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MEMORANDUM

Date: March 6, 2013

To: San Francisco County Transportation Authority – Chester Fung, Bob Masys

From: Fehr & Peers – Matthew Ridgway, Brooke DuBose, Andy Kosinski

LCW Consulting – Luba Wyznyckyj

CC: Camille Tsao, HNTB

Subject: **Technical Memo #1A and #1B** –
Balboa Park Station Area Circulation Study: Goals, Evaluation Framework, and Existing Transportation Conditions

SF12-0612

The Balboa Park Station Area Circulation Study (herein "the Circulation Study") will establish a set of implementable station- and freeway-related access and circulation improvements based on the conceptual vision set forth in the *Balboa Park Station Area Plan* and refined in subsequent technical analyses. This memorandum summarizes the purpose of the Circulation Study and how it relates to previous Balboa Park Station studies; identifies the Circulation Study goals and objectives, as well as the evaluation criteria to be used for those metrics; and existing transportation conditions in the project study area.

BACKGROUND

Balboa Park Station has been the subject of a number of planning and engineering feasibility studies, most of which were direct follow-up studies on issues identified in the *Balboa Park Station Area Plan* (2009), the comprehensive long-range planning vision for the station area. The two most recent technical studies - the *Balboa Park Station Pedestrian and Bicycle Connection Project* (2009) and the *Balboa Park Station Capacity and Conceptual Engineering Study* (2011) – identified short-term and medium-term projects to improve pedestrian access and transit operations at the station, as well as the feasibility of the proposals for larger infrastructure improvements within the area. The subsequent focused studies of the station area address specific elements of station access or rider experience at Balboa Park, including uncomfortable or limited pedestrian access to the station, inconvenient kiss-and-ride (drop-off) activities in problematic areas, and feasibility of the long-range planning vision (e.g., construction above the rail yards) for the neighborhood. The San Francisco Municipal Transportation Agency (SFMTA) has also pursued opportunities to improve transit travel times in the area, specifically along Geneva Avenue, and pedestrian crossings, such as the Ocean/San Jose Avenue crosswalk.

While those studies advanced some of the pedestrian and transit improvements identified in the Station Area Plan, they also identified the need to do additional multimodal operations analyses to develop a longer-range, feasible and preferred circulation plan for the Ocean and Geneva Avenue freeway on- and off-ramps. This study will focuses specifically on auto operations at and near the station, one mode that has not been analyzed beyond the analysis conducted for the *Station Area Plan* Environmental Impact Report. This study will also address other modes (i.e., transit, pedestrian and bicyclists) to the extent that modifications to the roadway network may affect them.

PURPOSE AND NEED

The Circulation Study will specifically address potential mid- to long-range options to:

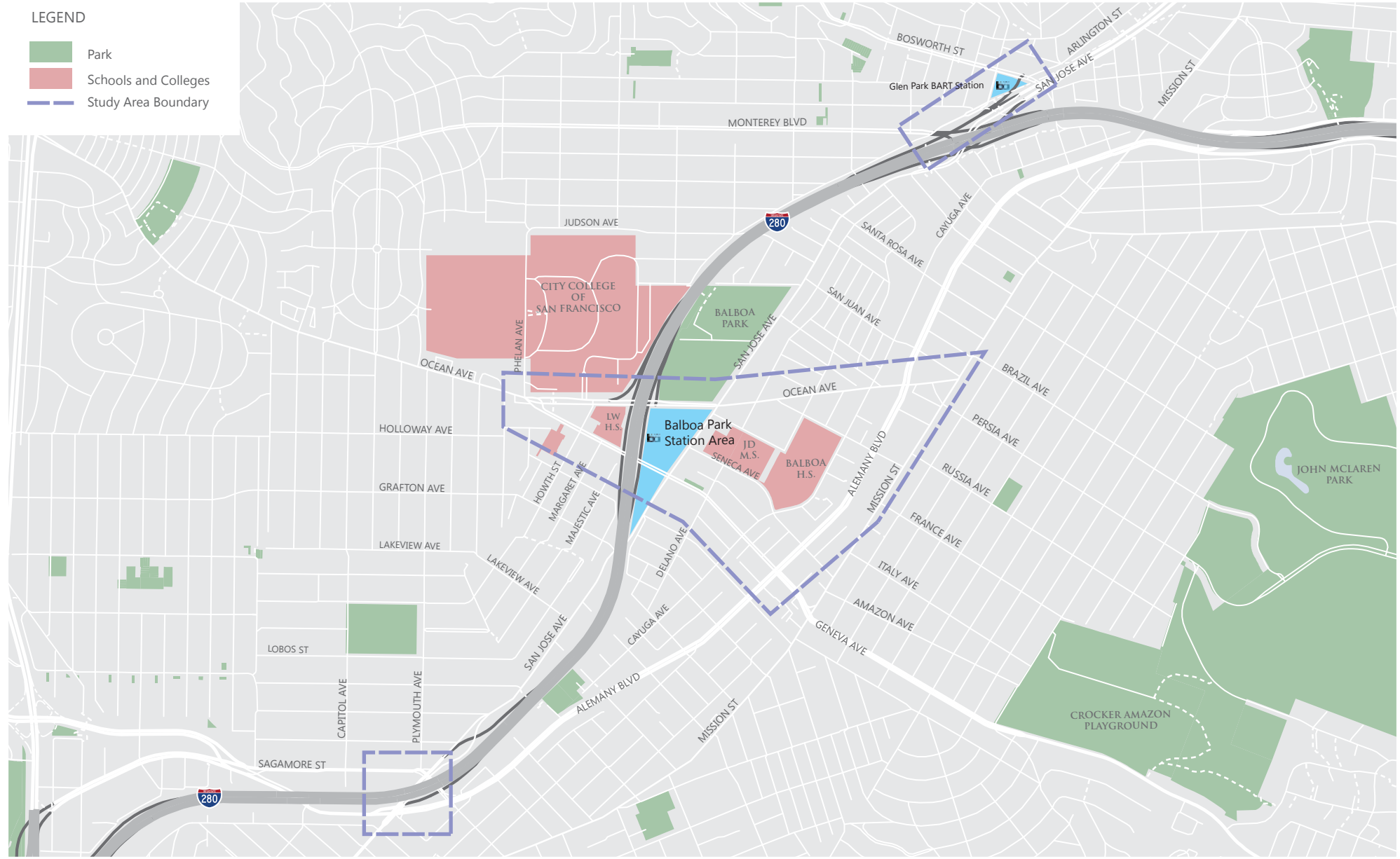
- improve vehicle circulation for regional (i.e., freeway-bound) and local traffic;
- reduce multi-modal conflicts at freeway ramp junctions and transit stops;
- improve transit access and operations, including kiss & ride activities; and
- address potential strategies for improving pedestrian and bicyclist access.

The solutions identified in this study will be sufficiently analyzed such that they could be pursued further if and when funding is available to reconstruct the I-280 interchange and the Ocean and Geneva Avenue overpasses.

STUDY AREA

The Circulation Study area is shown in **Figure 1**. In general, the Circulation Study's study area includes the streets bounded by Ocean Avenue, Geneva Avenue, and Alemany Boulevard. In addition, the study includes intersection analysis at I-280 ramp terminal intersections in Glen Park to the north, and along San Jose Avenue to the south, in order to capture the effects of potential modifications to the ramps at the Balboa Park Station.

Access to Balboa Park Station has been discussed in several plans and projects, including private development projects outside of this study's project study area. **Figure 2** highlights some previous and on-going studies within and near the project study area that may affect recommendations or considerations for this study.



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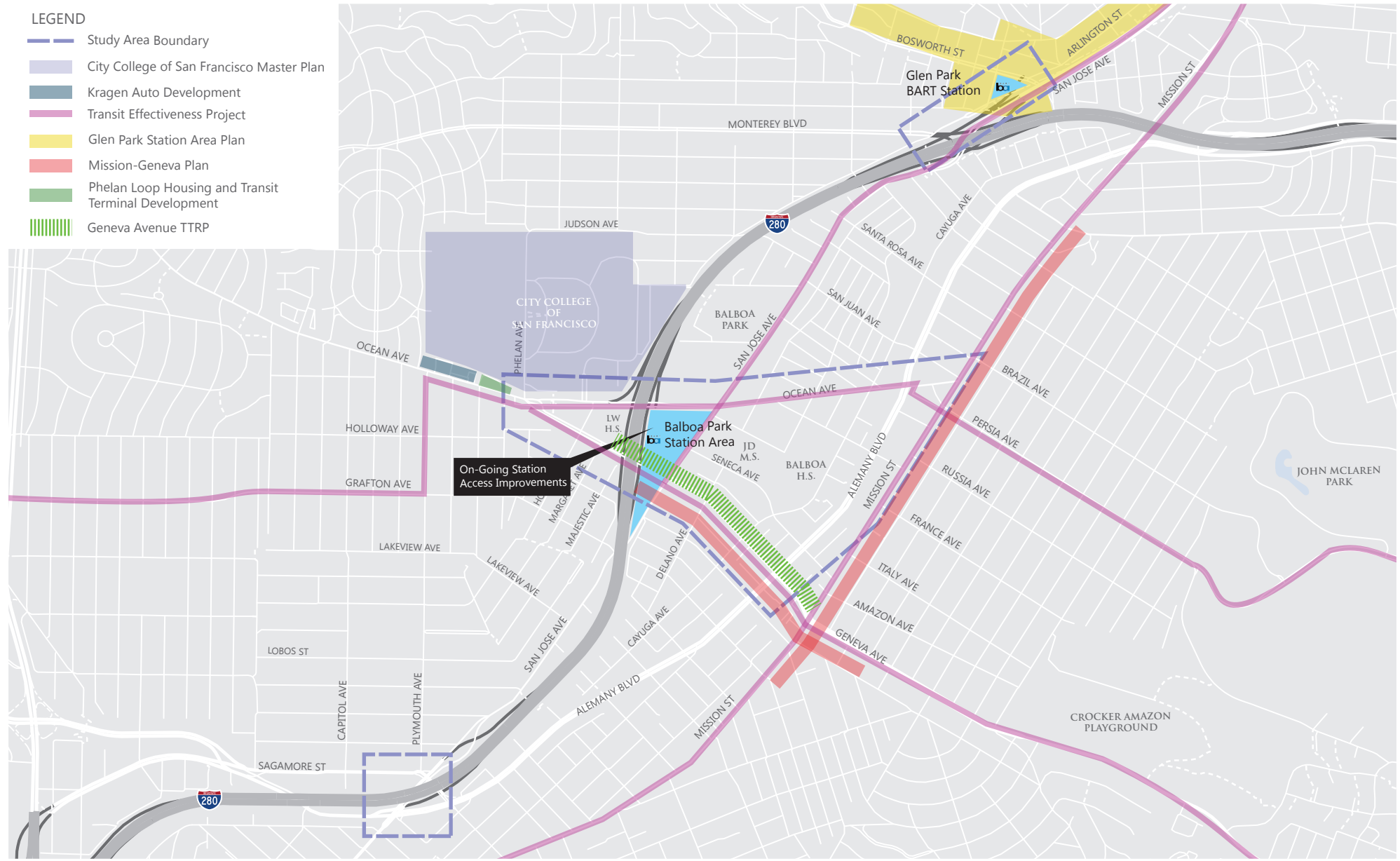
PROJECT STUDY AREA

FIGURE 1



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ON-GOING PROJECTS

FIGURE 2

POLICY FRAMEWORK

This section provides an overview of past studies and goals identified for Balboa Park Station, as well as the study goals, objectives, and evaluation metrics that will be used in this study.

RELATIONSHIP TO OTHER PLANS

Table 1 summarizes the projects and studies that have examined issues and opportunities at the Balboa Park Station. This study will rely heavily on these previous studies in order to advance and refine some of the circulation concepts previously considered. Table 1 identifies the key issues discussed in each report, as well as the status of any identified projects.

