle delay average would be over 90 seconds, a level of service “F.”

33 A = Less than 10 seconds of delay, B = 10 to 20 seconds, C = 20 to 35 seconds, D = 35 to 55 seconds, E = 55 to 80 seconds, F = Over 80 seconds.
34 Alternative 1, Basic Transit Priority, includes 2015 household and employment forecasts provided by the San Francisco Planning Department and in-progress or planned updates to the road and transit systems. Changes to the transportation network that are in the very early stages of planning (e.g., BRT on Van Ness Avenue), were not included. Follow-up scenario testing can be done in the next phase of the Study to better understand how the ridership changes on Geary are impacted by a BRT project on Van Ness Avenue. Models show that there will be some growth in total trip-making due to economic development. For example, westbound Geary in the Inner Richmond is estimated to carry about 6 percent more traffic in 2015 than in 2005.
The intersection of Geary and Masonic is discussed in more detail in Section 5.10. In short, even with most Geary thru traffic in the underpass, the width and traffic volumes on both Masonic and Geary, combined with the complexity of turning movements, cause baseline delays at Masonic to be relatively high, (current level of service is “E”). Because the analysis of the Center BRT alternatives assumed that some amount of auto traffic from the underpass lanes would be added to the surface, delays would increase substantially and the intersection would break down. In the next phase of work, additional center-running design options can be developed that would give the bus the travel time benefits of the underpass, but would not create breakdown conditions for traffic.

Basic Plus (Alt. 2) is expected to perform like Side BRT (Alt. 3) in the peak hour, peak direction and like the baseline (Alt. 1) in off-peak hours and in the peak hour, off-peak direction.

Figure 5-28 identifies locations where intersections are projected to operate at Level of Service D, E, or F under the various alternatives. No intersection between Arguello and Park Presidio would degrade below a level of service C for any alternative, therefore the map only shows the section of Geary Boulevard between Van Ness and Arguello.
Average Intersection Delay

In addition to understanding the “level of service” at each intersection, the models also allow evaluation of the average delay that would be experienced at all Geary intersections.

Conventional traffic operations models focus primarily on the intersection delay for each vehicle going through an intersection. This analysis is useful for understanding the level of automobile congestion, but is limited because it treats all vehicles the same, whether the vehicle is a single occupant auto or an articulated bus full of passengers.

More recently, traffic engineers have begun analyzing “person delay,” to capture the relative efficiencies of buses versus cars. The VISSIM model provides measures of intersection operations that are adjusted for the number of people using an intersection, not just the

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35 Synchro is an example of a conventional traffic model which is commonly used to analyze intersections. Synchro is actually a relatively new program, but uses traditional mathematical functions to analyze intersections.
number of vehicles. The VISSIM model is able to recognize that when a single bus carrying 60 passengers is delayed by 30 seconds this creates 30 minutes of total person delay.\textsuperscript{36} This is equivalent to delaying fifty cars, carrying the corridor average of 1.2 people, for the same 30 seconds.\textsuperscript{37} This Study used both a traditional intersection analysis tool, Synchro, and the VISSIM model to estimate the changes in intersection delay between the proposed alternatives (Alts. 2-5) and the baseline (Alt. 1).

This analysis presents how each alternative would compare to the baseline (Alt. 1) for four measures of delay, (results are presented in Figure 5-29 below). They are:

- Average delay to buses on Geary: how much each bus traveling on Geary would be delayed at an intersection on average,
- Average delay to vehicles on Geary: how much each vehicle driving on Geary, cars, trucks, and buses, would be delayed at an intersection on average,
- Average delay to each vehicle at the intersection, both on Geary and on cross streets: how much each vehicle that travels through the intersection, including all cars, trucks, and buses traveling on Geary or on the cross street, would be delayed at an intersection on average, and
- Average delay to each person at the intersection, both on Geary and on cross streets: how much each person that travels through the intersection, including all pedestrians, drivers, and bus riders traveling on Geary or on the cross street, would be delayed at an intersection on average.

**Bus Delay and Vehicle Delay on Geary**

Overall, all of the BRT alternatives are expected to reduce delay to buses on Geary from the baseline without significantly delaying cars traveling on Geary. In the PM peak, average bus delay under Center BRT (Alts. 4 & 5) is projected to be 9 seconds, a decrease of 8 seconds, or almost 50%, from the baseline (Alt. 1). Under Side BRT (Alt. 3) and Basic Plus (Alt. 2) average bus delay would be 11 seconds, a decrease of 6 seconds from the baseline. While accomplishing this benefit for transit riders, average delay to autos on Geary for all three BRT alternatives (Alts. 3-5) would change by less than 1 second, a virtually undetectable change to an individual driver.

**Total Intersection Delay: Vehicle Delay and Person Delay**

When the analysis considers all people using the intersection, including those on cross streets in addition to those on Geary, average vehicle delay would increase somewhat under the BRT alternatives. Under the Center BRT alternatives (Alts. 4 & 5) average delay for all vehicles (cars, buses, trucks, etc.) would be 20 seconds, a 6 second increase from the baseline (Alt. 1). Under Side BRT (Alt. 3) average vehicle delay would be 16 seconds, a mere 2 second increase from the baseline.\textsuperscript{38} This is primarily because signal timing

\textsuperscript{36} 30 second x 1 bus x 60 passengers = 1800 seconds ÷ 60 sec/minute = 30 minutes of delay.
\textsuperscript{37} 30 seconds x 50 cars x 1.2 passengers per car = 1800 seconds ÷ 60 sec/minute = 30 minutes of delay. Source of 1.2 average auto occupancy: SF-CHAMP.
\textsuperscript{38} Under the Center BRT alternatives, delay for vehicles crossing Geary is 48 seconds, an 18 second increase from the baseline. When combined with the relatively minor increase in delay for vehicles on Geary (1 second), the result
adjustments favor traffic on Geary (because traffic volumes are much higher on Geary) which creates additional delay to vehicles on cross streets.

However when “total person delay” is considered, the greater average delay for vehicles on cross streets would be offset by the considerably lower average delay to bus riders on Geary. And the signal timing adjustments on Geary also benefit auto drivers on Geary. For example, under Center BRT (Alts. 4 & 5) the average person delay of the whole intersection would be equivalent to baseline conditions. Total person delay under the Side BRT design (Alt. 3) would actually be reduced from baseline conditions (2 seconds less). Results for these intersection delay metrics are shown in Figure 5-29 below.

**Figure 5-29  Average Intersection Delay, 2015 PM Peak**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Average Bus Delay on Geary (Change from Alternative 1)</th>
<th>Average Vehicle Delay on Geary (Change from Alternative 1)</th>
<th>Average Vehicle Delay at entire intersection (Change from Alternative 1)</th>
<th>Average Person Delay at entire intersection (Change from Alternative 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt 1: Basic Transit Priority</td>
<td>17 sec</td>
<td>11 sec</td>
<td>14 sec</td>
<td>15 sec</td>
</tr>
<tr>
<td>Alt 2: Basic Plus 39</td>
<td>11 sec</td>
<td>10 sec</td>
<td>16 sec</td>
<td>13 sec</td>
</tr>
<tr>
<td>Alt 3: Side BRT</td>
<td>(6 sec decrease)</td>
<td>(1 sec decrease)</td>
<td>(2 sec increase)</td>
<td>(2 sec decrease)</td>
</tr>
<tr>
<td>Alt 4: Center BRT with 2 medians</td>
<td>9 sec</td>
<td>12 sec</td>
<td>20 sec</td>
<td>15 sec</td>
</tr>
<tr>
<td>Alt 5: Center BRT with 1 median</td>
<td>(8 sec decrease)</td>
<td>(1 sec increase)</td>
<td>(6 sec increase)</td>
<td>(no change)</td>
</tr>
</tbody>
</table>

**Auto Travel Time**

While transportation engineers rely on both LOS and person delay to understand estimated travel conditions, most Geary users evaluate the conditions based on how long it takes is that average vehicle delay to all vehicles traveling through the intersection is 20 seconds, a 6 second increase from the baseline. Under the Side BRT alternative, average delay for vehicles on the cross street is 37 seconds, a 17 second increase from the baseline. Average vehicle delay on Geary is 1 second less than in the baseline. Therefore overall average intersection vehicle delay is 16 seconds, 2 seconds more than in the baseline. 39 Alternative 2 is expected to perform similarly to Alternative 3 in the peak period, peak direction. At all other times of the day, Alternative 2 will likely perform similarly to Alternative 1.
them to travel from one place to another. VISSIM was used to estimate total travel time between 33rd and Gough for both autos and transit vehicles on Geary.\textsuperscript{40}

Total auto travel time from one end of the Geary corridor to the other would not be significantly impacted by any of the BRT alternatives (Alts. 3-5). During the PM peak hour, the change in auto travel time between 33rd Avenue and Gough Street (3.9 miles) would be no greater than 2 minutes more or less than in the baseline (Alt. 1) traveling in either direction for any of the alternatives. This would be a relatively minor change, especially when compared to the considerable travel time savings for transit (discussed in Section 5.3 above).\textsuperscript{41}

In the westbound direction, auto travel times would improve by 13% for Basic Plus (Alt. 2) and Side BRT (Alt. 3), and would remain constant for Center BRT (Alts. 4 & 5). In the eastbound direction, travel time would remain the same for Basic Plus and increase by about 2 minutes or 14% for all the BRT designs (Alts. 3-5). All travel time results are shown in Figure 5-30 below.

