FEHR PEERS

February 2022

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Subject: Golden Gate Park Traffic Study Technical Documentation

During the pandemic, selected roadways in Golden Gate Park were closed to private vehicles and opened to people walking, biking, and traveling using other non-motorized modes. All transit routes were maintained. The Golden Gate Park Traffic Study helps community members and decision makers understand how travel patterns and travel times have changed from Fall 2019 (pre-pandemic) to Fall 2021 (most recent data available to represent "current" conditions) for park neighbors who previously drove on the closed Golden Gate Park roadways, the travel time during differing road operation days in Golden Gate Park in 2019, as well as how selected roadway reopening to private vehicles would affect transit travel times on the 44 O'Shaughnessy.

In particular, the study assesses:

- Primary origin and destination zones for vehicle travel through Golden Gate Park via 8th Avenue or John F Kennedy Drive under pre-pandemic conditions (Fall 2019).
- Vehicle travel time changes between key origin-destination pairs from pre-pandemic (Fall 2019) to current (Fall 2021) conditions.
- Vehicle volume changes on key roadways from pre-pandemic (Fall 2019) to current (Fall 2021) conditions.
- Roadway capacities of Fulton Street and Lincoln Way, the two primary arterials that provide parallel access to JFK Drive through Golden Gate Park.
- Comparison of vehicle travel times in Winter 2019 of selected neighborhoods trips on Saturdays, when JFK was open to car traffic, versus Sundays, when JFK was closed to car traffic.
- The estimated effect on 44 O'Shaughnessy travel times of the potential reopening to vehicle traffic of a north-south route through the park via 8th Avenue, John F Kennedy Drive, Music Concourse Drive, and Hagiwara Tea Garden Drive.

This technical documentation is intended to complement the presentation 'Golden Gate Park Traffic Study, February 2022.

Contents

Results

The study began with an origin-destination analysis to understand which vehicle trips previously used Golden Gate Park roadways[1], and therefore were most affected by the COVID-19 temporary vehicle closures. Pre-closure travel times for the most affected trips from Fall 2019 were compared to Fall 2021 travel times for those trips to determine the change.

An origin-destination analysis looks at all daily travel between an origin – where a trip begins – and a destination – where a trip ends. The path taken between the origin and the destination is the route.

The analysis used 17 origin/destination zones by grouping all trips that started or ended within each of the 17 San Francisco Planning Districts, which is a designation used by the San Francisco Planning Department,[2] as well as three screenlines to capture trips entering San Francisco from the north, south, and east. The relevant trips for this study travelled from one origin/destination zone to another by taking a route that passed through one of two screenlines: (1) 8th Avenue between Fulton Street and John F Kennedy Drive; and (2) John F Kennedy Drive east of Nancy Pelosi Drive (see **Figure 2**, below). The origin-destination analysis captures all daily trips made midweek (Tuesday-Thursday) in Fall 2019 (September-October) and Fall 2021 (September-October).

North-South Travel via 8th Avenue

The first study location at 8th Avenue between Fulton Street and John F Kennedy Drive ("8th Avenue screenline") captures north-south vehicle trips through the park pre-pandemic before the road was closed to cars. On a typical weekday in Fall 2019, approximately 12,500 daily vehicles crossed this screenline. While the vehicle trips that passed through this screenline started in each of the 17 origin/destination zones, as well as north, south, and east of San Francisco, a significant number of trips started from only a few specific zones. The largest proportion of vehicle trips started in the Richmond (29% or 3,600 trips). The next largest started in Golden Gate Park (11% or 1,300), and the third largest started in the Inner Sunset (9% or 1,100). Each of the other zones served as the origin for 5% or less of the vehicle trips that passed through this screenline.

Of the 3,600 daily vehicle trips from the Richmond that passed through the 8th Avenue screenline, more than half (1,900) originated in the subarea between Arguello Boulevard and Park Presidio Boulevard ('Subarea 3'), and nearly one quarter originated in the subarea between Park Presidio Boulevard and 25th Avenue ('Subarea 2'). Of the 1,100 daily vehicle trips from the Inner Sunset that traveled through the 8th Avenue screenline, over three quarters (800) originated in the subarea north of Noriega Street ('North Inner Sunset').

For the north-south cross-park trips that used 8th Avenue pre-pandemic to travel between these key Richmond and Inner Sunset subareas, median travel times during the evening peak period of 3 PM to 6 PM decreased for three of the four pairs between 2019 and 2021: Subarea 2 to North Inner Sunset (- 3

[1] This study includes driving trips only; the data exclude trips made by walking or bicycling to the best of the ability of the data provider.

