ATTACHMENT A:

Richmond San Rafael Bridge Modified Pilot Evaluation Metrics and Benchmarks

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Prepared by the California Department of Transportation (Caltrans) Bay Area/District 4 Division of Traffic Operations

Introduction

On August 7, 2025, the San Francisco Bay Conservation and Development Commission (Commission) approved Amendment No. Six of BCDC Permit No. 1997.001, authorizing modifications to the previously approved pilot for a multi-use path on the westbound upper deck of the Richmond-San Rafael Bridge (Bridge). As a condition of approval, the Commission required Caltrans, the permittee, to prepare a Performance Thresholds and Alternatives Analysis by December 31, 2026. The purpose of the analysis is to establish performance thresholds to be used to measure the significance of any observed changes in Bridge operations (including any potential public safety issues or use conflicts) that can be attributed to the implementation of the multi-use pathway in the context of the benefits of providing public access, and meaningfully compares the effects and performance of different alternatives for providing public access on the Bridge.

As noted above, Amendment No. Six permits and modifies the continuation of uses originally authorized as part of a pilot project that was the subject of Amendment No. Four, hereafter referred to as the Original Pilot. Amendment No. Six includes a three-year extension of the use of the pre-existing shoulder on the westbound upper deck to pilot an accessible multi-use public access pathway, with a modified schedule, hereafter referred to as the Modified Pilot.

This document outlines the performance thresholds, as required by the Commission, which have been jointly developed, and will be monitored and reported by Caltrans with the input and assistance of the Bay Area Toll Authority (BATA). In developing these thresholds and benchmarks, Caltrans relied upon the evaluation of the Original Pilot that was developed by the Partners for Advanced Transportation Technology (PATH) at the University of California, Berkeley, titled *After Study for the Richmond-San Rafael Bridge (Phase II)*, hereafter referred to as the PATH Report. The PATH Report compares conditions observed during the Original Pilot against conditions that existed before the Original Pilot (pre-pilot conditions).

Please note, the performance of any metric relative to an identified benchmark is not necessarily a statement of whether the condition is "acceptable." This will be determined through a threshold analysis process that will be conducted with stakeholders.

Summary Tables

Table 1 summarizes the proposed metrics and preliminary benchmarks for the Performance Thresholds and Alternatives Analysis.

Table 2 summarizes findings to date for the original pilot and pre-pilot conditions and proposed data sources for the modified pilot.

Table 1: Richmond-San Rafael Bridge Modified Pilot Evaluation Metrics and Benchmarks Summary

What is being measured?	Why are we measuring this?	Metric	Preliminary Benchmark[1]	Explanation of Benchmark	Interpretation of Benchmark[2]
Weekday peak hour traffic volumes	Allows comparison to original pilot and pre-pilot conditions to show whether and how much a shoulder or bike path directly impacts the number of vehicles that are able to cross the bridge during peak hours.	Average weekday peak hour flow in vehicles per hour (vph)	3,400 vph	Based on predicted traffic volumes based on flows observed pre-pilot and traffic demand observed during the Original Pilot.	Flows observed above the benchmark may indicate that traffic is moving across the Bridge at a faster rate than they were during the Original Pilot, and that the increased flow may be a result of replacing the path with the shoulder. Flows observed at or below the benchmark may indicate that the presence of the shoulder does not increase traffic flows.
Travel time on the **westbound bridge approach (**from the I-80 interchange in Albany to the toll plaza)	Allows comparison to Original Pilot and pre-pilot conditions to show whether and how much a shoulder or bike path impacts the amount of time it takes to drive the westbound bridge approach.	Minutes (min)	**Weekdays**: 25 min peak, 7 min off-peak **Weekends**: 10 min peak, 6 min off-peak	Benchmark is the observed average travel times during the Original Pilot.	Times observed below the benchmark may indicate that travelers are moving more quickly through the corridor than they were during the Original Pilot, and that the decreased travel time may be a result of replacing the path with the shoulder. Flows observed at or above the benchmark may indicate that the presence of the shoulder does not decrease travel times.
Travel time across the **bridge** (from the toll plaza exit to the western bridge touchdown)	Allows comparison to Original Pilot and pre-pilot conditions to show whether and how much a shoulder or bike path impacts the amount of time it takes to drive across the bridge.	Minutes (min)	**Weekdays**: 7 min peak, 4 min off-peak **Weekends**: 5 min peak, 4 min off-peak	Weekday benchmarks are based on what was observed during pre-pilot conditions. Weekend benchmarks are based on what was observed during the Original Pilot	Times observed below the benchmark may indicate that travelers are moving more quickly across the bridge than they were during the Original Pilot, and that the decreased travel time may be a result of replacing the path with the shoulder. Flows observed at or above the benchmark may indicate that the presence of the shoulder does not decrease travel times.
Impact of schedule limitation on weekday cyclists	To understand whether those using cycling as an alternative to driving during the week are shifting transportation modes as a result of the modified pilot's schedule limitations.	Number of shuttle riders vs. number of cyclists during the Original Pilot	TBD	Benchmark to be determined based on the number of cyclists using the bridge on weekdays during the Original Pilot, in combination with results of surveys conducted as part of the environmental justice analysis and ongoing evaluation of the shuttle service.	If fewer cyclists are crossing the bridge using the shuttle than the benchmark, it may indicate that individuals who might otherwise have chosen cycling as a commute method cyclists and potential cyclists are instead choosing to drive or use transit due to the change in path availability. If the number of cyclists is equal to or above the benchmark, it may indicate that the shuttle service serves to accommodate at least as many cyclists as the path did during the Original Pilot.

