Feasibility Report

Clement Avenue Complete Street Corridor Concept

Alameda, California

Draft

October 2015

Feasibility Study

Clement Avenue Complete Street Corridor

Alameda, California

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EXECUTIVE SUMMARY

Through a process of community engagement, the City of Alameda considered complete streets design options for the Clement Avenue corridor from Grand Street to Broadway.

Background – Why Clement Avenue?

General Plan Transportation Element Policy:

> "Pursue opportunities to utilize the corridor of the former Alameda Belt Line railroad for transit, bicycle and pedestrian transportation"

Clement Avenue is classified as a truck route, transit priority street, and bicycle priority street.

Existing Conditions - What is on the street?

Within a 48 to 50-foot right-of-way, Clement Avenue has two travel lanes separated in the center by a single set of railroad tracks. Clement Avenue is a designated truck route with 11% heavy vehicles using this corridor. Clement has no current bikeway designations, but is used by bicyclists from the west side of Alameda to connect to the Park Street bridge as many as 35 bicyclists observed during an evening peak hour. As a corridor previously serving primarily industrial and marina uses, the sidewalks are narrow and in poor conditions along portions of the corridor, with trees and utility poles creating obstructions to someone trying to walk along Clement.

Goals from Community Meetings

From the initial community meetings, the following goals were identified for the corridor:

1. Remove the abandoned railroad tracks
2. Encourage bicycling and walking
3. Improve the streetscape
4. Traffic calming
5. Improve public access to the SF Bay via the estuary
6. Encourage transit use
7. Revitalize the Northern Waterfront area
8. Improve truck access

Key Opportunities / Features

This study identified several key opportunities to address the community goals, specifically:

1. Remove tracks
2. Construct new sewer and storm water lines

3. Underground utilities
4. Improve sidewalk
5. Provide amenities (lighting, trees)
6. Resurface pavement
7. Provide bikeway
8. Maintain truck access

Bikeway Options

The following street configurations were considered:

- No bikeway
- Traditional bike lane on each side of street
- Two-way bikeway on estuary side of street

Based on the goals from the initial community meetings, the two-way bikeway on the estuary side of the street appeared to be the preferred. This analysis found that the two-way bikeway resulted in fewer conflicts and was more inviting for bicyclists resulting in slowing motorists and allowing bicyclists to pass in the bikeway and putting bicyclists outside the "door zone" of parked cars. However, concerns include conflicts at intersections and driveways, particularly at the termini or end points at Grand and Broadway, sidewalk constraints, width for disabled parking, truck access and costs. The initial analysis focused on truck access and parking.

However, due to continued concerns regarding access to the marina uses and the potential conflicts between trucks and bicyclists, the Transportation Commission recommended the traditional bike lane concept.

Proposed Concept

The concept proposal includes the following elements, which were approved by the Transportation Commission on March 25, 2015:

a) **San Francisco Bay Trail corridor preference**: Staff will request the Association of Bay Area Governments to change the alignment of the San Francisco Bay Trail from Buena Vista Avenue to Clement Avenue for the instances where an estuary waterfront trail is not expected to occur in the near future such as adjacent to the US Navy property. Community workshop participants reached consensus on this approach.
b) **Traditional bike lanes on each side of the street**: Due to the trucks that carry wide boat loads, the Transportation Commission approved traditional bike lanes, which consist of a bike lane on each side of the street (see above inset).
c) **Railroad track removal**: Staff will seek monies to remove the abandoned railroad tracks, which will provide space for a bikeway.
d) **New sewer and storm water lines**: Staff is coordinating utility improvements to occur before pavement resurfacing and bikeway installation.
e) **Undergrounding overhead utilities**: Public Works staff is working with Alameda Municipal Power staff to potentially underground overhead utility lines and thereby eliminating some of

the utility poles on the street.

f) **Sidewalk improvements**: Staff will work to ensure all curb ramps are accessible and that a continuous path of travel exists along the sidewalks, especially at pinch points created by utility poles and trees. There would be about 20 parking spaces that would be eliminated to provide a continuous path of travel where the sidewalk width is less than 36 inches and prohibits access by individuals using wheelchairs and other assistive devices. If the utility poles are removed then adjacent parking spaces will not need to be eliminated.
g) **Pavement resurfacing**: Staff will prioritize pavement resurfacing to occur after railroad track removal, sidewalk improvements and utility work, and it will include bikeway installation.
h) **Intersections/driveways**: Staff will consider enhancements, such as green pavement, high visibility marked crosswalks, lighting, flashing lights, bulb-outs, bike signals, all-way stops and parking restrictions to ensure safety.
i) **Disabled parking spaces**: Staff will consider potential locations for designated disabled parking spots such as between Park Street and Oak Street and on Grand Street by Clement Avenue.
j) **Truck access**: As a truck route, this street needs to have adequate travel lane widths, turning radii and loading zones for deliveries. Parking will be restricted adjacent to intersections to allow for improved turning radii such as adjacent to Park Street.

Fine-tuning to consider the parking along Clement Avenue as well as maintaining access and parking for the marina uses. Additional parking occupancy surveys were conducted to determine if some of the parking on the north side of Clement Avenue between Grand and Oak Streets could be removed to provide for buffered bike lanes. The additional data showed that while parking is not

Feasibility Analysis of Preferred Concept

Multimodal Level of Service (LOS) analysis was conducted for the four intersections of Grand, Oak, Park, and Broadway. At Grand, Park, and Broadway intersections at Clement, the preferred concept would not alter the features of the traffic control and would not be expected to affect the vehicle LOS. With the installation of the signal at the Oak and Clement intersection, the vehicle LOS would improve from LOS E to LOS D. Similarly, for pedestrian LOS, which would only apply at signalized intersection of Park and Clement, the preferred concept would not change signal timing, and therefore, the pedestrian crossing delay is not expected to change. For bicycle LOS, which is a segment based measure, the preferred concept would improve bicycle LOS score primarily due to the repaving and the presence of the bike lane.

Further Refinements of Preferred Concept

Additional analysis of the traditional bike lanes to reefing the concept drawings and take the design to the next level would include:

- Intersection at Grand Street. This analysis would include truck turning analysis to refine the bulb-out on Grand Street and to adjust the no parking limits on the north side of Clement Avenue.
- Intersection at Park Street. This analysis would include truck turning analysis to refine alignment of either a bike lane or shared lane eastbound to accommodate the southbound trucks making right-

turns onto Clement Avenue. This would affect the bikeway configuration for eastbound through the intersection to continue on Clement Avenue.

- Intersection at Marina Access Driveways. This analysis would include truck turning analysis to refine the width of the marina access driveways, refining bulb-outs, and limiting parking along the north side of Clement Avenue at these access points to allow for large truck access.