[2] https://data.sfgov.org/Geographic-Locations-and-Boundaries/Planning-Districts/ttns-6zj3

minutes); North Inner Sunset to Subarea 3 (-4.5 minutes); and North Inner Sunset to Subarea 2 (-0.5 minutes). Median travel times increased from 2019 to 2021 for one trip pair, between Subarea 3 to North Inner Sunset (+1.5 minutes). The travel time analysis focused on the evening peak period from 3 PM to 6 PM to capture evening commute and school travel.

East-West Travel via John F Kennedy Drive

The second study location at John F Kennedy Drive east of Nancy Pelosi Drive captures east-west vehicle trips through the park pre-pandemic before the road was closed to cars. On a typical weekday in Fall 2019, approximately 8,700 vehicles crossed this screenline.[3] While the vehicle trips that passed through this screenline started and ended in each of the 17 origin/destination zones, as well as north, south, and east of San Francisco, the highest proportion of daily trips had an origin or destination in the Richmond. The Richmond is the origin or destination for seven of the top ten origin-destination pairs for pre-pandemic vehicle trips on John F Kennedy Drive east of Nancy Pelosi. Other origin-destination pairs in the top ten include Western Addition to Golden Gate Park; Western Addition to Outer Sunset; and Golden Gate Park to Buena Vista.

For the top ten origin-destination pairs of pre-pandemic vehicle trips on John F Kennedy Drive east of Nancy Pelosi Drive, median travel times during the evening peak period from 2019 and 2021 decreased for nine of the ten pairs. The only exception was the Richmond to South of Market, where median travel times increased by 1% or 30 seconds.

Traffic Volume Changes on Key Roadways

The median travel time changes during the evening peak period between key north-south and east-west origin-destination pairs corresponded with lower vehicle volumes on key roadways within and adjacent to Golden Gate Park between Fall 2019 and Fall 2021. For example, Fulton Street saw a 17% reduction in vehicle traffic over that time (4,500 fewer vehicles per weekday), Crossover Drive saw a 17% reduction (13,300 fewer vehicles per weekday), Lincoln Way saw a 16% reduction (6,900 fewer vehicles per weekday), and Stanyan Street saw an 8% reduction (2,200 fewer vehicles per weekday). While traffic volumes at some intersection approaches may have increased during the peak travel periods, this study found that overall traffic volumes generally were lower in Fall 2021 compared to Fall 2019. These findings are consistent with the results from a comparison of traditional single-day peak hour intersection traffic counts in Fall 2019 and Fall 2021 at available locations in the study area.

Adjacent Arterial Roadway Capacity

The two primary arterial roadways parallel to JFK Drive, Fulton Street and Lincoln Way, would be able to accommodate a return to pre-pandemic traffic levels, based on a sensitivity test finding that these arterials would not operate over capacity under this scenario. Further, Fulton Street and Lincoln Way have

[3] The Richmond-Sunset Circulation Study from summer 2021 identified approximately 13,000 vehicle trips on JFK Drive on a typical weekday in Fall 2019. The different volumes are a result of different screenline placement – the screenline used for that analysis was JFK Drive just west of Nancy Pelosi Drive, thereby capturing north-south trips via 8th Avenue/ Music Concourse Drive/Hagiwara Tea Garden Drive as well as the east-west trips captured in this analysis.

adequate capacity to accommodate traffic increases beyond pre-pandemic traffic levels that may or may not occur in the future, depending on commute patterns, return to the office timelines, and the way that people travel (e.g., by single-occupancy vehicle versus transit, bike, or walk),

Travel Time Changes on 2019 Weekend Days with Different Road Operations

The study also analyzed trips made in the pre-Covid condition. Pre-pandemic road operations offered a real-world experiment: during winter 2019 (January 1, 2019 to March 31, 2019), JFK Drive was fully open to vehicles on Saturdays and fully restricted to vehicles on Sundays. Comparing the average trip travel times there was no measurable impact to travel times with JFK Drive removed from the network. Generally, travel times were similar on Saturdays, when JFK Drive was open, and Sundays, when it was closed. An average vehicle trip from the Panhandle to the Outer Richmond on Saturdays took 15 minutes and 1 second compared to 16 minutes and 13 seconds on Sundays.

8th Avenue Alternative and Transit Travel Time

If 8th Avenue, John F Kennedy Drive, Music Concourse Drive, and Hagiwara Tea Garden Drive were reopened to north-south vehicle trips, and pre-pandemic demand for north-south vehicle travel through Golden Gate Park returned and were concentrated on these reopened roadways, the increased vehicle volumes on these roadways would increase PM peak hour travel times for the 44 O'Shaughnessy by nearly 50 percent in the southbound direction through Golden Gate Park, from approximately five minutes to seven minutes and 20 seconds. While this increased delay would not represent a significant impact according to the City of San Francisco CEQA thresholds, as it would not exceed the four-minute threshold for the 44 O'Shaughnessy, this additional travel time would negatively impact 44 O'Shaughnessy riders by increasing travel times. Further, the fluctuations in traffic demand over the course of the day could worsen SFMTA's ability to provide reliable service and maintain consistent headways.

