CITY OF ANTIOCH
COMMUNITY DEVELOPMENT DEPARTMENT

ANTIOCH
CALIFORNIA

Lone Tree Retail Project

IS/MND Addendum

January 2025

Prepared by

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A. INTRODUCTION AND SUMMARY

The purpose of this Addendum is to demonstrate that the Lone Tree Retail Project (proposed project) has been adequately analyzed in the previous environmental review under the California Environmental Quality Act (CEQA) and that further evaluation is not required.

B. PROJECT BACKGROUND

In December 2004, the City of Antioch prepared an Initial Study/Mitigated Negative Declaration (IS/MND), hereafter referred to as the "2004 IS/MND," for the previously approved In-Shape Health Club and Shopping Center Project. The 2004 IS/MND evaluated the development of an 18-acre site, located on the northeast side of Lone Tree Way, with 186,000 square feet (sf) of commercial uses. The commercial uses anticipated in the 2004 IS/MND included a 60,000-sf health club, 101,000-sf retail shopping center, two restaurant buildings totaling 14,000 sf, and a 10,000-sf medical office building. The 2004 IS/MND was adopted as part of a Planned Development approval (PD-04-05).

Of the commercial uses anticipated to be constructed within the 18-acre site in the 2004 IS/MND, only the In-Shape Family Fitness Center and an associated parking lot have been constructed to date, as well as frontage improvements along Long Tree Way for the entirety of the site. In the time since the adoption of the 2004 IS/MND, the City has ministerially approved a residential housing project on the eastern portion of the site through the City's Community Infill Housing overlay via an approval letter, which will replace the previously approved 101,000-sf retail shopping center. The remaining portions of the project site currently remain undeveloped.

C. PROJECT DESCRIPTION

The following provides a description of the project site's current location and setting, as well as the proposed project components and the discretionary actions required for the project.

Project Location and Setting

The proposed project site consists of the westernmost 3.22-acre portion of the overall 18-acre site analyzed in the 2004 IS/MND (see Figure 1). The project site is located at 4099 Lone Tree Way in the City of Antioch, California and is identified by Assessor's Parcel Numbers (APNs) 072-500-005, -006, and -007 (see Figure 2). The northern half of the project site consists of the 1.21-acre Parcel E (APN 072-500-005) and the 0.96-acre Parcel F (APN 072-500-006); Parcels E and F are undeveloped. The southern half of the project site consists of the 1.05-acre Parcel G (APN 072-500-007). The southern portion of Parcel G is developed with a segment of the In-Shape Family Fitness Center parking lot and the northern portion of the parcel is undeveloped. An existing signaled driveway bisects the project site and separates Parcels E and F from Parcel G. Surrounding existing land uses include medical offices, commercial uses, and undeveloped land which is approved for multi-family residential uses to the north; the In-Shape Family Fitness Center parking lot to the east; the In-Shape Family Fitness Center facility to the southeast; and open space and single-family residences to the west, across Lone Tree Way. The City of Antioch General Plan designates the site as Neighborhood Community Commercial and the site is zoned Planned Development (P-D).