**Figure 5-30  Total Auto Travel Time, 2015 PM Peak**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Westbound Auto Travel Time, Gough to 33rd, PM Peak (Change from Alt 1)</th>
<th>Eastbound Auto Travel Time, Gough to 33rd, PM Peak (Change from Alt 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt 1: Basic Transit Priority</td>
<td>15 min</td>
<td>14 min</td>
</tr>
<tr>
<td>Alt 2: Basic Plus</td>
<td>13 min (13% less)</td>
<td>14 min (No change)</td>
</tr>
<tr>
<td>Alt 3: Side BRT</td>
<td>13 min (13% less)</td>
<td>16 min (14% more)</td>
</tr>
<tr>
<td>Alt 4: Center BRT with 2 medians</td>
<td>15 min (No change)</td>
<td>16 min (14% more)</td>
</tr>
<tr>
<td>Alt 5: Center BRT with 1 median</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{40} Analysis of travel times on streets parallel to Geary were not included in this phase of work, but can be conducted in the next phase of study.

\textsuperscript{41} The auto travel times for the Center BRT alternatives are presented without the impact of the auto delay at Masonic, because the current design is failing for automobiles. A solution that works for both auto and transit can be identified in the environmental analysis phase of the Study.
Auto Speed

Auto speed is the ratio of auto travel time over a given distance. As would be expected based on the travel time results, auto speeds would not change significantly under any alternative. Average auto speeds are expected to neither increase nor decrease by more than 2 mph traveling in either direction. It should be noted that in the baseline (Alt. 1), traffic speeds are expected to decrease from the current average speed of about 19 mph to 16-17 mph under Alternative 1, because overall traffic volumes are estimated to increase by 2015. Changes in auto speed from baseline conditions (Alt. 1) for each alternative are shown in Figure 5-31 below.42

Figure 5-31  Average Auto Speed, 2015 PM Peak

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Westbound Average Auto Speed (Change from Alt. 1)</th>
<th>Eastbound Average Auto Speed (Change from Alt 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt 1: Basic Transit Priority</td>
<td>16 mph</td>
<td>17 mph</td>
</tr>
<tr>
<td>Alt 2: Basic Plus</td>
<td>18 mph (13% faster)</td>
<td>17 mph</td>
</tr>
<tr>
<td>Alt 3: Side BRT</td>
<td>18 mph (13% faster)</td>
<td>15 mph (12% slower)</td>
</tr>
<tr>
<td>Alt 4: Center BRT with 2 medians</td>
<td>16 mph (No change)</td>
<td>15 mph (12% slower)</td>
</tr>
<tr>
<td>Alt 5: Center BRT with 1 median</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Number of Turn Restrictions

The Study Team proposed a reduction in the number of left turns primarily to improve conditions for pedestrians. However, reducing the number of turn pockets also reduces delay for through traffic and for bus drivers. For the most part, although the number of intersections where left turns are permitted would be reduced, the remaining lefts would be protected by a dedicated left-turn pocket and dedicated signal phase. This should make left-turns easier and should also improve through movements in the remaining auto lanes.

Intersections with bus stops generally have the highest volumes of pedestrians and therefore were prioritized for left turn removal. The Study Team attempted to balance the needs of drivers to turn left with the impact of additional traffic lanes for pedestrians to cross

42 These are auto speeds for 2015, approximately 3 years after the project opens, once the City has adjusted to the change. Upon opening, as with any change in street operation, there may be some confusion and worsening traffic conditions. Considerable public education and publicity prior to the change taking effect will be necessary to ensure that auto travel is not considerably affected.
and reduced refuge widths for pedestrians. At this stage, left turns are provided about every 4 blocks in all the BRT alternative designs (Alts. 3-5). The next stage of the Study, the environmental analysis, can revisit this analysis and finalize recommendations for left turn removal.

**Traffic Volumes on Parallel Streets**

The removal of a general purpose traffic lane on Geary would no doubt change traffic patterns in the corridor. This Study estimated the magnitude of these changes, in particular the amount of traffic that would be diverted off of Geary and how this traffic would redistribute itself across the citywide street grid. These estimates should represent the worst case scenario because the Study Team estimated diversions at the PM peak hour, the worst period for traffic congestion. Midday diversions are expected to be lower than the diversions estimated here.43

Traffic diversions would not vary significantly based on the location of the dedicated lane (side or center of the street), therefore all alternative BRT designs, Alts. 3-5, would have about the same expected effect on traffic diversions and are analyzed together here. Diversions would vary by location however, so both an overall description of diversions, as well as diversions at two typical locations in the P.M. peak, are described below.

**Overall Traffic Diversions from Geary**

The analysis shows that overall changes in traffic patterns would be predictable, and would not be severe. Although one third of lane capacity on Geary would be removed, less than one third of traffic is expected to divert to parallel streets during the PM peak for all BRT alternatives (there are a variety of reasons for this which are mentioned below).

Traffic diversions would occur primarily between Gough and Park Presidio, where a mixed flow travel lane would be converted to a dedicated bus lane and some turning movements would be restricted in the BRT designs. West of Park Presidio, no significant traffic diversions are expected because the BRT lanes could be accommodated without converting traffic lanes.

Traffic would generally divert in a logical pattern, i.e. people tend to move to streets of similar character, speed, and size to those they were traveling on before. Geary is a major thoroughfare, which is commonly used to travel long distances on the corridor or to places outside the corridor (i.e. to the Presidio and to the Sunset). Therefore, as might be expected, 40% of diverted traffic is expected to avoid the corridor altogether, switching to streets like Fell Street, Lincoln Way, or 19th Avenue. The majority of traffic leaving Geary is expected to divert onto major parallel east/west arterial streets, e.g. Fulton and California in the Richmond, and Pine or Fell in Japantown, since these routes are signalized and have more capacity than the smaller parallel streets in the corridor. However, the increased volumes predicted on these streets would be modest and should be undetectable by most travelers on those streets. Some minor variations in traffic patterns are expected on individual streets due to the changes in left-turn restrictions along Geary.

43 During construction of BRT, traffic diversions could be worse than described here, but many techniques are planned to minimize these impacts, as described in Section 5.9.
The results from the traffic circulation and access evaluation, described above, confirm these results, showing that traffic continues to flow smoothly at all intersections in the corridor.

**Diversions at 4th Avenue**

At 4th Avenue in the Inner Richmond, less than 30% of the traffic on Geary is expected to divert to other streets after the lane conversion. The estimated increase in traffic volumes on parallel streets is expected to be relatively modest, increasing by less than 10% on most streets. Of the traffic that does divert, an estimated 25-30% would go to either California or Fulton Streets, however even these two streets are only expected to receive about 2 additional cars per minute in the PM peak. Traffic volume on Clement Street is estimated to increase by about 12%, however because the starting volumes are low, this only translates to about one extra car every two minutes.

