Analysis of Garage Parking Assets for Investments in EV Charging Infrastructure

SFMTA Draft August 2018

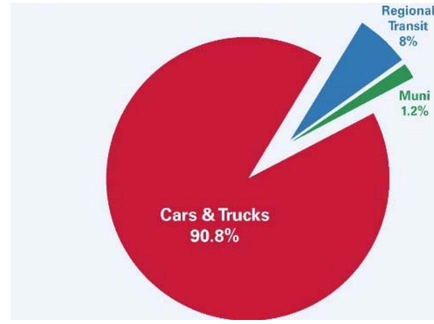


Fig 1-1. San Francisco Transportation Sector Emissions

I. Introduction

The transportation sector's reliance on fossil fuels makes the sector the city's largest source of greenhouse gas (GHG) emissions and criteria air pollutants. Along with mode shift to transit, walking and bicycling, strategic electrification of the transportation sector has the potential to reduce harmful emissions and air pollution from the transportation sector. Achievement of these reductions depends, in part, on the electrification of private vehicles by establishing Electric Vehicle Supply Equipment (EVSE) or Electric Vehicle (EV) charging infrastructure that is responsive to current and future demands, ensures consistency with key policies such as Transit First and public health and safety policies while providing equitable access across the city.

SFMTA garages and parking facilities have the potential to play an important role in the development of a citywide EV charging network. Additionally, increased private sector interest in SFMTA garage and parking facilities means the agency needs to understand the suitability of these assets for future investments in EV charging infrastructure. This study analyzes parking and charging utilization of the agency's 20 garages. The study also establishes suitability measures and makes site level investment recommendations. Additional research and further considerations are also highlighted.

Recommendations for SFMTA Garages

In order for San Francisco to maximize the benefits of EVs in San Francisco while minimizing potential conflicts with city and agency transportation goals and priorities, the metrics on the next page have been established to determine recommendations for EV charging infrastructure investments at SFMTA parking garages.

Ranked according to these metrics, the highest priority garage for investment in or expansion of EV charging is Japan Center garage. Japan Center Annex garage, though having a lower priority, has a higher electric capacity and could be ideal for the installation of DC fast chargers. Meanwhile, 5th & Mission garage has an enormous 2,585 parking spaces and more easily upgradable electric capacity—enabling the possibility of a large-volume fueling center.

Further details on findings can be found **on page 8**.

Key – Electric Capacity

- Sufficient for one L2 charging station (20 kW)
- Sufficient for one L3 charging station (150 kW)
- * Upgradeable electric capacity

Key – Conflicts

+ Possible consideration
! Restrictive conflict

Fig 1-2. Investment Priorities for EV Charging Infrastructure

Garage	Priority	Electric Capacity	Conflicts
Japan Center	8		
SF General Hospital	7		
Japan Center Annex	5		
Lombard Street	4		
Pierce Street	4		
Golden Gateway	3		
Portsmouth Square	3		
5th & Mission	2	*	+
Mission-Bartlett	2		
Union Square	1		
Sutter-Stockton	1		+
Performing Arts	1		
16th & Hoff	1		
Civic Center	-		+
Ellis-O'Farrell	-		
Polk-Bush	-		
Moscone Center	-		!
North Beach	-		
St. Mary's Square	-		
Vallejo Street	-		

Core Principles		Objective	Metric
Environmental Sustainability	A	Maximize Emissions Savings	1. High Emissions Savings per Charging Stall
	B	Optimize Existing Charging	2. High Average Charging Stall Occupancy
			3. High Peak Charging Stall Occupancy
	C	Encourage Fuel Shift	4. High Average Parking Volumes
			5. High Auto Ownership
			6. High Auto Use by Workers
Transit First, Congestion Management, and Safety	D	Discourage Mode Shift	7. Low Transit Use by Workers
			8. Low AllTransit Score
	E	Prevent Congestion	9. High Average Speed During Rush Hour
	F	Minimize Safety Impacts	10. Not on Vision Zero High Injury Networks

