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Technical Memorandum

February 13, 2023

Project# 24846.01

To: Gail Payne,
Senior Transportation Coordinator

City of Alameda, CA

From: Kittelson & Associates, Inc.

RE: Clement/Tilden Way Extension Recommended Alternative Technical Memo

INTRODUCTION

Kittelson & Associates Inc. (Kittelson) is supporting the city of Alameda with the Clement Avenue Extension and Tilden Way project (project). This memo provides technical and analysis details on the recommended alternative. This memo identifies project intended outcomes and relates the recommended alternative to the intended outcomes—including safety and mobility effects of the project. The memo is organized as follows:

- Project Intended Outcomes
- Recommended Alternative
- Mobility
- Safety and Speed Reduction
- Truck Access
- Miller-Sweeney Bridge Operations
- Evacuation Scenarios
- Next Steps

PROJECT INTENDED OUTCOMES

The Clement Avenue Extension/Tilden Way project uses the abandoned railroad right-of-way along the eastern terminus of Clement Avenue and Tilden Way to extend the Cross Alameda Trail between Broadway and the Miller-Sweeney/Fruitvale Rail Bridges. The project also considers ways to improve the truck and bus mobility and access in this area. The project connects directly to the City's Clement Avenue Complete Street project, and to the City of Oakland's planned and funded Fruitvale Avenue improvements. In 2017, the Alameda County Transportation Commission awarded a grant to the City of Alameda for $8.4 million to implement this project. This project is funded by Measure BB, Alameda County's transportation sales tax.

Intended project outcomes have been developed based on review of the City's Mobility Element, existing conditions, and community and stakeholder input.

Project intended outcomes have been identified as follows:

- Improve and prioritize safety for all road users. Promote safety by prioritizing the city's Vision Zero goals, reducing the fatal and serious injury crashes to zero within the study area
- Provide mobility for all modes (including AC Transit buses and trucks).

- Improve bicycle and pedestrian access to/from the Cross Alameda Trail and the Miller-Sweeney Bridge.
- Reduce the speeds and change the posted speed limit from the current 35 miles per hour to 25 mph through roadway design changes.
- Comply with City plans and policies (including the Mobility Element, Vision Zero Plan, and ATP).
- Provide flood reduction and landscaping opportunities.
- Reduce greenhouse gas emissions.

RECOMMENDED ALTERNATIVE

Kittelson worked with the City to develop and analyze alternatives and ultimately to select the preferred alternative. As previously described, a key goal of the project is to promote safety for all users. Therefore, Kittelson iteratively revised the proposed lane configurations to match the intersection size to its mobility needs and to avoid "overbuilding." The operations analysis results for the existing conditions demonstrated excess capacity in the system, even in the weekday peak hours. Therefore, the project team explored a lane reduction along Tilden Way from a four-lane cross section to a two-lane cross section, with a reduced lane configuration signal at Tilden/Broadway and at Tilden/Blanding/Fernside.

The concepts also incorporate bicycle, pedestrian, and multi-use facilities and do not change residential or commercial driveway access along approaching roadways. The project team developed preliminary concepts and ultimately narrowed alternatives to two options, both of which included a single-lane roundabout at Tilden/Blanding/Fernside. The recommended alternative includes a westbound right-only vehicle extension of Clement Avenue from Tilden Way to Broadway.

Figure 1 shows the draft concept for the recommended alternative. The sections that follow explain concept analysis and evaluation details related to the intended outcomes.

Figure 1: Recommended Alternative Concept

MOBILITY

Traffic and Multimodal Volumes

As described in the existing conditions memo, Kittelson analyzed an operations model describing motor vehicle mobility and delay in existing conditions. The existing conditions analyzed represent a "return to pre-pandemic" traffic condition created by adjusting March 2022 traffic counts upward by approximately 25 percent. However, a comparison over time of all-day counts taken along Tilden Way (Table 1) indicates that, nearly three years after the initial onset of the COVID-19 pandemic, daily traffic volumes continue to be lower than observed 2017 count levels. Therefore, the adjusted existing conditions represent a conservative representation of existing traffic volumes.