**Figure 5-32 Increase in PM Peak Diversions to Parallel Streets at 4th Avenue**

<table>
<thead>
<tr>
<th>Street</th>
<th>Vehicles per Hour at PM peak Currently</th>
<th>Additional Vehicles diverted per Hour</th>
<th>Additional Vehicles diverted per Minute</th>
<th>Illustration of Vehicles diverted per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake</td>
<td>280</td>
<td>5</td>
<td>0.1</td>
<td><img src="image1" alt="Illustration" /></td>
</tr>
<tr>
<td>California</td>
<td>1520</td>
<td>100</td>
<td>1.7</td>
<td><img src="image2" alt="Illustration" /></td>
</tr>
<tr>
<td>Clement</td>
<td>275</td>
<td>35</td>
<td>0.5</td>
<td><img src="image3" alt="Illustration" /></td>
</tr>
<tr>
<td>Anza</td>
<td>270</td>
<td>15</td>
<td>0.3</td>
<td><img src="image4" alt="Illustration" /></td>
</tr>
<tr>
<td>Balboa</td>
<td>1175</td>
<td>55</td>
<td>1.0</td>
<td><img src="image5" alt="Illustration" /></td>
</tr>
<tr>
<td>Cabrillo</td>
<td>280</td>
<td>20</td>
<td>0.3</td>
<td><img src="image6" alt="Illustration" /></td>
</tr>
<tr>
<td>Fulton</td>
<td>1660</td>
<td>130</td>
<td>2.1</td>
<td><img src="image7" alt="Illustration" /></td>
</tr>
</tbody>
</table>

**Diversions at Japantown/Fillmore**

In the Japantown area near Fillmore Street, a similar pattern emerges. About one third of traffic would divert off Geary. Major streets such as Pine, Turk, and Fell would carry about 30% of these diversions. The smaller streets in the vicinity would each pick up a small portion of diversions as well, yet traffic volumes on all parallel streets are expected to increase by less than 10% from the baseline.
**Figure 5-33 Increase in PM Peak Diversions to Parallel Streets at Japantown/Fillmore**

<table>
<thead>
<tr>
<th>Street</th>
<th>Vehicles per Hour at PM peak Currently</th>
<th>Additional Vehicles diverted per Hour</th>
<th>Additional Vehicles diverted per Minute</th>
<th>Illustration of Vehicles diverted per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay</td>
<td>220</td>
<td>5</td>
<td>0.08</td>
<td><img src="image" alt="Illustration" /></td>
</tr>
<tr>
<td>Sacramento</td>
<td>260</td>
<td>10</td>
<td>0.2</td>
<td><img src="image" alt="Illustration" /></td>
</tr>
<tr>
<td>California</td>
<td>1520</td>
<td>35</td>
<td>0.6</td>
<td><img src="image" alt="Illustration" /></td>
</tr>
<tr>
<td>Pine</td>
<td>2300</td>
<td>75</td>
<td>1.3</td>
<td><img src="image" alt="Illustration" /></td>
</tr>
<tr>
<td>Sutter</td>
<td>570</td>
<td>40</td>
<td>0.7</td>
<td><img src="image" alt="Illustration" /></td>
</tr>
<tr>
<td>Post</td>
<td>205</td>
<td>10</td>
<td>0.2</td>
<td><img src="image" alt="Illustration" /></td>
</tr>
<tr>
<td>Eddy</td>
<td>520</td>
<td>25</td>
<td>0.4</td>
<td><img src="image" alt="Illustration" /></td>
</tr>
<tr>
<td>Turk</td>
<td>1670</td>
<td>80</td>
<td>1.3</td>
<td><img src="image" alt="Illustration" /></td>
</tr>
<tr>
<td>McAllister</td>
<td>265</td>
<td>20</td>
<td>0.3</td>
<td><img src="image" alt="Illustration" /></td>
</tr>
<tr>
<td>Fulton</td>
<td>560</td>
<td>5</td>
<td>0.08</td>
<td><img src="image" alt="Illustration" /></td>
</tr>
<tr>
<td>Grove</td>
<td>205</td>
<td>20</td>
<td>0.3</td>
<td><img src="image" alt="Illustration" /></td>
</tr>
<tr>
<td>Hayes</td>
<td>535</td>
<td>5</td>
<td>0.08</td>
<td><img src="image" alt="Illustration" /></td>
</tr>
<tr>
<td>Fell</td>
<td>3225</td>
<td>75</td>
<td>1.3</td>
<td><img src="image" alt="Illustration" /></td>
</tr>
</tbody>
</table>

While some traffic would divert from Geary, it would still continue to be an attractive route for drivers. In fact, BRT would optimize traffic flow in the remaining mixed-use lanes making Geary a more attractive route for some drivers. Currently bus-auto conflicts are constraining the capacity of the right travel lane. BRT, by substantially or entirely moving buses from mixed flow lanes, would improve capacity for auto travel in the remaining mixed-traffic lanes.

Diversions to other streets would also be minimized because:

1. Some drivers would switch to transit and walking;
2. Those who continue to drive may change the time of their trip to avoid peak hours;
3. Drivers avoid slow local streets with lots of stop signs; and
4. Travel speeds on Geary would continue to be relatively high with very little additional delay to drivers.

The impact of traffic diversions into neighborhoods near the Geary corridor could be reduced through traffic calming, turn restrictions, and other means. Where traffic volumes in neighborhoods would increase, the Study Team is committed to working with neighborhoods to reduce the impacts. The magnitude of expected diversions onto parallel...
streets, and the expected impacts of those diversions on traffic flow, will be studied in greater detail in the next phase of this Study.

**On-Street Parking**

Minimizing on-street parking loss was identified as one of the highest priorities by participants at the December 2005 public workshops. The importance of retaining on-street parking was also emphasized by members of the Geary Citizen’s Advisory Committee since the Committee first met in 2004. Not only does on-street parking benefit auto users, it also provides a valuable buffer from traffic for pedestrians. Concerns about on-street parking loss are also frequently raised by local merchants and residents at community meetings.

The Study team sought to minimize on-street parking loss through the development of strategies to off-set parking reductions. For most alternatives, parking loss is minimized by a combination of the following strategies:

- 30-degree angled parking would be maintained on one side of the street from 14th Avenue to 28th Avenue; and
- 60-degree angled parking would be added on 12 sample cross streets between Arguello Boulevard and 33rd Avenue.

Replacing parallel metered parking with diagonal parking on cross-streets, as shown above on 11th Avenue, is one of several proposed strategies to minimize parking impacts.

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44 This strategy does not work for the Side BRT alternative (Alt. 3) so other strategies were used.
Both the design of each alternative and the way the alternative would be operated would have a significant effect on its parking impacts. The parking supply in the 2015 baseline (Alt. 1) is assumed to be equivalent to today. For the rest of the alternatives, the most significant parking change would occur west of Park Presidio where angled parking would have to be converted to parallel parking to accommodate the BRT lane. With the implementation of the replacement strategies, most of the alternatives would have a small negative impact on the number of spaces available, removing no more than 4% or about 40 spaces between Van Ness and 33rd Avenue. Center BRT with 2 medians (Alt. 4) would actually increase the number of parking spaces on Geary if all services were run in the busway.

Figure 5-34 summarizes the estimated net impact on the parking supply for each of the alternatives and operating scenarios. The parking impacts of each alternative are described in detail below.

### Figure 5-34 Change in Parking Supply (Van Ness to 33rd)

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Change in Parking Supply from Alt. 1 including replacement strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt 1: Basic Transit Priority</td>
<td>1060</td>
</tr>
<tr>
<td>Alt 2: Basic Plus</td>
<td>No change</td>
</tr>
<tr>
<td>Alt 3: Side BRT</td>
<td>40 spaces removed (4% less)</td>
</tr>
<tr>
<td>Alt 4: Center BRT with 2 Medians</td>
<td>165 spaces added (16% more)</td>
</tr>
<tr>
<td>All services in busway</td>
<td>10 spaces removed (1% less)</td>
</tr>
<tr>
<td>Local at curb</td>
<td>25 spaces removed (2% more)</td>
</tr>
<tr>
<td>Alt 5: Center BRT with 1 Median</td>
<td>185 spaces removed (17% less)</td>
</tr>
</tbody>
</table>

45 The estimates include off-setting strategies. For most alternatives these were: 1) 30-degree angled parking on one side of the street from 14th Avenue to 28th Avenue, and 2) 60-degree angled parking on 12 cross streets between Arguello and 33rd Avenue. These are not necessarily the exact strategies that will be used if the project moves forward to implementation. The total number of on-street spaces gained or lost per scenario represents a conceptual planning level estimate. The numbers have been rounded to the nearest 5 to reflect the conceptual nature of this stage of the study. As we refine the street designs over time, it is anticipated that the estimated parking impacts may change, and be higher or lower than the current estimates.
Alternative 2: Basic Plus

Basic Plus (Alt. 2) would result in a loss of parking because a dedicated lane would not operate well with angled parking (which currently exists on Geary west of 15th Avenue). As with the other alternatives, the spaces could be replaced with angled parking on side streets. In addition, Basic Plus would have longer bus stops in some locations which would require a small amount of parking removal.

Alternative 3: Side BRT

Without parking replacement strategies, Side BRT (Alt. 3) could result in a reduction of as many as 145 spaces, a 14% decrease from the baseline, due to longer bus stops and right turn pockets. With the implementation of simple replacement strategies, such as angled parking on side streets mentioned above, most of these could be re-gained, resulting in a net loss of only 40 spaces, a 4% reduction in spaces compared to the baseline.

Alternative 4: Center BRT with 2 medians

The Center BRT alternative could actually add to the amount of parking available by allowing parking to be restored where curb bus stops are currently located. Center BRT with 2 Medians (Alt. 4) would result in a 6% increase in the parking supply (60 more spaces than the baseline) if both local and BRT buses were run in the busway. In the event that local buses remained at the curb, parking gains would be eliminated and this alternative would result in an 11% decrease in the parking supply (115 fewer spaces than the baseline), without implementing replacement strategies.