Data Sources and Analysis Types

The analysis for this study was conducted using location-based service (LBS) data from smartphone applications for which the user has allowed location access. These data are anonymized and aggregated to protect the privacy of application users and assure the greatest sample size for generating metrics.

Anonymized smartphone data offer multiple advantages for a study of this type.

- **Scale:** Anonymized smartphone data enable traffic metric estimation at broader spatial and temporal scales than conventional data collection methods. Anonymized smartphone data enables analysis of dozens of road segments and neighborhoods in a way that would be infeasible and prohibitively expensive if attempted using traditional count data captured at individual locations at specific times. Rather than reporting one or two days of data, the data are averaged over multiple months to reduce the inconsistency caused by day-to-day variation in traffic patterns.
- **Historic data:** Anonymized smartphone data are available for both current and historic conditions. Relying on observed data from before COVID-19 would mean restricting the analysis to counts that happened to be collected in the months or years before the pandemic. These data would not be optimal for the needs of this study and would limit its findings. Instead, this dataset allows for the collection of pre-COVID-19 data comparable to current metrics and provides flexibility to run new analyses based on the changing needs of the project.

Analysis Types

Anonymized smartphone data analyses are centered around geographic areas called "zones", which could be road segments or larger areas like neighborhoods. Zones can either capture vehicle trips crossing through them or vehicle trips that begin or end within them.

The analyses used in this study are described below.

- Zone Activity Analysis provides estimates of the volume of vehicles passing through the zone or estimates of vehicle trips beginning or ending in the zone.
- Origin-Destination Analysis calculates the volume of vehicles traveling between defined geographic zones or road segment screenlines. It also generates travel time and speed metrics for the trips.
- Origin-Destination through Screenline Analysis is similar to an origin-destination analysis, with the addition of one or more intermediate zones to capture all vehicles that used a particular route for their trip between the origin and destination.
- Route Analysis expands on the origin-destination analysis to identify the routes on which vehicles traveled between the origin and destination zones or screenlines.

Analysis Parameters

Anonymized smartphone data can be accessed under various parameters, including date ranges, day types (e.g., weekday vs weekend), and time periods (e.g., daily, PM peak period).

This study used the following parameters:

- Date Ranges
  - Winter 2019
  - Fall 2019: 9/3 – 10/31
  - Fall 2021: 9/1 – 10/28 (excluding 9/4-6, Labor Day weekend)
- Day Types
  - Weekdays: Tuesday through Thursday
  - Weekends: Weekend analysis was not conducted for this study
- Time Periods
  - Daily, if not indicated otherwise
  - PM peak period (3-6 PM) for travel time analysis

