

MEMORANDUM

Date: July 20, 2021

Project #: 24846

To: Gail Payne
City of Alameda

From: Mike Alston, RSP; Erin Ferguson, RSP, PE; Polina Polikakhina

Project: Citywide Roundabout Analysis

Subject: Citywide Roundabout Screening

Kittelison & Associates, Inc. (Kittelison) is helping the City of Alameda (City) identify locations where roundabouts could provide a safety benefit and merit further evaluation through an intersection control evaluation (ICE). This memorandum documents an initial citywide screening to identify potential locations for roundabouts across the City using criteria established in discussion with the City. Candidate locations were identified first by selecting locations along the City's all modes high injury corridors (HIC) and then assigning points for additional criteria including presence along a bus route, the City's Social Vulnerability Index, planned or existing bikeways, and identified HIC intersections.¹

Kittelison and the City collectively identified nine locations which Kittelison assessed for feasibility. In summary:

- Three locations were identified with the maximum screening score possible.
- An additional four sites were identified among other screened locations with high scores and added to the list.
- One of the sites was added to see if it should be incorporated as part of the Clement Avenue Extension/Tilden Way project.
- One of the sites was analyzed - Otis Drive & Grand Street – to validate against initial findings from the Otis Drive Safety Improvement Project.
- Five of the sites are already being advanced by the City and were removed from consideration.

Table 1 presents the resulting candidate locations Kittelison considered, and the recommendations from Kittelison's feasibility analysis. Table 2 presents the locations currently under consideration by City

¹The all modes HIC was developed as part of the City's Vision Zero Action Plan. The map is available for download at www.alamedaca.gov/VisionZero#section-5

staff and therefore not evaluated in this memorandum. This memorandum describes the process to develop the list of locations and the resulting feasibility evaluation for each site.

Table 1: Top Potential Roundabout Locations and Feasibility Screening Recommendations

Location	Identified By	Feasibility Assessment
Atlantic Avenue & Constitution Way	Top Score in screening	Proceed with ICE for further evaluation of roundabout; there are potential design challenges at the intersection
Atlantic Avenue/Appezzato Parkway & Main Street	Top Score in screening	Proceed with ICE for further evaluation of roundabout; there are potential design challenges at the intersection
Main Street & Willie Stargell Avenue	Top Score in screening	Proceed with ICE for further evaluation of roundabout
Park Street & Otis Drive	Additional Selected Sites from screening	Pursue other safety countermeasures
Central Avenue & Versailles Avenue	Additional Selected Sites from screening	Pursue other safety countermeasures
Encinal Avenue & Park Avenue	Additional Selected Sites from screening	Pursue other safety countermeasures
Encinal Avenue & Fernside Boulevard	Additional Selected Sites from screening	Proceed with ICE for further evaluation of roundabout
Tilden Way & Blanding Avenue / Fernside Boulevard	Clement Avenue Extension	Proceed with ICE for further evaluation of roundabout
Otis Drive & Grand Street	City council vote	Recent safety project implemented; ICE could be considered as part of longer-term change in traffic control

Table 2: Locations Identified but not Analyzed in This Memorandum

Location	Identified By	Location / Project Status
Central Avenue & Main Street & Pacific Avenue	Central Avenue Safety Improvement	Approved by City Council
Central Avenue & Sherman Street & Encinal Avenue	Central Avenue Safety Improvement	Approved by City Council
Central Avenue & Third Street	Central Avenue Safety Improvement	Approved by City Council
Central Avenue & Fourth Street & Ballena Blvd.	Central Avenue Safety Improvement	Approved by City Council
Mecartney Road & Island Drive	Proposed by City staff	Currently being studied by the City

Among the nine locations evaluated:

- Five locations would be appropriate for an ICE.
- Three locations have challenges that would make roundabout implementation prohibitively expensive or otherwise difficult; other safety countermeasures would be appropriate at those locations.

At one location (Otis Drive & Grand Street), the City recently completed a protected intersection project with expected safety benefits. An ICE could be considered in the future as part of a potential project to modify intersection traffic control, but the recent project will deliver benefits in the near term.

\\kittelson.com\tsa\H_Proj\24\24846 - City of Alameda On-Call Services 2020\001 - Citywide Roundabout Analysis\Task 2 Citywide RBT screening\gis\24846_Fig 1_Final Screening Results.mxd Date: 7/20/2021

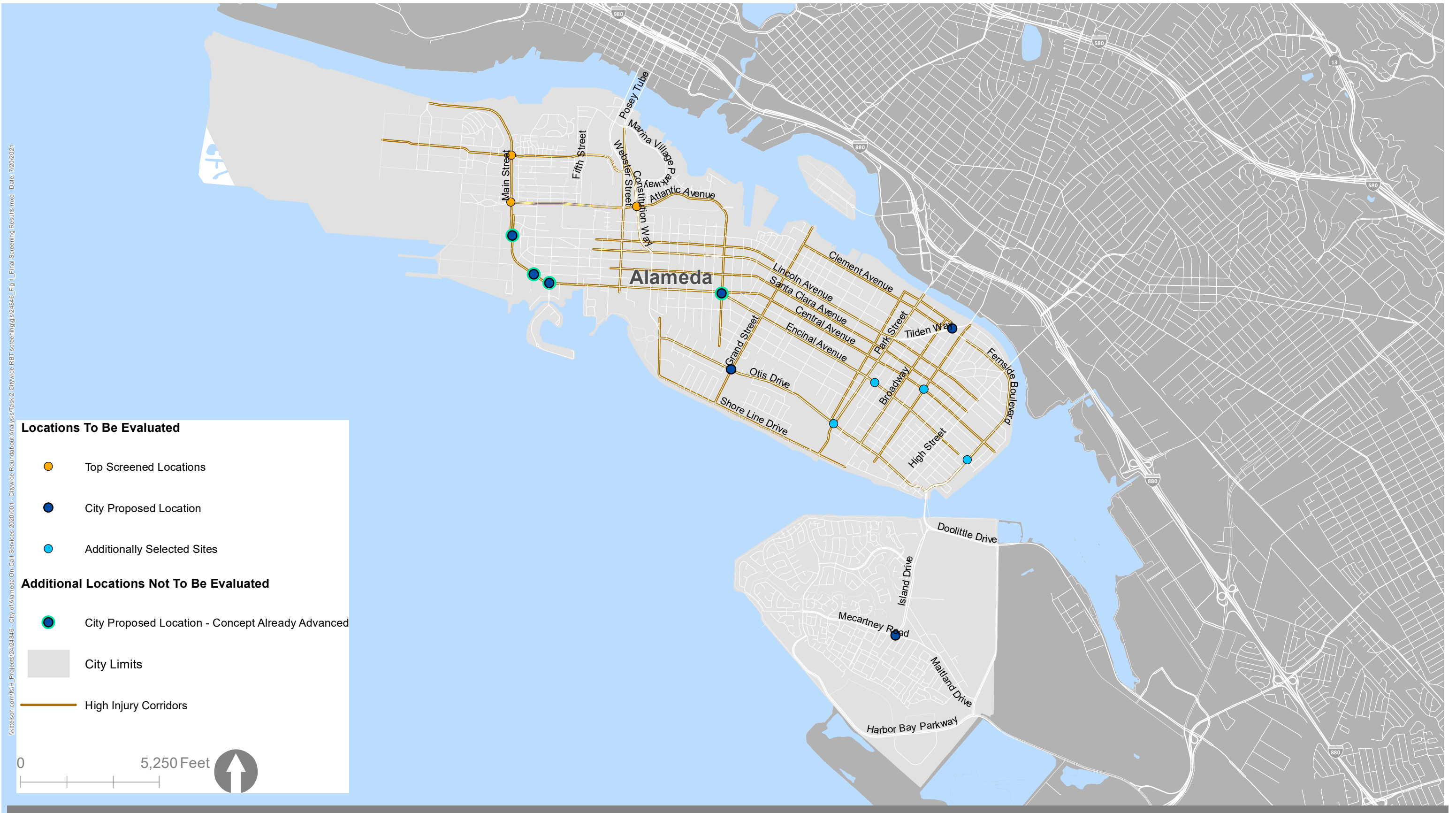


Figure 1: Roundabout Screening Results
Citywide Screening
City of Alameda

SCREENING METHODOLOGY

First, Kittelson used a spatial file provided by the City identifying the City's high injury corridors developed in 2020 for the Alameda Vision Zero Action Plan. The 376 intersections along those corridors were then screened as described below. All three HIC tiers were included.

The following criteria were then applied:

- **Alameda Social Vulnerability Index:** One point was assigned to intersections located within the City's most socially vulnerable areas as identified in the City of Alameda's 2019 Climate Action and Resiliency Plan.
- **Alameda Bikeways (Existing and Planned):** One point was assigned to intersections along existing or proposed bikeways (all classes) as identified in the City's Active Transportation Plan recommended bikeway network (July 2020).
- **Bus Routes:** One point was assigned to intersections along an existing AC Transit bus line.
- **High Crash Intersections:** One point was assigned to the "high crash intersections" that were identified in 2020 for the Alameda Vision Zero Action Plan.²¹

Intersections located on Park Street north of Otis Drive and on Webster Street were excluded from the analysis because the City has identified those streets as part of "Smart City Corridors" to include traffic signals.

The highest possible screening score was five points. Four locations obtained this highest possible score ("Level 1" locations). Three of the locations were advanced for feasibility analysis:

- Atlantic Avenue & Constitution Way,
- Atlantic Avenue/Appezzato Parkway & Main Street, and
- Main Street & Willie Stargell Avenue.

A fourth location (Santa Clara Avenue & Sherman Avenue) was identified to have a constrained footprint based on review of aerial imagery and was removed from further consideration.

Additional Selected Sites

The screening yielded 49 sites with four points ("Level 2" locations) and 160 sites with three points ("Level 3" locations). Among those sites, Kittelson also identified additional locations for further assessment:

- **Level 2 locations:** Park Street & Otis Drive and Central Avenue & Versailles Avenue

² A map of high-crash intersections is available for download at www.alamedaca.gov/VisionZero#section-5

- **Level 3 locations:** Encinal Avenue & Park Avenue and Encinal Avenue & Fernside Boulevard

These additional locations were identified with the following approach:

1. Identify additional Level 2 or 3 locations along a corridor where a potential roundabout location(s) was identified in Level 1, since roundabouts can be a useful corridor application.
2. Focus on identifying locations that would balance distribution geographically throughout the City.
3. Scan locations and measure the approximate existing diagonal curb-to-curb distance at the existing intersection with Google Earth Pro. This aerial scan provides a high-level understanding of whether a roundabout project would be prohibitively expensive or difficult to construct; locations with existing diagonal width well below planning-level estimated roundabout size were not considered.³

A list of Level 2 and 3 locations, excluding the sites already identified in Table 1, is provided as Attachment A to this memorandum.

FEASIBILITY ANALYSIS METHODOLOGY

For each site, Kittelson conducted a feasibility screening, either recommending that an ICE is an appropriate next step or that other countermeasures may be more appropriate for the City to explore at that location.

The feasibility screening consists of the following steps, which are explained in detail further below:

- 1. Estimate number of lanes needed:** Using the best available information, estimate if a single- or multilane roundabout (at least two circulating lanes on one portion of the roundabout) would be appropriate at the site.
- 2. Sizing estimates:** Based on step 1, estimate the approximate size of a roundabout at the site.
- 3. Recommendation:** Based on the size estimate ranges from step 2, determine whether a roundabout is a feasible option for further consideration. Recommend an ICE or no further study of a roundabout.

³ Exhibit 6-9 of NCHRP Report 672 – *Roundabouts: An Informational Guide* identifies the inscribed circle diameter of a typical single-lane roundabout to range from 90 to 180 feet, so intersections with an existing diagonal curb-to-curb width of considerably less than 90 feet were deemed impractical for further assessment.

Number of Lanes

The City provided Kittelson with historical intersection turning movement counts and roadway segment volumes.⁴ The turning movement counts were used as described below. The roadway segment volumes did not provide the key factors that determine roundabout sizing needs – namely, major/minor street and turning movement proportions. Depending on the data available, Kittelson used one of two methods to estimate the number of lanes for each roundabout. The first method uses turning movement counts, and the second method uses a qualitative assessment of local conditions and existing roadway cross-section. Kittelson used the qualitative method when suitable traffic volume data were not available for the turning movement count method.

When planning the roundabout footprint in more detail (e.g., as part of an ICE), a decision on single-lane versus multiple lanes can be made on an approach-by-approach basis (i.e., some but not all approaches may be multilane). However, for purposes of this feasibility screening, Kittelson used a generalized estimate of single or multilane footprint requirements rather than determining precise sizing needs. If a roundabout were implemented along with a road diet project, a single-lane roundabout would be appropriate at an existing multilane intersection.

Turning Movement Count Method

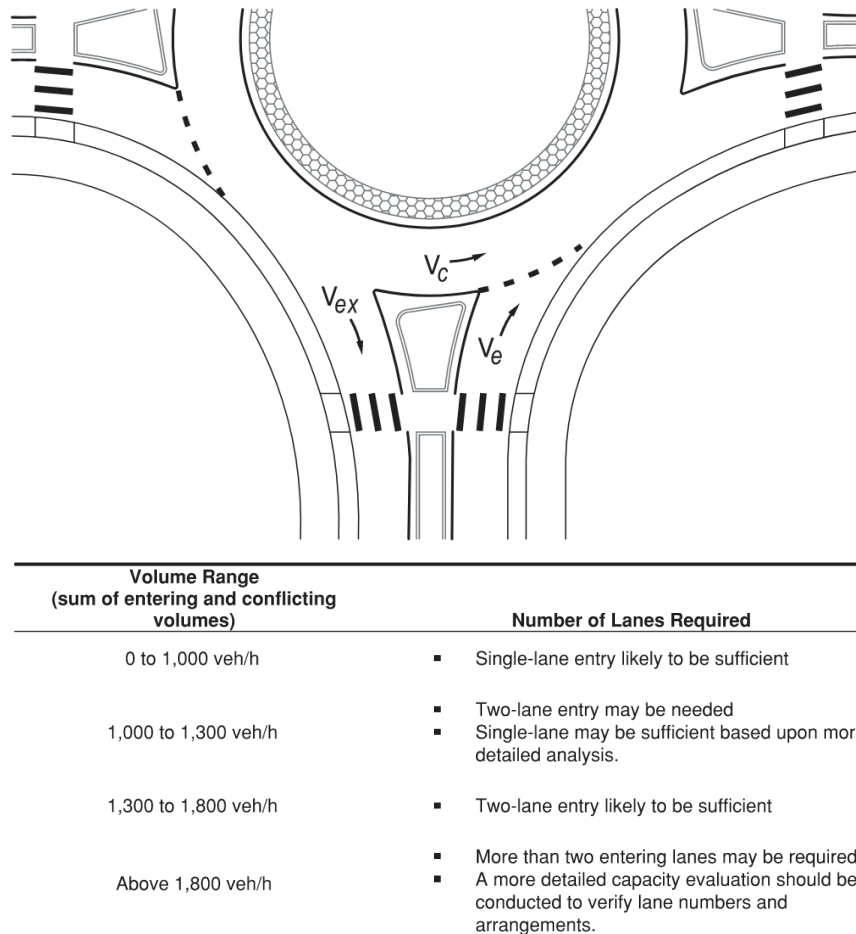
The first method used the guidance provided in NCHRP Report 672: *Roundabouts: An Informational Guide* (“Roundabout Guide”). Section 3.5 of the Roundabout Guide provides planning-level information to inform roundabout size needs. Exhibits 3-13 and 3-14 are reproduced below and provide guidance for estimating the size needed for a roundabout.

Figure 2 shows the three relevant inputs per intersection approach—circulating (V_c), entering (V_e), and exiting (V_{ex}) volumes—and provides a table for the number of lanes needed to accommodate different volume thresholds. If the sum of these three inputs does not exceed 1,000 vehicles per hour at any leg, a single-lane roundabout is a reasonable expectation.

The turning movement count method was applied at Atlantic Avenue & Constitution Way and Park Street & Otis Drive.

4

Figure 2: Entering and Conflicting Volumes Accommodated by Number of Lanes in Roundabout



Source: Exhibit 3-13 and 3-14 in NCHRP Report 672: *Roundabouts: An Informational Guide*

Qualitative Method

The qualitative method consisted of using knowledge of local conditions and Google aerial review. Kittelson used this approach for the intersections for which intersection traffic volume data were not available. Kittelson assumed the following:

- For intersections with approaching streets having a two- or three-lane total cross section, a single-lane roundabout is likely to be sufficient.
- For the intersections where one or all the approaches had four lanes, Kittelson assumed that a two-lane entry roundabout (or multilane roundabout) is likely to be appropriate or that a single-lane roundabout would be an appropriate to accompany a road diet project that reduces the approaching lane count.

The qualitative method was applied at Atlantic Avenue/Apezzato Parkway & Main Street, Main Street & Willie Stargell Avenue, Central Avenue & Versailles Avenue, Encinal Avenue & Park Avenue, Encinal

Avenue & Fernside Boulevard, Tilden Way & Blanding Avenue/Fernside Boulevard, and Otis Drive & Grand Street.