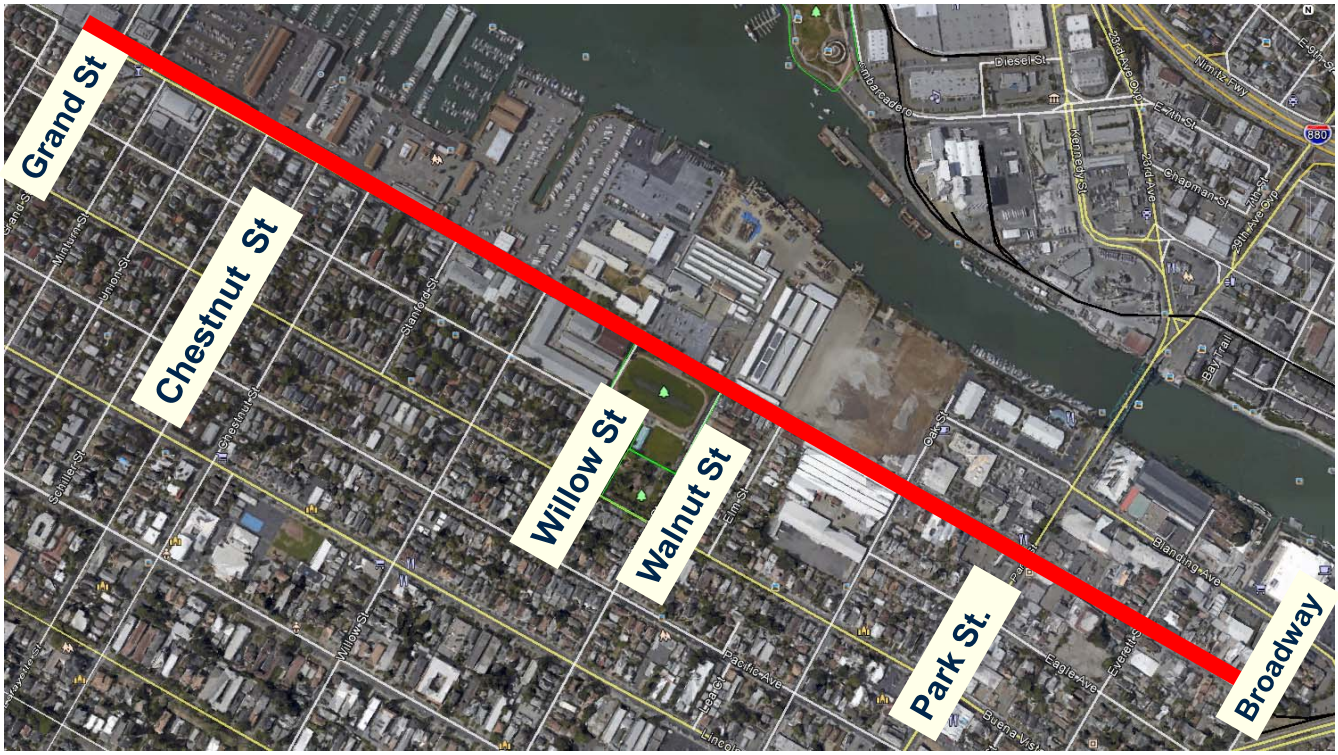
Section 2
Introduction

INTRODUCTION

STUDY PURPOSE

Public Works staff secured a grant from Alameda CTC in 2014 to develop a concept proposal to improve Clement Avenue between Grand Street and Broadway (Figure 1). This report serves as the final report for the study as an accompaniment to the concept plans and documents the study process.

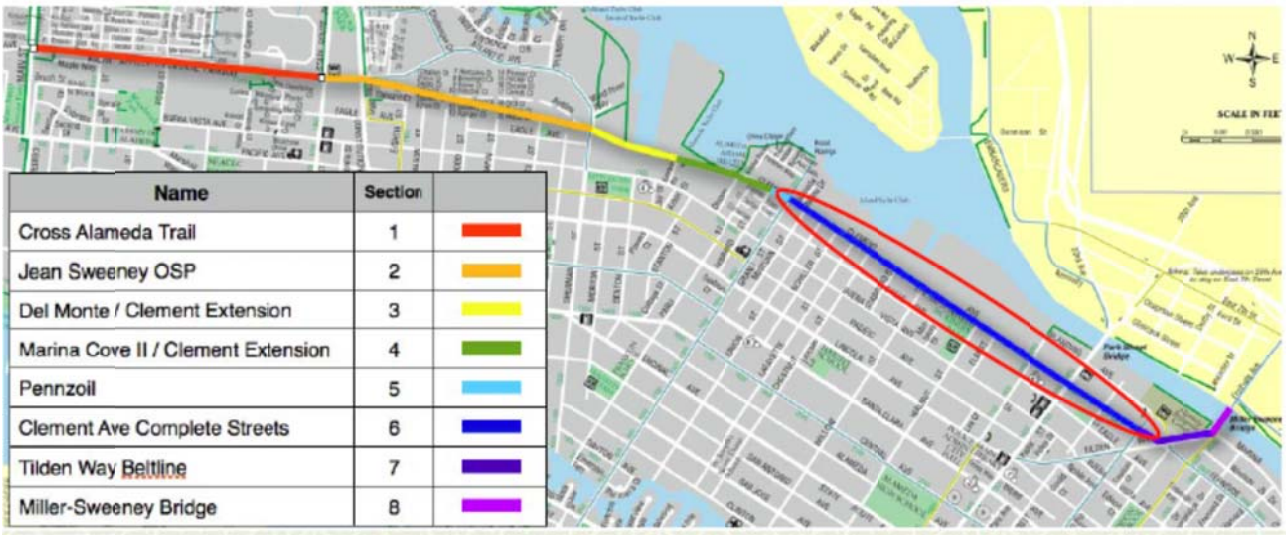
Figure 1: Clement Avenue Concept Proposal Location



BACKGROUND

Clement Avenue is part of the former Alameda Belt Line railroad, and was identified in the *Cross Alameda Trail Feasibility Study* (2005) as a short-term alternative to the San Francisco Bay Trail shoreline path. The current uses of the adjacent shoreline properties are not expected to all change in the foreseeable future.

Figure 2: Alameda Belt Line Trail



Source: Bike Walk Alameda, 2015.

In January 2009, the City Council approved the *Transportation Element of the General Plan* policy that directs staff to:

> "Pursue opportunities to utilize the corridor of the former Alameda Belt Line railroad for transit, bicycle and pedestrian transportation."

STUDY APPROACH

The study involved a coordinated effort with City staff to integrate a robust outreach process with the development of the conceptual improvements to the corridor.

Outreach Process

City staff distributed outreach materials on the project via a press release, project web page (http://alamedaca.gov/public-works/clement-avenue-complete-street), email listservs, neighborhood barricades, a letter to properties within 300 feet radius of the project and a letter to businesses on Clement Avenue. City staff conducted focus group meetings/discussions with Perforce, Bike Walk Alameda and Alameda Marina.

The outreach consisted of a series of community workshops and presentations to the Transportation Commission at key decision points during the concept development:

1. Community workshop in January 2015
2. Report to the Transportation Commission in January 2015
3. Community Workshop: in March 2015
4. Report to the Transportation Commission in March 2015
5. Presentation to the Recreation and Park Commission in March 2015,

6. Community Workshop #3 in April 29, 2015
7. Report to the Transportation Commission in May 2, 2015

The City's on-line Open Forum (http://alamedaca.gov/public-works/open-forum) provided an additional venue for those that could not attend in-person.

Community comments were compiled from the Open Forum, Community Workshops #1, #2, and #3, and the Transportation Commission meeting in March. Each workshop attracted about 40 participants. The Open Forum attracted about 50 participants and 170 individual viewings. The Clement Avenue concept listserv totals about 200 emails.

SCOPE OF THE REPORT

The report presents the selection and feasibility analysis of the preferred concept. The report presents the existing physical and regulatory context for the corridor and the corridor concepts. The physical and operational feasibility of the preferred concept includes the City's multimodal LOS measures. The report also includes the planning level cost estimate to support the concept plan.