What is being measured?	Why are we measuring this?	Metric	Preliminary Benchmark[1]	Explanation of Benchmark	Interpretation of Benchmark[2]
Weekend path usage	Can indicate whether there continue to be trends that are increasing usership of the path over time, such as growing awareness of the path; growing interest in cycling, walking, or jogging generally; effectiveness of the off-site network improvements funded by Caltrans and BATA during the pilot period; and whether those using the bridge as a means of recreation during the week are shifting their use of the bridge to the weekend as a result of the modified pilot's schedule limitations.	Total number of cyclists entering the bridge per day	**Summer**: 480 **Winter**: 300	Benchmark is the peak weekend usage observed during the Original Pilot.	If more members of the public are entering the bridge on weekends, it may indicate that individuals who used the bridge for recreation on weekdays have shifted their usage to weekends. It may also indicate a trend towards increased usership of the bridge for recreation or weekend travel.
Impact of shoulder on road user safety	Allows comparison to the Original Pilot conditions to show whether the physical presence of the path or shoulder contributes to an increase or decrease in the frequency of crashes.	Crash rate (number of crashes per vehicle miles traveled on the bridge)	TBD	Benchmark is the crash rate observed during the Original Pilot. Currently TBD as the crash data is available through 12/31/2024 only. Benchmark will be adjusted as new data through 10/27/2025 becomes available. (Note: 10/27/2025 is the date when pilot modifications were implemented).	Crash rates observed below the benchmark may indicate that fewer crashes may occur as a result of configuring the bridge with a shoulder rather than a path. Crash rates observed at or above the benchmark may indicate that the path does not cause more crashes than the shoulder.
Impact of incidents on travel times	Allows comparison to the Original Pilot and pre-pilot conditions to show whether and how much the shoulder or bike path impacts the amount of time an incident adds to travel times across the bridge and corridor.	Incident clearance time in minutes (min)	90 min	Benchmark is a Statewide standard since May 30, 2003.	It is measured as time taken from notification to Caltrans to clearance of the incident from the travelled way. If incident clearance time is 90 minutes or below in any scenario, then responders are able to meet the Caltrans standard.

Notes:

1. Note that "benchmarks" are not "thresholds." Benchmarks are intended to provide a reference point to contextualize the data collected and are not intended to be a statement of whether or not a condition is "acceptable." Thresholds that establish whether or not a condition is "acceptable" or "not acceptable" will be developed as part of the Performance Thresholds and Alternatives Analysis that will incorporate findings from the Environmental Justice Analysis and further stakeholder involvement.
2. All interpretations provided in this table are hypothetical for the purpose of illustrating how the benchmarks may be used as part of analyzing the data collected. The data will need to be interpreted in terms of statistical significance, and any other potential influencing factors will need to be identified and discussed prior to drawing any conclusions regarding cause and effect.

