Memo

To:	Gail Payne, Senior Transportation Coordinator, City of Alameda
CC:	Scott Wikstrom, City Engineer, City of Alameda
From:	David Parisi, Andrew Lee, Patrick Golier and Jasmine Stitt, Parisi Transportation Consulting
Date:	May 9, 2019
Subject:	**Otis Drive Traffic Calming and Safety Improvements Project**

The purpose of this memorandum is to summarize existing and proposed conditions for pedestrians, bicyclists, transit and motor vehicles as part of the Otis Drive Traffic Calming and Safety Improvement Project, located on Otis Drive between and including Westline Drive and Willow Street.

The project proposes to reduce the cross-section on Otis Drive, between its intersections, from two vehicular travel lanes in each direction to one vehicular travel lane in each direction plus a continuous two-way left-turn lane, enabling the provision of buffered bicycle lanes along the length of the corridor along with a number of pedestrian safety improvements and intersection-related treatments. These improvements are expected to reduce overall collision potential, decrease vehicular travel speeds, reduce the "Level of Traffic Stress" for people on bicycles, shorten pedestrian crossing distances, increase the visibility of pedestrians, improve transit operations, and enable left-turning vehicles to make turns from an exclusive lane instead of lane shared with through vehicles.

The Traffic Calming and Safety Improvement Project envisions Otis Drive as a Complete Street, which are streets designed and operated to enable safe access for all users.

PEDESTRIAN FACILITY IMPROVEMENTS

The project proposes to install four additional marked crosswalks, pedestrian warning signs and painted bulb outs at uncontrolled crosswalks at Tarryton Isle, Larchmont Isle, Arlington Isle/ Heather Walk, and Glenwood Isle. The project would also upgrade an existing crosswalk at Waterview Isle/ Sandcreek Way with painted bulb outs, pedestrian warning signs and upgrade the current pedestrian beacon to a rectangular rapid flashing beacon (RRFB). All new and existing crosswalks would be upgraded to a high-visibility ladder design.

Currently, Otis Drive between Westline Drive and Willow Street has two pedestrian crossings; one at the signalized intersection at Grand St, and one uncontrolled crossing at Waterview/

Sandcreek Way. When crossings are spaced far apart (generally more than 600- 800 feet), pedestrians may have to detour several minutes to a controlled crossing location. Pedestrians are more likely to wait for a gap in traffic and cross at an unmarked location, rather than travel a distance out of their way to find a marked crosswalk. The project would result in a total of 5 high-visibility marked crosswalks across uncontrolled crossing on Otis Drive, helping to facilitate safe and convenient pedestrian crossings. With the installation of the additional crosswalks, the maximum spacing between marked crosswalks in the project limits on Otis Drive would decrease from 2,800 feet to 850 feet.

New RRFBs would be installed at two of the new marked crosswalks at Larchmont Isle and Glenwood Isle. The additional two new marked crosswalks at Tarryton Isle and Arlington Isle/Heather Walk may have RRFBs installed in the future if warranted. RRFBs increase driver yielding behavior to pedestrians significantly which is expected to improve the safety of pedestrians crossing Otis Drive.

In addition to the pedestrian improvements along Otis Drive, the project proposes adding marked crosswalks along the side streets, which are unmarked under existing conditions. Marked crosswalks are preferred to unmarked crosswalks, as they alert drivers to expect crossing pedestrians.

In the short-term, the project proposes to install low cost, painted bulb-outs at the 4 new marked crosswalks and the current marked crosswalk across Otis Drive. These painted bulb outs will include soft hit posts to better define the pedestrian space. In the long-term, the painted bulb outs will be upgraded to concrete ones along with new ADA-compliant directional pedestrian curb ramps. These bulb outs will extend the pedestrian waiting area to provide better pedestrian visibility and shorten pedestrian crossing distances. Additionally, driver yielding compliance to pedestrians in the crosswalks is expected to increase and vehicular speeds are expected to decrease with the installation of these treatments.