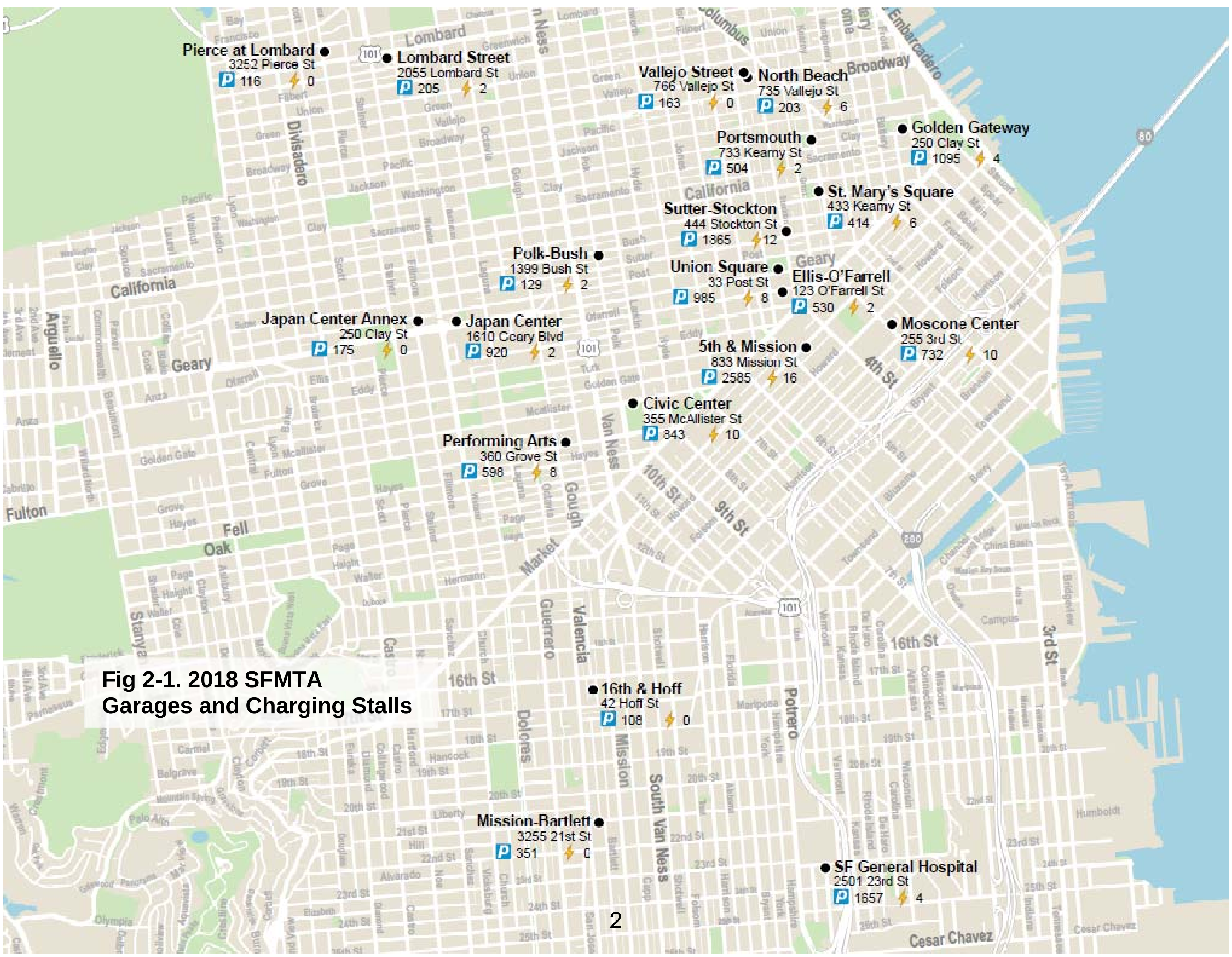


Fig 2-1. 2018 SFMTA Garages and Charging Stalls

Fig 2-2. 2018 SFMTA
EV Charging in Public Garages

20 garages

15 garages with chargers

14,178 parking spaces

95 charging stalls (49 stations)

Emissions savings year-to-date
108,000 kg CO_2e
250+ MWh charged
$49,000 revenue collected

(as of August 2018)

II. System Overview

The SFMTA owns and operates 20 publicly available parking garages. Of these, 15 garages house a total of 49 charging stations (95 individual ports or stalls), installed and monitored by ChargePoint. ChargePoint also tracks and records charging session data, including plug and unplug time, kWh charged, and fees collected.

This assessment uses data from 2017, when 48 public charging stations and 94 stalls were available.

Facility Characteristics

SFMTA's garages range from 108 spaces (16th & Hoff) to 2,585 (5th & Mission). Three other garages, Golden Gateway, SF General Hospital, and Sutter-Stockton, have over 1,000 spaces.

Eleven garages have sufficient reserve electric capacity to power at least one Level 2 charging station, which draw up to 20 kW and are able to support two charging stalls. Two garages have sufficient reserve capacity to power one Level 3 charging station, drawing up to 150 kW. Notably, 5th & Mission Garage has a "primary" voltage type which means that the electric capacity can more easily be upgraded to support larger power draws.

Some garages have potential conflicts. For example, SFMTA is accepting proposals to close and redevelop Moscone Center Garage, and EV charging infrastructure investment would not be recommended here. More details can be found in the Findings section on page 8.

Key – Electric Capacity

⚡ Sufficient for one L2 charging station (20 kW)
ϟ Sufficient for one L3 charging station (150 kW)
* Upgradeable electric capacity

Key – Conflicts

+ Possible consideration
! Restrictive conflict

Fig 2-3. Garage Facilities

	Parking Spaces	**Electric Capacity**	**Conflicts**
Pierce Street	116		
16th & Hoff	108		
Civic Center	843	⚡ϟ	+
Ellis-O'Farrell	530	⚡	
5th & Mission	2,585	* ⚡	+
Golden Gateway	1,095	⚡	
Japan Center	920	⚡	
Japan Center Annex	175	⚡ϟ	
Lombard Street	205		
Mission-Bartlett	351		
Moscone Center	732	⚡	!
North Beach	203		
Performing Arts	598	⚡	
Polk-Bush	129	⚡	
Portsmouth Square	504	⚡	
SF General Hospital	1,657		
St. Mary's Square	414		
Sutter-Stockton	1,865	⚡	+
Union Square	985	⚡ϟ	+
Vallejo Street	163		

III. Policy and Environmental Context

As EVs are becoming commonplace, SFMTA has an opportunity to support EV use as is consistent with the 2017 Transportation Sector Climate Action Strategy, the citywide Climate Action Strategy, and other agency and city initiatives. The transportation sector is the city's largest source of greenhouse gas (GHG) emissions. EV technology has the potential to play an important role in emission reductions as an alternative to traditional internal combustion engine vehicles (ICEVs). Along with strategies and initiatives identified above San Francisco and the SFMTA continue to advance electrification and climate goals. In May 2018 SFMTA committed to 100% electrification of its bus fleet to by 2035. In 2015, the late Mayor Ed Lee established an Electrical Vehicles Workgroup (EVWG) to identify actions and policies to continue EV growth in San Francisco. And in April 2018, former Mayor Mark Farrell announced a historic commitment to net-zero greenhouse gas emissions by 2050.