Table 2: Summary of Data Sources by Scenario/Condition

Metric	Preliminary Benchmark	Pre-Pilot Conditions	Original Pilot Conditions	Modified Pilot Conditions: With Shoulder/ Weekday Peak	Modified Pilot Conditions: With Path/ Weekends and Holidays
Average weekday peak hour flow in vehicles per hour (vph)	3,400 vph	Caltrans Performance Measurement System (PeMS)	PeMS, toll booth counts	PeMS, toll booth counts	PeMS, toll booth counts
Minutes (min)	**Weekdays**: 25 min peak, 7 min off-peak **Weekends**: 10 min peak, 6 min off-peak	INRIX (a transportation analytics service that collects data from connected vehicles and mobile devices to provide information on traffic patterns such as speeds and travel times.)	INRIX	INRIX	INRIX
Minutes (min)	**Weekdays**: 7 min peak, 4 min off-peak **Weekends**: 5 min peak, 4 min off-peak	INRIX	INRIX	INRIX	INRIX
Number of shuttle riders vs. number of cyclists during the Original Pilot	TBD	N/A	Eco-Sensor	Shuttle Data	N/A
Total number of cyclists and pedestrians entering the bridge per day	**Summer**: 480 **Winter**: 300	N/A	Eco-Sensor	n/a	Eco-Sensor
Crash rate	TBD	N/A	N/A	TASAS	TASAS
Incident clearance time in minutes (min)	90 min	Daily incident reports from CHP/Toll Bridge Logs from 2012-2018	Daily incident reports from CHP/Toll Bridge Logs from 2018-2025	Daily incident reports from CHP/Toll Bridge Logs from October 2025 - October 2027	Daily incident reports from CHP/Toll Bridge Logs from October 2025 - October 2027

Description of Metrics and Benchmarks

This section includes detailed descriptions of the proposed metrics and preliminary benchmarks.

Weekday Peak Hour Traffic Volumes

Why are we measuring this? Allows comparison to Original Pilot and pre-pilot conditions to show whether and how much a shoulder or bike path directly impacts the number of vehicles that are able to cross the bridge during peak hours.
Metric: Vehicles per hour (vph)
Preliminary benchmark: 3400 vph
Explanation of benchmark: During the weekdays the Bridge is expected to operate in a manner similar to pre-pilot conditions. This volume is an average of what was observed during pre-pilot conditions (refer to Figure 8-10 in the PATH Report, p. 83).
Data sources by scenario: Toll plaza count data; Caltrans Performance Measurement System (PeMS), which extracts data from the traffic monitoring system on the bridge.
Notes: Caltrans traditionally uses peak hour volumes to determine the need for roadway capacity. While hourly data can be provided, Caltrans believes that focusing on peak hour performance is the most appropriate approach. The RSR Forward Open Road Tolling (ORT) project will remove the structures at the toll plaza which will affect the flow of traffic onto the bridge. This could potentially lead to higher volumes across the bridge. It is recommended that the benchmark be re-evaluated after ORT is implemented due to this potential impact.

Travel Time along the Westbound Bridge Approach

Why are we measuring this? Allows comparison to original pilot and pre-pilot conditions to show whether and how much a shoulder or bike path impacts the amount of time it takes to drive the westbound bridge approach.
Metric: Travel time on the I-580 corridor, which extends from the I-80 interchange in Albany to the toll plaza (approximately 6.4 miles).
Preliminary Benchmark: Weekdays: 25 min. during peak periods, 7 min. during off-peak periods; Weekends: 10 min. during peak hours, 6 min. during off-peak periods.
Explanation for benchmark: The PATH Report indicates there was little impact from the Bridge operations on the performance of the approach and the main influence was the reduction in traffic volumes due to the COVID-19 pandemic. Therefore, the benchmarks are based on an average of what was observed during the Original Pilot. (Refer to Figures 8-61, 8-62, and 8-63 from the PATH Report, p.115.) Travel time on the bridge approach is being measured separately from travel time on the bridge to allow for further analysis of

other factors that may affect travel times. As noted above, any delays in the corridor related to the path or the shoulder would be indirect impacts related to back-ups as the Modified Pilot is not being implemented along this segment.