The project also proposes to install red curbs at the approaches to intersections, a practice known as daylighting. By restricting cars from parking close to the intersection, sight lines will increase along the side streets and increase the visibility of pedestrians crossing at these locations.

BICYCLE FACILITY IMPROVEMENTS

The project proposes to install five-foot one-way Class 2 bike lanes with painted buffers to the left and right of each lane along Otis Drive from Westline Drive to Willow Street. The bike lanes would be located between parked cars with a one-foot buffer in the door zone and a two-foot buffer between moving vehicles and people on bicycles. The proposed bicycle facility would connect with nearby bicycle facilities, mainly on Grand Street, Shoreline Drive and Westline Drive, as well as destinations such as Rittler Park, Wood Middle School and the various parks along the waterfront.

The project also proposes adding green markings where the bicycle path of travel crosses motor vehicle lanes. These marked merge zones would alert motorists to expect bicycles where conflicts could occur and clearly identify locations where bicycles and vehicles would be expected to merge. Painted bicycle boxes are proposed at the signalized intersections in order to facilitate left turning positioning for people on bicycles at intersections and increase the visibility of bicyclists.

The proposed bicycle facilities were evaluated using the bicycle Level of Traffic Stress (LTS) methodology developed by the Mineta Transportation Institute in San Jose, California.[1] The LTS method is an objective, data-driven evaluation model that identifies streets with high traffic stress experienced by people biking in or adjacent to heavy vehicle traffic and high-speed streets. The method classifies streets and intersections from LTS 1 (suitable for children) through LTS 4 (suitable for experienced adult cyclists who are comfortable sharing the road with automobiles traveling at 35 mph or more). Bikeways are considered low stress if they are on low traffic/ low-speed streets or, as roadways volumes and speeds increase, the physical separation between bikeways and traffic lanes also increases, such as bike lanes and protected bike lanes.

Under existing conditions, bicycle LTS of Otis Drive is LTS 4. LTS 4 represents a high level of traffic stress, suggesting the majority of the adult population would not be comfortable riding the street under current conditions. With the addition of buffered bicycle lanes, the proposed project decreases the level of traffic stress for cyclists from LTS 4 to LTS 2. LTS 2 represents a level of traffic stress that is comfortable for most adults and is similar to the criteria that Dutch bikeways are designed to meet. Table 1 describes the criteria used to determine the LTS level for existing and proposed conditions.

Table 1: Existing Conditions and Proposed Project's Bicycle Level of Traffic Stress Results

Configuration	LTS Level Criteria	LTS Level
Existing	Mixed Traffic 4 lanes (2 lanes per direction) Prevailing Speed = 33 mph ADT = 14,624	LTS 4
Proposed	Bike Lane Alongside a Parking Lane 3 lanes (1 lane per direction and a center turn lane) Prevailing Speed = 33* mph Bike Lane Reach = 15+ ft	LTS 2

Source: Parisi Transportation Consulting, 2019

Note: If traffic calming countermeasures are successful in lowering 85th percentile speeds to 25 mph, the proposed conditions' LTS level lowers to LTS 1

[1] Mekuria, Maaza C., Peter G. Furth, and Hilary Nixon. "Low-stress bicycling and network connectivity." Mineta Transportation Institution (2012). Retrieved from: https://transweb.sjsu.edu/research/low-stress-bicycling-and-network-connectivity

One proposed alternative for the design includes an approximately 1,100-foot segment on the south side of Otis Drive, between Rosewood Way and Sandcreek Way, which would provide a transition from an eastbound buffered bike lane to a parking protected bike lane and would position the bike lane between the sidewalk and parked cars. This alternate design would largely be implemented adjacent to Rittler Park, a popular destination for soccer, baseball and other recreational events. This alternative would largely eliminate conflicts in this location between people on bikes, vehicles in the travel lane, and the frequent vehicular parking activity that takes place on Otis Drive adjacent to Rittler Park.