SFMTA's charging program may have served as a catalyst for the proliferation of private sector charging stations since 2011. Currently, 160 distinct locations offer EV charging, including fifteen SFMTA garages and three other city-owned sites. This year to date, SFMTA chargers have provided more than 200,000 kilowatt-hours (kWh), which can be associated to a 84,000 kg CO_2 equivalent (CO_2e) savings in GHG emissions, or 200,000 fewer miles traveled by an average passenger vehicle. As a caveat, however, it is unclear whether EV trips are replacing transit or bicycle trips rather than ICEV trips as intended.

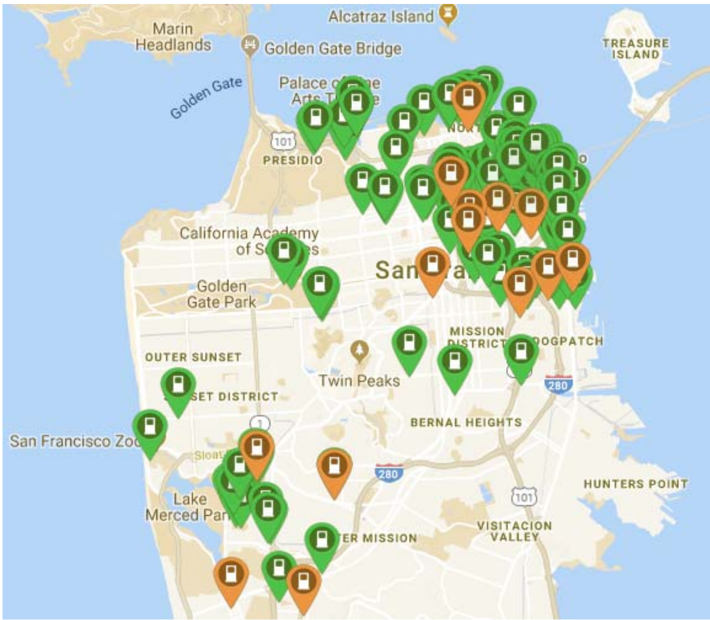


Fig 3-1. San Francisco EV Charging Locations

While electrification supports city and agency climate goals, there is the potential conflict transportation policies and priorities. Enabling and encouraging motor vehicle use could complicate safety and Vision Zero. Similarly, electrification and associated infrastructure contradicts city's Transit-First policy prioritizing travel by public transit, by bicycle, and on foot. Furthermore, already congested road networks in SF can accommodate few more motor vehicles. Any investment to EV charging infrastructure must minimize the number of drivers added to San Francisco roads and impacts on safety and transit.

That being said, political action, popular sentiment, or other funding may allow for the expansion of an EV charging network as one of many pathways to emissions reductions and 100% electrification, such as the $423 million Environmental Mitigation Trust to be received by California, established by a settlement involving environmental violations by Volkswagen in 2015. Pilot projects have suggested that expansion of the public charging network might be funded through such sources or other private investments. This assessment of existing EV charging infrastructure is intended to inform recommendations for future such investments.

IV. Methodology

Ten metrics developed for this analysis were chosen to align with core agency principles of environmental sustainability, safety, congestion management and Transit First. Each garage was assigned a Priority score based on the number of metrics for which the garage met the threshold value.

However, capital and operational constraints, including conflicting projects, parking capacity, and electric grid capacity, may make infrastructure investments costly or difficult. Additional metrics for have also been established to consider parking asset optimization and demand management.

<u>Facility and Operational Constraints</u>

Conflicting projects, limited parking capacity, or limited electric grid capacity may make charging infrastructure investments costly or impossible. Inversely, some garages have very large parking capacity and easily upgraded electric capacity that make large-volume investments worth considering.

- ☐ **No restrictive conflicts.**
  For example, the SFMTA is accepting proposals to close and redevelop Moscone Center Garage.

- ☐ **Adequate parking spaces available.**
  All garages have at least 100 parking spaces and flexibility for a few more charging stations. Some garages have capacity for a large number of additional charging spaces.

- ☐ **Adequate electric grid reserve capacity available.**
  Level 2 chargers require 6 – 20 kW and and DC Fast Chargers require 50 – 150 kW. The amount of reserve capacity available limits the number and type of charging stations that can be installed, as well as if charging stations can be installed at all.

<u>Investment Objectives</u>

Sustainability

Three objectives are established under the sustainability principle. Investments in EV charging infrastructure should both maximize emissions reductions from drivers already charging in SFMTA garages and help to enable new emission reductions by encouraging the shift from ICEVs.

A Maximize Emissions Savings

Multiple initiatives identify the transportation sector as the largest source of emissions, and, though it's unclear if all trips generated by EVs are shifted from ICEVs, ChargePoint equates each kWh charged with a savings of 0.42 kg CO_2e, or about the emissions from one mile traveled by an average passenger vehicle.

B Optimize Existing Charging

Currently, the number of available charging stalls is not enough to accommodate all EVs. During peak use, occupancy can reach as high as 90%. Adding charging stations to crowded garages can ensure that more EV users can find an available charging stall.

