



Great Highway Concepts Evaluation Report



San Francisco
County Transportation
Authority

Final Report

Acknowledgements

The Great Highway Concepts Evaluation was conducted as part of the District 4 Mobility Study, which was funded through the San Francisco County Transportation Authority's (Transportation Authority) Neighborhood Transportation Improvement Program (NTIP) at the request of Commissioner Gordon Mar. The NTIP was established to fund community-based efforts in San Francisco neighborhoods, especially in underserved neighborhoods and areas with vulnerable populations (e.g., seniors, children, and/or people with disabilities). The NTIP is made possible with Proposition K local transportation sales tax funds.

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1. Introduction

In Summer 2020, Commissioner Gordon Mar requested that the Transportation Authority conduct an evaluation of the long-term future of the Upper Great Highway from Sloat Blvd to Lincoln Way. His request followed the Recreation and Park's conversion of the roadway to a promenade temporarily under the COVID-19 emergency order in April 2020.

This evaluation was initially conducted as part of the District 4 Mobility Study, and was later split out as a separate report at the request of Commissioner Mar. Transportation Authority staff collaborated with the San Francisco Municipal Transportation Agency (SFMTA) and the Recreation and Parks Department throughout the study.

1.1 | BACKGROUND

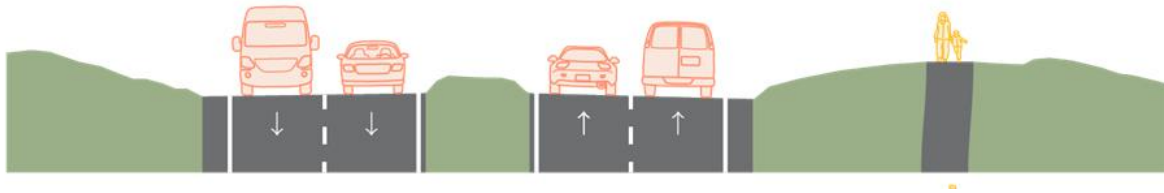
The Upper Great Highway is a four-lane roadway and coastal trail under the management of the Recreation and Park Department and maintained by Public Works. Traffic on the Great Highway and the surrounding street network and multimodal transportation system is managed by SFMTA. The San Francisco Public Utilities Commission has critical wastewater infrastructure under the Great Highway while the National Park Service manages Ocean Beach within the Golden Gate National Recreation Area. The California Coastal Commission has jurisdiction along the city's coastal zone. Finally, Caltrans manages Skyline Boulevard as State Route 35. Decisions about permanent changes to the configuration of the street rest with the Board of Supervisors.

The Upper Great Highway has long been impacted by sand build-up. Over the long term it is anticipated that climate change will exacerbate these challenges. Reducing the width of the Upper Great Highway is one of six key moves identified in the Ocean Beach Master Plan, an effort completed by SPUR in partnership with various City agencies and the Transportation Authority in 2012. The reduction of the roadway's vehicular function was recommended to provide space for the inland migration of sand dunes as sea level rise sets in – a strategy called “managed retreat”.

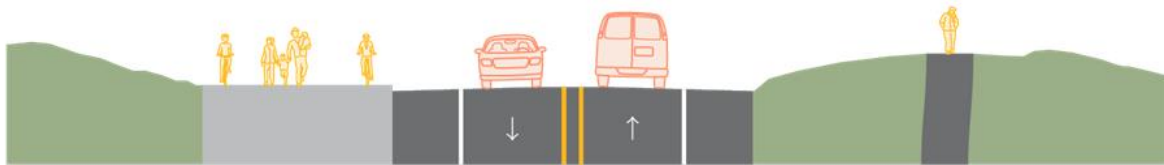
South of the study area for this evaluation report, the Great Highway Extension has been the primary connection between Skyline Blvd/Highway 35 and the Upper Great Highway. Due to erosion of the cliff and roadway, the Great Highway Extension is slated to close by 2023 as part of the San Francisco Public Utilities Commission (SFPUC) led South Ocean Beach Climate Change Adaptation Project. As of the publishing of this report, the SFPUC project is undergoing environmental review.

1.2 | CONCEPT DESCRIPTIONS

This evaluation is focused on the long-term future of the Upper Great Highway, after the Great Highway Extension is closed, and assuming ‘normal’ travel patterns in 2019, not pandemic-impacted travel patterns. We studied five concepts for the future of the Upper Great Highway.

Figure 1 Concept 1: Four-Lane Roadway

Under Concept 1, the Upper Great Highway would be maintained as a four-lane roadway with two vehicle lanes in each direction. Bicyclists are allowed on the roadway but must share the lanes with vehicles. No pedestrians are allowed on the roadway except to cross.

Figure 2 Concept 2: Promenade/Two-way Roadway

Concept 2 reduces the vehicle capacity of the Upper Great Highway to two lanes, one in each direction, and using the balance of the right of way for a promenade. This concept was originally introduced in the Ocean Beach Master Plan (2012). For the purposes of traffic safety, Concept 2 would require reconstructing the roadway and removing part of the median between the two sets of lanes to accommodate the following features:

- 12 ft. travel lanes in each direction
- 8 ft. shoulders to allow space for vehicles to pull over in emergencies
- A minimum 2 ft. median buffer between the travel lanes

Figure 3 Concept 3: Full Promenade/Complete Vehicle Closure

Concept 3 would close the Upper Great Highway completely to vehicle traffic. The roadway's four lanes would be open to people walking, running, biking and rolling.

Figure 4 Concept 4: Timed Promenade (Weekends)

Concept 4 would provide a full promenade on weekends. Other options considered included a seasonal closure or closure at certain times of day. A weekend closure was selected for this option because

bicycle/pedestrian usage data was not lower during winter months. Early analysis of user data indicating that the factors that most affected usage were the presence of smoke from wildfires, rain and wind. A peak period closure was not considered due to the significant additional cost and complexity of opening and closing the road multiple times of day, leading to confusion for people driving.

Figure 5 Concept 5: Promenade/One-way Roadway



In Concept 5, the promenade is located in the current southbound lanes. Two vehicle lanes in one direction would be provided in the current northbound lanes. Like Concept 2, this is a combination roadway/promenade concept but with the one-way traffic there is no need to reconstruct the roadway. Based on traffic patterns, the two vehicle lanes would carry southbound traffic.

1.3 | BASELINE ASSUMPTIONS ACROSS CONCEPTS

Several network improvements that are anticipated that were included consistently across all concepts.

In response to diverted traffic on local residential streets and at the request of Supervisor Mar, the SFMTA implemented a series of traffic calming measures over two phases, with Prop K sales tax funds from the Transportation Authority, among other sources. Phase 1 included four speed tables that were implemented in late 2020 as part of the Lower Great Highway Pedestrian Improvement Project. Phase 2 installed 12 stop signs, 24 speed cushions and a speed table along with placing six changeable message signs at strategic locations. Completed in April 2021, these measures help improve safety and divert traffic to higher capacity streets, such as Lincoln Way and Sunset Boulevard (Figure 6). SFMTA has been collecting data on volume and speed in various locations nearby to monitor the effectiveness of these installations. Findings from their data collection were not available at the time of this publication.

Figure 6 Outer Sunset Traffic Calming Measures



The study team assumed that the Great Highway Extension was closed in all five of the concepts, consistent with the proposed South Ocean Beach Climate Change Adaptation Project. This change is slated to begin implementation in 2023. Staff also assumed that planned improvements at the Sloat/Skyline and Skyline/Great Highway Extension intersection would be implemented consistent with the Adaptation Project and associated planning.

2. Evaluation of Concepts

To evaluate future Upper Great Highway concepts, staff considered factors related to several City policies and goals. These included:

- Climate change/Resiliency
- Recreation, health and well-being
- Transit First/Sustainable mode choices
- Vision Zero/Safety
- Economic Vitality/Mobility

Staff also estimated planning-level costs for each concept.

2.1 | CLIMATE CHANGE/RESILIENCY

The Ocean Beach Master Plan identified the need for managed retreat including closing the Great Highway Extension and reducing the width of the Great Highway over time. The Master Plan highlighted the threat of sea level rise and storm surge contributions to the erosion of the dunes thus exposing hard structures to the elements such the Upper and Lower Great Highway. Over more than a century, the beach has been moved more than 200 feet inland. Neighborhoods, roads, parks and municipal infrastructure have been built along the dunes and close to the coastline, and seawalls and other structures have been installed to protect them from strong, dynamic coastal forces.

As the coastline continues to recede, it will be harder to maintain the Great Highway as a roadway. As the Ocean Beach Master Plan identified, repurposing all or part of the roadway as a park can be part of a managed retreat strategy.

For each concept, we evaluated the Climate Change/Resiliency benefit based on the potential for add park acreage (Table 1).

Table 1 Additional Park Acreage

Concept 1: Four-lane Roadway	0 acres No roadway would be repurposed into additional park space.
Concept 2: Promenade/ Two-Way Roadway	6.7 acres About half in area size as Dolores Park.
Concept 3: Full Promenade/ Complete Vehicle Closure	17 acres Similar in area size as Dolores Park.
Concept 4: Timed Promenade (Weekends Only)	17 acres Similar in area size as Dolores Park but only accessible on weekends.
Concept 5: Promenade/ One-way Roadway	6.7 acres About half in area size as Dolores Park.

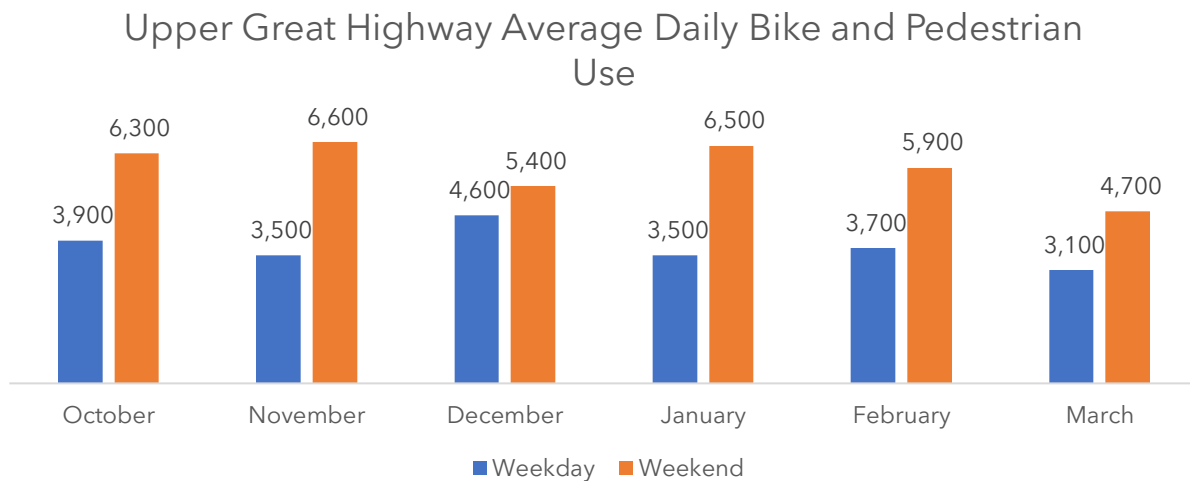
The project team estimates that the full promenade would provide about 17 acres of new park space, with the timed promenade providing that benefit only when in operation. For the combination concepts, staff estimates the additional acreage to be about 6.7 acres.

2.2 | RECREATION, HEALTH & WELL-BEING

The addition of park acreage can support City recreation, health and well-being goals. This is best illustrated by potential for bicycle and pedestrian usage. Regular cycling and walking can reduce individuals' mortality rates.¹ Staff considered data collected by the Recreation and Parks to estimate bicycle/pedestrian under future Great Highway concepts. In addition to being related to recreation, this evaluation factor is related to the City's Transit First policy to encourage the use of sustainable modes.

Future visitor rates are challenging to estimate because the temporary promenade has been in place entirely during the COVID-19 pandemic. To develop estimates, we considered the number of users on the promenade and at a similar facility.

Figure 7 Upper Great Highway Average Daily Bike and Pedestrian Use



From October 2020 to March 2021, the Upper Great Highway had on average 3,200 weekday bicycle and pedestrian users and 5,200 weekend day users (see Figure 7). This is about 26,400 weekly visitors.

By comparison, the Golden Gate Promenade which is the pathway next to the water at Crissy Field saw about 2,000 people on weekdays and 3,750 on weekends in September 2020, averaging about 17,500 weekly visitors.

Because we expect long-term weekday use to be lower than the usage observed during the pandemic with more people returning to office work, the project team assumed that low-end weekday usage may be more similar to Crissy Field usage at 2,000 people per weekday. For a low-end weekend day visitor number, the project team assumed this to be 4,700 or similar to the lowest weekend day monthly average observed in

¹ Kelly, Paul, et al. Systematic review and meta-analysis of reduction in all-cause mortality from walking and cycling and shape of dose response relationship (2014). <https://ijbnpa.biomedcentral.com/articles/10.1186/s12966-014-0132-x>

March 2021. For the higher end of the estimated range, we used the average weekday and weekend day usage from October 2020 to March 2021.

Given the above assumptions, the project team estimates the Full Promenade/Complete Vehicle Closure (Concept 3) to generate about 19,400 - 26,400 weekly visitors. For the Timed Promenade (Concept 4), the project team estimates of 4,700 – 5,200 visitors per weekend day, or about 9,400 – 10,400 weekly visitors for a weekend only closure.