Analysis Zones

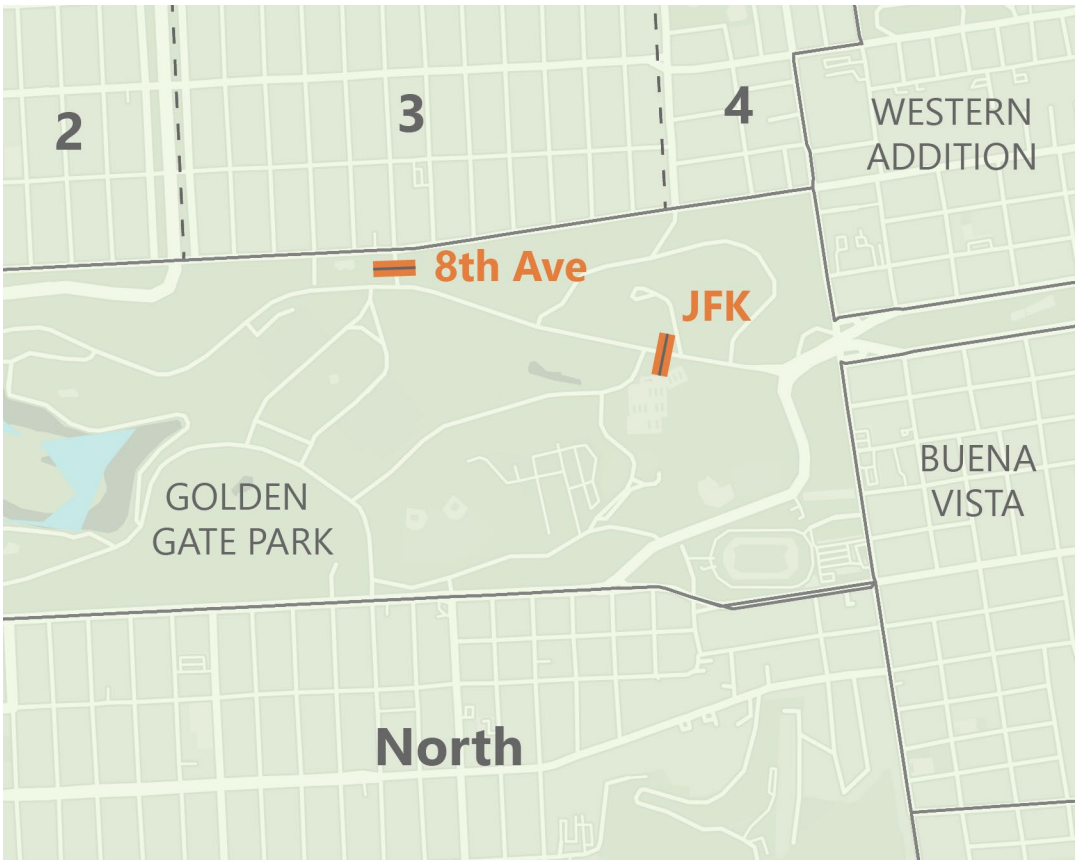
Most analyses in this study used a standard set of geographic zones based on San Francisco's Planning District geographies[4], with the addition of three screenlines to capture traffic entering the city from the north (Golden Gate Bridge), east (Bay Bridge), and south (San Mateo County). In addition, the Richmond and Inner Sunset Planning Districts were further subdivided to produce a more refined analysis for these key neighborhoods. The Richmond was divided into four subareas labeled Subarea 1 through Subarea 4 and the Inner Sunset was divided into two subareas, North and South. This set of geographic zones will henceforth be referred to as the "standard zone set". The standard zone set, including the subdivided Richmond and Inner Sunset, are shown in **Figure 1**. The 2019 weekend comparison analysis used San Francisco census tracts.

The metrics for 8th Avenue are based on a screenline on 8th Avenue between Fulton Street and John F Kennedy Drive ('JFK Drive'). The metrics for JFK Drive are based on a screenline on JFK Drive just east of Nancy Pelosi Drive. These screenlines are shown in **Figure 2**.

[4] https://data.sfgov.org/Geographic-Locations-and-Boundaries/Planning-Districts/ttns-6zj3

Figure 1: Standard Zone Set for Analysis

Figure 2: Study Screenlines across 8th Avenue and John F Kennedy Drive



Calibration

Vehicle volumes in anonymized smartphone data are estimated based on the density and behavior of devices with location-based services turned on. While the data provider uses a proprietary algorithm and count data samples to minimize error, the vehicle volume reported may differ from the actual vehicle volumes present on a roadway, especially in dense, urban areas with heavy transit and bicycle activity.

Consequently, an additional layer of calibration is necessary to assure that anonymized smartphone data outputs align with observed vehicle volume data in the area. A calibration factor is developed by comparing anonymized smartphone data to vehicle count data at the same locations and in the same general time period. The calibration factor is applied to all vehicle volumes reported by the data provider for that time period. It does not affect the relative volumes between zones.

The Fall 2021 calibration factor used for this study was developed based on count data collected in October 2021 by SFMTA at the following locations in the eastern portion of Golden Gate Park:

- Fulton Street between 4th Avenue and 5th Avenue
- Kezar Drive between Martin Luther King Jr Drive and Stanyan Street
- Lincoln Way between 8th Avenue and 9th Avenue

- Fulton Street and 8th Avenue
- Fulton Street and Arguello Boulevard
- Fulton Street and Stanyan Street
- Stanyan Street and John F Kennedy Drive/Kezar Drive
- Lincoln Way and 9th Avenue
- Lincoln Way and 19th Avenue
- Martin Luther King Jr Drive and Nancy Pelosi Drive

The Fall 2019 calibration factor used for this study was developed for the Richmond-Sunset Circulation Study in summer 2021 using historical count data collected in 2018 and 2019 at the following representative locations in the western portion of San Francisco:

- Geary Boulevard between 6th Avenue and 7th Avenue
- John F Kennedy Drive between Kezar Drive and Stanyan Street
- Stanyan Street between Oak Street and Page Street
- 41st Avenue between Lincoln Way and Irving Street
- Lincoln Way between 7th Avenue and 8th Avenue
- 20th Avenue between Judah Street and Kirkham Street
- Kirkham Street between 20th Avenue and 19th Avenue
- Upper Great Highway between Vicente Street and Sloat Boulevard
- Sloat Boulevard between Upper Great Highway and Lower Great Highway
- Skyline Boulevard between Sloat Boulevard and Lake Merced Boulevard

Methodologies

Pre-COVID Vehicle Travel Patterns

The study analyzed the origins and destinations of vehicle trips on 8th Avenue and JFK Drive prior to the COVID-19 pandemic. The methodology described below uses 8th Avenue as an example, and the same methodology was used for the JFK Drive analysis as well.