Figure 1
Regional Vicinity

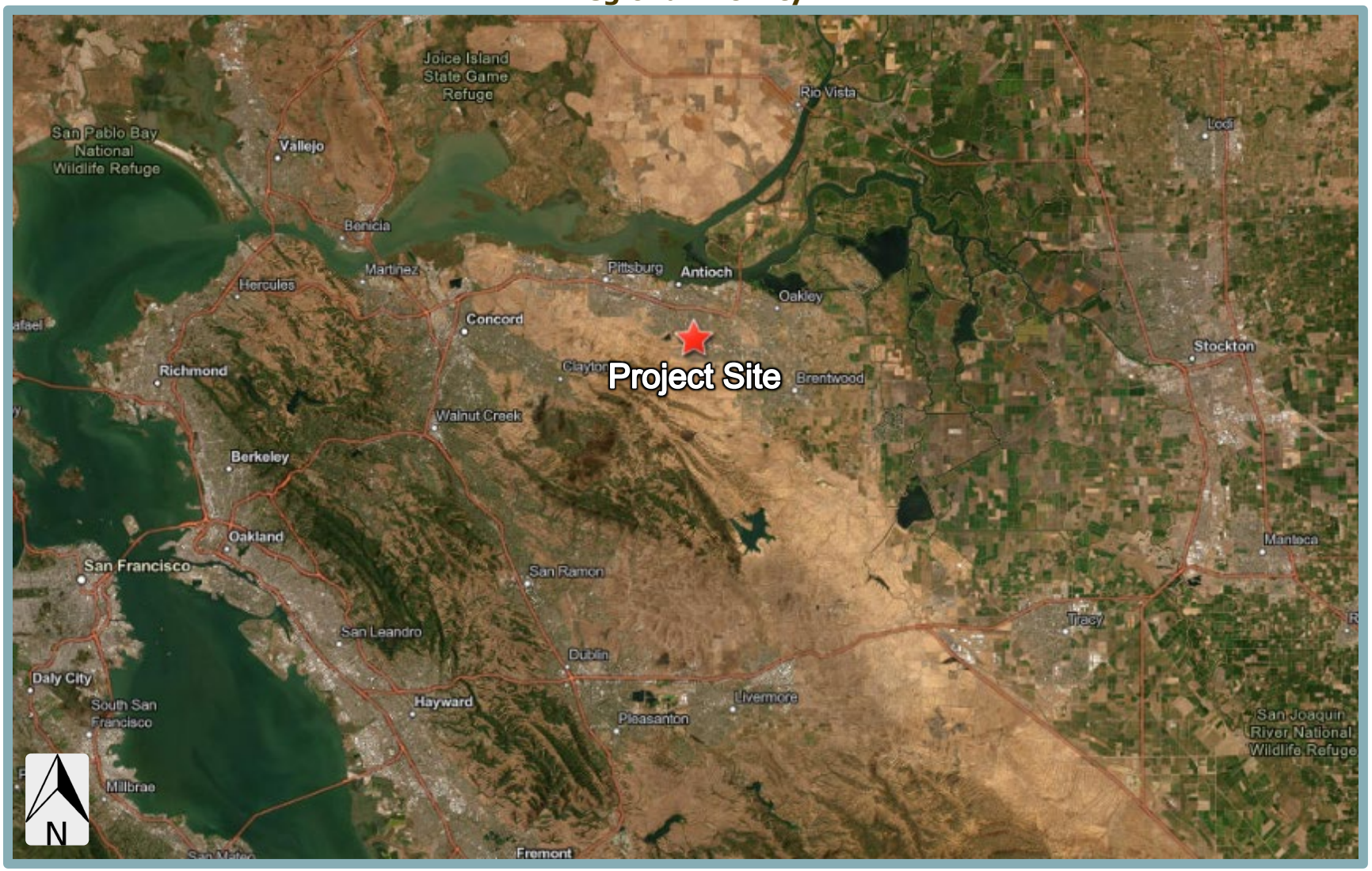


Figure 2
Project Site Boundaries

Project Components

The project site was previously approved for development of two restaurant buildings totaling 14,000 sf, as well as a 10,000-sf medical office building. The proposed project would include the construction of a car wash facility, a quick-service restaurant, and a quick-service restaurant/retail building (see Figure 3).

The proposed project would develop Parcel E with a 4,708-sf car wash, Parcel F with a 2,550-sf quick service restaurant, and Parcel G with a 3,760-sf quick service restaurant/retail building. The proposed project would also include new landscaping medians along the eastern portions of Parcels E and F, adjacent to the future multi-family residential uses.

A comparison of the previously approved and the currently proposed uses within the project site is presented in Table 1, below.

Table 1
Approved vs. Proposed Commercial Uses

Approved	Proposed
Medical Office Building (10,000 sf) Restaurant Buildings (14,000 sf)	Car Wash (4,708 sf) Quick Service Restaurant– Parcel F (2,550 sf) Quick Service Restaurant/Retail Building – Parcel G (3,760 sf)
Total	
24,000 sf	**11,018 sf**

The proposed car wash facility would operate from 7:00 AM to 7:00 PM during winter months, and from 7:00 AM to 8:00 PM during summer months. The quick service restaurant within Parcel F would operate from 10:00 AM to 11:00 PM, and the quick service restaurant/retail building within Parcel G would operate from 10:45 AM to 11:00 PM. Compliance with the foregoing hours of operation would be required as a Condition of Approval for the proposed project.

Vehicle access to the project site would be provided by two existing driveways off of Lone Tree Way located in the center of the site between Parcels F and G, as well as one new driveway from Lone Tree Way into Parcel E the northern portion of the site. Consistent with City requirements, based on the square footage of the proposed retail uses, Parcel E would include 11 parking stalls, including two Americans with Disabilities Act (ADA) compliant spaces; Parcel F would include 17 parking stalls, including two compact spaces and two ADA-compliant spaces; and Parcel G would include 19 parking stalls, including two ADA-compliant spaces. Overall, the proposed project would include 47 new parking spaces. It is noted that the southern portion of Parcel G is currently developed with approximately 27 existing parking spaces that are shared with the In-Shape Family Fitness Center.