Table 1. Related Balboa Park Station Area Studies and Projects

Study/Project Title	Lead Agency	Year	Key Issues	Status of Projects
Completed Studies				
Capacity and Conceptual Engineering Study ("Capacity Study")	SFMTA	2011	o Provided engineering feasibility analysis and planning recommendations for the long-range concepts identified in the Station Area Plan.	Improvements Identified and Subsequently Funded: o Eastside Pedestrian Connection o Close Track Walkway near Ocean Avenue o Construct Accessible J/K platform on San Jose Avenue o Upgrade Existing J/K platform next to BART Station o Improve pedestrian connection between the BART station and San Jose Avenue walk o Straighten Geneva Avenue/NB I-280 crosswalk at BART Station o Add signal at Geneva Avenue/Howth St
Pedestrian and Bicycle Connections Project ("Ped and Bike Study")	SFMTA	2009	o Identified and prioritized short-term access and safety improvements for pedestrians and bicyclists around the station, including recommended conceptual designs	Recently Completed: o Westside Walkway between Ocean Avenue and the BART Station o Ocean Avenue/NB I-280 Crosswalk o Westbound Ocean Avenue Bike Lane o Westbound Ocean Avenue Bus Stop at BART Station o Pedestrian beacon at I-280 SB off-ramp on Ocean Avenue

Table 1. Related Balboa Park Station Area Studies and Projects

Study/Project Title	Lead Agency	Year	Key Issues	Status of Projects
Station Area Plan and EIR	SF Planning	2008/09	o Established preferred broad, long-term land use and circulation goals for Balboa Park neighborhood o Identified the need for improvements to connectivity for transit passengers o Identified the creation of a transit village on the Upper Yard and decking of I-280	The Station Area Plan is the most current long-range vision for the Station Area.
Station Profile Study	BART	2008	o Summary of BART station access characteristics by station and system-wide	
BART Comprehensive Station Plan	BART	2002	o Identified a vision for the BART station consistent with the City's Station Area Plan, including an intermodal transit village concept o Focused on BART access to/from Ocean Avenue, including the Westside walkway along the Muni tracks	
Forthcoming Studies				
Transit Effectiveness Project ("TEP")	SFMTA	On-going	o Identifies short- and long-range transit improvements to make Muni operate more efficiently and reliably o Identifies specific route changes within the Balboa Park study area	Proposed Improvements: o Reroute 29 Sunset from Geneva to Ocean o Reroute the 54 Felton through Excelsior o M Oceanview Short Line o Various Headway Modifications
Geneva Avenue Transit Travel Time Reduction Project ("TTRP")	SFMTA	On-going	o Identifies short-term signal operation changes to improve transit operations on Geneva Avenue	
Daly City Fast Pass Extension Study	SFCTA	On-going	o Evaluates the feasibility and potential transportation effects of extending the "in-city" BART/Muni Fast Pass agreement to Daly City Station	

Source: Prepared by Fehr & Peers, 2012

KEY CONSTRAINTS AND OPPORTUNITIES

Of the studies presented in Table 1, the *Station Capacity Study* and *Pedestrian and Bike Connections Study* most comprehensively identified potential constraints of concepts discussed in the *Station Area Plan*.

Most noted, the *Capacity Study* specifically identified that the preferred ramp circulation option – decking the freeway and providing a spread single-point interchange (SPUI) – is infeasible within the short- to medium-term (less than 20 years) due to substantial costs and the need to reconstruct the freeway to meet design standards for such a facility. This finding directly relates to this study's objective of finding a feasible alternative to the spread SPUI.

Additionally, future transit-oriented development on the Muni facilities was determined to be a major challenge in the short- to medium-term. To accommodate new retail or residential at Balboa Park Station, light rail storage, staging and maintenance would need to be relocated to other Muni facilities. The relocation of these activities would likely require additional upgrades in other portions of the Muni system, as well as revisions to operations to account for transit vehicle storage in other areas of the City. Although new retail and residential above the rail yards was considered infeasible, the *Capacity Study* did acknowledge that incorporating new uses into the existing plaza and buildings is feasible.

Current kiss-and-ride operations were also determined to be challenging and non-ideal. Although the *Pedestrian and Bicycle Connections Study* identified several potential design options at the designated kiss-and-ride location, the options have not been carried forward. The study determined that future kiss-and-ride activities should be accommodated in areas that are more convenient to those who are using them today, including those traveling to and from the freeway as well as local drop-offs. The study also acknowledges that drop-off patterns could change in the future if the Muni Fast Pass zone is extended.

Other issues identified include:

- Relocating the southbound I-280 off-ramp at Ocean Avenue to form a square intersection
- Studying parking management options
- Substandard pedestrian pathways within and adjacent to the Station
- Substandard boarding platforms for light rail vehicles
- Traffic delay on Geneva Avenue
- Lack of station amenities
- Crowded light rail operations
- Future development at Parkmerced, Candlestick/Hunters Point Shipyard, and in Brisbane will substantially increase ridership at the station

Table 2 summarizes the feasibility outcomes from the *Capacity Study* for physical improvements, including the status of the short-term improvements. Several lower cost improvements have already been implemented by the SFMTA as part of on-going capital projects.

Table 2. Selected Identified Proposed Projects Recommended for Implementation

	Proposed Improvement	Recommended?	Implementation Period (from 2011)		
			1-5 Years	6-10 years	>10 years
Accessibility	South Geneva Transit Plaza Elevator	Yes	x	--	--
	Pedestrian Walkway between BART and San Jose Avenue through Green Yard	Yes	x	--	--
	ADA Accessible Ramps	Yes	x	--	--
	Repaving Eastside Crosswalk at Geneva/I-280 NB	Yes	x	--	--
	Geneva Avenue Bridge Modification	Yes	x	--	--
	North Sidewalk Widening into Travel Lane	No[1]	--	--	--
	Left-Turn Lanes	No[2]	--	--	--
	Remove Sidewalk Obstructions	Yes	x	--	--
	Pedestrian Crosswalk Improvements at Ocean/I-280 NB	Yes	Partially Complete	--	--
	Closing Tracks at Ocean Avenue from Pedestrians	Yes	Partially Complete	--	--
LRT Service Operations	J/K Alighting Platform near Eastside Connector	Yes	x	--	--
	J/K Line Boarding Platform				
	Boarding Platform Near BART	No[1]	--	--	--
	Boarding Platform Along San Jose Avenue	Yes	x	--	--
	K Ingleside Boarding Platform Relocated South of Green Administration Building	Yes	--	x	--
	Relocate Ocean Avenue City College Stop East of Howth Street	Yes	--	x	--
	Reconfigure M Oceanview Stops on San Jose				
	Center Platform on San Jose north of Geneva	No[2]	--	--	--
	Farside Platforms on San Jose at Geneva	Yes	x	--	--
	Alighting Platform on San Jose south of Niagra	No[1]	--	--	--
Geneva Avenue	Westbound Improvements: Straighten Sidewalk, BUS STOP Box, Queue Jump, Curb Radius Reduction	Yes	Under Study	--	--
	Eastbound Improvements: Straighten Sidewalk, BUS STOP Box	Yes	x	--	--
	Kiss-and-Ride Reconfiguration	Yes	x	--	--
	One-Way Access with Geneva Exit	No Preferred Option	--	--	--
	Cul-de-Sac with No Geneva Access		--	--	--
	Cul-de-Sac with Geneva Access		--	--	--
	Signal Synchronization	Yes	Complete	--	--
	Signalize Howth/Geneva or Louisburg/Geneva				
	Howth/Geneva	Yes	x	--	--
	Louisburg/Geneva	No[1]	--	--	--
Ocean Avenue	Intersection Consolidation of Ocean/Geneva/Phelan	Yes	x	--	--
	Westbound Class II bike lane/Eastbound Sharrows on Ocean Between San Jose and Howth	Yes	Complete per Bike Plan	--	--
	Replace Ocean Avenue Pedestrian Bridge; Extend Bike Lanes	Yes	--	x	--
	Center-Running Westbound Transit Lane on Ocean	Yes	--	--	x
	Install Flashing Beacon at I-280 SB Off-Ramp Crosswalk	Yes	Complete	--	--
	Realign I-280 SB Off-Ramp	Yes	--	x	--
Freeway	I-280 Deck	No[2]	--	--	--
	Spread Single-Point Interchange (SPUI)	No[2]	--	--	--
	Elevated Kiss-and-Ride Roadway				
	Connecting to Ocean Avenue	No[2]	--	--	--
	Connecting to I-280 NB	Yes	--	--	x

Notes:
1. Feasible within 20 years, but not recommended.
2. Not Feasible within 20 years.

Source: Jacobs, 2010; SFMTA, 2011

STUDY GOALS, OBJECTIVES AND EVALUATION METRICS

Although each previous study has built on the framework developed in the *Station Area Plan*, none has analyzed the potential vehicle circulation issues in depth. As discussed earlier, one of the primary purposes of this study is to identify a preferred circulation alternative that reduces some of the multi-modal conflicts identified previously, and identifies a feasible circulation alternative for freeway and station access. **Table 3** summarizes the objectives and metrics that will guide the development of these alternatives; each is organized around the following five goals of the project:

1. Reduce negative impacts on the local community resulting from vehicles accessing the regional road network
2. Support bus and light rail transit operations
3. Enhance intermodal connectivity, particularly for pedestrians and bicyclists.
4. Minimize potential effects to I-280 freeway operations
5. Develop feasible solutions that can be implemented within 2-10 years

Table 3. Study Goals and Objectives

Goal	Objective	Metrics	Key Areas for Evaluation
1. Reduce negative impacts on the local community resulting from vehicles accessing the regional road network	1.1 Reduce multimodal conflicts at I-280 interchange ramp intersections	1.1.1 Intersection configuration/geometry 1.1.2 Volume of conflicting users (e.g., pedestrians-vehicle volumes) 1.1.3 Intersection operations, including delay to transit	Geneva Ave/I-280 and Ocean Ave/I-280 ramp intersections
	1.2 Do not substantially degrade operations at other key intersections in the study area	1.2.1 Existing and Future Intersection vehicle operations (v/c, average delay) that account for other development in the area	Other study intersections along Ocean and Geneva Avenue between Alemany Boulevard and Phelan Avenue.
	1.3 Do not substantially degrade operations at adjacent I-280 interchanges	1.3.1 On- and off-ramp peak-hour volumes 1.3.2 Ramp intersection operations 1.3.3 Ramp queuing lengths	Ramp intersections at Monterey Boulevard (to the north) and San Jose Avenue (to the south)
	1.4 Provide Kiss & Ride design that is convenient for those who should be using it	1.4.1 Convenience of drop-off areas for those who should be using it.	Existing kiss and ride behavior and origin-destination pattern
	1.5 Reduce kiss-and-ride conflicts with other modes	1.5.1 Kiss-and-ride design	Kiss-and-ride behavior
2. Support bus and light rail transit operations	2.1 Provide efficient routing for transit as feasible, with particular attention to conflicts at intersections and stops.	2.1.1 Number of types & character of conflicts, volume of conflicting movements involving buses and LRV 2.1.2 Traffic operational delay for bus movements	Ocean Ave/I-280 ramps Ocean/San Jose Avenue Geneva Ave/I-280 ramps Geneva/San Jose Avenue Geneva/Ocean/Phelan Avenue

Table 3. Study Goals and Objectives

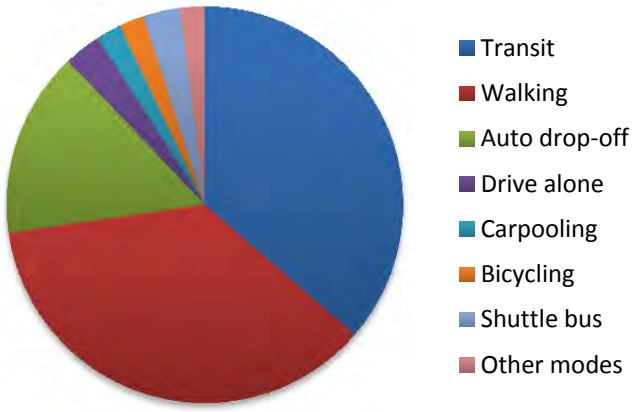
Goal	Objective	Metrics	Key Areas for Evaluation
	2.2 Do not increase conflicts involving LRT at key intersections	2.2.1 Number of types & character of conflicts, volume of conflicting movements involving LRT 2.2.2 Traffic operational delay for LRT movements	Ocean/I-280 ramps Ocean/San Jose Ocean/Geneva/Phelan
	2.3 Provide convenient stops that support intermodal access at the Station	2.3.1 Location of stops 2.3.2 Ridership at stops	Ridership at stops, connectivity to BART/Muni Metro stops
4. Improve station access for pedestrians and bicyclists	4.1 Provide safe & accessible pedestrian facilities	4.1.1 Alternative supports pedestrian demand/patterns (informed by pedestrian volumes, key institutions near the station, and transit ridership volumes) 4.1.2 Number of types & character of vehicle-pedestrian conflicts, volume of motorized movements conflicting with pedestrian crossings	Across I-280 ramps Geneva Ave/Balboa Park Station Geneva/San Jose Avenue Ocean Ave/Balboa Park Station
	4.2 Provide convenient connections for intermodal transfers	4.2.1 Distance and character of intermodal transfers	Transfers between bus, LRT and BART
	4.3 Avoid adding/exacerbating conflicts to key streets serving as bike routes	4.3.1 Supports bicycle activity (informed by bicycle volumes) 4.3.2 Number of types & character of vehicle-pedestrian conflicts, volume of motorized movements conflicting with bike routes	Ocean and Geneva Avenue between Phelan Loop and Alemany Boulevard
5. Minimize potential effects to I-280 freeway mainline operations	5.1 Avoid changes to ramp volumes that would impact mainline operations	5.1.1 On- and off-ramp peak-hour volumes 5.1.2 Ramp queuing lengths	I-280 interchange ramps at Ocean, Geneva, San Jose Ave/Monterey Blvd, Alemany Blvd/Sagamore Street
6. Develop feasible solutions that can be implemented within 2-10 years	6.1 Develop solutions that will be feasible both in engineering and cost	6.1.1 Ability to get through Caltrans PSR process 6.1.2 Relative cost 6.1.3 Engineering feasibility	
	6.2 Develop solutions that support the community's values & goals	6.2.1 Alternatives reflect community's vision & values	
	6.3 Develop alternative that can be constructed without substantial construction-related impacts	6.3.1 Alternatives are cost effective ways to address identified issues 6.3.2 Alternatives do not result in substantial rerouting of transit or vehicles to other ramps	

EXISTING TRANSPORTATION CONDITIONS

This section describes the transportation network in the vicinity of the Balboa Park BART Station. The information provided in this section will be used as a framework to develop circulation improvements, as well as assess the impact of the improvements on transit, traffic, pedestrians, and bicyclists.