Section 3
Existing Conditions

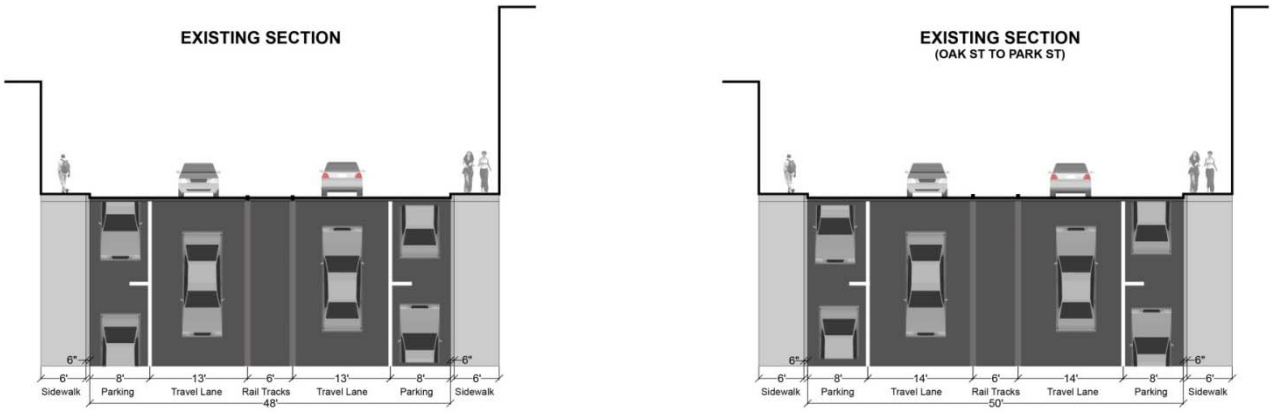
EXISTING CONDITIONS

The Transportation Element lists Clement Avenue as a truck route, a transit priority street and a bicycle priority street. In March 2010, the City acquired the former railroad property - Alameda Belt Line. In November 2010, the City Council approved the *Bicycle Plan Update* that prioritized the Clement Avenue bikeway project as a high-priority project. In October 2012, the Alameda County Transportation Commission (Alameda CTC) included the project in the *Countywide Bicycle and Pedestrian Plans* as part of the Bicycle Vision Network.

STREET CONDITIONS

Along this section of Clement Avenue from Grand Street to Broadway, the Alameda Belt Line railroad tracks run within the center of the roadway. The curb-to-curb width of Clement Avenue is generally 48 feet with 5 to 6-foot wide sidewalks on both sides of the street. Clement Avenue between Oak Street and Park Street is about 50 feet curb-to-curb with 6 to 9-foot wide sidewalks. Figure 3 shows the existing cross-sections.

Figure 3: Existing Cross-sections



Source*: Kittelson & Associates, Inc.*

Figure 4: Existing Conditions

LAND USES

The existing uses along the corridor include marina uses on the north side along the estuary with primarily marina-associated and industrial uses. Between Oak Street and Broadway and on the south side of the street, the uses tend to be commercial and single-family residences. Near Park Street, the uses transition to more commercial and retail uses.

Clement Avenue is in the Northern Waterfront priority development area (PDA) and part of it is in the city's northern Park Street designated area, which is known as the Park Street Gateway. The Northern Waterfront PDA has a future place type designation of "Transit Neighborhood" with 291 net acres. The City of Alameda envisions this area being redeveloped as a series of mixed use, waterfront and transit oriented neighborhoods that will provide a mix of jobs and transit oriented housing types.

The Park Street Gateway, which is the area of Park Street north of Lincoln Avenue, was studied in the Park Street Gateway District Strategic Plan (2008). The following transportation-related goals of this plan direct staff to "Create attractive and pedestrian-oriented streetscapes and public spaces throughout the district" and to "Remedy the auto-oriented feeling throughout the district."

BICYCLIST USAGE

Despite the lack of bikeways and poor pavement condition, this segment of Clement Avenue, which has been identified as a priority project by the city, attracts growing numbers of bicyclists. Weekday, peak-hour counts taken in 2007 and 2015 at the Oak Street/Clement Avenue

intersection reveal a significant increase in cycling (a 450% increase in the morning and a 250% in the evening peak-hours).

The 2015 weekday peak-hour intersection counts were conducted at four intersections along Clement Avenue: Broadway, Park Street, Oak Street, and Grand Street. The average number of bicyclists passing through the study intersections ranged from 9 per hour to 25 per hour (at Grand Street and Oak Street, respectively).

TRUCK ACCESS

Clement Avenue is a designated truck route providing key east-west connections to destinations on the north side of Alameda and many of the businesses along the corridor. A 48-hour count conducted on Clement Avenue between Willow and Walnut Streets in January 2015 revealed that articulated trucks (Class 8 through Class 13) make up about 10% of the total traffic on the corridor out of an average of 8,300 vehicles per day. 1% to 1.6% of the total traffic consists of Class 13 trucks, which are the largest trucks (multi-trailer trucks with 7 or more axles).

Section 4
Corridor Concepts

CORRIDOR CONCEPTS

The initial corridor concepts were developed through site visits and data collection, including a topographic survey of the entire corridor. The initial concepts incorporated input from the Outreach Process using cross-sections and renderings to visually convey to the public the potential concepts. An initial screening of the concepts focused on the issues of truck access, effects on parking, and driveway access and safety, which were identified by staff and through public outreach as concerns. The result of the screening analysis was a recommended concept to move forward for more detailed design.

GOALS

During the outreach for the concept, community member and Open Forum participants reached consensus on the following project goals in priority order:

1. Remove the abandoned railroad tracks.
2. Encourage bicycling and walking.
3. Improve the streetscape.
4. Traffic calming.
5. Improve public access to the San Francisco Bay.
6. Encourage transit use.
7. Revitalize Northern Waterfront area.
8. Improve truck access.

CONCEPT DESIGN ELEMENTS

Based on the goals and the feedback from the community as well, the corridor concept includes the following key features on Clement Avenue between Broadway and Grand Street:

- Removal of disused railroad tracks and repaving
- New traffic signal at Oak Street/ Clement Avenue
- Upgraded corner curb ramps at all pedestrian intersection crossings that comply with the Americans with Disabilities Act (ADA) guidelines
- Marked, high-visibility crosswalks across Clement Avenue at select intersections with bulb-outs to reduce pedestrian crossing distances and improve visibility between pedestrians and motorists.
- Widened walkways at pinch points and building frontage where sidewalk widths are less than 36 inches.
- Undergrounding of overhead utilities (some or all)

These improvements will generally take place within the existing right-of-way.

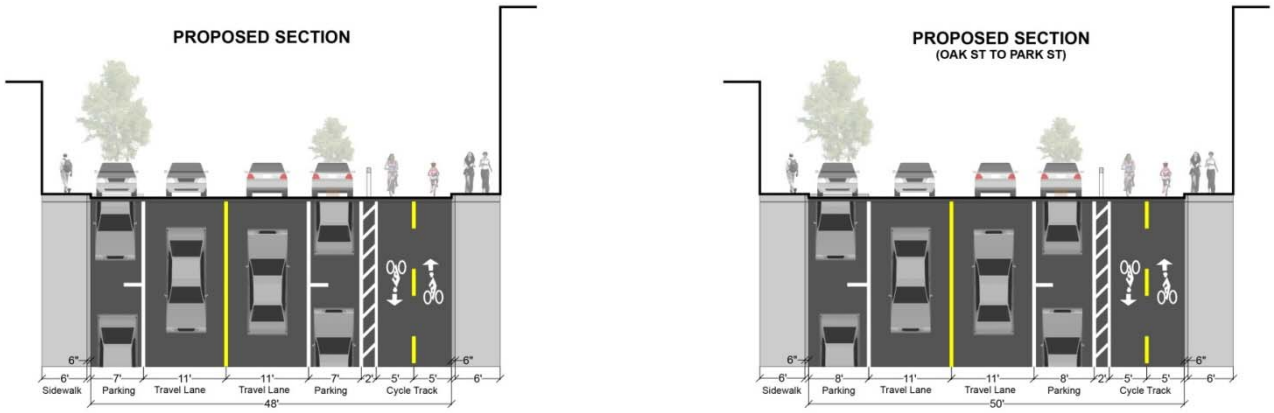
PROPOSED CONCEPTS

The following street configurations were considered:

- No bikeway
- Traditional bike lane on each side of street
- Two-way bikeway on estuary side of street

Based on the goals from the initial community meetings, the two-way bikeway on the estuary side of the street met the goals. As the more complex of the bikeway concepts, the two-way bikeway, as shown in Figure 5, on the north side of Clement Avenue resulted in fewer conflicts with and was more inviting for bicyclists. Research and current practices had shown that the two-way bikeway concept slows motorists, allows bicyclists to pass in the bikeway, and puts bicyclists outside the "door zone" of parked cars. However, given the more complex nature of this concept, concerns included conflicts at intersections and driveways, particularly at the termini or end points at Grand and Broadway. The two-way cycle track would require the buffer which results in sidewalk constraints and limited width for disabled parking. In addition, truck access to the marina, which required crossing of the two-way cycle track, and costs to construct and maintain were concerns. Due to continued concerns regarding access to the marina uses and the potential conflicts between trucks and bicyclists, the Transportation Commission recommended the traditional bike lane concept.