For Concepts 2 and 5, the promenade/roadway combinations, we estimate lower usage due to reduced space for walking and biking, the need to cross two lanes of traffic to access the promenade, and the proximity of fast-moving traffic. No precise estimate is available for these two concepts, but we anticipate half or fewer of the users as in the full closure.

For the Four-lane Roadway (Concept 1), which provides the least amount of space dedicated for bicycles and pedestrians, we expect the fewest visitors, and no more visitors than used the Upper Great Highway before it was closed to vehicles.

Upper Great Highway Bicycle/Pedestrian Usage Estimates

Concept 1: Four-lane Roadway	Low Least pedestrian space and bicyclists share road with vehicles.
Concept 2: Promenade/ Two-Way Roadway	Medium Reduced bike/ped space, adjacent to traffic, crossing two lanes of traffic to access
Concept 3: Full Promenade/ Complete Vehicle Closure	High Most bike/ped space, no traffic on promenade. Estimated 19,400 - 26,400 weekly visitors
Concept 4: Timed Promenade (Weekends Only)	Medium Part-time space with no traffic on promenade. Estimated 9,400 – 10,400 weekly visitors
Concept 5: Promenade/ One-way Roadway	Medium Reduced bike/ped space, adjacent to traffic, crossing two lanes of traffic to access

2.3 | VISION ZERO/SAFETY

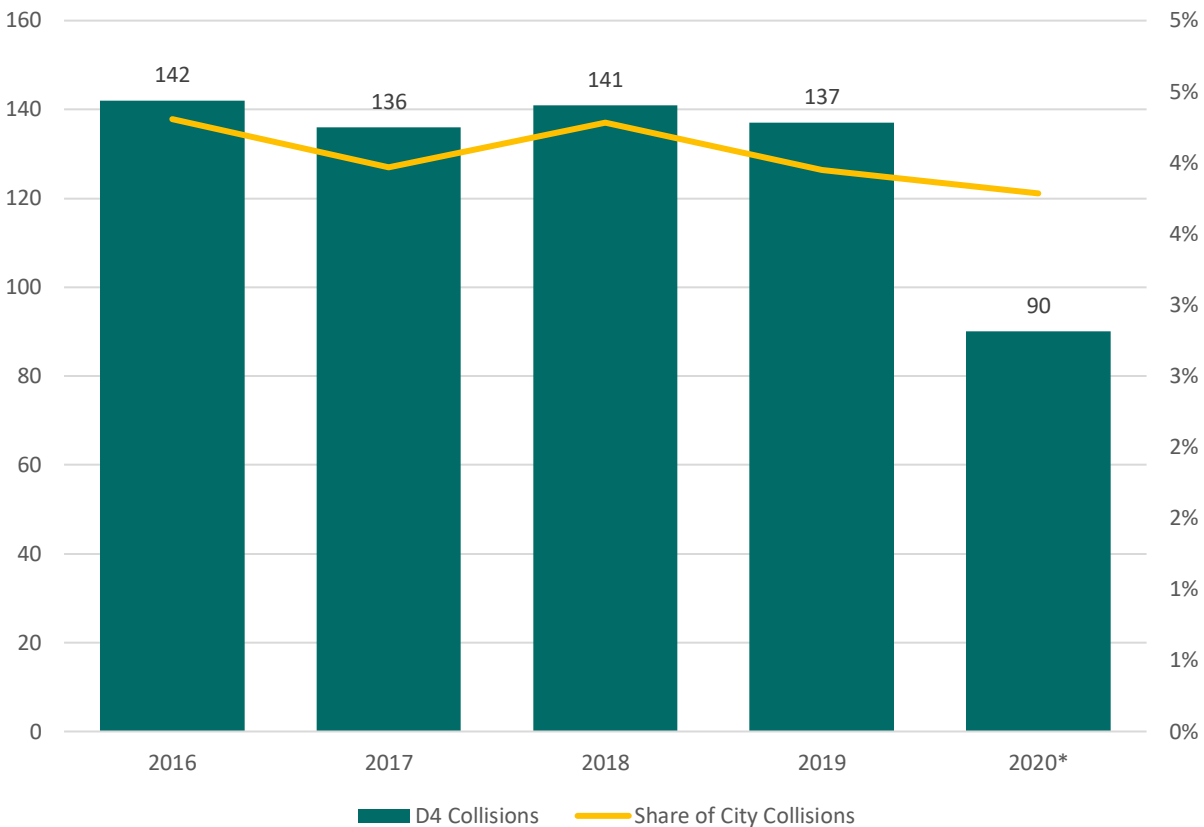
San Francisco adopted Vision Zero in 2014 and set a goal to achieve zero traffic fatalities by 2024. This evaluation factor considers the recent collision history and any features of the concepts that may impact traveler safety.

COLLISION HISTORY

The project team examined the number of collision reports near the Upper Great Highway and District 4 overall during the pandemic and in the years prior (January 2016 to December 2020). These represent any reported collision between any modes whether it be between two vehicles, vehicles/pedestrians, vehicles/bicyclists, or bicyclists/pedestrians. These data are drawn from the SF Department of Public Health, which integrates data from police and hospital reports to provide a more comprehensive view of traffic collisions in San Francisco.

District 4 has low overall rates of traffic collisions. District 4 represent 9% of the City's population, but only 3% of total collisions (Figure 8).

Figure 8 Collisions in District 4, 2016-2020



On the Upper Great Highway, Lower Great Highway, and La Playa, there were few reported collisions either before or during the pandemic; about 5-6 each year. However, District 4 overall saw a 47% decline in collisions during the pandemic while citywide there was a 27% decline.

It is not possible to draw strong conclusions from this small data set, but it is important to flag that Upper Great Highway, Lower Great Highway, and La Playa collisions remained the same while the District 4 collision numbers declined. SFMTA has installed several traffic calming improvements during the temporary promenade, but they have not been in place long enough for a thorough evaluation. Ongoing monitoring of collision data is warranted as traffic patterns continue to change during economic recovery.

More information about safety, see Appendix A.

POTENTIAL FOR MULTI-MODAL CONFLICTS

In addition to reviewing collision data, we evaluated the potential for multi-modal conflicts based on each conceptual design. Each of the concepts introduce potential risks that may need to be addressed with infrastructure improvements.

Staff identified Concept 1 (the four-lane roadway) risks related to the need for pedestrians to cross four vehicle lanes to access the beach and because cyclists share the road with vehicles. There are several signalized crossings along the Upper Great Highway that provide protection for pedestrians. Note that there were no vehicle-pedestrian or vehicle-bicycle fatality along the Upper Great Highway in the years leading up to the current closure.

Under the partial promenade alternatives (Concepts 2 and 5), risk may be reduced somewhat for pedestrians as they only cross two vehicle lanes to access the promenade or the beach. Bicyclists would have space separate from vehicles along the Upper Great Highway, significantly reducing conflicts. These partial concepts also have the advantage of somewhat less risk of traffic diverting on neighborhood streets (in comparison to a Full Promenade). Concept 2 could generate an additional risk of head-to-head vehicle collisions, depending on the final design. As will be identified in what follows, a safer design of a two-way roadway requires reconstruction of the median and the southbound roadbed to ensure that the design would meet requirements for a signalized roadway, which includes some degree of median separation. Simply striping a two-way roadway on one side of the roadway without any other changes would significantly increase collision risks.

The project team assessed the Full Promenade (Concept 3) and found that, while pedestrians would no longer experience conflicts with vehicles on the Upper Great Highway, there may be increased risk of collisions on residential streets if pass through traffic is not diverted to larger arterials.

Finally, under Concept 4 (the timed promenade), pedestrians would still need to cross the four lanes on the five weekdays, and there may be risk of collision among drivers who may not be aware of the part-time roadway closure schedule.

The following table summarizes the risks and advantages of each of the five concepts (Table 2).

Table 2 Potential Safety Risks and Advantages of Concept Designs

	RISKS	ADVANTAGES
Concept 1: Four-lane Roadway	<ul style="list-style-type: none"> • Pedestrian cross 4-lane roadway. • Cyclists ride with vehicles 	<ul style="list-style-type: none"> • Less traffic on local streets
Concept 2: Promenade/Two-Way Roadway	<ul style="list-style-type: none"> • Potential for head-on vehicle collisions. • Some traffic on local streets 	<ul style="list-style-type: none"> • Somewhat less traffic on local streets
Concept 3: Full Promenade/Complete Vehicle Closure	<ul style="list-style-type: none"> • Increased traffic/speed on local streets. 	<ul style="list-style-type: none"> • Complete separation from traffic of people walking and biking along the Upper Great Highway and crossing.
Concept 4: Timed Promenade (Weekends Only)	<ul style="list-style-type: none"> • Peds cross 4-lane roadway on weekdays. • Schedule confusion may cause collision. 	<ul style="list-style-type: none"> • Walking and biking separate from traffic on weekends.
Concept 5: Promenade/One-way Roadway	<ul style="list-style-type: none"> • Some traffic on local streets. 	<ul style="list-style-type: none"> • Somewhat less traffic on local streets

EMERGENCY RESPONSE

SFMTA has been in conversation with the San Francisco Fire Department (SFFD) to understand emergency access issues under potential closure scenarios. SFFD has stated that roadway configuration is not an access issue. The Fire Department has keys for the closed gates on each end at Sloat and Lincoln or alternatively can use the opposite side of the roadway that is not gated. The main access concern for the Fire Department is the sand build up on the roadway. For this reason, under any concept, sand should be cleared regularly from the roadway. In addition, emergency response times should be monitored under any scenario where all or part of the roadway is closed to traffic.

2.4 | ECONOMIC VITALITY/MOBILITY

Smooth and efficient traveler circulation for all modes impacts our social and economic access to work/school, shopping and recreational opportunities. Vehicular traffic impacts not only mobility for drivers, but also people using transit, biking and walking on those congested streets.

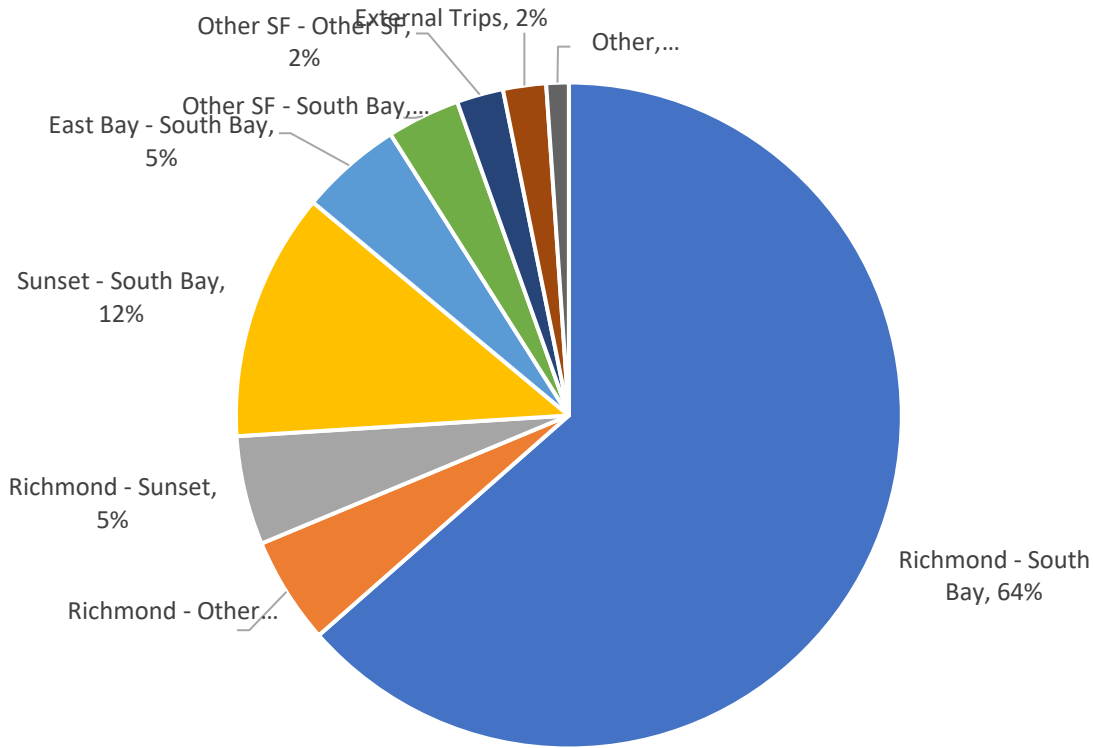
For this part of the evaluation, the project team conducted transportation and traffic modeling of the concepts under pre-pandemic traffic conditions and volumes. There were three key elements in this process:

- **Traffic Volumes** – Transportation network modeling to identify how travel patterns would change with and without the Great Highway in the network, with a focus on where vehicles are expected to travel under the several scenarios.
- **Network Speeds** – This network analysis also identified expected changes in traffic speeds on the streets that have increased vehicle volumes from diverted traffic.
- **Intersection Delay** – Intersection traffic analysis that considers how specific intersections on the network operate given potential increases in traffic volumes.
- **Transit Performance** – Evaluation of how these traffic changes would impact transit routes in the study area.