Zones and Analyses

The vehicle travel patterns analysis used the standard zone set, including all San Francisco Planning Districts, regional screenlines, and Richmond and Inner Sunset subareas, based on the time periods established in the Analysis Parameters section above.

Analysis elements included:

- An origin-destination analysis among all zones in the standard zone set, providing the vehicle volumes traveling among all zones in Fall 2019, and
- An origin-destination through screenline analysis among all zones in the standard zone set, restricted to vehicle trips that passed through the 8th Avenue screenline in Fall 2019

The analyses included all-day vehicle volume data for an average weekday.

Travel Pattern Calculation

From the analyses, the following metrics were derived:

- Percentage of total origin-destination volume for a given zone pair using 8th Avenue, and
- Absolute volume and percentage of total volume on 8th Avenue represented by each origin-destination pair

The first metric indicates the dependency of a given travel pattern on 8th Avenue; for example, 46% of trips from Richmond Subarea 3 to the North Inner Sunset used 8th Avenue in Fall 2019. The second metric highlights the origin-destination pairs contributing the most vehicle trips to 8th Avenue; for example, trips from Richmond Subarea 3 to the North Inner Sunset represented 2.8% of total vehicle volume on 8th Avenue in Fall 2019.

For full results from this analysis, see **Appendix A** and **Appendix B.**

Change in Vehicle Travel Times, 2019 v 2021

The study also analyzed the change in vehicle travel times between key origin-destination zones between Fall 2019 and Fall 2021 using an origin-destination analysis and travel time metrics. The results of the vehicle travel pattern analysis above were used to identify the key origin-destination pairs that used 8th Avenue and JFK Drive in Fall 2019, which were the focus of study for vehicle travel time changes.

The methodology described below uses 8th Avenue as an example, and the same methodology was used for the JFK Drive analysis as well.

Zones and Analyses

The vehicle travel times analysis used the standard zone set, including all San Francisco Planning Districts, regional screenlines, and Richmond and Inner Sunset subareas, based on the time periods established in the Analysis Parameters section above.

Analysis elements included:

- An origin-destination analysis among all zones in the standard zone set, providing travel time metrics for vehicles traveling among all zones in Fall 2019, and
- An origin-destination analysis among all zones in the standard zone set, providing travel time metrics for vehicles traveling among all zones in Fall 2021

The analyses included PM peak period data, defined as 3-6 PM on an average weekday.

Travel Time Calculation

Travel time metrics were generated using travel time "bins", or intervals, of one minute, up to 49 minutes. The data provider reports the number of trips whose travel time fell within each travel time bin. The binned data were processed in a Python script using a package called wquantiles[5], which allows the

[5] https://pypi.org/project/wquantiles/

calculation of a weighted median for a set of data; the weights used were the number of trips in each bin. From these weighted median travel times for each origin-destination pair, the absolute difference and percentage difference in travel time between Fall 2019 and Fall 2021 were calculated.

The travel time metrics reflect all travel within and into San Francisco, not specifically travel that used 8th Avenue or JFK Drive. Therefore, interpretation of the travel time metrics focused on the specific origin-destination pairs identified as most affected by the 8th Avenue and JFK Drive closures, including the pairs that contributed the highest vehicle volume to 8th Avenue and JFK Drive prior to the closure and the pairs that were most dependent on the routes.

For full results from this analysis, see **Appendix A** and **Appendix B.**

Corridor Volumes

The corridor volumes analysis determined the change in vehicle volumes along key corridors throughout Golden Gate Park and the west side of San Francisco between Fall 2019 and Fall 2021. The corridors used were the same as presented for the Richmond-Sunset Circulation Study in summer 2021; this zone set included 98 major road segments around Golden Gate Park, such as Fulton, Stanyan, Lincoln, Fell, Oak, Crossover, Chain of Lakes, Irving, 19th Avenue, Sunset, and Great Highway.

Analysis elements included:

- An activity analysis for all roadway segments on a key corridor, providing vehicle volumes by segment in Fall 2019, and
- An activity analysis for all roadway segments on a key corridor, providing vehicle volumes by segment in Fall 2021

The analyses included all-day data for an average weekday.

Data for the two analyses were calibrated and used to determine the change in volume between 2019 and 2021, both as an absolute change and as a percentage of 2019 volume.