Size

Section 6.3.1 of the Roundabout Guide provides planning-level footprint size estimates. Footprint size requirements are based on the number of lanes and on the design vehicle. Figure 3 is reproduced from the Roundabout Guide and provides typical inscribed circle diameter (ICD) ranges, which account for distance to the edge of the traveled way.

These values assume the following:

- 90-degree angles between entry legs, and
- No more than four intersection legs.

For the intersections that do not meet these assumptions, the required size is likely to exceed the presented ICD parameters. For intersections meeting these assumptions, a roundabout within the size range shown in Figure 3 could be designed to accommodate the typical design vehicle shown in Figure 3 while also maintaining appropriately low vehicle entry speeds (i.e., below 25 mph for single-lane entries and below 30 mph for multiple entries).

Design Vehicle

The City of Alameda provided Kittelson with a truck route map (see Attachment B). To estimate a required ICD, Kittelson used planning information from the Roundabout Guide (see Figure 3). Kittelson used B-40 as the design vehicle for intersections not located on a truck route and WB-67 as the design vehicle for the intersections located on a designated truck route. The B-40 design vehicle is a 40-foot-long bus, and the WB-67 design vehicle is a truck with cab and trailer that total 67 feet long. For planning purposes, the WB-67 is comparable to the California Legal truck.

Figure 3: Typical Inscribed Circle Diameters

Roundabout Configuration	Typical Design Vehicle	Common Inscribed Circle Diameter Range*	
Mini-Roundabout	SU-30 (SU-9)	45 to 90 ft	(14 to 27 m)
Single-Lane Roundabout	B-40 (B-12)	90 to 150 ft	(27 to 46 m)
	WB-50 (WB-15)	105 to 150 ft	(32 to 46 m)
	WB-67 (WB-20)	130 to 180 ft	(40 to 55 m)
Multilane Roundabout (2 lanes)	WB-50 (WB-15)	150 to 220 ft	(46 to 67 m)
	WB-67 (WB-20)	165 to 220 ft	(50 to 67 m)
Multilane Roundabout (3 lanes)	WB-50 (WB-15)	200 to 250 ft	(61 to 76 m)
	WB-67 (WB-20)	220 to 300 ft	(67 to 91 m)

* Assumes 90° angles between entries and no more than four legs. List of possible design vehicles is not all-inclusive.

Source: Exhibit 6-9 in NCHRP Report 672: *Roundabouts: An Informational Guide*

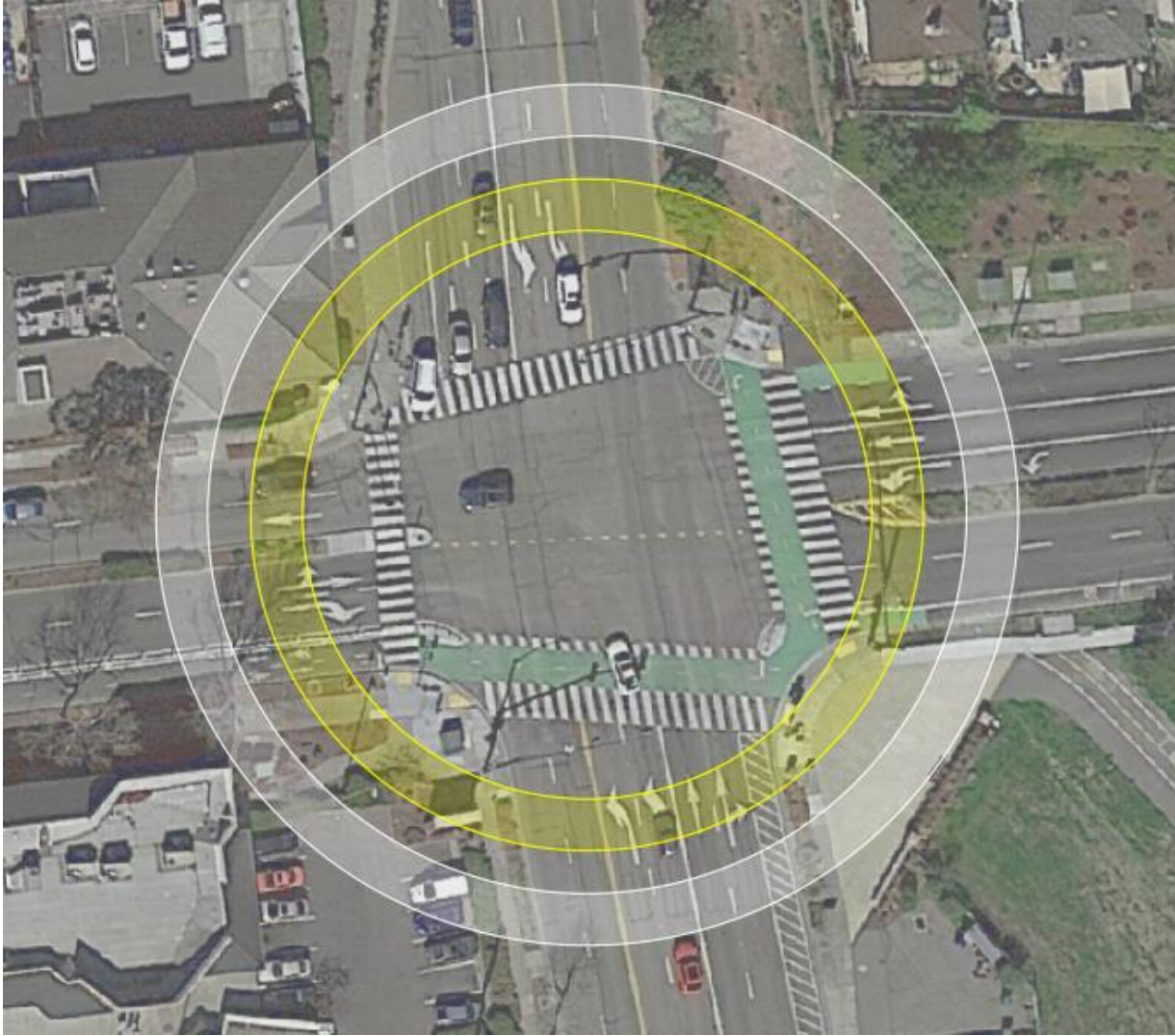
Roundabout Footprint Planning

Roundabout sizes presented above in Figure 3 indicate the ICD as measured from the outside of edge of traveled way on one side of the roundabout to the outside edge of traveled way on the opposite side. Additional width is needed to accommodate curbs, sidewalks, bicycle lanes, landscape buffers, and drainage. For the purposes of footprint planning, Kittelson assumes a 15-foot-wide buffer added to the edge of the traveled way. This is subsequently represented in this memo with the use of concentric circles. For example, Figure 4 shows an estimated 165-foot ICD (inside yellow circle) and an associated 15-foot-wide buffer for a sidewalk or path (outer yellow circle). The inner white circle shows a 220-foot ICD, and the outer white circle represents the edge of an associated path or sidewalk.

Each ring therefore represents the area between the vehicle traveled way and an outer edge of intersection right-of-way. For planning purposes, the *outer* circles of each color represent the assumed right-of-way needed to accommodate a roundabout at a given location.

Figure 4: Example Roundabout Footprint Planning.

Yellow ring represents the smaller range of the potential ICD, and the white ring represents the larger range of potential ICD.



Source: Kittelson, 2021; Google.

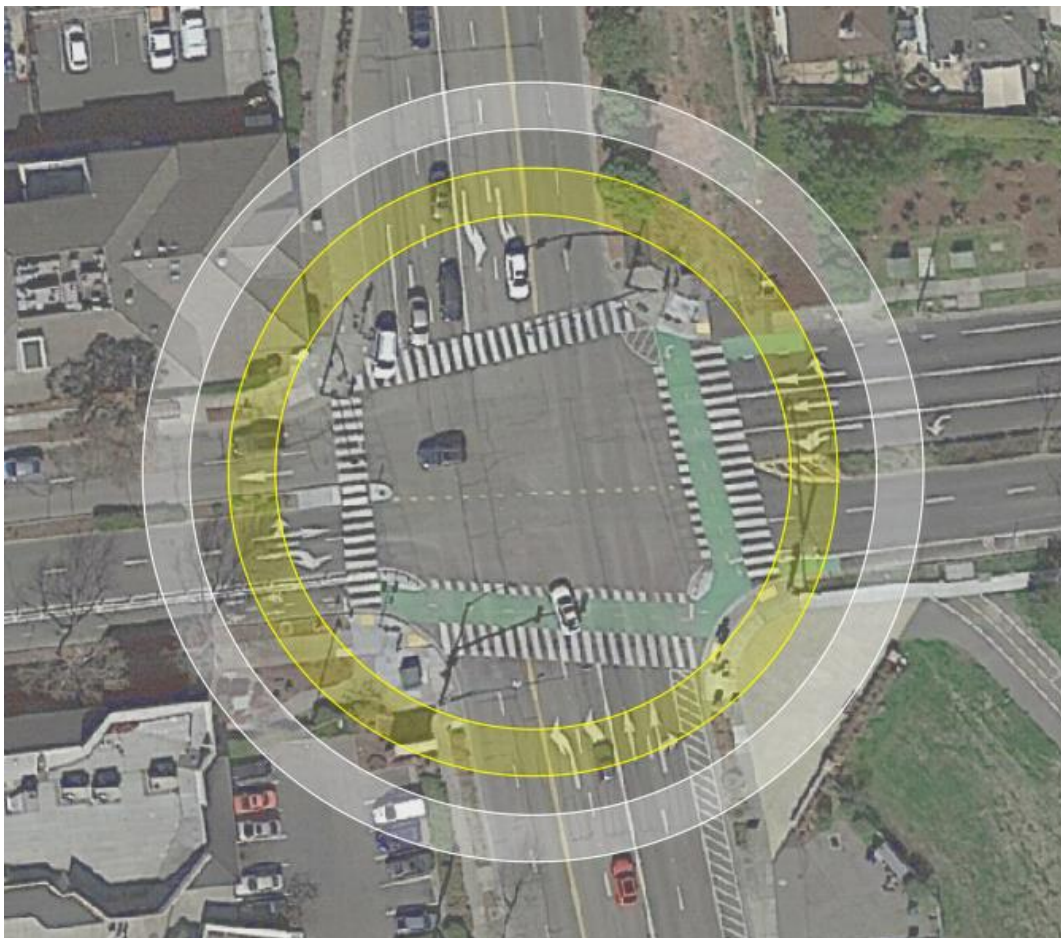
SITE RECOMMENDATIONS

Atlantic Avenue and Constitution Way

Atlantic Avenue / Constitution Way is a four-leg signalized intersection. To the west is a four-lane cross section with a two-way separated bicycle lane on the south side. To the east, Atlantic Avenue is a three-lane cross-section with turn lanes developed at the intersection. Constitution Way includes four through lanes to the north and south, with turn lanes developed at the intersection. A recently completed project connected the separated bike lane on the west side to the paths on the northeast and southeast corner and included a protected intersection channelized island.

Kittelson obtained turning movement counts from 2016 and 2018. Analysis of the PM peak hour turning movements indicated that a multilane roundabout would be appropriate to serve traffic volumes at the intersection (see Attachment C). Constitution Way (north of the intersection) and Atlantic Avenue in both directions are truck corridors, so the estimated ICD range would be 165 to 220 feet (shown in yellow and white respectively in Figure 5).

Figure 5: Footprint Estimate at Atlantic Avenue / Constitution Way



Source: Kittelson, 2021; Google.

Assessment

The upper end of the ICD range (outer edge of white circle) would require right-of-way takes of active existing land uses at three of the four intersection corners and would likely be prohibitively expensive. The lower end of the ICD range (outer edge of yellow circle) is closer to fitting within the existing footprint but would need to be shifted southeast to avoid right-of-way impacts, which itself would increase roadway realignment costs and potential impacts on the approach to the roundabout.

Constructing a roundabout at this location would entail high construction costs and right-of-way challenges. The City also recently implemented a project that included infrastructure to improve bicyclist and pedestrian safety. Incorporating a two-way separated bicycle path into a multilane roundabout presents an additional design challenge.

The City could proceed with an ICE; however, this would be a challenging location to implement a roundabout given the likely right-of-way impacts and costs. In the near-term, Kittelson suggests the City monitor the recent active transportation improvements at the location to determine if those or other improvements like those could most cost effectively address roadway safety needs at this location.

Table 3: Atlantic Avenue and Constitution Way Assessment

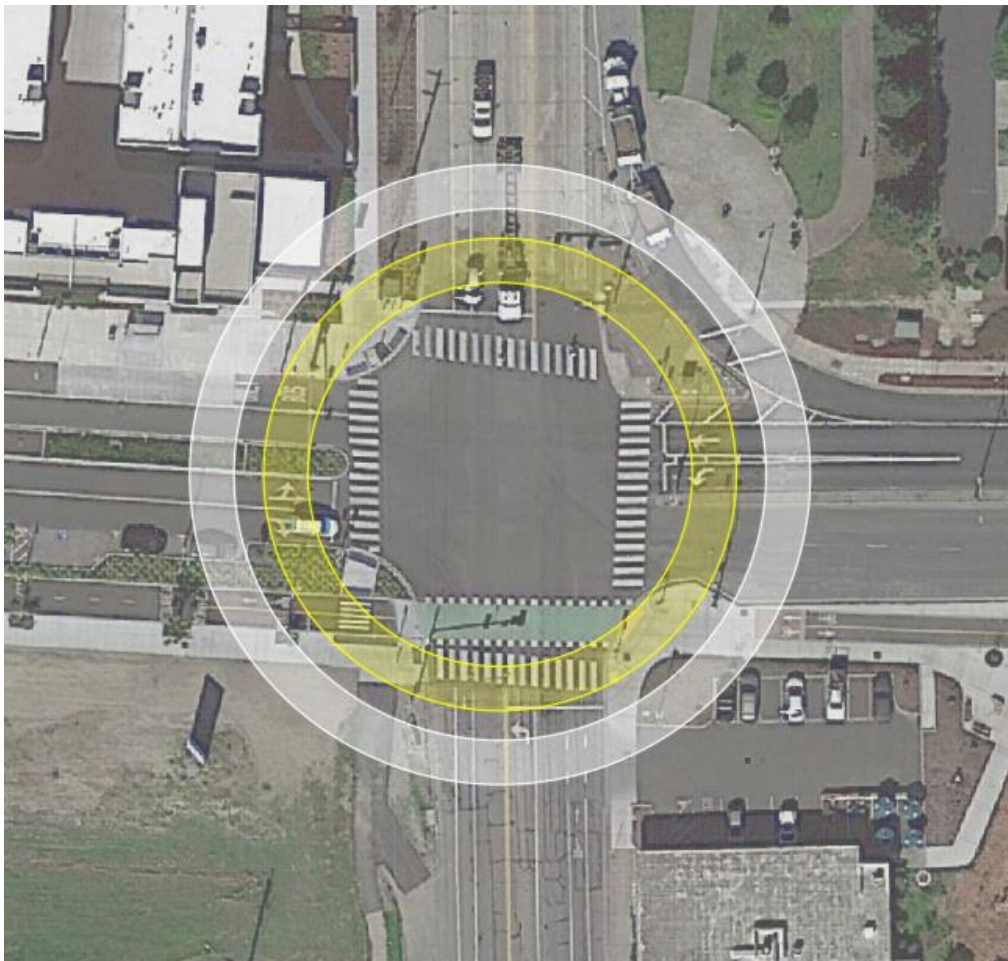
Location	Truck Route	Bicycle Route	Transit Route	Lane Sizing Assessment	Assumed single lane or multilane?	Assumed ICD Range (feet)	Feasibility Assessment and Recommendation
Atlantic Avenue & Constitution Way	Y	Y	Y	Turning Movement Counts	Multilane	165-220	Proceed with ICE for further evaluation of roundabout; there are potential design challenges at the intersection

Atlantic Avenue/Apezzato Parkway and Main Street

Atlantic Avenue / Apezzato Parkway / Main Street is a four-leg signalized intersection. Running along Apezzato Parkway is a four-lane street that includes the Cross Alameda Trail (walking and biking paths). Atlantic Avenue to the west was formerly a four-lane cross-section, but in conjunction with the recent Alameda Point development, the roadway has been reconfigured to include one general purpose lane in each direction with one dedicated bus lane in each direction. Main Street north and south of the intersection includes a single through lane in each direction, with turn lanes developed at the intersection and bike lanes along Main Street.