CHANGES IN TRAFFIC VOLUMES/DIVERSIONS

The project team used the San Francisco Chained Activity Modeling Process (SF-CHAMP) to evaluate how traffic patterns would change under various closure scenarios. We first used the model to understand who used the Upper Great Highway prior to its closure. We examined the origins and destinations of people driving on the Great Highway using data from SF-CHAMP (Figure 9). Nearly two-thirds of people driving on the Upper Great Highway in 2019 were traveling between the Richmond and South Bay (San Mateo and Santa Clara Counties), and in particular between the Outer Richmond and the northern Peninsula communities. The second largest set of users are people traveling between the Sunset and the South Bay, indicating that these users actually travel somewhat out of their way to get to the Upper Great Highway, because there is no local access from the Sunset to the Upper Great Highway.

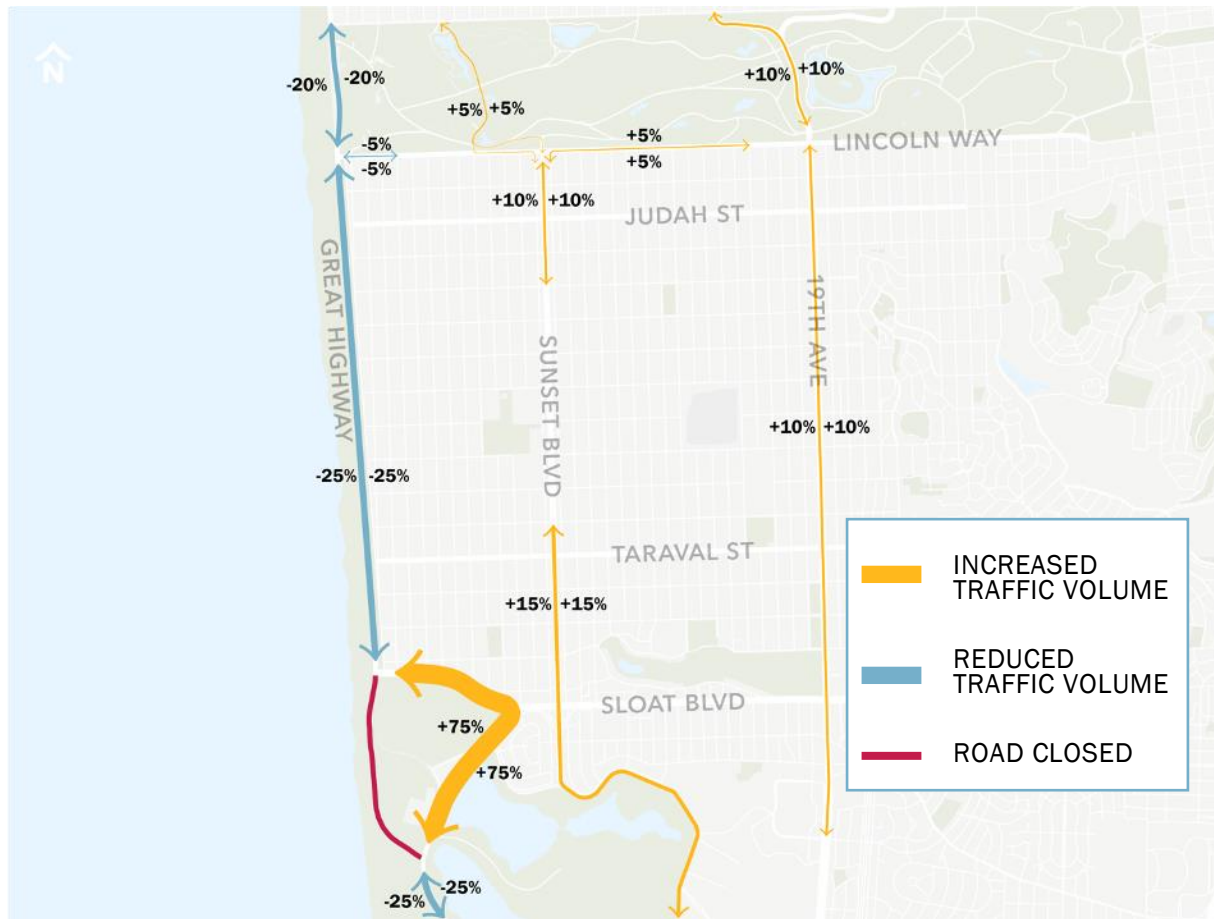
Figure 9 Travel Patterns for Motorists of the Upper Great Highway



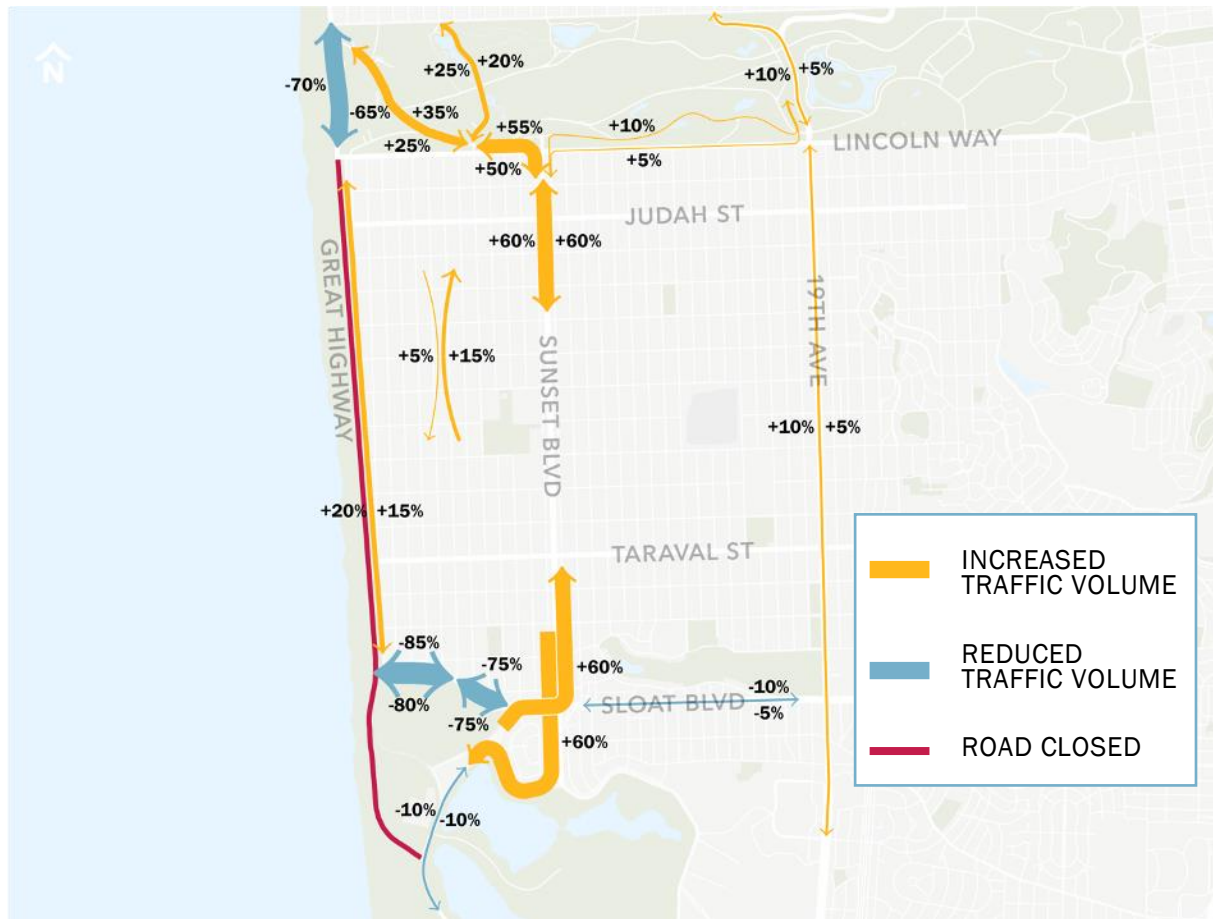
Source: SF-CHAMP

The project team then began to estimate how these vehicle trips may change based on the proposed long-term closures. As previously noted, the Great Highway Extension is planned for closure due to erosion. We first developed a baseline scenario that includes the closure of this segment of road.

We estimate that Upper Great Highway volumes would decline by up to 25 percent as a result of the closure of the Great Highway Extension. Most of the traffic that was on the Great Highway Extension (75 percent) would use the Sloat/Skyline intersection to travel between the Upper Great Highway and Skyline, while the remaining vehicles use Sunset and 19th Avenues. We do also expect a shift of vehicle volumes from the segment of the Great Highway adjacent to Golden Gate Park to other north-south roads through the park, in particular Chain of Lakes and Crossover (Figure 10).

Figure 10 Traffic Diversions in the Baseline (Great Highway Extension Closed)

We next used SF-CHAMP to estimate additional travel pattern changes with the Upper Great Highway also closed (Figure 11). We estimate that most (60-70%) of diverted traffic would use Sunset and that the remaining would use local streets between Lower Great Highway and Sunset (about 20-25%) or 19th Ave (about 5-10%). We also anticipate further increases in traffic across Golden Gate Park, especially at Chain of Lakes, but also along John F Kennedy Drive and 47th Avenue. It is also expected that much of the Southbound travel on Sunset will use Lake Merced Blvd to reach Skyline Blvd. In the east-west directions, we anticipate increased volumes on Lincoln between Chain of Lakes and Sunset and on Sloat Blvd in the vicinity of the ramps between Sloat Blvd and Sunset Blvd.

Figure 11 Traffic Diversions in with the Upper Great Highway Closed**NETWORK PERFORMANCE – VEHICLE SPEEDS**

SF-CHAMP provides estimates of travel speeds for vehicles based on volumes and the capacity of the roads. These are demand projection-based estimates and do not fully account for potential delay generated by specific intersection operations, especially where there are many complex travel movements and modes at an intersection. However, they give a general indication of traffic flow effects of potential closure scenarios, especially in comparison with one another.

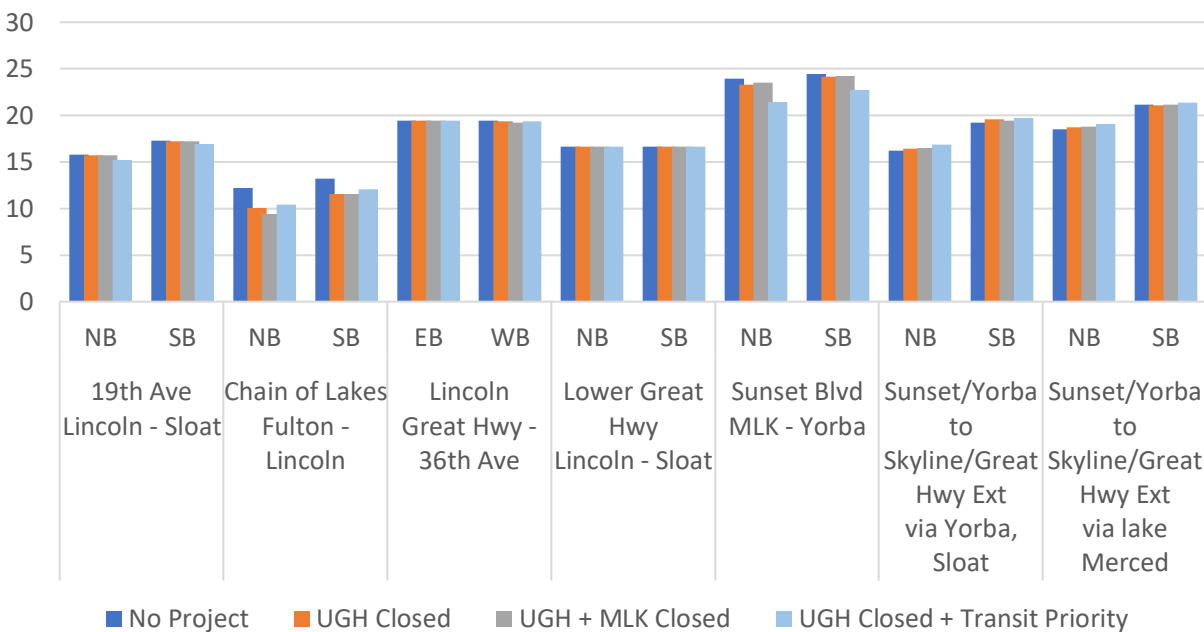
To understand the network impact on vehicle speeds, we evaluated four scenarios:

1. Baseline (Concept 1) – Upper Great Highway is open to vehicles, but the Great Highway Extension is closed. All conceptual scenarios assume this baseline.
2. Concept 3 – Upper Great Highway is closed to vehicles
3. Concept 3, variation 1 – Upper Great Highway and Martin Luther King, Jr Way (an east-west street in Golden Gate Park) are closed to vehicles to represent a potential maximum long-term road network closure scenario)
4. Concept 3, variation 2 – Upper Great Highway is closed to vehicles, but transit improvements have been implemented on Sunset Blvd (bus only lanes and signal priority) and 19th Ave (2+ high occupancy vehicle lanes). This variant also includes the addition of an express bus connecting the outer Richmond to the northwestern San Mateo Peninsula (the largest Origin/Destination travel pattern)

Most street segments in this analysis have similar travel speeds in the closure scenarios as they do in the baseline no project scenario (Figure 12). Findings of note include:

- Speeds on 19th Avenue are nearly 10 miles below the posted speed limit. While not expected to change significantly due to the small increase in vehicle volumes anticipated with the Upper Great Highway closure, these intersections would need ongoing monitoring and signal timing evaluation. It will also be critical to evaluate any impacts on the 28 19th Avenue bus route, which already experiences significant delays along 19th Ave.
- Chain of Lakes experiences slow travel speeds in the baseline scenario at under 15 miles per hour, consistent with observations made by SFMTA staff in 2020 and early 2021. The combination of the closure of the Upper Great Highway and 2019 traffic volumes would reduce speeds on this road by 2 to 3 miles per hour. This improves slightly with transit enhancements, which include some mode shift.
- Sunset Blvd also experiences some reduction in vehicle speeds with the Upper Great Highway closed, especially in the Northbound direction. However, vehicle speeds remain above 20 miles per hour in each direction. Even when one lane is converted to a bus and right turn lane, average vehicle speeds remain above 20 mph.