Table 1: All-Day Traffic Volumes over Time, Tilden Way near Miller-Sweeney Bridge

Collection Date	All-Day Bidirectional Vehicle Volumes	Percent Change, Compared to 2017
March 2017	23,825	-
March 2022	16,846	-29%
December 2022	15,350	-36%

OPERATIONS ANALYSIS

Vehicle mobility and operations was assessed for the project conditions, which includes:

- Lane geometry (reduction) and signal timing changes at the Broadway/Tilden intersection.
- A single-lane roundabout at the Fernside/Blanding/Tilden intersection and right-in/right-out restrictions at Fernside/Pearl.
- The Clement Avenue one-way (westbound) vehicle extension and all-way stop control at Broadway/Clement (and rerouted traffic to account for drivers taking the Clement Avenue extension rather than previously routes).

The mobility analysis identifies operational characteristics of the study intersections. All operations analyses described in this memo were performed in accordance with the procedures stated in the 6th *Edition Highway Capacity Manual* (HCM 6th Edition) using Synchro 11 SIDRA or software. Peak 15-minute flow rates were used in the evaluation of all intersection levels of service to provide analyses based on a worst-case scenario. For this reason, the analyses reflect conditions that are only likely to occur for 15 minutes out of each average peak hour.

Table 2 shows the comparative average delay at each intersection in the project study area. Overall, the average vehicle travel delay generally shows modest decreases: at all but one intersection, average travel

time delays are decreased by between two to 10 seconds with a two-second increase at Broadway/Tilden.

Table 2: Existing Traffic Conditions (with Adjusted Traffic Volumes)

Study Intersection		Traffic Control	Existing Conditions	Project Conditions
			Delay (s)	Delay (s)
1	Broadway/Blanding Avenue	AWSC	17	15
2	Broadway/Clement Avenue	TWSC / AWSC	16	11
3	Broadway/Tilden Way	Signalized	35	37
4	Broadway/Eagle Avenue	TWSC	11	12
5	Fernside Boulevard/Blanding Avenue/Tilden Way	Signalized / Roundabout	39	29
6	Fernside Boulevard/Pearl Street	TWSC	16	11

AWSC = All-Way-Stop-Control
LOS = Intersection level-of-service (signalized and AWSC) / Critical approach level-of-service (TWSC)

Figure 2 shows a comparison of the median and 95th percentile queue lengths in the existing condition with and without the proposed project changes. As previously explained, the "existing condition" represents a conservative adjustment to anticipate up to 25 percent future growth compared to 2022 traffic volume levels, and the modeled project condition uses those same traffic volumes with routing adjustments to account for project changes with the Clement Avenue extension and the Pearl Street turn restrictions.

At Broadway/Tilden, the project condition shows negligible changes to queue lengths with the lane reductions given a more efficient signal phasing and the elimination of some turn movements. At Fernside/Blanding/Tilden, the project condition extends the average queues along Tilden Way in both directions but reduces the queue lengths on the Blanding Avenue and Fernside Boulevard approaches, given the roundabout operations which allows drivers to enter the intersection when gaps are available rather than to wait for a green signal indication. The queue lengths approaching the intersection on Tilden Way from the bridge are longer, and the 95th percentile queue length extends to the bridge. The 95th percentile queue length represents the worst (i.e., most congested) 5 percent of traffic conditions expected to occur within the peak hour, which is already adjusted upward with the use of a peak factor to approximate the peak 15 minutes within the hour. Therefore, this 95th percentile condition could be expected to occur up to three to five minutes per day.

Figure 2: Queue Lengths Analysis -- Existing Conditions with Project

RESILIENCE AGAINST FUTURE VOLUME GROWTH

The mobility analysis included additional conservative future growth estimates in addition to the previously described existing conditions adjustments. Using the Alameda County Travel Demand model, the project team analyzed potential future traffic growth up to and including a scenario that includes approximately 60 percent traffic growth over 2022 volumes. In such a future scenario, travel delays could increase to an average of, for example, 91 seconds per vehicle at the Fernside/Blanding/Tilden intersection.

External factors would likely prevent traffic at the study intersections from increasing by 60 percent. Some limiting factors include capacity constraints elsewhere in the transportation network (on the Oakland side of the Miller-Sweeney Bridge and at other points within the City leading to the study intersections), continued telecommuting, and new transportation technologies. As previously described, traffic volumes in the area have actually decreased from 2017 to 2022.

However, in the event that future traffic volume increases create vehicle queues that negatively affect traffic operations in the project area, entrance metering is a solution that could be deployed at the Fernside/Blanding/Tilden intersection. Roundabout entrance metering has been successfully deployed for at least four roundabouts in the United States, including by the Washington Department of Transportation.[1] Figure 3 demonstrates the concept.

[1] More information is available at https://www.youtube.com/watch?v=ieKxXKtOADs&ab_channel=wsdot.