C Encourage Fuel Shift

Availability of charging stations encourages fuel shift from ICEVs. Studies suggest that public charging infrastructure enables drivers without garages or access to charging to make the switch to EVs.[1] According to the US Department of Energy, employees with workplace charging are six times more likely to drive an EV.[2]

Transit First, Congestion Management, and Safety

Three additional objectives are considered in regards to policies around Transit First, congestion management, and Vision Zero.

D Discourage Mode Shift

Both transit use and transit access are considered, as driving and parking should not be a strong alternative where workers depend on transit or where transit provides very good access.

E Mitigate Congestion

EV charging infrastructure should not contribute to congestion. Vehicle speed during rush hour is currently the best measure of congestion, tracked by the SFCTA.

F Minimize Safety Impacts

Infrastructure supporting driving should not be built near the High Injury Network, where safer modes should be prioritized.

Metrics for Investment

Core Principles	Objective		Metric
Environmental Sustainability	A	Maximize Emissions Reductions	**1. High Emissions Reductions per Charging Stall** Each additional stall[3] will increase emissions reductions at this rate (with decreasing returns).
	B	Optimize Existing Charging	**2. High Average Charging Stall Occupancy** Additional capacity will accommodate higher demand.
			3. High Peak Charging Stall Occupancy Additional capacity will relieve crowding during peak use.
	C	Encourage Fuel Shift	**4. High Average Parking Volumes** Drivers who already park in garages may be encouraged to drive EVs instead. At garages with higher parking volumes, more drivers are likely to see available charging stalls.
			5. High Auto Ownership Drivers who live nearby may be encouraged to drive EVs instead.
			6. High Auto Use by Workers Drivers who work nearby may be encouraged to drive EVs instead.

[1] Seattle EVCROW Pilot: https://www.seattle.gov/transportation/projects-and-programs/programs/new-mobility-program/electric-vehicle-charging-in-the-public-right-of-way
[2] US Department of Energy: https://www.energy.gov/sites/prod/files/2017/01/f34/WPCC_2016%20Annual%20Progress%20Report.pdf
[3] kWh charged per stall relates charging with number of vehicles or parking spaces (one stall per parking space), whereas kWh charged per station relates charging with the cost of each station. As the impacts of mode shift are key to this analysis, we use kWh charged per stall.

Transit First, Congestion Management, and Safety	**D**	Discourage Mode Shift	**7. Low Transit Use by Workers** Driving should not be encouraged where workers are likely to use a more sustainable mode.
			8. Low AllTransit Score Driving should not be encouraged in areas with good transit access.
	E	Mitigate Congestion	**9. High Average Speed During Rush Hour** Driving should not be encouraged in congested areas.
	F	Minimize Safety Impacts	**10. Farther than 500 feet from High Injury Networks** Driving should not be encouraged near streets with high rates of injury.

<u>Special Treatment: Fast Charging for Demand Management</u>

DC Fast Charging stations, which shorten the time for a full charge to as low as half an hour, can help to 1) maintain availability when demand is high and 2) maximize emissions reductions during short charging sessions.

SF*park* and other pilots have demonstrated that dynamic parking rates can affect demand and maintain the availability of parking spaces during congested periods. Similarly, supply of EV charging infrastructure and associated charging durations and rates can help to promote shorter, more frequent charging sessions maximizing cost recovery for the energy provided. High parking turnover and daytime availability are key to some areas, especially commercial and shopping districts, where “cruising for parking” can be a major contributor to traffic and congestion.

Garages in areas characterized above typically experience short charging and parking sessions where fast charging can increase the charge provided per parking session. In addition to the ten primary metrics, it is recommended that DC Fast Charging stations be added in garages that meet all of the following metrics:

- ☐ **<u>High</u> peak charging stall occupancy.**
  Fast charging capacity will relieve crowding during peak use.
- ☐ **<u>Low</u> charging session durations.**
  Fast charging can increase charge provided for short charging sessions.
- ☐ **<u>Commercial</u> zoning.**
- ☐ **<u>At least level 3</u> zoning in surrounding areas.**
- ☐ **<u>At least 150 kW</u> reserve capacity available.**
  DC Fast Charging stations draw up to 150 kW.

V. Findings

Each garage was assigned a priority score based on the number of metrics for which the garage met the threshold value. The final results of this assessment are presented here

Key – Electric Capacity

Sufficient for one L2 charging station (20 kW)
Sufficient for one L3 charging station (150 kW)
* Upgradeable electric capacity

Key – Conflicts

+ Possible consideration
! Restrictive conflict

Case Studies and Conflicts

Fig 5-1. Investment Priorities for EV Charging Infrastructure

Garage	Priority	Electric Capacity	Conflicts
Japan Center	8		
SF General Hospital	7		
Japan Center Annex	5		
Lombard Street	4		
Pierce Street	4		
Golden Gateway	3		
Portsmouth Square	3		
5th & Mission	2	*	+
Mission-Bartlett	2		
Union Square	1		
Sutter-Stockton	1		+
Performing Arts	1		
16th & Hoff	1		
North Beach	1		
Vallejo Street	1		
Civic Center	-		+
Ellis-O'Farrell	-		
Polk-Bush	-		
Moscone Center	-		!
St. Mary's Square	-		

Japan Center **8**
Japan Center Annex **5**

The Japan Center and Japan Center Annex garages are the highest priority garages for investment in EV charging infrastructure. Japan Center's two charging stalls are the second most used of all the garages, reaching 76% utilization during peak hours. Parking and auto use in the area is high for both garages, which are located on neighboring blocks.

Though the Japan Center Annex garage has no data for either parking or charging, it is likely that additional charging stalls will be well used in both garages.