Figure 12 Vehicle Travel Speeds on Road Segments by Scenario



Source: SF-CHAMP

INTERSECTION OPERATIONS ANALYSIS

The network analysis findings are not able to capture the detailed operations of intersections. This section reviews traffic analysis work that was conducted to understand these questions. The intersection traffic analysis was conducted by Mott MacDonald using a microsimulation analysis tool called Transmodeler. This

model simulates travel through several intersections 10 separate times to understand how natural variations in travel patterns impact the functioning of these intersections.

We generated three measures of intersection performance from this model:

1. Overall intersection delay – average minutes of delay per vehicle
2. Intersection delay by approach – average minutes of delay per vehicle at each approach to the intersection (i.e., East, North, West, and South, though some intersections have unique geometry).
3. Queueing by approach – average distance of the longest vehicle queue at each approach to the intersection

The initial set of findings focuses on two scenarios: (1) **baseline no project** scenario (with Great Highway Extension closed) and (2) **Upper Great Highway closed** scenario. Consistent with observations, overall delay was experienced in the baseline scenario primarily at Chain of Lakes and along 19th Ave (Figure 13). With the Upper Great Highway closed, we find additional delay along Chain of Lakes, as well as new delay on Sunset at Lincoln and Martin Luther King, Jr. Dr and at Skyline Blvd and Lake Merced Blvd (Figure 14).

Figure 13 Intersection Delay - Baseline Condition

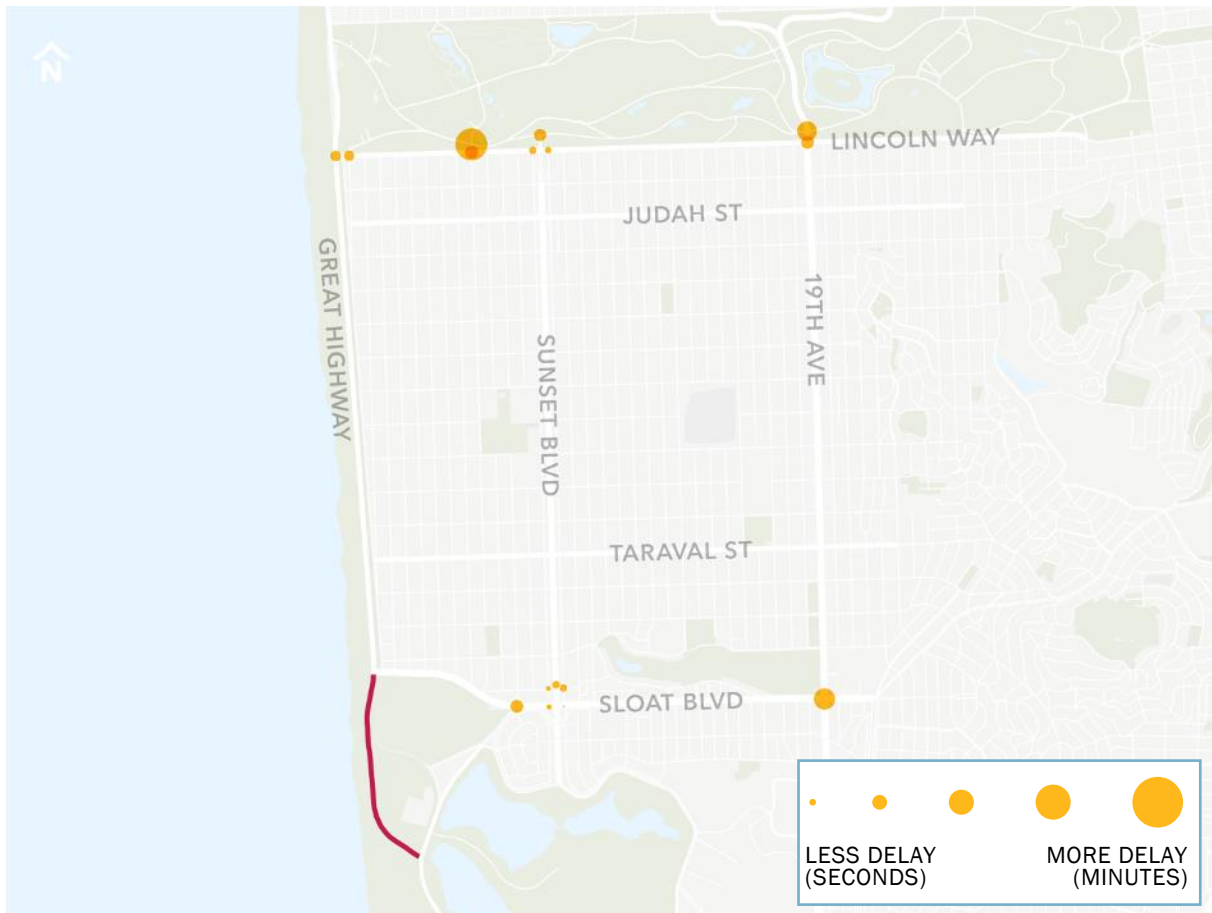
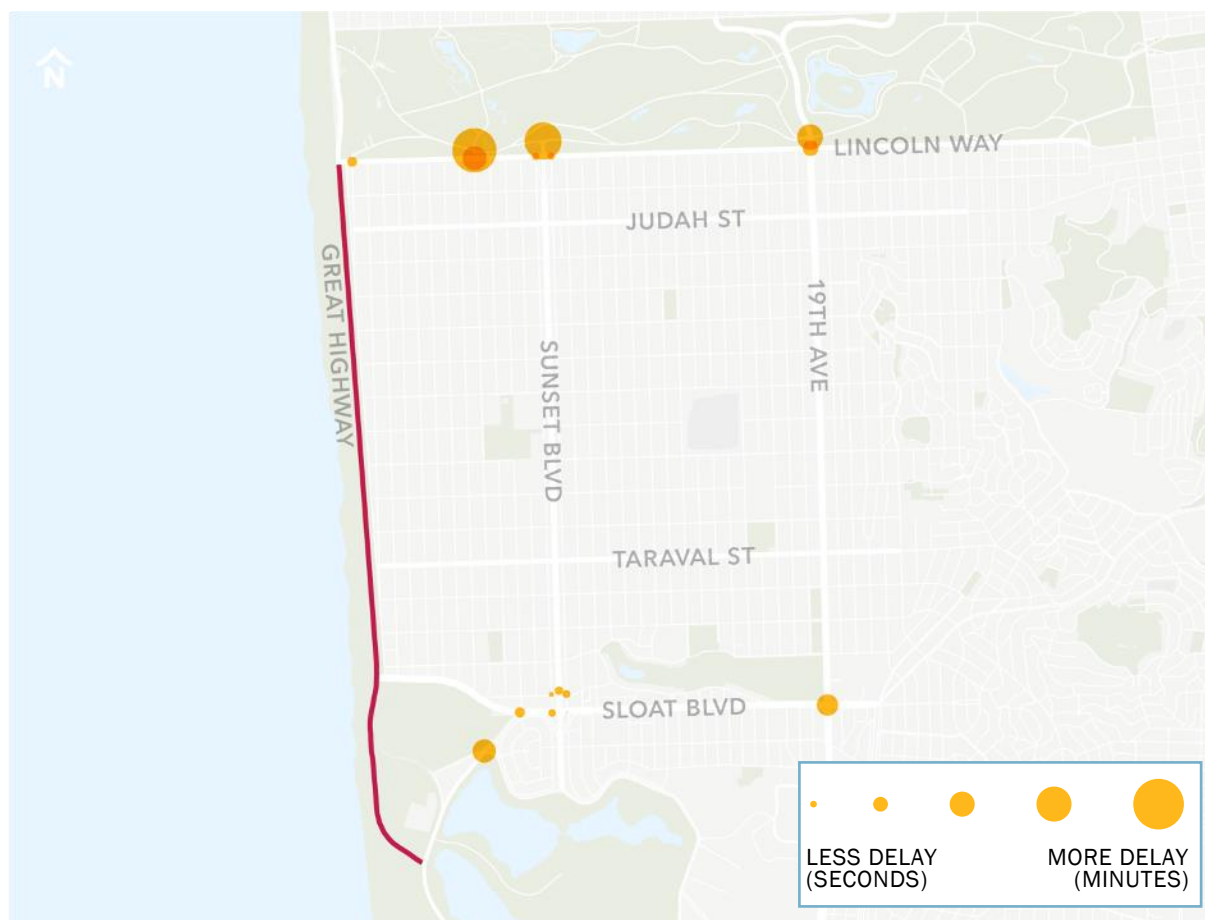


Figure 14 Intersection Delay - Upper Great Highway Closed

Using a combination of the initial analysis, staff observations, and feedback from the public, four key areas were identified for more detailed analysis:

- Northern end of study area, including Chain of Lakes intersections with Lincoln Way and Martin Luther King, Jr. Dr and Sunset intersection with Lincoln Way (including 36th/37th Ave access between Lincoln Way and Sunset) and Sunset Blvd & Martin Luther King, Jr. Dr
- Southern end of study area, including Sloat Blvd & Skyline Blvd, Lake Merced Blvd & Skyline Blvd, and Sunset Blvd & Sloat Boulevard
- Local streets between Upper Great Highway and Sunset Blvd
- 19th Avenue corridor, including intersections at Martin Luther King, Jr. Dr, Lincoln Way, and Sloat Blvd

SFMTA is also conducting area-wide operational analyses of north-south traffic across and around Golden Gate Park using micro-simulation traffic models to evaluate some of these effects in more detail. This work was in progress at the time this report was completed and all findings from this study were shared with the SFMTA team.

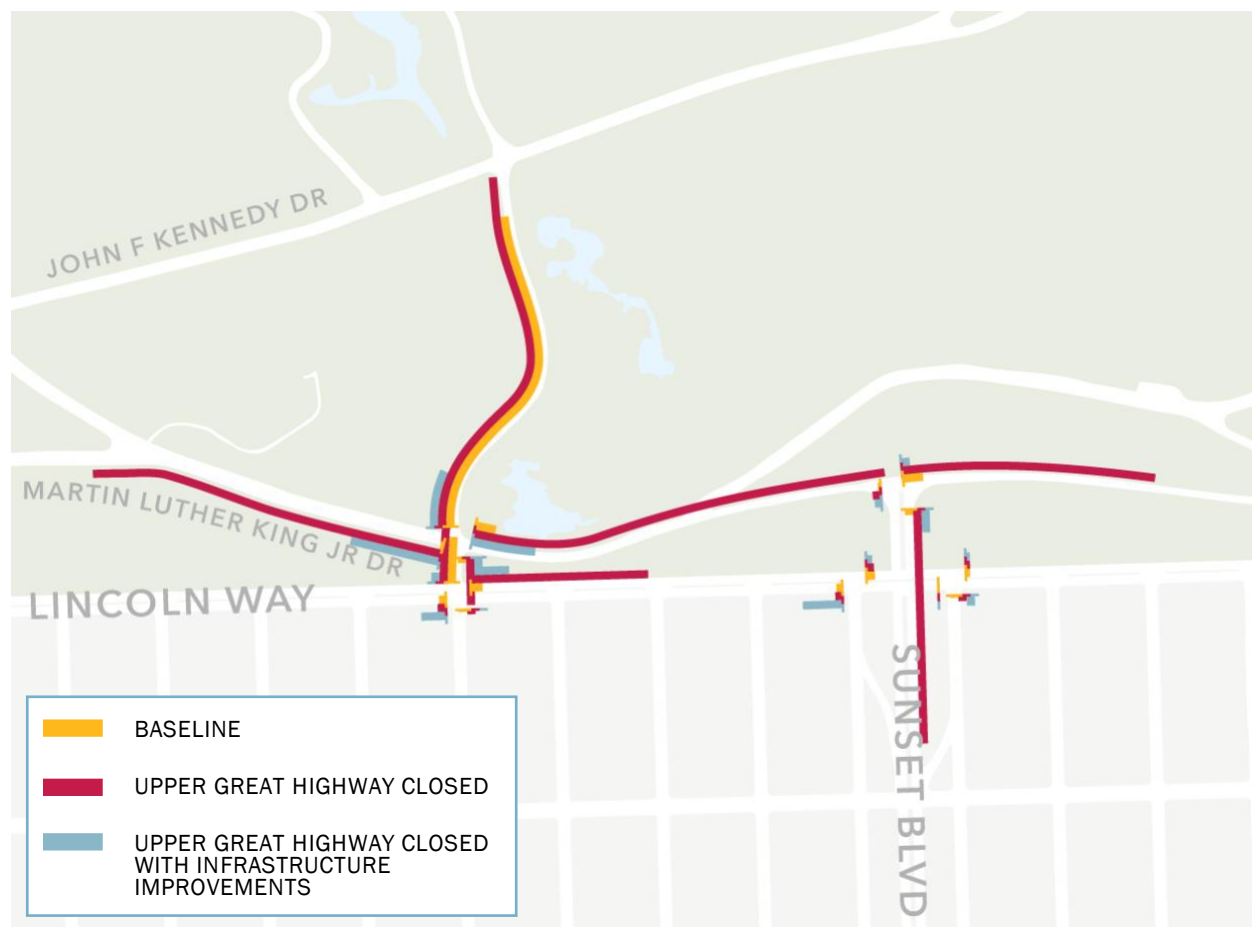
Northern End of Study Area – Chain of Lakes and Northern Sunset

Lincoln and Martin Luther King, Jr. Dr are about 75 feet apart along Chain of Lakes, so the operations at one intersection directly impact the other. These intersections experience significant delay and queuing (Figure 15) in the baseline scenario.