Figure 5: Two-Way Bikeway Concept



Source*: Kittelson & Associates, Inc.*

PREFERRED CONCEPT

The concept proposal includes the following elements, which were approved by the Transportation Commission on March 25, 2015:

a) **San Francisco Bay Trail corridor preference**: Staff will request the Association of Bay Area Governments to change the alignment of the San Francisco Bay Trail from Buena Vista Avenue to Clement Avenue for the instances where an estuary waterfront trail is not expected to

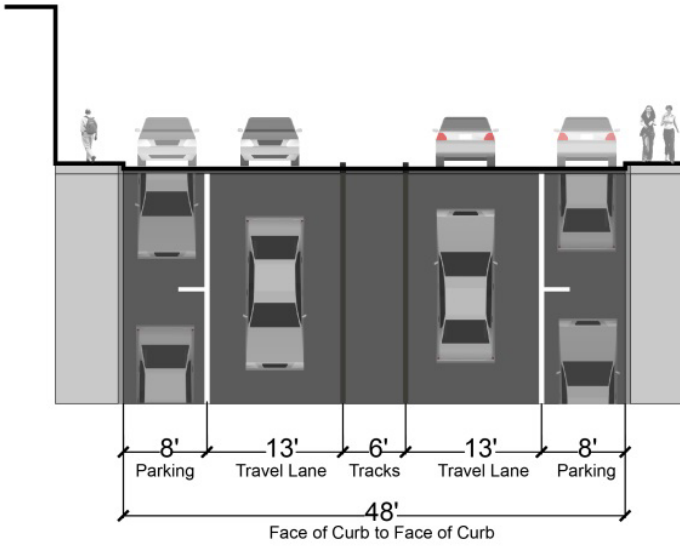
occur in the near future such as adjacent to the US Navy property. Community workshop participants reached consensus on this approach.

b) **Traditional bike lanes on each side of the street**: Due to the trucks that carry wide boat loads, the Transportation Commission approved traditional bike lanes, which consist of a bike lane on each side of the street (see Figure 6).
c) **Railroad track removal**: Staff will seek monies to remove the abandoned railroad tracks, which will provide space for a bikeway.
d) **New sewer and storm water lines**: Staff is coordinating utility improvements to occur before pavement resurfacing and bikeway installation.
e) **Undergrounding overhead utilities**: Public Works staff is working with Alameda Municipal Power staff to potentially underground overhead utility lines and thereby eliminating some of the utility poles on the street.
f) **Sidewalk improvements**: Staff will work to ensure all curb ramps are accessible and that a continuous path of travel exists along the sidewalks, especially at pinch points created by utility poles and trees. There would be about 20 parking spaces that would be eliminated to provide a continuous path of travel where the sidewalk width is less than 36 inches and prohibits access by individuals using wheelchairs and other assistive devices. If the utility poles are removed then adjacent parking spaces will not need to be eliminated.
g) **Pavement resurfacing**: Staff will prioritize pavement resurfacing to occur after railroad track removal, sidewalk improvements and utility work, and it will include bikeway installation.
h) **Intersections/driveways**: Staff will consider enhancements, such as green pavement, high visibility marked crosswalks, lighting, flashing lights, bulb-outs, bike signals, all-way stops and parking restrictions to ensure safety.
i) **Disabled parking spaces**: Staff will consider potential locations for designated disabled parking spots such as between Park Street and Oak Street and on Grand Street by Clement Avenue.
j) **Truck access**: As a truck route, this street needs to have adequate travel lane widths, turning radii and loading zones for deliveries. Parking will be restricted adjacent to intersections to allow for improved turning radii such as adjacent to Park Street.

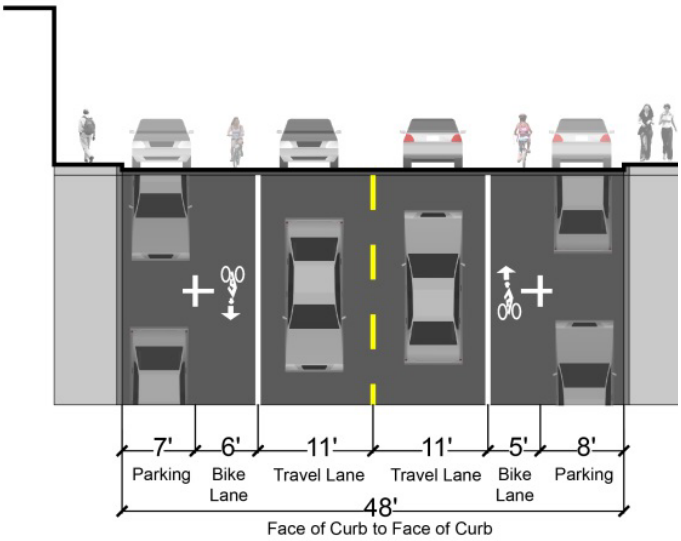
The corridor concept drawing, cross sections, and preliminary cost estimate were prepared for the recommended concept and submitted as part of an application for the Active Transportation Program grant.