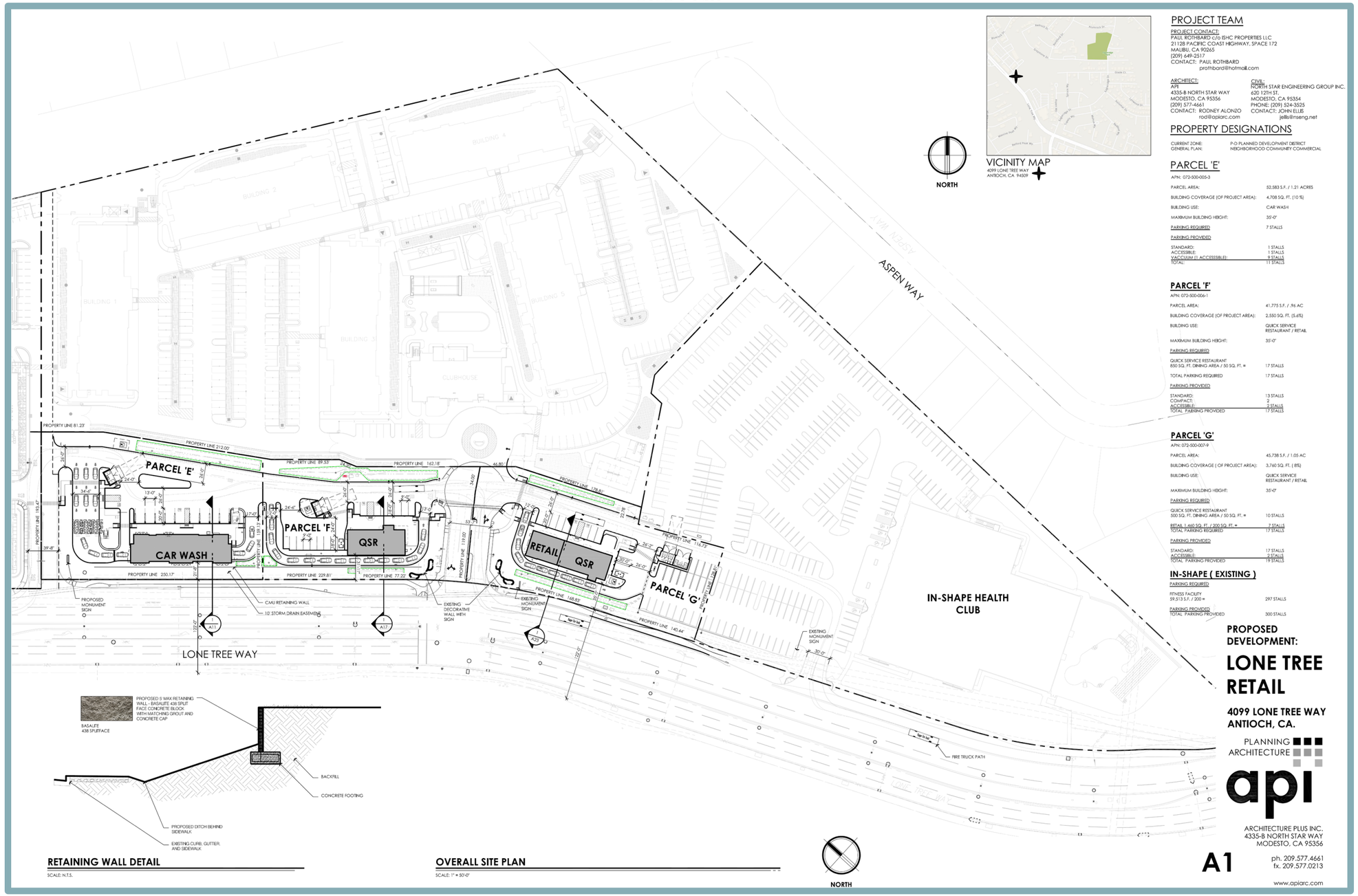
Requested/Required Entitlements

The proposed project would require the following approvals from the City of Antioch:

- Final Development Plan;
- Use Permit; and
- Design Review.

It should be noted that as part of the adjacent multi-family residential development north of the project site, the developer will submit a tentative map to the City, which will include adjusted lot lines for that site and the project site.

Figure 3
Site Plan



PROJECT TEAM

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PROPERTY DESIGNATIONS

CURRENT ZONE:	P-D PLANNED DEVELOPMENT DISTRICT
GENERAL PLAN:	NEIGHBORHOOD COMMUNITY COMMERCIAL

PARCEL 'E'

APN: 072-500-005-3

PARCEL AREA:	52,583 S.F. / 1.21 ACRES
BUILDING COVERAGE (OF PROJECT AREA):	4,708 SQ. FT. (10 %)
BUILDING USE:	CAR WASH
MAXIMUM BUILDING HEIGHT:	35'-0"
PARKING REQUIRED	7 STALLS
PARKING PROVIDED	
STANDARD:	1 STALLS
ACCESSIBLE:	1 STALLS
VACCUUM (1 ACCESSSIBLE):	9 STALLS
TOTAL:	11 STALLS

PARCEL 'F'

