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TECHNICAL MEMORANDUM

Clement Avenue Complete Street Plan for the City of Alameda

Initial Feasibility Study

Preliminary Analysis

Date: March 17, 2015 Project #: 178340

To: Gail Payne

From: Kamala Parks, Alice Chen

This initial feasibility study presents preliminary analysis of the concept plan developed for the Clement Avenue Complete Street Plan for the City of Alameda. The purpose of this analysis is to determine any fatal flaws with the proposed concept. This preliminary analysis focuses 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.

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).

PROJECT DESCRIPTION

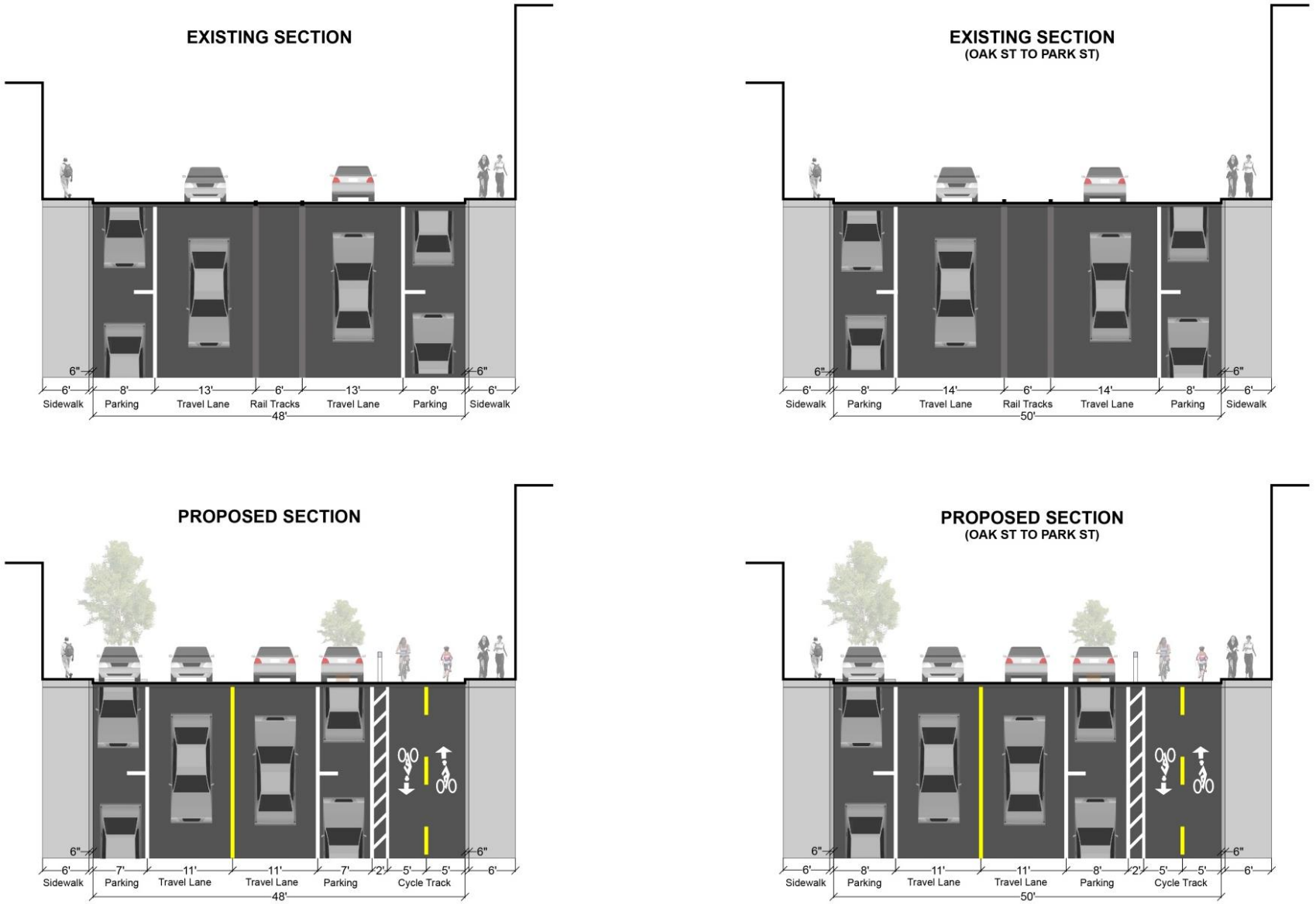
The project includes the following key features on Clement Avenue between Broadway and Grand Street:

- Removal of disused railroad tracks and repaving
- New traffic signal at Oak Street/ Clement Avenue
- The installation of a two-way cycle track on the north side of Clement Avenue, along with bicycle signals at Park Street and Oak Street traffic signals

- 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 on the south side of the street 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. 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 1 shows the existing and proposed cross-sections.

Figure 1: Existing and Proposed Cross-Sections for Clement Avenue



Source*: Kittelson & Associates, Inc.*

The most innovative feature of this project includes a two-way cycle track (also known as a separated bikeway, protected bike lanes, or an on-street bike path). Cycle tracks can be configured in a number of different ways, but the key features include marked bike lanes and a buffer area separating the bike lanes from moving traffic. The buffer area may include vertical elements, such as flex posts, bollards, landscaped planters, or permanent concrete barriers. On-street parking can be located next to the buffer in order to provide bicyclists with additional protection from moving traffic. Figure 2 shows a photo of a two-way cycle track protected by flex posts and parked vehicles, which is similar to the proposed cycle track for Clement Avenue.

Figure 2: Two-Way Cycle Track on Dearborn Street in Chicago, IL

Source: *Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the U.S*., National Institute for Transportation and Communities, NITC-RR-583, June 2014

The proposed two-way cycle track concept, as well as other conceptual features, raise preliminary questions from city staff and community members in three areas:

- Truck access – Clement Avenue is a designated truck route and there are concerns related to turning movements and lane widths
- On-street parking – Expected changes to the number and location of parking spaces along Clement Avenue
- Driveway access and safety – The interaction of two-way bicycling with vehicles entering and exiting driveways along the north side of Clement Avenue, particularly as the parcels are redeveloped.

