Attachment J: Transportation Study

July 12, 2021

Mr. Jason Brandman
First Carbon Solutions, Inc.
1350 Treat Boulevard, Suite 380
Walnut Creek, CA 94597

Transportation Study for the 820 West MacArthur Boulevard Residential Development

Dear Mr. Brandman;

As requested, W-Trans has prepared a transportation study for a proposed residential development at 820 West MacArthur Boulevard in Oakland. The purpose of this letter is to identify the potential transportation impacts associated with the proposed project.

Project Description

The proposed project includes the construction of a new building with 92 affordable housing apartment units. The project site, located at 820 West MacArthur Boulevard, is currently occupied by a vacant building that would be removed to make way for the project. The project as proposed would include long-term indoor bicycle storage for 23 bicycles plus five short-term bike rack spaces on the sidewalk adjacent to the building. Off-street vehicle parking would not be included as part of the project. Access to the project site would be provided via a pedestrian entrance at the southwest corner of the building. Four existing driveways (two on West Street and two on West MacArthur Boulevard) would be closed, creating four additional on-street parking spaces. The proposed project site plan is enclosed.

Trip Generation

The anticipated trip generation for the proposed project was estimated using standard rates published by the Institute of Transportation Engineers (ITE) in *Trip Generation Manual*, 10th Edition, 2017 for "Multifamily Housing (Mid-Rise)" (ITE LU #221) and adjustment factors from The *City of Oakland Transportation Impact Review Guidelines* (TIRG), adopted on April 14, 2017. The existing building on the site is currently unoccupied and therefore not generating any trips.

Since this project is located within an urban area and is less than one-half mile from the MacArthur BART Station, the ITE-based trip generation was reduced by 46.9 percent to account for non-automobile travel. This reduction is consistent with the procedure described in Section 3.1.1 of the TIRG.

As shown in Table 1, the proposed project is expected to generate an average of 266 net-new vehicle trips per day, including 18 trips during the a.m. peak hour and 21 during the p.m. peak hour; these net-new trips represent the increase in traffic associated with the project over existing levels. This is a conservative estimate as the project does not include any off-street parking spaces for tenants and automobile ownership amongst residents is therefore not anticipated. These trips would therefore be made via transportation network companies (such as Uber and Lyft) or locally available on-demand car rental services (e.g., ZipCar or GigCar) to access travel by motor vehicles.

Table 1 – Motor Vehicle Trip Generation Summary

Land Use	Units	Daily		AM Peak Hour				PM Peak Hour			
		Rate	Trips	Rate	Trips	In	Out	Rate	Trips	In	Out
Multifamily Residential (Mid-Rise)	92 du	5.44	500	0.36	33	9	24	0.44	40	25	15
Mode Split-Internal Capture Adjustments			*-234*		*-15*	*-4*	*-11*		*-19*	*-12*	*-7*
TOTAL			**266**		**18**	**5**	**13**		**21**	**13**	**8**

Note: du = dwelling unit

As required by the TIRG, estimates of the project's trip generation for all travel modes are shown in Table 2.

Table 2 – Trip Generation by Travel Mode

Mode	Percent	Daily	AM Trips	PM Trips
Motor Vehicle Trips	53.1%	266	18	21
Transit	29.7%	149	10	12
Bike	5.1%	26	1	2
Walk	10.5%	53	3	4
Other	1.6%	6	1	1
TOTAL	**100%**	**500**	**33**	**40**

Note: Based on City of Oakland Transportation Impact Study Guidelines assuming project site is in an urban environment less than 0.5 miles from a BART Station.

Trip Distribution

Daily volume model outputs from the Alameda County Transportation Commission Travel Demand Forecast model were reviewed to identify prevailing travel patterns within the study area. The applied distribution assumptions (with manual adjustments for rounding) and resulting trips are shown in Table 3.

Table 3 – Trip Distribution Assumptions

Route	Percent	Daily Trips	AM Trips	PM Trips
To/from the north via West St	20%	53	4	4
To/from the south via West St	20%	53	4	4
To/from the west via W. MacArthur Blvd	40%	107	6	9
To/from the east via W. MacArthur Blvd	20%	53	4	4
TOTAL	**100%**	**266**	**18**	**21**

Traffic Operation Standards

The City of Oakland does not formally define a Level of Service standard in either the TIRG or the most recent General Plan. In the absence of a formal motor vehicle Level of Service performance standard, it was assumed that all study intersections should strive to maintain LOS D or better operation.

Intersection Evaluation

Study Intersection

West MacArthur Boulevard/West Street is a signalized intersection with protected left-turn phasing on the West MacArthur Boulevard approaches. Crosswalks are provided on all four legs.

Intersection Level of Service

The Existing Conditions scenario provides an evaluation of current operation based on existing traffic volumes during the weekday a.m. and p.m. peak periods. Intersection turning movement counts were collected on Tuesday, September 11, 2018 during the a.m. and p.m. peak periods when all local school were in session.