APN: 072-500-006-1

PARCEL AREA:	41,775 S.F. / .96 AC
BUILDING COVERAGE (OF PROJECT AREA):	2,550 SQ. FT. (5.6%)
BUILDING USE:	QUICK SERVICE RESTAURANT / RETAIL
MAXIMUM BUILDING HEIGHT:	35'-0"
PARKING REQUIRED	
QUICK SERVICE RESTAURANT: 850 SQ. FT. DINING AREA / 50 SQ. FT. =	17 STALLS
TOTAL PARKING REQUIRED	17 STALLS
PARKING PROVIDED	
STANDARD:	13 STALLS
COMPACT:	2
ACCESSIBLE:	2 STALLS
TOTAL PARKING PROVIDED	17 STALLS

PARCEL 'G'

APN: 072-500-007-9

PARCEL AREA:	45,738 S.F. / 1.05 AC
BUILDING COVERAGE (OF PROJECT AREA):	3,760 SQ. FT. (8%)
BUILDING USE:	QUICK SERVICE RESTAURANT / RETAIL
MAXIMUM BUILDING HEIGHT:	35'-0"
PARKING REQUIRED	
QUICK SERVICE RESTAURANT 500 SQ. FT. DINING AREA / 50 SQ. FT. =	10 STALLS
RETAIL 1,460 SQ. FT. / 200 SQ. FT. =	7 STALLS
TOTAL PARKING REQUIRED	17 STALLS
PARKING PROVIDED	
STANDARD:	17 STALLS
ACCESSIBLE	2 STALLS
TOTAL PARKING PROVIDED	19 STALLS

IN-SHAPE (EXISTING)

PARKING REQUIRED	
FITNESS FACILITY 59,513 S.F. / 200 =	297 STALLS
PARKING PROVIDED TOTAL PARKING PROVIDED	300 STALLS

PROPOSED DEVELOPMENT:

LONE TREE RETAIL

4099 LONE TREE WAY ANTIOCH, CA.

PLANNING
ARCHITECTURE

api

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The tentative map will be subject to separate City review and approval.

D. DISCUSSION

New significant effects or other grounds require additional environmental review in support of further agency action on a project pursuant to Public Resources Code (PRC) Section 21166 and State CEQA Guidelines Sections 15162 and 15164. Under the guidelines, additional environmental review shall be required if any of the following criteria are met:

15162. Subsequent EIRs and Negative Declarations

(a) When an EIR has been certified or a negative declaration adopted for a project, no subsequent EIR shall be prepared for that project unless the lead agency determines, on the basis of substantial evidence in the light of the whole record, one or more of the following:

(1) Substantial changes are proposed in the project which will require major revisions of the previous EIR or negative declaration due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects;
(2) Substantial changes occur with respect to the circumstances under which the project is undertaken which will require major revisions of the previous EIR or negative declaration due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects; or
(3) New information of substantial importance, which was not known and could not have been known with the exercise of reasonable diligence at the time the previous EIR was certified as complete or the negative declaration was adopted, shows any of the following:

(A) The project will have one or more significant effects not discussed in the previous EIR or negative declaration;
(B) Significant effects previously examined will be substantially more severe than shown in the previous EIR;
(C) Mitigation measures or alternatives previously found not to be feasible would in fact be feasible and would substantially reduce one or more significant effects of the project, but the project proponents decline to adopt the mitigation measure or alternative; or
(D) Mitigation measures or alternatives which are considerably different from those analyzed in the previous EIR would substantially reduce one or more significant effects on the environment, but the project proponents decline to adopt the mitigation measure or alternative.

(b) If changes to a project or its circumstances occur or new information becomes available after adoption of a negative declaration, the lead agency shall prepare a subsequent EIR if required under subdivision (a). Otherwise the lead agency shall determine whether to prepare a subsequent negative declaration, an addendum, or no further documentation.

(c) Once a project has been approved, the lead agency‘s role in project approval is completed, unless further discretionary approval on that project is required. Information appearing after an approval does not require reopening of that approval. If after the project is approved, any of the conditions described in subdivision (a) occurs, a subsequent EIR or negative declaration shall only be prepared by the public agency which grants the next discretionary approval for the project, if any. In this situation no other responsible agency shall grant an approval for the project until the subsequent EIR has been certified or subsequent negative declaration adopted.

(d) A subsequent EIR or subsequent negative declaration shall be given the same notice and public review as required under Section 15087 or Section 15072. A subsequent EIR or negative declaration shall state where the previous document is available and can be reviewed.

15164. Addendum to an EIR or Negative Declaration

(a) The lead agency or responsible agency shall prepare an addendum to a previously certified EIR if some changes or additions are necessary but none of the conditions described in Section 15162 calling for preparation of a subsequent EIR have occurred.

(b) An addendum to an adopted negative declaration may be prepared if only minor technical changes or additions are necessary or none of the conditions described in Section 15162 calling for the preparation of a subsequent EIR or negative declaration have occurred.