The implementation of parking replacement strategies, would maximize available parking, resulting in a 16% increase in the supply of parking (165 net spaces gained over the baseline) if both the local and BRT buses operated in the center busway, and would essentially eliminate all parking losses even if local buses remained at the curb (10 spaces less than the baseline).

Alternative 5: Center BRT with 1 median

The Center BRT alternative with 1 median (Alt. 5) would have a higher impact on the parking supply than the other Center BRT alternative (Alt. 4), primarily because parking would be removed to accommodate left turn pockets, as illustrated below in Figure 5-35.
If a passing lane option can be developed for Alternative 5, or if the skip stop service plan were adopted, and all buses run in the center busway, the maximum parking loss would be about 12% (130 spaces removed). If the local bus remained at the curb, a maximum of 27% of the parking supply between Van Ness and 33rd Avenue would be lost under this alternative (285 spaces removed). The Study Team is optimistic that a passing lane option can be developed in the next stage of this Study.

As with other alternatives, the implementation of simple parking replacement strategies could significantly reduce potential parking losses. If all buses were run in the center busway (skip stop service or passing lane option developed) parking loss would only be 2% (25 spaces removed). If local buses remained at the curb, the parking supply would be reduced by 185 spaces, 17% less than in the baseline.

These estimates are based on the two replacement strategies mentioned above. If additional replacement strategies were implemented for these alternatives, parking impacts could possibly be reduced even further as described below.

**Further Mitigations**

Additional strategies can be developed as the project progresses to further reduce the overall change in the on-street parking supply. They could include:

- Maximizing utilization of existing parking supply by:
  - Identifying all opportunities for shared parking between uses and encouraging sharing for current and new development
  - Identifying opportunities for valet parking which achieves more efficient use of parking spaces
  - Designating employee parking locations that are appropriate and advantageous to users in the whole corridor
- Modifying the allocation of parking spaces by type and time period through:
Reallocating the mix of commercial loading/unloading and passenger parking spaces

Change the hours of existing parking meters to match the hours of business activity, for example, a convenience store could have shorter time limits than a restaurant.

- Adjusting the rates charged for existing parking to encourage short term usage and frequent turn-over to improve availability for customer use
- Converting metered parking spaces on side streets from parallel to angled
- Installing signage to identify access to off-street parking lots
- Identifying funding sources to increase enforcement
- Investing in new payment technologies to allow for more payment options, more flexibility in pricing and management, and more customer convenience (e.g. paystations that accept credit cards or promoting use of the citywide parking card).

The Authority is undertaking a citywide parking management study to evaluate the potential of a variety of parking management techniques to increase on-street parking turnover in commercial corridors. The pilot neighborhoods have not yet been determined, but it is likely that the findings from the study could be applied to Geary.

All of the potential mitigations would require extensive community involvement and outreach to local businesses to identify appropriate opportunities, in addition to more detailed design work. This level of analysis goes beyond the scope of this conceptual study and can be continued in the next phases of the project.

Community Feedback

There were many questions and general concerns about the effects of BRT on overall traffic conditions on Geary, though most feedback centered on traffic diversions from Geary to parallel streets and potential changes in parking availability on Geary. During the public workshops hosted by the Authority and other community meetings, some felt that short term impacts on motorists could be overcome whereas others felt that decreasing the number of auto travel lanes to accommodate a transit-only lane would cause auto congestion and divert traffic onto neighborhood streets. Some of the concern focused on traffic impacts during construction, and some was more general to impacts of the potential project overall.

Interest in available on-street parking varied by location along the corridor. Most concerned were residents and merchants in the Richmond’s commercial corridor who urge retaining or even increasing on-street parking for shoppers and for deliveries to local businesses. Some community members encouraged the Study Team to develop proactive methods of guiding motorists to off-street parking areas within the corridor to maximize use of existing parking spaces. Community members called for more analysis of parking impacts of each alternative during an environmental review.
Key Conclusions

Overall, all of the BRT alternatives (Alts. 3-5) would provide significant improvements to bus operations without significantly impacting travel by automobile. Overall traffic conditions would not significantly deteriorate from conditions in the baseline (Alt. 1) for any alternative and traffic would continue to flow at acceptable levels at all intersections in the corridor (with the exception of Masonic, described in Section 5.10). Auto travel time between 33rd Avenue and Gough Street would change by no more than 2 minutes from the baseline (Alt. 1) and average auto speed would change by no more than 2 mph in either direction.

Traffic diversions would occur under with implementation of a BRT system, primarily between Gough and Park Presidio. However, the increased volumes predicted on streets parallel to Geary would be modest and should be undetectable by most travelers. Finally, most of the alternatives would have only a small negative impact on the number of parking spaces available in the corridor, removing no more than 4% of spaces between Van Ness and 33rd Avenue. The following table summarizes the results of the Traffic Operations and Parking evaluation.

<table>
<thead>
<tr>
<th>PM Peak</th>
<th>Average Vehicle Delay on Geary at PM peak</th>
<th>Average Person Delay for whole Intersection at PM peak</th>
<th>Auto Travel Time (Westbound)</th>
<th>Auto Speed (Westbound)</th>
<th>On-street Parking (all services in busway)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt 1: Basic Transit Priority</td>
<td>11 sec</td>
<td>15 sec</td>
<td>15 min</td>
<td>16 mph</td>
<td>1060 spaces</td>
</tr>
<tr>
<td>Alt 2: Basic Plus</td>
<td>10 sec</td>
<td>13 sec</td>
<td><img src="up" alt="up" /></td>
<td><img src="up" alt="up" /></td>
<td><img src="down" alt="down" /></td>
</tr>
<tr>
<td></td>
<td>(-1 sec)</td>
<td>(-2 sec)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alt 3: Side BRT</td>
<td>10 sec</td>
<td>13 sec</td>
<td><img src="up" alt="up" /></td>
<td><img src="up" alt="up" /></td>
<td><img src="down" alt="down" /></td>
</tr>
<tr>
<td></td>
<td>(-1 sec)</td>
<td>(-2 sec)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alt 4: Center BRT with 2 medians</td>
<td>12 sec</td>
<td>15 sec</td>
<td><img src="up" alt="up" /></td>
<td><img src="up" alt="up" /></td>
<td><img src="up" alt="up" /></td>
</tr>
<tr>
<td></td>
<td>(+1 sec)</td>
<td>(no change)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alt 5: Center BRT with 1 Median</td>
<td>12 sec</td>
<td>15 sec</td>
<td><img src="up" alt="up" /></td>
<td><img src="up" alt="up" /></td>
<td><img src="down" alt="down" /></td>
</tr>
<tr>
<td></td>
<td>(+1 sec)</td>
<td>(no change)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.8 Cost

Purpose
This section provides conceptual level capital cost estimates for the BRT alternatives on Geary Boulevard, including hard costs (e.g. materials, labor) and soft costs (e.g. planning, design, etc.). The cost estimates below include pedestrian and bus stop enhancements along the whole corridor (48th to Market) in addition to the lane and median changes between 33rd and Van Ness.

Note that cost estimates are based on the conceptual designs, and would be further refined during preliminary engineering. This measure is intended to estimate the costs of constructing BRT on Geary, and to determine the magnitude of the capital improvements that would accompany a BRT project on Geary. These estimates can also be used to begin identifying a potential funding plan for transportation improvements on Geary.

The cost analysis also addresses likely impacts to operating costs and identifies potential sources for funding transit improvements on Geary. This evaluation category helps assess how each alternative would meet the project goal of efficient, effective and equitable transit service.

Methodology
The cost of BRT on Geary was estimated by the Study Team based on the conceptual designs for each alternative and adjusted to reflect the historical costs of implementing transit construction projects in San Francisco. The estimates include the full range of project elements, along with traffic management activities during construction. Capital costs were estimated for all alternatives; however, capital costs for Alternative 1 are expected to be relatively minor. Costs for the remaining alternatives are incremental to the basic improvements currently anticipated for Geary in the coming years. Funding options for the project are discussed in Chapter 6.

Findings

Capital Costs
BRT on Geary is expected to cost between $157 million (Alt 3) and $172 million (Alts 4 & 5) in 2010 dollars ($39 - $43 million per mile)\(^{46}\) for the typical sections, depending on the alternative selected. The Center BRT alternatives (Alts. 4 & 5) would cost slightly more than the Side BRT alternative (Alt. 3) due to the considerable median changes they require. The costs are higher once the special intersections at Fillmore and Masonic are factored in. With the less expensive surface Fillmore and Masonic designs, Geary BRT is expected to cost between $172 million and $187 million. With the more expensive underground designs, Geary BRT is expected to cost between $197 million and $212 million. Cost estimates for these special locations at Fillmore and Masonic are discussed further below.