WHY A TWO-WAY CYCLE TRACK?

The two-way cycle track is proposed on the north side (estuary side) of Clement Avenue for the following reasons:

- Continuity - Two-way cycle tracks are proposed for Clement Avenue west of Grand Street that will connect to paths through the future Jean Sweeney Park and Cross-Alameda Trail.
- Encourage cycling – protected bikeways are more attractive than traditional bike lanes to a wide range of users particularly school-age children and occasional bicyclists who are uncomfortable riding with traffic.
- Minimized conflicts – The north side of Clement has fewer driveways and cross streets than the south side between Oak and Grand Streets.

Cycle tracks are a relatively new concept in the United States, but installations are found in the following cities:

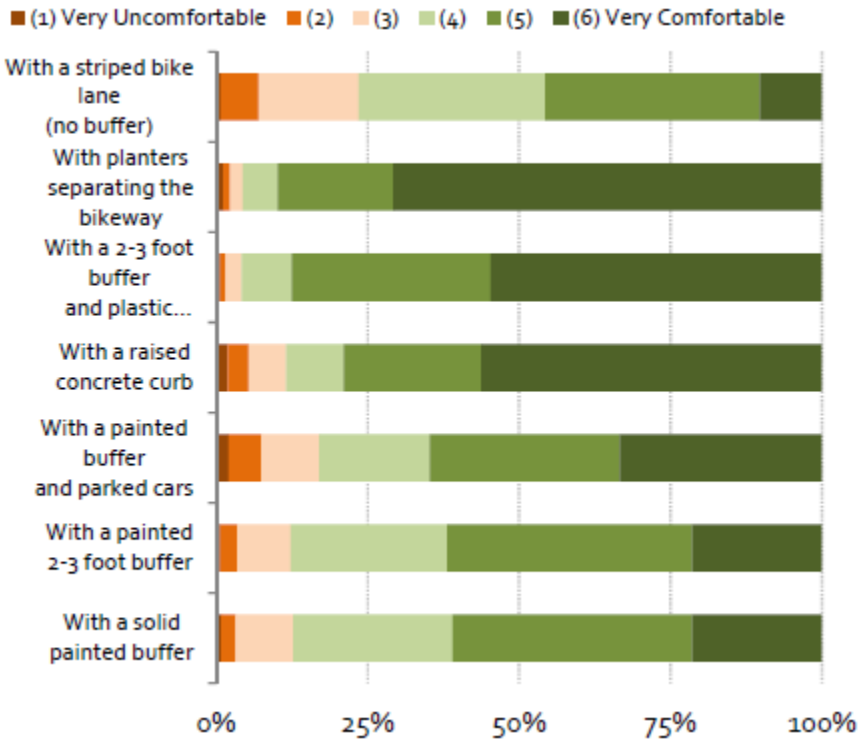
- Seattle, WA
- San Francisco, CA
- Austin, TX
- Chicago, IL
- Portland, OR
- Washington, DC
- New York City, NY

Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the U.S., a report issued in June 2014 by the National Institute for Transportation and Communities is the most comprehensive study of cycle tracks in the U.S. thus far. Researchers conducted surveys, performed on-site and video observations, analyzed data, and summarized design features of nine cycle tracks in five cities. The following summarizes the report's findings about cycle tracks (both one-way and two-way):

- Attractiveness to cyclists – Increase in bicycling activity of 21% to 171% within one year of installation
- Design features – The use of green paint in areas is effective at communicating locations where bicyclists and motorists can expect to interact with one another, such as at driveways or through intersections. 92% of bicyclists who used signalized intersections with a separate bike signal phase felt safe and compliance by bicyclists and motorists at these intersections was high (77 % to 93%).
- Bicyclists' perception of safety – Bicyclists had a higher degree of comfort with the cycle tracks compared to traditional bike lanes, as shown in Figure 3. It's also important to note that 40% surveyed residents who categorized themselves as non-bicyclists (the "No way, no how" group) indicated that they are riding a bicycle more often because of the cycle

track. 85% of surveyed "interested but concerned" residents indicated they would be more like to ride a bicycle if they were physically separated from motor vehicles, as did 37% of the "no way, no how" group of residents.

Figure 3: Bicyclists' Stated Comfort Level with Hypothetical Buffer Options



Source: *Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the U.S.*, National Institute for Transportation and Communities, NITC-RR-583, June 2014, Figure ES-7

- Residents' perception of safety – 76% of surveyed residents responded that the cycle track increased the safety of bicycling on the street. 69% of non-bicycling residents supported building more cycle tracks at other locations.
- Motorists' perception of safety – 37% of surveyed motorists replied that the driving environment was safer with the cycle track as opposed to 26% who responded that it was less safe.
- Pedestrians' perception of safety – 33% of surveyed pedestrians thought that the walking environment was safer with the cycle track as opposed to 13% who thought that it was less safe.
- Residents' perception of parking – 30% to 55% of residents indicated that the impact of the cycle track on parking was negative even when minimal parking was removed or parking was increased.
- Observed safety – 144 hours of video observations captured no collisions at intersections. Compliance was highest and observed conflicts lowest in mixing zones (where motorists

and bicyclists interact with one another at intersections) where yield signs and pavement markings were installed for motorists, as shown in Figure 4.

Figure 4: Mixing Zone with Yield Markings Example in Portland, Oregon

Source: *Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the U.S.*, National Institute for Transportation and Communities, NITC-RR-583, June 2014

INITIAL FEASIBILITY ANALYSIS OF THE CYCLE TRACK

This section discusses the two-way cycle track's effects on truck access, parking and driveways.

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).