However, due to the constrained right-of-way, optimal dimensions cannot be provided, with minimum dimensions used for the travel lane, parking, buffer and bike lane. Under this scenario the dimension of the bike lane would be 5 feet with a 10.5 foot vehicle travel lane, versus 5.5 feet and 10 feet, respectively. This would not provide bicyclists with a desired amount of room to maneuver and could potentially result in conflicts with people accessing and egressing vehicles parked adjacent to the bike lane. In addition, the parking protected bike lane scenario may create conflicts between people on bikes and those trying to access Rittler Park from their parked vehicles.

Further, this design may also not provide drivers with an optimal amount of room to maneuver in and out of parking spaces from the travel lane. These conditions may be exasperated by the heavy southbound left turn volume turning from Grand Street onto eastbound Otis Drive.

PUBLIC TRANSIT IMPROVEMENTS

In addition to the safety improvements to Otis Drive, the project proposes several improvements intended to improve transit operations. The project proposes moving bus stops from the near side to the far side of intersections, providing ADA provisions and removing low ridership bus stops.

Far-side stops are generally preferred because they reduce conflicts between right-turning vehicles and stopped buses, eliminate sight-distance deficiencies on approaches to an intersection and encourage pedestrian crossing at the rear of the bus.

The proposed project would also provide ADA provisions by removing obstacles on the sidewalk such as planters in order to allow for the required accessible landing zone. The project proposes removing one bus stop in the eastbound direction and one in the westbound direction at Arlington Isle/Heater Walk. This would result in a bus stop spacing along the Otis Drive corridor of 1,300 – 1,400 feet which better aligns with AC Transit’s standard for bus stop spacing of 1,000 feet, outside downtown areas. These two bus stops experience low ridership and their proposed removal is expected to result in an increase in AC transit bus travel speeds.

TRAFFIC OPERATIONS

As part of the project improvements would be made to the four signalized intersections: Westline Drive, Grand Street, Willow Street “West” and Willow Street “East.” The Willow Street intersections are tied together with a common signal controller and work in tandem. The signalized intersections, rather than the roadway segments between intersections, would continue to limit the capacity of the overall corridor and therefore are studied in detail within this memo.

Each intersection has been evaluated to review its current operation during weekday AM and PM peak hours, as well as expected operations in the future assuming no changes were made to the intersections. The analysis was conducted for each intersection using existing and year 2040 projected traffic volumes for both the recommended “short-term” and “long-term” intersection configurations. The analysis was conducted using Synchro 10 traffic operations software to assess intersection approach and overall intersection level of service (LOS) and motorist delay.

The preliminary concept plan illustrates the proposed short-term and long-term configurations for each of the four study intersections. The short-term plan includes modifying lane configurations while keeping existing signal equipment. As more funding becomes available, the long-term option would add new signal equipment and include a roundabout option at Grand Street and Otis Drive. The following pages discuss the existing and expected operations for each intersection.

WESTLINE DRIVE

As shown in Table A1, the Otis Drive/Westline Drive intersection currently operates at an acceptable level of delay during the AM and PM peak hours. By 2040 the intersection, as it is currently configured, would be expected to continue functioning at an acceptable level of delay during both peak hours.

The short-term improvements would consist of the provision of a westbound bike box and the inclusion of leading pedestrian and bicycle phasing intervals for east-west movements. With these enhancements the intersection would be expected to continue to operate at an acceptable level of delay during both the AM and PM peak hours. Using projected 2040 volumes, the intersection would be expected to function at 36 seconds of delay during the AM peak hour and operate at an acceptable amount of delay during the PM peak hour.

The long-term improvements would provide a separated accessway for westbound bicyclists and would combine Westline Drive’s southbound through and right-turn lane into a shared lane. It would also include leading pedestrian and bicycle signal intervals for east-west movements. Based on projected 2040 volumes, the intersection would be expected to operate at 36 seconds of delay during the AM peak hour and operate at an acceptable amount of delay in the PM peak hour.