The Japan Center garage also is suitable in all five metrics for the installation of DC Fast Charging, despite not having enough reserve electric capacity to support an additional 150 kW of power draw. However, the neighboring Japan Center Annex garage does, and it may be a solution to install DC Fast Charging in the Japan Center Annex garage instead.

Lombard Street **4**
Pierce Street **4**

The Pierce Street and Lombard Street garages are examples of small garages (116 and 205 spaces respectively) whose EV charging stalls are not well-utilized. Pierce Street garage doesn't have any chargers currently. However, both are located in areas where auto use and ownership is high and transit use is relatively low. The SFCTA does not consider nearby corridors to be extremely congested, and these garages' location near Highway 101 and the Golden Gate Bridge can make charging stalls here useful fueling stations for new and current EV users.

5th & Mission **2 * +**
Sutter-Stockton **1 +**

Both 5th & Mission and Sutter-Stockton garages are low priority garages for new investment. However, their large size and 5th & Mission's primary voltage type might invite different types of EV charging use. As potential parking needs decline and more San Franciscans switch to transit or ride-hailing or other modes, large garages like these, with over 4,000 parking spaces combined, may be useful as fueling stations for both single-occupancy EVs and EV fleets operated by a wide array of mobility providers.

Currently, SFMTA is reviewing proposals for projects to install charging infrastructure in SFMTA garages. As of this writing, Tesla and GM Cruise have requested to install 40 restricted access EV charging stations each at the 5th & Mission Garage exclusively for use by Tesla and GM vehicles, respectively. GM Cruise is further proposing to install 40 stations at the Sutter-Stockton Garage.

One possible outcome for these garages is that Tesla and GM Cruise may be asked to provide and install publicly accessible charging stations in addition to or in lieu of paying a lease, drastically reducing the cost of expanding the charging network at these garages. It is recommended that policies and priorities are established in regards to access and exclusivity of future projects and investments.

Civic Center **0** +

Charging stations in Civic Center Garage are underutilized and transit is the preferable mode in the area. But, Civic Center the site for a pilot project to install on-street charging stations. As on-street charging stations are more visible, they are likely to increase demand impacting safety and congestion as a result of on-street queueing. In this case, the charging stations in Civic Center Garage may provide alternative for drivers, collecting overflow from the proposed Civic Center on-street charging stations.

Moscone Center **0** **!**

Lastly, SFMTA is also accepting proposals for redevelopment of Moscone Center Garage with hotels or housing projects to complement the Moscone Expansion project. Regardless, charging infrastructure investments are a low priority for this garage, which does not perform well on any of the ten metrics.

VI. Next Steps and Further Considerations

This assessment can be used as a guide for prioritizing future investment, repair, and upgrade of EV charging networks in SFMTA garages. It is important to recognize that the ten metrics focus on the trade-off between environmental sustainability and other policies surrounding safety, congestion, and transit. As other priorities come into play, the score assigned to each garage in this assessment is one of many factors to be considered in a project involving EV charging stations and public garages. At the same time, further study contributes to SFMTA's understanding of its assets, EV charging, and parking.

<u>Other SFMTA Parking Assets</u>

If SFMTA garages are suitable for charging infrastructure, it reasonably follows that other agency-owned or managed parking may also ideal for the expansion of an EV charging network. SFMTA garages without EV chargers and surface parking lots are the most logical next step. Without utilization data, the approach is similar, but should focus on driving landscape, especially general parking utilization and auto use or ownership.

Currently, a pilot program at Civic Center is evaluating the possibility of installing charging stations at on-street parking spots—that is, in the public right-of-way. While stations installed at garages and surface lots take up parking spaces, the impacts of curbside charging is far more significant. A 2017 internal SFMTA document concerning EV charging on sidewalks raised a variety of concerns in addition to the conflicts with Vision Zero and Transit First discussed in this assessment. While it ultimately concluded that chargers should not be added to curbside parking, the pilot is ongoing at the time of writing.

<u>Cost Effectiveness and Cost Recovery</u>

Although this assessment seeks to maximize emissions reductions and EV charging, it does not address the cost effectiveness of the EV charging network, both as a method to reduce emissions and for revenue capture. The 2013 analysis developed by Nelson\Nygaard and SPUR lists transportation electrification as the sixth most costly emissions reduction pathway out of a list of thirty nine strategies, costing the public \$830 per ton of CO_2e saved; still, the cost of each kWh charged at each garage will vary depending on the cost of electricity, the cost of charging stations, and the usage demand at each station. Adjusting charging station placement based on costs rather than maximizing emissions reductions may be preferable if budgets are stringent. More data on capital and operating costs must be obtained.

Furthermore, the California Public Utilities Commission forbids utility users to re-sell electricity, so fees charged for EV charging must be established solely for cost recovery. The current pricing structure has a rate of $1.89 per kWh, but the total fee has an upper limit of $5.00; any charging past 2.8 kWh is free.

From a revenue perspective, any charging sessions lasting longer than half an hour are undesirable because they don't contribute any revenue. Where the cost of parking is not prohibitive, EV drivers are incentivized to charge their vehicles past the $5.00 cap at cost to the agency and to the public. Unless it is demonstrable that EV charging stations attract drivers to pay for parking in garages (hopefully from privately-owned garages and on-street parking, rather than more sustainable modes), it is difficult to conclude that EV charging in public garages is cost-effective or revenue neutral.

However, current trends indicate that use of single occupancy vehicles and year-over-year parking revenues are declining. While charging infrastructure remains a consideration for SFMTA, long-term strategies for use of SFMTA parking assets must be developed. One such strategy is involves leasing spaces for private sector vehicle storage or charging, discussed below.