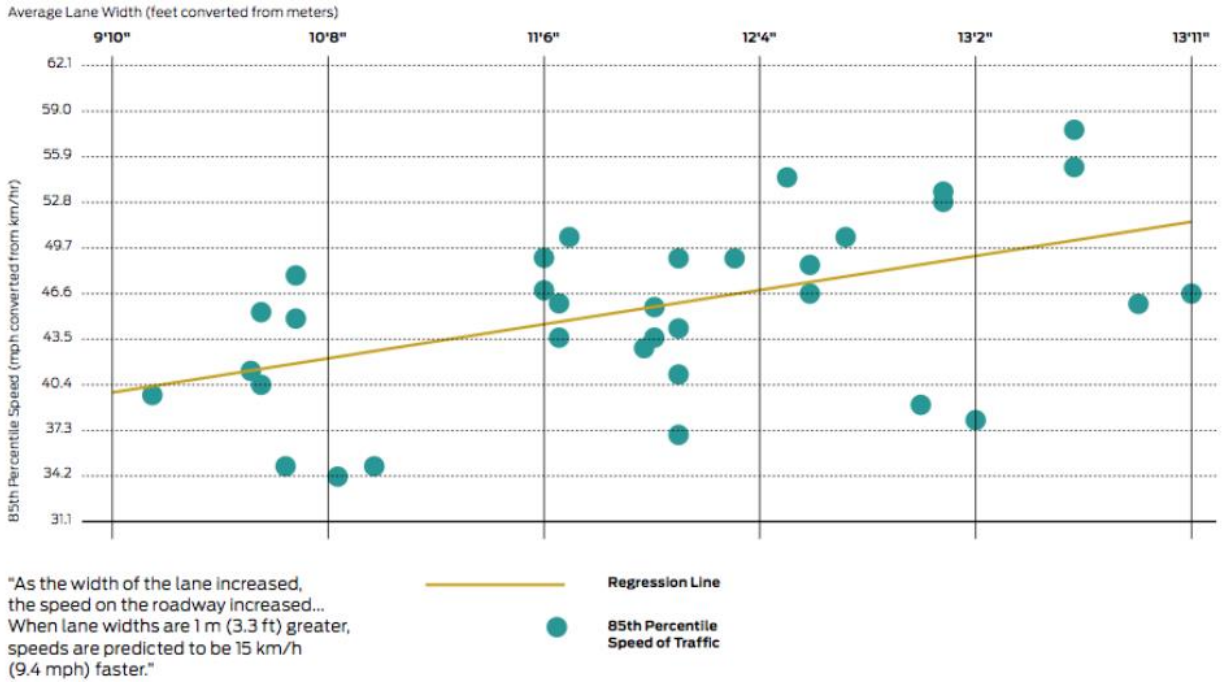
Two key concerns about the effects of this project on truck access pertain to the reduction of lane widths from 13 feet to 11 feet and turning movements at intersections and driveways.

Lane Widths

The City of Alameda has a number of approved projects that specify 11-foot wide lanes on truck route streets, including Marina Cove II and Alameda Point Master Infrastructure Plan. The 6th Edition of "*A Policy on Geometric Design of Highways and Streets",* published by the American

Association of State Highway and Transportation Officials, suggests that 11-foot lanes are appropriate in urban areas regardless of truck or transit route designations. The National Association of City Transportation Officials (NACTO) design guidelines recommend that designated truck or transit routes have lane widths of no more than 11 feet, particularly because wider travel widths are associated with higher vehicle speeds, as shown in Figure 5.

Figure 5: Lane Widths and Vehicle Speeds

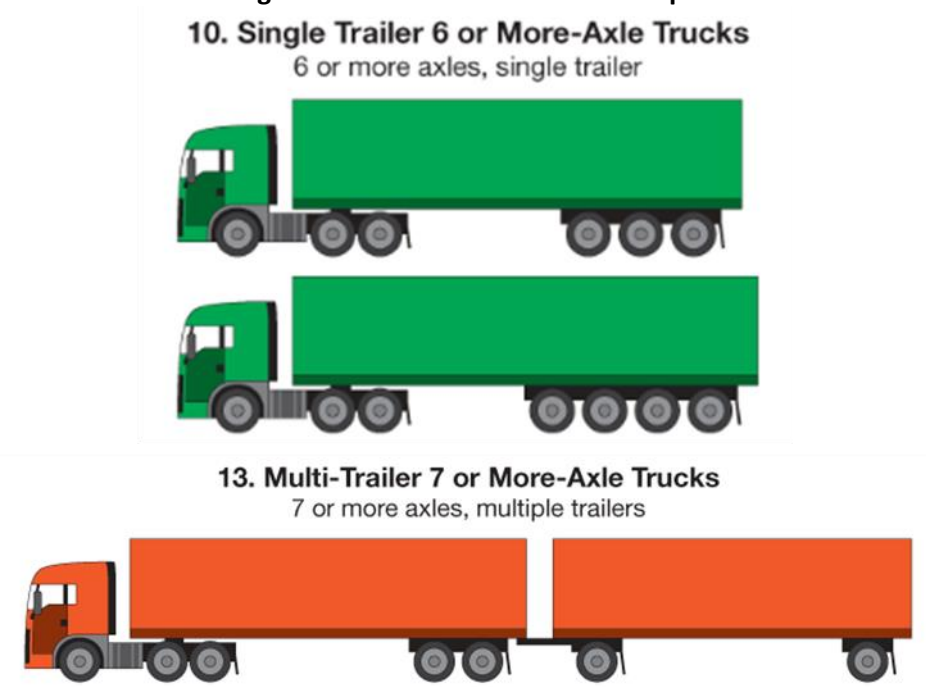


Source: http://nacto.org/usdg/street-design-elements/lane-width/ reproduced from *Design Factors that Affect Driver Speed on Suburban Streets*, Fitzpatrick, Kay, Paul Carlson, Marcus Brewer, and Mark Wooldridge, 2000, Transportation Research Record 1751: 18-25

Truck Turning Movements

Analyses of truck turning movements were conducted for a Class 10 truck and a Class 13 truck with the two-way cycle track and proposed corner bulb-outs. As shown in Figure 6, 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.

Figure 6: 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

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 below and the analysis results are contained in the appendices. It should be noted that AutoTurn tends to produce more conservative analysis than what tends to happen in the field.

Clement Avenue & Park Street

This intersection was analyzed with the potential for two-lanes in the eastbound direction on Clement Avenue to allow for an eastbound left-turn pocket and one for a straight-through lane. The analysis movement was southbound right turn from Park Street onto Clement Avenue. The findings are summarized below:

- The eastbound left-turn lane/pocket cannot be accommodated because of the Class 13 truck (Class 10 would allow for a left-turn lane);

Design suggestions for the project include:

- Setting the stop bar for cycle track for eastbound bicyclists at least 12 feet behind the striped crosswalk (based on the Class 13 truck tracks); and
- Restricting parking on the north side of Clement Avenue west of Park Street at least 75 feet from the intersection (based on the Class 13 truck tracks).