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\(^{46}\) Capital costs have been escalated to the year of construction, 2010, using a 3% rate of escalation.
For the BRT alternatives (Alts. 3-5), this estimate includes:

- Street resurfacing and any changes to street configuration required by the project for the focused area of analysis (between Gough Street and 33rd Avenue);
- BRT and local stop platforms and station amenities, including shelter upgrades, ticket vending machines, real-time information, landscaping, and station lighting for the full length of Geary (Market Street to the Pacific Ocean);
- Signal upgrades to support transit signal priority and optimize traffic flow along Geary Boulevard; and
- Pedestrian and streetscape improvements, such as curb extensions, and median landscaping along Geary Boulevard.

Estimates also include construction management activities intended to coordinate a safe construction environment and maintain vehicular and pedestrian access to businesses and homes throughout the construction period. The contribution that each of these features makes to the overall cost of the project is shown in Figure 5-37. This figure does not include the Fillmore and Masonic intersections.

The baseline (Alt. 1) would draw from funds already programmed as part of Muni’s existing 5-year funding prioritization plan. For the Basic Plus alternative (Alt. 2), basic transit priority improvements on Geary are expected to cost up to $8 million. This estimate includes additional and/or extended bus bulbs at targeted locations, real-time information at additional locations, new signage to identify the transit-only lane, and signal upgrades required to support additional transit signal priority and optimize traffic flow.

**Figure 5-37  Distribution of BRT Costs—Typical Sections**

Based on typical sections for Center BRT, excluding improvements at Fillmore and Masonic. Proportions for Side BRT would be similar, though costs would be lower.
The cost of acquiring new vehicles is not included in these estimates, since SFMTA’s regular vehicle replacement cycle already anticipates new vehicles on Geary within approximately the same timeframe as the project. More detail on potential vehicle acquisition, if warranted, and other potential costs would be addressed in a subsequent phase of work. Costs presented within this report have been escalated to the year of construction, 2010. Further detail on capital cost estimates is provided in Appendix XX.

**Special Intersections**

Improvements at the intersections of Geary at Fillmore and at Masonic are expected to be more extensive, and require a higher level of investment. For Geary at Fillmore, estimates for capital costs range between $11 million and $20 million, with each of the “fill” options (Center and Side) at $11 million and the Underground option with an underground station at $20 million. For Geary at Masonic, estimates for capital costs range between $4 million for Surface BRT and $20 million for Underpass BRT with an underground station. Given the complexity of construction at these locations, and the need to redesign some of the alternatives, the contingency factor applied to cost estimates for these locations is 50%, higher than that for the typical sections (30%). More detail on these designs can be found in Section 5.10.

**Operating Costs**

A BRT system on Geary Boulevard is expected to deliver additional service while operating within the current operating cost envelope. In fact, all the BRT alternatives should provide more service with little to no increase in operating cost. The key determinant of the cost to operate a service is the cycle time of the route—the average time required to make a round trip, including a break—which dictates the number of buses and drivers required to operate at a given frequency of service. For example, if a bus “cycle time” is one hour, and the bus is scheduled to operate at 15 minute headways, then 4 buses are needed to meet the scheduled headway. If bus “cycle time” is reduced by 15 minutes then only 3 buses are needed to run at the same frequency.

By improving bus travel times and reducing delays, BRT shortens the amount of time a bus requires to complete its route. This reduction enables the same number of drivers and buses to operate more route cycles and ultimately provide a higher frequency of service, at little to no additional cost. Center BRT alternatives (Alts. 4 & 5) would have the greatest travel time savings and reliability improvements, as discussed earlier, and would therefore maximize the level of service Muni could obtain for its existing operating budget.

Reinvesting operating cost savings is expected to offer a major benefit that transit riders desire: higher frequencies and a wider span of service on Geary. Savings could result in BRT frequencies as low as 3 or 4 minutes in the peak periods and/or BRT service hours that coincide with Muni Metro service hours at little to no additional cost, particularly when service is efficiently allocated between the BRT and local services. More detailed operating cost analyses, along with costs for maintenance of any new infrastructure or streetscape amenities, would be pursued during an environmental analysis.
Community Feedback

While cost was a concern, most stakeholders did not perceive this as an overriding constraint for further study. Members of the public indicated that cost estimates, though detailed, need further detail and development during a subsequent phase of study, in particular for the intersections at Fillmore and Masonic and for operating and maintenance costs.

Key conclusions

BRT on Geary is expected to cost between $157M - $172M for the typical sections, with an additional $15M - $40M for the intersections of Fillmore and Masonic. The total project could cost between $172M - $212M depending on the alternative that is chosen for the typical locations and for the special intersections.

BRT is expected to reduce operating costs by reducing the amount of time a bus takes to complete one round trip route. These cycle time savings for BRT could lead to increased transit frequencies and longer service hours with little to no change in the operating costs.
5.9 Construction Impacts

Purpose
This section describes the likely duration and intensity of Geary BRT construction, and identifies strategies to reduce construction impacts on adjacent land uses. Construction impacts are assessed based on the expected duration of construction, in months, and the expected intensity, in the number of street area/blocks under construction during a given span of time.

Methodology
Construction impacts were assessed through consultations with construction firms who have experience in San Francisco. Based on the conceptual engineering drawing of the BRT alternatives, the Study Team developed potential construction approaches to minimize the duration and intensity of BRT construction.

Findings

Construction Duration
BRT alternatives on Geary (Alts 3-5) can be constructed within 1½ to 2 years; duration varies little across BRT alternatives. Construction of BRT would be arranged in segments of 3-6 blocks at a time, with each segment lasting about 2-3 months in total, including some night and weekend construction as appropriate. Working on more than one segment at a time at different parts of the corridor would allow the overall construction to move more quickly than would otherwise be possible. Construction staging and traffic management would be designed to keep at least one lane of traffic open and maintain pedestrian access throughout construction.

Construction impacts for the Basic Plus Alternative (Alt. 2) would be less intense and shorter overall than the BRT alternatives, with spot treatments at key locations along the corridor. The duration of construction at some of these locations, however, could be approximately the same as the BRT segments (2-3 months per segment).

Given the length of the corridor, construction could be phased to minimize impacts and/or to address more congested areas before others. More detail on construction phasing would be developed during an environmental impact analysis. See Section 5.10 for more information on Fillmore and Masonic, where construction would be more intensive than in the typical sections.

All feasible project delivery methods that could reduce construction time or minimize disruptions will be explored. During an environmental analysis the Study Team would also explore new ways to either minimize impacts on businesses or to make existing business retention and support programs more accessible to businesses along the corridor during construction.
Construction Intensity

Construction of BRT is lower intensity compared to light rail or subway construction; for the most part, construction would be similar to a street resurfacing project particularly since designs would not result in substantial changes to sidewalk widths along the typical sections.

If the full project were pursued in one phase, it is likely that 2-3 short segments of 3-6 blocks would be under construction at a given time, at different areas of the corridor. During that time, roadway access for land uses fronting Geary would be preserved. A more detailed construction schedule would be developed during an environmental analysis.

Each BRT alternative involves several key construction elements: resurfacing, curb extensions, median work, and transit stations/platforms. Because each BRT alternative involves all of these elements, construction impacts do not differ significantly among the BRT alternatives. Again, construction impacts for the Basic Plus alternative (Alt. 2) would be less intense than the BRT alternatives, as spot treatments would only include bus bulbs or extended bus zones and curb extensions at key locations.

Community Feedback

At many points throughout the Study, including public workshop series and stakeholder meetings, merchants and others have expressed concerns about the impact of project construction. Workshop participants and other stakeholders along the corridor have urged the Study Team to take steps to minimize the construction impacts of all alternatives on adjacent land uses. Other community members have expressed a strong desire for construction jobs and other project development opportunities to be made available to affected residents.

In most areas, community members and stakeholders supported the Study Team’s efforts to incorporate designs that would avoid sidewalk reconstruction. This was an intentional effort to minimize impacts of BRT construction on access to businesses and other active land uses along the corridor. At locations like Fillmore and Masonic where construction activities could be more intensive, community members have expressed an interest in widening sidewalks to increase pedestrian comfort and offer more areas for other streetscape amenities.