The Balboa Park BART Station and adjacent intersections serve as a multi-modal hub, facilitating transfers between transit modes (i.e., bus, heavy rail, and light rail), as well as transfers between transit modes and other modes, such as walking, bicycling, and driving. The modes most often used to access the Balboa Park BART Station are transit (36 percent) and walking (36 percent), followed by auto drop-off (15 percent). Other modes, such as driving alone (3 percent), carpooling (2 percent), bicycling (2 percent), and shuttle bus (3 percent), or other modes (2 percent) are less frequent.[1]

Access Mode to the Balboa Park BART Station



The study area roadway network is presented first to provide a context for the transportation system serving the Balboa Park BART Station. This is followed by descriptions of transit, traffic, pedestrian, and bicycle conditions.

STUDY AREA ROADWAYS

Four roadways – Ocean Avenue, Geneva Avenue, San Jose Avenue, and I-280 – define the project study area, as well as provide primary access to the station area.

Interstate I-280 (I-280) runs adjacent to the Balboa Park BART Station and has six ramp connections in the immediate vicinity of the station. I-280 is a six- to eight-lane major freeway that serves as a major regional connector between the City of San Jose and the communities of San Mateo County with downtown San Francisco. The freeway provides a direct connection to U.S. 101 and terminates at surface streets in the South of Market area. In the vicinity of Balboa Park, I-280 carries approximately 178,000 vehicles per day.

Figure 3 presents I-280 on-ramps and off-ramps in the vicinity of Balboa Park BART Station on Geneva Avenue and Ocean Avenue. At Geneva Avenue, on- and off-ramps are provided in both northbound and southbound directions. Partial freeway connections are provided at Ocean Avenue – a southbound off-ramp (to westbound Ocean Avenue only) which is about 570 feet to the north of the Geneva Avenue off-ramp, and a northbound on-ramp which is about 650 feet to the north of the Geneva Avenue on-ramp. The ramps are very closely-spaced (at 570 to 650 feet

[1] Balboa Park BART Station Capacity and Engineering Study, SFMTA, 2011. Pages 29-30, *Balboa Park Transit Passenger Intercept Survey* results.

or about 0.11 to 0.12 miles), and provides redundant freeway access. Caltrans policies typically recommend a minimum of one mile distance between ramps in urban areas and discourage partial interchanges because of potential driver confusion. Due to the dense older urban grid of San Francisco, many ramps, including those near Balboa Park, do not meet these recommended practices.

The upstream and downstream ramps from Balboa Park are located in the Glen Park neighborhood (to the north) at Monterey Boulevard/Circular Avenue (northbound on-ramp and southbound off-ramp) and at Arlington/Bosworth (southbound on-ramp) and in the Oceanside and Excelsior neighborhoods (to the south) at San Jose Avenue/Alemany Boulevard (northbound on-ramp) and San Jose Avenue/Sagamore Street (southbound off-ramp).

Table 4 presents the AM and PM peak hour and average daily traffic volumes at the on- and off-ramps in the vicinity of the Balboa Park BART Station, and the ramps to the north and south. As indicated in the table, the daily and peak hour ramp volumes are lowest at the southbound off-ramps and northbound on-ramps at Ocean and Geneva Avenue. These ramp volumes will be used to develop and assess circulation improvements.

Table 4: Existing AM and PM Peak Hour Ramp Volumes

	AM Peak Hour	PM Peak Hour	Average Daily Traffic (ADT)
Northbound (north to south)			
On-ramp from Monterey Blvd (Glen Park)	1,220	600	12,200
Off-ramp to San Jose Ave (Glen Park)[1]	NA	NA	19,300
On-ramp from Ocean Ave	*820*	*680*	*9,000*
On-ramp from Geneva Ave	*550*	*310*	*6,900*
Off-ramp to Geneva Avenue	*1,120*	*1,090*	*14,700*
On-ramp from northbound San Jose Ave (at Alemany)	1,620	430	17,300
Southbound (north to south)			
Off-ramp to Monterey Blvd (Glen Park)	890	1,390	13,600
On-ramp from San Jose Ave (Glen Park)[1]	NA	NA	21,200
Off-ramp to westbound Ocean Avenue	*690*	*630*	*7,600*
Off-ramp to Geneva Avenue	*440*	*670*	*8,000*
On-ramp from Geneva Avenue	*970*	*660*	*11,400*
Off-ramp to southbound San Jose Ave (at Sagamore)[3]	2,000	1,900	22,000

Notes:
1. NA = Not available.
2. Ramps serving the Balboa Park BART Station at Geneva Avenue and Ocean Avenue shaded.
3. AM and PM peak hour volumes include off-ramp traffic merging with southbound San Jose Avenue.
Source: 2011 Ramp Volumes on the California State Freeway System, District 4, Caltrans for Average Daily Volumes, and intersection volume data for peak hour volumes.

Geneva Avenue is an east-west arterial street that connects Balboa Park and Visitacion Valley, stretching from Phelan Avenue to Bayshore Boulevard. Geneva Avenue forms the southern boundary of the study area between Phelan Avenue to the west and Alemany Boulevard to the east. Within the study area, Geneva Avenue has a speed limit of 25 miles per hour (mph) and typical daily traffic volumes ranging between 20,000 and 30,000 vehicles. Excluding the station entrance plaza area, sidewalks range from 6 to 8 feet in width. The main entrance to Balboa Park BART Station faces Geneva Avenue, between I-280 and San Jose Avenue.

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EXISTING I-280 FREEWAY ACCESS ROUTES

FIGURE 3

Ocean Avenue is an east-west arterial that connects the Sunset District and Balboa Park, stretching all the way from Sunset Boulevard to Mission Street. Within the Balboa Park BART Station site vicinity, it forms the northern boundary of the study area, west to Phelan Avenue and east to San Jose Avenue. Within the study area, Ocean Avenue has a speed limit of 25 mph and typical daily traffic volumes of 20,000 vehicles. Excluding the station entrance plaza area, sidewalks range from 6 to 8 feet in width.

San Jose Avenue is a major north-south arterial roadway stretching through several neighborhoods between the City's southern border and Noe Valley. In the segment adjacent to Balboa Park BART Station Muni Metro tracks are located in the median, and are segregated from vehicular traffic. South of the I-280 underpass, in the vicinity of the Balboa Park BART Station, the Muni Metro LRT tracks in the segregated median join the roadway and share the two travel lanes in each direction. San Jose Avenue in the vicinity of Randall Street, has typical daily traffic volumes ranging between 44,500 and 46,500 vehicles. San Jose Avenue narrows to one travel lane in each direction and crosses I-280 via an underpass in the Glen Park neighborhood.

TRANSIT

Figure 4 presents the existing transit network in the vicinity of the Balboa Park BART Station. **Table 5** provides details on the transit service, hours of operation, and frequencies for the BART and Muni service in the Balboa Park BART Station area. **Table 6** presents the daily ridership at the bus stops on Geneva Avenue, Ocean Avenue, San Jose Avenue, and Mission Street in the vicinity of the Balboa Park BART Station.

Total daily ridership at the transit stops varies substantially, depending on the number of transit routes serving the stop, and whether the stop is a local stop serving the neighborhood, or a transfer point to other bus or rail lines. The transit stops on Geneva Avenue between the Muni/BART station entrance and San Jose Avenue serve over 11,000 Muni passengers daily, whereas the stop at the station on Ocean Avenue serves only about 3,000 passengers daily. Realignment of the 29 Sunset and 54 Felton to Ocean Avenue as part of the TEP will substantially increase the number of passengers using the Ocean Avenue entrance to the station; however, Geneva Avenue will continue to serve a substantial number of transit passengers. **Table 7** presents the daily ridership at the transit stops in the study area for each of the routes included in Table 6. The bus routes with the greatest number of passengers in the study area are the 8X Bayshore Express, the 43 Masonic, and the 49 Van Ness-Mission, with nearly 5,000 boardings and alightings per day in the study area. Of the light rail lines serving the study area, the M Ocean View has the highest ridership, with about 3,300 total boardings and alightings per day.

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EXISTING TRANSIT NETWORK

FIGURE 4

Table 5: Weekday BART & Muni Transit Service in the Balboa Park Bart Station Area

Route	Destination	Daily Frequency Range (min.)	AM/PM Peak Hour Headway (min.)	Weekday Hours of Operation
BART				
Richmond-Millbrae		15-20	15	4:00 am – 1:00 am
Fremont-Daly City		15-20	15	
Dublin/Pleasanton-Millbrae		15-20	15	
Pittsburg/Bay Point-SFO		15-20	15	
Muni Light Rail				
J Church	Balboa Park and downtown San Francisco via Church St and the Market St Subway (from the Van Ness Station to the Embarcadero Station)	9-20	9 / 7	5:00 am – 12:50 am
K Ingleside	Balboa Park and downtown San Francisco via Ocean Ave, Geneva Ave, Junipero Serra Blvd, and the Market St Subway (from the West Portal Station to the Embarcadero Station). After the Embarcadero Station, the K Ingleside switches names to the T Third light rail line.	9-20	10 / 9	5:00 am – 12:50 am
M Ocean View	Balboa Park and downtown San Francisco via San Jose Ave, Broad St, Randolph St, 19th Ave, and the Market St Subway (from the West Portal Station to the Embarcadero Station)	9-20	9 / 9	5:00 am – 12:50 am
Muni Bus				
8X Bayshore Express	Balboa Park to Downtown San Francisco via Bayshore Blvd and US-101	8-15	8 / 8	4:40 am – 1:15 am
8BX Bayshore Express		8	8 / 8	6:20 – 10:00 am; 3:30 – 7:50 pm
29 Sunset	Visitacion Valley to Presidio via Balboa Park and Sunset District	10-20	10 / 10	5:15 am – 1:30 am
43 Masonic	Balboa Park BART to Forest Hill (serves CCSF campus)	10-30	10 / 12	5:00 am to 1:30 am
49 Van Ness-Mission	Balboa Park to North Point via Mission St and Van Ness Ave	8-20	8 / 8	4:30 am – 1:15 am
54 Felton	Daly City BART to Hunters Point via Balboa Park	20-30	20 / 20	5:30 am – 1:00 am
88 BART Shuttle	San Francisco State University to Balboa Park BART via Mission St	20	20 / 20	6:40 – 9:00 am; 4 to 6:40 pm
Shuttle Service				
Brisbane-Crocker Park BART/Caltrain Shuttle	Balboa Park BART Station to the Brisbane - Crocker Industrial Park via the Bayshore Caltrain Station.	10-30	--	5:45 am – 9:35 am
Red Brisbane		20-60	--	3:15 pm – 7:30 pm
Blue Brisbane		10-30	--	5:45 am – 9:35 am
Sierra Point	Balboa Park BART Station to Sierra Point Office Park via US 101	10-15	--	7:00 am – 9:45 am; 4:00 pm – 6:45 pm
Paratransit				
San Francisco Paratransit	--	On-Call	On-Call	24 hours/day; 7 days/week

Source: SFMTA, 2012; LCW Consulting, 2012; Nelson\Nyygard, 2012

Table 6: Daily Muni Ridership by Transit Stop

Street/Station Stop	Daily Ridership		
	Boardings	Alightings	Total
Geneva Avenue – Eastbound[1]			
Ocean Ave & Geneva Ave	1,125	219	1,344
Geneva Ave & Howth St	158	108	266
Balboa Park BART Station/Muni Metro Terminal	2,988	1,101	4,089
Geneva Avenue - Westbound[1]			
Balboa Park BART station/Muni Metro Terminal	1,267	2,983	4,250
Geneva Ave & Howth St	80	338	418
Phelan Loop at SFCC	0	924	924
Ocean Avenue – Eastbound[2]			
Ocean Ave & Geneva Ave	447	15	462
City College Pedestrian Bridge	62	335	397
Ocean Ave & Howth St	294	9	303
Balboa Park BART Station/Ocean Avenue	47	1,183	1,130
Ocean Ave & San Jose Ave	217	49	266
Ocean Avenue - Westbound[2]			
Ocean Ave & San Jose Ave	37	224	261
Balboa Park BART Station/Ocean Avenue	822	0	822
Ocean Ave & Howth St	20	396	416
City College Pedestrian Bridge	471	58	529
San Jose Avenue – Northbound[3]			
San Jose Ave & Geneva Ave	0	1,526	1,526
Geneva Terminal	0	32	32
Green Division Yard	648	0	648
San Jose Ave & Ocean Ave	207	21	227
San Jose Avenue – Southbound[3]			
San Jose Ave & Ocean Ave	3	172	176
Green Division Yard	0	412	412
Geneva Terminal	26	0	26
San Jose Ave & Geneva Ave	1,749	0	1,749

Notes:
1. Includes 8x, 8BX, 29, 43, 54, and 88 (note pending data from SFMTA: 54 Felton not included in eastbound ridership, and 29 Sunset not included in westbound ridership)
2. Includes 49 Mission-Van Ness and K Ingleside.
3. Includes J Church and M Ocean View
4. Note pending data from SFMTA: 29 Sunset does not include southbound ridership
Source: SFMTA, 2007 2011; Fehr & Peers, 2012

Table 7: Daily Muni Ridership by Route at Transit Stops in Study Area

Transit Route	Daily Ridership within Study Area[1]		
	Boardings	Alightings	Total
8X Bayshore	4,413	4,111	8,524
8BX Bayshore BX Express	598	832	1,430
29 Sunset (along Geneva Ave)[2]	1,427	1,674	3,101
43 Masonic	2,561	2,494	5,055
49 Van Ness-Mission	2,250	2,179	4,429
54 Felton[2]	793	646	1,439
88 BART Shuttle	194	292	486
K Ingleside	1,354	1,506	2,861
J Church	1,204	988	2,192
M Ocean View	1,775	1,558	3,333

Notes:
1. Total daily ridership for transit stops within study area – see **Table 5** above.
2. Pending additional data from SFMTA.
Source: SFMTA, 2011; Fehr & Peers, 2012

Transit Operations

The Balboa Park BART Station is one of the highest volume intermodal transfer stations within the BART/Muni system. Despite the frequency of transfers between modes, there are a number of existing constraints related to station and transit stop design/location that affect the efficiency and operations of transit in the vicinity of the Balboa Park BART Station.