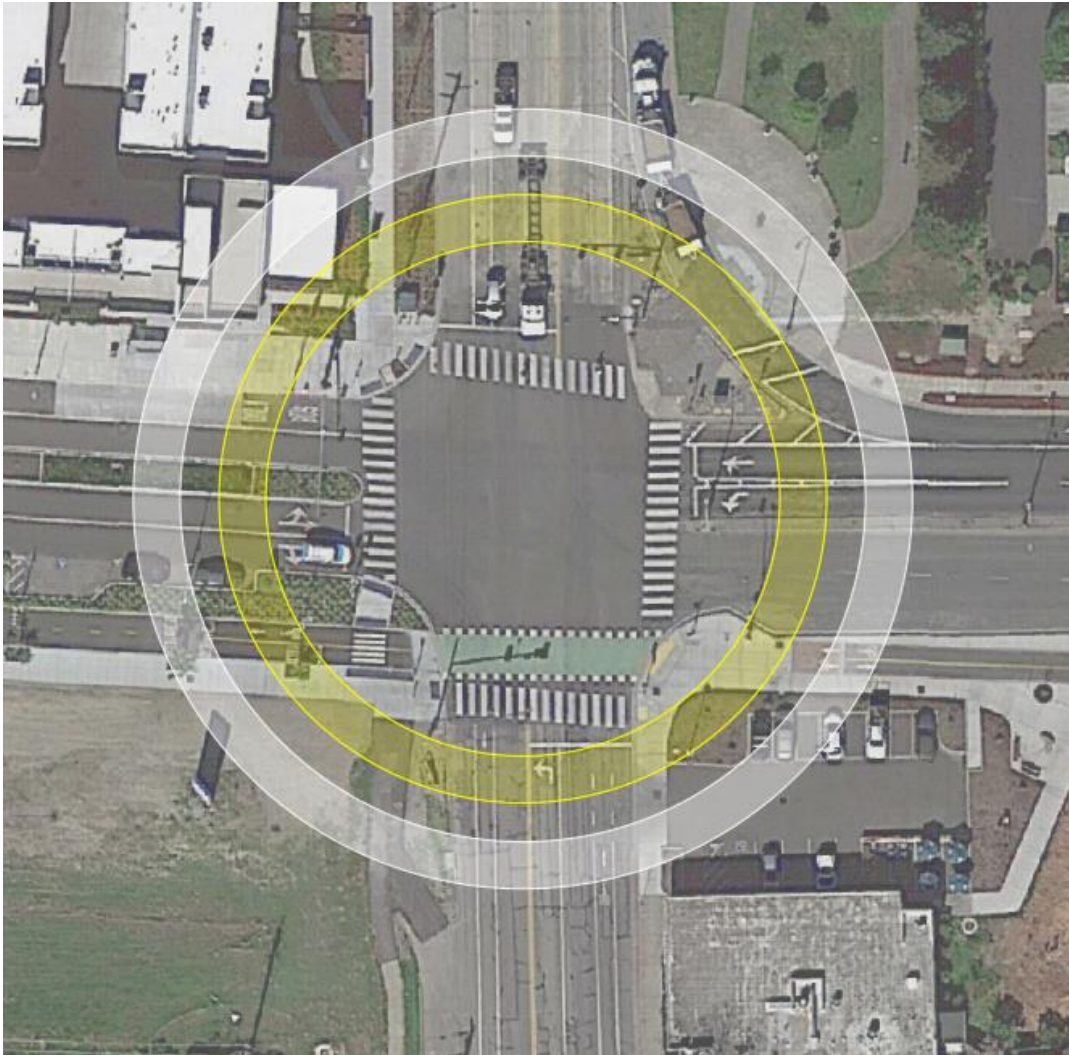
Kittelson obtained directional roadway volumes to the west of the intersection from 2017. However, given substantial changes associated with recent development and based on the roadway cross-sections, Kittelson estimated single-lane and multilane roundabout options. Both streets are truck corridors, so the estimated ICD range would be between 130 and 180 for a single-lane roundabout and 165 to 220 feet (shown in yellow and white respectively in Figure 6 and in Figure 7).

Figure 6: Single-Lane Footprint Estimate at Atlantic Avenue / Main Street



Source: Kittelson, 2021; Google.

Figure 7: Multilane Footprint Estimate at Atlantic Avenue / Main Street



Source: Kittelson, 2021; Google.

Assessment

The lower end of the ICD range may impact the Alameda Point development at the northwest corner of the intersection and would impact the parking lot at Hometown Donuts (southeast corner). Shifting the center of the roundabout from the position that is currently shown in Figure 6 to the southwest or northeast may decrease the footprint's impact on existing active land uses but could increase the design costs to realign the approaching roadways.

Constructing a roundabout at this location would include relatively high construction costs and would include right-of-way challenges. The City also recently reconfigured the intersection and approaching roadways with geometric design features that could improve safety at the intersection. Incorporating a two-way separated bicycle path along the southern intersection leg and multiuse path connections north and south present additional design challenges.

However, an ICE would be appropriate to help the City identify with updated traffic volumes whether a single or multilane roundabout would be appropriate. If the City were to plan a road diet along Appezzato Parkway, a single-lane assumption would be appropriate and would present fewer design challenges than a multilane roundabout. An ICE would screen alternatives and further detail the site needs and constraints.

Table 4: Atlantic Avenue/Apezzato Parkway & Main Street Assessment

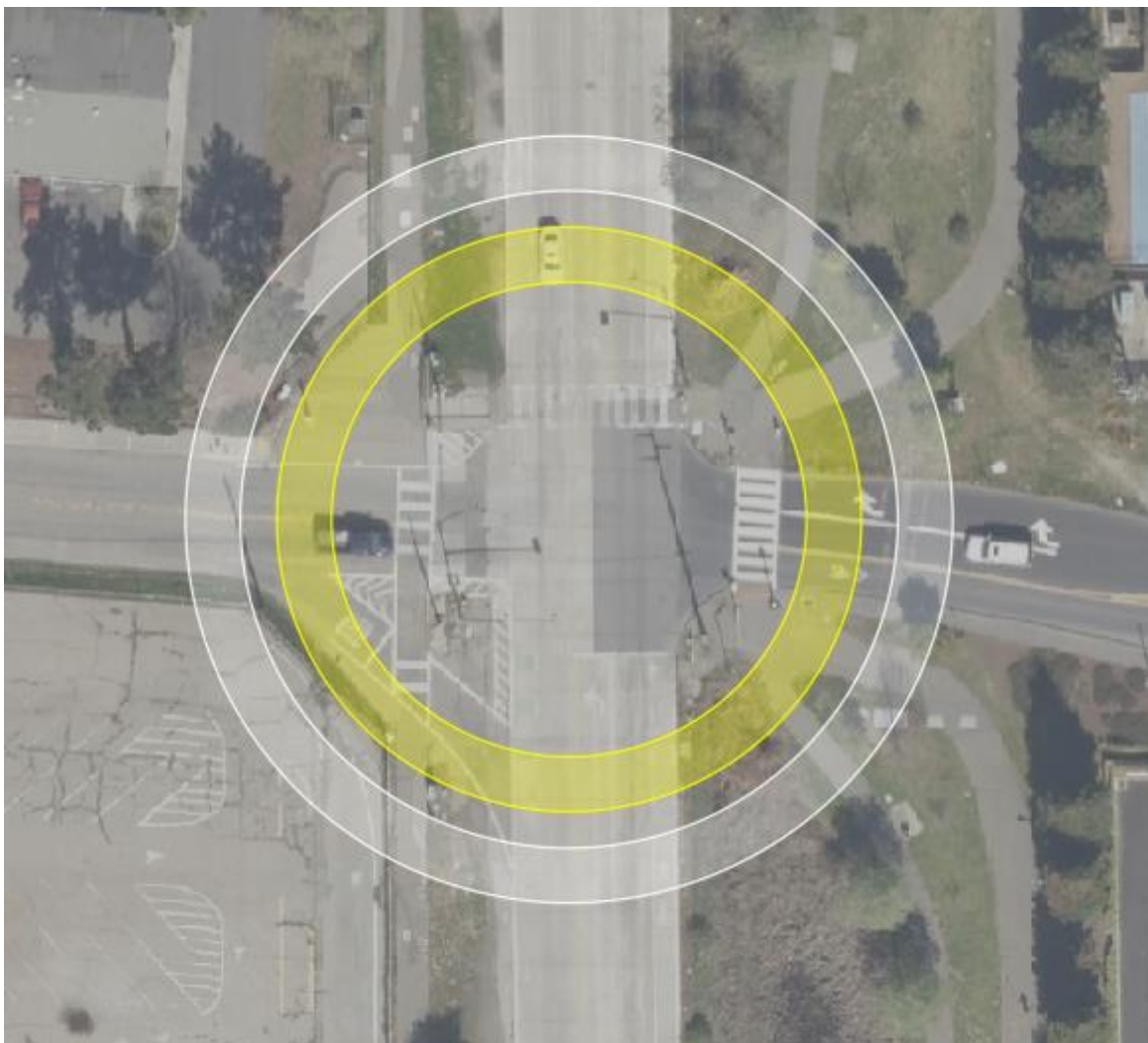
Location	Truck Route	Bicycle Route	Transit Route	Lane Sizing Assessment	Assumed single lane or multilane?	Assumed ICD Range (feet)	Feasibility Assessment and Recommendation
Atlantic Avenue & Appezzato Parkway & Main Street	Y	Y	Y	Qualitative	Single lane and multilane	130-220	Proceed with ICE for further evaluation of roundabout; there are potential design challenges at the intersection

Main Street and Willie Stargell Avenue

Main Street / Willie Stargell Avenue is a four-leg signalized intersection approximately 0.3 miles north of Atlantic Avenue / Main Street. Willie Stargell Avenue is a two-lane cross section to the east and west. A project is planned to add walking and bicycle paths and potential bus lanes or bus queue jump lanes along Willie Stargell Avenue, extending from this intersection to Fifth Street approximately 0.5 miles to the east. The City completed a road diet project along Main Street in 2019, converting Main Street from a four-lane cross-section to a three-lane cross-section (one through lane in each direction plus a two-way left turn lane).

Kittelsohn did not review any traffic volume data at this intersection. Based on the existing cross-section, Kittelsohn assumes a single-lane roundabout would be adequate. The intersection is on a truck corridor (Main Street), so the expected ICD is 130 to 180 feet (shown in yellow and white respectively in Figure 8).

Figure 8: Footprint Estimate at Main Street / Willie Stargell Avenue



Source: Kittelsohn, 2021; Google.

Assessment

The lower end of the ICD range could fit the existing location, with the area outside the ICD to accommodate pedestrian and bicycle travel in area currently dedicated to existing bike paths. Because the roadways are perpendicular, the lower ICD estimate may be achievable. The outer ICD range has more impact relative to the existing footprint but could be located to avoid impacting existing active land uses. Any challenges with right-of-way would be related to the existing paved area on the southwest corner and the residential land use on the northwest corner, which is set back from the roadway at the corner.

This location is promising for a roundabout and would be well served by the treatment. An ICE is an appropriate next step and would need to reconcile plans for a recommended cross-section in the Alameda Point Master Infrastructure Plan and site-specific concerns with flooding related to sea level rise. An ICE would identify any location-specific challenges for alternatives at the site.

Table 5: Main Street and Willie Stargell Avenue Assessment

Location	Truck Route	Bicycle Route	Transit Route	Lane Sizing Assessment	Assumed single lane or multilane?	Assumed ICD Range (feet)	Feasibility Assessment and Recommendation
Main Street & Willie Stargell Avenue	Y	Y	Y	Qualitative	Single lane	130-180	Proceed with ICE for further evaluation of roundabout

Park Street and Otis Drive

Park Street / Otis Drive is a four-leg signalized intersection with residential land uses on three corners and the South Shore Center commercial area on its southwest corner. Park Street is a three-lane cross-section to the north (one through lane in each direction) and a four-lane cross section to the south that widens to accommodate turn lanes at the intersection. Otis Drive is a three-lane cross section to the east that widens to accommodate turn lanes at the intersection, and a 5-lane cross section to the west. The City recently implemented a road diet project further west along Otis Drive that ends approximately 0.4 miles to the west of this intersection.

Kittelson obtained turning movement counts from 2016. Based on that existing data, a multilane entry roundabout is appropriate to accommodate traffic volumes (see Attachment C). The intersection is not on a truck route. The estimated ICD range is between 165 to 220 feet (shown in yellow and white respectively in Figure 9).

Figure 9: Footprint Estimate at Park Street / Otis Drive



Source: Kittelson, 2021; Google.

Assessment

A multilane roundabout at this location would have a footprint with encroachments into existing active land uses on all intersection corners. Given the recent roadway reconfiguration to the west, traffic volumes may have rebalanced or diminished within the City and are lower through this intersection than recorded in 2016. If the City implemented a roadway reconfiguration and vehicle lane reduction through this intersection, a single-lane roundabout as part of such a project would merit an ICE. Otherwise, a roundabout does not currently appear to be feasible at this location.

This intersection has been identified for Highway Safety Improvement Program (HSIP)-funded improvements that include high-visibility crosswalks, newly-painted red curb, striped bulbouts with bollards, a new signal cabinet and controller and upgraded signal timing, and new backplates on 12" signal heads. In the near-term, Kittelson suggests the City monitor these improvements to determine if those address the desire to improve safety at the intersection. Further significant investments, such as a roundabout, may no longer be needed at this location. At some point in the future, the City could decide to move forward in conducting an ICE for this intersection.

Table 6: Park Street and Otis Drive Assessment

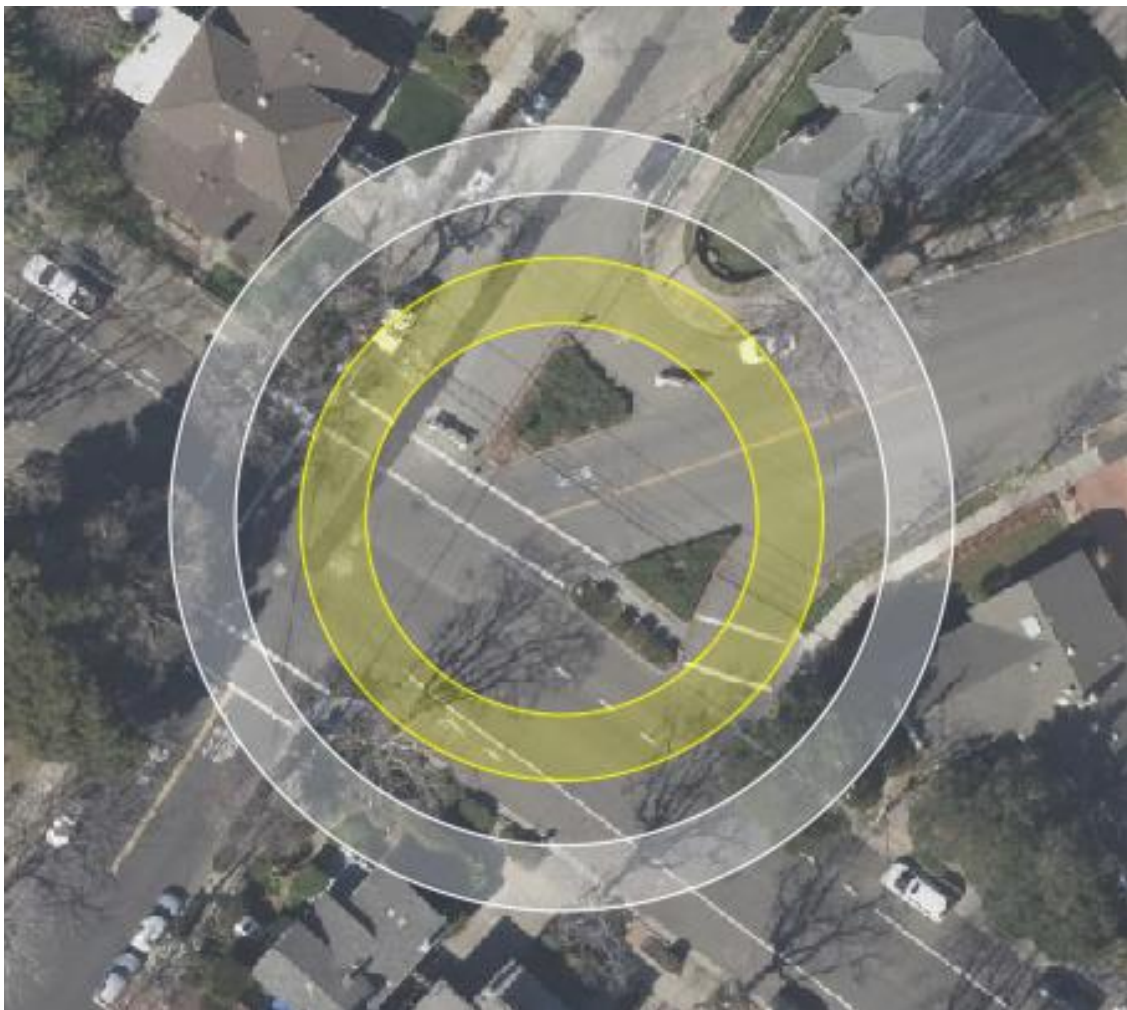
Location	Truck Route	Bicycle Route	Transit Route	Lane Sizing Assessment	Assumed single lane or multilane?	Assumed ICD Range (feet)	Feasibility Assessment and Recommendation
Park Street & Otis Drive	N	Y	Y	Turning Movement Counts	Multilane	165-220	Pursue other safety countermeasures

Central Avenue and Versailles Avenue

Central Avenue / Versailles Avenue is a five-leg intersection with stop control along Central Avenue and along a fifth northeastern leg, Gibbons Drive. All approaching roadways are two-lane cross sections. Kittelson did not review any traffic volume data at this intersection. Based on the existing roadway configurations, Kittelson assumed a single-lane roundabout would be adequate. The intersection is not on a truck route; therefore, the expected ICD is 90 to 150 feet (shown in Figure 10).