Demand Management

The SFMTA's lack of authority to set pricing also serves as a barrier to effective demand management of EV charging stalls. In garages where demand is high, these pricing constraints (plus the current pricing structure) are likely to keep charging spaces occupied when the parked vehicle is already fully charged, slowing turnover at charging stations and reducing the supply of parking for incoming drivers. Currently, there is a four-hour parking time limit restriction at spaces where EV charging is provided. Such a policy is difficult to enforce, and over half of garages have an average plugged-in time over 4.5 hours.

Two schemes can encourage turnover in crowded garages. First, as suggested in this assessment, the provision of DC fast charging stations will allow EVs to be charged more quickly so drivers can leave sooner with a full charge. Second, if possible, parking or charging prices can increase as vehicles are parked or plugged-in time. As an example to enforce time limits, a $10 fee can be applied for every hour an EV is plugged in past four hours or past a full charge.

However, current trends indicate that year-over-year parking revenues are declining. While the demand for charging stalls still at times exceeds supply, long-term strategies must be developed for SFMTA parking assets. One such strategy involves leasing spaces for EV storage or charging, discussed below.

Business Model and Private Sector Involvement

Given cost and revenue constraints, it may ultimately be more effective for SFMTA to lease space in garages for the private sector to operate charging stations not owned by the agency. This practice will help ensure a net positive revenue and transfer responsibility for operations expenses and managerial difficulties to the operating party instead. The agency can guide private sector proposals to garages where impacts on safety, transit, and parking or travel demand are minimal, and any emissions reductions will come at no cost to the agency.

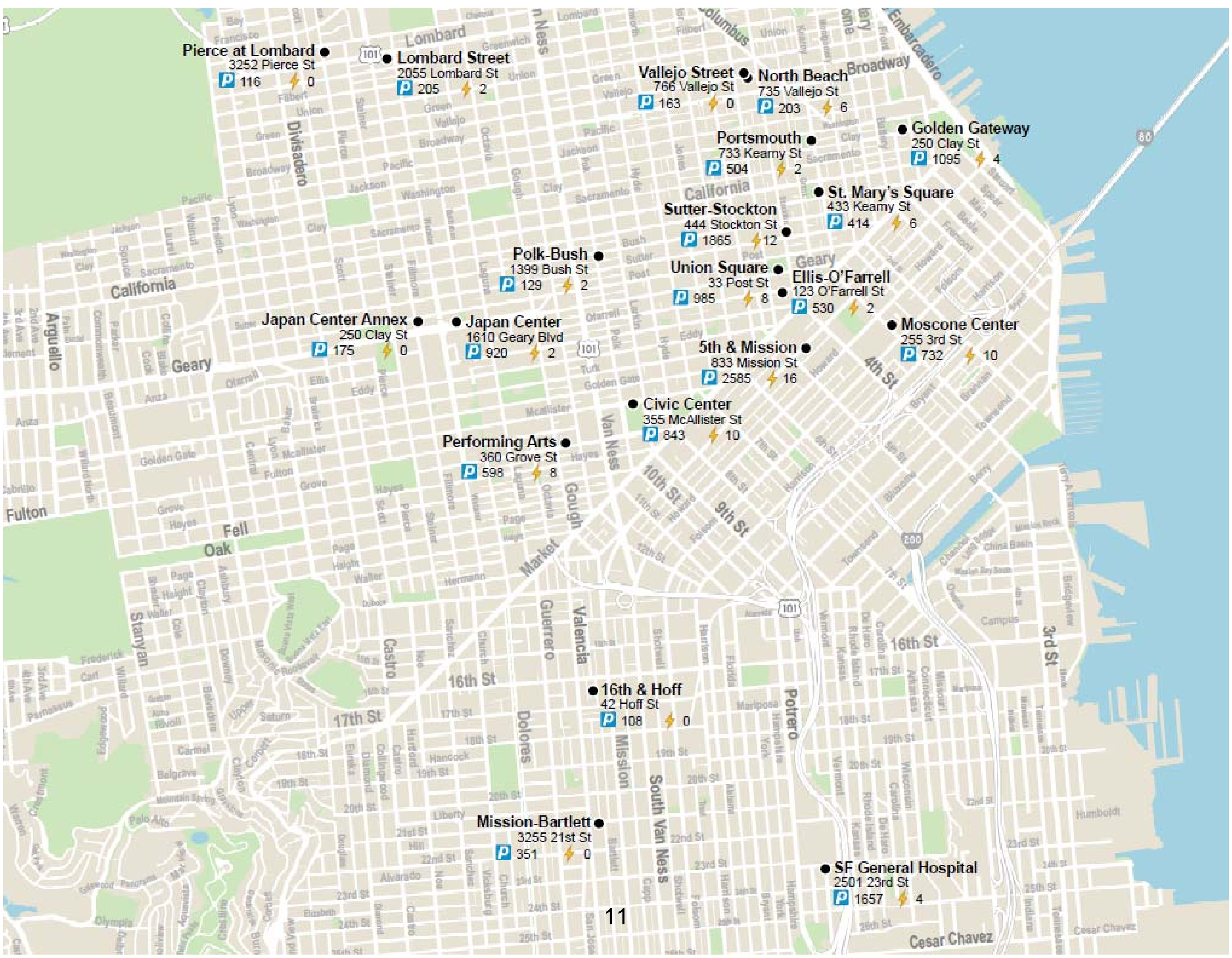
Current proposals from the private sector to add charging infrastructure in SFMTA garages typically are accepted through an intake form on the SFMTA website. Many private sector proposals are restricted access, including those by Tesla, GM Cruise, Scoot, and Jump. While restricted access charging infrastructure does contribute to emissions reductions and supports emerging mobility modes, these charging stations should likely be located out of the right-of-way in low-use garages, leaving high-use garages and charging stations open for public use.