Figure 3: Roundabout Metering Example

(a) Detectors installed on the north leg indicate a queue extending past a certain distance, triggering a red indication on the east leg

(b) The east leg can return to green or "pulse," allowing one vehicle at a time, until the north leg queue has cleared.

Source: Washington Department of Transportation

SAFETY AND SPEED REDUCTION

One of the primary intended outcomes of the proposed project is to improve and prioritize safety for all road users, including to reduce the speeds and change the posted speed limit on Tilden Way from the current 35 mph to 25 mph through roadway design changes.

Two of the major changes the project represents are the roundabout at Fernside/Blanding/Tilden and the lane reduction along Tilden Way. Research has demonstrated safety and speed reduction benefits for both:

- Roundabouts have been shown to reduce fatal and injury crashes by up to 78 percent when converted from a traffic signal. The chief explanations for these reductions are a reduction in speeds (which lowers the severity of any potential conflicts and increases drivers' ability to react to the given conditions) and a reduction in the type and severity of conflicts (e.g., no left-turn, head-on, or perpendicular angle conflicts).[2]
- Roadway reconfigurations, commonly referred to as "road diets," have demonstrated up to a 47 percent reduction in total crashes where 4-lane roadways have been reduced to a single lane in each direction. The treatment has a demonstrated traffic calming and speed consistency effect.[3]

The project also includes raised crossings on the north leg of the proposed roundabout (along Blanding Avenue) and along the Clement Avenue extension. Raised crossings vary in design but are designed to reduce vehicle speeds and promote yielding, thereby improving safety for all users and improving the crossing conditions for people biking or walking along these crossings. Raised crosswalks have demonstrated up to a 46 percent reduction in vehicle/pedestrian crashes.[4]

TRUCK ACCESS

Another intended project outcome is to comply with the City's Mobility Element, including completing the City's truck route network (see **Error! Reference source not found.**). Tilden Way and Clement Avenue are part of the City's truck route network, with the Miller-Sweeney Bridge serving connections from Oakland to areas south of the project area and to destinations west along Clement Avenue. In existing conditions, truck drivers cannot make the connection from Tilden Way to Clement Avenue directly.

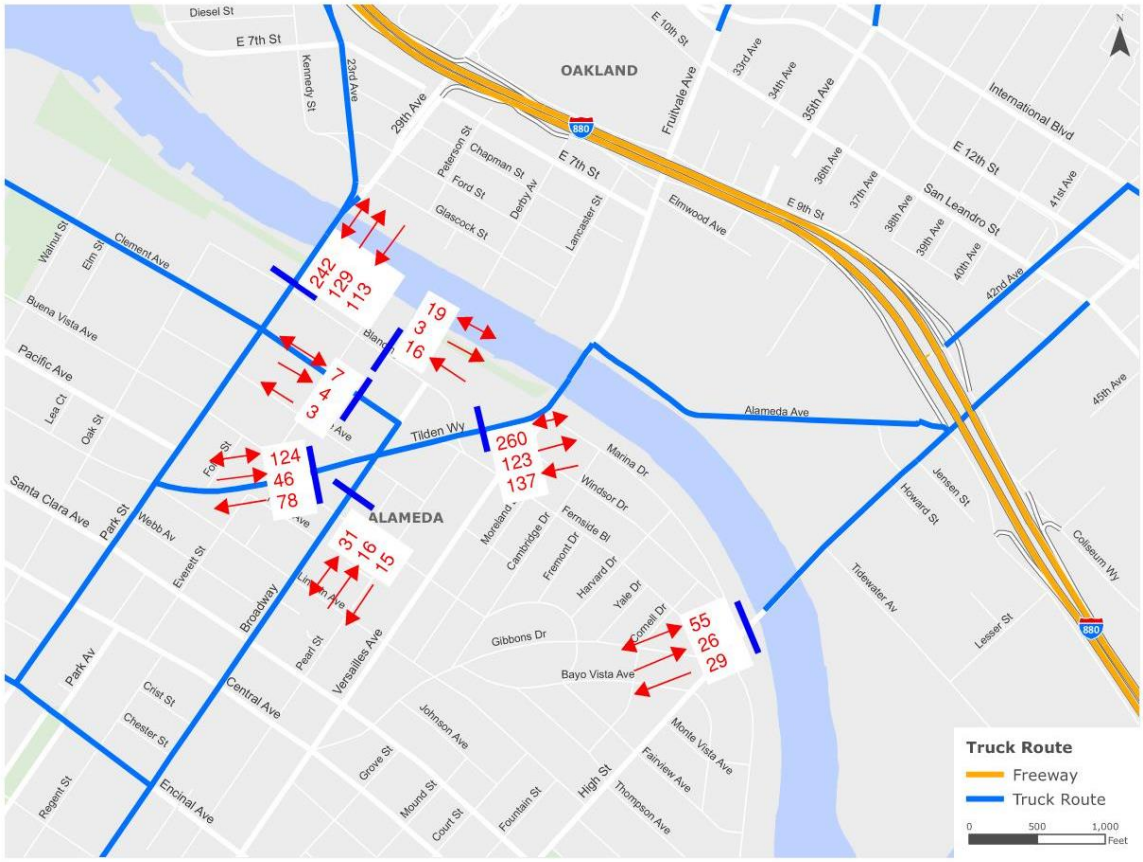
The project team collected all-day truck counts for three days in December 2022 to assess how truck drivers are traveling to, from, and within the project study area and what benefit a Clement Avenue extension may provide. Figure 4 shows daily average counts of large trucks (i.e., trucks towing trailers) at seven locations in or near the project study area.