Accommodating a fifth leg into a roundabout generally increases the expected footprint necessary. At this intersection it would require some roadway realignment depending on the location of the center island. Thus, a roundabout here would be closer to (or would exceed) the larger end of the ICD range shown—which already shows four impacted homes.

Figure 10: Single-Lane Footprint Estimate at Central Avenue/ Versailles Avenue



Source: Kittelson, 2021; Google.

Assessment

A roundabout at this location would have a footprint with encroachments into existing active land uses. A roundabout does not appear to be feasible at this location. Other safety countermeasures may be more appropriate.

Table 7: Central Avenue and Versailles Avenue Assessment

Location	Truck Route	Bicycle Route	Transit Route	Lane Sizing Assessment	Assumed single lane or multilane?	Assumed ICD Range (feet)	Feasibility Assessment and Recommendation
Central Avenue & Versailles Avenue	N	Y	N	Qualitative	Single lane	90-150	Pursue other safety countermeasures

Encinal Avenue and Park Avenue

Encinal Avenue / Park Avenue is a stop-controlled intersection. Encinal Avenue is the major, uncontrolled street; Park Avenue is a two-way minor street on the north leg and becomes a one-way couplet on the south leg. The couplet defines the boundaries of Chochenyo Park, which abuts the south side of the intersection. Encinal Avenue is a four-lane cross section, and Park Avenue includes a single lane in each direction. Encinal Avenue is a Caltrans facility, and Caltrans is planning a road diet to reduce the cross-section from four lanes to three.

Kittelson did not review any traffic volume data at this intersection. Based on the proposed reduction to a three-lane cross-section on Encinal Avenue, Kittelson assumed a single-lane roundabout would be appropriate. Encinal Avenue is a truck corridor, so the estimated ICD range would be between 130 to 180 feet (shown in yellow and white respectively in Figure 11, right). Because of the wide intersection footprint and the offset Park Avenue couplet approaches, Kittelson explored other footprint options to accommodate the one-way couplet, including non-traditional roundabout shapes like an oval or a dogbone shape. A roundabout would impact a considerable amount of Chochenyo Park and land uses at the intersection corner. All options explored had footprints with at least as much right-of-way impact as shown in Figure 11.

Figure 11: Footprint Estimate at Encinal Avenue / Park Avenue



Source: Kittelson, 2021; Google.

Assessment

Any roundabout at this intersection—even those closer to the lower end of the estimated ICD range—would encroach significantly into Chochenyo Park and possibly into active land uses on the northern side of the intersection. A roundabout does not appear to be feasible at this location. Other safety countermeasures may be more appropriate, and Caltrans will be installing a rectangular rapid flashing beacon (RRFB) here within the next year, in addition to the planned road diet and bike lane project.

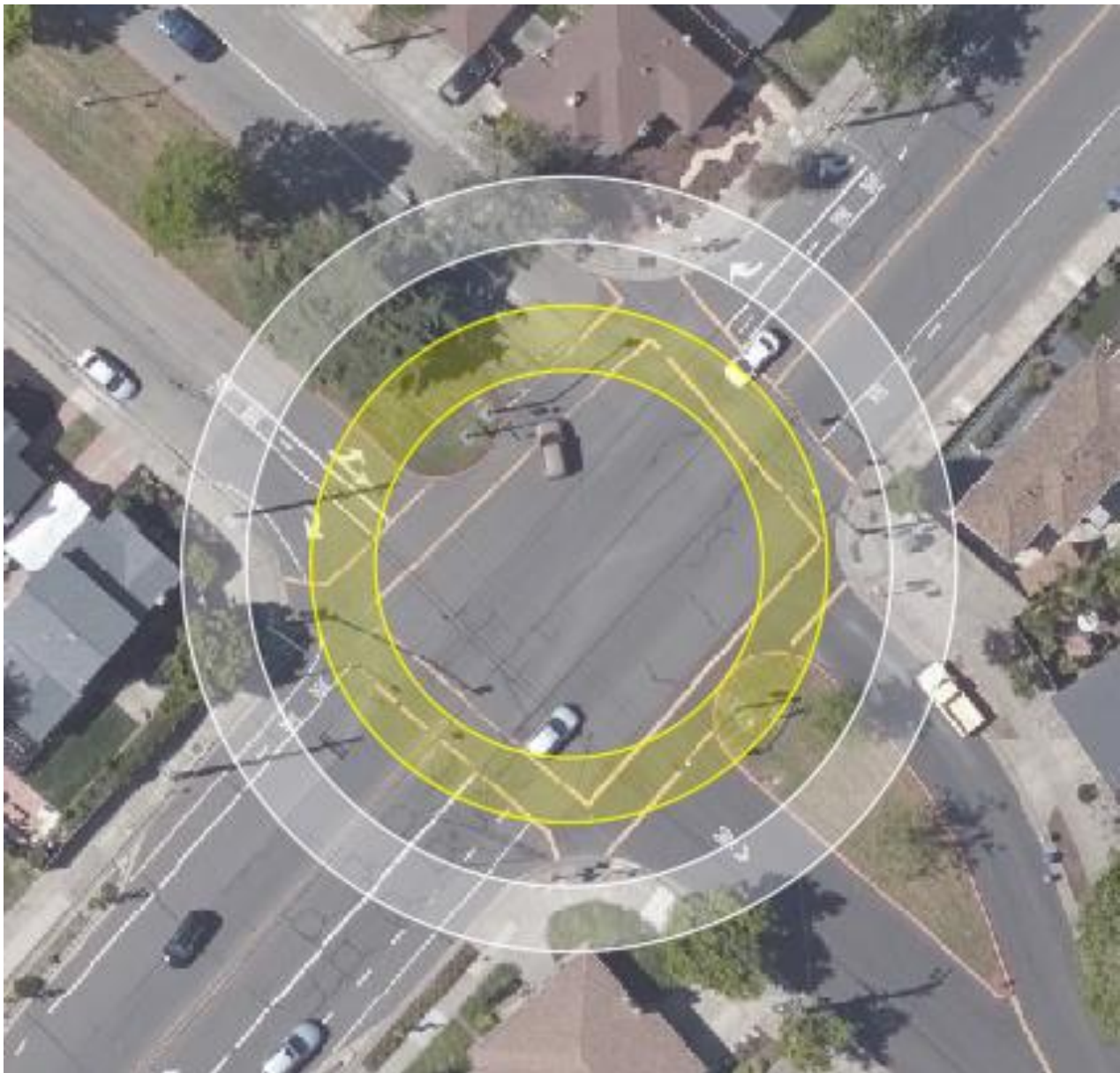
Table 8: Encinal Avenue and Park Avenue Assessment

Location	Truck Route	Bicycle Route	Transit Route	Lane Sizing Assessment	Assumed single lane or multilane?	Assumed ICD Range (feet)	Feasibility Assessment and Recommendation
Encinal Avenue & Park Avenue	Y	Y	Y	Qualitative	Single lane and multilane	130-180	Pursue other safety countermeasures

Encinal Avenue and Fernside Boulevard

Encinal Avenue / Fernside Boulevard is a four-leg signalized intersection. Encinal Avenue and Fernside Boulevard both include two-lane cross sections with additional turn lanes developed at the intersection. Kittelson did not review any traffic volume data at this intersection; based on the existing cross-sections, Kittelson assumes a single-lane roundabout would be adequate. The intersection is not on a truck route, so the expected ICD range would be from 90 to 150 feet (shown in yellow and white, respectively, in Figure 12).

Figure 12: Footprint Estimate at Encinal Avenue / Fernside Boulevard



Source: Kittelson, 2021; Google.

Assessment

Provided that the lower end of the ICD range is achievable, a roundabout in the approximate location shown would have minimal or no significant right-of-way impacts to the existing residential land uses at the corners. The existing medians would need to be altered to accommodate splitter islands.

This intersection would be well served by a roundabout, which may be able to be accommodated within existing right-of-way. An ICE is an appropriate next step for the City. An ICE would identify any location-specific challenges for recommended intersection control types and forms.

Table 9: Encinal Avenue and Fernside Boulevard Assessment

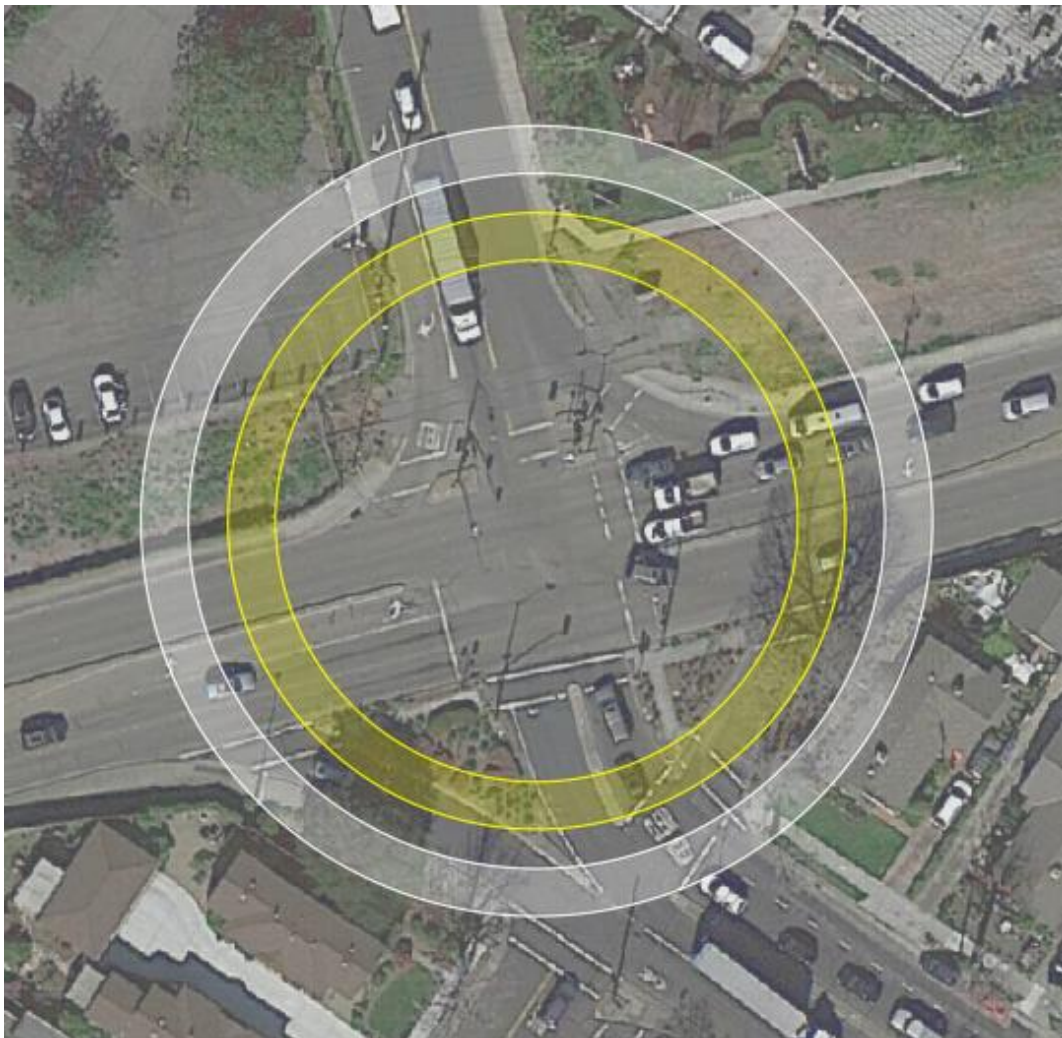
Location	Truck Route	Bicycle Route	Transit Route	Lane Sizing Assessment	Assumed single lane or multilane?	Assumed ICD Range (feet)	Feasibility Assessment and Recommendation
Encinal Avenue & Fernside Boulevard	N	Y	Y	Qualitative	Single lane	90-150	Proceed with ICE for further evaluation of roundabout

Tilden Way and Blanding Avenue/Fernside Boulevard

Tilden Way / Blanding Avenue / Fernside Boulevard is a four-leg signalized intersection. Tilden Way is a four-lane cross-section in both directions, with additional turn lanes developed at the intersection. Blanding Way to the north (is a two-lane cross section), and Fernside Boulevard (to the south) is a three-lane cross-section (one through lane in each direction). Approximately 800 feet east of the intersection, Tilden Way becomes Fruitvale Avenue and provides an estuary crossing connecting to Oakland (the Miller-Sweeney Bridge). The City has indicated that the vacant right-of-way on the north side of the intersection is planned for a multi-use path and/or transit queue jump lanes.

Kittelson did not review any traffic volume data at this intersection. Based on the existing Fernside Boulevard and Tilden Way cross-sections, Kittelson assumed a multilane roundabout would be appropriate. The intersection is on a truck route (Tilden Way), so the estimated ICD range is from 165 to 220 feet (shown in yellow and white, respectively, in Figure 13).

Figure 13: Multilane Footprint Estimate at Tilden Way and Blanding Avenue/Fernside Boulevard



Source: Kittelson, 2021; Google.

Assessment

The presented footprint estimates show that, if a multilane roundabout could be designed on the smaller end of the presented range, it could mostly be accommodated within existing right-of-way. Even so, some right-of-way takes at the northwest corner (currently a mortuary parking lot) would be necessary. The Pearl Street connection that serves northbound right turns would be removed to accommodate any roundabout design.

A multilane roundabout at this location would come with some right-of-way implications and would present some design challenges. Accommodating a two-way multi-use path at a multilane roundabout is feasible but presents design challenges and imposes additional right-of-way needs. Planned transit queue jump lanes are only a feasible solution at a signalized intersection, not a roundabout.

However, the location could be well served by a roundabout, and ICE is an appropriate next step. If the City were to plan a road diet along Tilden Way, a single-lane assumption would likely be appropriate and would present fewer design challenges than a multilane roundabout. An ICE would screen alternatives and indicate the detailed needs at the site to determine if a roundabout is a preferred intersection control type here.

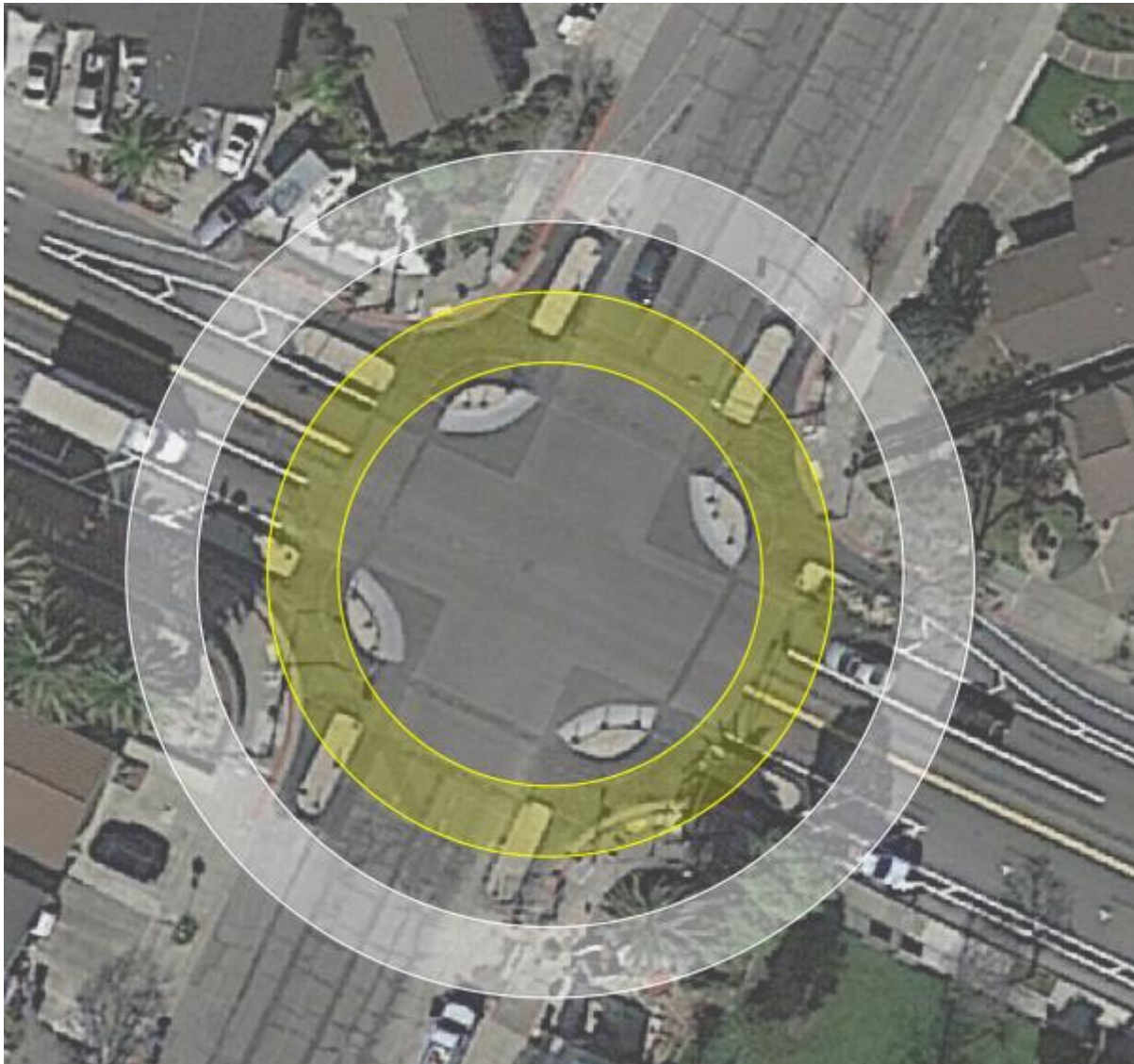
Table 10: Tilden Way & Blanding Avenue / Fernside Boulevard Assessment

Location	Truck Route	Bicycle Route	Transit Route	Lane Sizing Assessment	Assumed single lane or multilane?	Assumed ICD Range (feet)	Feasibility Assessment and Recommendation
Tilden Way & Blanding Avenue / Fernside Boulevard	Y	Y	Y	Qualitative	Multilane	165-220	Proceed with ICE for further evaluation of roundabout

Otis Drive and Grand Street

Otis Drive / Grand Street is a four-leg signalized intersection. Otis Drive and Grand Street both include a single through lane in each direction, with left-turn lanes developed at the intersection. A roadway reconfiguration project was completed in 2021 that installed a protected intersection at this location. Kittelson did not review any traffic volume data at this intersection. The intersection is not on a truck route, so the estimated ICD range is between 90 and 150 feet (shown in yellow and white respectively in Figure 14).