Because these volumes are more than two years old, steps were taken to estimate current volumes. Peak hour model outputs from the Alameda County Transportation Commission Travel Demand Forecast model were used to derive an annual growth rate. Since the traffic count occurred during pre-pandemic conditions, the previously derived annual growth rate was applied to the intersection volumes to approximate 2021 (non-pandemic) conditions. Under these estimated existing volumes, the study intersection of West MacArthur Boulevard/West Street is operating acceptably at LOS C during the a.m. peak hour, but at LOS F during the p.m. peak hour.

Upon the addition of project-generated traffic to the existing volumes, the study intersection is expected to continue operating at the same service levels with nominal changes to average delay. A summary of the intersection Level of Service calculations is contained in Table 4 and detailed calculations are enclosed.

Table 4 – Existing and Existing plus Project Peak Hour Intersection Levels of Service

Study Intersection *Approach*	Control Type	Existing Conditions				Existing plus Project			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
W. MacArthur Blvd/West St	Signal	22.7	C	102.5	F	23.9	C	101.4	F

Notes: TWSC = Two-Way Stop-Control; Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*

It is noted that with the addition of project-generated traffic volumes the average delay at the study intersection is projected to decrease during the p.m. peak hour. While this is counter-intuitive, this condition occurs when a project adds trips to movements that are currently underutilized or have delays that are below the intersection average, resulting in a better balance between approaches and lower overall average delay. The conclusion could incorrectly be drawn that the project actually improves operation based on this data alone; however, it is more appropriate to conclude that the project trips are expected to make use of excess capacity, so drivers will experience little, if any, change in operating conditions as a result of the project.

Finding – The study intersection is expected to operate at LOS C during the a.m. peak hour and LOS F during the p.m. peak hour with or without the proposed project.

Collision Analysis

The collision history for the study area was reviewed to determine any trends or patterns that may indicate a safety issue. Collision rates were calculated based on records available from the California Highway Patrol as published in their Statewide Integrated Traffic Records System (SWITRS) reports. The most current five-year period available is September 1, 2014 through August 31, 2019.

With 20 collisions during the 5-year study period, the calculated collision rate for the study intersection is 0.60 collisions per million vehicles entering (c/mve). This was compared to the average collision rate for similar facilities statewide, as indicated in 2016 Collision Data on California State Highways, California Department of Transportation (Caltrans), which is 0.24 c/mve. As the collision rate for the study intersection is above the statewide average, the data was investigated further for any trends. The predominant recorded crash types at this intersection were broadside collisions and vehicle-bicyclist collisions, with the primary cause being improper turning, right-of-way violation and traffic signals and signs. Three of the broadside crashes at this location involved vehicles turning left off West MacArthur Boulevard or West Street. All five reported vehicle-bicyclist collisions resulted in injuries. The collision rate calculations are enclosed.

Vehicular Site Access

The project proposes to close four existing driveways (two on West Street and two on West MacArthur Boulevard) thereby creating the potential for approximately four additional on-street parking spaces. Parking restrictions should be considered at these spaces to accommodate short-term parking related to on-demand "for-hire" services (such as Uber, Lyft or DoorDash). The City may consider designating these spaces for passenger loading only (white curb), 12-minute parking only (green curb) or other similar restriction.

Alternative Modes

Pedestrian Facilities

Pedestrian facilities include sidewalks, crosswalks, pedestrian signal phases, curb ramps, curb extensions, and various streetscape amenities such as lighting, benches, etc. In general, a network of sidewalks, crosswalks, and curb ramps provide access for pedestrians in the vicinity of the proposed project site. Ten to fifteen-foot-wide sidewalks are currently provided along the project frontages on West Street and West MacArthur Boulevard. The City of Oakland's 2017 Pedestrian Master Plan does not list any planned improvements along either project frontage.

Bicycle Facilities

The *Highway Design Manual*, Caltrans, 2017, classifies bikeways into four categories:

- **Class I Multi-Use Path** – a completely separated right-of-way for the exclusive use of bicycles and pedestrians with cross flows of motorized traffic minimized.
- **Class II Bike Lane** – a striped and signed lane for one-way bike travel on a street or highway.
- **Class III Bike Route** – signing only for shared use with motor vehicles within the same travel lane on a street or highway.
- **Class IV Bikeway** – also known as a separated bikeway, a Class IV Bikeway is for the exclusive use of bicycles and includes a separation between the bikeway and the motor vehicle traffic lane. The separation may include, but is not limited to, grade separation, flexible posts, inflexible physical barriers, or on-street parking.

Bicyclists ride in the roadway and/or on sidewalks along the streets within the project study area. West MacArthur Boulevard is designated as a Buffered Bike Lane between Market Street and Telegraph Avenue. West Street has a bike lane from 52nd Street to San Pablo Avenue. Future bicycle-related improvements in the vicinity of the project site include the establishment of Protected Bike Lanes along West MacArthur Boulevard and Buffered Bike Lanes along West Street. Implementation of these future improvements is currently in varying stages of preliminary design or construction. A complete list of proposed improvements is illustrated in the 2019 Oakland Bike Plan, "Let's Bike Oakland".