Three datasets - Fall 2019, Fall 2021, and change between them - were visualized on a map of San Francisco using thicker lines to represent larger volumes. As presented in the maps in **Appendix C**, average daily traffic volumes have decreased between Fall 2019 and Fall 2021 on all major roadways surrounding Golden Gate Park.

Single Day Traffic Count Comparison

Table 1 presents locations where traffic counts were available for comparison between the pre-pandemic and Fall 2021 periods. These results are presented to provide additional context to the above corridor-level findings. These counts are primarily PM peak hour counts and represent a single day of counts compared to the months of anonymized smartphone data used for the corridor volumes, and therefore the change in volumes at some intersections may differ compared to the corridor volume comparisons. These intersection counts illustrate how at certain periods of the day, traffic volumes at some legs of the day may be higher in Fall 2021. This may lead to a perception by some drivers that overall traffic

congestion around Golden Gate Park is worse, due to the worsening of traffic conditions at one leg of an intersection during the busiest time for travel. However, the overall trends are similar to the daily corridor volumes in that total PM peak hour intersection traffic volumes were similar to or went down between pre-pandemic and Fall 2021 conditions. The detailed traffic counts are presented in **Appendix D**.

Table 1: Pre- and Post-Pandemic Traffic Count Comparisons

	Scenario	Northbound	Southbound	Eastbound	Westbound	Total
PM Peak Hour Intersection Counts						
8th Avenue / Fulton Street[1]	Pre-COVID	-	-	1,070	1,122	2,192
	Fall 2021	-	-	1,008	1,099	2,107
	% Change	-	-	**-6%**	**-2%**	**-4%**
9th Avenue / Lincoln Way	Pre-COVID	305	419	1,064	1,795	3,583
	Fall 2021	248	220	1,187	1,545	3,200
	% Change	**-19%**	**-47%**	**12%**	**-14%**	**-11%**
Stanyan / Fell / Oak / JFK	Pre-COVID	618	1,119	1,349	2,562	5,648
	Fall 2021	674	1,213	1,321	1,950	5,158
	% Change	**9%**	**8%**	**-2%**	**-24%**	**-9%**
Fulton / Stanyan	Pre-COVID	929	452	997	420	2,798
	Fall 2021	939	508	999	420	2,866
	% Change	**1%**	**12%**	**0%**	**0%**	**2%**
Daily Roadway Counts						
Kezar Drive from Lincoln Way to Oak Street[2]	Before	-	-	20,135	19,249	39,384
	After	-	-	15,950	17,589	33,538
	% Change	-	-	**-21%**	**-9%**	**-15%**

Notes:
1. Northbound and southbound were not compared because 8th Avenue south of Fulton Avenue was closed in 2021.
2. Represents daily roadway counts, so no northbound and southbound travel.

Source: SFMTA and Fehr & Peers, 2022.

Adjacent Arterial Roadway Capacity

Whether traffic volumes return to pre-pandemic levels in the future depends on commute and travel patterns returning to their pre-pandemic normal. Given the uncertainty associated with the future of commute patterns, return to the office timelines, and the way that people travel (e.g., by single-occupancy vehicle versus transit, bike, or walk), a sensitivity test was conducted to explore the potential capacity of the two primary arterial roadways parallel to JFK Drive, Fulton Street and Lincoln Way, to accommodate a return to pre-pandemic traffic levels.

Traffic engineers traditionally use the concept of level of service (LOS) to determine whether traffic volumes exceed the capacity of intersections or roadway segments. LOS A conditions represent underutilized roadways with free-flow traffic conditions while LOS E and F represent conditions at or above capacity where drivers must frequently wait through multiple traffic signal cycles. Arterial roadway capacities are the most constrained at signalized intersections. This sensitivity test uses the intersections of Fulton Street / 8th Avenue and Lincoln Way / 9th Avenue to represent constrained locations along each arterial where traffic volumes do not currently exceed the roadway capacities. As shown in **Appendix D**, Fulton Street and Lincoln Way currently operate under-capacity at LOS B or C conditions during the times of the day with the highest traffic volumes (AM and PM peak hours).

As presented in the maps in **Appendix C**, average daily traffic volumes have decreased by 16 to 17 percent between Fall 2019 and Fall 2021 on Fulton Street and Lincoln Way. During the PM peak hour, however, traffic volumes have decreased by only four to 11 percent (see **Table 1**), indicating that traffic conditions are closer to pre-pandemic levels during the busiest hours of the day and thus represent a worst-case condition for the sensitivity test. As shown in **Table 2**, Fulton Street and Lincoln Way could accommodate at least 40 percent more vehicles during the AM peak hour and at least 20 percent more vehicles during the PM peak hour compared to Fall 2021 conditions without exceeding the roadway's capacity. This level of traffic increase would substantially exceed the traffic volumes from pre-pandemic (Fall 2019) conditions, representing an additional 800 to 1,000 vehicles during the AM peak hour and 400 to 500 vehicles during the PM peak hour on each roadway. During most times of day, traffic volumes are lower and would need to increase by substantially more than 40 percent to reach the arterial roadway capacities.