(c) An addendum need not be circulated for public review but can be included in or attached to the final EIR or adopted negative declaration.

(d) The decision making body shall consider the addendum with the final EIR or adopted negative declaration prior to making a decision on the project.

(e) A brief explanation of the decision not to prepare a subsequent EIR pursuant to Section 15162 should be included in an addendum to an EIR, the lead agency's findings on the project, or elsewhere in the record. The explanation must be supported by substantial evidence.

In addition to the above, the following guidance is relevant to the proposed analysis:

- If new measures will be adopted to mitigate new potentially significant impacts to a less-than-significant level, the agency may adopt a subsequent negative declaration addressing those impacts.
- If the agency makes minor technical changes or additions to the prior negative declaration, it may prepare an addendum to the negative declaration.
- If the agency concludes that none of the conditions requiring a subsequent EIR or negative declaration have occurred, and if there is no need to make changes or additions to the prior negative declaration, the agency need not prepare any further environmental documentation but may make a record of its determination.

The applicability of the criteria to the proposed project is described in the following sections.

Criterion 15162(a)(1)

As described above, whereas the 2004 IS/MND anticipated the development of the project site with two restaurant buildings, the currently proposed project would include the construction of a car wash facility, a quick-service restaurant, and a quick-service restaurant/retail building. Although altered from what was originally anticipated, the proposed commercial uses would be consistent with the commercial nature of the anticipated uses, and would be consistent with what is permitted in the Neighborhood Community Commercial land use and P-D zoning designations. In addition, as discussed in additional detail below, the proposed project would not result in any new significant environmental impacts or a substantial increase in the severity of any previously identified significant impacts.

Based on the above, substantial changes to the project which would require major revisions of the previous IS/MND due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects would not occur as a result of the proposed project. Therefore, the proposed project would not meet the criteria set forth in CEQA Guidelines Section 15162(a)(1), and preparation of an addendum would provide the appropriate level of environmental review.

Criterion 15162(a)(2)

As discussed above, the 2004 IS/MND that assessed the impacts of commercial development of the project site has been adopted by the City. Significant updates to local, State, and federal regulations have not been adopted since the certification of the previous IS/MND that would require major revisions to the previous analysis due to a resultant new significant environmental effect or substantial increase in the severity of a previously identified significant effect. Similarly, other substantial changes have not occurred with respect to the circumstances under which the proposed project will be undertaken requiring major revisions of the 2004 IS/MND due to new or substantially more severe effects. Therefore, the proposed project would not meet the criteria set forth in CEQA Guidelines Section 15162(a)(2), and preparation of an addendum would provide the appropriate level of environmental review.

Criterion 15162(a)(3)

As discussed above, an IS/MND that assessed the impacts of commercial development of the project site has been adopted by the City. The proposed project would involve commercial development similar to what was anticipated for the site in the 2004 IS/MND, and would not modify the land use designation of the site. There is no new information of substantial importance, which was not known and could not have been known with the exercise of reasonable diligence at the time the previous IS/MND was adopted, indicating that the proposed project would result in a new or more severe significant impact from what was identified in the 2004 IS/MND, as discussed in further detail below. Therefore, the proposed project would not meet the criteria set forth in in CEQA Guidelines Section 15162(a)(3), and preparation of an addendum would provide the appropriate level of environmental review.

E. ENVIRONMENTAL IMPACT ANALYSIS

The following sections provide discussions of potential impacts associated with the proposed project in comparison to those previously identified in the 2004 IS/MND. According to CEQA Guidelines Section 15164(b), an addendum may be prepared if only minor technical changes or additions to the previous mitigated declaration are necessary or if none of the conditions described in Section 15162 calling for the preparation of a subsequent mitigated declaration have occurred. Given the limited scope of changes to the project, this Addendum provides a detailed evaluation of those select CEQA topics most affected by the changes, whereas the remaining CEQA topics are appropriately discussed at a lesser level of detail.

Air Quality

The 2004 IS/MND determined that the In-Shape Health Club and Shopping Center Project would not result in any significant impacts related to air quality. The currently proposed project would result in a similar amount of ground disturbance as what was anticipated in the 2004 IS/MND for the project site. In addition, whereas the 2004 IS/MND anticipated construction of approximately 24,000 sf of commercial uses within the project site, the proposed project would develop a total of approximately 11,018 sf of commercial uses, which is less than half of what was analyzed in the 2004 IS/MND. The proposed project would also be required to comply with the most current applicable laws and regulations related to reducing construction emissions, which are more strict

than those in effect when the 2004 IS/MND was adopted. Therefore, construction emissions associated with buildout of the project site would be less than what was anticipated and analyzed in the 2004 IS/MND.