Transit Facilities

Bay Area Rapid Transit (BART)

The BART system provides regional rail service between San Mateo, San Francisco, Alameda, Contra Costa, and Santa Clara counties, with eight stations in Oakland. The nearest station is the MacArthur station located at 555 40th Street, which is less than one-half mile from the project site. This station is served by the Antioch-San Francisco Airport/Millbrae, Richmond-Millbrae, and Richmond-Berryessa/North San Jose lines. On weekdays during peak commute periods trains have 15-minute headways. During all other times (off-peak periods and weekends) trains operate at 20-minute headways. Typical hours of operation for BART are between the hours of 5:00 a.m. and midnight weekdays, 6:00 a.m. to midnight on Saturdays and 8:00 a.m. to midnight on Sundays.

Alameda-Contra Costa Transit District (AC Transit)

Alameda-Contra Costa County (AC) Transit provides fixed route bus service throughout the East Bay. There are numerous bus routes that run along major streets in Oakland, connecting to adjacent cities such as Berkeley, Alameda, San Leandro, and Emeryville, along with trans bay service to San Francisco. Two bicycles can be carried on most AC Transit buses. Bike rack space is on a first come, first served basis. Additional bicycles are allowed on AC Transit buses at the discretion of the driver.

Within 1,500 feet of the project site there are bus stops for Routes 6, 18, 57, 88 and 800. The combined service areas of these routes provides access between the project site and a variety of destinations such as the University of California Campus at Berkeley, Downtown Oakland, Mills College, Foothill Square Shopping Center, Grand Lake and Dimond Districts, Downtown Berkeley, Albany, Emeryville, San Francisco, and Central Richmond. Bus service for these routes is generally available on weekdays from 4:30 a.m. to 11:00 p.m. at 10- to 60-minute headways and weekends from 7:00 a.m. to 11:00 p.m. at 30- to 60-minute headways.

Emery Go-Round

The Emery Go-Round is a last-mile shuttle service, provided by the Emeryville Transportation Management Association, to connect employees, residents, and visitors situated along the service routes between various locations in Emeryville to the MacArthur BART Station. The service is free to the public and generally operates on weekdays from 6:00 a.m. to 10:00 p.m., Saturdays from 8:00 a.m. to 10:00 p.m. and Sundays from 9:00 a.m. to 7:00 p.m. Bus stops serving the Hollis (H) and Shellmound/Powell (SP) lines are located within one-half a mile from the project site.

Amtrak

Amtrak is a passenger railroad service that provides medium- and long-distance service between cities in the United States and Canada with a station in Emeryville located approximately 1.8 miles from the project site at 5885 Horton Street. The Emeryville Amtrak Station is served by the Capitol Corridor, Coast Starlight, California Zephyr and San Joaquin passenger train services.

San Francisco Bay Area Water Emergency Transportation Authority (WETA)

The San Francisco Bay Area Water Emergency Transportation Authority (WETA) operates ferry service between San Francisco, Alameda, and the terminal at 10 Clay Street in Oakland. The ferry service operates on weekdays from approximately 6:00 to 10:00 a.m. and from 2:00 to 7:40 p.m. The ferry terminal is located approximately 2.5 miles from the project site.

East Bay Paratransit

Paratransit is an on-demand service for persons with disabilities who cannot independently use regular fixed-route transit services. AC Transit and BART provide paratransit service in Oakland through its East Bay Paratransit service.

On-Demand Transportation Services

On-demand private taxi services and transportation network companies (TNCs such as Uber and Lyft), as well as short-term car and bike rental services, are available in Oakland 24 hours a day. Taxis and vehicle rentals can be used for trips within the local Planning Area and farther destinations, including nearby airports. This includes services such as ZipCar, GigCar and Bay Wheels which maintain a supply of motor vehicles and bicycles typically within one-half mile of the project.

CEQA Significance Criteria

The TIRG includes criteria to determine the level of significance of the impact of a project's vehicle miles traveled (VMT). This document states that the project would have a significant impact on the environment if it would:

1. Conflict with a plan, ordinance, or policy addressing the safety or performance of the circulation system, including transit, roadways, bicycle lanes, and pedestrian paths (except for automobile level of service or other measures of vehicle delay); or
2. Cause substantial additional VMT per capita, per service population, or other appropriate efficiency measure; or
3. Substantially induce additional automobile travel by increasing physical roadway capacity in congested areas (i.e., by adding new mixed-flow lanes) or by adding new roadways to the network.

For residential projects, the TIRG states that a project would cause substantial additional VMT if it exceeds existing regional household VMT per capita minus 15 percent.

1. Local Area Plan Review

The project would not conflict with any adopted local plans, ordinances, or policies. Pedestrian, bicycle, and transit facilities are adequate to serve the project as proposed. The project may incrementally increase the use of transit but would not conflict with, or decrease the performance of, the existing transit system based on the size of the project and the number of transit lines and their frequency of service.