Clement Avenue & Chestnut Street (Svendsen Boat Yard)

The analysis movement was westbound right turn from Clement Avenue into the Svendsen Boat Yard.

- Class 13 truck must track into opposing lane in order to complete turn into the boat yard; and
- Class 10 truck has minimal tracking into opposing lane in order to complete turn into boat yard.

Design suggestions for the project include:

- Maintaining current parking restrictions on the north side of Clement Avenue near driveways; and
- Installing yield-controlled mixing zones, as shown in Figure 4, to allow westbound trucks and motorists to position themselves for right-turn movements, while looking out for bicyclists on the cycle track.

Clement Avenue & Grand Street

This intersection was analyzed assuming a 4-foot bulb-out on the southeast corner in order to reduce the crossing distance for pedestrians on the east leg of Clement Avenue and to reduce speeds of northbound right-turning vehicles from Grand Street onto Clement Avenue. The analysis movement was northbound right turn from Grand Street onto eastbound Clement Avenue.

- The Class 13 truck significantly tracks over the proposed bulb-out and tracks into opposing travel and parking lanes;
- In order for Class 13 truck to complete the turn with the bulb-out in place, the truck would have to track well into the cycle track on the north side of Clement Ave; and
- Class 10 truck can maneuver around the bulb-out but would have to track into opposing lane (westbound approach at Clement Ave).

Design suggestions for the project include:

- Install bulb-out only on the Grand Street side in order to slow down northbound right-turning vehicle movements; and
- Remove parking on the north side of Clement Avenue at least 50 feet from the intersection's stop bar.

Parking

Inventory count of on-street parking spaces were conducted by Metro Traffic Data in January 2015. 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.

Potential Parking Loss

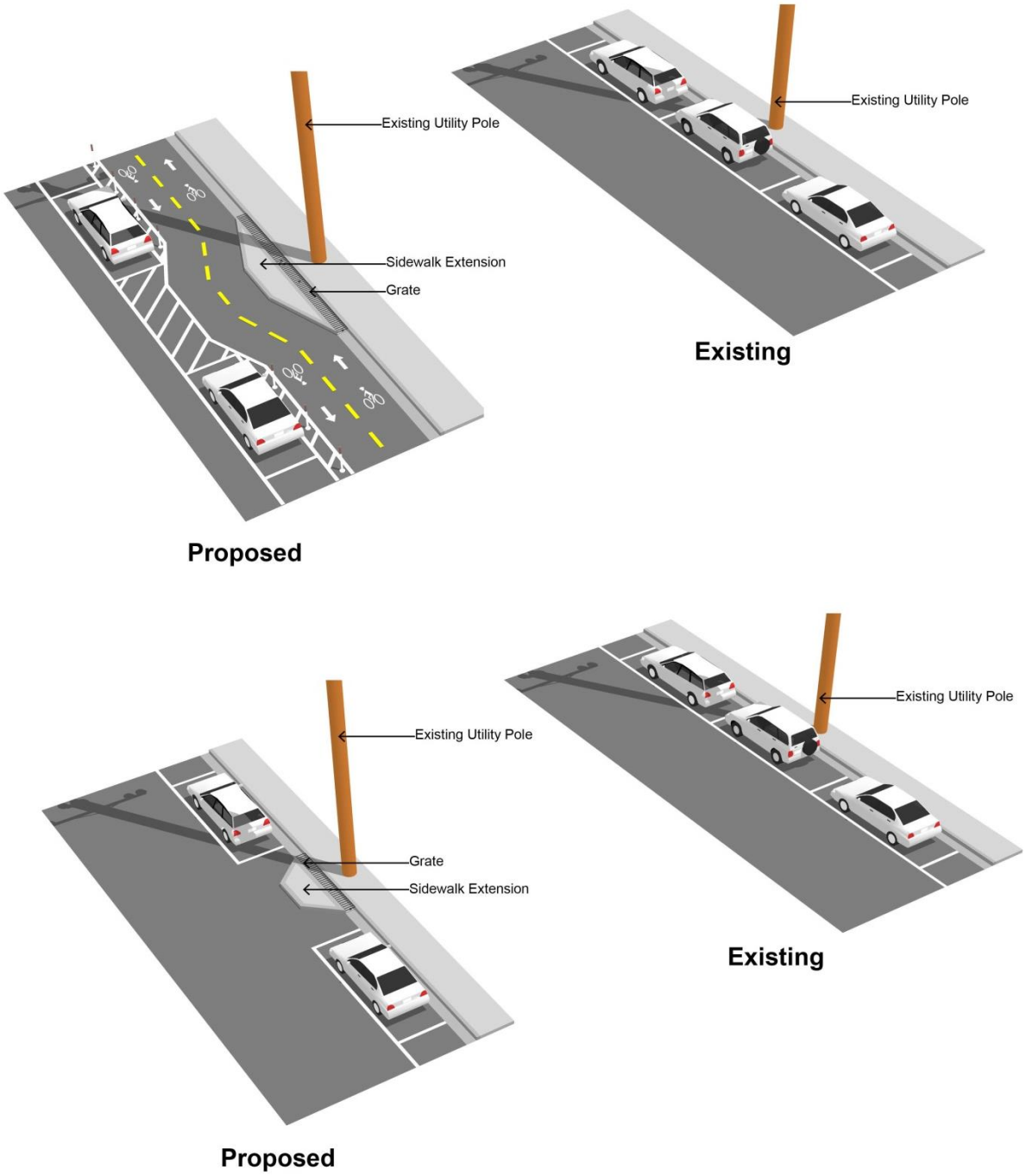
The NACTO bikeway design guidelines suggest no parking within 10 feet of a driveway for cycle tracks. Most commercial driveways on the north side of Clement Street have ample red curb adjacent to the driveways that will be maintained for the project in order to ensure adequate sight distances for the cycle track.