GRAND STREET

The Otis Drive/Grand Street intersection currently operates at an acceptable amount of delay during both the AM and PM peak hours, as shown in Table A2. By 2040 the intersection, as it is currently configured, would be expected to continue functioning at an acceptable level of delay during both peak hours.

The short-term improvements would result in all four of the intersection's approaches to consist of a left-turn lane and a shared through and right-turn lane. The left-turning movements would remain "permissive," i.e., left-turning motorists would be required to yield to oncoming vehicles and pedestrians in the opposing crosswalk. Left-turn lanes allow separation of left-turn and through-traffic streams, reducing the potential for rear-end collisions. Because they provide a sheltered location for drivers to wait for a gap in opposing traffic, left-turn lanes may encourage drivers to be more selective in choosing a gap to complete the left-turn maneuver. This may reduce the potential for collisions between left-turn and opposing through vehicles and/or non-motorized road users.

With these changes the intersection would be expected to continue operating at an acceptable level of delay during both periods. Based on projected 2040 volumes, the intersection would also be expected to continue functioning at an acceptable level of delay during both peak hours.

The long-term improvements would reconfigure the intersection to a modern roundabout. Based on projected 2040 volumes, the intersection would be expected to operate at an acceptable level of delay during both peak hour periods. The roundabout configuration would provide safety benefits compared to a standard signalized intersection design by reducing the number of potential conflict points, including the most severe of those conflict points, in an intersection. Roundabouts can also provide traffic calming benefits by reducing vehicle speeds, and generally result in lower delay for drivers versus signalized and all-way stop controlled intersections.

It should be noted that if in the long-term the intersection is signalized with protected left-turns (left-turn arrows) for Grand Street's left-turn lanes, the intersection would be expected to perform at 25 seconds of delay conditions during AM peak hour and an acceptable amount of delay during the PM peak hour based on 2040 traffic volumes. If protected left-turn phasing is also installed for eastbound and westbound Otis Drive approaches to Grand Street, the overall intersection service levels are expected to degrade to LOS E or worse conditions during both peak hours.

WILLOW STREET ("WEST" AND "EAST")

As shown in Table A3 the Otis Drive/Willow Street (West) intersection currently operates at an acceptable amount of delay during the AM and PM peak hours. By 2040 the intersection, as it is currently configured, would be expected to continue to function at an acceptable level. The

Otis Drive/Willow Street (East) intersection currently operates at an acceptable level of delay during both the AM and PM peak hours, as shown in Table A4. In 2040, under its current configuration, the intersection would be expected to continue to operate at an acceptable level of delay.

The short-term and long-term improvements would reduce the number of westbound vehicle through-lanes on Otis Drive from two to one, and transition the current right-hand westbound lane approaching Willow Street (East) into an exclusive right-turn lane (except for buses, which would be allowed to progress straight after leaving the adjacent bus stop). The right-hand eastbound through lane approaching Willow Street (West) would be reduced in length. The two Willow Street approaches would continue to have split/approach traffic signal phasing, i.e., they would be served at different times.

Under both the short-term and long-term enhancement scenarios the Otis Drive/Willow Street (West) intersection is expected to operate at an acceptable level using both existing and projected 2040 traffic volumes. The Otis Drive/Willow Street (East) intersection would remain at an acceptable amount of delay during both peak hours based on current traffic volumes and would be expected to function at 35 seconds of delay during the AM peak hour and 37 seconds of delay during the PM peak hour using projected 2040 traffic volumes.

Vehicular travel delays would generally decrease at both intersections if the signal phasing is modified to serve both Willow Street approaches simultaneously instead at different times, as shown in Table 5. For example, at Otis Drive/Willow Street (East), concurrent signal phasing instead of split/approach phasing would be expected to reduce overall motorist delays by 7 to 10 seconds using existing traffic volumes and by 13 to 19 seconds based on projected 2040 traffic projections.