At the same time, parking uses are declining and San Franciscans are switching from private vehicle use other forms of mobility. Parking garages, especially large ones like 5th & Mission garage, may be useful as fueling stations for both single-occupancy EVs and EV fleets operated by emerging mobility providers.

VII. Data Appendix

The spreadsheet attached contains data on each garage. See the table below for how to read the spreadsheet. A summary of data can be found on the next page.

Garage Profile	Contains priority score, name, and other necessary information on each garage.
Operational Constraints	Electric Capacity and Conflicts. Electric Capacity cells highlighted in yellow can support at least one L2 charger (20 kW max), and cells highlighted in blue can support at least one L3 charger (150 kW).
Primary Metrics	The ten metrics used to determine the Priority score. If a garage meets the determined threshold for each metric, then the cell is highlighted in green and a point is added to the Priority score.
Special Treatment: DC Fast Charging	Five metrics used to determine a garage's suitability for added DC Fast Charging stations. If a garage meets the determined threshold for each metric, then the cell is highlighted in blue.



Summary of Data

2017 data is used for all metrics, except for information retrieved from the 2016 5-year American Community Survey.

A Emissions Savings

For the fifteen garages offering EV charging, ChargePoint collects charge session data, including amount of charge provided. Each kilowatt-hour charged is equated to an emissions savings of 0.42 kg CO_2e. This assessment measures emissions savings per charging stall, such that each additional stall will increase emissions reductions at this rate (with decreasing returns).

Metric		
1. Emissions Savings per Charging Stall	Min	894 kg CO_2e
	Max	3,579 kg CO_2e
	Threshold (75th pctile)	≥ 2,699 kg CO_2e

B Charging Utilization

Occupancy data can be calculated from session start and end times, also provided by ChargePoint.

Metric		
2. Average Charging Stall Occupancy	Min	9.6%
	Max	44.4%
	Threshold (75th pctile)	≥ 29.6%
3. Peak Charging Stall Occupancy Portsmouth Square Garage sees very high peak occupancies at nearly 90%.	Min	28.1%
	Max	88.3%
	Threshold (75th pctile)	≥ 65.5%

C Parking and Auto Use

Twelve of twenty garages provide parking data. Auto ownership and auto use data is retrieved from 2016 5-year American Community Survey responses aggregated at the ZIP code level.

Metric		
4. Average Parking Volumes The largest garages see the highest parking volumes (where more drivers are likely to see available charging stalls).	Min	85 vehicles
	Max	818 vehicles
	Threshold (75th pctile)	≥ 353 vehicles
5. Auto Ownership Citywide auto ownership is 41.1%. Most garages are below this value.	Min	22.4%
	Max	55.0%
	Threshold (75th pctile)	≥ 44.5%
6. Auto Use by Workers Citywide auto use by workers is 42.2% All garages are below the citywide average.	Min	16.8%
	Max	41.0%
	Threshold (75th pctile)	≥ 34.4%

D Transit and Sustainable Mode Share

Mode share data is also collected at the ZIP code level from the 2016 5-year American Community Survey. AllTransit scores are provided by CNT based on garage addresses.

7. Transit Use by Workers
Citywide, 33.6% of workers age 16 and older took transit. All garages are above the citywide average.

Min	43.4%
Max	73.4%
Threshold (25th pctile)	≤ 55.4%

8. AllTransit Score
Eleven garages have a perfect score of 10.

Min	9.5
Max	10.0
Threshold	≤ 9.7

E Congestion

The San Francisco County Transportation Authority (SFCTA) has several measures of congestion throughout the city's road networks, including overall traffic speed and transit speed. The most applicable impact to congestion is traffic speed, as EVs are single occupancy vehicles. Transit speed can be affected by other factors such as stop distance or bus-only lanes.

Average speed for each garage is calculated by taking the average rush hour speed of all road segments within a 500-foot buffer.

9. Average Speed During Rush Hour

Min	8.1 mph
Max	32.1 mph
Threshold (75th pctile)	≥ 14.5 mph

F Safety

As part of Vision Zero, SFMTA and the Department of Public Health (DPH) identifies the High Injury Network: a set streets and intersections where a disproportionate number of collisions occur.

10. Distance from Vision Zero High Injury Network
Only one garage, Golden Gate Garage, is more than 500 feet from any street on the Vision Zero High Injury Network.