The NACTO bikeway design guidelines also suggest no parking within 30 feet of intersections (a potential loss of one to four spaces per intersection) with cycle tracks. There are five intersections along the corridor (at Broadway, Everett, Park, Oak, and Grand) on the north side of Clement Avenue. The implementation of the cycle track would result in some parking loss at these intersections.

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 7. A field survey revealed about twenty (20) utility poles that are substandard for 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 7: Sidewalk Extensions with and without Cycle Track



Potential Parking Gain

Field surveys revealed that several driveways were no longer used along the corridor and may be repurposed for general parking spaces upon discussion with the property owners and residents.

Cycle Track Treatments at Intersections and Driveways

There are five intersections and a number of residential and commercial driveways located along the north side of Clement Avenue where the cycle track would be located. The project proposes green paint treatment across the length of each driveway and intersection in order to increase awareness of the mixing zone between motorists and bicyclists, as shown in Figure 8.

Figure 8: Mixing Zone Green Treatment at Intersections and Driveways

Current research has not established a threshold for the number of potential "conflicts" between motorists and bicyclists for considering more intensive treatments for the mixing zone on the cycle track. For the FHWA cycle track guide research, some agencies contacted indicated that they will consider a mixing zone treatment on a one-way bikeway when the number of right turns into a driveway reached 50 to 150 vehicles per hour.

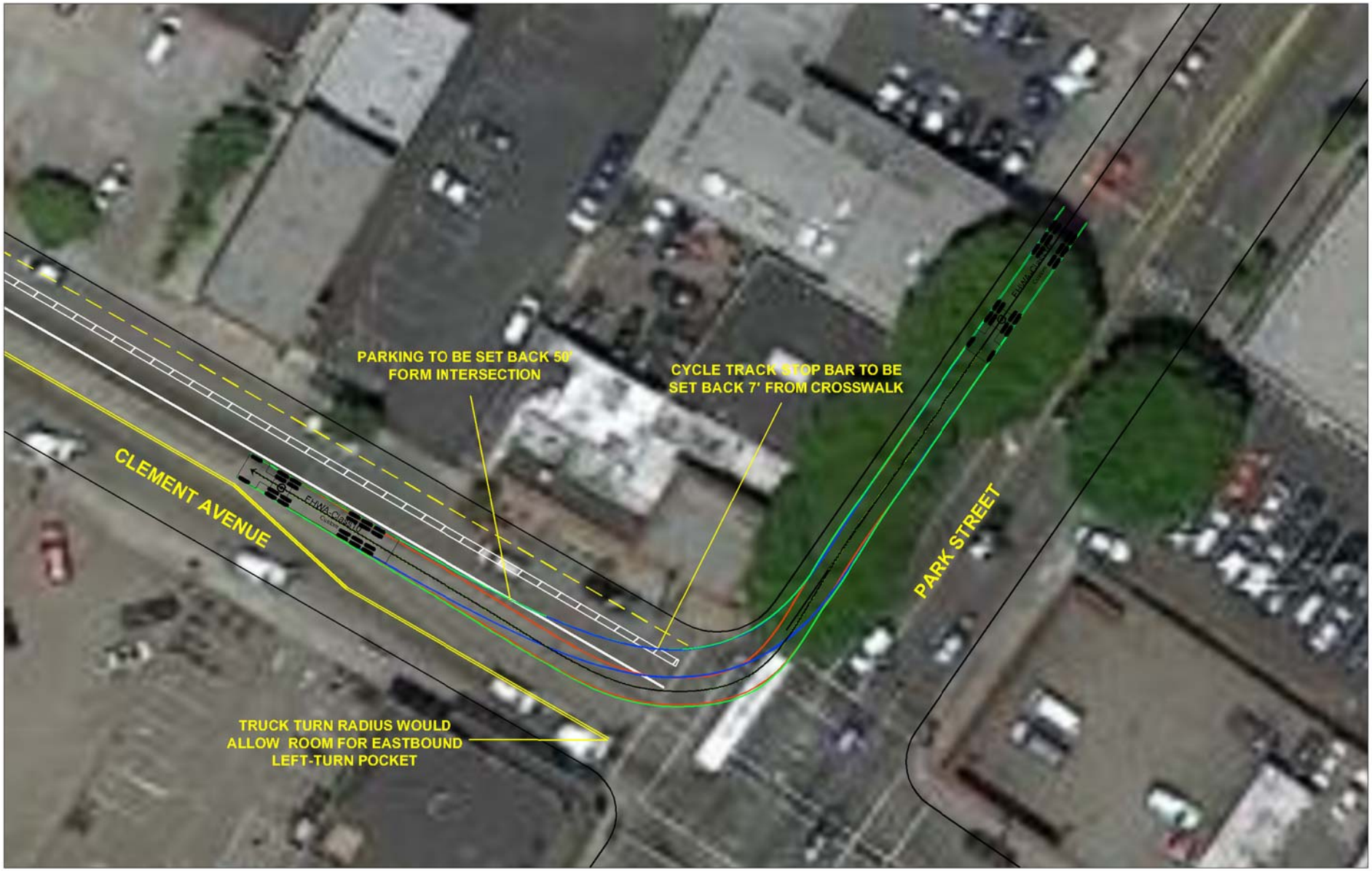
It's important to note that both Seattle and Chicago have two-way protected bike lanes that go across gas station driveways, which generate about 100 vehicle trips per hour during the PM peak. These driveways use the green paint treatment that the project is proposing along all of the driveways and intersections on Clement Avenue.