Operational air quality impacts associated with the proposed project would also be reduced from what was anticipated for the project site in the 2004 IS/MND. According to the Local Transportation Analysis (LTA) prepared for the proposed project by Kimley-Horn (see Appendix A),[1] the proposed car wash facility, quick-service restaurant, and quick-service restaurant/retail building are anticipated to generate a total of 1,542 new daily trips. The 2004 IS/MND anticipated that the entire In-Shape Health Club and Shopping Center Project would generate 8,454 daily trips; without the trips generated by the existing In-Shape Family Fitness Center and the Shopping Center anticipated for development north of the current project site, the 2004 IS/MND anticipated that the on-site development would generate approximately 2,141 daily trips. As such, the currently proposed project would generate 599 fewer daily trips than was previously anticipated in the 2004 IS/MND. Due to the commercial nature of both the currently proposed project and the development previously anticipated for the project site in the 2004 IS/MND, other operational emissions generated by the proposed project would also be within the scope of what was previously anticipated in the 2004 IS/MND. While the proposed project would include drive-throughs, idling events associated with light-duty vehicles (i.e., passenger vehicles and light duty trucks) represent a relatively minor percentage of total vehicle operations, and, as a result, the California Air Resources Board (CARB) has indicated that idling emissions are accounted for within typical mobile emissions associated with light-duty vehicles. As such, idling emissions associated with the proposed drive-throughs are not assumed to substantially generate pollutant emissions beyond presumed mobile emissions accounted for within the prior analysis. Therefore, operational air quality impacts associated with the proposed project would be within the scope of the prior analysis.

Overall, based on the above, the proposed project would not result in any new significant impacts or a substantial increase in the severity of a previously identified significant impact related to air quality.

Greenhouse Gas Emissions

Since the 2004 IS/MND was adopted, a number of regulations have been enacted for the purpose of, or with an underlying goal for, reducing greenhouse gas (GHG) emissions, such as the California Green Building Standards Code (CALGreen Code) and the California Building Energy Efficiency Standards Code. Such regulations have become increasingly stringent since the 2004 IS/MND was adopted. The proposed project would be required to comply with all current applicable regulations associated with GHG emissions, including the CALGreen Code and California Building Energy Efficiency Standards Code. Requirements of the CALGreen Code include, but are not limited to, the following measures:

- Compliance with relevant regulations related to future installation of electric vehicle (EV) charging infrastructure in residential and non-residential structures;
- Indoor water use consumption is reduced through the establishment of maximum fixture water use rates;
- Outdoor landscaping must comply with the California Department of Water Resources' Model Water Efficient Landscape Ordinance (MWELO), or a local ordinance, whichever is more stringent, to reduce outdoor water use;

[1] Kimley-Horn. *Antioch Lone Tree Shopping Center Local Transportation Analysis (LTA)*. May 2, 2024.

- Diversion of 65 percent of construction and demolition waste from landfills;
- Required solar photovoltaic system and battery storage standards for certain buildings; and
- Mandatory use of low-pollutant emitting interior finish materials such as paints, carpet, vinyl flooring, and particle board.

In addition, technological advancements for the reduction of GHG emissions are ever-evolving. As such, the currently available technologies and regulations would inherently cause the proposed project to result in substantially fewer GHG emissions than what would have been predicted for the site had such analysis been undertaken during the preparation of the 2004 IS/MND.

The primary GHG emitted by human activities is carbon dioxide (CO_2); one of the largest sources of CO_2 includes the burning of fossil fuels for transportation and electricity. Although the proposed commercial uses are similar to what was anticipated for the site in the 2004 IS/MND, unlike the previously approved In-Shape Health Club and Shopping Center Project, the proposed project would include two quick-service restaurants with drive-throughs and a car wash, which would result in idling vehicles on-site. However, as discussed above, according to the LTA, the proposed project would generate 599 fewer daily vehicle trips than what was anticipated for the site in the 2004 IS/MND. Because vehicle trips would decrease under the proposed project as compared to what was anticipated in the 2004 IS/MND, the associated GHG emissions would also decrease. Furthermore, the proposed project would result in the reduction of 12,982 sf of commercial use as compared to what was anticipated in the 2004 IS/MND, and would be required to comply with the most current and more stringent regulations. Therefore, GHG emissions associated with the proposed project would not result in a new or significant impact beyond what was anticipated in the 2004 IS/MND.

Noise

The 2004 IS/MND determined that given compliance with applicable City noise ordinances, the In-Shape Health Club and Shopping Center Project would not result in any significant impacts related to noise.

According to the 2015 Supreme Court Case, *California Building Industry Association v. Bay Area Air Quality Management District (Case No. S213478),* "agencies subject to CEQA generally are not required to analyze the impact of existing environmental conditions on a project's future users or residents." As such, because the CEQA Guidelines do not require analysis of effects of the environment on the project, including impacts of noise on future residents, or in the case of the proposed project, customers of the proposed commercial uses, the potential effects related to noise exposure at the proposed project are not considered a CEQA impact. Any subsequent analysis of noise impacts associated with the proposed project on future residents of the adjacent planned residential development is presented for informational purposes only, and does not affect the CEQA analysis.