Transit stop/station design – The primary entrance to the BART and Muni Metro Station is located on Geneva Avenue immediately east of the I-280 northbound off-ramp and on-ramp. Bus stops are located on both sides of Geneva Avenue, just east of the BART station. Most Muni bus routes also stop at this location. However, there are several other bus and rail stops located on surface streets in the study area, including a major off-street terminal loop for buses and electric trolley buses at Ocean and Phelan Avenues. Two lines in particular are more disconnected from the station entrance, the M Oceanview's terminal stop is located 600 feet south of the Station entrance on San Jose Avenue, and the 49 Van Ness stops 350 north of the station on Ocean Avenue. The construction of the westside walkway at the station improved north-south access; however, M Oceanview riders must cross San Jose Avenue and walk two or three minutes to BART or other Muni bus routes on Geneva.

Passenger waiting areas for the J Church and K Ingleside light rail lines are located just to the east of the BART station, north of Geneva Avenue. Due to the design of the station complex and the high volume of light rail vehicles serving it, there is limited waiting space for passengers. In addition to loading and unloading passengers in the below-grade trench-like platform area for the J Church and K Ingleside lines, the site is also used for LRV layovers. The convergence of transit operations at this single location provides numerous services and routes for the community but also presents an uncomfortable pedestrian environment, with potential conflicts between LRVs and passengers, particularly at the San Jose/Geneva intersection where LRV can exit the station area.

On Ocean Avenue, LRV preemption along Ocean Avenue causes intermittent congestion at the I-280 northbound on-ramp intersection, as the LRVs trigger transit preemption to enter the Muni Green Yard and hold traffic. When a number of light rail vehicles need to enter the site, this can cause substantial congestion on Ocean Avenue. When Muni vehicles enter the Green Yard from the west, eastbound traffic, both through traffic on Ocean Avenue and left-turning vehicle traveling to the freeway are held with a red light. Based on scheduled headways, this occurs approximately seven to eight times during the peak hours. Vehicles exiting the Green Yard at this intersection cause similar delay to vehicles along Ocean Avenue.

On Geneva Avenue, the high traffic volumes accessing I-280 freeway ramps and the bus activity at the station entrance conflict, resulting in transit vehicle delay. Transit vehicles pull out of the travel lane to pick up passengers on both the north and south sides of Geneva, but high traffic volumes make re-entering the travel lane challenging. Vehicle queues on Geneva also result in additional travel delay. SFMTA is currently working on travel time reduction proposals for Geneva Avenue to address some of the existing issues in the area.

Figure 5. Light Rail Vehicle Circulation at Balboa Park BART Station
(*Capacity Study*, SFMTA, 2011)

Muni Bus Layovers - The Balboa Park BART Station is the terminus for several bus routes (i.e., the 36 Teresita and the 88 BART Shuttle) and layovers for buses waiting between scheduled runs often occur in front of the BART station entrance and the Muni Green Yard in the bus loading/unloading zone. These layovers, combined with the previous reference to high traffic volumes, increase the friction along Geneva Avenue experienced by both private vehicles and transit vehicles.

Independent Shuttles – As indicated in Table 5, four independent shuttles travel to the Balboa Park BART Station. Employer shuttles currently use the section of Geneva Avenue adjacent to the entrance of the BART station as a loading and unloading location, as well as for vehicle layovers. Because there is no official shuttle loading area, and shuttle operators do not necessarily perceive the nearby kiss-and-ride area as convenient, they wait along Geneva Avenue and reduce the available space for Muni buses to load and unload at Balboa Park BART Station. Depending on bus and shuttle traffic, the loading area can reach capacity and cause queues that block through-traffic on Geneva Avenue. The SFCTA is currently evaluating the role these shuttles provide within San Francisco.

Transit Delay

Geneva, Ocean and San Jose Avenues are all major routes for vehicles traversing the south side of San Francisco. Combined with Muni bus and LRV service along these corridors and signal coordination issues at study intersections, the area experiences consistent traffic congestion. This congestion negatively affects transit times and pedestrians, as buses sit in queues and pedestrians must navigate across congested intersections.

Transit delay for Muni routes in the study area was calculated to assist in developing circulation improvements, and as a means to assess the impact of proposed circulation improvements on Muni transit routes in the study area. For purposes of this study, transit delay includes the delay associated with traffic congestion at intersections, and the delay associated with transit vehicles re-entering the travel lane. In general, transit routes that operate in restricted travel lanes (e.g., bus-only) or within their own right-of-way experience (e.g., J Church along San Jose Avenue) less transit delay than transit lines that operate within mixed-flow traffic.

- *Traffic congestion delay* – Traffic congestion associated with changes in area traffic patterns or changes to the roadway geometry would affect transit delay. Traffic congestion delays are calculated by summing the average vehicle delay at each intersection along the transit line's route within the study area.
- *Transit reentry delay* – Transit vehicles typically experience delays after stopping to pick up and drop off passengers while waiting for gaps in adjacent street traffic in order to pull out of bus stops. As traffic volumes on the adjacent streets increase, reentering the flow of traffic becomes more difficult and transit vehicles experience increased delays. Transit reentry delay was calculated using data collected from the SFMTA's Automatic Passenger Counters (APC). This data includes geocoded travel time information that can be sorted by delay incurred at varies time points along the route, including time with the door open for passenger boarding and time spent reentering traffic. Total transit reentry delay for each route was calculated as the sum of transit reentry delay at each stop within the study area.

Table 8 presents the transit delay and pace for the six bus routes and two LRT routes in the immediate vicinity of the Balboa Park BART Station for AM and PM peak hour conditions. **Appendix B** presents the transit delay by line, disaggregated by delay associated with traffic congestion versus the transit reentry delay.

During the AM peak hour, transit delay for the bus routes is generally greater in the westbound direction than in the eastbound direction, and is particularly influenced by congestion in the westbound direction at the intersection of Geneva/I-280 northbound on-ramp for the 8X Bayshore Express, 29 Sunset, 43 Masonic, 54 Felton, and the 88 BART Shuttle, and at the intersection of Ocean/I-280 Northbound on-ramp for the 49 Van Ness-Mission. During the PM peak hour, transit delay is generally similar for both directions of travel.

Transit delay for the J Church and the K Ingleside is lower than for the bus lines as the analysis segment is shorter (LRT vehicles travel through fewer intersections), and the LRT vehicles are not subject to re-entry delay. During both the AM and PM peak hours, the K Ingleside has greater transit delay than the J Church.

Table 8: Existing AM and PM Peak Hour Transit Delay for Muni Routes within Study Area

Route	AM Peak Hour (minutes:seconds)[6]				PM Peak Hour (minutes:seconds)[6]			
	Pace (min/mi)	Signal Delay[7]	Re-Entry Delay[7]	Dwell Time[7]	Pace (min/mi)	Signal Delay[7]	Re-Entry Delay[7]	Dwell Time[7]
8X Bayshore Express[1]								
Eastbound	**6.36**	3:23	0:56	0:40	**7.78**	4:55	1:39	1:27
Westbound	**8.93**	5:34	1:32	1:57	**8.75**	4:06	2:05	1:22
29 Sunset[1]								
Eastbound	**7.72**	3:23	1:21	1:08	**8.07**	4:55	1:36	1:34
Westbound	**6.90**	5:34	1:40	1:43	**7.96**	4:06	1:47	1:38
43 Masonic[1]								
Eastbound	5.72	3:23	1:05	N/A	**8.44**	4:55	1:40	N/A
Westbound	**9.27**	5:34	1:40	N/A	**8.03**	4:06	2:10	N/A
49 Van Ness-Mission[2]								
Eastbound	5.88	3:51	1:14	1:05	**6.33**	3:26	1:21	1:08
Westbound	**7.32**	3:42	1:25	1:11	**6.89**	2:55	1:25	1:11
54 Felton[3]								
Eastbound	4.26	2:14	1:05	N/A	**8.49**	2:55	1:40	N/A
Westbound	4.02	1:05	1:05	N/A	**9.78**	3:37	1:40	N/A
88 BART Shuttle[1]								
Eastbound	6.00	3:23	1:18	N/A	**8.87**	4:55	2:00	N/A
Westbound	**8.85**	5:34	1:20	N/A	**7.48**	4:06	1:44	N/A
J Church[4]								
Northbound	--	0:14	--	N/A	--	0:53	--	N/A
Southbound	--	0:14	--	N/A	--	0:59	--	N/A
K Ingleside[5]								
Northbound	--	1:37	--	N/A	--	0:36	--	N/A
Southbound	--	2:38	--	N/A	--	1:54	--	N/A

Notes:
1. 8x Bayshore Express, 29 Sunset, 43 Masonic, and 88 BART Shuttle transit delay for the route segment between intersections of Geneva/Mission and Geneva/Phelan (about 0.78 miles)
2. 49 Van Ness-Mission transit delay for the route segment between intersections of Ocean/Alemany and Ocean/Phelan (about 0.82 miles)
3. 54 Felton transit delay for the route segment between intersections of Geneva/Mission and Geneva/I-280 Southbound off-ramp (about 0.54 miles)
4. J Church transit delay for turnaround segment south of the intersection of Ocean/San Jose
5. K Ingleside transit delay for turnaround segment east of the intersection of Ocean/Phelan
6. Pace is representative of travel time, excluding re-entry delay and dwell time, divided by travel distance; therefore, the columns in this table are not additive.
7. Values in this column are route totals for the study area
Source: Fehr & Peers, 2013

Although **Table 8** represents a snapshot of the overall line's delay, it suggests that congestion along Geneva and Ocean may lead to some headway reliability and inefficiencies along the individual routes. For lines running along Geneva Avenue, substantial eastbound delay (over 30 seconds) occurs at the Geneva/Ocean/Phelan and Geneva/I-280 NB Off-Ramp intersections, and substantial westbound delay occurs at the Geneva/I-280 NB Off-Ramp and Geneva/Alemany intersections. Generally, westbound delay is greater in the morning and eastbound delay is greater in the evening. Along Ocean Avenue, substantial eastbound delay is experienced at Geneva/Ocean/Phelan in the morning and at the Ocean/I-280 NB On-ramp in the evening.

Charts 1 and **2** summarize the information in **Table 8** by segment on Ocean and Geneva Avenues for the AM and PM peak hours, respectively.