Section	Metric	Threshold										
Garage Profile	Off-Street Parking ID		916	930	931	932	933	934	935	936	938	939
	Priority score		**4**	**1**	**0**	**0**	**2**	**3**	**8**	**5**	**4**	**1**
	Garage name		**Pierce Street**	**16th & Hoff**	**Civic Center**	**Ellis-O'Farrell**	**5th & Mission**	**Golden Gateway**	**Japan Center**	**Japan Center Annex**	**Lombard Street**	**Mission-Bartlett**
	Charging Stalls		NA	NA	10	2	16	4	2	NA	2	NA
	Parking spaces		116	108	843	530	2585	1095	920	175	205	351
Operational Constraints	Available electric capacity	L2: 6-20 kW L3: 50-150 kW		0.85	210.43	34.82	32.03	42.39	73.28	261.79	12.49	10.16
	Conflicts				On-street EV charging pilot near this site.		Voltage Type Primary: more able to increase Electric Capacity. Private sector proposals for EV charging. Tesla, Cruise, 40 spc each.					
Primary Metrics: A Emissions Savings	Emissions savings per charging stall	≥ 2,699 CO2e	NA	NA	1305	2053	2482	2846	3363	NA	1795	NA
B Charging Utilization	Charging occupancy (avg)	≥ 29.6%	NA	NA	0.144	0.203	0.310	0.281	0.365	NA	0.187	NA
	Charging occupancy (peak)	≥ 65.5%	NA	NA	0.530	0.559	0.524	0.594	0.762	NA	0.434	NA
C Parking and Auto Use	Parking occupancy (avg)	≥ 353			341	151	818	260	386		85	
	Auto ownership (households)	≥ 44.5%	0.550	0.441	0.240	0.240	0.357	0.534	0.457	0.457	0.550	0.441
	Auto use (workers)	≥ 34.4%	0.410	0.344	0.194	0.194	0.242	0.329	0.379	0.379	0.410	0.344
D Transit and Mode Share	Transit use (workers)	≤ 55.4%	0.434	0.554	0.731	0.731	0.674	0.574	0.501	0.501	0.434	0.554
	AllTransit Score	≤ 9.7	9.5	9.9	10	10	10	10	9.9	9.7	9.7	9.9
E Congestion	Vehicle speeds during rush hour	≥ 14.5 mph	14.4	10.3	8.2	8.1	9.9	9.5	18.3	14.7	14.4	11.4
F Safety	Less than 500 ft from HIN	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Special Treatment: DC Fast Charging	Activity Type (Zoning)	Commercial	Commercial	Commercial	Special	Commercial/ Retail	Commercial	Commercial/ Office	Commercial	Commercial	Commercial	Commercial
	Activity Intensity	≥ 3	2	3	4	3	3	3	3	3	2	3
	Charging duration (avg)	≤ 3.6 hrs	NA	NA	3.9	3.1	4.6	4.7	3.4	NA	3.6	NA
	% of Charging Sessions < 2 hrs	≥ 2.2%	NA	NA	0.010	0.021	0.020	0.011	0.046	NA	0.020	NA
	Parking duration (avg)	≤ 3.3 hrs			4.5	3.1	3.5	6.7	3.3		4.8	

Section	Metric	Threshold	941	942	943	944	945	946	948	949	950	951
Garage Profile	Off-Street Parking ID		941	942	943	944	945	946	948	949	950	951
	Priority score		**0**	**1**	**1**	**0**	**3**	**7**	**0**	**1**	**1**	**1**
	Garage name		**Moscone Center**	**North Beach**	**Performing Arts**	**Polk-Bush**	**Portsmouth Square**	**SF General Hospital**	**St. Mary's Square**	**Sutter-Stockton**	**Union Square**	**Vallejo Street**
	Charging Stalls		10	6	8	2	2	4	6	12	8	NA
	Parking spaces		732	203	598	129	504	1657	414	1865	985	163
Operational Constraints	Available electric capacity	L2: 6-20 kW L3: 50-150 kW	31.90	12.83	52.58	28.93	33.72	16.02	17.00	35.05	341.61	5.51
	Conflicts		RFP for closure and redevelop-ment.							Private sector proposals for EV charging. Cruise, 40 spc		
Primary Metrics: A Emissions Savings	Emissions savings per charging stall	≥ 2,699 CO2e	1016	894	2031	1527	3579	3059	2350	2553	2274	NA
B Charging Utilization	Charging occupancy (avg)	≥ 29.6%	0.124	0.096	0.281	0.214	0.376	0.444	0.236	0.279	0.199	NA
	Charging occupancy (peak)	≥ 65.5%	0.548	0.281	0.734	0.547	0.883	0.717	0.562	0.497	0.465	NA
C Parking and Auto Use	Parking occupancy (avg)	≥ 353	186	119	213			(assumed)	102	569	327	
	Auto ownership (households)	≥ 44.5%	0.357	0.367	0.240	0.361	0.224	0.441	0.224	0.224	0.224	0.367
	Auto use (workers)	≥ 34.4%	0.242	0.253	0.194	0.236	0.168	0.344	0.168	0.168	0.168	0.253
D Transit and Mode Share	Transit use (workers)	≤ 55.4%	0.674	0.644	0.731	0.652	0.734	0.554	0.734	0.734	0.734	0.644
	AllTransit Score	≤ 9.7	10	10	10	9.9	10	9.5	10	10	10	9.9
E Congestion	Vehicle speeds during rush hour	≥ 14.5 mph	9.9	14.9	9.3	9.6	9.2	32.1	8.8	9.1	9.1	14.9
F Safety	Less than 500 ft from HIN	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Special Treatment: DC Fast Charging	Activity Type (Zoning)	Commercial	Commercial/ Office	Commercial	Commercial	Commercial	Commercial/ Office	Special	Commercial/ Office	Commercial/ Retail	Commercial/ Retail	Commercial
	Activity Intensity	≥ 3	3	2	3	4	3	2	3	3	3	2
	Charging duration (avg)	≤ 3.6 hrs	5.4	3.8	4.8	4.8	3.5	4.9	5.0	4.5	3.5	NA
	% of Charging Sessions < 2 hrs	≥ 2.2%	0.005	0.012	0.010	0.013	0.035	0.016	0.010	0.023	0.025	NA
	Parking duration (avg)	≤ 3.3 hrs	5.4	4.2	5.4				5.5	3.3	2.8	