CONCLUSION

From this preliminary analysis of the proposed concept plan for Clement Avenue between Grand Street and Broadway, no fatal flaws related to truck access, parking, and driveway access and safety have been identified. However, the analysis provides the following recommendations that would be taken into consideration as part of the design phase of the project:

- Truck turning movements:
    - Clement Avenue & Park Street:
        - Set stop bar for cycle track for eastbound bicyclists at least 12 feet behind the striped crosswalk
        - Restrict parking on the north side of Clement Avenue west of Park Street for at least 75 feet
    - Clement Avenue & Chestnut Street (Svendsen Boat Yard):
        - Maintain current parking restriction on the north side of Clement near driveway
        - Install yield-controlled mixing zones for westbound traffic making right-turns
    - Clement Avenue & Grand Street:
        - Install bulb-out only on Grand Street to slow northbound right turns
        - Remove parking on the north side of Clement at least 50 feet from the stop bar
- Parking:
    - Restrict parking within 20 feet of driveways for cycle track
    - Restrict parking within 30 feet of intersections (at Broadway, Everett, Park, Oak, and Grand) for cycle track
    - Install sidewalk extensions to provide access around utility poles (if not undergrounded) to meet the ADA requirements
    - Consider repurposing unused driveways

Appendix 1: AutoTurn Analysis for Class 10 and Class 13 Trucks



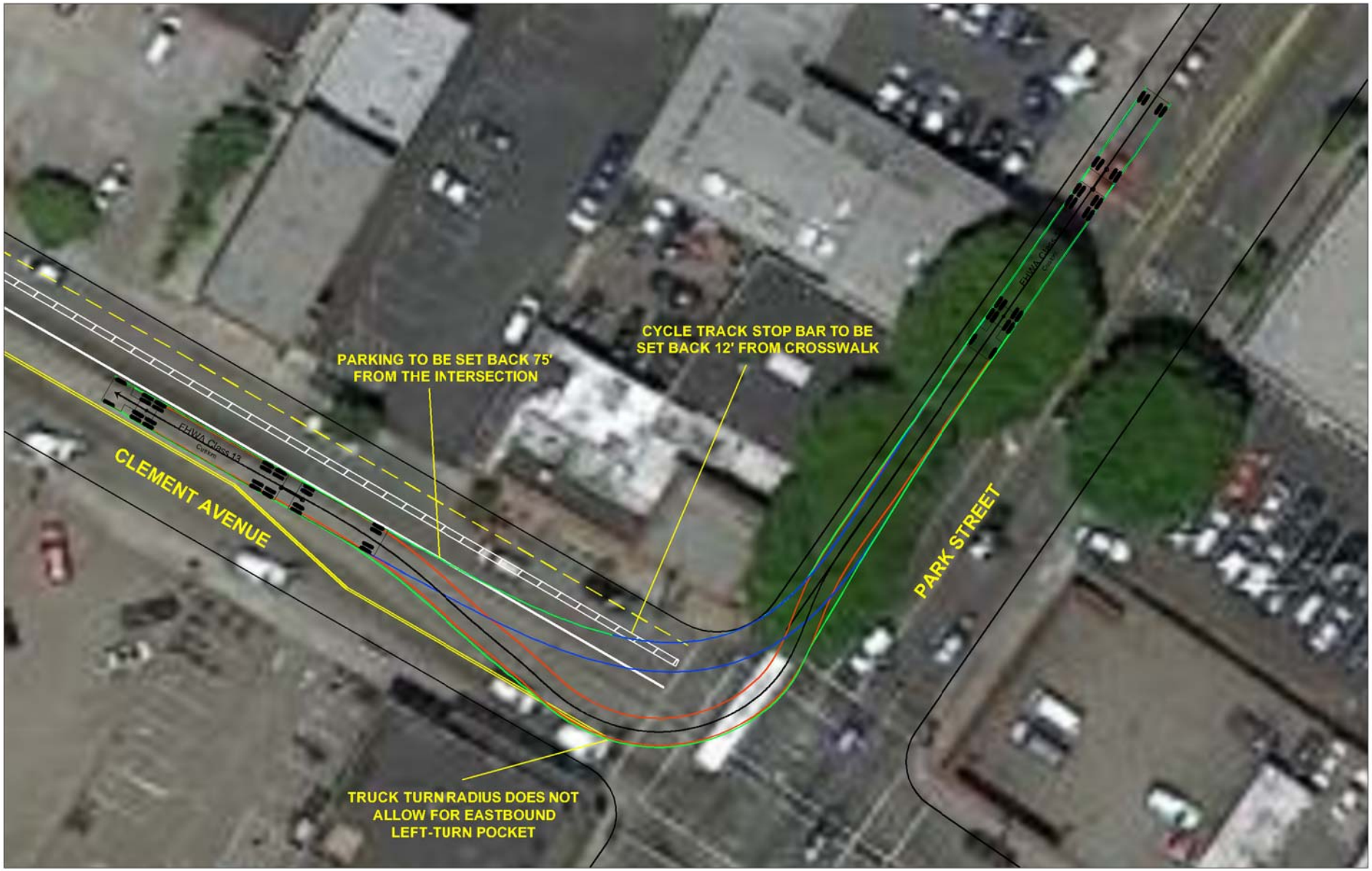
TRUCK TURN TEMPLATE

- Front Tires
- Rear Tires
- Vehicle Body

FHWA CLASS 10 TRUCK TURN
CLEMENT AVENUE & PARK STREET
ALAMEDA, CALIFORNIA

Figure
A-2

K:\H_Oakland\proj\file\17834 - Alameda Clement Ave Complete St Corridor\AutoTurn\17834_TruckTurns.dwg Feb 24, 2015 - 10:34pm - bkorporaal Layout Tab: Clement&Park_FHWA10