Data sources by scenario: INRIX (INRIX is a transportation analytics service that collects data from connected vehicles and mobile devices to provide information on traffic patterns such as speeds and travel times.)

Notes: The toll plaza serves as a major bottleneck and results in much of the delay seen along the westbound bridge approach. The RSR Forward Open Road Tolling (ORT) project will remove the structures at the toll plaza which will affect the flow of traffic onto the bridge. This could potentially lead to increased travel times across the bridge. It is recommended that the benchmark be re-evaluated after ORT is implemented due to this potential impact.

Travel Time Across the Bridge

Why are we measuring this? This metric compares the Modified Pilot, Original Pilot, and pre-pilot conditions to show whether and how much a shoulder or bike path impacts the amount of time it takes to drive across the Bridge.

Metric: Travel time across the bridge, which extends from the toll plaza exit to the western touchdown of the bridge (approximately 5.5 miles).

Preliminary Benchmark: Weekdays: 7 min. during peak periods, 4 min. during off-peak periods; Weekends: 5 min. during peak periods, 4 min. during off-peak periods.

Explanation for benchmark: During the weekdays the Bridge is expected to operate in a manner similar to the pre-pilot conditions and on weekends the Bridge is expected to operate in a manner similar to the Original Pilot. These benchmarks are averages of data shown in the PATH Report; weekday benchmarks are based on what was observed during pre-pilot conditions while weekend benchmarks are based on what was observed during the Original Pilot (refer to Figures 8-73, 8-74, and 8-75 from the PATH Report, pp. 121-122).

Data sources by scenario: INRIX

Notes: The PATH Report shows that the path seems to have had minimal impact on travel times across the bridge during the Original Pilot. The toll plaza serves as a major bottleneck upstream of the bridge. The RSR Forward Open Road Tolling (ORT) project will remove the structures at the toll plaza and could potentially lead to higher volumes across the bridge due to improved flow of traffic. This could potentially lead to increased travel times depending on the increase in traffic volumes. It is recommended that this benchmark be re-evaluated after ORT is implemented due to this potential impact.

Impact of Schedule Limitation on Weekday Cyclists

Why are we measuring this? To understand whether those using cycling as an alternative to driving during the week are shifting transportation modes as a result of the Modified Pilot's schedule limitations.

Metric: Number of shuttle riders during the Modified Pilot vs. number of cyclists during the Original Pilot

Preliminary Benchmark: TBD

Explanation for benchmark: Benchmark is to be determined based on the number of cyclists using the bridge on weekdays during the Original Pilot, in combination with results of surveys conducted as part of the environmental justice analysis and ongoing evaluation of the shuttle service.

Data sources by scenario: Shuttle usage data

Notes: A comparison to the Original Pilot is not entirely possible as the shuttle will only carry full trips across the entire Bridge and does not operate 24/7. Not all trips observed during the Original Pilot may have involved a full trip across the Bridge, and some trips occurred outside of the shuttle's current operating hours. Other factors to consider are that not all shuttle riders may be cyclists, not all weekday cyclists were commuters who needed to travel the Bridge during the week, and the number of people who may have chosen to cycle to commute today who did not cycle during the original pilot is currently unknown.

Weekend Path Usage

Why are we measuring this? This data can indicate whether there continue to be trends that are increasing usership of the path over time, such as growing awareness of the path; growing interest in cycling, walking, or jogging generally; effectiveness of the off-site network improvements funded by Caltrans and BATA during the pilot period; and whether those using the bridge as a means of recreation during the week are shifting their use of the bridge to the weekend as a result of the modified pilot's schedule limitations.