Figure 6: Proposed Concept - Traditional Bike Lanes

Figure 7: Preferred Concept - Typical Section between Park Street and Broadway



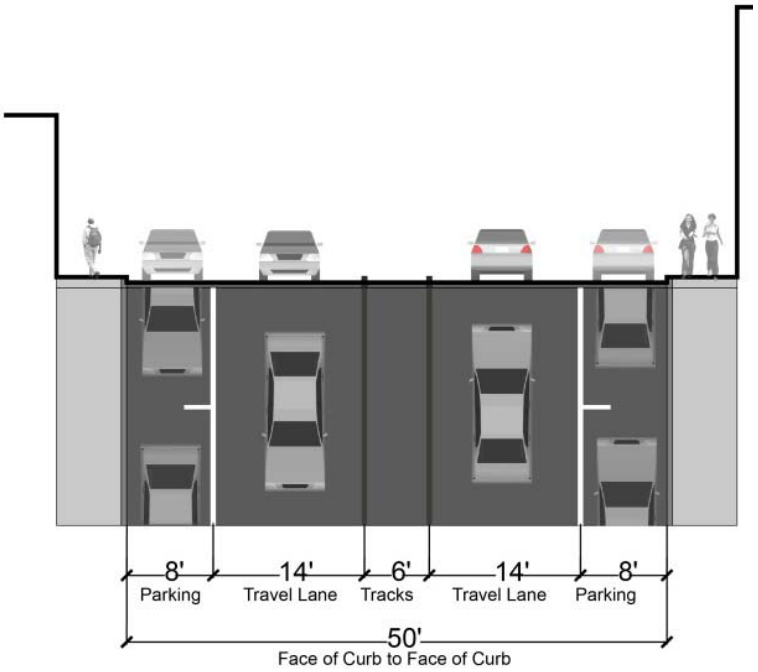
Existing Typical Section



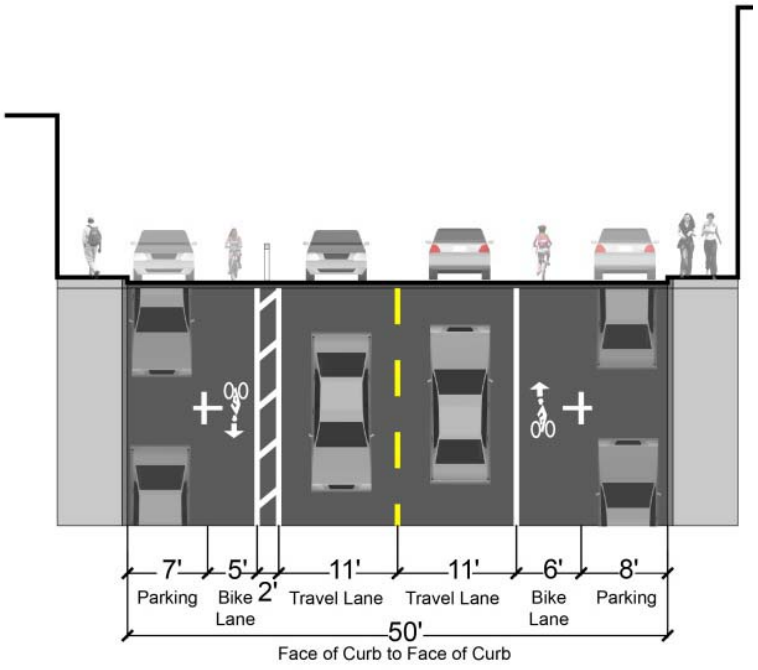
Proposed Typical Section

N →

Figure 8: Preferred Concept - Typical Section between Oak and Park Streets



Existing Typical Section



Proposed Typical Section

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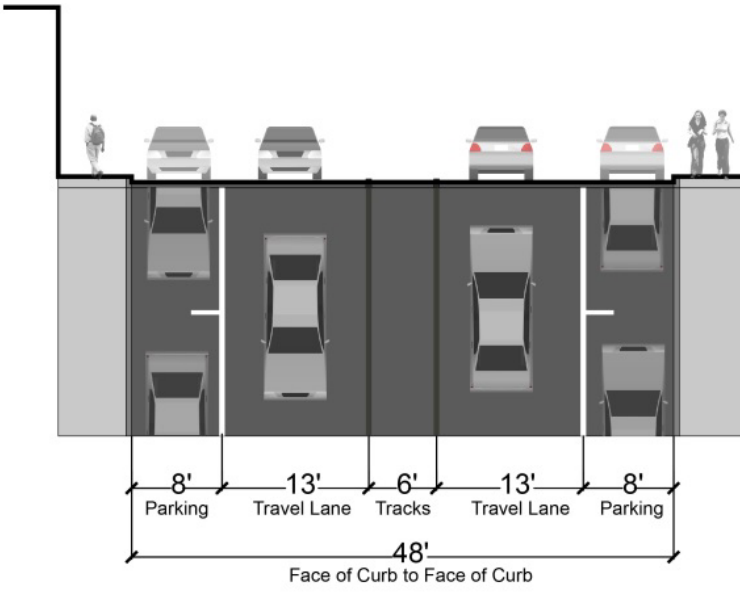
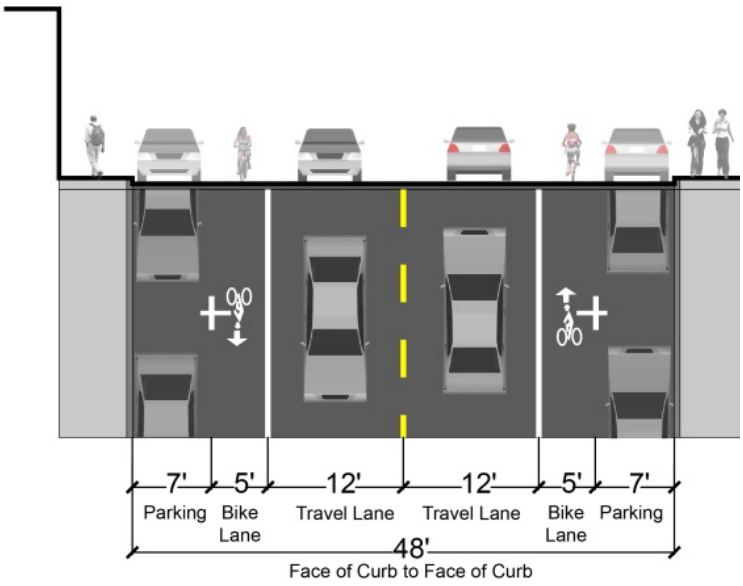
Figure 9: Preferred Concept- Typical Section between Grand and Oak Streets



Existing Typical Section



Proposed Typical Section

N →

Section 5 Feasibility Analysis

FEASIBILITY ANALYSIS

The feasibility analysis of the preferred concept considered both the physical and operational feasibility. The analysis applied the City's multimodal level of service (LOS) measures, specifically the segment-based Bicyclist LOS, vehicle LOS for motorists and pedestrian delay at intersections. The truck turning templates were applied at key intersections as part of the initial feasibility analysis. Planning level cost estimates were prepared to support the concept plan that was submitted for the Active Transportation Program (ATP) grant application.

INITIAL FEASIBILITY ANALYSIS

As part of the initial screening of potential concepts analysis included the effects on truck access, parking and driveways. That analysis focused on two-way cycle track concept as it was more complex than the traditional bike lanes. However, some of the discussion of effects of the two-way cycle track are transferrable to the traditional bikeway concept and are discussed below. The initial feasibility analysis can be found in Appendix 2.

Truck Access

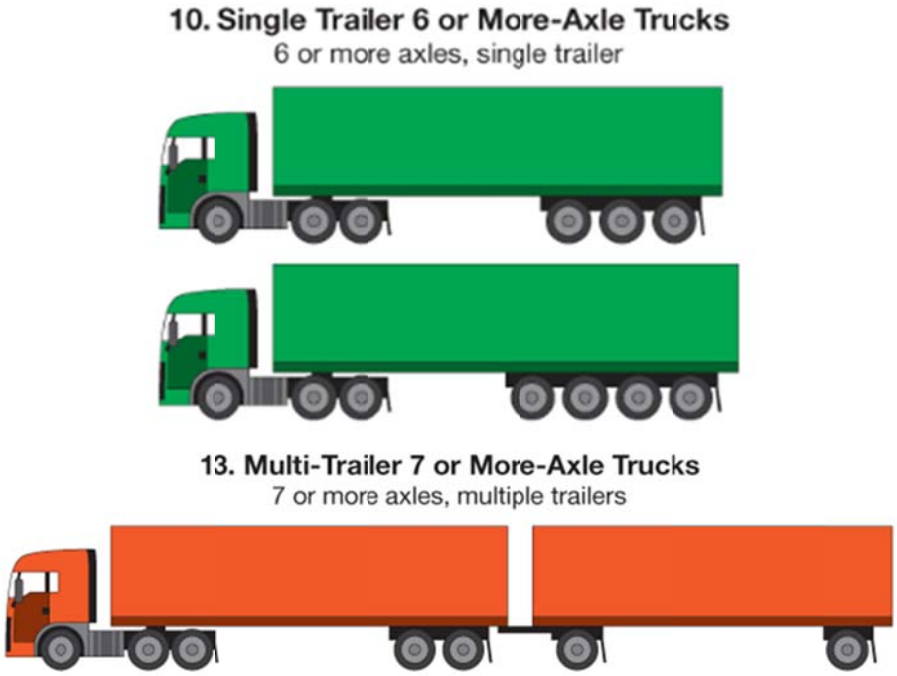
The concern about the effects of this project on truck access pertain to turning movements at intersections and driveways, specifically the ability of the design to accommodate large trucks that travel along Clement as a truck route as well as access the marina. Analyses of truck turning movements were conducted for a Class 10 truck and a Class 13 truck for the two-way cycle track concept as part of the initial feasibility analysis. As shown in Figure 10, a Class 10 truck is an articulated truck with a single trailer and 6 or more axles, while a Class 13 truck is an articulated truck with multiple trailers and 7 or more axles.