TRUCK TURN TEMPLATE

- Front Tires
- Rear Tires
- Vehicle Body

FHWA CLASS 13 TRUCK TURN
CLEMENT AVENUE & PARK STREET
ALAMEDA, CALIFORNIA

Figure
A-1

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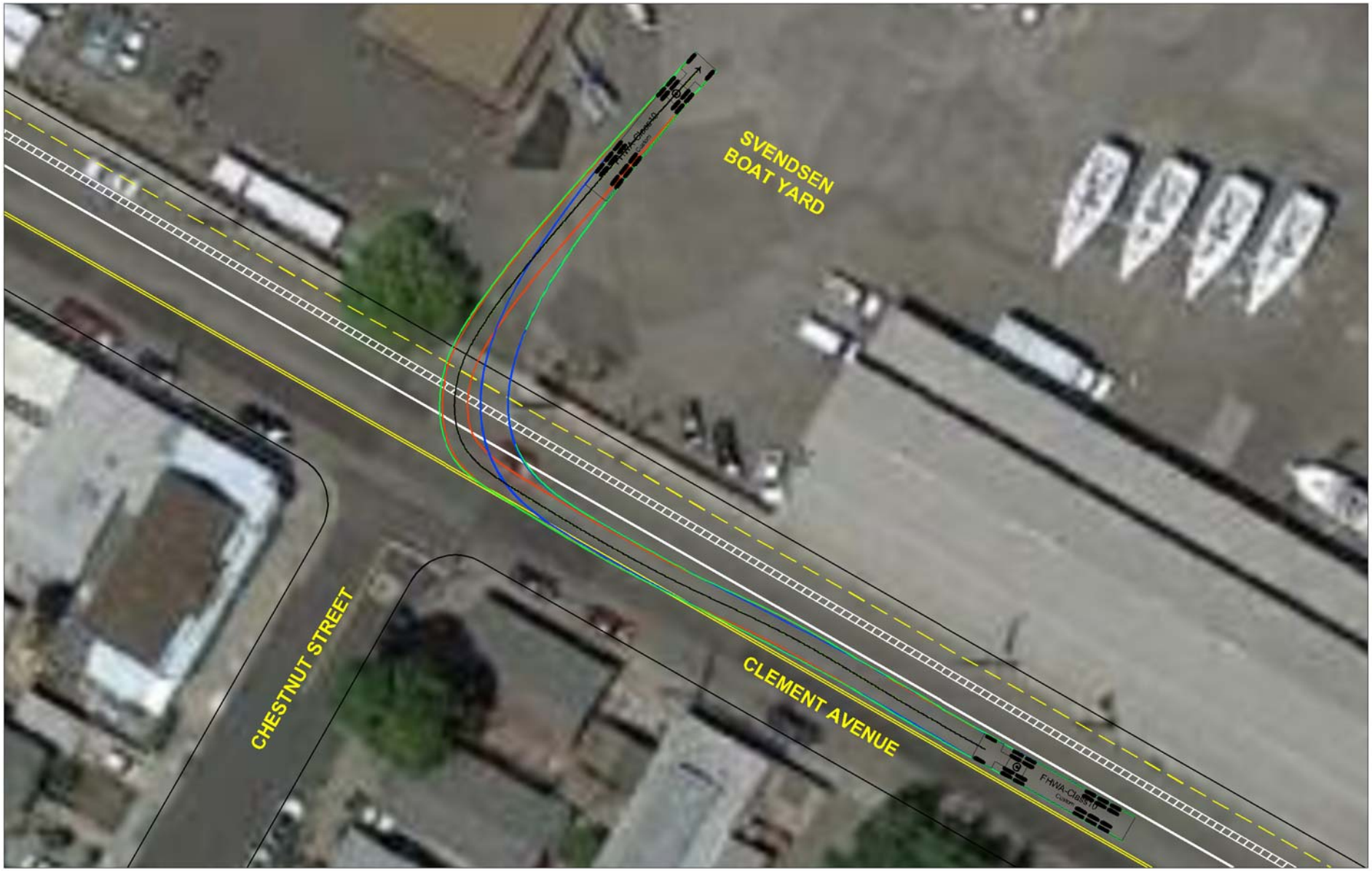

TRUCK TURN TEMPLATE

- Front Tires
- Rear Tires
- Vehicle Body

FHWA CLASS 10 TRUCK TURN
CLEMENT AVENUE & CHESTNUT STREET
ALAMEDA, CALIFORNIA

Figure
B-2

K:\H_Oakland\proj\file17834 - Alameda Clement Ave Complete St Corridor\AutoTurn\17834_TruckTurns.dwg Feb 24, 2015 - 10:42pm - bkorporaal Layout Tab: Clement&Chestnut_FHWA10

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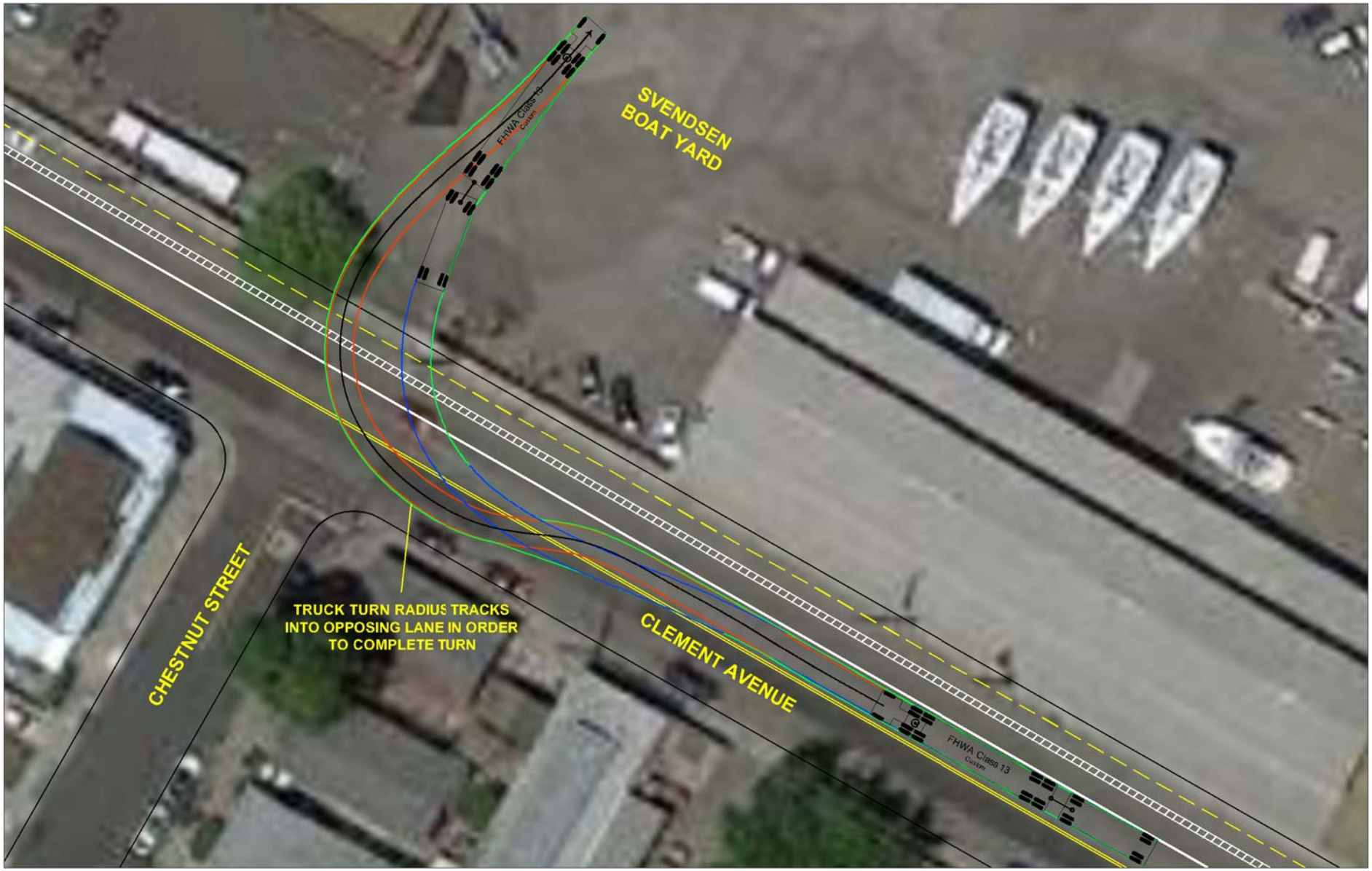