In the baseline scenario, there are over 5 minutes of delay on southbound Chain of Lakes approach Martin Luther King, Jr. Dr and vehicles queue for over 1,100 feet. With the Upper Great Highway closed, delay increases by 2.5 minutes per vehicle and the queue increases somewhat. Queues and delays are anticipated to increase substantially at the East and West approaches along Martin Luther King, Jr. Dr with the Upper Great Highway closed.

We also evaluated a scenario with Martin Luther King, Jr. Dr closed permanently, consistent with the temporary closure in place today. This scenario shifts traffic to Lincoln Way to travel between Chain of Lakes and Sunset, creating delays and queues at 37th Avenue and Lincoln and shifting the delays and queues along Chain of Lakes to the Lincoln intersection (from the Martin Luther King, Jr. Dr intersection).

Figure 15 Vehicle Queuing in the Northern Study Area



There are two primary connections between Chain of Lakes and Sunset Blvd – (1) Martin Luther King, Jr. Dr and (2) Lincoln and 36th Ave/37th Ave. Martin Luther King, Jr. Dr is the more direct route because of the

grade separation of Lincoln Way and Sunset Blvd. Martin Luther King, Jr. Dr is currently closed to vehicles west of Sunset Blvd as part of an emergency order related to the coronavirus pandemic.

None of these intersections experiences significant delay or queueing in the baseline scenario. Closing the Upper Great Highway to vehicles is expected to create delay at Martin Luther King, Jr. Dr and Sunset Blvd (especially the northbound and westbound movements), a stop-controlled intersection that warrants consideration for signalization in the baseline/"no project" scenario. Under the scenario under which Martin Luther King, Jr. Dr is also closed to vehicles, that delay transfers to the intersection of Lincoln Way and 37th Ave, the primary remaining path to access Chain of Lakes.

We then evaluated infrastructure improvements to address the findings for each scenario. Potential vehicle-handling capacity enhancement ideas include:

1. Adding a traffic signal at the intersections that experience the most delay (Figure 16). This likely includes Lincoln Way & Chain of Lakes, Martin Luther King, Jr. Dr & Chain of Lakes, and Martin Luther King, Jr. Dr & Sunset Blvd. This could also include restricting left turn movements from Lincoln Way to Chain of Lakes/41st and restricting travel to from 41st Ave consistent with a proposal to make 41st Ave a neighborway that limits access to vehicles.
2. Closing Martin Luther King, Jr. Dr to vehicles, adding a traffic signal at the intersection of Lincoln Way & Chain of Lakes, and striping additional space for left turns at 37th Ave SB to Lincoln Way WB and increasing signal timing at this intersection to allow more vehicles to use this movement (Figure 17).
3. Closing Chain of Lakes to vehicles between Lincoln Way and Martin Luther King, Jr. Dr and allowing vehicle travel on Martin Luther King, Jr. Dr between Sunset Blvd and Chain of Lakes (Figure 18). This would allow north-south travel between the Richmond and the Sunset and the Peninsula a relatively unimpeded path via Chain of Lakes, Martin Luther King, Jr. Dr, and Sunset. It may require additional traffic calming to manage speeds and active transportation mode safety and circulation impacts along Martin Luther King, Jr. Dr.

Figure 16 Improvement Idea 1 - Northern Study Area



Figure 17 Improvement Idea 2 - Northern Study Area



Figure 18 Improvement Idea 3 - Northern Study Area



Table 3 summarizes the strengths and challenges of each of these ideas:

Table 3 Summary of Northern Study Area Improvement Ideas

	1 – TWO NEW SIGNALS ON CHAIN OF LAKES AND ONE ON SUNSET BLVD AND MARTIN LUTHER KING JR DR, TURN RESTRICTIONS ON LINCOLN WAY	2 – UPPER GREAT HIGHWAY AND MARTIN LUTHER KING JR DR CLOSED, SIGNALIZED 41ST & LINCOLN	3 – CHAIN OF LAKES CLOSED B/T MARTIN LUTHER KING JR WAY & LINCOLN, MARTIN LUTHER KING JR DR OPEN B/T SUNSET & CHAIN OF LAKES
STRENGTHS	<ul style="list-style-type: none"> Most options for vehicle travel, reducing delay at individual intersection 	<ul style="list-style-type: none"> Continuous slow street along Middle and JFK Reduces the number of conflict points 	<ul style="list-style-type: none"> No new signals needed (lowest cost) Potential to realign bike crossing away from Martin Luther King, Jr. Dr/Chain of Lakes intersection Balances use of Great Highway and Chain of Lakes
CHALLENGES	<ul style="list-style-type: none"> 3 new signals likely needed (significant cost) Requires investment to create a continuous path of travel for bikes through Golden Gate Park 	<ul style="list-style-type: none"> Lincoln would need traffic calming for pedestrian safety 1 new signal needed (moderate cost) and signal retiming at 37th/Lincoln Challenging crossing for bikes at Martin Luther King, Jr. Dr given proximity to Lincoln Potential impact to the 29 Sunset, which uses 36th Ave to access Lincoln Way 	<ul style="list-style-type: none"> May need traffic calming for pedestrian safety Requires investment to create a continuous path of travel for bikes through Golden Gate Park Converts park road to a primary vehicle through route May cause some diversion to Irving to access Chain of Lakes via Sunset & Martin Luther King, Jr. Dr Diverts some vehicles to Great Highway for some north-south trips

We evaluated Ideas 1 and 2 using the traffic analysis model and found the following:

- Idea 1 reduced delay at all approaches to the affected intersections, reducing delays at southbound Chain of Lakes at Martin Luther King, Jr. Dr to under a minute (from over 5 minutes in the baseline) and queuing to around 180 feet (from over 1,100 feet). With Martin Luther King, Jr. Dr open, some delay remains in the EB direction of Martin Luther King, Jr. Dr due to a preference for the much heavier southbound to eastbound travel pattern.
- Idea 2 (w/Martin Luther King, Jr. Dr closed) also reduced delays at all approaches to the affected intersections. The Martin Luther King, Jr. Dr intersections are closed to vehicles in this iteration and experience no delay, though bicycle and pedestrian safety measures would likely be needed at the Martin Luther King, Jr. Dr/Chain of Lakes intersection if this remains a primary bicycle and pedestrian crossing.
- Idea 3 was not directly modeled due to time and resource constraints. However, it is apparent from other scenarios that this scenario would reduce delays – with Martin Luther King, Jr. Dr only handling through north-south vehicles between Sunset Blvd and Chain of Lakes, there would be fewer conflicts with turning movements. Some vehicles would divert to Lincoln, but scenario 2 (with Martin Luther King, Jr. Dr closed) indicates that there is capacity on Lincoln to accommodate expected east-west vehicle volumes, though additional analysis is needed to evaluate pedestrian and bicycle safety and transit operations. A signal would not be needed at Chain of Lakes because it would no longer allow vehicles, simplifying this travel pattern. The

signal at 37th Ave and Lincoln Way would need ongoing monitoring to determine if this changed traffic pattern is supported. Finally, an upgrade to the bicycle and pedestrian connection from Middle Ave to Martin Luther King, Jr. Dr would likely be needed, but we anticipate it would cost less than the signals required to address the impacts of the other two ideas.

In summary, each of these ideas presents feasible improvements if the Upper Great Highway is closed permanently and when traffic volumes and patterns return to what was experienced before the pandemic. As the economy reopens, we recommend that these concepts be included in area-wide network planning and operational analyses being conducted by the SFMTA and the Recreation and Park Department.

Southern End of Study – Sunset/Sloat/Skyline

The primary paths of diversions expected with the Upper Great Highway closure are:

- In the southbound direction, Sunset to Lake Merced Blvd to Skyline Blvd
- In the northbound direction, Skyline Blvd to Sloat Blvd to Sunset Blvd via the cloverleaf ramp across from 36th Ave

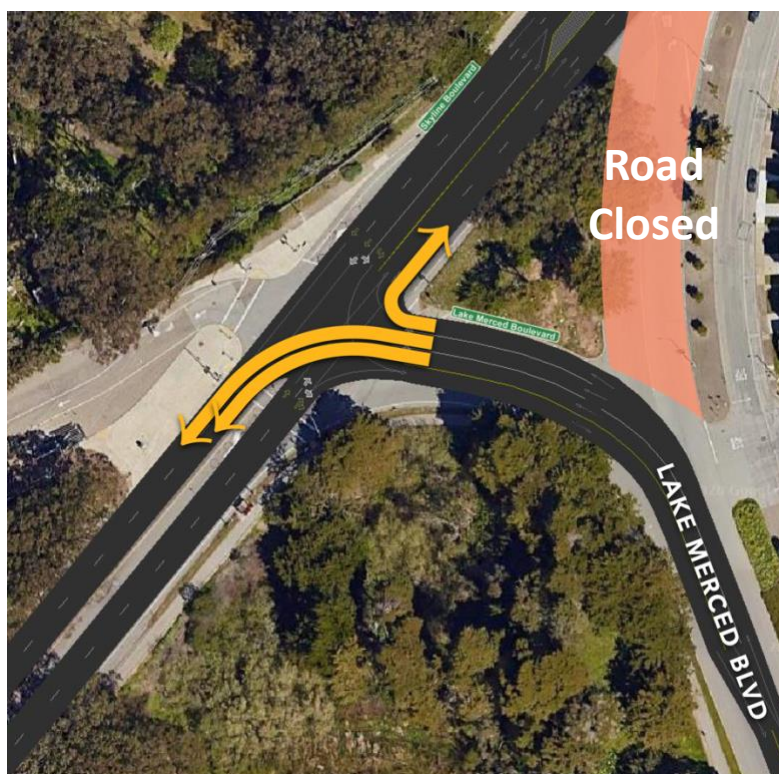
As noted above, the closure of the Great Highway Extension as part of the South Ocean Beach Climate Change Adaptation Project includes planned addition of signals of the Sloat Ave/Skyline Blvd intersection and the Skyline Blvd/Great Highway Extension intersection.

None of the intersections in this part of the study area is expected to have significant delay or queueing in the baseline condition assuming signalization of Sloat/Skyline (or equivalent improvement) and other supporting measures. With the closure of the Upper Great Highway, we expect a significant increase in delay and queueing at Skyline Blvd & Lake Merced Blvd and some delay on the ramp from southbound Sunset Blvd to eastbound Sloat Blvd (Figure 19).

Figure 19 Vehicle Queuing in the Southern Part of the Study Area

We investigated potential improvements at the Skyline/Lake Merced intersection that could address the increased delay and queuing at this location. There is significant space at this intersection, creating an opportunity to consolidate the intersection and add a second left turn lane from Lake Merced westbound to Skyline Blvd southbound (Figure 20). We modeled this idea, which showed significant reduction in delay and queuing at this intersection due to quicker clearing of the intersection.

There is a potential impact at this location to the Muni-18 46th Avenue that should be evaluated. The 18 line uses the piece of Lake Merced Blvd proposed to be closed in this concept to travel between Skyline Blvd and Lake Merced Blvd. This could increase travel time for the 18 line. There is a potential to use the closed piece of road as a bus only lane.

Figure 20 Potential Skyline/Lake Merced Improvement

We also explored ideas that might direct vehicle travel to Sloat/Sunset instead of Lake Merced/Skyline. Sloat Blvd and Skyline Blvd are State Highway 35 and are intended to carry regional vehicle travel. Bicycle and pedestrian safety and comfort on Lake Merced Blvd are also a focus of two recent studies. The Lake Merced Pedestrian Safety Community Based Transportation Plan (CBTP) is focused on pedestrian safety and the recently completed Lake Merced Bikeway Feasibility Study identified potential off street and on street improvements to make a continuous biking path around the lake. We see one idea that could reduce vehicle travel on Lake Merced Blvd and identified additional ideas that may improve bicycle and pedestrian safety on Sloat Blvd (Figure 21):

- Convert 37th Ave to one-way southbound operation from Yorba St to Sloat Blvd to facilitate travel from southbound Sunset to westbound Sloat Blvd (and the connection to Skyline Blvd). This would create a double left from 37th Ave to Sloat Blvd that may need to be signalized. This addition could help balance vehicle travel between Sloat Blvd and Lake Merced Blvd.
- Adjust the median on Sloat Blvd to allow left turns from 37th Ave to Sloat Blvd eastbound. This would require addition of a signal and would allow removal of the current cloverleaf ramp from Sunset southbound to Sloat eastbound.
- Further adjust the median to allow a double left turn from Sloat eastbound to 36th Ave northbound to access Sunset Blvd northbound. This would require making 36th Ave one way northbound from Sloat Blvd to Yorba St and would require additional signalization. It would also allow the removal of the other cloverleaf ramp from Sloat eastbound to Sunset northbound with associated pedestrian and bicycle circulation benefits.