Chart 1. AM Peak Hour Transit Pace and Delay

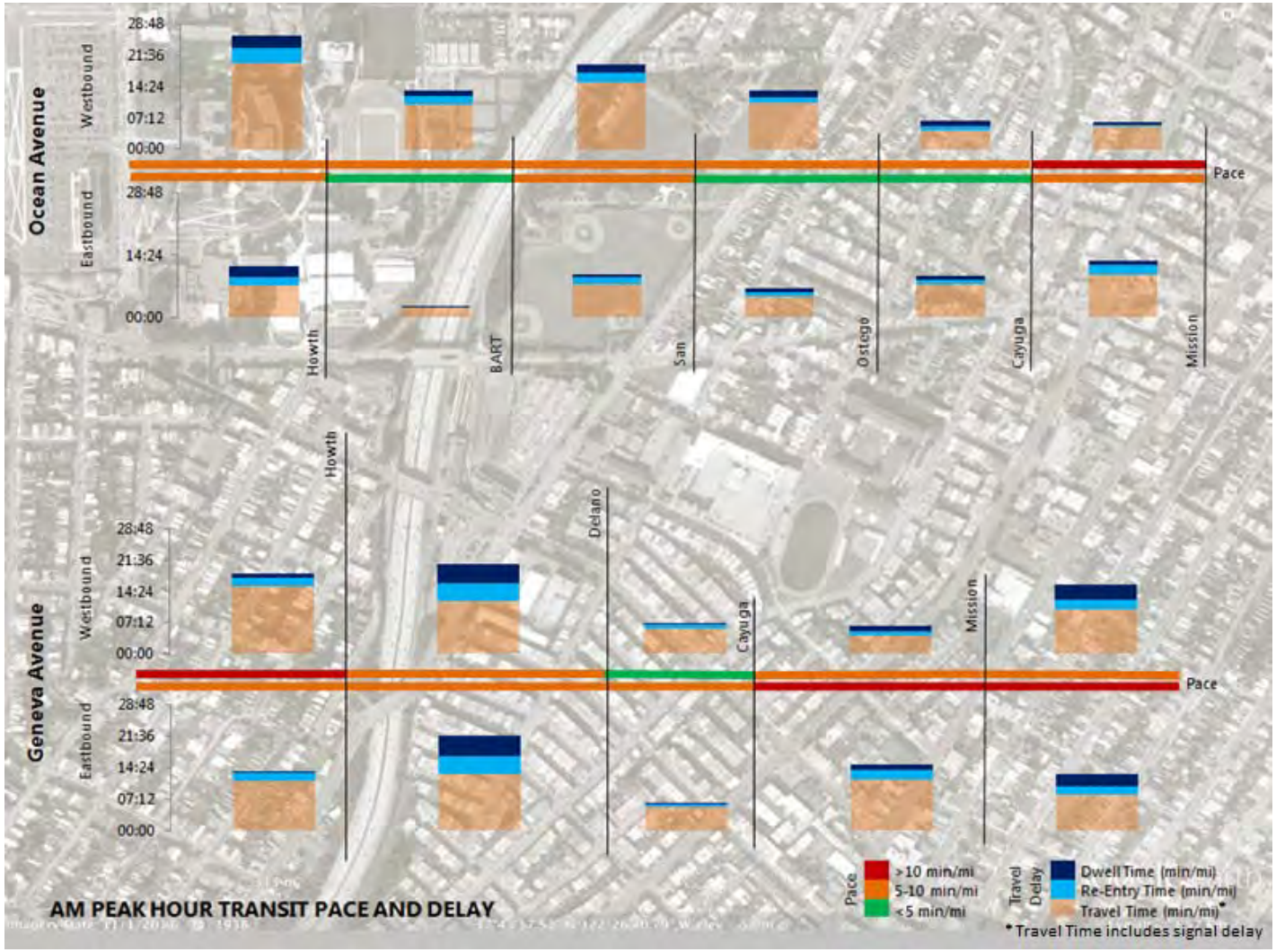
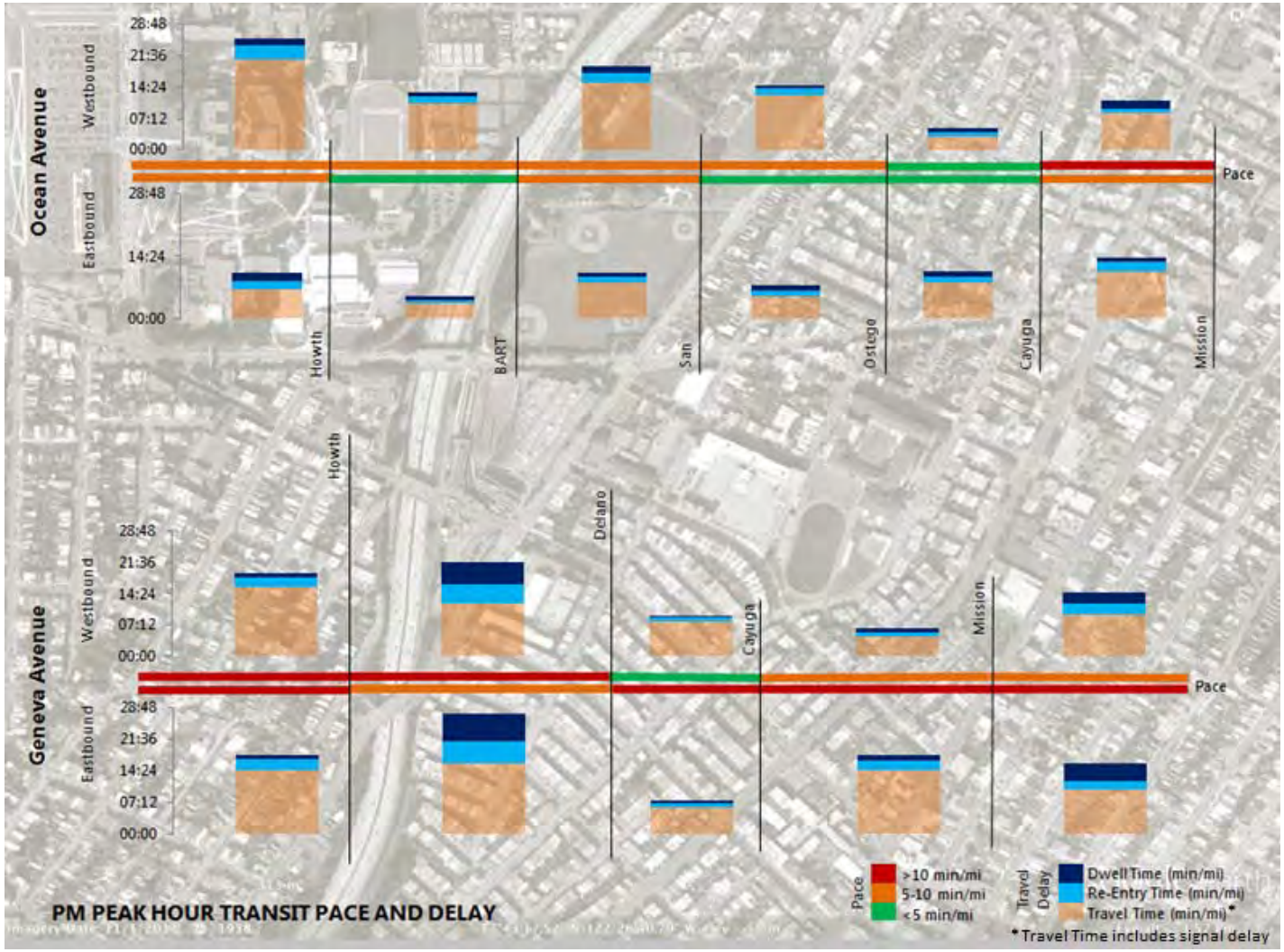


Chart 2. PM Peak Hour Transit Pace and Delay



VEHICLE CIRCULATION

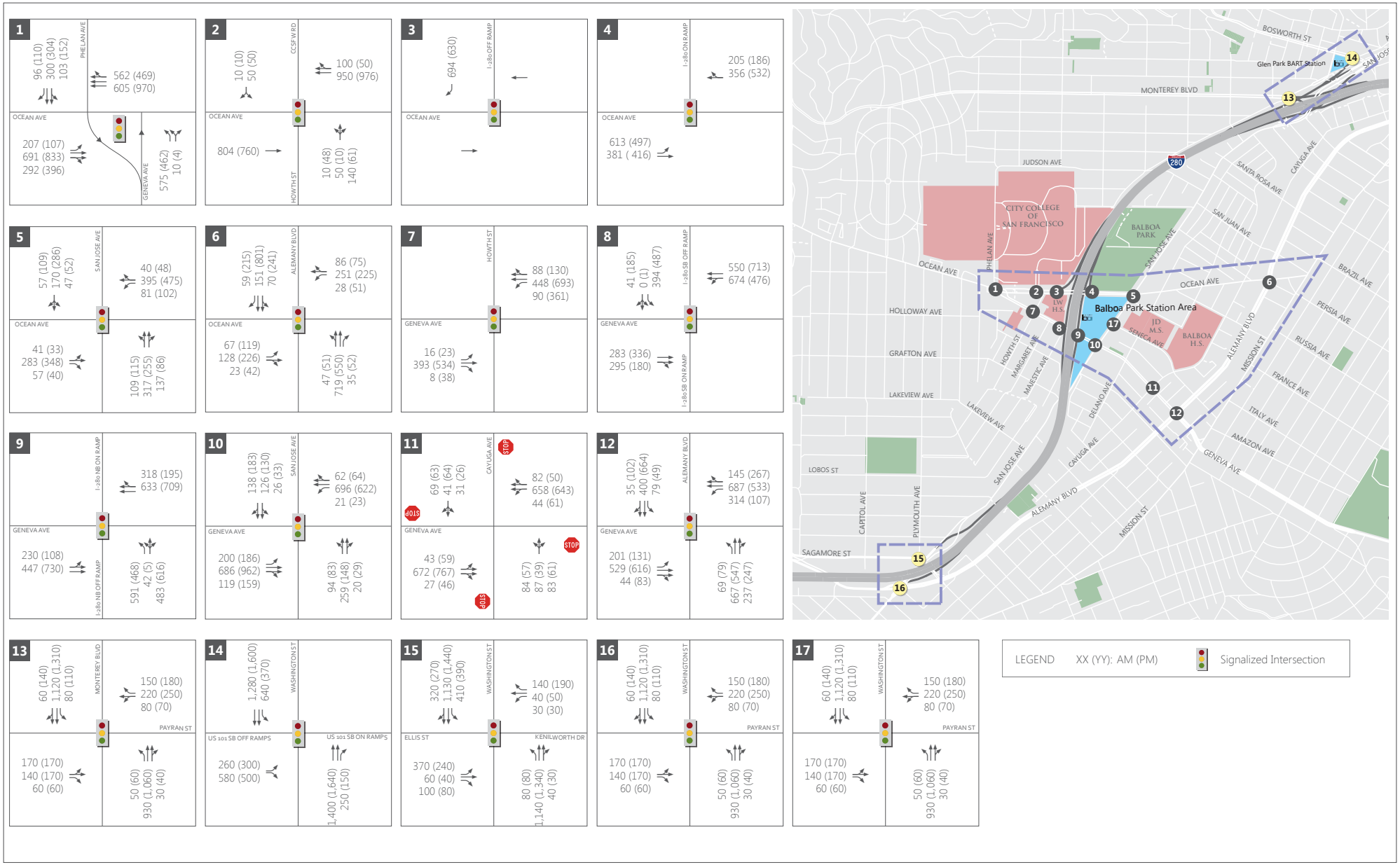
Figure 6 presents the location of the 17 vehicle study intersections. The study intersections were selected as they are the intersections most directly affected by traffic congestion and transit operations in the vicinity of the Balboa Park BART Station. In addition, intersections adjacent to I-280 ramps to the north and south of the station were analyzed, as circulation improvements may result in shifts in traffic patterns which could impact intersection operations.

Existing intersection operating conditions were evaluated for the peak hour (hour of the day with the highest traffic volumes) of the weekday AM peak period (7:00 to 9:00 AM) and PM peak period (4:00 to 6:00 PM). Intersection turning movement counts were obtained from previous studies conducted in the area, including the Station Area Plan and more recent analyzes. New counts were conducted at the intersections of San Jose/Alemany, San Jose/Sagamore, Howth/Geneva, and Alemany/Ocean.[2] The AM and PM peak hour turning movement volumes and lane geometries are illustrated on Figure 6**.**

Operating characteristics of signalized and unsignalized intersections are described by the concept of LOS ("LOS"). LOS is a qualitative description of the performance of an intersection based on the average delay per vehicle. Intersection levels of service range from LOS A, which indicates free flow or excellent conditions with short delays, to LOS F, which indicates congested or overloaded conditions with extremely long delays. LOS A through LOS D is considered excellent to satisfactory service levels, LOS E is undesirable, and LOS F conditions are generally representative of gridlock. In San Francisco, intersection LOS E and LOS F are considered unacceptable.

The results of the intersection LOS analysis for the existing weekday AM and PM peak hour conditions is presented in **Table 6. Appendix C** contains the intersection LOS calculation sheets. During the AM and PM peak hours, the majority of the intersections in the study area operate with minimal to moderate levels of delay, and acceptable LOS operating conditions of LOS D or better.

[2] *Final Report, Balboa Park BART Station Pedestrian and Bicycle Connection Project*, SFMTA, October 2009, Balboa Park Station Area APlan EIR, SF Planning Department, 2006, Transit Effectiveness Project Transportation Study, SF Planning Department, On-going, Glen Park Station Area Plan EIR, SF Planning Department, 2010, CCSF Master Plan, and intersection counts conducted on July X10, 2012.



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EXISTING INTERSECTION LANE CONFIGURATIONS AND TURNING MOVEMENT VOLUMES

FIGURE 6

FEHR PEERS

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Table 9 - Intersection Delay and Level of Service – Existing Conditions

Intersection	Control	AM Peak Hour		PM Peak Hour	
		Delay[1]	LOS[2]	Delay[1]	LOS[2]
1. Ocean/Geneva/Phelan	Signal	47.1	D	16.3	B
2. Ocean/Howth	Signal	16.2	D	13.8	B
3. Ocean/I-280 SB Off-ramp[2]	Uncontrolled	--	**--**	--	--
4. Ocean/I-280 NB On-ramp	Signal	**60.7**	**E**	38.7	D
5. Ocean/San Jose	Signal	15.9	B	19.3	B
6. Ocean/Alemany	Signal	16.3	B	22.9	C
7. Geneva/Howth[3]	Unsignalized	0.9	A	2.7	A
8. Geneva/I-280 SB Ramps	Signal	20.2	C	36.5	D
9. Geneva/I-280 NB Ramps	Signal	**73.7**	**E**	**>80**	**F**
10. Geneva/San Jose	Signal	30.2	C	25.4	C
11. Geneva/Cayuga	AWSC[4]	**39.5 (eb)**	**E**	**46.3 (eb)**	**E**
12. Geneva/Alemany	Signal	51.1	D	33.9	C
13. Monterey/I-280 ramps	Signal	**59.9**	**E**	51.3	D
14. Bosworth/Arlington	OWSC[5]	30.7 (sb)	D	30.4 (sb)	D
15. Sagamore/San Jose	Signal	29.9	C	30.8	C
16. Alemany/I-280 NB On-Ramp	Signal	48.4	D	30.5	C
17. Seneca/San Jose Ave	OWSC[5]	12.0 (wb)	B	12.5 (wb)	B

Notes:
1. Delay indicated in seconds per vehicle using HCM 2000 Method.
2. I-280 southbound off-ramp merges onto westbound Ocean Avenue as a lane addition (i.e., the number of travel lanes on westbound Ocean Avenue increases from one travel lane east of the I-280 southbound off-ramp, to two travel lanes west of the I-280 southbound off-ramp merge).
3. Howth Street is one-way northbound between Geneva Avenue and Ocean Avenue, and one-way southbound south of Geneva Avenue, and therefore, there are no northbound or southbound approaching vehicles at the intersection of Geneva/Howth. Eastbound and westbound vehicles on Geneva Avenue stop for pedestrians in the crosswalk.
4. AWSC = All-way stop-controlled.
5. OWSC = One-way stop controlled. At the intersection of Bosworth/Arlington, the southbound approach of Arlington Street to Bosworth Street is stop-sign controlled. At the intersection of Seneca /San Jose Avenue, the westbound approach of Seneca Avenue to San Jose Avenue is stop-sign controlled.
Source: Fehr & Peers, 2012

During the AM peak hour, four study intersections currently operate at LOS E conditions.