Finding – The project would be expected to have a less-than-significant transportation impact on local programs, plans, ordinances, and policies.

2. Vehicles Miles Traveled

Consideration was given to the project's potential generation of Vehicle Miles Traveled (VMT). According to the Alameda County Travel Demand Model estimates, the existing regional household (countywide) VMT per resident is 19.4 miles. Based on TIRG guidance, a project generating a VMT that is 15 percent or more below this value, or 16.5 miles per capita, would have a less-than-significant VMT impact. The Alameda County model includes traffic analysis zones (TAZ) covering geographic areas throughout the County. This project is located within a TAZ which has a projected VMT per capita of 9.7 miles. Because the VMT per capita for this TAZ is lower than the significance threshold of 16.5 miles, the project would be considered to have a less-than-significant VMT impact. Further, as this development does not include parking, vehicle ownership and travel by motor vehicle is expected to be lower than other developments that do provide parking.

A summary of the VMT findings is provided in Table 5. A copy of the Alameda County Travel Demand Model Plots showing VMT is enclosed.

Table 5 – Vehicle Miles Traveled Analysis Summary

VMT Metric	Existing Regional (Countywide) VMT	Significance Threshold	Project VMT	Resulting Significance
Residential VMT per Capita	19.4	16.5	9.7	Less Than Significant

Note: VMT Rate is measured in VMT per capita, or the number of daily miles driven per resident

Finding – The proposed residential project would theoretically be expected to have a VMT per capita of 9.7, which is less than the VMT threshold of 16.5. This is considered a less-than-significant impact. Also, with no parking proposed as part of the project, vehicle ownership is expected to be considerably lower than in a similar development that provides parking, further supporting the finding that the VMT impact would be less than significant.

3. Roadway Capacity

The project would not alter the roadways serving the site by increasing physical capacity for additional vehicles.

Finding – The project would have a less-than-significant transportation impact on roadway capacities.

Conclusions and Recommendations

- The proposed project is expected to generate an average of 266 trips per day, including 18 trips during the weekday a.m. peak hour and 21 during the p.m. peak hour.
- The addition of project-related traffic is expected to nominally alter the average delay at the intersection of West MacArthur Boulevard/West Street.
- The City should consider assigning parking restrictions to the on-street parking spaces directly adjacent to the project to accommodate on-demand vehicle trips.
- Pedestrian, bicycle, and transit facilities are adequate to serve the project as proposed.
- The proposed project would have a less-than-significant transportation impact on vehicle miles traveled.

Thank you for giving W-Trans the opportunity to provide these services. Please call if you have any questions.