Figure 21 Potential Sloat/Sunset Improvements**Ideas**

1. 37th Ave one way SB from Yorba to Sloat – improves Sunset → Sloat → Skyline connection
2. Allow left turn from 37th Ave SB to Sloat EB
Close Sunset SB to Sloat EB ramp
3. Also install 2 left turns from Sloat EB to 36th Ave
36th Ave NB only to Yorba
Close Sloat EB to Sunset NB ramp

While the Sloat/Sunset ideas were not included in our model runs, we did conduct preliminary analyses that confirmed that these improvements appear feasible and may be worth further study as SFMTA evaluates improvements to connections between Sunset Blvd and Sloat Blvd.

For the Lake Merced Pedestrian Safety CBTP, SFMTA should consider the findings of this analysis as they develop recommendations for pedestrian improvements.

Table 4 summarizes the expected strengths and challenges of each of these options.

Table 4 Summary of Southern Study Area Improvement Ideas

	1 – LAKE MERCED & SKYLINE CONSOLIDATION	2 – SLOAT/SUNSET		
		2A – 37TH ONE WAY SB FROM YORBA-TO SLOAT	2B – ADD LEFT TURN FROM 37TH AVE SB TO SLOAT EB	2C – ADD LEFT FROM SLOAT EB TO 36TH NB
STRENGTHS	<ul style="list-style-type: none"> Intersection improvement needed to support safer bike connection 	<ul style="list-style-type: none"> Reduces traffic volume on Lake Merced Blvd 	<ul style="list-style-type: none"> Allows closure of cloverleaf ramp from Sunset SB to Sloat EB – some bike safety improvement 	<ul style="list-style-type: none"> Allows closure of cloverleaf ramp from Sloat EB to Sunset NB – bike safety improvement
CHALLENGES	<ul style="list-style-type: none"> Potential for increased traffic on Lake Merced (should be considered in Lake Merced Pedestrian Study) May impact 18 46th Avenue, should be carefully evaluated Medium cost improvement 	<ul style="list-style-type: none"> Potential local impact to residents on 37th Ave b/t Sloat and Yorba Cost includes new signal (2 directions only) 	<ul style="list-style-type: none"> Potential local impact to residents on 36th Ave b/t Sloat and Yorba Significant cost to alter median and signalize all directions May increase delays for bikes and peds on north side of Sloat 	<ul style="list-style-type: none"> Potential local impact to residents on 36th Ave b/t Sloat and Yorba Significant cost to remove median, install new turn lanes May increase delays for bikes & peds Need to evaluate significant weaving movement from Skyline and Sloat Blvd to Sloat Blvd and 36 Ave

Local Outer Sunset Streets

One of the concerns raised during the current closure has been the impact of diversions on the Lower Great Highway and parallel avenues between the Lower Great Highway and Sunset Blvd. In the diversion scenarios identified above, we expect some increase in traffic volumes on Lower Great Highway and relatively small volume increases on the other parallel avenues between Lower Great Highway and Sunset Blvd. From a traffic standpoint, we did not find increases in delays at these intersections.

The concern about these increased volumes relates more directly to speeds and safety on these local streets. As described above, SFMTA has implemented two sets of traffic calming improvements to address these safety concerns. SFMTA is monitoring these improvements currently and may need to make additional improvements on other streets as new traffic patterns emerge with the Upper Great Highway closed. Up to \$200,000 in additional traffic calming need is assumed.

19th Avenue Corridor

19th Avenue is California Highway 1 under the jurisdiction of Caltrans. In 2019, it carried between 60,000 and 70,000 vehicles on a typical weekday (all day) and between 2,500 and 3,000 in the peak hour. The closure of Upper Great Highway is expected to add only between 100 and 200 vehicles to 19th Avenue, a small proportion of the vehicles already using the street in the peak period

Our initial analysis showed potential queueing and delay in the baseline condition at the three main intersections potentially impacted by the closure of the Upper Great Highway - Martin Luther King, Jr. Dr, Lincoln Way, and Sloat Blvd. In the baseline condition, there is substantial delay and queueing at the two northern intersections, consistent with the existing volumes on these roads. At Sloat Blvd and 19th Ave, we also observed delays in the eastbound direction due to the short left-turn pocket and the lack of signal time available for this movement.

The signals along 19th Ave are coordinated and vehicle progress through those signals is controlled to manage the overall flow across the state highway. To be able to accurately evaluate traffic at these three intersections, the model would have needed to incorporate the several signalized intersections between Lincoln Way and Sloat Blvd, as well as signalized intersections to the north and south. Intersection controls help vehicles approach these intersections at more regular intervals, making it challenging to accurately estimate delays without modeling all intersections in the corridor as a system. Because the resources of this project could not support evaluation of all intersections and because relatively few additional vehicles are expected to divert to 19th Ave, especially relative to the number of vehicles using 19th Ave in 2019, we did not investigate specific improvements along this corridor.

We recommend ongoing monitoring of 19th Ave to identify if the small addition of traffic requires any changes to signal timing.

Partial Closure

While the focus of our intersection operations analysis is on the full closure scenarios, we did also evaluate the potential traffic impacts of Concept 5, which provides a promenade on one side of the road and one direction of vehicle travel. We evaluated southbound travel because that is the predominant movement and because it experiences more significant impacts in the evaluation of the full closure concept.

The findings of this scenario include:

- Chain of Lakes SB at Martin Luther King, Jr. Dr continues to have substantial delays and queues, but is unchanged from the baseline condition. This also creates delays westbound at Martin Luther King, Jr. Dr and Chain of Lakes and westbound at Lincoln Way and Chain of Lakes. Improvements along Chain of Lakes appear to be required regardless of the closure of the Upper Great Highway.
- Northbound delay is still experienced at Sunset Blvd and Martin Luther King, Jr. Dr, which also creates delay for westbound vehicles on Martin Luther King, Jr. Dr.

For the northern study area, some of the improvements identified for the full closure would also be needed for Concept 5 (one-way operation). Improvements at Chain of Lakes have been identified as needed in the baseline scenario, and we anticipate that one of the three ideas identified above for the northern study area could be applied:

- For the scenario where both Lincoln Way and Martin Luther King, Jr. Dr are open to vehicles, southbound vehicle volumes on Chain of Lakes create delays in the baseline condition. As a result, signalization of these three intersections may be required
- If Martin Luther King, Jr. Dr is closed, signal adjustments would be needed at 36th Ave/Lincoln Way and a new signal at Lincoln Way/Chain of Lakes, similar to the full closure scenario.

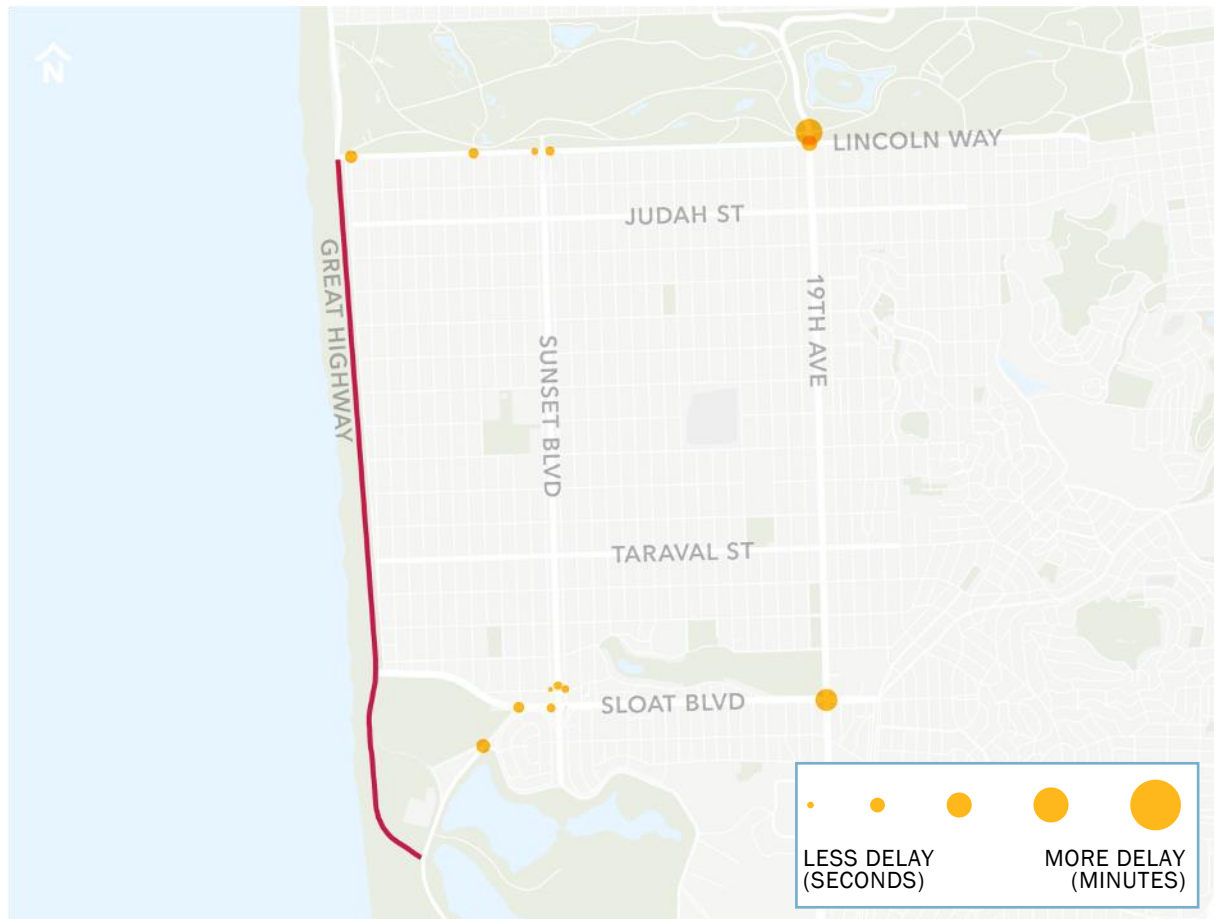
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- There may be an opportunity to combine one way vehicle operation with partial closure of Martin Luther King, Jr. Dr to vehicles. Ideally this would be from northbound Sunset Blvd to westbound Martin Luther King, Jr. Dr to northbound Chain of Lakes. This would likely require additional safety measures to minimize conflicts between vehicles and bicycles.

Because one direction of travel is more heavily impacted than the other, there may be hybrids of the above options that were not explored with the full closure. These would need further study.

There are not significant impacts at the southern study area intersections for this Concept 5, which would reduce the need for improvements at Skyline/Lake Merced or Sloat/Sunset. We also anticipate somewhat less impact on the local streets between the Upper Great Highway and Sloat Blvd, though some additional northbound traffic is expected for the one-way closure. As with the full closure, ongoing monitoring of the local streets is appropriate and additional traffic calming may be needed, though potentially at a reduced cost.

TRAFFIC IMPACTS SUMMARY

Promenade options will contribute to traffic issues both within and beyond the District 4 study area. With improvements to the transportation system, the impact of the diversion is expected to reduce delay to levels similar or better than existing conditions (Figure 22). More information on the costs of these improvements is provided in following sections.

Figure 22 Intersection Delay - with Infrastructure Improvements

Additional detail of the traffic analysis findings is available in Appendix B.

TRANSIT IMPACTS

Vehicle congestion also impacts transit. In the Outer Sunset, the Muni 29 and 28 bus routes operate on the streets expected to experience increased traffic from diversions. Based on the changes in network speeds and congested locations identified above, we expect the following impacts for the full closure (Concept 3):

- Vehicle speeds drop slightly along Sunset Blvd (1-2%). We expect somewhat larger declines in bus speeds as a result, due to the need to pick up passengers along the route. Average speeds on Sunset Blvd exceed 20 MPH, so these changes may not be significantly noticeable to passengers.
- The 29 bus uses 36th Ave to turn right on to Lincoln Way. Under scenarios where Martin Luther King, Jr. Dr is also closed, we anticipate significant additional volumes at this intersection. While proposed signal changes appear to be effective in facilitating traffic through this intersection, bus operations at this intersection should be evaluated and any impacts should be addressed with transit priority treatments.
- Vehicle speeds are 12 to 15 mph on 19th Ave in the peak period. SFCTA's Congestion Management Program estimates that bus speeds were below 10 mph in 2019.
- The closure could also impact the 18 - 46th Ave, depending on the amount of traffic diverted to local residential streets.

We estimated potential transit impacts from other scenarios as follows:

- Concept 2 (Two lane, two-way road) was not evaluated due to the significant additional cost.
- Concept 4 (Weekend closure) would not have impacts during the peak period when traffic is greatest.
- Concept 5 (One way southbound) would impact northbound bus travel on Sunset and 19th Ave.

Without further transit priority improvements, we expect the most significant transit impacts and risks under Concept 3 – Full Promenade concept. Potential transit priority improvements have been identified by the District 4 Mobility Study and ConnectSF Transit Strategy.

For ConnectSF, both Sunset Blvd and 19th Ave are part of the proposed 5-Minute network, which is intended to provide fast, frequent, and prioritized transit service. Achieving the five-minute network requires street improvements such as transit signal priority and lanes dedicated to buses. On 19th Ave, a pilot of high occupancy vehicle lanes that would benefit both buses and carpools is under consideration. On Sunset Blvd, this would likely include a bus only lane and transit priority.