- Ocean/I-280 Northbound On-ramp – At this signalized intersection, the eastbound movement operates at LOS E conditions. Along the Ocean Avenue corridor, signal operations rely on actuated signal design without coordination. The lack of coordination between the signals slightly increases delay along the corridor. As discussed, an inefficiency contributing to delays along the Ocean Avenue corridor is the timing for LRV preemption at the entrance to the Muni Green Yard. The excess timing causes vehicles to idle at an all-red light even after the LRV has cleared the intersection. The traffic impacts from LRVs are sporadic, specifically causing increases in delay between I-280 and San Jose Avenue.

- Geneva/I-280 Northbound On-ramp – At this signalized intersection, the westbound movement operates at LOS F conditions, reflecting the peak period congestion associated with passenger drop-offs, transit service, and pedestrian movements.

- Geneva/Cayuga – At this all-way-stop unsignalized intersection, the high volume eastbound and westbound approaches operate at LOS E. The eastbound movement experiences the greatest delay per vehicle. Caltrans peak hour signal warrants are met for AM peak hour conditions.

- Monterey/I-280 ramps – At this signalized intersection, the eastbound and southbound approaches operate at LOS E conditions. These approaches serve freeway-bound traffic.

While the intersection of Ocean/Geneva/Phelan operates at acceptable LOS D during the AM peak hour, due to surges in students and faculty travelling to CCSF during the AM peak hour, at times this intersection can operate at worse LOS conditions (i.e., LOS E or LOS F).

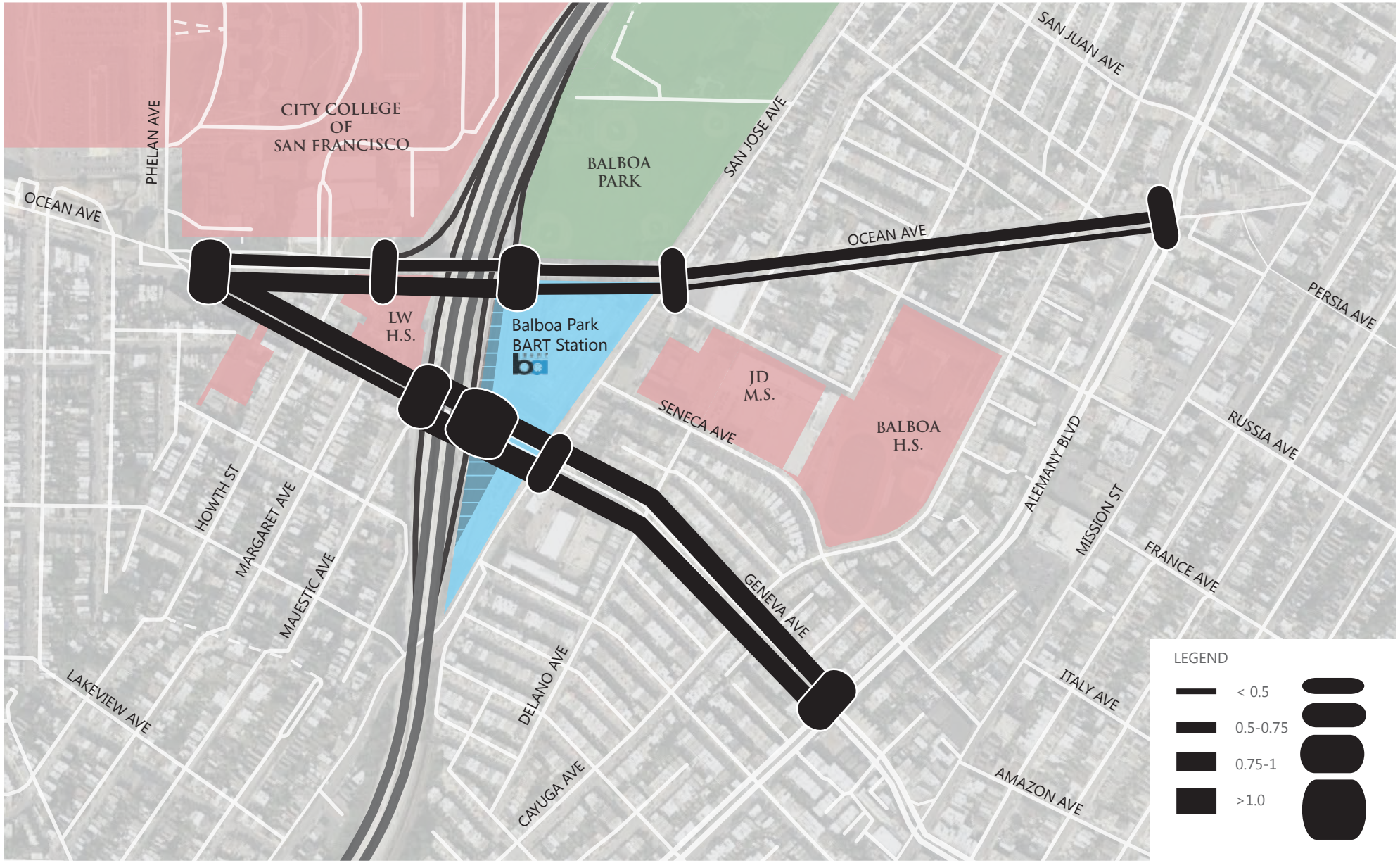
During the PM peak hour, two study intersections operate at LOS E or LOS F conditions,

- Geneva/I-280 Northbound On-ramp – At this signalized intersection, the westbound and northbound movements operate at LOS F conditions, reflecting the peak period congestion associated with passenger drop-offs and pick-ups, transit service, and pedestrian movements. During the PM peak hour, northbound queues extend upstream onto the freeway.

- Geneva/Cayuga – At this all-way-stop unsignalized intersection, the high volume eastbound approach operates at LOS E. Caltrans peak hour signal warrants are met for the PM peak hour conditions.

Volume-to-Capacity Ratios (v/c)

As noted above, travel lane capacity along Geneva and Ocean Avenues is affected by the Balboa Park BART Station, the I-280 ramp system, light rail vehicle operations, and signal control, including signal coordination. **Figure 7A** and **7B** summarize the volume-to-capacity (v/c) ratios for the AM and PM peak hour conditions, respectively. The volume-to-capacity conditions are based on the intersection LOS analyses presented above. During both the AM and PM peak hours, the segment of Geneva Avenue between San Jose Avenue and the I-280 southbound off-ramp operates at a v/c greater than 1.0 and the intersection of Geneva/San Jose is particularly affected by operations at the I-280 ramp intersections. Ratios approaching or exceeding 1.0 indicate locations were volumes exceed operational capacity, resulting in delays and queuing.



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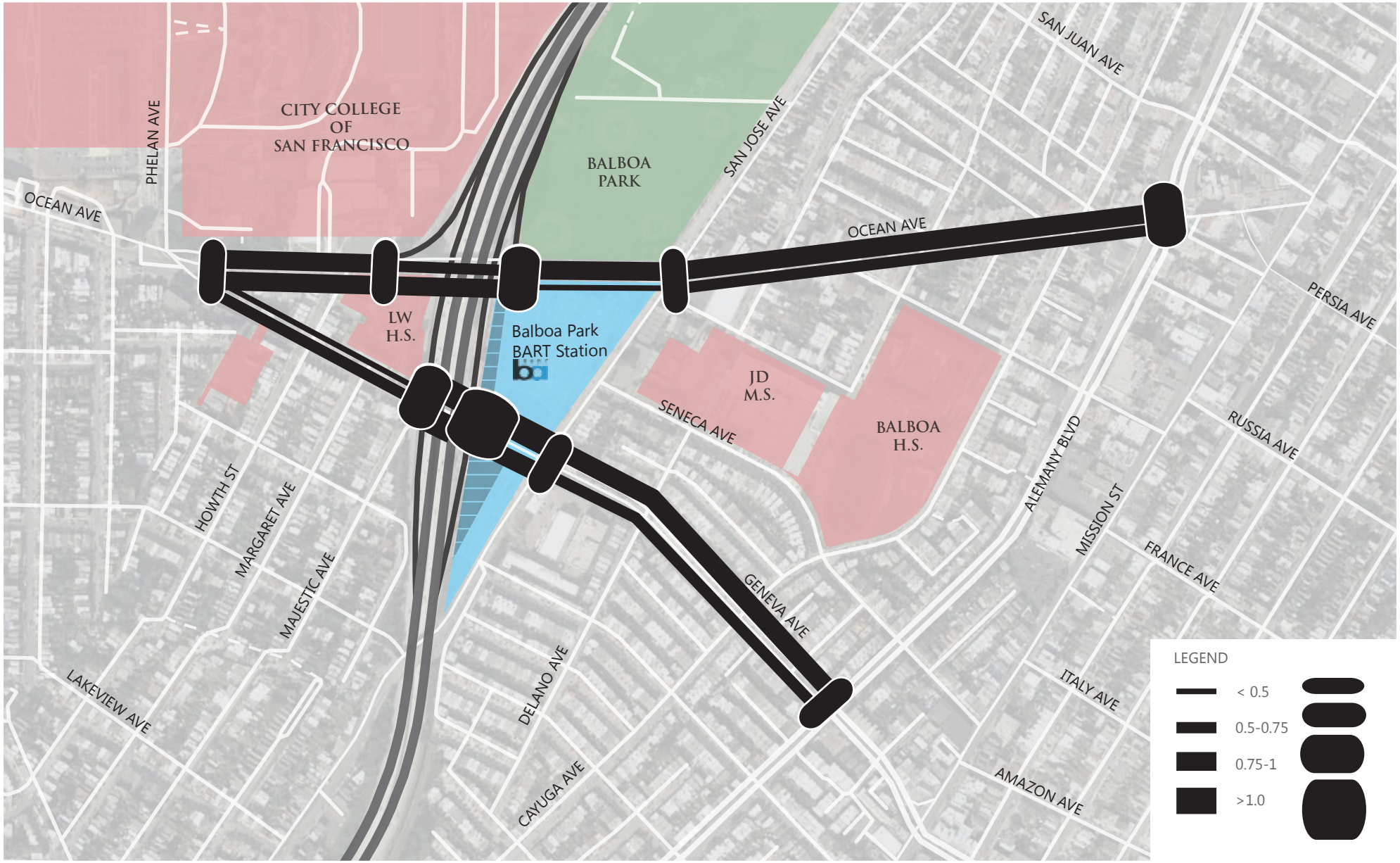
EXISTING AM PEAK HOUR V/C RATIOS

FIGURE 7A



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EXISTING PM PEAK HOUR V/C RATIOS

FIGURE 7B

I-280 Ramp Queuing

The *Balboa Park BART Station Pedestrian and Bicycle Connection Project* study, conducted in 2009, identified congestion at the following locations along the Geneva Avenue corridor:

- At Geneva Avenue and the I-280 northbound ramps – Passenger drop-offs at the ramp terminus and lack of signal coordination results in queues on the ramps. Signal coordination may have been recently adjusted, as this issue was identified in previous studies.

- At Geneva Avenue and the I-280 southbound ramps – Lack of signal coordination results in queues on the southbound off-ramp.

These queues are also affected by high levels of pedestrian traffic at ramp intersections, where individuals are crossing and slowing right-turn movement by vehicles. These intersections were observed to operate with less delay and queuing during the summer versus the school year, when vehicle and pedestrian volumes in the area are higher.

Wayfinding/Circulation Patterns

According to the *2008 BART Station Profile*, approximately 62 percent of BART riders at Balboa Park Station come from a home origin to the Station. A large majority of these riders live within a mile of the Station, and most of these riders walk or take transit to the Station. Riders are generally dispersed throughout a mile radius from the Station, but a majority come from the south and west of the Station or use transit along Geneva Avenue and Ocean Avenue. Of those who were dropped-off at the Station, most appeared to come from the south; however, no clear trend emerged from the data set. Non-home based BART riders to the Station tended to be coming from local schools near the Station.

During the AM peak hour, traffic on Geneva Avenue is slightly heavier compared to Ocean Avenue; however, the number of turning movements is greater, which may make congestion more noticeable. About an equal number of people are coming to and from the ramps on Ocean Avenue and Geneva Avenue. Volumes on the northbound on-ramp on Ocean are slightly higher than those on Geneva. Similarly, the southbound off-ramp on Ocean Avenue has more vehicles than the southbound off-ramp to Geneva. Through traffic on both streets is about the same in both directions during the peak hour.