Figure 14: Footprint Estimate at Otis Drive/Grand Street



Source: Kittelson, 2021; Google.

Assessment

Because the approaching roadways are perpendicular and not along a truck route, a roundabout closer to the lower end of the estimate may be achievable. As demonstrated in the aerial, such a design could fit within existing right-of-way. However, the City recently completed a protected intersection project as part of a roadway reconfiguration with expected safety benefits. In the near-term, Kittelson suggests the City monitor the recent active transportation improvements at this location to determine if those address the desire to improve safety and active transportation at the intersection. Further significant investments, such as a roundabout, may no longer be needed at this location. At some point in the future, the City could decide to move forward in conducting an ICE for this intersection.

Table 11: Otis Drive & Grand Street Assessment

Location	Truck Route	Bicycle Route	Transit Route	Lane Sizing Assessment	Assumed single lane or multilane?	Assumed ICD Range (feet)	Feasibility Assessment and Recommendation
Otis Drive & Grand Street	N	Y	Y	Qualitative	Single lane	165-220	Recent safety project implemented; ICE could be considered as part of longer-term change in traffic control

RECOMMENDATIONS AND NEXT STEPS

Table 12 presents the locations evaluated, along with input values, sizing assumptions, and feasibility assessments. Table 13 presents intersections identified but not evaluated in this memo. Based on these findings, the City may consider advancing some of the candidate locations for further consideration as part of an ICE. The assessment recommendations are also presented in Figure 15.

ICE is intended to be a flexible evaluation process that provides a framework for assessing tradeoffs among intersection form and control options. ICE can include the performance measures relevant to the City's intended outcomes – typically some level of operations analysis and qualitative or quantitative safety evaluation – as well as public input opportunities. An ICE may also include site-specific measures like the ability to accommodate transit preferential measures or a given bike lane design. At some locations reviewed in this memorandum, a necessary first step of ICE will be to collect turning movement counts or to determine the planned scenario (e.g., as part of a road diet project, or reconciling the existing cross-section with proposed cross-sections).

In short, an ICE can vary in detail but can be structured to provide “just enough” information to screen alternatives in an objective and reproducible manner. Once an ICE has been completed for a given location, the City may proceed with environmental clearance, grant funding pursuits and construction.

Table 12: Evaluation Locations, Inputs, Assumptions, and Recommendations









Location	Truck Route	Bicycle Route	Transit Route	Lane Sizing Assessment	Assumed single lane or multilane?	Assumed ICD Range (feet)	Feasibility Assessment and Recommendation
Atlantic Avenue & Constitution Way	Y	Y	Y	Turning Movement Counts	Multilane	165-220	Proceed with ICE for further evaluation of roundabout; there are potential design challenges at the intersection
Atlantic Avenue & Appezato Parkway & Main Street	Y	Y	Y	Qualitative	Single lane and multilane	130-220	Proceed with ICE for further evaluation of roundabout; there are potential design challenges at the intersection
Main Street & Willie Stargell Avenue	Y	Y	Y	Qualitative	Single lane	130-180	Proceed with ICE for further evaluation of roundabout
Park Street & Otis Drive	N	Y	Y	Turning Movement Counts	Multilane	165-220	Pursue other safety countermeasures
Central Avenue & Versailles Avenue	N	Y	N	Qualitative	Single lane	90-150	Pursue other safety countermeasures
Encinal Avenue & Park Avenue	Y	Y	Y	Qualitative	Single lane and multilane	130-180	Pursue other safety countermeasures
Encinal Avenue & Fernside Boulevard	N	Y	Y	Qualitative	Single lane	90-150	Proceed with ICE for further evaluation of roundabout
Tilden Way & Blanding Avenue / Fernside Boulevard	Y	Y	Y	Qualitative	Multilane	165-220	Proceed with ICE for further evaluation of roundabout
Otis Drive & Grand Street	N	Y	Y	Qualitative	Single lane	165-220	Recent safety project implemented; ICE could be considered as part of longer-term change in traffic control

Table 13: Locations Identified but not Analyzed in This Memorandum

Location	Identified By	Location / Project Status
Central Avenue & Main Street & Pacific Avenue	Central Avenue Safety Improvement	Approved by City Council
Central Avenue & Sherman Street & Encinal Avenue	Central Avenue Safety Improvement	Approved by City Council
Central Avenue & Third Street	Central Avenue Safety Improvement	Approved by City Council
Central Avenue & Fourth Street & Ballena Blvd.	Central Avenue Safety Improvement	Approved by City Council
Mecartney Road & Island Drive	Proposed by City staff	Currently being studied by the City

\\kittelson.com\GIS\Projects\24\24846 - City of Alameda On-Call Services 2020\001 - Citywide Roundabout Analysis\Task 2 Citywide RBT screening\gis\24846_Final Evaluation Map.mxd Date: 7/20/2021

Final Location Evaluation Results

-  Proceed with ICE; potential design challenges
-  Proceed with ICE
-  Pursue other safety countermeasures
-  Recent safety project implemented
-  Approved by City Council
-  Currently being studied by the City
-  City Limits
-  High Injury Corridors

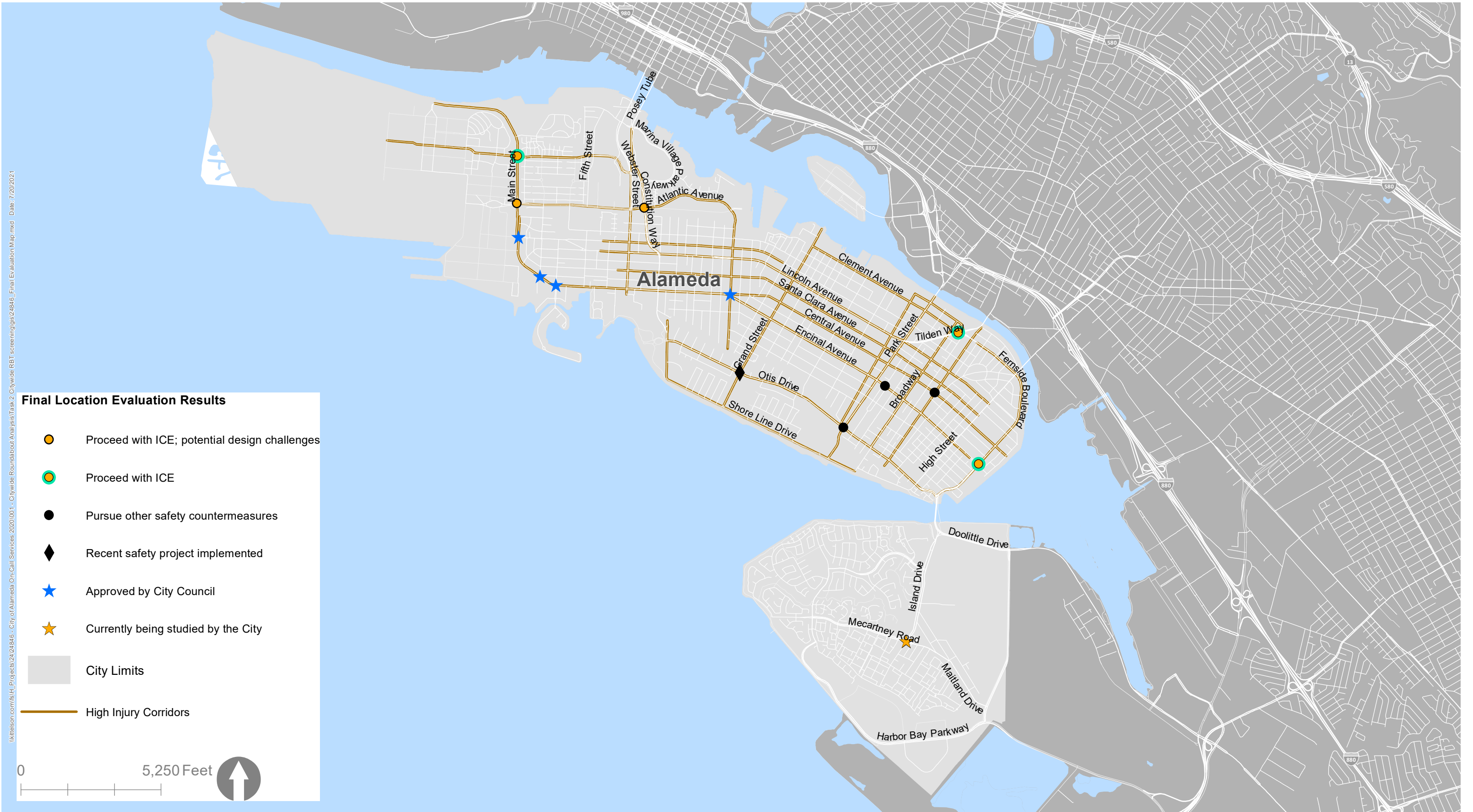


Figure 15: Roundabout Screening Results
Citywide Screening
City of Alameda

ATTACHMENT A: LEVEL 2 AND 3 LOCATIONS

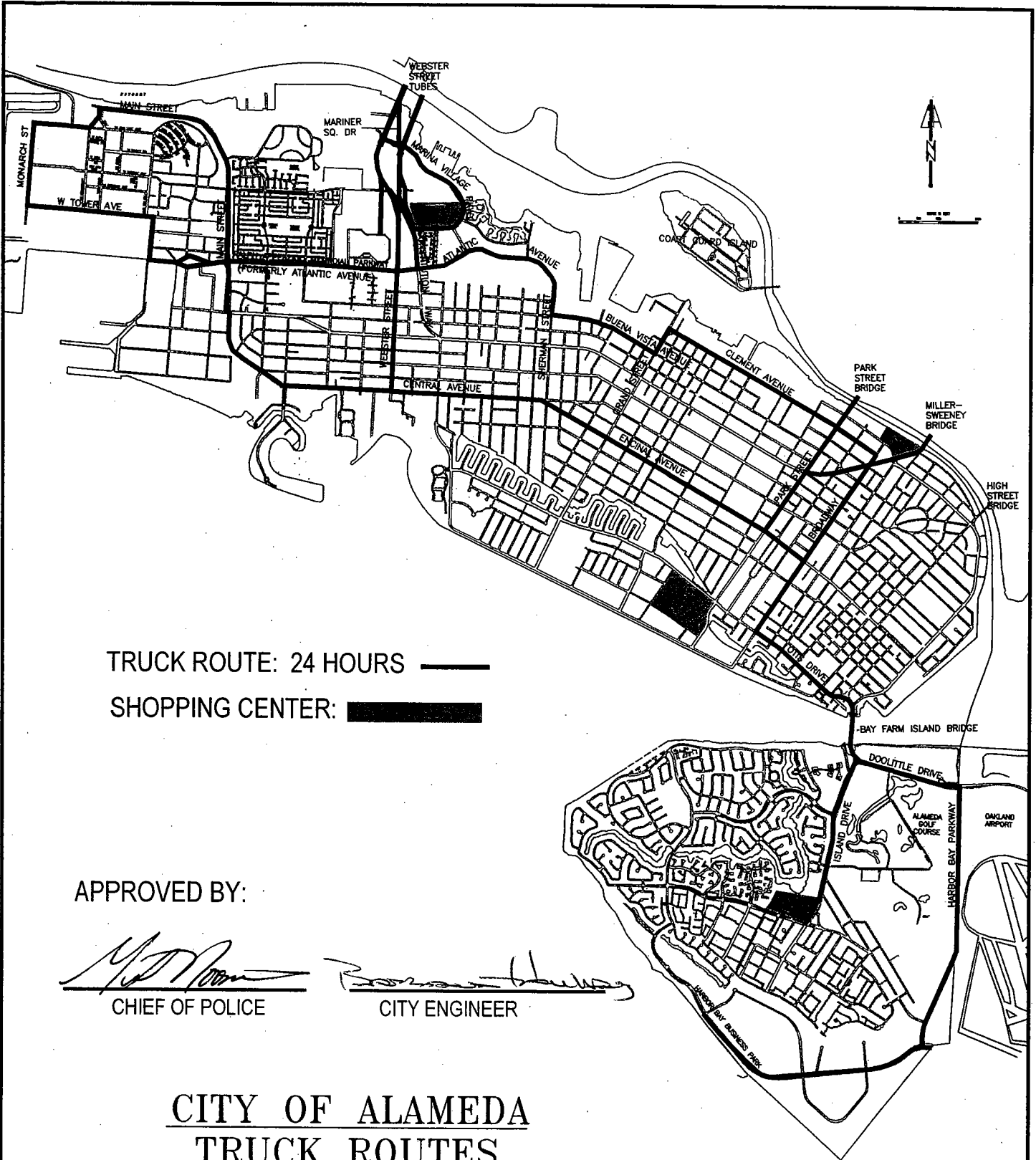
Table 14: Level 2 and 3 Screened Locations (excludes location already identified in Table 1)

Location	
Level 2 Locations	
Avenue D & Main	Midway & Saratoga
Benton & Santa Clara	Midway & Todd
Blanding & Tilden	Moonlight & Midway
Broadway & Central	Morton & Santa Clara
Broadway & Lincoln	Mosley & Ralph Appezzato Memorial
Broadway & Otis	Oak & Central
Broadway & Saint Margaret	Oak & Encinal
Broadway & Santa Clara	Oak & Lincoln
Buena Vista & Grand	Oak & Santa Clara
Central & Access Road	Otis & Broadway
Central & Crolls Garden	Otis & Del Mar
Central & Oriskany	Otis & Grand
Central & Page	Otis & Regent
Driveway & Atlantic	Pacific & Sherman
Encinal & High	Pan Am & Midway
Everett & Santa Clara	Rainbow & Midway
Grand & Shoreline	Ralph Appezzato Memorial & Coral Sea
Main & Access Road	Santa Clara & Cottage
Marina Village & Constitution	Stanton & Santa Clara
Midway & 5 th	Walnut & Encinal
Midway & Barbers Point	Westline & Access Road
Midway & Hancock	Willow & Otis
Midway & Orion	
Level 3 Locations	
6th & Pacific	Bay & Santa Clara
8th & Santa Clara	Benton & Central
9th & Central	Benton & Encinal
9th & Pacific	Bette & Willie Stargell
Arbor & Pacific	Blanding & Broadway
Atlantic & Challenger	Broadway & Buena Vista
Atlantic & Triumph	Broadway & Calhoun
Bartlett & Atlantic	Broadway & Chester
Bay & Central	Broadway & Clement

Location	
Broadway & Crist	Encinal & Central
Broadway & Eagle	Encinal & College
Broadway & Encinal	Encinal & Fountain
Broadway & Noble	Encinal & Grove
Broadway & Tilden	Encinal & Lafayette
Buena Vista & Sherman	Encinal & Mound
Caroline & Central	Encinal & Pearl
Central & 8th	Encinal & Regent
Central & Benton	Everett & Central
Central & Burbank	Fernside & Adams
Central & Cottage	Fernside & Cambridge
Central & Lincoln	Fernside & Cornell
Central & Morton	Fernside & High
Central & Sherman	Fernside & Moreland
Central & St Charles	Fernside & San Jose
Central & Walnut	Fernside & Washington
Chestnut & Encinal	Fremont & Fernside
Chestnut & Santa Clara	Grand & Encinal
Clement & Alameda Marina	Grand & Fortmann
Clement & Chestnut	Harvard & Fernside
Clement & Grand	High & Central
Clement & Mulberry	Jay & Pacific
Clement & Willow	Lafayette & Clement
College & Ralph Appezato Memorial	Lafayette & Santa Clara
Constitution & Buena Vista	Lincoln & 9th
Constitution & Pacific	Lincoln & Grand
Constitution & Webster St Tube	Lincoln & Sherman
Coral Sea & Willie Stargell	Lincoln & Versailles
Court & Encinal	Madison & Fernside
Driveway & Constitution	Main & Barbers Point
Eagle & Constitution	Main & Singleton
Eagle & Grand	Mariner Square & Constitution
Eagle & Sherman	Mckay & Central
Ellen Craig & Grand	Midway & Lexington
Elm & Clement	Minturn & Clement