Metric: Total number of bicyclists entering the Bridge per day on Saturdays and Sundays

Preliminary Benchmark: Cyclists Per Day: 480 in summer, 300 in winter

Explanation for benchmark: Page 58 of the PATH Report states that the peak weekend usage on the path occurred on Saturdays, with westbound and eastbound averages of 264 and 219 cyclists per day, respectively, during the summer and westbound and eastbound averages of 177 and 135 cyclists per day, respectively during the winter. These figures were added up and rounded to 480 cyclists per day in the summer and 300 cyclists per day in the winter. While the path will be in operation on Thursday from 2 PM and all day on Fridays, the proposal is only to focus on bicyclists entering the Bridge on Saturdays and Sundays in order to provide a direct comparison with the weekend usage rates seen in the Original

Pilot. These benchmarks currently serve as placeholders. More refined benchmarks will be developed based on further observations, surveys conducted as part of the environmental justice analysis, and stakeholder engagement.

Data sources by scenario: Counting equipment installed for the Original Pilot.

Notes: The number of weekend trips may be expected to increase since this will be the only time access is available. Some trips may involve people only traveling partially across the span and returning, versus crossing the full span. Lack of collection equipment may cause some trips to be missed if they only go partially across the span. Other factors to consider are that usership may have continued to trend upward regardless of whether the schedule modifications had taken place, and that some recreational users may have previously used the Bridge for recreation both on weekdays and weekends and would not have the ability to shift their usage.

Impact of shoulder on road user safety

Why are we measuring this? To assess whether having a highway shoulder lane has a material impact on improving safety across the bridge. Crash rate when the bike path i.e., no highway shoulder, was in place on Mondays, Tuesdays, and Wednesdays from 10/27/24 - 10/26/25 will be compared to the crash rate when there is a highway shoulder in place on Mondays, Tuesdays, and Wednesdays from 10/27/25 - 10/26/26.

Metric: Crash rate (number of crashes per vehicle miles traveled along the stretch of the roadway where rate is being calculated)

Preliminary Benchmark: TBD

Explanation for benchmark: A "crash" is a collision between objects, such as one vehicle with another, or a vehicle with an obstacle. Proposed benchmark is the crash rate observed during the Original Pilot before the hours of operation for the multi-use path were modified. Crash rate is a standard rate used by Caltrans to identify if a facility needs any safety improvements and is calculated as follows:

$$\text{Crash Rate} = \frac{(\text{Number of Crashes}) \text{ x } (1{,}000{,}000)}{\text{Vehicle Miles Traveled}}$$

$$\text{Vehicle Miles Traveled} = \left(\frac{\text{Vehicles}}{\text{Day}}\right) \text{x} \left(\frac{365 \text{ Days}}{\text{Year}}\right) \text{x} \left(\frac{1 \text{ Year}}{1}\right) \text{ x } \left(\frac{\text{Miles of roadway}}{1}\right)$$

Data sources by scenario: Traffic Accident Surveillance and Analysis System (TASAS).

Notes: Preliminary benchmark is TBD as the crash data is currently available through 12/31/2024 only. Benchmark will be adjusted as new data through 10/27/2025 becomes

available (note that 10/27/2025 is the date when the pilot modifications were implemented).

Improvement in response to incidents

Why are we measuring this? To assess whether having a highway shoulder lane reduces the incident clearance times in the corridor.

Metric: Incident clearance time (measured as time taken from notification to Caltrans to clearance of the incident from the travelled way). See Figure 1 below.

Preliminary Benchmark: 90 minutes

Explanation for benchmark: An "incident" is any distinct event affecting the travelled way, such as a crash, fire, shooting, hazardous material spill, disabled vehicle, or any other natural or human-made disasters. To reduce non-recurrent congestion and secondary crashes, Since May 30, 2003, Caltrans, with support from California Highway Patrol (CHP), has established a goal of 90 minutes to clear State highways after an incident has been reported. Incidents will be analyzed to find out not only how long it takes for traffic flow to return to normal conditions but also how often the incidents negatively impact traffic flow.

Data sources by scenario: CHP Computer-Aided Dispatch (CAD) system and Toll Bridge Logs document incident notification and clearance time. In some instances, incident notification/clearance time or incident details may be approximate due to limited information available.

Notes: Incident clearance comprises of several incident components as seen below. Efficient incident management increases safety, improves traffic operations, and overall roadway system performance for compliance with FHWA requirements.

Figure 1: Incident Components