This sensitivity test indicates that these arterials adjacent to Golden Gate Park would not operate over capacity even if traffic volumes returned to pre-pandemic levels. Further, Fulton Street and Lincoln Way have adequate capacity to accommodate additional traffic increases that may occur in the future.

Table 2: Arterial Roadway Sensitivity Test

	AM Peak Hour – 40% Increase over Fall 2021 (Delay / LOS)		PM Peak Hour – 20% Increase over Fall 2021 (Delay / LOS)	
Arterial Roadway	**Eastbound**	**Westbound**	**Eastbound**	**Westbound**
Fulton Street	63 / E	26 / C	25 / C	43 / D
Lincoln Way	62 / E	24 / C	23 / C	64 / E
Exceeds Capacity (e.g., LOS F)?	**No**	**No**	**No**	**No**

Notes: Approach delay shown for arterial roadways to represent roadway capacity (LOS F). The LOS E values indicate conditions where drivers must sometimes wait through multiple traffic signals before proceeding. The sensitivity test was conducted with increments of five percent increases to the Fall 2021 arterial roadway traffic volumes until an approach on either roadway reached LOS F conditions.
Source: Fehr & Peers, 2022.

Change in Vehicle Travel Times, 2019 Weekends

The study also analyzed the change in vehicle travel times between key origin-destination census tracts between Saturdays in Winter 2019 versus Sundays in Winter 2019 using origin-destination analysis and travel time metrics. The origin-destination pairs were randomly selected based on popular trips.

The vehicle travel times analysis used selected census tracts, on Saturdays from 10 am to 4 pm and Sundays from 10 am to 4 pm during Winter, defined as January 1, 2019 to March 31, 2019.

Transit Travel Times

The San Francisco Planning Department uses thresholds of significance and qualitative criteria to determine whether a project would substantially delay public transit in a manner consistent with California Environmental Quality Act (CEQA) requirements. For individual Muni routes, if a project would result in transit delay greater than or equal to four minutes, then it might result in a significant impact.[6] This study evaluates the potential for additional north-south vehicle traffic on 8th Avenue, JFK Drive, Music Concourse Drive, and Hagiwara Tea Garden Drive to increase delay to the 44 O'Shaughnessy Muni route, which travels between the Richmond District and the Bayview via this route. The analysis included:

- Number of vehicles that travelled north-south across Golden Gate Park when 8th Avenue was open under pre-COVID conditions
- Delay currently experienced by buses while traveling through the park
- Estimated delay under the potential scenario where 8th Avenue, JFK Drive, Music Concourse Drive, and Hagiwara Tea Garden Drive are reopened to north-south vehicular traffic, while JFK Drive east of 8th Avenue and west of Hagiwara Tea Garden Drive remains closed.

[6] The threshold uses the adopted Transit-First Policy, City Charter section 8A.103, percent on-time performance service standard for Muni. The charter considers transit vehicles arriving more than four minutes beyond a published schedule time as late.

The transit travel delay compares existing conditions and a condition where 8th Avenue is open to private vehicles (herein referred to as "Existing plus 8th Avenue Open" conditions). The methodology and results for developing the estimated cross-park volume and transit travel delay for these two scenarios are presented below.

Cross-Park Volume

In Fall 2019, turn restrictions limited vehicle access to the Music Concourse from 8th Avenue and JFK Drive, as the *Golden Gate Park Music Concourse – Surface Circulation Plan* specifically prohibits the use of the Music Concourse for cut-through automobile traffic. Under the future Existing plus 8th Avenue Open condition, these restrictions would remain. However, due to the high demand for north-south vehicle travel and the design challenges associated with allowing specific users while preventing general traffic as noted above, SFMTA staff are concerned that this will become a popular route for illegal cut-through traffic and be contrary to the policies and plans that support low vehicular use of Golden Gate Park, particularly the Music Concourse.

Therefore, this analysis assumes that all the vehicle trips traveling between 8th Avenue / Fulton Street and 9th Avenue / Lincoln Way in Fall 2019 would continue to do so under the Existing plus 8th Avenue Open condition. These vehicles were assigned to the route between 8th Avenue, JFK Drive, Music Concourse Drive, and Hagiwara Tea Garden Drive.

The vehicle volume demand between 8th Avenue / Fulton Street and 9th Avenue / Lincoln Way were determined through an analysis of anonymized smartphone data. Vehicle trips that passed through the 8th Avenue screenline and a 9th Avenue screenline just north of Lincoln Way were captured. This volume was calibrated based on nearby pre-COVID-19 traffic counts.