Location	
Monarch & Midway	Ralph Appezzato Memorial & Campus
Morton & Encinal	Regent & Central
Mosley & Willie Stargell	Rock Isle & Otis
Mound & Otis	Santa Clara & Ninth
Mozart & Santa Clara	Santa Clara & Caroline
Oak & Alameda	Santa Clara & Grand
Oak & Clement	Santa Clara & Page
Oak & Times	Santa Clara & Paru
Otis & Arlington Isle	Santa Clara & Schiller
Otis & Fernside	Santa Clara & Willow
Otis & High	Schiller & Clement
Otis & Larchmont Isle	Shore & Shoreline
Otis & Rosewood	Shoreline & Kitty Hawk
Otis & Sand Hook Isle	Shoreline & Willow
Otis & Shore	St Charles & Santa Clara
Otis & Waterfall Isle	Tarryton Isle & Otis
Otis & Windemere Isle	Union & Clement
Pacific & Eighth	Union & Encinal
Pacific & Ninth	Union & Santa Clara
Pacific & Bay	Verdi & Santa Clara
Pacific & Benton	Versailles & Encinal
Pacific & Concordia	Versailles & Fernside
Pacific & Grand	Versailles & Otis
Pacific & Morton	Versailles & Santa Clara
Pacific & Nason	Walnut & Clement
Pacific & St Charles	Walnut & Lincoln
Pacific & Stanton	Walnut & Santa Clara
Pacific & Wood	Wayne & Encinal
Park & Central	Weber & Central
Park & Santa Clara	Willie Stargell & 5th
Paru & Encinal	Willow & Central
Pearl & Otis	Willow & Encinal
Pease & Encinal	Willow & Otis
Post & Encinal	Yale & Fernside
Ralph Appezzato Memorial & 5th	

ATTACHMENT B: CITY OF ALAMEDA TRUCK ROUTE MAP



APPROVED BY:

[Signature]
CHIEF OF POLICE

[Signature]
CITY ENGINEER

CITY OF ALAMEDA TRUCK ROUTES

DATE:01-20-09

ATTACHMENT C: TURNING MOVEMENT COUNT DATA AND LANE ESTIMATES

B.A.Y.M.E.T.R.I.C.S.
INTERSECTION TURNING MOVEMENT SUMMARY

PROJECT: ALAMEDA ON-CALL SERVICE (9)				SURVEY DATE: 10/11/2016				DAY: TUESDAY															
N-S APPROACH: CONSTITUTION WAY				SURVEY TIME: 7:00 AM				TO 9:00 AM															
E-W APPROACH: ATLANTIC AVENUE				JURISDICTION: ALAMEDA				FILE: 3610083															
<div>PEAK HOUR 7:45 AM to 8:45 AM</div> <div><div><div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div></div><div>726591890</div><div>02832052</div><div>2135</div><div>105247830</div><div>09725231</div><div>NORTH</div><div>ATLANTIC AVENUE</div><div>CONSTITUTION WAY</div></div></div>												<div>ARRIVAL / DEPARTURE VOLUMES</div> <div>PHF = 0.93</div> <div>920385</div> <div>PHF = 0.68</div> <div>435540</div> <div>PHF = 0.89</div> <div>794380</div> <div>PHF = 0.83</div>											
TIME PERIOD		NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL					
From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT						
SURVEY DATA																							
7:00 AM	to 7:15 AM	9	46	5		16	145	4		3	14	16		9	13	8		288					
7:15 AM	to 7:30 AM	25	92	14		36	322	12		7	37	45		18	33	17		658					
7:30 AM	to 7:45 AM	41	165	18		63	526	19		12	82	66		30	63	27		1112					
7:45 AM	to 8:00 AM	60	227	26		117	701	24		19	164	89		45	103	50		1625					
8:00 AM	to 8:15 AM	94	303	30		166	866	43		26	253	99		73	200	86		2239					
8:15 AM	to 8:30 AM	114	358	36		212	1043	67		30	327	110		95	259	118		2769					
8:30 AM	to 8:45 AM	138	417	49		252	1185	91		40	402	118		113	310	132		3247					
8:45 AM	to 9:00 AM	175	480	56		277	1303	117		52	459	133		126	353	157		3688					
TOTAL BY PERIOD																							
7:00 AM	to 7:15 AM	0	9	46	5	0	16	145	4	0	3	14	16	0	9	13	8	288					
7:15 AM	to 7:30 AM	0	16	46	9	0	20	177	8	0	4	23	29	0	9	20	9	370					
7:30 AM	to 7:45 AM	0	16	73	4	0	27	204	7	0	5	45	21	0	12	30	10	454					
7:45 AM	to 8:00 AM	0	19	62	8	0	54	175	5	0	7	82	23	0	15	40	23	513					
8:00 AM	to 8:15 AM	0	34	76	4	0	49	165	19	0	7	89	10	0	28	97	36	614					
8:15 AM	to 8:30 AM	0	20	55	6	0	46	177	24	0	4	74	11	0	22	59	32	530					
8:30 AM	to 8:45 AM	0	24	59	13	0	40	142	24	0	10	75	8	0	18	51	14	478					
8:45 AM	to 9:00 AM	0	37	63	7	0	25	118	26	0	12	57	15	0	13	43	25	441					
HOURLY TOTALS																							
7:00 AM	to 8:00 AM	0	60	227	26	0	117	701	24	0	19	164	89	0	45	103	50	1625					
7:15 AM	to 8:15 AM	0	85	257	25	0	150	721	39	0	23	239	83	0	64	187	78	1951					
7:30 AM	to 8:30 AM	0	89	266	22	0	176	721	55	0	23	290	65	0	77	226	101	2111					
7:45 AM	to 8:45 AM	0	97	252	31	0	189	659	72	0	28	320	52	0	83	247	105	2135					
8:00 AM	to 9:00 AM	0	115	253	30	0	160	602	93	0	33	295	44	0	81	250	107	2063					
PEAK HOUR SUMMARY																							
7:45 AM to 8:45 AM		NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL					
		NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR						
		0	97	252	31	0	189	659	72	0	28	320	52	0	83	247	105	2135					
		PHF BY MOVEMENT	0.00	0.71	0.83	0.60	0.00	0.88	0.93	0.75	0.00	0.70	0.90	0.57	0.00	0.74	0.64	0.73	OVERALL				
		PHF BY APPROACH	0.83				0.93				0.89				0.68				0.87				
		TRUCK	IN	OUT		IN	OUT			IN	OUT			IN	OUT			OVERALL					
		TRUCK VOLUMES	7	4		5	9			6	6			3	2			21					
		TRUCK PERCENTAGE	1.8%	1.0%		0.5%	1.1%			1.5%	1.1%			0.7%	0.5%			1.0%					
		BUS VOLUMES	0	7		7	7			21	0			0	0			21					
		BUS PERCENTAGE	0.0%	0.8%		1.8%	1.6%			1.0%	0.0%			0.0%	0.0%			1.0%					
		BICYCLE	0				2				9				2				13				
		PEDESTRIAN BY DIR	5				16				24				25				70				
			N-LEG				S-LEG				E-LEG				W-LEG								
		PEDESTRIAN BY LEG	25				34				0				0				70				
TEL: (510) 232 - 1271 FAX: (510) 232 - 1272																							