The following analysis includes a discussion of noise standards and criteria applicable to various land uses, as well as potential traffic noise and non-transportation noise sources associated with the proposed project. The analysis below is based on the Environmental Noise and Vibration

Assessment (ENVA) prepared for the proposed project by Bollard Acoustical Consultants, Inc. (BAC) (see Appendix B).[2] The following terms are referenced in this discussion:

- Decibel (dB): A unit of sound energy intensity. An A-weighted decibel (dBA) is a decibel corrected for the variation in frequency response to the typical human ear at commonly encountered noise levels. All references to dB in this discussion will be A-weighted unless noted otherwise.
- Day-Night Average Level (DNL): The average sound level over a 24-hour period, with a penalty of 10 dB applied to noise occurring during nighttime hours (10:00 PM to 7:00 AM).
- Community Noise Equivalent Level (CNEL): The average sound level over a 24-hour period, with a penalty of 5 dB applied to noise occurring during daytime hours (7:00 AM to 10:00 PM) and a penalty of 10 dB applied to noise occurring during nighttime hours (10:00 PM to 7:00 AM).
- Equivalent Sound Level (L_{eq}): The average sound level over a given time-period.
- Maximum Sound Level (L_{max}): The maximum sound level over a given time-period.
- Sound Exposure Level (SEL): A rating (dB) of a discrete event that compresses the total sound energy of the event into a one-second time period.

Sensitive Receptors

Noise-sensitive land uses are generally defined as locations where people reside or where the presence of unwanted sound could adversely affect the primary intended use of the land. Places where people live, sleep, recreate, worship, and study are considered to be sensitive to noise because intrusive noise can be disruptive to such activities. Within the project vicinity, and for the purposes of a CEQA evaluation, the nearest sensitive receptors are the single-family residences to the north, east, west, and south of the project site.

Existing Noise and Vibration Environment

The ambient noise environment in the immediate project vicinity is defined by noise from traffic on Lone Tree Way, as well as activities at nearby commercial uses. In order to quantify the existing ambient noise environment within the project vicinity, BAC conducted long-term ambient noise level measurements at three locations on June 19 and 20, 2023. The noise survey locations are shown in Figure 4, and are identified as Sites 1, 2, and 3. The ambient noise level survey results are summarized below in Table 2.

The ambient noise measurements obtained at Sites 1, 2, and 3 are believed to be representative of the existing ambient noise environments at the existing single-family residential uses to the north, east, and west of the project site, respectively.

During BAC site visits on June 18 and 21, 2024, vibration levels at the project site were below the threshold of human perception.

[2] Bollard Acoustical Consultants, Inc. *Environmental Noise and Vibration Assessment: Lone Tree Retail Project*. December 12, 2024.

Figure 4
Noise Survey Locations

Source: Bollard Acoustical Consultants, Inc. 2024.

Table 2
Ambient Noise Survey Results

Survey Location[1]	Date	Time Period[2]	Average Measured Noise Levels (dB)		CNEL (dB)
			L_{eq}	L_{max}	
Site 1	6/19/24	Daytime	47	64	51
		Evening	47	68	
		Nighttime	43	57	
	6/20/24	Daytime	46	63	51
		Evening	47	64	
		Nighttime	43	59	
Site 2	6/19/24	Daytime	52	68	56
		Evening	54	74	
		Nighttime	48	62	
	6/20/24	Daytime	52	68	55
		Evening	52	74	
		Nighttime	47	64	
Site 3	6/19/24	Daytime	58	78	62
		Evening	61	87	
		Nighttime	53	69	
	6/20/24	Daytime	59	77	62
		Evening	58	80	
		Nighttime	54	72	

Notes:
[1] Noise survey site locations are shown in Figure 4.
[2] Daytime: 7:00 AM to 7:00 PM; Evening: 7:00 PM to 10:00 PM; Nighttime: 10:00 PM to 7:00 AM.

Source: Bollard Acoustical Consultants, Inc. 2024.

City Noise Standards and Criteria

The Environmental Hazards Element of the City of Antioch General Plan contains objectives and policies to ensure that City residents are not subjected to noise beyond acceptable levels. Pursuant to Objective 11.8.1, Noise Objective, of the General Plan, the allowable exterior noise level for single-family residential uses is defined as 60 dB CNEL within rear yards, and the allowable exterior noise level for multi-family residential uses is 60 dB CNEL within interior open spaces. In addition, pursuant to General Plan Policy 11.8.2(g), appropriate noise mitigation is required when a new development would cause noise in excess of the General Plan noise objectives or an audible (3 to 5 dBA) increase in noise in areas where General Plan noise objectives are already exceeded due to existing development.