The analysis concluded that 250 to 500 vehicles would use the north-south 8th Avenue route to cut through Golden Gate Park during the peak hour if the managed access is not legible or self-enforcing to ordinary users. This is a 20 to 30 times increase in the number of vehicles crossing the car-free promenade along JFK Drive in Fall 2021. The analysis showed the highest vehicle demand in the southbound direction in the PM peak hour (approximately 340 additional vehicle trips), while northbound travel was relatively stable between the AM and PM peak hours (approximately 190 additional vehicle trips). Southbound AM demand was the lowest with approximately 70 additional vehicle trips. The additional cross-park vehicle trips are presented in **Appendix D**.

Delay Analysis

Existing transit travel times for the 44 O'Shaughnessy through Golden Gate Park range from 4.5 to 5.5 minutes, as shown in **Appendix D**. These travel times remained relatively stable between October 2019 and 2021. The largest changes occurred in the southbound direction, with up to 20 seconds of travel times savings during the busiest time of the day (2-4 PM and 4-7 PM). October 2021 travel times were more consistent throughout the day compared to October 2019 travel times, indicating that reliability and schedule adherence improved during this period. Northbound travel times changed by less than 10 seconds during all periods.

The transit travel delay analysis used Synchro/SimTraffic traffic operations software to estimate the delay experienced by transit vehicles at intersections along the 44 O'Shaughnessy route under existing and Existing plus 8th Avenue Open conditions. The study intersections included 8th Avenue / Fulton Street, 8th Avenue / JFK Drive / Music Concourse / Hagiwara Tea Garden, Martin Luther King Jr Drive / Nancy Pelosi Drive, and 9th Avenue / Lincoln Way. These intersections were selected to represent the potential bottlenecks for transit vehicles as they travel through Golden Gate Park between Lincoln Way and Fulton Street. The Existing plus 8th Avenue Open conditions analysis accounts for the introduction of the pre-COVID-19 vehicle demand presented above traveling through the study intersections. Due to increased congestion under Existing plus 8th Avenue Open conditions, the study intersections were modeled using the SimTraffic simulation tool to capture the effects of vehicle queues extending between adjacent study intersections. This tool also captures the effects of bicyclists and pedestrians traveling on JFK Drive and factors such as parking and buses stopping at bus stops.

Table 3 presents the results of the transit travel delay analysis for the 44 O'Shaughnessy. The largest increase in delay would occur in the southbound direction during the PM peak hour as this period experiences the highest vehicle demand. The additional vehicles would create or worsen vehicle queues on 8th Avenue, JFK Drive, MLK Drive, and 9th Avenue and add delay to the 44 O'Shaughnessy at each study intersection. The largest increase in delay would occur at southbound 9th Avenue at Lincoln Way during the PM peak hour, where additional vehicles would cause vehicle queues that occasionally reach the intersection of MLK Drive / Nancy Pelosi Drive and add approximately 100 seconds of delay between Lincoln Way and Nancy Pelosi Drive. Conflicts between people walking and biking on JFK Drive and the new vehicles turning left onto Music Concourse Drive also would cause vehicle queues on JFK Drive and extend back to 8th Avenue. This would add approximately 30 seconds of delay to the 44 O'Shaughnessy and increase potential hazards for people walking and biking on the remaining car-free portion of JFK Drive. The results of the Synchro/SimTraffic analysis at the study intersections are shown in **Appendix D**.

Table 3: 44 O'Shaughnessy Travel Delay Analysis

	AM Peak Hour		PM Peak Hour	
Scenario	**Southbound**	**Northbound**	**Southbound**	**Northbound**
Existing Delay	1:01	0:59	0:59	0:47
Existing plus 8th Avenue Open	1:10	1:26	3:21	1:25
Change in Delay	**+0:09**	**+0:27**	**+2:22**	**+0:38**

Source: Fehr & Peers, 2022.

The additional delay would increase travel times for the 44 O'Shaughnessy by nearly 50 percent through Golden Gate Park during PM peak hour in the southbound direction, from approximately five minutes to seven minutes and 20 seconds. While this increased delay would not represent a significant impact according to the City of San Francisco CEQA thresholds, as it would not exceed the four-minute threshold for the 44 O'Shaughnessy, this additional travel time would negatively impact 44 O'Shaughnessy riders by increasing travel times. Further, the fluctuations in traffic demand over the course of the day could worsen

SFMTA's ability to provide reliable service and maintain consistent headways. Other directions and periods would experience less added delay due to the lower vehicle demand volumes crossing Golden Gate Park.

Sincerely,

FEHR & PEERS

Attachments:

Appendix A through Appendix D