B.A.Y.M.E.T.R.I.C.S.
INTERSECTION TURNING MOVEMENT SUMMARY

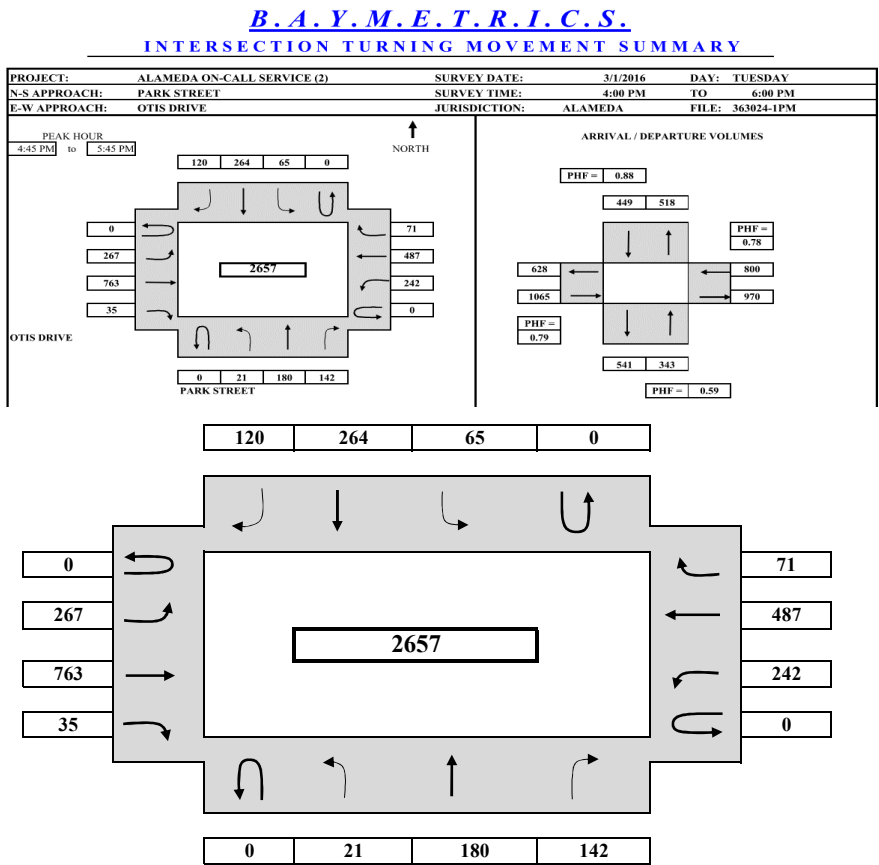
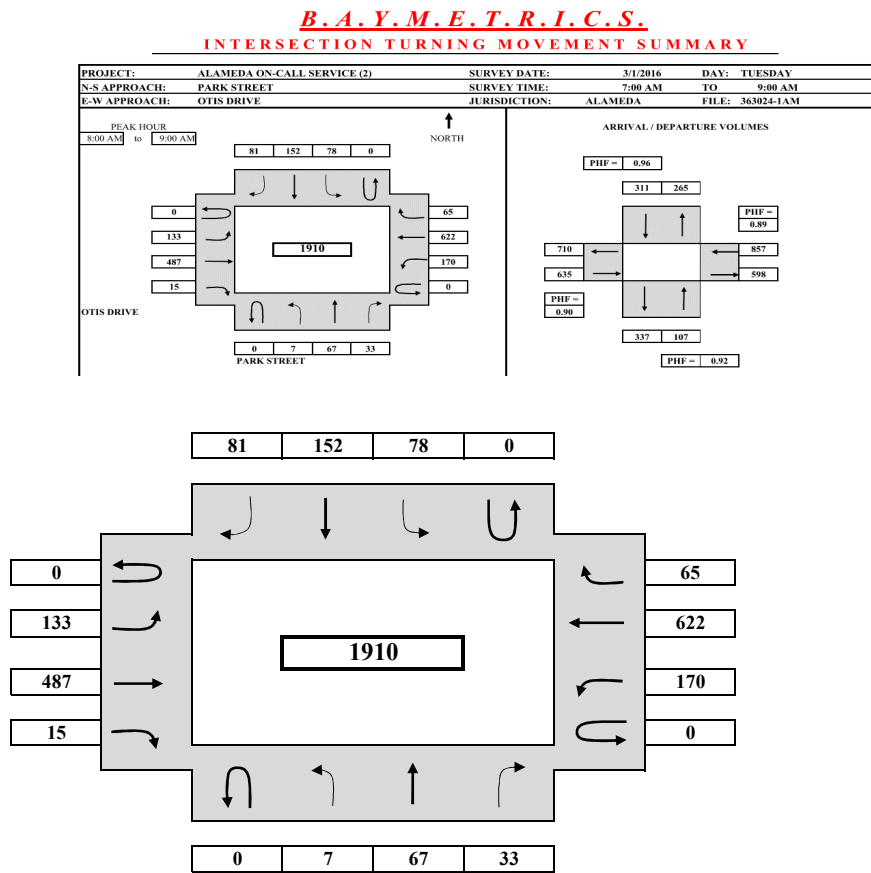
PROJECT: ALAMEDA ON-CALL SERVICE (9)				SURVEY DATE: 10/11/2016				DAY: TUESDAY																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
N-S APPROACH: CONSTITUTION WAY				SURVEY TIME: 4:00 PM				TO 6:00 PM																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
E-W APPROACH: ATLANTIC AVENUE				JURISDICTION: ALAMEDA				FILE: 3610083																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
<div>PEAK HOUR 5:00 PM to 6:00 PM</div> <div><div><div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div></div><div>114291300</div><div>066295111</div><div>2779</div><div>187256570</div><div>0149103949</div><div>NORTH</div><div>ATLANTIC AVENUE</div><div>CONSTITUTION WAY</div></div><div><div>ARRIVAL / DEPARTURE VOLUMES</div><div>PHF = 0.95</div><div>5701292</div><div>PHF = 0.91</div><div>500474</div><div>PHF = 0.98</div><div>5971237</div><div>PHF = 0.90</div></div></div>												<table><tr><th colspan="2">TIME PERIOD</th><th colspan="4">NORTHBOUND</th><th colspan="4">SOUTHBOUND</th><th colspan="4">EASTBOUND</th><th colspan="4">WESTBOUND</th><th rowspan="2">TOTAL</th></tr><tr><th>From</th><th>To</th><th>U-TURN</th><th>LEFT</th><th>THRU</th><th>RIGHT</th><th>U-TURN</th><th>LEFT</th><th>THRU</th><th>RIGHT</th><th>U-TURN</th><th>LEFT</th><th>THRU</th><th>RIGHT</th><th>U-TURN</th><th>LEFT</th><th>THRU</th><th>RIGHT</th></tr><tr><td colspan="19">SURVEY DATA</td></tr><tr><td>4:00 PM</td><td>to 4:15 PM</td><td>28</td><td>197</td><td>12</td><td></td><td>36</td><td>116</td><td>8</td><td></td><td>11</td><td>53</td><td>24</td><td></td><td>13</td><td>45</td><td>42</td><td></td><td>585</td></tr><tr><td>4:15 PM</td><td>to 4:30 PM</td><td>53</td><td>418</td><td>28</td><td></td><td>55</td><td>213</td><td>16</td><td></td><td>24</td><td>135</td><td>47</td><td></td><td>30</td><td>90</td><td>69</td><td></td><td>1178</td></tr><tr><td>4:30 PM</td><td>to 4:45 PM</td><td>85</td><td>675</td><td>42</td><td></td><td>84</td><td>320</td><td>25</td><td></td><td>34</td><td>175</td><td>72</td><td></td><td>40</td><td>149</td><td>115</td><td></td><td>1816</td></tr><tr><td>4:45 PM</td><td>to 5:00 PM</td><td>121</td><td>914</td><td>64</td><td></td><td>119</td><td>436</td><td>32</td><td></td><td>49</td><td>234</td><td>99</td><td></td><td>53</td><td>206</td><td>165</td><td></td><td>2492</td></tr><tr><td>5:00 PM</td><td>to 5:15 PM</td><td>152</td><td>1141</td><td>82</td><td></td><td>150</td><td>535</td><td>40</td><td></td><td>66</td><td>302</td><td>133</td><td></td><td>63</td><td>275</td><td>210</td><td></td><td>3149</td></tr><tr><td>5:15 PM</td><td>to 5:30 PM</td><td>194</td><td>1436</td><td>90</td><td></td><td>173</td><td>646</td><td>44</td><td></td><td>82</td><td>378</td><td>159</td><td></td><td>77</td><td>325</td><td>260</td><td></td><td>3864</td></tr><tr><td>5:30 PM</td><td>to 5:45 PM</td><td>231</td><td>1701</td><td>104</td><td></td><td>206</td><td>759</td><td>48</td><td></td><td>101</td><td>454</td><td>184</td><td></td><td>96</td><td>385</td><td>305</td><td></td><td>4574</td></tr><tr><td>5:45 PM</td><td>to 6:00 PM</td><td>270</td><td>1953</td><td>113</td><td></td><td>249</td><td>865</td><td>43</td><td></td><td>115</td><td>529</td><td>210</td><td></td><td>110</td><td>462</td><td>352</td><td></td><td>5271</td></tr><tr><td colspan="19">TOTAL BY PERIOD</td></tr><tr><td>4:00 PM</td><td>to 4:15 PM</td><td>0</td><td>28</td><td>197</td><td>12</td><td>0</td><td>36</td><td>116</td><td>8</td><td>0</td><td>11</td><td>53</td><td>24</td><td>0</td><td>13</td><td>45</td><td>42</td><td>585</td></tr><tr><td>4:15 PM</td><td>to 4:30 PM</td><td>0</td><td>25</td><td>221</td><td>16</td><td>0</td><td>19</td><td>97</td><td>8</td><td>0</td><td>13</td><td>82</td><td>23</td><td>0</td><td>17</td><td>45</td><td>27</td><td>593</td></tr><tr><td>4:30 PM</td><td>to 4:45 PM</td><td>0</td><td>32</td><td>257</td><td>14</td><td>0</td><td>29</td><td>107</td><td>9</td><td>0</td><td>10</td><td>40</td><td>25</td><td>0</td><td>10</td><td>59</td><td>46</td><td>638</td></tr><tr><td>4:45 PM</td><td>to 5:00 PM</td><td>0</td><td>36</td><td>239</td><td>22</td><td>0</td><td>35</td><td>116</td><td>7</td><td>0</td><td>15</td><td>59</td><td>27</td><td>0</td><td>13</td><td>57</td><td>50</td><td>676</td></tr><tr><td>5:00 PM</td><td>to 5:15 PM</td><td>0</td><td>31</td><td>227</td><td>18</td><td>0</td><td>31</td><td>99</td><td>8</td><td>0</td><td>17</td><td>68</td><td>34</td><td>0</td><td>10</td><td>69</td><td>45</td><td>657</td></tr><tr><td>5:15 PM</td><td>to 5:30 PM</td><td>0</td><td>42</td><td>295</td><td>8</td><td>0</td><td>23</td><td>111</td><td>4</td><td>0</td><td>16</td><td>76</td><td>26</td><td>0</td><td>14</td><td>50</td><td>50</td><td>715</td></tr><tr><td>5:30 PM</td><td>to 5:45 PM</td><td>0</td><td>37</td><td>265</td><td>14</td><td>0</td><td>33</td><td>113</td><td>4</td><td>0</td><td>19</td><td>76</td><td>25</td><td>0</td><td>19</td><td>60</td><td>45</td><td>710</td></tr><tr><td>5:45 PM</td><td>to 6:00 PM</td><td>0</td><td>39</td><td>252</td><td>9</td><td>0</td><td>43</td><td>106</td><td>5</td><td>0</td><td>14</td><td>75</td><td>26</td><td>0</td><td>14</td><td>77</td><td>47</td><td>697</td></tr><tr><td colspan="19">HOURLY TOTALS</td></tr><tr><td>4:00 PM</td><td>to 5:00 PM</td><td>0</td><td>121</td><td>914</td><td>64</td><td>0</td><td>119</td><td>436</td><td>32</td><td>0</td><td>49</td><td>234</td><td>99</td><td>0</td><td>53</td><td>206</td><td>165</td><td>2492</td></tr><tr><td>4:15 PM</td><td>to 5:15 PM</td><td>0</td><td>124</td><td>944</td><td>70</td><td>0</td><td>114</td><td>419</td><td>32</td><td>0</td><td>55</td><td>249</td><td>109</td><td>0</td><td>50</td><td>230</td><td>168</td><td>2564</td></tr><tr><td>4:30 PM</td><td>to 5:30 PM</td><td>0</td><td>141</td><td>1018</td><td>62</td><td>0</td><td>118</td><td>433</td><td>28</td><td>0</td><td>58</td><td>243</td><td>112</td><td>0</td><td>47</td><td>235</td><td>191</td><td>2686</td></tr><tr><td>4:45 PM</td><td>to 5:45 PM</td><td>0</td><td>146</td><td>1026</td><td>62</td><td>0</td><td>122</td><td>439</td><td>23</td><td>0</td><td>67</td><td>279</td><td>112</td><td>0</td><td>56</td><td>236</td><td>190</td><td>2758</td></tr><tr><td>5:00 PM</td><td>to 6:00 PM</td><td>0</td><td>149</td><td>1039</td><td>49</td><td>0</td><td>130</td><td>429</td><td>11</td><td>0</td><td>66</td><td>295</td><td>111</td><td>0</td><td>57</td><td>256</td><td>187</td><td>2779</td></tr><tr><td colspan="19">PEAK HOUR SUMMARY</td></tr><tr><td>5:00 PM</td><td>to 6:00 PM</td><td colspan="4">NORTHBOUND</td><td colspan="4">SOUTHBOUND</td><td colspan="4">EASTBOUND</td><td colspan="4">WESTBOUND</td><td rowspan="2">TOTAL</td></tr><tr><td colspan="2">VOLUME</td><td>NBU</td><td>NBL</td><td>NBT</td><td>NBR</td><td>SBU</td><td>SBL</td><td>SBT</td><td>SBR</td><td>EBU</td><td>EBL</td><td>EBT</td><td>EBR</td><td>WBU</td><td>WBL</td><td>WBT</td><td>WBR</td></tr><tr><td colspan="2">PHF BY MOVEMENT</td><td>0.00</td><td>0.89</td><td>0.88</td><td>0.68</td><td>0.00</td><td>0.76</td><td>0.95</td><td>0.34</td><td>0.00</td><td>0.87</td><td>0.97</td><td>0.82</td><td>0.00</td><td>0.75</td><td>0.83</td><td>0.94</td><td>OVERALL</td></tr><tr><td colspan="2">PHF BY APPROACH</td><td colspan="4">0.90</td><td colspan="4">0.95</td><td colspan="4">0.98</td><td colspan="4">0.91</td><td>0.97</td></tr><tr><td colspan="2">TRUCK</td><td colspan="2">IN</td><td colspan="2">OUT</td><td colspan="2">IN</td><td colspan="2">OUT</td><td colspan="2">IN</td><td colspan="2">OUT</td><td colspan="2">IN</td><td colspan="2">OUT</td><td>OVERALL</td></tr><tr><td colspan="2">TRUCK VOLUMES</td><td colspan="2">6</td><td colspan="2">3</td><td colspan="2">5</td><td colspan="2">4</td><td colspan="2">4</td><td colspan="2">6</td><td colspan="2">5</td><td colspan="2">7</td><td>20</td></tr><tr><td colspan="2">TRUCK PERCENTAGE</td><td colspan="2">0.5%</td><td colspan="2">0.2%</td><td colspan="2">0.9%</td><td colspan="2">0.7%</td><td colspan="2">0.8%</td><td colspan="2">1.3%</td><td colspan="2">1.0%</td><td colspan="2">1.7%</td><td>0.7%</td></tr><tr><td colspan="2">BUS VOLUMES</td><td colspan="2">0</td><td colspan="2">1</td><td colspan="2">2</td><td colspan="2">2</td><td colspan="2">5</td><td colspan="2">0</td><td colspan="2">0</td><td colspan="2">0</td><td>5</td></tr><tr><td colspan="2">BUS PERCENTAGE</td><td colspan="2">0.0%</td><td colspan="2">0.2%</td><td colspan="2">0.4%</td><td colspan="2">0.4%</td><td colspan="2">0.2%</td><td colspan="2">0.0%</td><td colspan="2">0.0%</td><td colspan="2">0.0%</td><td>0.2%</td></tr><tr><td colspan="2">BICYCLE</td><td colspan="2">0</td><td colspan="2"></td><td colspan="2">1</td><td colspan="2"></td><td colspan="2">1</td><td colspan="2"></td><td colspan="2">5</td><td colspan="2"></td><td>7</td></tr><tr><td colspan="2">PEDESTRIAN BY DIR</td><td colspan="2">13</td><td colspan="2"></td><td colspan="2">14</td><td colspan="2"></td><td colspan="2">40</td><td colspan="2"></td><td colspan="2">20</td><td colspan="2"></td><td>87</td></tr><tr><td colspan="2"></td><td colspan="4">N-LEG</td><td colspan="4">S-LEG</td><td colspan="4">E-LEG</td><td colspan="4">W-LEG</td><td></td></tr><tr><td colspan="2">PEDESTRIAN BY LEG</td><td colspan="4">54</td><td colspan="4">22</td><td colspan="4">0</td><td colspan="4">0</td><td>87</td></tr><tr><td colspan="19">TEL: (510) 232 - 1271 FAX: (510) 232 - 1272</td></tr></table>												TIME PERIOD		NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	SURVEY DATA																			4:00 PM	to 4:15 PM	28	197	12		36	116	8		11	53	24		13	45	42		585	4:15 PM	to 4:30 PM	53	418	28		55	213	16		24	135	47		30	90	69		1178	4:30 PM	to 4:45 PM	85	675	42		84	320	25		34	175	72		40	149	115		1816	4:45 PM	to 5:00 PM	121	914	64		119	436	32		49	234	99		53	206	165		2492	5:00 PM	to 5:15 PM	152	1141	82		150	535	40		66	302	133		63	275	210		3149	5:15 PM	to 5:30 PM	194	1436	90		173	646	44		82	378	159		77	325	260		3864	5:30 PM	to 5:45 PM	231	1701	104		206	759	48		101	454	184		96	385	305		4574	5:45 PM	to 6:00 PM	270	1953	113		249	865	43		115	529	210		110	462	352		5271	TOTAL BY PERIOD																			4:00 PM	to 4:15 PM	0	28	197	12	0	36	116	8	0	11	53	24	0	13	45	42	585	4:15 PM	to 4:30 PM	0	25	221	16	0	19	97	8	0	13	82	23	0	17	45	27	593	4:30 PM	to 4:45 PM	0	32	257	14	0	29	107	9	0	10	40	25	0	10	59	46	638	4:45 PM	to 5:00 PM	0	36	239	22	0	35	116	7	0	15	59	27	0	13	57	50	676	5:00 PM	to 5:15 PM	0	31	227	18	0	31	99	8	0	17	68	34	0	10	69	45	657	5:15 PM	to 5:30 PM	0	42	295	8	0	23	111	4	0	16	76	26	0	14	50	50	715	5:30 PM	to 5:45 PM	0	37	265	14	0	33	113	4	0	19	76	25	0	19	60	45	710	5:45 PM	to 6:00 PM	0	39	252	9	0	43	106	5	0	14	75	26	0	14	77	47	697	HOURLY TOTALS																			4:00 PM	to 5:00 PM	0	121	914	64	0	119	436	32	0	49	234	99	0	53	206	165	2492	4:15 PM	to 5:15 PM	0	124	944	70	0	114	419	32	0	55	249	109	0	50	230	168	2564	4:30 PM	to 5:30 PM	0	141	1018	62	0	118	433	28	0	58	243	112	0	47	235	191	2686	4:45 PM	to 5:45 PM	0	146	1026	62	0	122	439	23	0	67	279	112	0	56	236	190	2758	5:00 PM	to 6:00 PM	0	149	1039	49	0	130	429	11	0	66	295	111	0	57	256	187	2779	PEAK HOUR SUMMARY																			5:00 PM	to 6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	VOLUME		NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	PHF BY MOVEMENT		0.00	0.89	0.88	0.68	0.00	0.76	0.95	0.34	0.00	0.87	0.97	0.82	0.00	0.75	0.83	0.94	OVERALL	PHF BY APPROACH		0.90				0.95				0.98				0.91				0.97	TRUCK		IN		OUT		IN		OUT		IN		OUT		IN		OUT		OVERALL	TRUCK VOLUMES		6		3		5		4		4		6		5		7		20	TRUCK PERCENTAGE		0.5%		0.2%		0.9%		0.7%		0.8%		1.3%		1.0%		1.7%		0.7%	BUS VOLUMES		0		1		2		2		5		0		0		0		5	BUS PERCENTAGE		0.0%		0.2%		0.4%		0.4%		0.2%		0.0%		0.0%		0.0%		0.2%	BICYCLE		0				1				1				5				7	PEDESTRIAN BY DIR		13				14				40				20				87			N-LEG				S-LEG				E-LEG				W-LEG					PEDESTRIAN BY LEG		54				22				0				0				87	TEL: (510) 232 - 1271 FAX: (510) 232 - 1272																		
TIME PERIOD		NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
SURVEY DATA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4:00 PM	to 4:15 PM	28	197	12		36	116	8		11	53	24		13	45	42		585																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
4:15 PM	to 4:30 PM	53	418	28		55	213	16		24	135	47		30	90	69		1178																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
4:30 PM	to 4:45 PM	85	675	42		84	320	25		34	175	72		40	149	115		1816																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
4:45 PM	to 5:00 PM	121	914	64		119	436	32		49	234	99		53	206	165		2492																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
5:00 PM	to 5:15 PM	152	1141	82		150	535	40		66	302	133		63	275	210		3149																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
5:15 PM	to 5:30 PM	194	1436	90		173	646	44		82	378	159		77	325	260		3864																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
5:30 PM	to 5:45 PM	231	1701	104		206	759	48		101	454	184		96	385	305		4574																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
5:45 PM	to 6:00 PM	270	1953	113		249	865	43		115	529	210		110	462	352		5271																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
TOTAL BY PERIOD																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4:00 PM	to 4:15 PM	0	28	197	12	0	36	116	8	0	11	53	24	0	13	45	42	585																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
4:15 PM	to 4:30 PM	0	25	221	16	0	19	97	8	0	13	82	23	0	17	45	27	593																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
4:30 PM	to 4:45 PM	0	32	257	14	0	29	107	9	0	10	40	25	0	10	59	46	638																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
4:45 PM	to 5:00 PM	0	36	239	22	0	35	116	7	0	15	59	27	0	13	57	50	676																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
5:00 PM	to 5:15 PM	0	31	227	18	0	31	99	8	0	17	68	34	0	10	69	45	657																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
5:15 PM	to 5:30 PM	0	42	295	8	0	23	111	4	0	16	76	26	0	14	50	50	715																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
5:30 PM	to 5:45 PM	0	37	265	14	0	33	113	4	0	19	76	25	0	19	60	45	710																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
5:45 PM	to 6:00 PM	0	39	252	9	0	43	106	5	0	14	75	26	0	14	77	47	697																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
HOURLY TOTALS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4:00 PM	to 5:00 PM	0	121	914	64	0	119	436	32	0	49	234	99	0	53	206	165	2492																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
4:15 PM	to 5:15 PM	0	124	944	70	0	114	419	32	0	55	249	109	0	50	230	168	2564																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
4:30 PM	to 5:30 PM	0	141	1018	62	0	118	433	28	0	58	243	112	0	47	235	191	2686																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
4:45 PM	to 5:45 PM	0	146	1026	62	0	122	439	23	0	67	279	112	0	56	236	190	2758																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
5:00 PM	to 6:00 PM	0	149	1039	49	0	130	429	11	0	66	295	111	0	57	256	187	2779																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
PEAK HOUR SUMMARY																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
5:00 PM	to 6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
VOLUME		NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
PHF BY MOVEMENT		0.00	0.89	0.88	0.68	0.00	0.76	0.95	0.34	0.00	0.87	0.97	0.82	0.00	0.75	0.83	0.94	OVERALL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
PHF BY APPROACH		0.90				0.95				0.98				0.91				0.97																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
TRUCK		IN		OUT		IN		OUT		IN		OUT		IN		OUT		OVERALL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
TRUCK VOLUMES		6		3		5		4		4		6		5		7		20																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
TRUCK PERCENTAGE		0.5%		0.2%		0.9%		0.7%		0.8%		1.3%		1.0%		1.7%		0.7%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
BUS VOLUMES		0		1		2		2		5		0		0		0		5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
BUS PERCENTAGE		0.0%		0.2%		0.4%		0.4%		0.2%		0.0%		0.0%		0.0%		0.2%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
BICYCLE		0				1				1				5				7																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
PEDESTRIAN BY DIR		13				14				40				20				87																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
		N-LEG				S-LEG				E-LEG				W-LEG																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
PEDESTRIAN BY LEG		54				22				0				0				87																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
TEL: (510) 232 - 1271 FAX: (510) 232 - 1272																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																