TRUCK TURN TEMPLATE

- Front Tires
- Rear Tires
- Vehicle Body

FHWA CLASS 13 TRUCK TURN
CLEMENT AVENUE & CHESTNUT STREET
ALAMEDA, CALIFORNIA

Figure
B-1

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TRUCK TURN TEMPLATE

- Front Tires
- Rear Tires
- Vehicle Body

FHWA CLASS 10 TRUCK TURN
CLEMENT AVENUE & GRAND STREET
ALAMEDA, CALIFORNIA

Figure
C-2

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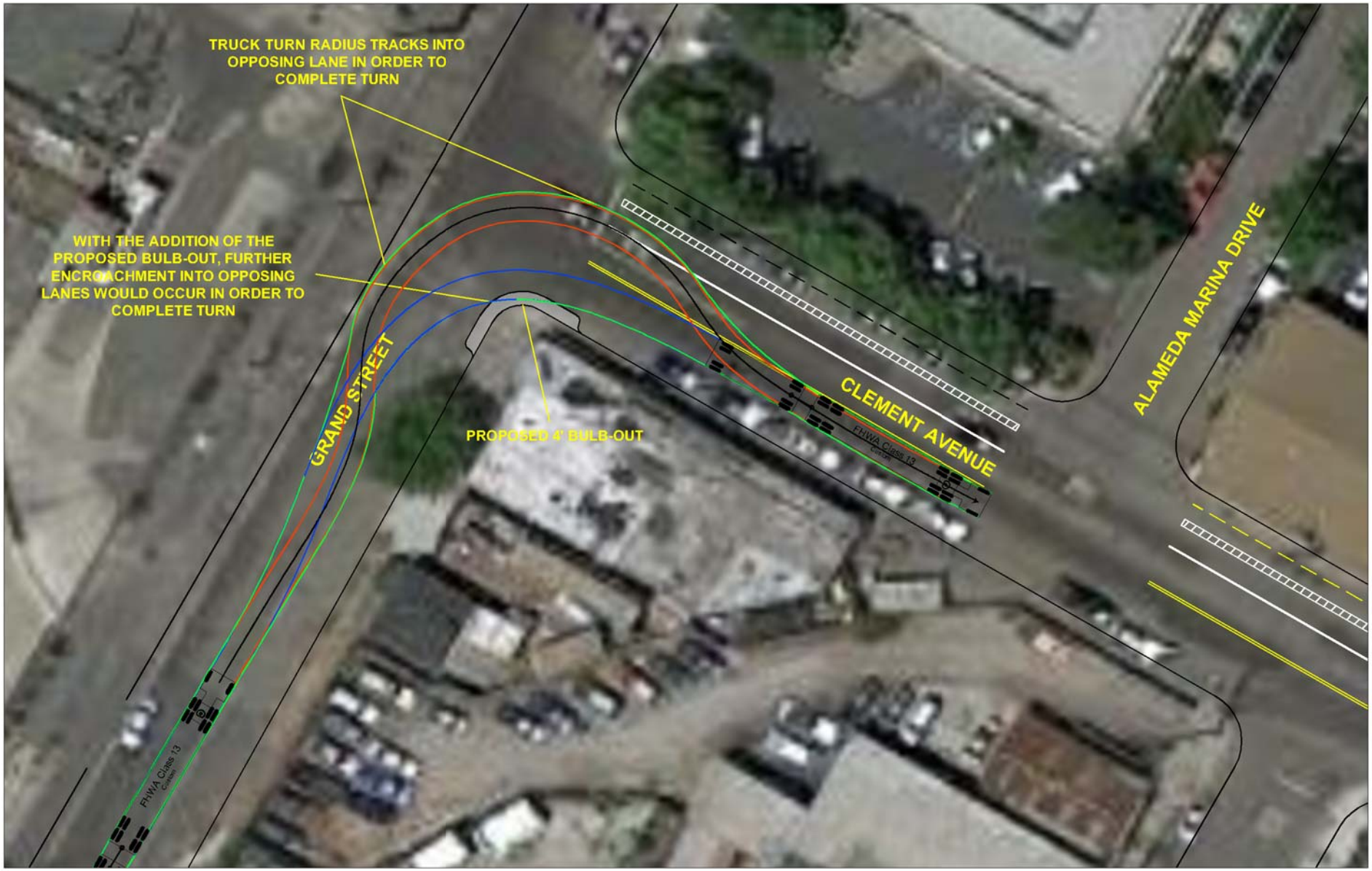

TRUCK TURN TEMPLATE

- Front Tires
- Rear Tires
- Vehicle Body

FHWA CLASS 13 TRUCK TURN
CLEMENT AVENUE & GRAND STREET
ALAMEDA, CALIFORNIA

Figure
C-1

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