Sincerely,

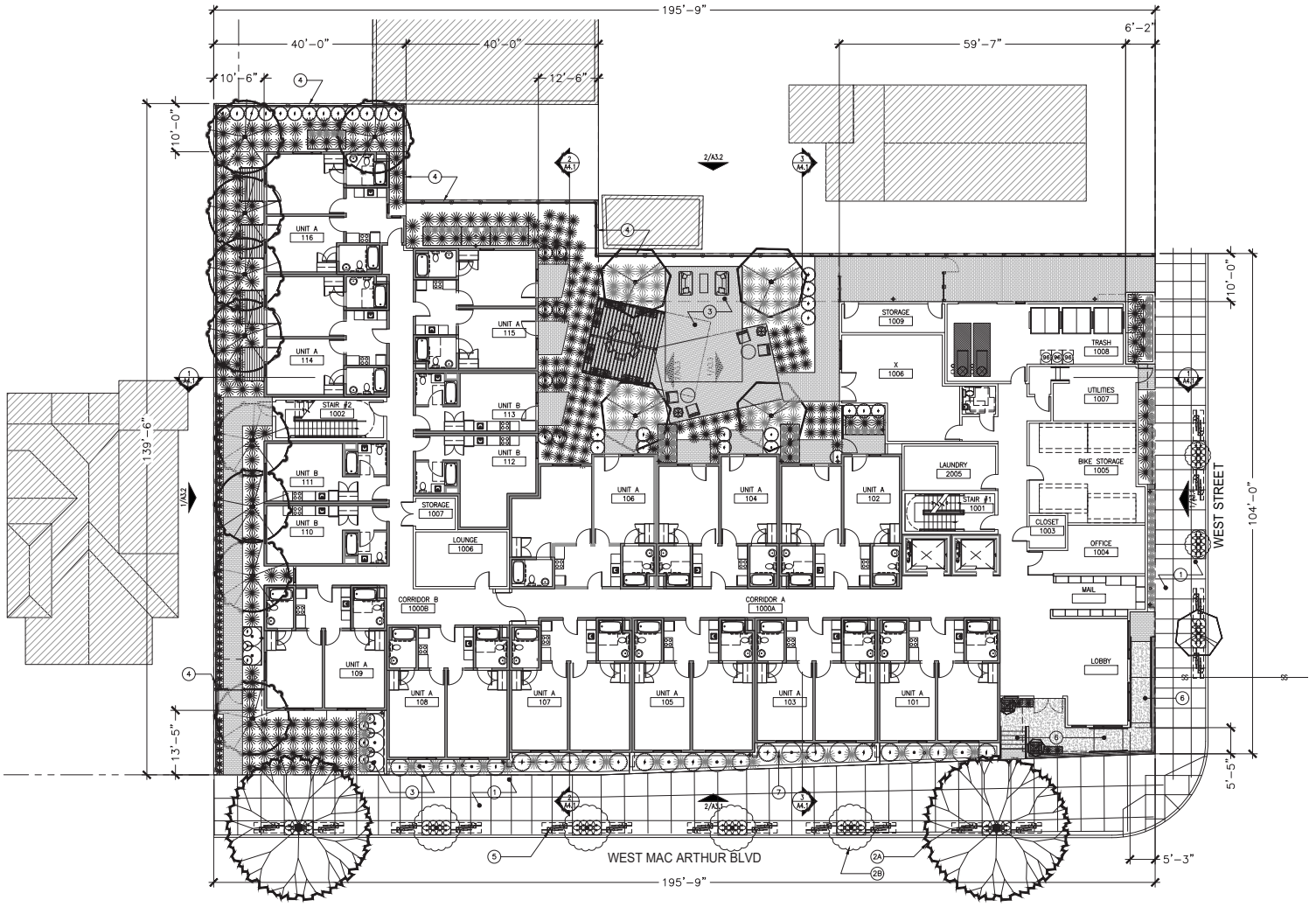
Kenny Jeong, PE
Traffic Engineer

REGISTERED PROFESSIONAL ENGINEER
MARK E. SPENCER
TR001737
TRAFFIC
STATE OF CALIFORNIA

Mark Spencer, PE
Senior Principal

MES/kbj/OAK066.L1

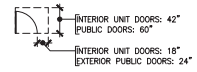
Enclosures: Site Plan, Intersection Level of Service Outputs, Collision Rate Worksheet, Alameda County Travel Demand Model VMT Plots for the North Planning Area



1 PLAN: 1ST FLOOR
3/32"=1'-0"

GENERAL NOTES

1. ALL RESIDENTIAL UNITS TO BE ADAPTABLE PER 2019 CBC 1128A–1134A
   1.1. KITCHENS TO COMPLY WITH 2019 CBC 1133A
   1.2. BATHROOMS TO COMPLY WITH 2019 CBC 1134A
2. DOORS TO COMPLY WITH THE FOLLOWING:



2. CONTRACTOR TO PROVIDE SOLID CONTINUOUS BACKING FOR ALL WALL MTD. FIXTURES, ACCESSORIES, MILLWORK, EQUIPMENT RACKS, SHELVING, ETC. ALL BLOCKING TO BE SAME DIMENSION AS ASSOCIATED FRAMING

SHEET NOTES

(1) (N) SIDEWALK, CURBS & GUTTER; S.C.D & S.L.D.
(2A) (N) STREET TREE, TYP. OF 3; S.L.D.
(2B) (E) STREET TREE, TYP. OF 6; S.L.D.
(3) (N) PLANTERS & LANDSCAPING, S.L.D.
(4) (N) PERIMETER FENCING
(5) (N) BIKE RACKS, TYP.
(6) (N) ENTRY STAIRS & RAMP
(7) (N) BUILDING ABOVE
(8) (N) BUILDING BELOW
(9) (N) AWNING
(10) (N) OCCUPIABLE DECK; S.L.D.
(11) (N) NON–OCCUPIABLE ROOF