The District 4 Mobility Study evaluated these improvements in the local context. To supplement transit in this north-south market, the project team paired increased service on the 28 and 29 with a conceptual peninsula express bus that would serve: the Richmond, the Sunset, and the Northern Peninsula (Daly City, Colma, and South San Francisco). The findings of this analysis included:

- 4.5% increase in transit trips to, from and within D4
- 2,100 more daily riders on 28/28R – 19th Ave
- 11,600 more daily riders on 29/29R – Sunset Blvd
- Additional benefits include travel time savings and improved reliability for new and existing riders. We expect that bus speeds would increase on 19th Ave by 6 to 7 percent and on Sunset Blvd by 7 to 10 percent with transit priority in this corridor and increased traffic volumes with the Upper Great Highway closed.

Table 5 Summary of Transit Impacts

CONCEPT 1: FOUR-LANE ROADWAY	No impact on existing transit speeds.
CONCEPT 2: PROMENADE/ TWO-WAY ROADWAY	Not evaluated
CONCEPT 3: FULL PROMENADE/ COMPLETE VEHICLE CLOSURE	Potential for reduced speeds of 29-Sunset, especially if Martin Luther King, Jr. Dr is also closed. Potential bottleneck at 36 th Ave and Lincoln without more detailed mitigation. Small potential to increase existing delays on 28-19th Ave. Potential impact to 18-46th Ave.
CONCEPT 4: TIMED PROMENADE (WEEKENDS ONLY)	Slower 29-Sunset on weekends. Potential to exacerbate existing delays on 28-19th Ave on weekends. Potential impact to 18-46th Ave on weekends.
CONCEPT 5: PROMENADE/ ONE-WAY ROADWAY	Slower 29-Sunset northbound, exacerbated if Martin Luther King, Jr. Dr is closed. Potential to exacerbate existing delays on 28-19th Ave.

CONCEPT 3, 4, OR 5 WITH TRANSIT INVESTMENTS

Transit priority on Sunset Blvd and HOV lanes on 19th Ave do provide modest improvements in transit speeds.

2.5 | COSTS OF NEEDED IMPROVEMENTS

There are several types of costs associated with this evaluation:

- Baseline improvements that are needed regardless of any future change to the Upper Great Highway
- Upper Great Highway improvements
- Improvements needed to address the impacts from a closure
- Operating costs for all scenarios

BASELINE IMPROVEMENTS

Several street improvements that are expected under all concepts:

- Lower Great Highway: As noted above, SFMTA implemented traffic calming improvements to Lower Great Highway in early 2021. Additional traffic management improvements to support future closure scenarios are assumed as follows:
- Sloat and Upper Great Highway: This intersection will receive a redesign as part of the planned South Ocean Beach Climate Adaptation Project, which includes closure of the Great Highway extension roadway south of Sloat. SFPUC estimates the cost of improvements to this intersection, including a new traffic signal and other changes at around \$2,000,000.
- The Sloat/Skyline intersection was also identified by the South Ocean Beach Climate Change Adaptation Project to be updated. SMTA is considering multiple options for this intersection, which could include signalizing the intersection or installing a roundabout. For the purposes of this project, we assumed that the current stop-controlled intersection would be replaced by a signalized intersection. This would also include substantial reconstruction of the intersection. Due to the complexity of the project, we estimate the cost to upgrade this intersection around \$3,000,000 - \$4,000,000.

CAPITAL COSTS OF UPPER GREAT HIGHWAY IMPROVEMENTS

Under each of the concepts, various improvements are needed to the Upper Great Highway, immediately adjacent streets, and streets on the approach to the Upper Great Highway. Table 6 outlines the improvements needed for each concept. Costs for direct Upper Great Highway Improvements are comparable across the scenarios with the exception of Concept 2 which requires much higher costs to due to the need to reconstruct the roadway to ensure a safe design.

Table 6 Upper Great Highway Improvement Costs

Dollar amounts in thousands	CONCEPT 1: FOUR-LANE ROADWAY	CONCEPT 2: PROMENADE /TWO-WAY ROADWAY	CONCEPT 3: FULL PROMENADE /COMPLETE VEHICLE CLOSURE	CONCEPT 4: TIMED PROMENADE	CONCEPT 5: PROMENADE /ONE-WAY ROADWAY

Traffic signals replacement*	\$2,500	\$2,500	n/a	\$2,500	\$2,500
Traffic signal removal	n/a	n/a	\$1,500	n/a	n/a
Roadway reconstruction	n/a	\$15,600	n/a	n/a	n/a
Lincoln & Upper Great Highway Intersection Improvements	n/a	\$2,000	\$1,500	n/a	\$1,500
Additional improvements (i.e. wayfinding signs, changeable message signs, speed tables)	n/a	\$156	\$196	\$175	\$114

* SFMTA has a project on hold to design and install these upgrades

For more detail about the baseline and Upper Great Highway improvements cost estimates, see Appendix C.

NETWORK IMPROVEMENTS DUE TO DIVERSIONS

Based on the analysis, staff expects that there are additional network improvements beyond the immediate Great Highway area. Some of these additional improvements are covered by existing projects.

Table 7 identifies potential costs for network improvements needed to reduce the impacts of the potential diversions. These are preliminary, planning level costs that would need to be updated as specific concepts moved forward. Costs for additional network improvements for Concept 2 are not included in this table as this scenario was not estimated due to the high costs needed on improving Upper Great Highway itself.

Table 7 Costs for Network Improvements Due to Traffic Diversions

Costs in \$M	CONCEPT 1: FOUR-LANE ROADWAY	CONCEPT 3: FULL PROMENADE/ COMPLETE VEHICLE CLOSURE	CONCEPT 4: TIMED PROMENADE	CONCEPT 5: PROMENADE/ ONE-WAY ROADWAY
Sunset/Sloat or Sunset/Lake Merced	n/a	\$0.5 – \$4.9	\$0.5 – \$4.9	
Lincoln/Upper Great Highway	n/a	\$0.1 – \$0.25	\$0.1 – \$0.25	\$0.1 – \$0.25
Lincoln/36th Ave	n/a	\$0 – \$0.3*		
Lincoln & 41st Ave	\$0.3 – \$2.1	\$0.3 – \$2.1	\$0.3 – \$2.1	\$0.3 – \$2.1
Subtotal of improvement costs	\$0.3 – \$2.1	\$1.7 – \$5.7	\$1.3 – \$5.4	\$0.4 – \$2.4

*need for improvement at Lincoln/36th Ave is only needed for the version of Concept 3 that also includes closure of Martin Luther King, Jr. Dr

ANNUAL OPERATING AND MAINTENANCE COSTS

Operating and maintenance costs are similar across most concepts (Table 8). Concept 4 notably has additional operating costs due to the need for SFMTA Parking Control Officers to provide oversight each weekend. Concepts that are expected to have more bicycle and pedestrians users require increased gardening, litter removal, restroom cleaning, and park ranger presence. These costs scale with the estimated number of visitors.

Table 8 Annual Operating and Maintenance Costs

COST DESCRIPTION	CONCEPT 1: 4-LANE ROADWAY	CONCEPT 2: 2-LANE 2-WAY ROAD + PROMENADE	CONCEPT 3: FULL PROMENADE	CONCEPT 4: TIME PROMENADE / 4-LANE ROADWAY	CONCEPT 5: ONE WAY ROADWAY + PROMENADE
Intersection open/closure	N/A	N/A	N/A	\$13,000	N/A
PCO oversight	N/A	N/A	N/A	\$457,600	N/A
Signal maintenance	\$45,000	\$45,000	\$10,000	\$45,000	\$45,000
Roadway maintenance	\$200,000	\$100,000	\$20,000	\$200,000	\$100,000
Structural maintenance	\$93,000	\$93,000	\$93,000	\$93,000	\$93,000
Street sweeping	\$255,000	\$255,000	\$255,000	\$255,000	\$255,000

Sand clearing	\$230,000	\$230,000	\$230,000	\$230,000	\$230,000
Recology garbage	100000	\$100,000	100000	100000	100000
Gardening/litter removal	446000	\$530,000	\$656,000	526000	\$530,000
Median landscaping	\$29,000	N/A	\$29,000	\$29,000	\$29,000
Restrooms/custodial	\$103,000	\$120,000	\$145,000	\$119,000	\$120,000
Security	N/A	\$22,000	\$55,000	\$21,000	\$22,000
SUBTOTAL	\$1,501,000	\$1,495,000	\$1,593,000	\$2,088,600	\$1,524,000

For more detail about the operating and maintenance cost estimates, see Appendix C.

SUMMARY OF COSTS

These estimates are cumulative of baseline and Great Highway Improvements for each scenario.

Table 9 Summary of Concept Costs

	BASELINE AND CAPITAL	NETWORK IMPROVEMENTS DUE TO DIVERSION	MAINTENANCE AND OPERATIONS
CONCEPT 1: FOUR-LANE ROADWAY	\$\$ \$5M	\$0.3 – \$2.1	\$1.5M
CONCEPT 2: PROMENADE/ TWO-WAY ROADWAY	\$\$\$\$ \$22.8M	Not explored due to high baseline & capital costs	\$1.5M
CONCEPT 3: FULL PROMENADE/ COMPLETE VEHICLE CLOSURE	\$\$ \$5.6M	\$1.7 – \$5.7	\$1.6M
CONCEPT 4: TIMED PROMENADE (WEEKENDS ONLY)	\$\$ \$5.2M	\$1.3 – \$5.4	\$2.1M
CONCEPT 5: PROMENADE/ ONE-WAY ROADWAY	\$\$ \$6.6M	\$0.4 - \$2.4	\$1.5M

3. Outreach Summary

3.1 | OUTREACH EVENTS

TOWN HALL IN NOVEMBER 2020

Project staff presented updates on traffic management for the Great Highway and five roadway configuration options for the long-term future of the Great Highway. Throughout the event, check points were held to provide the audience with opportunities to share questions and comments and to engage with poll questions.

There were approximately 500 attendees who participated in this outreach event.

OPEN HOUSE IN MARCH 2021

Project staff presented updates on the evaluation of the five concepts that were introduced at the November 2020 town hall during the first half of the event. The event also introduced concepts to improve transportation options in the Outer Sunset and Parkside Neighborhoods which will be summarized in the District 4 Mobility Study Final Report. The updates related to the Great Highway included a high-level synthesis of the responses from the survey and factors involved in the evaluation approach. The factors that were considered as part of the evaluation approach align with City policies and included climate change resiliency, well-being and health, transit first/sustainable mode choices, equity, Vision Zero, and economic vitality. Staff also presented the estimated costs associated with each of the concepts. Throughout the event, check points were held to provide the audience with opportunities to share questions and comments and engage with poll questions.

There were approximately 190 attendees who participated in this outreach event.

WHAT WE HEARD

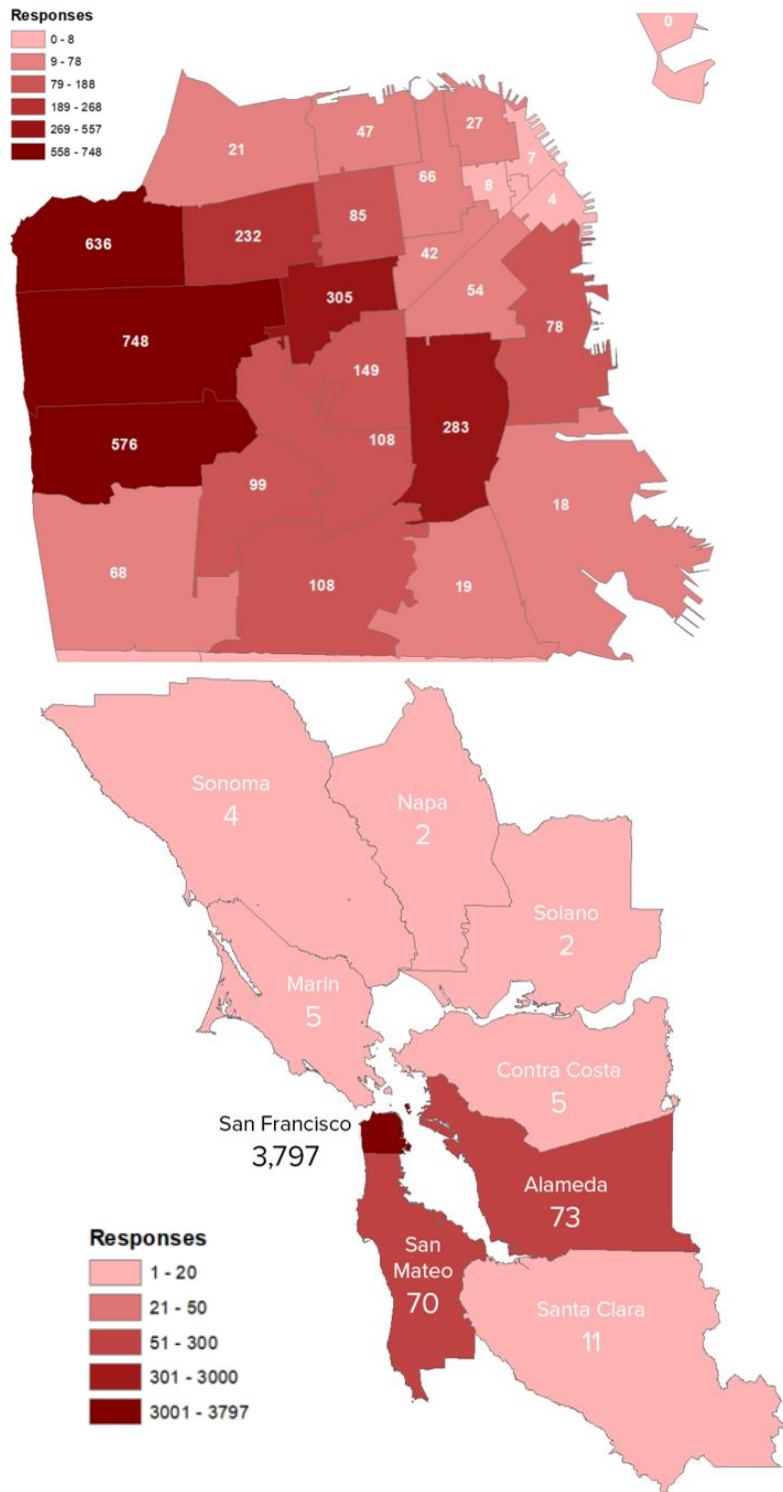
During the outreach events, common comments we received were related to the following topics:

- Impact of closure options on traffic and congestion
- Safety considerations for the Upper Great Highway and adjacent neighborhood streets
- Questions about the decision-making process for the future of the Upper Great Highway
- Questions about data collection and methods of the study

The project team has worked to provide more detail and insight to the above comments and questions through the evaluation factors and this report.