The expected construction impacts for Geary BRT would continue to be refined in the environmental analysis, through additional study and partnerships with other city agencies such as the Mayor’s offices of Economic and Workforce Development and of Neighborhood Services. The Study Team would work proactively to develop and identify innovative project delivery methods that could reduce impacts as well as city programs that would support businesses during construction. Job access programs such as Citybuild would also provide opportunities for affected communities.
Key Conclusions

- BRT is low-intensity and quick relative to major transportation projects such as light rail or subway construction, and is more akin to a resurfacing project.
- BRT on Geary can be constructed in 1½ to 2 years, in 3 to 6 block segments of 2-3 months each.
- Expected construction impacts of the BRT alternatives do not differ significantly.
- Construction for the Basic Plus alternative would likely be of similar time and intensity where construction is warranted, but would be shorter given the smaller number of areas where treatments would be required.
- An array of construction approaches is available to reduce the duration and intensity of construction, including night/weekend construction where appropriate.
- Access to businesses would be maintained throughout the construction period.
5.10 Special Intersections

If San Francisco decides to move forward with one of the three BRT designs (Alts. 3-5) evaluated in this Study, there are two intersections that would require special attention and design treatments due to unique traffic patterns and street layout. These intersections are:

- Fillmore Street and Geary Boulevard, and
- Masonic Avenue and Geary Boulevard.

The primary feature that sets these two intersections apart is the presence of an auto underpass that creates “express” lanes for through traffic and street-level service roads that serve transit, local traffic, and parking. These intersections are also wider than the typical cross section of Geary. The combination of these features offers both challenges and opportunities for improving the transportation conditions to the benefit of all users and nearby attractions and neighborhoods. The BRT designs were adapted to accommodate the unique street layout at each of these locations (described fully in Chapter 4).

In addition to addressing the needs of the BRT system at these special locations, the designs also provide an opportunity to improve the surrounding neighborhood by reducing the impacts that these very large intersections currently have on the surrounding environment. The Needs Assessment Report identified several issues at these intersections that should be addressed in any reconstruction design:

- Bus traffic at the Fillmore and Masonic intersections is relegated to slow, inefficient service roads, while auto traffic operates on the “express” lanes in an underpass. Consequently, these intersections represent areas of significant delay for buses, while auto travel times are exceptionally fast. Designs for improving these intersections need to better balance the needs of all users.

- These locations are two of the highest transfer points on the corridor, however they have some of the poorest pedestrian and station conditions: long, onerous or circuitous pedestrian crossings; narrow sidewalks, and poor station areas.

- Geary serves as a significant barrier between neighborhoods to the north and south (particularly at Fillmore), because of the very wide street and poor pedestrian links. Community members identified this as a high priority for improvement in the re-design.

The scope of this feasibility study only allowed for initial design work at these locations to ensure that feasible designs exist. All alternatives would require further development and more detailed study before the best physical design for each location can be identified. A more thorough examination can be done in the next stage of the study, the environmental analysis.

**Fillmore Street and Geary Boulevard**

The intersection of Fillmore Street and Geary Boulevard has some of the poorest pedestrian conditions and widest street widths on the entire corridor. The street serves as a barrier between Japantown to the north from the Western Addition to the south of Geary.
Four alternatives were considered for this intersection (described fully in Chapter 4). Two alternatives would fill in the underpass, bringing all traffic to the surface:

- Fillmore Side BRT
- Fillmore Center BRT

Two alternatives would maintain two lanes in each direction in the underpass, and dedicate one lane in each direction for transit:

- Fillmore Viaduct BRT
- Fillmore Underpass BRT.

All of the Fillmore alternatives would provide a high level of transit priority, while helping to bring the neighborhoods to the north and south of Geary closer together and improving urban design, pedestrian conditions, and street identity. They would all considerably reduce pedestrian crossing distances and create wider, more frequent pedestrian refuges. They would address major inadequacies at the bus stops, by providing needed platform space and amenities at one of the busiest locations on the route. Conditions for auto traffic at the Fillmore intersection would remain at acceptable levels in all the alternatives.

In many cases, the two alternatives that fill the underpass would perform similarly, as would the two that maintain the underpass, therefore the overall advantages and disadvantages of these two types of alternative are discussed together below and then unique advantages/disadvantages of each alternative are mentioned.

**Fillmore Side and Center BRT**

The two alternatives that fill in the underpass (Fillmore Side and Center BRT) would do a better job of “bridging” the neighborhoods to the north and south of Geary than the two alternatives that maintain the underpass. They would promote a sense of neighborhood cohesion by removing the perceived and actual pedestrian barrier of the freeway-like underpass. They would also enhance the crossing experience and waiting experience for transit riders by providing wider medians with high-quality landscaping, possibly exceeding that of the standard BRT alternatives (Alts. 3-5) since more space is available. These would not only serve as pedestrian refuges, but would also enhance street identity. In fact, consistency of the street’s cross section with some of the standard BRT alternatives would lend itself towards strong street identity and BRT identity for the project as a whole.

**Fillmore Side BRT**

The overall design of the Fillmore Side BRT alternative is similar to the standard Side BRT alternative (Alt. 3), except the Fillmore version maintains the service roads on both sides of Geary. This “boulevard” design would maintain high auto capacity while greatly improving transit conditions and enhancing pedestrian features. The conflicts with cars that occur on prototypical sections of standard Side BRT (Alt 3) design would be substantially eliminated at the Fillmore intersection because parking, local, and turning traffic would be accommodated in the side service roads. The result is that transit performance at this
important intersection would be expected to be enhanced and could perform similar to the prototypical Center BRT alternative sections.

**Fillmore Center BRT**

The overall benefits of the Fillmore Center BRT alternative would be quite similar to those of the standard Center BRT alternative with 2 medians (Alt. 4). In the Fillmore version, the extra space gained by the elimination of the service road would allow for a 35-foot sidewalk which would create an opportunity for a linear park or promenade. This would not only increase the quality of pedestrian conditions and open space in the neighborhood, but also, in combination with the visible, prominent center transit lane, create a strong street identity and strong urban design.

**Fillmore Viaduct and Underground BRT**

The Fillmore Viaduct and Underground BRT alternatives would maintain all or part of the existing underpass. Both would have the potential to create street-level plaza areas, which would buffer waiting passengers from auto traffic, and provide space for landscaping and other pedestrian and transit rider amenities. With additional analysis and design, these alternatives could create more public open space than the two “fill” alternatives.

By keeping pedestrians separate from high-speed auto traffic at Fillmore, the underpass would help bridge connections to the north and south at Fillmore. Despite this, the characteristics that make this intersection a barrier between neighborhoods would remain, particularly at Webster and Steiner where pedestrian crossings are relegated to overhead
bridges. Because these designs would dramatically improve the street-level pedestrian experience at all of these intersections, they would remove the obvious disadvantage of the underpass while maintaining the separation between autos and pedestrians. Bus passengers transferring between Geary buses and Fillmore buses would not need to cross heavy Geary traffic to make transfers as they do in the Fillmore Side and Center BRT alternatives.

Lastly, the plazas would deliver strong BRT branding because they would be distinct transit-only infrastructure that is highly visible. The dimensions, design, and feasibility of the plaza designs in these two alternatives will need more substantial development in future stages of study.

**Fillmore Viaduct BRT**

Fillmore Viaduct BRT would fill the center lane of the underpass in each direction, leaving two through traffic lanes in each direction and BRT and 38-Local buses would run in the center of the road at street level. The benefits of Fillmore Viaduct BRT for transit and auto operations would be similar to those of the standard Center BRT with 2 medians (Alt. 4).

**Fillmore Underground BRT**

The Fillmore Underground BRT alternative would maintain and expand the underpass to allow for 2 lanes of through traffic plus a transit station underground in the underpass. Transit passengers would descend from the street-level transit plaza to the underground station to board the bus. This design would provide strong BRT branding because the underground platforms would be unique and separate infrastructure from other Muni stops, however this alternative requires passengers to wait below street level with limited visibility from adjacent land uses. Passengers could reduce underground waiting time by relying on real-time transit arrival information displayed in the surface-level transit plazas. In addition, transit riders would have to change levels to transfer to Fillmore buses, which would be less convenient and more time-consuming than street-level transfers. As discussed in Section 5.8, this alternative is the most expensive of the Fillmore alternative designs due to substantial retrofit of the underpass, as well as the addition of escalators/elevators and possibly additional operations and maintenance costs to maintain the underground station area.
Masonic Avenue and Geary Boulevard

The intersection of Masonic at Geary is the most complex intersection on the corridor. In addition to the issue of “express” lanes for through traffic with side service roads for transit and local traffic, high demand for northbound traffic Geary requires a double left turn lane in the westbound direction. This intersection has one of the highest left-turn volumes on the entire corridor. This added complexity creates a unique challenge for the design of BRT alternatives at this intersection. For one, it adds physical design challenges, but more important the great width, high traffic volumes on both streets, and complexity of turning movements at this location create current intersection delays at Masonic that are already high (a current level of service of “E”). The existing tunnel provides a significant auto advantage considering the sheer volume of turning and through movements. In addition, the underpass at Masonic separates traffic over 4 intersections, unlike the Fillmore underpass that eliminates only 1. Given the existing conditions and level of service, dedicating a lane exclusively to transit while minimizing impacts to autos was uniquely challenging.