Truck turning movements were analyzed using AutoTurn for the following movements and locations:

- Southbound right turn from Park Street onto Clement Avenue
- Westbound right turn from Clement Avenue into the Svendsen Boat Yard driveway at Chestnut Street
- Northbound right turn from Grand Street onto Clement Avenue

The results for AutoTurn are summarized in Appendix 2. It should be noted that AutoTurn tends to produce more conservative analysis than what tends to happen in the field. The results of the truck turning analysis served to inform locations of curb bulb outs to reduce crossing distances, locations of stop bars, need for parking restrictions, widths of driveways, and other design treatments.

Figure 10: Lane Widths and Vehicle Speeds



Source: Texas Department of Transportation online manuals, *Appendix A: Vehicle Classification using FHWA 13-Category Scheme*, accessed online on March 13, 2015 at http://onlinemanuals.txdot.gov/txdotmanuals/tri/vehicle_classification_using_fhwa_13category_scheme.htm

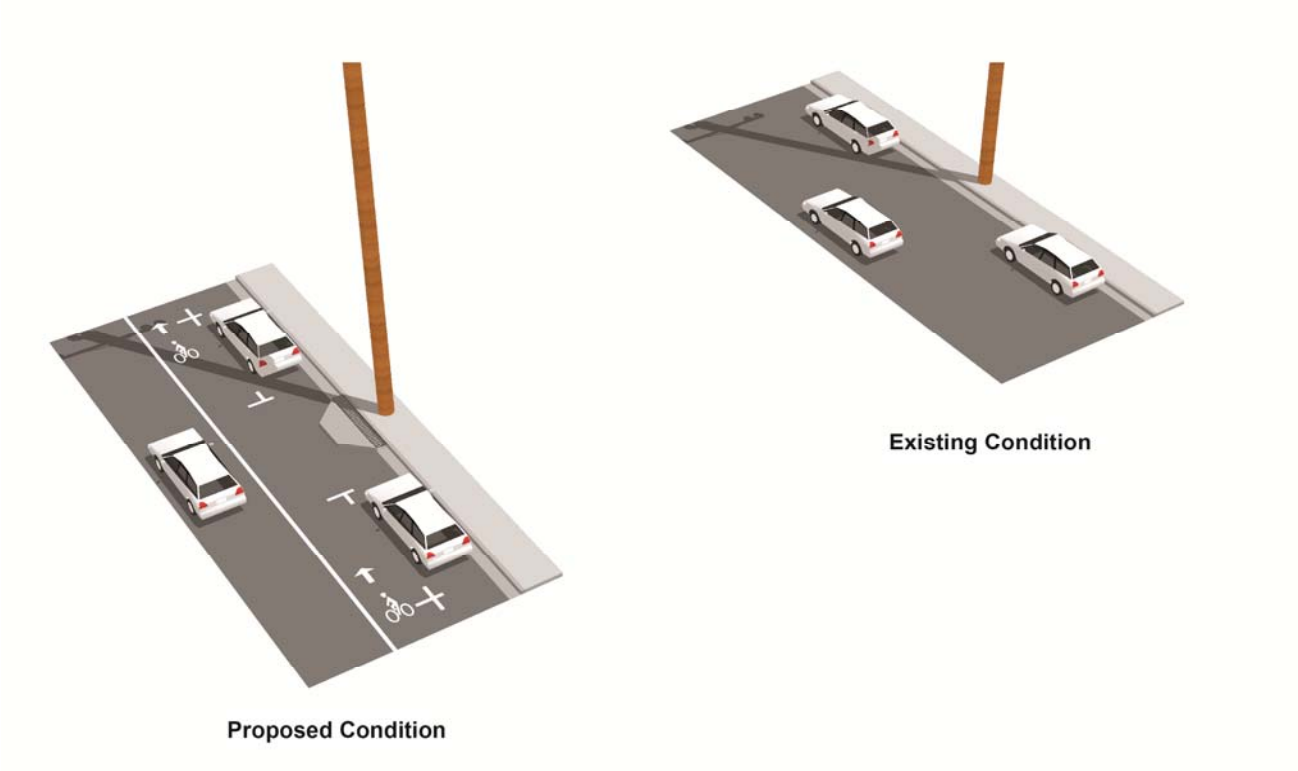
Parking

Inventory count of on-street parking spaces were conducted by Metro Traffic Data in January 2015 and again in May 2015 based on concerns from community members over the loss of parking. The inventory included unrestricted parking, green curb (time-limited), and yellow curb (loading zones). Using a 22-foot standard for parking spaces between other parking spaces and an 18-foot standard for parking spaces adjacent to driveways, red zones, and intersection corners, a total of 220 stalls were inventoried, with about an equal number on each side of corridor.

Due to truck turning movements, the intersections of Park Street and Grand Street would need additional parking restrictions on the north side of Clement Avenue. In particular, a total of 75 feet (about two or three spaces) of parking west of Park Street would need to be restricted and a total of 50 feet (about two spaces) east of Grand Street would need to be restricted.

In addition, to meet ADA requirements, the project would improve access around utility poles by installing sidewalk extensions, as shown in Figure 11. A field survey revealed about twenty (20) utility poles that would obstruct wheelchair access. However, the number of parking spaces lost due to the project would depend upon the decision to underground some or all of the utilities located along Clement Avenue.

Figure 11: Sidewalk Extensions

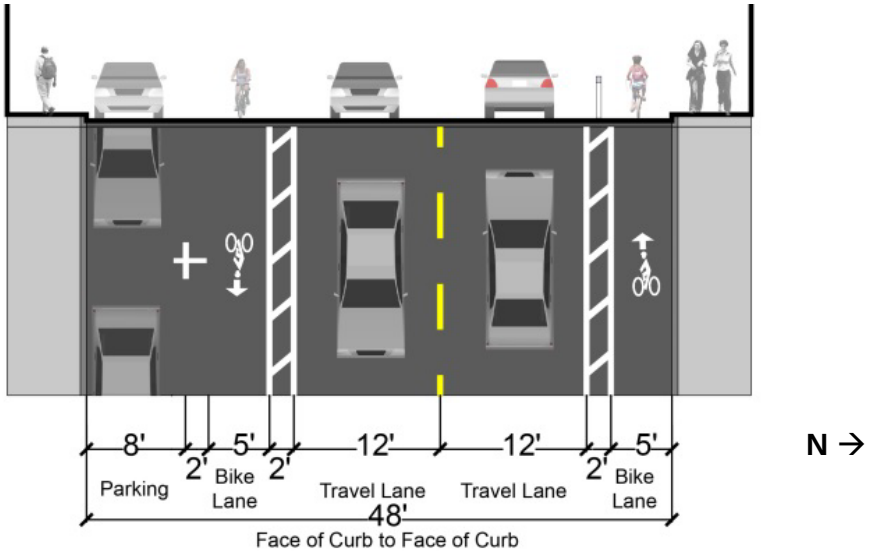


Parking Removal Consideration

On March 25, 2015, the Transportation Commissioners requested staff to consider parking removal on Clement Avenue to allow for a more protected bikeway. Buffered bike lanes provide more separation between bicyclists and motorists, provide more space for bicyclists to pass each other, appeal to a wider cross section of bicyclists and encourage riding outside the door zone. Nevertheless, buffered bike lanes would require parking removal on one side of the street. Parking removal only between Oak Street and Grand Street and only on the north/estuary side of the street was considered. Parking removal between Oak Street and Broadway or on the south side of the street was not considered because of the higher density of commercial and single-family residents between Oak Street and Broadway and on the south side of the street.