During the PM peak hour, traffic on Geneva Avenue is slightly higher than Ocean Avenue; however, the northbound on-ramp on Ocean Avenue carries about 25 percent more vehicles than the northbound on-ramp at Geneva. The southbound off-ramp volumes are approximately equal on both the Ocean Avenue and Geneva Avenue off-ramps. Ocean Avenue traffic tends to continue west, whereas, approximately 70 percent of the southbound off-ramp volume at Geneva Avenue makes a left to continue southeast.

In general, all turns are permitted at all intersections near the Station with the exception of Ocean/Geneva/Phelan. Westbound left turns are prohibited. Howth Street is one-way northbound between Geneva Avenue and Ocean Avenue, and one-way southbound south of Geneva Avenue.

Kiss and Ride

The Balboa Park BART Station kiss-and-ride area, located to the south of Geneva Avenue between I-280 and San Jose Avenue (across the street from the main station entrance), is underutilized, likely due to its poor access. Drivers are required to navigate several blocks before dropping off their passengers. Drivers have demonstrated their preference for drop offs in other locations, including on the freeway off-ramps and at the bus loading areas along Geneva Avenue.

The *2009 Transit Passenger Intercept Survey* noted that 7 percent of all customers at the Balboa Park BART Station are dropped off at the station[3]. The existing kiss-and-ride area serves only about 8 percent (11 percent during the AM peak period) of those who are dropped off. During field observations completed by SFMTA, approximately 60 percent of the users enter on Geneva Avenue during the PM peak period. A maximum of 80 vehicles during the AM peak period and 140 vehicles in the PM peak period enter the Geneva Avenue driveway (there is also an entrance/exit along San Jose Avenue).

The high level of passenger drop-offs on freeway ramps on Geneva Avenue near Balboa Park BART Station can be attributed to several key factors. Those being dropped off are typically BART or Muni riders who can easily walk the short distance from the ramps into the station itself. Motorists dropping off passengers can then proceed back onto northbound I-280 without navigating other local streets. However, this drop-off behavior slows traffic flow on the ramps, and it creates a safety issue for both pedestrians and vehicles. Along Geneva Avenue, pedestrians often cross midblock near the BART station entrance after being dropped off on the I-280 northbound off-ramp. This presents additional safety issues for pedestrians and vehicles alike.

Kiss and ride patterns were observed in 2012 during the AM (7:30 to 8:30 PM) and PM (4:45 to 5:45 PM) peak hours to note the specific routes taken by drivers, in order to identify travel behavior, bottlenecks, and traffic conflicts with other modes of transportation. The surveyors observed each drop-off/pick-up location (as shown in Figure 8) for thirty minutes during these peak hours. During the observation periods, observers recorded the time of drop-off or pick-up, the street from which the driver entered the study area (i.e., origin), and the street onto which the driver exited the study area (i.e., destination).

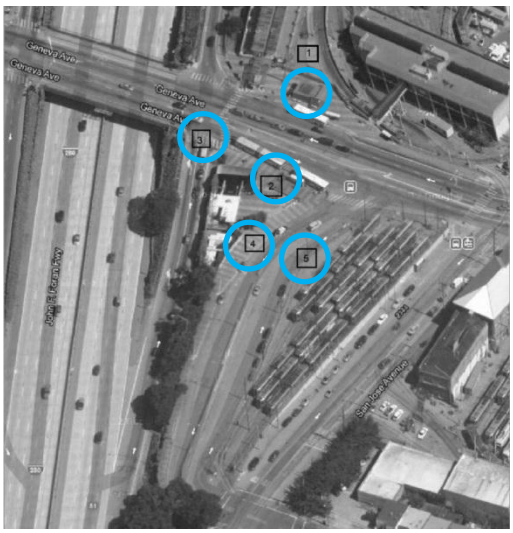


Figure 8: Observed Kiss and Ride Locations

[3] *Balboa Park BART Station Capacity and Conceptual Engineering Study*, SFMTA, 2011.

Due to the location of the designated kiss and ride area and temporal behavioral differences, slightly different information was recorded during the morning and afternoon peak hours. During the AM peak, observers recorded the number and travel pattern of drop-offs by observing the entry and exit point of the kiss and ride lanes. During the PM peak, collectors recorded only the pick-up and drop-off counts and not the travel patterns of drivers. This is because drivers tended to wait in the kiss and ride area for longer periods of time and then leave in waves with each BART train. This made it difficult to record origins and destinations of drivers.

Figure 9 shows the routes most frequently used by drivers dropping off or picking up passengers in the study area. Five routes accounted for 50 percent of drop-off activity on the observation days.

Figure 9: Drop-Off Route Frequencies, Top 50%

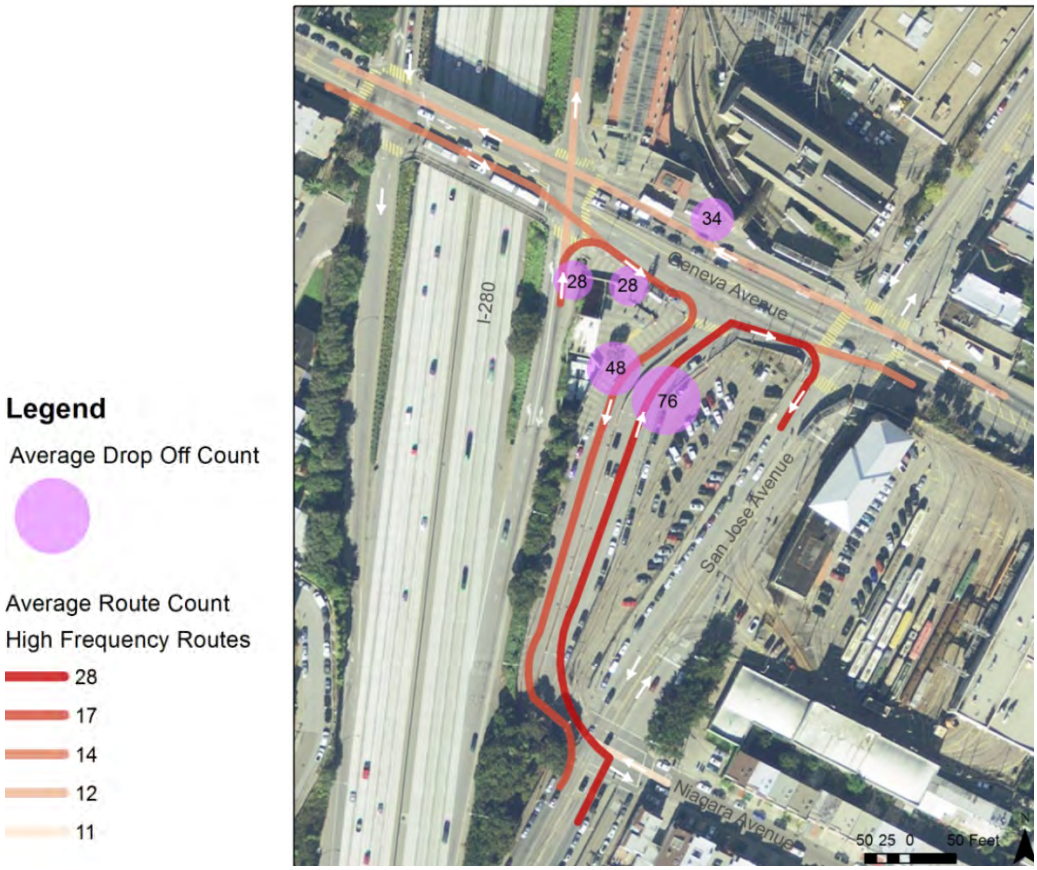
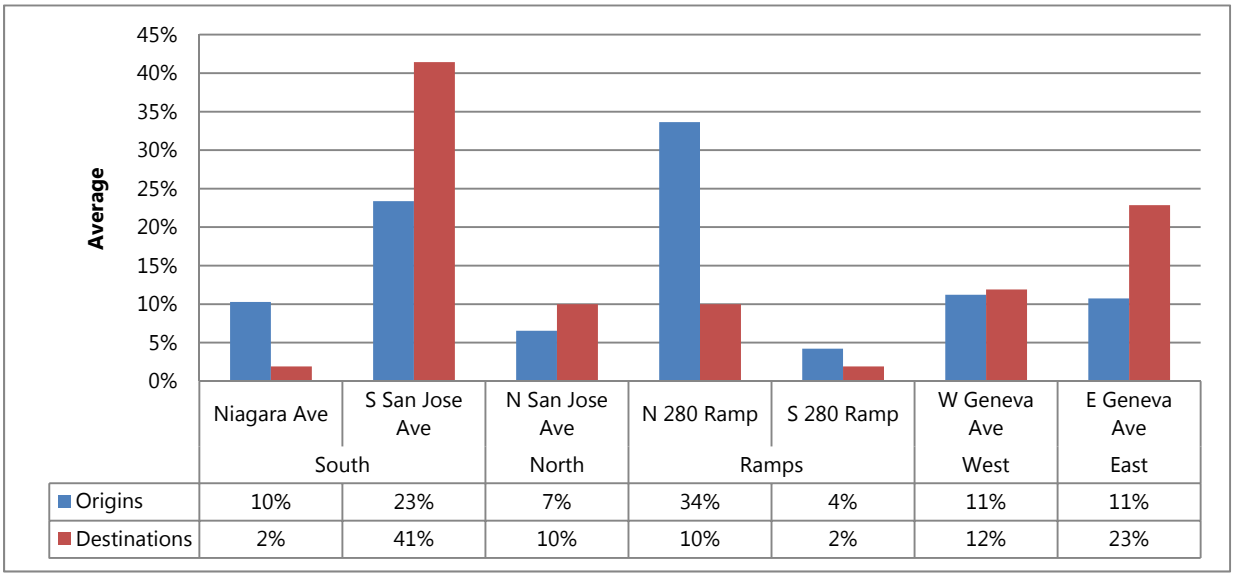


Chart 3 summarizes the frequency of AM peak origins and destinations. In terms of direction, most of the drop-offs originated from the south, for a combined count of 33 percent of all origins observed. In terms of origin, most of the drop-offs came from the northbound I-280 freeway exit ramp, accounting for 34 percent of the total drop-offs. The majority of drivers, 43 percent, headed to the south after dropping off passengers.

Chart 3. AM Peak Hour Kiss and Ride Origins and Destinations



	Niagara Ave	S San Jose Ave	N San Jose Ave	N 280 Ramp	S 280 Ramp	W Geneva Ave	E Geneva Ave
	South		North	Ramps		West	East
Origins	10%	23%	7%	34%	4%	11%	11%
Destinations	2%	41%	10%	10%	2%	12%	23%

- The observations indicate that the majority (58%) of kiss-and-ride activity occurs in the designated K&R area for both the AM and PM peak periods.
- Activity is much more dispersed in the AM than in the PM: 42% of drop-offs occurred outside the K&R during the AM peak, compared to 15% during the PM Peak.
- The three drop-off points outside the K&R were used in roughly equal proportion during the AM peak, with the westbound bus stop seeing slightly greater activity.
- The most frequently used route, accounting for 26% of AM drop-off activity, is one where drivers enter the east K&R lane from the south on San Jose Avenue and exit traveling southbound again on San Jose Avenue.
- There is a mixture of drop-off and pick-up activities at both bus stations during the PM peak.
- There was an average of 28 drop-offs per hour on the North 280 exit ramp during the AM peak.
- During the AM peak, the most frequent origin for drop-off activity is the north 280 exit ramp; the most frequent destination is southbound on San Jose Ave. For both the AM and PM peak periods, the majority of drivers originate from the south side and depart to the south side of the station along San Jose Ave.
- Conflicts were occasionally observed between cars stopping to drop-off or pick-up passengers in the bus stops on both the north and south sides of Geneva Ave.
- Drivers tended to dwell longer in the K&R area in the PM peak waiting to pick up passengers.

The kiss and ride area has two lanes, one on the east side for cars entering from the south and one on the west side for cars entering from the north. Both sides have two parking lanes. The standing parking capacity of the kiss and ride area was estimated by dividing the length of each parking lane (approximately 300 to 350 feet) by an average car length. Cars waiting in the kiss and

ride area tended not to parallel park so to be conservative, a car length of 30 feet was assumed. These parameters led to an estimated standing capacity of 42 vehicles. During the observation periods, an average of 6 BART and Muni vehicles, and one Carshare vehicle, were parked in the kiss and ride area, reducing the capacity to 35 vehicles.

To estimate the capacity of the kiss and ride area to process waiting vehicles, an average waiting time per vehicle of 10 minutes was assumed. During the PM peak, BART headways are 3-5 minutes in either direction, so this assumes drivers wait 2 or 3 trains for their arriving passengers.

Based on these assumptions, the average capacity of the kiss and ride was estimated to be 210 vehicles per hour (35 vehicles / 10 minutes per vehicle). The observed arrival rate was 176 vehicles per hour suggesting the kiss and ride area is close to but not at capacity. This is supported by the fact that no queuing was observed during the observation periods.