[2] https://highways.dot.gov/safety/proven-safety-countermeasures/roundabouts

[3] https://highways.dot.gov/safety/proven-safety-countermeasures/road-diets-roadway-configuration

[4] Elvik, R. and Vaa, T., "Handbook of Road Safety Measures." Oxford, United Kingdom, Elsevier, (2004)

Figure 4: All-Day Counts, Trucks with Trailers



The counts show similar levels of large truck traffic along the Park Street Bridge (242 daily) and the Miller-Sweeney Bridge (260 daily). More truck drivers travel into Alameda and out on the Miller-Sweeney Bridge; conversely, more drivers leave Alameda than enter on the Park Street Bridge. The Park Street Bridge offers trucks more direct northbound freeway connections than the Miller-Sweeney Bridge.

Because westbound truck drivers cannot make a direct connection to Clement Avenue from the Miller-Sweeney Bridge, they appear to have three basic alternatives:

- **Use Park Street Bridge from Oakland to Alameda**, traveling along Park Street (which is a High Injury Corridor) to access Clement Avenue and other destinations. Up to 113 large truck drivers are entering the City on the Park Street bridge, but it is not clear from the data how many then access Clement or would use the Miller-Sweeney Bridge to do so with a direct Clement extension.
- **Use Miller-Sweeney Bridge and take a right at Blanding Avenue**, either traveling along Blanding to Broadway and then Clement, or traveling along Blanding to Park Street (increasing volumes on the High Injury Corridor) to make the connections west. Clement Avenue carries a lower large truck volume than Blanding Avenue (which is not on the truck route), indicating that some truck drivers (up to 16 per day) are taking this indirect route.
- **Use Miller-Sweeney Bridge and travel further south along either Tilden Way or Broadway** to make a westbound connection, increasing travel distance. Up to 93 large truck drivers are traveling south along one of these two roads per day. Some may opt to use a Clement Avenue extension were it available to them to reach destinations west and south, but it is not apparent what portion would make use of that connection.

In summary, the Clement Avenue westbound vehicle extension would complete the proposed truck route network and would provide redundancy for large trucks traveling to Alameda and westbound from the project area. The data show that a direct Clement Avenue extension would provide direct connections for up to 16 daily large truck trips that are currently traveling westbound along Blanding Avenue (not a truck route) and may provide benefit for some modest portion of another 206 large truck trips.

MILLER-SWEENEY BRIDGE OPERATIONS

The Miller-Sweeney Bridge is located to the north of the project site and connects the city of Alameda to the city of Oakland as a drawbridge. Its proximity to the study intersections impacts the traffic operations of the study area. A traffic signal for the bridge to stop traffic for bridge operations is approximately 750 feet north of the Fruitvale / Tilden / Blanding / Fernside intersection.

Based on correspondence with and data provided by the County of Alameda, the bridge was opened an average of 36 times per month in 2021 and 32 times per month through August in 2022. The peak month in 2021 and 2022 was June 2021, with 66 bridge openings.

When the bridge is opened, a typical opening takes between 5 to 10 minutes, which may vary based on the speed, type, and number of vessels being served. According to the Alameda's County Public Works Agency[5], the bridge is not opened during the AM and PM Peak hours 8AM-9AM – 4:30PM-6:30PM. Therefore, bridge operations are not expected to affect the study area traffic operations during the AM and PM peak hours.