Table A1: Otis Drive/Westline Drive Level-of-Service and Delay (Seconds)

Configuration	Year	Peak Hour	Actuated Cycle (s)	Eastbound LOS	Eastbound Delay (s)	Westbound LOS	Westbound Delay (s)	Northbound LOS	Northbound Delay (s)	Southbound LOS	Southbound Delay (s)	Overall LOS	Overall Delay (s)
Existing	Existing	AM	65	A	0.0	C	26.3	B	13.1	C	29.4	**C**	**23.9**
Short-Term	Existing	AM	69	A	0.0	C	28.2	B	15.5	D	39.2	**C**	**29.2**
Long-Term	Existing	AM	69	A	0.0	C	28.2	B	15.5	C	39.2	**C**	**29.2**
Existing	2040	AM	65	A	0.0	C	26.3	B	14.0	D	42.1	**C**	**29.4**
Short-Term	2040	AM	69	A	0.0	C	28.2	B	16.6	D	54.5	**D**	**35.8**
Long-Term	2040	AM	69	A	0.0	C	28.2	C	16.6	B	54.5	**D**	**35.8**
Existing	Existing	PM	66	C	26.4	C	27.3	B	16.9	B	16.8	**B**	**19.7**
Short-Term	Existing	PM	70	C	28.5	C	29.5	B	19.5	C	20.7	**C**	**22.9**
Long-Term	Existing	PM	70	C	28.5	C	29.5	B	19.5	B	20.8	**B**	**23.0**
Existing	2040	PM	66	C	26.4	C	27.5	B	18.0	C	20.6	**C**	**22.1**
Short-Term	2040	PM	71	C	28.5	C	29.5	C	20.5	C	27.3	**C**	**26.7**
Long-Term	2040	PM	71	C	28.5	C	29.5	C	20.5	C	27.5	**C**	**26.8**

Source: Parisi Transportation Consulting, 2019

Table A2: Otis Drive/ Grand Street Level-of-Service and Delay (Seconds)

Configuration	Year	Peak Hour	Actuated Cycle (s)	Eastbound LOS	Eastbound Delay (s)	Westbound LOS	Westbound Delay (s)	Northbound LOS	Northbound Delay (s)	Southbound LOS	Southbound Delay (s)	Overall LOS	Overall Delay (s)
Existing	Existing	AM	67	B	12.0	B	13.0	B	15.6	B	18.3	**B**	**14.5**
Short-Term	Existing	AM	67	B	13.6	B	19.1	B	13.9	B	13.6	**B**	**15.6**
Long-Term (Roundabout)	Existing	AM	n/a	B	11.7	C	26.2	B	15.3	B	12.3	**B**	**17.8**
L-T Option (Signal)	Existing	AM	75	B	19.8	D	35.9	C	32.4	C	26.3	**C**	**29.8**
Existing	2040	AM	67	B	12.3	B	13.4	B	16.6	C	21.8	**B**	**15.7**
Short-Term	2040	AM	67	B	14.3	C	21.7	B	14.4	B	14.5	**B**	**17.0**
Long-Term (Roundabout)	2040	AM	n/a	B	13.8	D	42.3	B	19.6	B	14.8	**C**	**25.4**
L-T Option (Signal)	2040	AM	79	C	21.0	D	46.4	C	36.3	C	29.5	**D**	**35.3**
Existing	Existing	PM	67	B	12.7	B	12.7	B	11.7	C	26.7	**B**	**16.7**
Short-Term	Existing	PM	67	B	11.9	B	19.5	B	11.2	B	15.7	**B**	**16.3**
Long-Term (Roundabout)	Existing	PM	n/a	A	9.0	B	13.5	A	8.2	B	18.1	**B**	**13.9**
L-T Option (Signal)	Existing	PM	74	B	16.5	C	30.4	C	32.3	C	28.6	**C**	**28.1**
Existing	2040	PM	67	B	13.1	B	13.1	B	11.9	D	36.6	**B**	**19.8**
Short-Term	2040	PM	67	B	12.5	C	22.2	B	11.4	B	16.9	**B**	**17.9**
Long-Term (Roundabout)	2040	PM	n/a	B	10.2	B	16.6	A	9.1	C	24.9	**B**	**17.8**
L-T Option (Signal)	2040	PM	75	B	16.9	D	40.1	C	33.4	C	34.9	**C**	**34.5**