Figure 12: Clement Avenue Rendering - Parking Removal

Figure 13: Clement Avenue Cross Section - Parking Removal



Proposed Typical Section

Parking utilization on Clement Avenue between Oak Street and Grand Street at 10 a.m. (Table 1), 3 p.m. (Table 2) and 10 p.m. (Table 3) was compared to expected parking occupancy with the removal of parking on the north side. If parking were removed on the north side of the street, parking occupancy

is expected to be higher than the optimal of 85 percent for the street during the peak times. Thus, staff is not recommending parking removal on the north/estuary side of Clement Avenue between Oak Street and Grand Street.

Table 1: Parking Utilization Between Oak and Grand at 10 am

	South Side of St.	North Side of St.	South + North
Total Spaces	118	78	118
Parking Demand	69	50	119
Parking Occupancy	58%	64%	101%
Block(s) at Capacity	Lafayette to Chestnut	Grand to Union	Grand to Schiller Lafayette to Chestnut Stanford to Willow Elm to Oak

Table 2: Parking Utilization Between Oak and Grand at 3 pm

	South Side of St.	North Side of St.	South + North
Total Spaces	118	78	118
Parking Demand	62	44	106
Parking Occupancy	53%	56%	90%
Block(s) at Capacity	Grand to Minturn	Grand to Minturn Stanford to Walnut	Grand to Schiller Lafayette to Chestnut Stanford to Willow

Table 3: Parking Utilization Between Oak and Grand at 10 pm

	South Side of St.	North Side of St.	South + North
Total Spaces	118	78	118
Parking Demand	30	4	34
Parking Occupancy	25%	5%	29%
Block(s) at Capacity	NA	NA	NA

The westernmost part of Clement Avenue between Grand Street and Stanford Street would be the most impacted by parking removal because this part of the corridor has businesses on the north side of the street with direct street access. Note that the block of Willow Street to Walnut Street already restricts parking on the north side of the street due to US Navy requirements for red zone adjacent to their establishment.

MULTIMODAL LEVEL OF SERVICE

The vehicle level-of-service analyses described in this report were performed in accordance with the procedures stated in the 2000 *Highway Capacity Manual* (HCM). A description of level of service and the criteria by which they are determined is presented in Appendix 3.

Table 4 summarizes the level-of-service analysis for the study intersections under the a.m. and p.m. peak hour existing traffic conditions. Appendix 4 includes the level-of-service worksheets under year 2015 existing traffic conditions. Vehicle LOS is directly related to the control delay experienced at an intersection. At the intersections at Grand Avenue, Park Street, and Broadway, the preferred concept does not alter the lane geometrics or the features of traffic control used to quantify control delay and, therefore, would not affect vehicle LOS.

Table 4: Existing Vehicle LOS for Key Intersections

#	Street Name		Control	AM Peak Hour			PM Peak Hour		
	North-South	East-West		V/C	Delay (s/veh)	LOS	V/C	Delay (s/veh)	LOS
1	Grand St	Clement Ave	One-way stop	0.29	11.7	B	0.43	13.6	B
2	Oak St	Clement Ave	All-way stop	-	21.7	C	-	40.7	E
3	Park St	Clement Ave	Signal	0.89	42.0	D	0.88	38.5	D
4	Broadway	Clement Ave	One-way stop	0.23	16.1	C	0.52	16.3	C

Source: Kittelson & Associates, Inc., 2015.

The preferred concept includes installation of a traffic signal at the Oak Street intersection, which would improve vehicle LOS at this intersection during the peak hours. See Table X for the comparison of existing LOS at the Oak Street intersection with the expected LOS after installation of a traffic signal.

Table 5: With Preferred Concept at Oak and Clement Intersection

Conditions	Street Name		Control	AM Peak Hour			PM Peak Hour		
	North-South	East-West		V/C	Delay (s/veh)	LOS	V/C	Delay (s/veh)	LOS
Existing	Oak St	Clement Ave	All-way stop	-	21.7	C	-	40.7	E
With Preferred Concept	Oak St	Clement Ave	Signal	0.58	9.9	A	0.72	12.3	B

Source: Kittelson & Associates, Inc., 2015.

Pedestrian LOS is directly related to the amount of effective green time an approach (e.g., the eastbound approach) receives during one full signal cycle. As such, pedestrian LOS is not measured for the stop-controlled intersections at Grand Avenue, Oak Street, and Broadway. Because the preferred concept would not change signal timing at the Park Street intersection, the preferred concept does not affect pedestrian LOS at this location.

Bicycle LOS is a segment-based metric derived from the average effective width of the outside lane (in this case, the only lane) in a given direction, vehicle volumes and speeds, percentage of heavy vehicles, and pavement condition. The methodology captures the benefit to bicyclists of a bicycle lane over that of a shared-lane. With the presence of a bicycle lane in lieu of a shared lane and the resurfacing of the street, the preferred concept would improve bicycle LOS during both peak periods. See Table 6 for the change in bike LOS along the segment between Grand Avenue and Oak Street.

Table 6: Bicycle LOS

Conditions	AM				PM			
	Westbound		Eastbound		Westbound		Eastbound	
	Score	LOS	Score	LOS	Score	LOS	Score	LOS
Existing	5.2	E	5.3	E	5.3	E	5.3	E
With Preferred Concept	4.3	D	4.3	D	4.3	D	4.3	D

Source: Kittelson & Associates, Inc., 2015.

COST ESTIMATE

For the Active Transportation Program grant, an engineer's estimate was prepared based on the preliminary concept plan for the traditional bike lanes with parking on both sides of Clement Avenue between Grand Street and Broadway. (See Table 7.)

Table 7: Preliminary Planning Level Cost Estimate

Engineer's Estimate (for Construction Items Only)