PROJECT NORTH

TRUE NORTH

LEVY DESIGN PARTNERS
95 South Park
San Francisco
CA 94107

820 WEST MACARTHUR
OAKLAND, CA

TOBY STELLA LEVY
No. 10421
REN. 6-30-21
STATE OF CALIFORNIA

820 WEST MACARTHUR

BLOCK/PARCEL/LOT:
APN: 012-0959-009-03
OAKLAND, CA
PROJECT NO. 2017-12.4

DATE	SET ISSUE
11-11-2020	PLANNING SUBMISSION
03-29-2021	PLANNING SUBMISSION REV01

CONTACT: TOBY LEVY

(415) 777-0561 P
(415) 777-5117 F

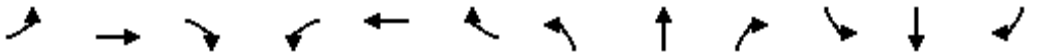
SCALE: AS NOTED

FLOOR PLAN:
GROUND FLOOR

A2.1

HCM 6th Signalized Intersection Summary
1: West St & W MacArthur Blvd

04/30/2021



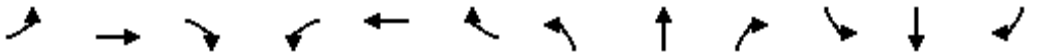
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	35	237	50	37	366	69	113	392	104	39	202	53
Future Volume (veh/h)	35	237	50	37	366	69	113	392	104	39	202	53
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	40	272	57	43	421	79	130	451	120	45	232	61
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	78	455	94	82	472	88	467	568	151	261	570	150
Arrive On Green	0.04	0.16	0.16	0.05	0.16	0.16	0.40	0.40	0.40	0.40	0.40	0.40
Sat Flow, veh/h	1781	2933	605	1781	2990	557	1086	1423	379	841	1427	375
Grp Volume(v), veh/h	40	163	166	43	249	251	130	0	571	45	0	293
Grp Sat Flow(s),veh/h/ln	1781	1777	1761	1781	1777	1770	1086	0	1802	841	0	1803
Q Serve(g_s), s	1.0	3.8	4.0	1.1	6.2	6.3	4.4	0.0	12.6	2.2	0.0	5.3
Cycle Q Clear(g_c), s	1.0	3.8	4.0	1.1	6.2	6.3	9.7	0.0	12.6	14.8	0.0	5.3
Prop In Lane	1.00		0.34	1.00		0.31	1.00		0.21	1.00		0.21
Lane Grp Cap(c), veh/h	78	276	273	82	280	279	467	0	720	261	0	720
V/C Ratio(X)	0.51	0.59	0.61	0.52	0.89	0.90	0.28	0.00	0.79	0.17	0.00	0.41
Avail Cap(c_a), veh/h	1738	276	273	1699	280	279	780	0	1239	504	0	1239
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.1	17.7	17.8	21.0	18.6	18.6	13.2	0.0	11.9	18.4	0.0	9.7
Incr Delay (d2), s/veh	1.9	2.3	2.8	1.9	26.5	28.7	0.1	0.0	0.8	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	1.6	1.6	0.4	4.3	4.5	1.0	0.0	4.2	0.4	0.0	1.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	23.0	20.0	20.5	22.9	45.1	47.4	13.3	0.0	12.7	18.5	0.0	9.8
LnGrp LOS	C	C	C	C	D	D	B	A	B	B	A	A
Approach Vol, veh/h		369			543			701			338	
Approach Delay, s/veh		20.6			44.4			12.8			11.0	
Approach LOS		C			D			B			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.1	13.0		24.0	8.0	13.1		24.0				
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0				
Max Green Setting (Gmax), s	43.0	7.0		31.0	44.0	7.0		31.0				
Max Q Clear Time (g_c+I1), s	3.1	6.0		16.8	3.0	8.3		14.6				
Green Ext Time (p_c), s	0.0	0.1		1.2	0.0	0.0		2.9				

Intersection Summary			
HCM 6th Ctrl Delay		22.7	
HCM 6th LOS		C	

Notes

User approved pedestrian interval to be less than phase max green.



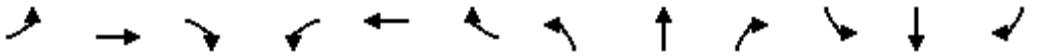
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	71	739	37	55	537	95	83	378	81	28	152	23
Future Volume (veh/h)	71	739	37	55	537	95	83	378	81	28	152	23
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	76	795	40	59	577	102	89	406	87	30	163	25
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	124	600	30	105	494	87	492	516	111	260	548	84
Arrive On Green	0.07	0.17	0.17	0.06	0.16	0.16	0.35	0.35	0.35	0.35	0.35	0.35
Sat Flow, veh/h	1781	3443	173	1781	3019	532	1195	1493	320	904	1584	243
Grp Volume(v), veh/h	76	410	425	59	339	340	89	0	493	30	0	188
Grp Sat Flow(s),veh/h/ln	1781	1777	1839	1781	1777	1775	1195	0	1813	904	0	1827
Q Serve(g_s), s	1.8	7.5	7.5	1.4	7.0	7.0	2.5	0.0	10.4	1.3	0.0	3.2
Cycle Q Clear(g_c), s	1.8	7.5	7.5	1.4	7.0	7.0	5.7	0.0	10.4	11.8	0.0	3.2
Prop In Lane	1.00		0.09	1.00		0.30	1.00		0.18	1.00		0.13
Lane Grp Cap(c), veh/h	124	310	321	105	291	291	492	0	627	260	0	631
V/C Ratio(X)	0.61	1.32	1.32	0.56	1.16	1.17	0.18	0.00	0.79	0.12	0.00	0.30
Avail Cap(c_a), veh/h	1833	310	321	1792	291	291	945	0	1314	603	0	1325
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	19.3	17.6	17.6	19.6	17.9	17.9	12.3	0.0	12.6	17.9	0.0	10.2
Incr Delay (d2), s/veh	1.8	166.7	166.2	1.8	105.1	107.1	0.1	0.0	0.8	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	16.9	17.5	0.6	10.9	11.1	0.6	0.0	3.6	0.3	0.0	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	21.2	184.3	183.9	21.3	123.0	125.0	12.4	0.0	13.4	17.9	0.0	10.3
LnGrp LOS	C	F	F	C	F	F	B	A	B	B	A	B
Approach Vol, veh/h		911			738			582			218	
Approach Delay, s/veh		170.5			115.8			13.2			11.3	
Approach LOS		F			F			B			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.5	13.5		20.8	9.0	13.0		20.8				
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0				
Max Green Setting (Gmax), s	43.0	7.0		31.0	44.0	7.0		31.0				
Max Q Clear Time (g_c+I1), s	3.4	9.5		13.8	3.8	9.0		12.4				
Green Ext Time (p_c), s	0.1	0.0		0.7	0.1	0.0		2.3				

Intersection Summary			
HCM 6th Ctrl Delay		102.5	
HCM 6th LOS		F	

Notes

User approved pedestrian interval to be less than phase max green.