Source: Parisi Transportation Consulting, 2019

Table A3: Otis Drive/ Willow Street (West) Level-of-Service and Delay (Seconds)

Configuration	Year	Peak Hour	Actuated Cycle (s)	Eastbound LOS	Eastbound Delay (s)	Westbound LOS	Westbound Delay (s)	Northbound LOS	Northbound Delay (s)	Overall LOS	Overall Delay (s)
Existing	Existing	AM	83	B	19.7	A	7.7	C	33.5	**B**	**15.0**
Short-Term/Long-Term	Existing	AM	89	C	23.2	A	9.2	D	36.2	**B**	**17.4**
S-T/L-T Concurrent Willov	Existing	AM	73	B	11.9	B	19.7	C	25.7	**B**	**17.3**
Existing	2040	AM	87	C	22.2	A	8.2	C	34.4	**B**	**16.3**
Short-Term/Long-Term	2040	AM	93	C	26.2	B	10.7	D	37.1	**B**	**19.4**
S-T/L-T Concurrent Willov	2040	AM	73	B	12.8	C	28.4	C	25.3	**C**	**22.0**
Existing	Existing	PM	89	C	27.5	A	7.9	C	34.0	**C**	**20.3**
Short-Term/Long-Term	Existing	PM	96	C	32.5	A	10.0	D	37.1	**C**	**23.9**
S-T/L-T Concurrent Willov	Existing	PM	75	B	14.3	B	15.7	C	26.1	**B**	**16.2**
Existing	2040	PM	95	C	34.1	A	8.5	D	35.2	**C**	**23.9**
Short-Term/Long-Term	2040	PM	101	D	40.3	B	11.8	D	37.9	**C**	**28.5**
S-T/L-T Concurrent Willov	2040	PM	76	B	15.9	C	20.2	C	25.6	**B**	**18.7**

Source: Parisi Transportation Consulting, 2019

Table A4: Otis Drive/ Willow Street (East) Level-of-Service and Delay (Seconds)

Configuration	Year	Peak Hour	Actuated Cycle (s)	Eastbound LOS	Eastbound Delay (s)	Westbound LOS	Westbound Delay (s)	Southbound LOS	Southbound Delay (s)	Overall LOS	Overall Delay (s)
Existing	Existing	AM	83	B	12.8	C	24.0	C	32.9	**C**	**21.5**
Short-Term/Long-Term	Existing	AM	89	B	13.8	C	32.8	D	35.9	**C**	**26.4**
S-T/L-T Concurrent Willov	Existing	AM	73	B	14.3	B	18.7	C	31.0	**B**	**19.2**
Existing	2040	AM	87	B	13.5	C	28.6	C	34.1	**C**	**24.1**
Short-Term/Long-Term	2040	AM	93	B	14.6	D	50.1	D	37.6	**D**	**35.1**
S-T/L-T Concurrent Willov	2040	AM	73	B	15.7	C	23.1	C	31.4	**C**	**21.8**
Existing	Existing	PM	89	A	8.5	C	28.3	D	40.5	**C**	**21.9**
Short-Term/Long-Term	Existing	PM	96	A	9.5	D	35.9	D	44.8	**C**	**26.2**
S-T/L-T Concurrent Willov	Existing	PM	75	A	8.5	B	16.5	D	36.8	**B**	**16.3**
Existing	2040	PM	95	B	12.2	D	35.1	D	43.8	**C**	**26.9**
Short-Term/Long-Term	2040	PM	101	B	13.5	E	56.1	D	48.2	**D**	**37.2**
S-T/L-T Concurrent Willov	2040	PM	76	A	9.0	C	20.0	D	37.0	**B**	**18.0**

Source: Parisi Transportation Consulting, 2019