Following the November Town Hall, the Transportation Authority opened a public survey to gain an understanding of community preferences related to the configuration options for the long-term future of the Great Highway. The survey was distributed through our website, email, and social media and closed in January 2021. We received a total of 3,989 responses to the survey with about 95% of respondents described as residents of San Francisco (Figure 23).

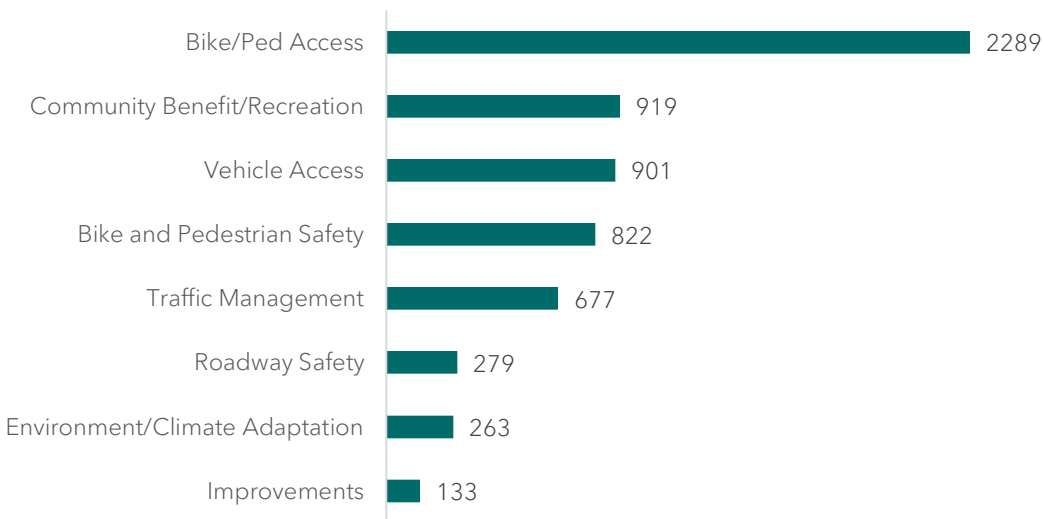
Figure 23 Respondents to Transportation Authority Survey by Zip Code



Respondent Priorities

As part of the survey, we asked residents about their priorities for the Upper Great Highway and the surrounding neighborhood (Figure 24). The residents identified a variety of topics including access, safety, parking and enforcement. After coding their feedback, we identified the following themes in order of highest to lowest total mentions. The most common priority shown in the responses was bicycle and pedestrian access, then community benefit and recreation, vehicle access, bike and pedestrian safety, and traffic management. Other topics mentioned include the following: Business/economics, Transit, Parking, Enforcement, Disability Access, and Wayfinding.

Figure 24 Respondents' Priorities for Upper Great Highway and Surrounding Neighborhood



Note: Many comments were coded as having multiple priorities, while some only mentioned a single priority. The data above contains some overlap where some comments fall into multiple categories.

Concept preferences

The most cited preferred concepts were Concepts 3 and 1, which represent a full promenade/vehicle closure and a full return of vehicles, respectively. About 53% of all respondents cited Concept 3 (full promenade) as their preferred scenario. Concept 1, returning to a four-lane roadway, was second most cited preference, with 21% of total responses.

About 33% of the total respondents were residents of the Sunset, while 16% were residents of the Outer Richmond. These two neighborhoods are located nearest to the Upper Great Highway. About 52% of residents of the Sunset expressed support for Concept 3 (Full Promenade), while 52% of Outer Richmond residents support Concept 1 (Four-Lane Roadway).

	ALL RESPONDENTS	SUNSET (94116/94122)	OUTER RICHMOND (94121)	OTHER SAN FRANCISCO RESIDENTS
CONCEPT 1: FOUR-LANE ROADWAY	21%	22%	52%	11%
CONCEPT 2: PROMENADE/TWO-WAY ROADWAY	10%	7%	10%	11%
CONCEPT 3: FULL PROMENADE	53%	52%	22%	64%
CONCEPT 4: TIMED PROMENADE	13%	15%	13%	12%

The project team focused on analyzing comments and concerns on the top two cited concepts, Concepts 1 and 3. The primary comments about Concept 1 (Four-lane roadway) were that:

- it is perceived as unsafe,
- bicyclists and drivers sharing the roadway is a safety issue, and
- it is seen as giving too much room for cars.

For Concept 3 (Full promenade), the main comments were that it:

- it is perceived as increasing traffic in the area,
- it could increase safety on the Upper Great Highway, and
- it could decrease safety on surrounding streets requiring traffic calming.

More details about the survey are available in Appendix D.

3.2 | PUBLIC PETITIONS

In response to the temporary promenade and planning efforts, the Transportation Authority and other City partners received several petitions. These petitions and their known number of signees are listed below. Related efforts were also organized, including a protest and a rally.

PETITIONS	NUMBER OF SIGNATURES
Open the Great Highway	8,141 (as of 6/9/21)
Open the Upper Great Highway	626 (as of 6/9/21)
Great Highway Park	~4,600 (as of 6/18/21)
Save Kid Safe Great Walkway	318 (as of 6/9/21)

3.3 | CORRESPONDENCE FROM THE PUBLIC

Throughout the course of the study, the Transportation Authority received over 1,200 emails. The sentiments of emails we received are summarized in the table below.

SENTIMENT	NUMBER OF EMAILS RECEIVED
In support of four-lane roadway	120
In support of full promenade	1,047
Other (questions, public records requests, alternative concepts)	39

4. Findings and Recommendations

4.1 | FINDINGS

The study team finds that partial and full promenade concepts are feasible in the long-term though each has tradeoffs between benefits, risks and costs.

- **Concept 3: Full Promenade/Complete Vehicle Closure**

- This concept has significant benefits of increased climate/change resiliency, recreation/open space, increased well-being associated with bicycle/pedestrian activity, and a more connected bicycle/pedestrian network.
- A full promenade also is a significant change that has different impacts on different groups. Some Sunset residents adjacent to the Upper Great Highway during the temporary closure to vehicles have experienced significant impacts in terms of additional traffic on local streets and speeding. Richmond residents have lost access to this route to access the Peninsula. SFMTA has made substantial investments in traffic calming on Outer Sunset streets. Further investment may be needed based on ongoing monitoring.
- From a network perspective, there is sufficient capacity to absorb the diversion of traffic from the Upper Great Highway, with Sunset Blvd able to absorb most of the diverted traffic. However, several intersections would experience increased vehicle delays and associated conflicts for all other modes.
- While costs of mitigations and improvements to the Upper Great Highway and adjacent areas are comparable to other concepts, this concept is expected to require the highest level of costs for network improvements to address the traffic diversion impacts (in the range of \$1.7 – \$5.7M). There are also schedule risks associated with delivering these improvements, due to the conceptual nature of these ideas and better understanding needed of site conditions at these locations.

- **Concept 4: Timed Promenade**

- This concept provides the recreation/open space and bicycle/pedestrian network benefits of the Full Promenade on a part-time basis (two days a week in a weekend only promenade).
- While this concept would only be operating on a part-time basis, it would still require significant improvements to other parts of the network to address impacts of traffic diversion on the weekends. These additional network improvements would cost in the range of \$1.3 – \$5.4M, close to the range of additional improvements needed for a Full Promenade. Decisionmakers would have to consider if the part-time benefits justify this potential cost.
- A Timed Promenade may be more useful as an interim step prior to a long-term decision to help alleviate traffic impacts that are expected in the peak weekday commute periods.

- **Concept 5: Promenade/One-Way Roadway**

- With this concept, there are fewer traffic impacts on southern end of the study area, but existing traffic issues would remain at Chain of Lakes Drive.

- There are some network improvements needed to address impact of traffic diversion. These improvements would be in the range of \$0.4 - \$2.4M, which is lower than the additional network improvement costs that accompany a Full Promenade or a Timed Promenade. Additional investment would be required at the intersections on each end on the Upper Great Highway to facilitate the travel of southbound vehicles on the current northbound lanes.
- Prior to intersection alignment needed on the two ends, a one-way southbound concept could be operable on the west side of roadway where the southbound lanes currently operate. In the long-term, the traffic should eventually be transferred to the existing northbound lanes to the east to support the strategy of managed retreat of infrastructure from the coast as outlined in the Ocean Beach Master Plan.

Our analysis focused on the activity and traffic levels consistent with pre-pandemic levels. We believe this does a good job of representing the next several years given relative stable traffic volumes in the Outer Sunset over time. However, the timing of the return to these levels is uncertain given changing population, employment, transit provision and telecommuting dynamics. One thing to note is that Transportation Authority post-COVID scenario testing work indicates that even the most dramatic changes to these factors is not likely to impact traffic volumes much on the west side of town.

4.2 | RECOMMENDATIONS

Considering the tradeoffs in our evaluation findings, staff recommends that a full promenade (Concept 3) or Promenade/One-way Roadway (Concept 5) be pursued in the long-term, assuming availability of funding to implement associated traffic, transit and safety mitigations and needed network improvements. We do not recommend a timed promenade for the long term because it has nearly all of the costs of the full promenade but only a portion of the potential benefits.

Through this evaluation, the project team has outlined the overall benefits and costs of each of these concepts and a number of improvement ideas that can be considered as short- and long-term decisions are made by RPD, SFMTA, and the Board of Supervisors.

MONITORING

Any closure will require both monitoring and further improvements. If the Upper Great Highway remains closed as part of a pilot, we recommend monitoring several metrics to help shape ongoing improvements and inform long-term decision-making:

- Safety: Collision incidents and trends on streets associated with the project Upper Great Highway, Lower Great Highway/La Playa, and other adjacent streets.
- Traffic: Volumes, delays, and vehicle queues issues at key intersections and corridors where Upper Great Highway traffic is expected to be diverted.
- Transit: Performance of 29 Sunset, 28 19th Avenue and 18 46th Avenue bus lines.
- Parking: availability of parking for local and visitor use, and need for time limit or price management.

We recommend identifying clear metrics and thresholds of performance to determine if an interim closure is working or not and, if needed, that a pilot be re-evaluated/re-designed as necessary in a timely way.

Potential metrics would include: crash/collision data, chronic increased traffic queueing (considering total

person-trips and not just vehicle trips for a given corridor, e.g. where HOV or bus priority measures are in place), and transit travel time increases/delays on the Muni 28 and 29 lines, as well as public feedback.

OTHER ISSUES

There is a separate effort by the city considering whether Martin Luther King, Jr. Drive in Golden Gate Park should be closed to vehicles in the long-term. We expect this area, especially at Chain of Lakes, to be impacted by traffic diversions from the Upper Great Highway. The ideas for additional network improvements needed for potential Great Highway promenade/vehicle closure scenarios should be considered in tandem with long-term decision-making for Martin Luther King, Jr Drive.

In addition, over the next few years, the 19th Avenue Combined City project will be underway. This is a long-overdue investment to replace the aging roadway infrastructure on Highway 1 -19th Avenue and will include ongoing construction through February 2023. While the project team expects most traffic to divert to other routes, the small addition of traffic in combination with the reduction of lanes during construction may cause further congestion and delay at key intersections on this corridor. The construction team is monitoring traffic impacts of the project. If traffic increases or changes in tandem with an Upper Great Highway pilot, this may call for adjustments to signal timing/phasing and lane configuration.

4.3 | NEXT STEPS

SFMTA and RPD will be considering the concepts, network improvement ideas, and findings in this report and are developing an outreach process to gather more public input for near-term design options for the Upper Great Highway. This effort began with a joint hearing of the RPD Commission and SFMTA Board of Directors on June 10, 2021. They will be conducting further analysis and collecting more community feedback to prepare to propose a near-term recommendation by fall 2021.

Any near-term or long-term action on the Upper Great Highway would need to be approved by the Board of Supervisors before it can be implemented.