The existing traffic signal at Fruitvale / Tilden / Blanding / Fernside is not coordinated with the bridge operations; it cycles as usual when the bridge is up. When the bridge is raised, vehicle traffic headed into Oakland queues along Fruitvale Avenue, sometimes extending back to the Fruitvale / Tilden / Blanding / Fernside intersection (see Figure 5). Similarly, drivers seeking to turn onto Fruitvale Avenue may block drivers trying to continue through along Blanding / Fernside.

Figure 5: Vehicle Traffic at Fruitvale / Tilden / Blanding / Fernside

The proposed project would have little if any effect on the Miller-Sweeney Bridge operations. As shown in Figure 2, vehicle queueing into the City along Tilden Way would on average be longer than under existing

[5] https://pwainsp.acgov.org/pwa/about/maintenance/bridges/bridge_millersweeney.htm

conditions. However, the signals operating on either side of the Miller-Sweeney Bridge would still prevent drivers from accessing the bridge in advance of its raising for estuary traffic. Heading eastbound from the Fernside/Blanding/Tilden intersection to the bridge, the lane reduction would result in a loss of storage space for about 20 passenger car vehicles, making vehicle queues more likely to extend to the proposed roundabout. As in existing conditions, the Fernside/Blanding/Tilden intersection would operate independently of the bridge and the ability to continue to travel along Blanding and Fernside would depend on drivers stopping before the intersection rather than queueing across it.

EVACUATION SCENARIOS

The Miller-Sweeney Bridge is one of five ways to exit the City of Alameda (along with the Posey Tube, Park Street Bridge, High Street Bridge, and the Bay Farm Island Bridge). It provides a critical link in the event of an emergency evacuation scenario. Figure 6 shows the project area and Miller-Sweeney Bridge along with available connections on the Oakland side. Of note, Tilden way and the bridge include a four-lane cross section (two lanes in each direction). Just beyond the bridge, Fruitvale Avenue drops to a single lane in the northbound direction. Alameda Avenue connects to Fruitvale providing two lanes (one in each direction) but does not provide direct regional connections. Therefore, although the bridge provides two lanes of capacity exiting Alameda, that capacity is constrained by connections on the Oakland side of the bridge.

Figure 6: Project Area in Relation to Evacuation Capacity

There are many possible evacuation scenarios, but in the event the island needs to be evacuated with the proposed project built, there are two basic scenarios as described below:

- **Unmanaged scenario.** In an unmanaged evacuation scenario, no traffic control personnel would be present within the project study area. Traffic would proceed as usual and Tilden Way would provide a single lane of capacity exiting the island. Compared to existing conditions, the project would have a lower hourly evacuation capacity (one lane compared to two) for about 1/3 mile from the Fernside/Blanding/Tilden intersection. At that point, Fruitvale Avenue in Oakland would present a capacity bottleneck where it drops from two lanes to one. As a result, the loss in capacity with the project would only really be a loss in vehicle storage given the capacity constraint on the Oakland side. The roundabout would provide the benefit of continuing normal operations even in a power outage scenario.

- **Managed Scenario.** In a managed scenario, traffic control personnel would be present and could use traffic cones or other implements to allow for creative use of the roadway to evacuate. For example, the roundabout could be run in a "contraflow" manner as shown in Figure 7. In such a scenario, the project condition would allow for two lanes of traffic exiting the island. Absent any coordination with

Oakland, Fruitvale Avenue in Oakland would again present a capacity constraint on the system that would limit the effectiveness of a managed strategy at the roundabout.

The managed scenario described above would be a capacity reduction compared to a potential managed scenario in the existing condition (with up to four potential lanes of contraflow traffic along Tilden Way). However, four lanes of exiting capacity may be more than could arrive at the project study area given available capacity elsewhere in the City transportation network, and Fruitvale Avenue in Oakland would again present a capacity constraint in this scenario.

The City is currently developing an evacuation planning tool that will allow it to test various scenarios, which will allow further development of the scenarios describe above. Coordination with the City of Oakland would be required to maximize evacuation capacity, and lane reduction along Tilden Way may not present a practical limit to evacuation capacity.

Figure 7: Potential Roundabout Operations in a Managed Evacuation Scenario

NEXT STEPS

Following approval or further direction, the next phase of detailed design and analysis would begin immediately and would include more design detail on some of the concept elements discussed in this memo.