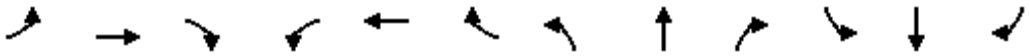
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	37	237	50	37	367	70	114	393	104	39	205	59
Future Volume (veh/h)	37	237	50	37	367	70	114	393	104	39	205	59
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	43	272	57	43	422	80	131	452	120	45	236	68
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	82	454	94	82	462	87	459	570	151	262	559	161
Arrive On Green	0.05	0.15	0.15	0.05	0.15	0.15	0.40	0.40	0.40	0.40	0.40	0.40
Sat Flow, veh/h	1781	2933	605	1781	2985	562	1075	1424	378	840	1396	402
Grp Volume(v), veh/h	43	163	166	43	250	252	131	0	572	45	0	304
Grp Sat Flow(s),veh/h/ln	1781	1777	1761	1781	1777	1769	1075	0	1802	840	0	1798
Q Serve(g_s), s	1.1	3.9	4.0	1.1	6.2	6.3	4.5	0.0	12.6	2.2	0.0	5.5
Cycle Q Clear(g_c), s	1.1	3.9	4.0	1.1	6.2	6.3	10.0	0.0	12.6	14.8	0.0	5.5
Prop In Lane	1.00		0.34	1.00		0.32	1.00		0.21	1.00		0.22
Lane Grp Cap(c), veh/h	82	275	273	82	275	274	459	0	722	262	0	720
V/C Ratio(X)	0.52	0.59	0.61	0.52	0.91	0.92	0.29	0.00	0.79	0.17	0.00	0.42
Avail Cap(c_a), veh/h	1735	275	273	1695	275	274	766	0	1237	502	0	1234
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.1	17.8	17.8	21.1	18.8	18.8	13.4	0.0	11.9	18.4	0.0	9.8
Incr Delay (d2), s/veh	1.9	2.3	2.8	1.9	30.7	33.3	0.1	0.0	0.8	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	1.6	1.6	0.4	4.6	4.8	1.0	0.0	4.2	0.4	0.0	1.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	23.0	20.1	20.6	23.0	49.5	52.1	13.5	0.0	12.7	18.5	0.0	9.9
LnGrp LOS	C	C	C	C	D	D	B	A	B	B	A	A
Approach Vol, veh/h		372			545			703			349	
Approach Delay, s/veh		20.7			48.6			12.8			11.0	
Approach LOS		C			D			B			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.1	13.0		24.1	8.1	13.0		24.1				
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0				
Max Green Setting (Gmax), s	43.0	7.0		31.0	44.0	7.0		31.0				
Max Q Clear Time (g_c+I1), s	3.1	6.0		16.8	3.1	8.3		14.6				
Green Ext Time (p_c), s	0.0	0.1		1.3	0.0	0.0		2.9				

Intersection Summary			
HCM 6th Ctrl Delay		23.9	
HCM 6th LOS		C	

Notes

User approved pedestrian interval to be less than phase max green.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	77	739	37	55	539	97	85	380	81	28	154	27
Future Volume (veh/h)	77	739	37	55	539	97	85	380	81	28	154	27
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	83	795	40	59	580	104	91	409	87	30	166	29
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	130	608	31	105	489	87	486	519	110	258	538	94
Arrive On Green	0.07	0.18	0.18	0.06	0.16	0.16	0.35	0.35	0.35	0.35	0.35	0.35
Sat Flow, veh/h	1781	3443	173	1781	3012	539	1188	1495	318	901	1551	271
Grp Volume(v), veh/h	83	410	425	59	342	342	91	0	496	30	0	195
Grp Sat Flow(s),veh/h/ln	1781	1777	1839	1781	1777	1773	1188	0	1813	901	0	1822
Q Serve(g_s), s	2.0	7.6	7.6	1.4	7.0	7.0	2.6	0.0	10.6	1.3	0.0	3.4
Cycle Q Clear(g_c), s	2.0	7.6	7.6	1.4	7.0	7.0	6.0	0.0	10.6	11.9	0.0	3.4
Prop In Lane	1.00		0.09	1.00		0.30	1.00		0.18	1.00		0.15
Lane Grp Cap(c), veh/h	130	314	325	105	289	288	486	0	629	258	0	632
V/C Ratio(X)	0.64	1.31	1.31	0.56	1.18	1.19	0.19	0.00	0.79	0.12	0.00	0.31
Avail Cap(c_a), veh/h	1819	314	325	1777	289	288	928	0	1304	594	0	1310
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	19.4	17.7	17.7	19.7	18.0	18.0	12.5	0.0	12.7	18.0	0.0	10.3
Incr Delay (d2), s/veh	1.9	159.1	158.7	1.8	112.2	114.3	0.1	0.0	0.8	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	16.5	17.1	0.6	11.4	11.6	0.6	0.0	3.7	0.3	0.0	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	21.4	176.8	176.4	21.5	130.2	132.3	12.6	0.0	13.5	18.1	0.0	10.4
LnGrp LOS	C	F	F	C	F	F	B	A	B	B	A	B
Approach Vol, veh/h		918			743			587			225	
Approach Delay, s/veh		162.6			122.6			13.4			11.4	
Approach LOS		F			F			B			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.5	13.6		20.9	9.1	13.0		20.9				
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0				
Max Green Setting (Gmax), s	43.0	7.0		31.0	44.0	7.0		31.0				
Max Q Clear Time (g_c+I1), s	3.4	9.6		13.9	4.0	9.0		12.6				
Green Ext Time (p_c), s	0.1	0.0		0.8	0.1	0.0		2.4				