Two alternatives were considered for this complex intersection:

- Masonic Surface BRT
- Masonic Underground BRT

Both of these options would improve the transit rider experience by improving wayfinding and creating a more convenient transfer between the 43-Masonic and the 38-Geary at a consolidated signature station between Masonic and Presidio. Overall, both alternatives would provide better transit performance. As currently designed the Masonic Surface BRT would perform better for autos while the Underground alternative would offer better transit performance. However, they both require additional development to meet the needs of all users. Additional engineering work can be completed during the next phase of this Study. The unique advantages and disadvantages of each alternative are described below.

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48 “Level of service” is a tool for measuring the performance of an intersection, it is measured by assigning a grade of A through F. So, E is one level above breakdown conditions. Level of service is described fully in Section 5.7.
Masonic Surface BRT

In this alternative, buses would operate at the surface, local traffic would remain on the service roads, and auto through-traffic would be maintained in the tunnel. Eastbound buses would operate in a bus-only lane on the service road and westbound buses would operate on the service road to the east and west of the intersection, but would utilize the center lanes from Presidio to Masonic.

The pedestrian and transit rider experience would be improved relative to the Masonic Underground alternative through integrated, street-level transfers between Geary and Masonic buses and reduced potential for auto-pedestrian conflicts, achieved by maintaining through traffic in the underpass. Pedestrian access and safety would also be improved by reducing the crossing distance at Masonic and Presidio and by adding needed pedestrian refuges and sidewalk space, in particular the 180-foot long bus bulb on the north side of Geary and the widened sidewalk/plaza opportunity at the southeast corner (in front of Mervyn's and Best Buy).

Masonic Surface BRT would maintain traffic conditions and intersection delay at acceptable levels because through traffic would remain in the underpass. However, the dedicated bus lane would have to enter a short segment of mixed traffic west of the intersection between Masonic and Wood, which would introduce potential for conflicts with cars and could impact service reliability and transit performance. This option would also maintain bus operations on steep, slow service roads as they approach the Masonic intersection, which entails further impacts on transit operations. Finally, the configuration of Masonic Surface BRT would be different in the eastbound and westbound directions which would detract somewhat from its ability to create unique BRT branding that is distinct from standard Muni service.

Masonic Underground BRT

In this alternative, the existing underpass would be dedicated exclusively to Geary buses and an underground station would be built. At the street-level, Masonic buses would operate in center-running transit-only lanes and service roads would be widened to two lanes to carry all auto traffic.
The design would create strong BRT branding because it would be similar to the Muni Metro system and the surface transit plaza for the 43-Masonic bus would highlight this intersection as a transit hub. It would also offer some increases in sidewalk width. However, pedestrians would have no buffer from traffic, and the traffic volumes would be significantly increased on the surface. Also, this alternative could be perceived as less safe than Surface BRT because passengers would have to wait below street level with limited visibility from adjacent land uses. Furthermore, they would have to change levels to transfer to Masonic buses, which would be less convenient and more time-consuming than street-level transfers. As discussed in Section 5.8, this alternative is more expensive than the other Masonic alternative due to construction of the underground station, the addition of elevators/escalators, and possibly additional operations and maintenance costs to maintain the underground station area.

The design would offer tremendous advantages to transit performance because the buses would have exclusive access to the underground express lanes. However, Masonic Underground BRT would cause auto conditions at the intersection to break down. Because all auto traffic would be brought from the underpass lanes to the surface average vehicle delay would increase substantially, to a level of service “F”, where cars would experience significant queues and wait multiple signals to advance through the intersection.

The substantial impact on auto operations makes this alternative infeasible as currently designed. The scope of this phase of work did not allow for design of additional center-running options that give buses the travel time benefits of the underpass without creating breakdown conditions for auto traffic. The Study Team is confident that a solution that works for autos, transit, and other modes could be identified in the environmental analysis phase of the Study.

**Cost and Construction Impacts**

While both cost and construction impacts would vary by location, cost and construction impacts are expected to be significantly higher at these locations than at the more typical
locations along Geary Boulevard. Based on the conceptual designs, preliminary cost estimates are projected to be between $11 and $20 million at Fillmore and $4 and $20 million at Masonic in year 2010 dollars. Construction impacts for these special intersection designs would also be considerably greater (both in intensity and length) than for other segments of the corridor. Most of the alternative designs call for substantial reconstruction of the underpass layout, either by filling it in to accommodate above-ground transit-only lanes, or by expanding it to accommodate a subterranean transit station.\footnote{The Masonic Surface BRT is an exception to this. This alternative requires minimal reconstruction and thus costs and construction impacts would be considerably lower than all the other special intersection designs at Fillmore and Masonic.} Both these impacts will require further study to determine their exact scale.
## 5.11 Achievement of Study Goals

The alternatives evaluation was designed to assess the degree to which each of the proposed alternatives would achieve the project goals. Each evaluation category is linked to the Geary BRT project goals as follows:

<table>
<thead>
<tr>
<th>Goal</th>
<th>Evaluation Categories</th>
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| Robust and Stable Ridership (Keeping people on transit) | 1) Transit Operations & Performance  
2) Transit Rider Experience  
3) Pedestrian Safety & Access                                      |
| Efficient, Effective, and Equitable Transit Service (Providing better transit service for all people and at a lower cost) | 2) Transit Operations & Performance  
6) Capital & Operating Costs                                           |
| Neighborhood Livability and Commercial Vitality (Strengthening the local economy, turning transit into true economic activity generator, while protecting existing businesses and community values) | 3) Pedestrian Safety & Access  
4) Urban Design & Landscaping  
5) Traffic & Parking Impacts  
7) Construction Impacts                                                   |
| Transit Priority Network System Development (Strengthening image and role of transit) | 1) Transit Operations & Performance  
2) Transit Rider Experience  
4) Urban Design & Landscaping                                      |

The project goals were developed by the Study Team in close coordination with the Geary Citizens Advisory Committee and other key stakeholders to ensure that the project is always guided by broad objectives for the neighborhoods, the transit system, and the City. These goals recognize that the Geary BRT project must not only improve bus performance, but must also improve mobility and balance among all modes and the quality of the neighborhoods that Geary BRT serves. (The process for developing these goals is fully described in Chapter 3.)

Based on the results reported previously in this Chapter, each alternative was evaluated on how well it would meet the project goals, by assigning a ranking of “high,” “medium,” or “low” in each goal area as described below.
Summary of Alternatives’ Contribution to Project Goals

- While all of the BRT alternatives (Alts. 3-5) would lead to improvements in each of the project goal areas, the Center BRT alternatives\(^5\) (Alts. 4 & 5) would provide the best overall enhancement, with results higher than or equal to all the other alternatives in every goal area. Center BRT ranked “high” on all goals except *neighborhood livability and commercial vitality*, where all alternatives received a “medium”. This overall advantage is due to a couple key benefits that the center transit lane configuration would have over the other designs. First, the physically separated transit lane would maximize efficiency and effectiveness of transit operations, and would fully eliminate bus and auto conflicts. In addition, the prominent center station designs would provide the best pedestrian conditions and urban design opportunities for the neighborhood, as well as create the most distinct and recognizable identity for Geary and image for the BRT service.

- Side BRT (Alt. 3) also performs well, getting a ranking of “medium” for three goals and “high” for one. Side BRT does not perform quite as well as Center BRT for two main reasons. First, the transit-only lane would be permeable to mixed traffic and the resulting conflicts would diminish the operational efficiency benefits of the bus lane for both transit and drivers. Secondly, the location of the new transit-only infrastructure adjacent to the sidewalk would not create as distinct an image for street identity or the BRT system, nor would it provide as many pedestrian and urban design opportunities for the neighborhood.

- Basic Plus (Alt. 2) would not effectively meet the project goals, receiving a score of “low” for all goals except one. This is primarily due to the fact that the transit service improvements would only be in effect 5 hours each day in only one direction (peak period, peak direction) which would minimize transit efficiency gains, inequitably distribute benefits, and would not create a unique image for transit. Also, there would be no major or consistent infrastructure improvements, landscaping, or amenities that would improve pedestrian and urban design conditions for the neighborhood.

- Each alternative’s ranking for each project goal is shown in Figure 5-38. A brief explanation of the scores for each goal is included below.