Item No.	Item	Quantity	Units	Unit Cost	Total Item Cost
1	MOBILIZATION	1	LS	$20,000.00	$20,000
2	TRAFFIC CONTROL	1	LS	$20,000.00	$20,000
3	SWPPP PREPARATION AND IMPLEMENTATION	1	LS	$5,000.00	$5,000
4	REMOVE (E) RAILS, TIES, RAILWAY SIGNS	6800	LS	$70.00	$476,000
5	REMOVE (E) 4" AC IN TRACK FOOTPRINT (6')	40800	SF	$7.00	$285,600
6	REMOVE (E) 15" AB / BASE IN TRACK FOOTPRINT (6	3778	CY	$150.00	$566,667
7	REMOVE (E) DRIVEWAY	408	SF	$5.50	$2,244
8	REMOVE (E) CURB RAMP	2940	SF	$5.50	$16,170
9	REMOVE (E)CONCRETE CURB AND GUTTER	2600	LF	$15.00	$39,000
10	REMOVE (E) 4"AC PAVEMENT (AC PLUG)	5200	SF	$7.00	$36,400
11	REMOVE (E)8" AB (AC PLUG)	128	CY	$27.50	$3,531
12	REMOVE (E) 4"SIDEWALK CONCRETE	1733	SF	$5.50	$9,533
13	INSTALL 4" CONCRETE SIDEWALK	19133	SF	$13.71	$262,400
14	INSTALL CONCRETE CURB AND GUTTER FOR BULB	3988	LF	$63.00	$251,244
15	INSTALL 4" AC PAVEMENT AT TRACK REMOVAL	80	TON	237	$19,019
16	INSTALL 15" AB AT TRACK REMOVAL	3778	TON	43	$162,444
17	INSTALL GRIND AND 2" AC OVERLAY ON BIKE LANES ONLY (5' + 6')	1154	TON	$237.00	$273,574
18	INSTALL CURB RAMPS	60	EA	$3,500.00	$210,000
19	INSTALL DRIVEWAY	408	SF	$30.00	$12,240
20	INSTALL DRAINAGE INLET	5	EA	$5,000.00	$25,000
21	INSTALL 12" STORM DRAINAGE PIPE	120	LF	$140.00	$16,800
22	ADJUST MANHOLE AND VAULT TO FINISH GRADE	55	EA	$1,500.00	$82,500
23	STRIPING AND MARKING	40800	LF	$2.00	$81,600
24	ALLOWANCE FOR FILL AND GRIND CONCRETE SID	1	LS	$150,000.00	$150,000
25	CURB COLOR MARKING	13600	LF	$2.00	$27,200
26	TRAFFIC SIGNS	20	EA	$500.00	$10,000
27	PEDESTRIAN SIGNS	20	EA	$500.00	$10,000
28	BIKE RACKS	24	EA	$2,000.00	$48,000
29	GATEWAY FEATURES	3	EA	$20,000.00	$60,000
30	BUS SHELTERS	2	EA	$12,000.00	$24,000
31	ACCESSIBLE PARKING AND SIGNAGE	3	EA	6,000	$18,000
32	STREET LIGHTING UPGRADES AT MARKED CROSSV	9	EA	10,000	$90,000
33	RECTANGULAR RAPID FIRE BEACON	2	EA	$25,000.00	$50,000
34	ALLOWANCE FOR GREEN INFRASTRUCTURE	1	LS	$250,000.00	$250,000
35	INSTALL / REFURBISH TREES AND TREE WELLS	100	EA	$2,500.00	$250,000
36	WAY FINDING SIGNAGE	50	EA	500	$25,000
				Subtotal of Construction Items:	**$3,889,166**
				Construction Item Contingencies (% of Construction Items)**: Enter in the cell to the right**	**10.00%**	**$388,917**
				Total (Construction Items & Contingencies) cost:	**$4,278,082**

FURTHER ANALYSIS FOR DESIGN

From this analysis of the preferred concept plans for Clement Avenue between Grand Street and Broadway, no fatal flaws related to intersection operations, parking, and driveway access and safety have been identified. However, further analysis should be taken into consideration as part of the design phase of the project:

- Truck turning movements:
    - Clement Avenue & Park Street:
        - Review stop bar for eastbound bicyclists
        - Review parking restrictions on the north side of Clement Avenue west of Park Street
        - Review width of eastbound travel lane
    - Clement Avenue & Chestnut Street (Svendsen Boat Yard):
        - Review parking restriction on the north side of Clement near driveway
        - Consider yield-controlled mixing zones for westbound traffic making right-turns
    - Clement Avenue & Grand Street:
        - Review bulb-out on Grand Street
        - Review parking restrictions on the north side of Clement
- Parking:
    - Review parking restrictions at driveways
    - Review parking restrictions at intersections (at Broadway, Everett, Park, Oak, and Grand)
    - Consider repurposing unused driveways
- Intersection / Driveway Treatments (including Bike Boxes, Green Pavement, High Visibility Marked Crosswalks, Bulb-outs, lighting, and flashing lights)
    - Review locations of bike boxes, which are considered experimental treatment by MUTCD-CA, but standard in NACTO.

The preferred concept plan has been created in AutoCAD 2012.

Appendix 1
Community Comments

Appendix 2
Initial Feasibility Analysis

Appendix 3
Description of Level-of-Service Methods and Criteria

APPENDIX 3 LEVEL-OF-SERVICE CONCEPT

Traffic conditions in urban areas are affected more by the operations of intersections than by the capacities of local streets because traffic control devices (signals and stop signs) at intersections control the capacity of the street segments. The operations are measured in terms of a grading system called Level of Service (LOS), which is based on "control delay" experienced at the intersections. That delay is a function of the signal timing, intersection lane configuration, hourly traffic volumes, pedestrian volumes, and parking and bus conflicts among other factors.

Level of Service Analysis Methodologies

The operation of a local roadway network is commonly measured and described using an LOS grading system, which qualitatively characterizes traffic conditions associated with varying levels of vehicle traffic, ranging from LOS A (indicating free-flow traffic conditions with little or no delay experienced by motorists) to LOS F (indicating congested conditions where traffic flows exceed design capacity and result in long queues and delays). This LOS grading system applies to both signalized and unsignalized intersections (see Table 3-1).

Signalized Intersections. For the signalized study intersections, traffic conditions were evaluated applying the 2000 *Highway Capacity Manual* (HCM) operations methodology, using Synchro computer software program (Transportation Research Board, 2000). The operation analysis uses various intersection characteristics (e.g., traffic volumes, lane geometry, and signal phasing/timing) to estimate the average control delay experienced by motorists traveling through an intersection.

Unsignalized Intersections. For the unsignalized (all-way stop-controlled and side-street stop-controlled) study intersections, traffic conditions were evaluated applying the 2000 HCM operations methodology, using the Synchro computer software program. With this methodology, the LOS is related to the total delay per vehicle for the intersection as a whole (for all-way stop-controlled intersections), and for each stop-controlled movement or approach (for side-street stop-controlled intersections). Total delay is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs the stop line. This time includes the time required for a vehicle to travel from the last-in-queue position to the first-in-queue position.

Table 3-1: Definitions for Intersection Level of Service

Unsignalized Intersections		Level	Signalized Intersections	
Description	**Average Total Vehicle Delay (Seconds)**	**of Service Grade**	**Average Control Vehicle Delay (Seconds)**	**Description**
No delay for stop-controlled approaches.	≤10.0	A	≤10.0	Free Flow or Insignificant Delays: Operations with very low delay, when signal progression is extremely favorable and most vehicles arrive during the green light phase. Most vehicles do not stop at all.
Operations with minor delay.	>10.0 and ≤15.0	B	>10.0 and ≤20.0	Stable Operation or Minimal Delays: Generally occurs with good signal progression and/or short cycle lengths. More vehicles stop than with LOS A, causing higher levels of average delay. An occasional approach phase is fully utilized.
Operations with moderate delays.	>15.0 and ≤25.0	C	>20.0 and ≤35.0	
Operations with increasingly unacceptable delays.	>25.0 and ≤35.0	D	>35.0 and ≤55.0	Approaching Unstable or Tolerable Delays: Influence of congestion becomes more noticeable. Longer delays result from unfavorable signal progression, long cycle lengths, or high volume to capacity ratios. Many vehicles stop. Drivers may have to wait through more than one red light. Queues may develop, but dissipate rapidly, without excessive delays.
Operations with high delays, and long queues.	>35.0 and ≤50.0	E	>55.0 and ≤80.0	Unstable Operation or Significant Delays: Considered to be the limit of acceptable delay. High delays indicate poor signal progression, long cycle lengths and high volume to capacity ratios. Individual cycle failures are frequent occurrences. Vehicles may wait through several signal cycles. Long queues form upstream from intersection.
Operations with extreme congestion, and with very high delays and long queues unacceptable to most drivers.	>50.0	F	>80.0	Forced Flow or Excessive Delays: Occurs with oversaturation when flows exceed the intersection capacity. Represents jammed conditions. Many cycle failures. Queues may block upstream intersections.

SOURCE: Transportation Research Board, Special Report 209, *Highway Capacity Manual*, 2000.

Appendix 4
Existing Conditions Level-of-Service Worksheets

Appendix 5
Crash Data