B.A.Y.M.E.T.R.I.C.S.
INTERSECTION TURNING MOVEMENT SUMMARY

PROJECT: ALAMEDA ON-CALL SERVICE (I)				SURVEY DATE: 2/1/2018				DAY: THURSDAY																		
N-S APPROACH: CONSTITUTION WAY				SURVEY TIME: 7:00 AM				TO 9:00 AM																		
E-W APPROACH: ATLANTIC AVENUE				JURISDICTION: ALAMEDA				FILE: 3802008-2AM																		
<div>PEAK HOUR 7:30 AM to 8:30 AM</div> <div></div>				<div>ARRIVAL / DEPARTURE VOLUMES</div> <div></div>																						
TIME PERIOD		NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL								
From To		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN*	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT									
SURVEY DATA																										
7:00 AM to 7:15 AM		15	133	3		7	46	6		0	14	22	7		6	28	17	304								
7:15 AM to 7:30 AM		28	329	10		16	99	11		0	21	38	15		12	53	34	666								
7:30 AM to 7:45 AM		59	507	23		43	163	16		0	36	72	50		18	110	54	1151								
7:45 AM to 8:00 AM		110	672	46		77	239	23		0	54	123	53		25	188	70	1680								
8:00 AM to 8:15 AM		161	823	54		102	312	31		1	73	179	88		36	270	83	2213								
8:15 AM to 8:30 AM		186	974	72		133	386	42		1	92	256	125		44	312	93	2716								
8:30 AM to 8:45 AM		225	1104	85		161	453	51		1	120	314	143		50	355	103	3165								
8:45 AM to 9:00 AM		251	1216	99		188	548	57		1	134	362	175		59	379	113	3582								
TOTAL BY PERIOD																										
7:00 AM to 7:15 AM		0	15	133	3	0	7	46	6	0	14	22	7	0	6	28	17	304								
7:15 AM to 7:30 AM		0	13	196	7	0	9	53	5	0	7	16	8	0	6	25	17	362								
7:30 AM to 7:45 AM		0	31	178	13	0	27	64	5	0	15	34	35	0	6	57	20	485								
7:45 AM to 8:00 AM		0	51	165	23	0	34	76	7	0	18	51	3	0	7	78	16	529								
8:00 AM to 8:15 AM		0	51	151	8	0	25	73	8	1	19	56	35	0	11	82	13	533								
8:15 AM to 8:30 AM		0	25	151	18	0	31	74	11	0	19	77	37	0	8	42	10	503								
8:30 AM to 8:45 AM		0	39	130	13	0	28	67	9	0	28	58	18	0	6	43	10	449								
8:45 AM to 9:00 AM		0	26	112	14	0	27	95	6	0	14	48	32	0	9	24	10	417								
HOURLY TOTALS																										
7:00 AM to 8:00 AM		0	110	672	46	0	77	239	23	0	54	123	53	0	25	188	70	1680								
7:15 AM to 8:15 AM		0	146	690	51	0	95	266	25	1	59	157	81	0	30	242	66	1909								
7:30 AM to 8:30 AM		0	158	645	62	0	117	287	31	1	71	218	110	0	32	259	59	2050								
7:45 AM to 8:45 AM		0	166	597	62	0	118	290	35	1	84	242	93	0	32	245	49	2014								
8:00 AM to 9:00 AM		0	141	544	53	0	111	309	34	1	80	239	122	0	34	191	43	1902								
PEAK HOUR SUMMARY																										
7:30 AM to 8:30 AM		NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL								
		NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR									
VOLUME		0	158	645	62	0	117	287	31	1	71	218	110	0	32	259	59	2050								
PHF BY MOVEMENT		0.00	0.77	0.91	0.67	0.00	0.86	0.94	0.70	0.25	0.93	0.71	0.74	0.00	0.73	0.79	0.74	OVERALL								
PHF BY APPROACH		0.90				0.93				0.75				0.83				0.96								
TRUCK		IN		OUT		IN		OUT		IN		OUT		IN		OUT		OVERALL								
TRUCK VOLUMES		9		9		7		11		9		8		10		7		35								
TRUCK PERCENTAGE		1.0%		1.2%		1.6%		2.6%		2.3%		2.0%		2.9%		1.6%		1.7%								
TRANSIT VOLUMES		0		0		4		6		10		0		0		0		10								
TRANSIT PERCENTAGE		0.0%		0.0%		1.0%		1.7%		0.5%		0.0%		0.0%		0.0%		0.5%								
BICYCLE		2		0		0		2		2		3		3		0		7								
PEDESTRIAN BY DIR		14		9		9		24		24		24		24		24		56								
		N-LEG				S-LEG				E-LEG				W-LEG												
PEDESTRIAN BY LEG		31				25				19				19				56								
TEL: (510) 232 - 1271 FAX: (510) 232 - 1272																										

B.A.Y.M.E.T.R.I.C.S.
INTERSECTION TURNING MOVEMENT SUMMARY

PROJECT: ALAMEDA ON-CALL SERVICE (I)				SURVEY DATE: 2/1/2018				DAY: THURSDAY										
N-S APPROACH: CONSTITUTION WAY				SURVEY TIME: 4:00 PM				TO 6:00 PM										
E-W APPROACH: ATLANTIC AVENUE				JURISDICTION: ALAMEDA				FILE: 3802008-2PM										
<div>PEAK HOUR 4:45 PM to 5:45 PM</div> <div><div>9011601270</div><div><div><div>0</div><div>58</div><div>244</div><div>196</div></div><div><div>120</div><div>183</div><div>67</div><div>0</div></div><div>2856</div><div><div>0</div><div>124</div><div>463</div><div>24</div></div></div><div>ATLANTIC AVENUE</div><div>CONSTITUTION WAY</div><div>NORTH</div></div>				<div>ARRIVAL / DEPARTURE VOLUMES</div> <div><div>PHF = 0.95</div><div>1377641</div><div><div>PHF = 0.82</div><div><div>370</div><div>395</div></div></div><div><div>397</div><div>498</div></div><div><div>PHF = 0.92</div></div><div>1423611</div><div>PHF = 0.93</div></div>														
TIME PERIOD		NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	
SURVEY DATA																		
4:00 PM	to 4:15 PM	36	125	6		19	207	23		10	45	42		9	43	32		597
4:15 PM	to 4:30 PM	64	206	10		39	429	35		29	91	78		18	85	64		1148
4:30 PM	to 4:45 PM	87	335	16		74	711	51		43	132	115		29	121	92		1806
4:45 PM	to 5:00 PM	113	454	27		113	1016	69		58	179	168		41	150	109		2497
5:00 PM	to 5:15 PM	146	580	32		134	1328	91		77	241	218		57	196	160		3260
5:15 PM	to 5:30 PM	182	683	38		168	1601	112		88	305	260		76	238	191		3942
5:30 PM	to 5:45 PM	211	798	40		201	1871	141		101	376	311		96	304	212		4662
5:45 PM	to 6:00 PM	252	891	46		229	2105	157		116	429	351		103	363	235		5277
TOTAL BY PERIOD																		
4:00 PM	to 4:15 PM	0	36	125	6	0	19	207	23	0	10	45	42	0	9	43	32	597
4:15 PM	to 4:30 PM	0	28	81	4	0	20	222	12	0	19	46	36	0	9	42	32	551
4:30 PM	to 4:45 PM	0	23	129	6	0	35	282	16	0	14	41	37	0	11	36	28	658
4:45 PM	to 5:00 PM	0	26	119	11	0	39	305	18	0	15	47	53	0	12	29	17	691
5:00 PM	to 5:15 PM	0	33	126	5	0	21	312	22	0	19	62	50	0	16	46	51	763
5:15 PM	to 5:30 PM	0	36	103	6	0	34	273	21	0	11	64	42	0	19	42	31	682
5:30 PM	to 5:45 PM	0	29	115	2	0	33	270	29	0	13	71	51	0	20	66	21	720
5:45 PM	to 6:00 PM	0	41	93	6	0	28	234	16	0	15	53	40	0	7	59	23	615
HOURLY TOTALS																		
4:00 PM	to 5:00 PM	0	113	454	27	0	113	1016	69	0	58	179	168	0	41	150	109	2497
4:15 PM	to 5:15 PM	0	110	455	26	0	115	1121	68	0	67	196	176	0	48	153	128	2663
4:30 PM	to 5:30 PM	0	118	477	28	0	129	1172	77	0	59	214	182	0	58	153	127	2794
4:45 PM	to 5:45 PM	0	124	463	24	0	127	1160	90	0	58	244	196	0	67	183	120	2856
5:00 PM	to 6:00 PM	0	139	437	19	0	116	1089	88	0	58	250	183	0	62	213	126	2780
PEAK HOUR SUMMARY																		
4:45 PM	to 5:45 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME		0	124	463	24	0	127	1160	90	0	58	244	196	0	67	183	120	2856
PHF BY MOVEMENT		0.00	0.86	0.92	0.55	0.00	0.81	0.93	0.78	0.00	0.76	0.86	0.92	0.00	0.84	0.69	0.59	OVERALL
PHF BY APPROACH		0.93				0.95				0.92				0.82				0.94
TRUCK		IN		OUT		IN		OUT		IN		OUT		IN		OUT		OVERALL
TRUCK VOLUMES		3		5		6		7		6		7		6		2		21
TRUCK PERCENTAGE		0.5%		0.8%		0.4%		0.5%		1.2%		1.8%		1.6%		0.5%		0.7%
TRANSIT VOLUMES		0		0		5		4		9		0		0		0		9
TRANSIT PERCENTAGE		0.0%		0.0%		1.0%		1.1%		0.3%		0.0%		0.0%		0.0%		0.3%
BICYCLE		0				0				2				1				3
PEDESTRIAN BY DIR		15				21				20				16				72
		N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG		25				11				7				29				72
TEL: (510) 232 - 1271 FAX: (510) 232 - 1272																		



		ebl	ebt	ebr	wbl	wbt	wbr	nbl	nbt	nbr	sbl	sbt	sbr	minor TEV	major TEV	minor/tota	W&E major	low ADT	high ADT	PCT left turns
TMCs	am	133	487	15	170	622	65	7	67	33	78	152	81	418	1492	0.22	0.57	17,364	21,222	20%
	pm	267	763	35	242	487	71	21	180	142	65	264	120	792	1865	0.30	0.57	24,155	29,522	22%

		S leg				N leg				W leg				E leg			
		v_exit	v_conflict	v_eneter	v_conflict+v_eneter	v_exit	v_conflict	v_eneter	v_conflict+v_eneter	v_exit	v_conflict	v_eneter	v_conflict+v_eneter	v_exit	v_conflict	v_eneter	v_conflict+v_eneter
Volumes	am	337	698	107	805	265	799	311	1110	710	400	635	1035	733	207	857	1064
	pm	541	1095	343	1438	518	750	449	1199	628	571	1065	1636	694	468	800	1268

<1000 Single-lane entry may be sufficient

1,000-1,300 Two-lane entry may be needed

1,300-1,800 Two-lane entry likely to be sufficient

B.A.Y.M.E.T.R.I.C.S.
INTERSECTION TURNING MOVEMENT SUMMARY

PROJECT: ALAMEDA ON-CALL SERVICE (I)				SURVEY DATE: 2/28/2017				DAY: TUESDAY										
N-S APPROACH: GRAND STREET				SURVEY TIME: 7:00 AM				TO 9:00 AM										
E-W APPROACH: OTIS DRIVE				JURISDICTION: ALAMEDA				FILE: 3702008-2AM										
<div>PEAK HOUR 7:30 AM to 8:30 AM</div> <div></div>				<div>ARRIVAL / DEPARTURE VOLUMES</div> <div></div>														
TIME PERIOD		NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	
SURVEY DATA																		
7:00 AM	to 7:15 AM	5	7	2		18	10	4		6	40	0		1	51	18		162
7:15 AM	to 7:30 AM	6	28	6		38	19	7		14	89	2		4	106	37		356
7:30 AM	to 7:45 AM	12	60	19		63	34	10		27	150	7		9	193	72		656
7:45 AM	to 8:00 AM	20	104	28		105	74	11		42	218	17		15	270	119		1023
8:00 AM	to 8:15 AM	34	198	70		145	147	19		52	307	36		31	355	191		1585
8:15 AM	to 8:30 AM	45	270	104		184	178	22		64	396	45		41	443	249		2041
8:30 AM	to 8:45 AM	48	294	110		213	193	28		73	457	45		45	523	297		2326
8:45 AM	to 9:00 AM	50	322	116		258	204	32		80	503	47		47	615	350		2624
TOTAL BY PERIOD																		
7:00 AM	to 7:15 AM	0	5	7	2	0	18	10	4	0	6	40	0	0	1	51	18	162
7:15 AM	to 7:30 AM	0	1	21	4	0	20	9	3	0	8	49	2	0	3	55	19	194
7:30 AM	to 7:45 AM	0	6	32	13	0	25	15	3	0	13	61	5	0	5	87	35	300
7:45 AM	to 8:00 AM	0	8	44	9	0	42	40	1	0	15	68	10	0	6	77	47	367
8:00 AM	to 8:15 AM	0	14	94	42	0	40	73	8	0	10	89	19	0	16	85	72	562
8:15 AM	to 8:30 AM	0	11	72	34	0	39	31	3	0	12	89	9	0	10	88	58	456
8:30 AM	to 8:45 AM	0	3	24	6	0	29	15	6	0	9	61	0	0	4	80	48	285
8:45 AM	to 9:00 AM	0	2	28	6	0	45	11	4	0	7	46	2	0	2	92	53	298
HOURLY TOTALS																		
7:00 AM	to 8:00 AM	0	20	104	28	0	105	74	11	0	42	218	17	0	15	270	119	1023
7:15 AM	to 8:15 AM	0	29	191	68	0	127	137	15	0	46	267	36	0	30	304	173	1423
7:30 AM	to 8:30 AM	0	39	242	98	0	146	159	15	0	50	307	43	0	37	337	212	1685
7:45 AM	to 8:45 AM	0	36	234	91	0	150	159	18	0	46	307	38	0	36	330	225	1670
8:00 AM	to 9:00 AM	0	30	218	88	0	153	130	21	0	38	285	30	0	32	345	231	1601
PEAK HOUR SUMMARY																		
7:30 AM	to 8:30 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
		0	39	242	98	0	146	159	15	0	50	307	43	0	37	337	212	1685
		PHF BY MOVEMENT				PHF BY MOVEMENT				PHF BY MOVEMENT				PHF BY MOVEMENT				OVERALL
		0.00	0.70	0.64	0.58	0.00	0.87	0.54	0.47	0.00	0.83	0.86	0.57	0.00	0.58	0.96	0.74	0.75
		PHF BY APPROACH				PHF BY APPROACH				PHF BY APPROACH				PHF BY APPROACH				0.75
		0.63				0.66				0.85				0.85				0.75
		BICYCLE				BICYCLE				BICYCLE				BICYCLE				12
		2				9				0				1				12
		PEDESTRIAN				PEDESTRIAN				PEDESTRIAN				PEDESTRIAN				111
		15				57				29				10				111
		N-LEG				S-LEG				E-LEG				W-LEG				
		9				30				50				22				111
TEL: (510) 232 - 1271 FAX: (510) 232 - 1272																		

B.A.Y.M.E.T.R.I.C.S.
INTERSECTION TURNING MOVEMENT SUMMARY

PROJECT: ALAMEDA ON-CALL SERVICE (1)				SURVEY DATE: 2/28/2017				DAY: TUESDAY										
N-S APPROACH: GRAND STREET				SURVEY TIME: 4:00 PM				TO 6:00 PM										
E-W APPROACH: OTIS DRIVE				JURISDICTION: ALAMEDA				FILE: 3702008-2PM										
<div>PEAK HOUR 5:00 PM to 6:00 PM</div> <div></div>				<div>ARRIVAL / DEPARTURE VOLUMES</div> <div></div>														
TIME PERIOD		NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	
SURVEY DATA																		
4:00 PM	to 4:15 PM	4	23	5		57	26	5		7	82	4		3	69	39		324
4:15 PM	to 4:30 PM	9	45	16		108	59	20		15	168	9		8	178	93		728
4:30 PM	to 4:45 PM	16	65	20		153	82	26		23	259	12		10	255	125		1046
4:45 PM	to 5:00 PM	21	79	25		202	101	37		33	346	17		12	326	171		1370
5:00 PM	to 5:15 PM	23	98	32		276	130	52		41	457	21		18	409	216		1773
5:15 PM	to 5:30 PM	26	124	35		349	171	62		46	537	32		19	502	274		2177
5:30 PM	to 5:45 PM	31	147	41		432	200	73		57	638	36		24	607	320		2606
5:45 PM	to 6:00 PM	31	164	45		495	234	90		68	737	39		26	693	372		2994
TOTAL BY PERIOD																		
4:00 PM	to 4:15 PM	0	4	23	5	0	57	26	5	0	7	82	4	0	3	69	39	324
4:15 PM	to 4:30 PM	0	5	22	11	0	51	33	15	0	8	86	5	0	5	109	54	404
4:30 PM	to 4:45 PM	0	7	20	4	0	45	23	6	0	8	91	3	0	2	77	32	318
4:45 PM	to 5:00 PM	0	5	14	5	0	49	19	11	0	10	87	5	0	2	71	46	324
5:00 PM	to 5:15 PM	0	2	19	7	0	74	29	15	0	8	111	4	0	6	83	45	403
5:15 PM	to 5:30 PM	0	3	26	3	0	73	41	10	0	5	80	11	0	1	93	58	404
5:30 PM	to 5:45 PM	0	5	23	6	0	83	29	11	0	11	101	4	0	5	105	46	429
5:45 PM	to 6:00 PM	0	0	17	4	0	63	34	17	0	11	99	3	0	2	86	52	388
HOURLY TOTALS																		
4:00 PM	to 5:00 PM	0	21	79	25	0	202	101	37	0	33	346	17	0	12	326	171	1370
4:15 PM	to 5:15 PM	0	19	75	27	0	219	104	47	0	34	375	17	0	15	340	177	1449
4:30 PM	to 5:30 PM	0	17	79	19	0	241	112	42	0	31	369	23	0	11	334	181	1449
4:45 PM	to 5:45 PM	0	15	82	21	0	279	118	47	0	34	379	24	0	14	352	195	1560
5:00 PM	to 6:00 PM	0	10	85	20	0	293	133	53	0	35	391	22	0	14	367	201	1624
PEAK HOUR SUMMARY																		
5:00 PM to 6:00 PM		NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME		0	10	85	20	0	293	133	53	0	35	391	22	0	14	367	201	1624
PHF BY MOVEMENT		0.00	0.50	0.82	0.71	0.00	0.88	0.81	0.78	0.00	0.80	0.88	0.50	0.00	0.58	0.87	0.87	OVERALL
PHF BY APPROACH		0.85				0.97				0.91				0.93				0.95
BICYCLE		4				3				0				0				7
PEDESTRIAN		6				14				0				0				24
		N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:		2				2				13				7				24
TEL: (510) 232 - 1271 FAX: (510) 232 - 1272																		