\(^5\) The Center BRT alternatives (Alts. 4 & 5) perform similarly on so many criteria that they are assessed together in terms of how they meet the project goals.
Figure 5-38 Alternatives’ Contribution to Project Goals

<table>
<thead>
<tr>
<th></th>
<th>Robust and Stable Ridership</th>
<th>Efficient, Effective and Equitable Transit Service</th>
<th>Neighborhood Livability and Commercial Vitality</th>
<th>Transit Priority Network System Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt. 2: Basic Plus</td>
<td>LOW</td>
<td>LOW</td>
<td>MED</td>
<td>LOW</td>
</tr>
<tr>
<td>Alt. 3: Side BRT</td>
<td>MED</td>
<td>MED</td>
<td>MED</td>
<td>HIGH</td>
</tr>
<tr>
<td>Alt. 4: Center BRT with 2 medians Alt. 5: Center BRT with 1 median</td>
<td>HIGH</td>
<td>HIGH</td>
<td>MED</td>
<td>HIGH</td>
</tr>
</tbody>
</table>

Robust and Stable Ridership

All BRT alternatives (Alts. 3-5) would raise transit ridership considerably by increasing the attractiveness of transit through improved performance and a more comfortable and pleasant waiting environment. As the reputation developed for more reliable and comfortable service, these gains would only increase. Center BRT received a “high” score because it would attract the most new riders to transit (25% increase). Side BRT received a “medium” score because it would attract somewhat fewer riders (15% increase) due to lower transit performance.

Basic Plus (Alt. 2) received a “low” score because it would attract fewer than 5% more transit riders to Geary. This is because reliability improvements would be limited, only occurring during the peak period, peak direction, and because Basic Plus would provide no improvement in the passenger waiting experience. While this alternative would be an improvement over current conditions, ridership increases and operational improvements would be limited to peak periods, making it difficult to achieve a “robust and stable ridership”.

Efficient, Effective and Equitable Transit Service

All BRT alternatives (Alts. 3-5) would considerably increase overall efficiency of the transit service on Geary due to increased ridership and decreased travel time as well as allowing for more service within the current operating budget (higher frequency, longer hours, and/or Sunday service) from the reinvestment of travel time savings. These benefits would be equitably distributed to all users at all times of day. Center BRT scores “high” because its design would maximize efficiency, whereas Side BRT received a “medium” score because it would have somewhat diminished efficiency from remaining mixed traffic operations.

Basic Plus received a “low” score on this goal. Although it would achieve some peak hour efficiency gains, there would be no efficiency gains in other time periods. Furthermore,
benefits would be focused exclusively on commuters, which would leave out approximately 75% of existing riders, including most transit-dependent riders.

**Neighborhood Livability and Commercial Vitality**

All alternatives scored “medium” in meeting this goal, although each alternative had different strengths and weaknesses.

All BRT alternatives (Alts. 3-5) would include considerable investment in pedestrian safety, bus stations, and other amenities which would enhance the overall quality of the street environment. In addition, the increased service resulting from reinvestment of travel time savings should lead to more commercial activity from increased foot traffic. On the other hand, the BRT alternatives would have parking tradeoffs and construction impacts on the neighborhoods. However, these impacts should be relatively minimal with the implementation of mediating strategies: construction could occur in short segments, and parking loss would be less than 4% once replacement strategies are undertaken. Center BRT alternatives in some scenarios would actually increase curb parking by up to 16%.

Basic Plus (Alt. 2) ranked medium in this category because it would minimize construction impacts, but would not provide benefits to the surrounding neighborhoods through improvements in the pedestrian and rider environment, nor would it increase foot traffic or improve the attractiveness of transit for shopping or other trips in the neighborhoods. Parking impacts of this alternative could be high, if the peak period transit lane was implemented as a tow-away lane, which could eliminate as many as 500 parking spaces.

**Transit Priority Network System Development**

Both the Center and Side BRT alternatives (Alt. 3-5) ranked “high” for this goal, because they would both create a recognizable and distinct rapid transit service along a critical corridor in San Francisco, building a key link in what could become a bus rapid transit network. Like light rail improvements, permanent bus rapid transit infrastructure that is visible and in effect over the full course of the day would inspire confidence in transit performance. This type of infrastructure investment often helps to inspire other investments in the neighborhood as property owners understand that the City is making a permanent improvement on the corridor.

Basic Plus (Alt. 2) was ranked “low” for this goal, because it would only operate in the peak period and would not entail any investment in unique transit infrastructure. This would not lend a sense of permanence and would be less likely to inspire investment or considerably improve perception of transit in San Francisco.
Chapter 6. Next Steps

6.1 Introduction

This section describes the next steps involved in implementing a potential BRT project on Geary Boulevard. The discussion outlines a potential funding plan for BRT on Geary, while later portions outline the proposed timeline for implementation of BRT on Geary. This section also summarizes community input on the next steps, and describes opportunities for community participation in any subsequent stages of study.

Funding

The following preliminary funding plan identifies both committed and potential funding sources for a Geary BRT project. A more detailed funding plan would be developed during later phases of study. The 30-year expenditure plan for transportation improvements funded by the Prop K sales tax was approved by voters in 2003, and dedicates close to $200 million for a citywide network of BRT and improvements for Transit Preferential Streets. Of this amount, more than $30 million is currently allocated for BRT on Geary in the Proposition K Strategic Plan, and more could be applied if the project is further prioritized in the next update of the 5-year Prioritization Plan (5YPP) in summer 2007. It is anticipated that these Prop K funds would serve as local match to leverage several times this amount, in order to deliver the project. Geary BRT would be highly competitive for all of the funding programs listed below, due to its high ridership and the significant benefits offered to a diverse group of San Francisco residents.

Figure 6-1: Potential Distribution of Funds for BRT on Geary
A funding plan for BRT on Geary would likely include several of the following programs, in addition to the Prop K sales tax funds already dedicated to Geary BRT. Many regional, state, and federal programs are available to fund transit improvements. There are also opportunities to combine improvements on Geary with other developments and improvements along the corridor, through public-private partnerships. These potential funding sources include:

- Federal Transit Administration’s (FTA) Small Starts program, which offers up to $75 million for projects under $250 million
- Federal Highway Administration’s Urban Partnerships program, which offers several hundred million dollars for congestion management activities that include significant transit improvements, including transit vehicles and facilities
- Research and Innovative Technology Administration’s Program on Intelligent Transportation Systems Operational Testing, which offers up to $100 million for technology improvements that better manage roadways and reduce congestion
- Public-private partnerships
- Developer contributions

Implementation Roadmap

Study Approval
This report presents the complete findings of the Geary Corridor BRT Study. This report will be presented to the Geary Citizens Advisory Committee, then to the Transportation Authority Board for approval. The report and findings will also be presented to the Municipal Transportation Authority Board of Directors, and will be reviewed by other agency partners.

Next Steps
All alternatives presented in this report will require environmental analysis if they are to be implemented. Following the approval of this Study, the Authority Board may direct staff to take steps to initiate an environmental analysis of BRT on Geary pursuant to state and federal rules, and to conduct an alternatives analysis per FTA rules. These studies are intended to analyze environmental impacts and benefits of BRT alternatives in detail, further develop and analyze the performance of the various design alternatives presented, and identify specific strategies and activities to reduce or address impacts observed. The environmental and alternatives analysis would be conducted over a timeframe of approximately 1 to 1½ years, beginning sometime in fall 2007 if pursued. These processes would result in selection of a preferred design for transit improvements on Geary. Each of these processes would produce a report that will require review and/or approval by the same agencies listed above, the Authority Board, MTA, FTA, and other agency partners.

Preliminary engineering designs would also be prepared for the potential project, including surveys, detailed plan, profile and section drawings, and an assessment of required utility and drainage modifications. Following identification and preliminary engineering of the preferred alternative, final designs and construction staging plans would be prepared.
These steps would be coordinated with any elements of Alternative 1, the baseline for transit improvements on Geary. The Authority will work proactively with the Study Team as a whole to ensure expedient and efficient coordination at each stage of the next steps. A graphic representation of implementation steps is presented below, in Figure 6-2.

**Figure 6-2: Geary BRT Implementation Timeline**

![Geary BRT Implementation Timeline Diagram]

**Community Feedback**

At public workshops hosted by the Authority in November 2006, participants voiced their opinions on next steps for the study of BRT on Geary, and identified issues that they would like to see addressed in more detail in the next stage of study. Key issues include the effects of traffic diversions onto local streets along the corridor and strategies to reduce diversions, impacts of construction on local businesses and strategies to maintain support businesses during construction, and impacts on parking of the various alternatives along with strategies to reduce them. Some participants also hope to see more detailed analysis of economic impacts of BRT in the next phase, while others hope to see further analysis of a comparison of the costs and benefits of BRT in the contrast with light rail.

Geary transit riders, residents, merchants, and other stakeholders would continue to be involved in the process as it moves forward, particularly during the environmental analysis, when interested parties would participate in refining the alternative designs, developing strategies to address any impacts, and defining a preferred alternative that best addresses the traveling needs of residents, merchants and visitors to the many locations along the Geary Corridor.