Intersection Summary		
HCM 6th Ctrl Delay	101.4	
HCM 6th LOS	F	

Notes

User approved pedestrian interval to be less than phase max green.

Intersection Collision Rate Worksheet

820 West MacArthur Boulevard

Intersection # 1: West MacArthur Blvd & West St
Date of Count: Tuesday, September 11, 2018

Number of Collisions: 20
Number of Injuries: 12
Number of Fatalities: 0
Average Daily Traffic (ADT): 18400
Start Date: September 1, 2014
End Date: August 31, 2019
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{20 \times 1{,}000{,}000}{18{,}400 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.60 c/mve**	**0.0%**	**60.0%**
Statewide Average*	**0.24 c/mve**	**0.5%**	**44.6%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2016 Collision Data on California State Highways, Caltrans

Vehicle Miles Traveled per Capita
North Planning Area

North Planning Area Average (Target -15%): 13.3 (11.3)
Alameda County Average (Target -15%): 19.4 (16.5)

2020 Vehicle Miles Traveled per Capita by TAZ

- > 25.00
- 20.01 - 25.00
- 15.01 - 20.00
- 10.01 - 15.00
- 0.01 - 10.00
- 0.00

DRAFT
For discussion purposes only

Data Source: Alameda Countywide Travel Model, Plan Bay Area 2040 version, May 2019

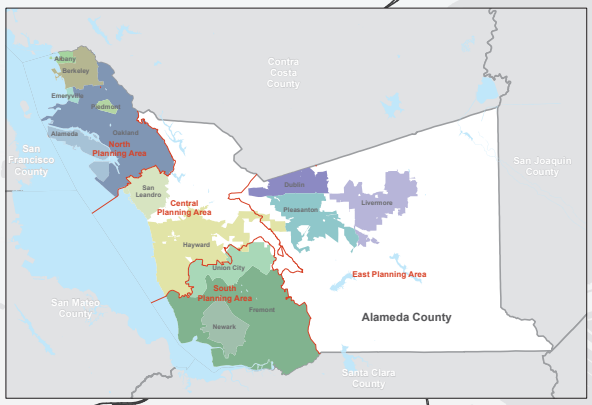
Vehicle miles traveled (VMT) = home-based trips (home-based work, school, shopping/errands, social/recreation) at transportation analysis zone (TAZ) containing residence site

VMT also includes estimates of non-home trips generated by residents at the non-residential end of the home-based trip (e.g. lunch trips from workplace)

VMT per capita = home-based VMT at residence TAZ divided by total population in TAZ

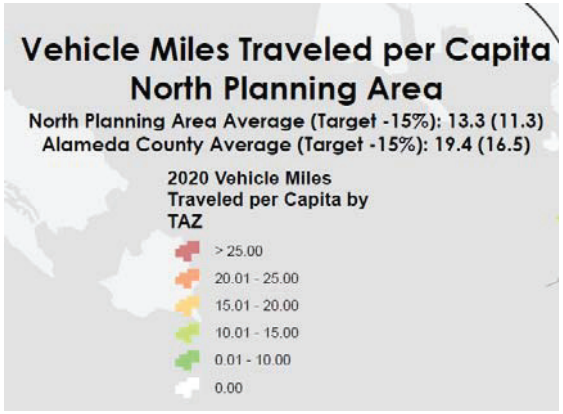
VMT includes all travel within 9-county Bay Area plus San Joaquin County plus estimates of travel distances beyond the 10-county model area

TAZs with zero values (white) did not have population in the 2020 model



0 1 2 3 Miles

ALAMEDA County Transportation Commission



Legend:

820 West MacArthur Blvd Site

Traffic Analysis Zone (TAZ) Boundaries