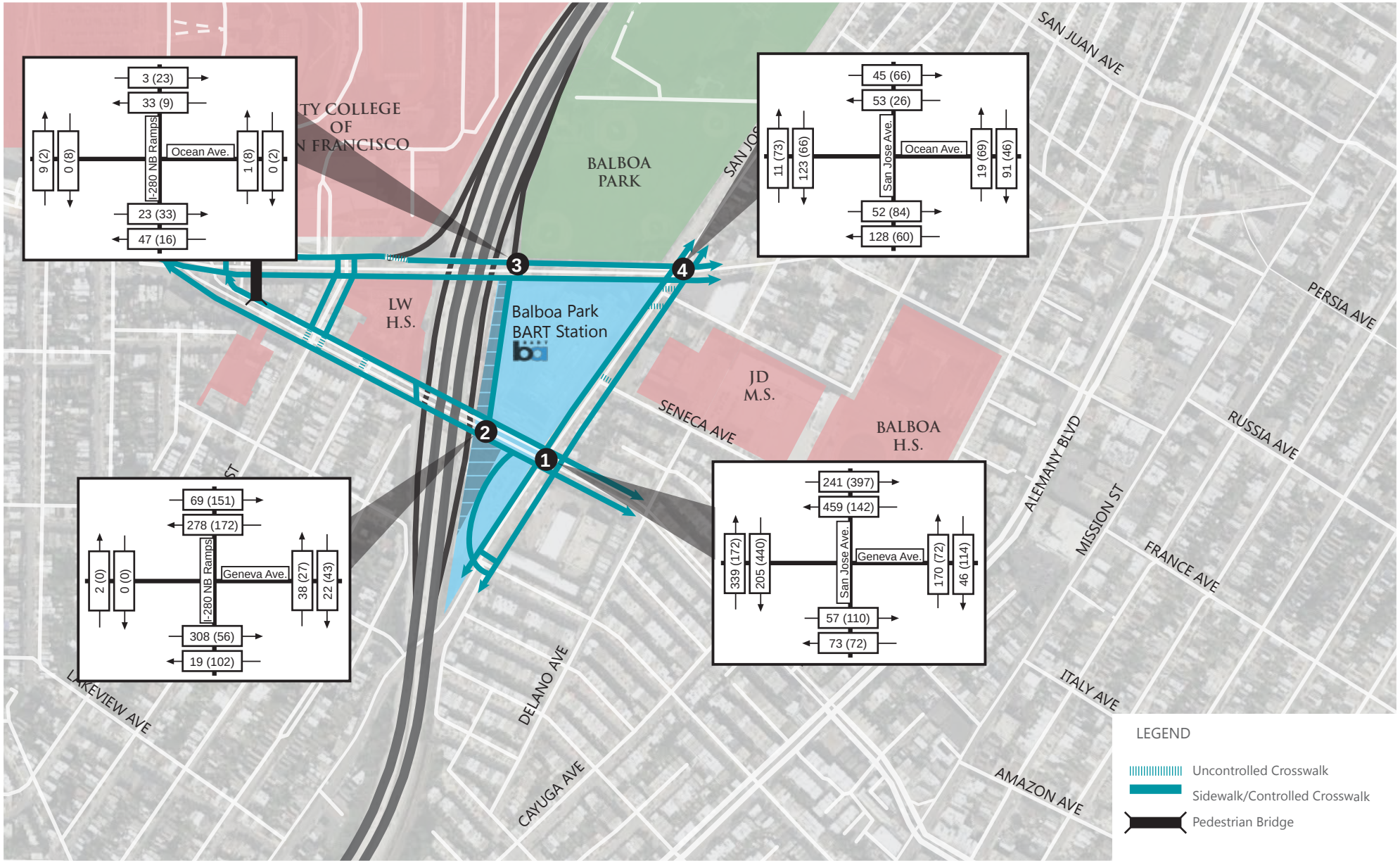
PEDESTRIANS

Figure 10 presents the pedestrian circulation network in the vicinity of the Balboa Park BART Station, including the location of controlled and unsignalized crosswalks. Major pedestrian destinations within the Balboa Park BART Station vicinity include the City College of San Francisco, Lick-Wilmerding High School, Balboa Park, and neighborhood retail along Ocean Avenue to the west of the study area. The I-280 freeway ramps on Ocean and Geneva Avenue are a major impediment to safe, comfortable walking trips around the Station Area. Likewise, high pedestrian volumes at these crossings delay vehicles turning off and on to the ramps.

Geneva Avenue has sidewalks on both sides of the street, with the heaviest pedestrian utilization near the Balboa Park BART Station. Sidewalks surrounding the station are narrow in places, especially on the north side of Geneva Avenue, and have a constrained capacity. Pedestrian platoons from Muni light rail vehicles, buses, and BART trains frequently exceed the sidewalk's capacity, particularly during peak hours.

The pedestrian environment along **Ocean Avenue** is influenced substantially by both CCSF and the Balboa Park BART Station. A significant flow of pedestrian traffic connects these two major activity centers. The crosswalk at Howth Street and at the northbound on-ramp are the only marked pedestrian crossings on Ocean Avenue for the segment between San Jose Avenue and Geneva Avenue. Because of this, mid-block crossing is quite common, even though the crosswalk at the northbound on-ramp is a recent improvement.

Balboa Park BART Station has a newly improved pedestrian path along the west side of the station connecting the BART station entrance on Geneva Avenue to the intersection of Ocean Avenue and the northbound I-280 ramps. A high number of pedestrians continue to walk along the LRT tracks due to its higher level of perceived safety, convenient access to Muni and BART. The forthcoming eastside improvements will upgrade this route as well.



Not to Scale

EXISTING PEDESTRIAN CIRCULATION

FIGURE 10

FEHR PEERS

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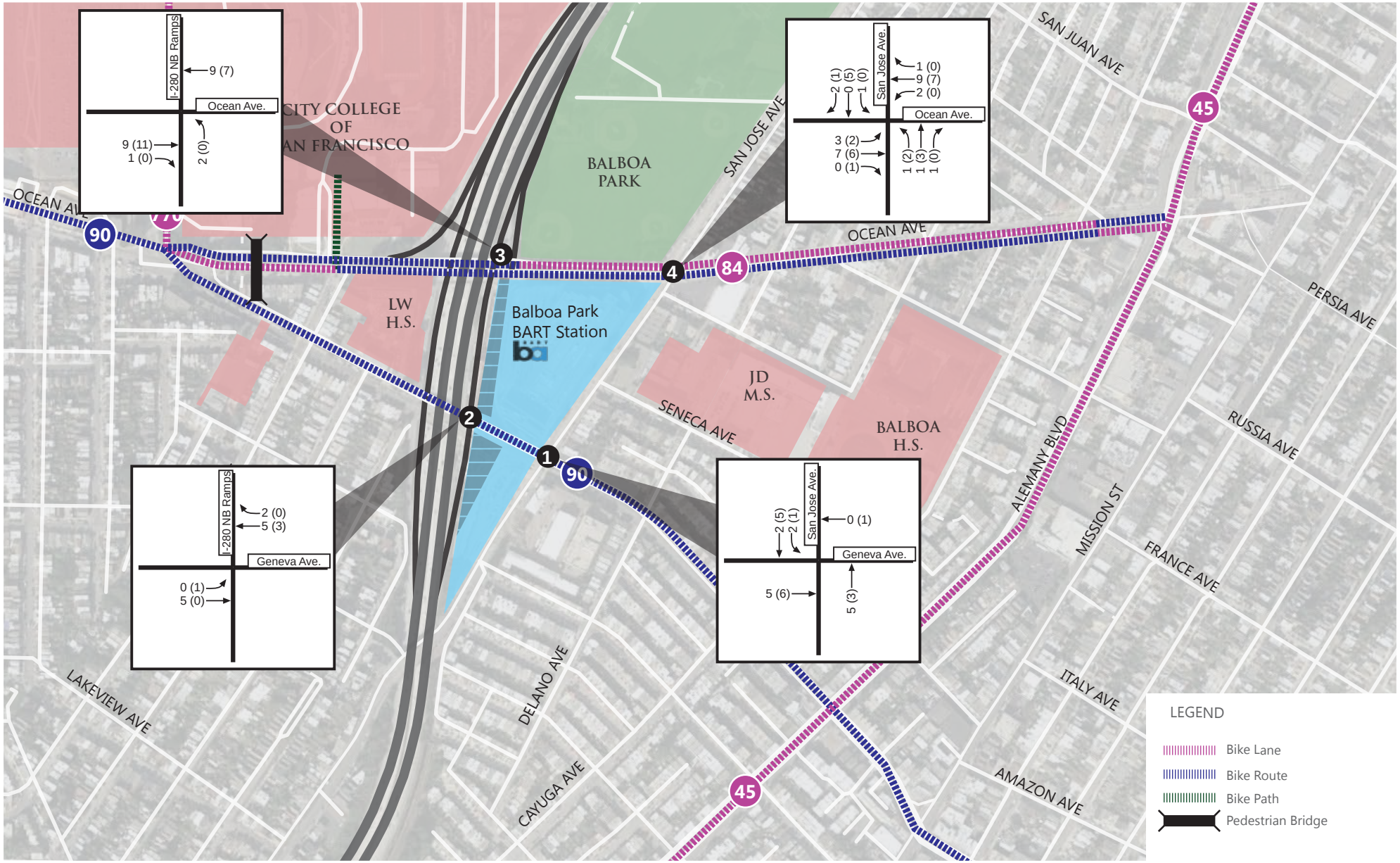
BICYCLISTS

Figure 11 presents the bicycle route network in the vicinity of the Balboa Park BART Station. In the vicinity of the station, Geneva Avenue, Ocean Avenue, and Alemany Boulevard are the primary designated bike routes. Bicycle routes on Phelan Avenue, and Sagamore Street/Sickles Avenue also serve the study area.

The *Balboa Park BART Station Pedestrian and Bicycle Connection Project* conducted in 2009 observed more bicyclists on Ocean Avenue than on Geneva Avenue, and observed that bicycle volumes are generally low in the Balboa Park study area.[4] The low bicycle volumes were generally attributed to heavy traffic volumes, challenging topography, and the lack of on-street bicycle facilities. Since the 2009 *Balboa Park BART Station Pedestrian and Bicycle Connection Project*, bicycle lanes were implemented on Ocean Avenue (completed in November 2010), Alemany Boulevard, Phelan Street, and Sagamore Street and Sickles Avenue (completed in June 2011). The *2011 Bicycle Count Report* conducted by SMTA did not identify increases in bicyclists at the study intersection of Geneva/Phelan and Ocean Avenue between counts conducted in 2010 and 2011, and in general, bicycle volumes at this location were lower than many other locations in the City.[5] The combination of arterial streets with higher speed limits, more car lanes, and fewer bicycle facilities could indicate that bicyclists may be concerned for their safety. This perceived safety concerns could also contribute to the low bicycle mode share.

[4] *Final Report, Balboa Park BART Station Pedestrian and Bicycle Connection Project*, SFMTA, October 2009.
[5] *2011 Bicycle Count Report,* SFMTA, December 2011.



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EXISTING BICYCLE NETWORK

FIGURE 11

KEY MULTI-MODAL ISSUES & OPPORTUNITIES

Although each mode has unique characteristics and methods of evaluation, their convergence around the station results in more complex interactions. **Figure 12** summarizes many of the issues that have already been discussed. From the preceding existing conditions discussion, the following five key issues emerge:

1. **The southbound freeway exit onto Ocean Avenue is a high-speed, uncontrolled ramp** that only provides vehicle access in the westbound direction. Plans to realign the ramp and square off the intersection will improve pedestrian and bicyclist safety and access, and also create an opportunity for eastbound vehicles to turn left.

2. **Collectively**, **the I-280 interchange has redundant southbound off- and northbound on-ramps**. While distributed ramps disperse vehicle traffic throughout multiple roads, no road operates well for a specific user. Consolidated freeway access at Ocean Avenue provides access to local destinations, whereas, Geneva Avenue serves as a major transit transfer hub. Reducing the number of ramps may help rationalize vehicle circulation, and create opportunities to improve transit service, passenger drop-offs, and the pedestrian and bicycle experience. However, potential impacts to the local circulation network will need to be analyzed.

3. **The northbound ramps on Geneva Avenue conflict with pedestrian activity**. Passenger drop-offs along the ramps create safety issues and contribute to queues along the off-ramp. Providing both a local and freeway accessible drop-off area could better serve those who drop-off and pick-up passengers in the area. In addition, high pedestrian volumes at the ramp crossings conflict with vehicle turning movements and cause delay along Geneva Avenue and the off-ramp. Vehicle volumes and the number of conflicts could be reduced at this intersection by reconfiguring one or more of the freeway ramps.

4. **Northbound freeway access on Ocean Avenue reduces the vehicles accessing the freeway on Geneva Avenue**; however, access to the northbound on-ramp conflicts with LRVs entering and existing the Green Yard. Ocean Avenue could also serve as a more direct connection to CCSF.

5. **Geneva Avenue is the most congested street within the study area and negatively impacts Muni bus operations**. The TEP recommendations to relocate some activity to Ocean Avenue should be carried through and considered in this analysis.

6. **The designated Kiss-and-Ride area is difficult to access and is underutilized**, particularly during the AM peak period. Strategies to relocate kiss-and-ride activities or create multiple drop-off and pick-up locations based on current patterns will be identified in the next project planning phase.

Using this existing conditions and evaluation framework as a baseline, future opportunities to improve access and circulation through the study area will be developed and evaluated.

Not to Scale

IDENTIFIED ISSUES: BALBOA PARK STATION

FIGURE 12

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