Pursuant to Sections 5-17.04 and 5-17.05 of the City of Antioch Code of Ordinances, the operation of heavy construction equipment and construction activities are prohibited on weekdays prior to 7:00 AM and after 6:00 PM; on weekdays within 300 feet of occupied dwelling space prior to 8:00 AM and after 5:00 PM; and on weekends and holidays prior to 9:00 AM and after 5:00 PM, irrespective of the distance from an occupied dwelling.

Project Construction Noise

During project construction activities, heavy equipment would be used for grading excavation, paving, and building construction, which would increase ambient noise levels when in use. Noise levels would vary depending on the type of equipment used, how it is operated, and how well it is maintained. Noise exposure at any single point outside the project work area would also vary depending upon the proximity of equipment activities to that point.

Table 3 includes the range of maximum noise levels for equipment commonly used in general construction projects at full-power of operation at a distance of 50 feet. It should be noted that not all of the construction activities would be required of the proposed project. Table 3 data also include predicted maximum (L_{max}) equipment noise levels at the nearest existing and planned residential uses, which assume a standard spherical spreading loss of 6 dB per doubling of distance. As discussed above, the project construction noise levels at the adjacent future multi-family residential development are presented for informational purposes only, and do not affect the analysis.

Table 3
Reference and Projected Noise Levels for Construction Equipment

Type of Equipment	Reference Noise Level at 50 feet, L_{max} (dB)	Projected Noise Level, L_{max} (dB)			
		Site 1 (575 feet)	Site 2 (385 feet)[1]	Site 3 (300 feet)	Future Multi-Family Residential (220 feet)[2]
Air compressor	80	59	52	64	62
Backhoe	80	59	52	64	62
Ballast equalizer	82	61	54	66	64
Ballast tamper	83	62	55	67	65
Compactor	82	61	54	66	64
Concrete mixer	85	64	57	69	67
Concrete pump	82	61	54	66	64
Concrete vibrator	76	55	48	60	58
Crane, mobile	83	62	55	67	65
Dozer	85	64	57	69	67
Excavator	85	64	57	69	67
Generator	82	61	54	66	64
Grader	85	64	57	69	67
Impact wrench	85	64	57	69	67
Loader	80	59	52	64	62
Paver	85	64	57	69	67
Pneumatic tool	85	64	57	69	67
Pump	77	56	49	61	59
Saw	76	55	48	60	58
Scarifier	83	62	55	67	65
Scraper	85	64	57	69	67
Shovel	82	61	54	66	64
Spike driver	77	56	49	61	59
Tie cutter	84	63	56	68	66
Tie handler	80	59	52	64	62
Tie inserter	85	64	57	69	67
Truck	84	63	56	68	66
Low		**55**	**48**	**60**	**58**
High		**64**	**57**	**69**	**67**
Average		**61**	**54**	**67**	**64**

Notes:
[1] Predicted noise levels at Site 2 include a -10 dB offset to account for the existing 10-foot wall.
[2] Predicted noise levels at the future multi-family residential development include a -5 dB offset for screening of pool area by buildings.

Source: ***Federal Highway Administration, Roadway Construction Noise Model User's Guide, January 2006. Bollard Acoustical Consultants, Inc. 2024.***

Consistent with Section 5-17.05 of the City's Code of Ordinances, it is assumed that construction activities associated with the proposed project would not occur on weekdays prior to 7:00 AM and after 6:00 PM; on weekdays within 300 feet of occupied dwelling space prior to 8:00 AM and after 5:00 PM; and on weekends and holidays prior to 9:00 AM and after 5:00 PM. Based on the measured ambient maximum (L_{max}) daytime noise levels at Sites 1, 2, and 3, which encapsulates the City's allowable construction hours (7:00 AM to 6:00 PM), as presented in Table 2, the predicted construction activity noise levels presented in Table 3 are either below or within the range of the ambient measured maximum noise levels at the nearest residential uses.

However, noise from heavy equipment operations during on-site construction activities would add to the noise environment in the immediate project site vicinity. A potentially significant impact would occur if project-related construction activities were to noticeably increase ambient noise levels above background levels at the nearby noise-sensitive residential uses. As discussed above, the threshold of perception of the human ear is approximately 3 to 5 dB; a 5 dB change is considered to be clearly noticeable. Consistent with General Plan Policy 11.8.2(g), a noticeable increase in ambient noise levels is therefore assumed to occur where noise levels increase by 3 dB or more over existing ambient noise levels.

Using the calculated average measured maximum (L_{max}) noise levels at Sites 1, 2, and 3 during the allowable construction hours (7:00 AM to 6:00 PM), and the calculated averages of predicted construction equipment maximum noise levels shown in Table 3, BAC calculated the ambient plus project construction equipment noise level increases at the nearby existing residential uses. BAC concluded that project-generated increases in ambient maximum noise levels would range from 0.2 dB L_{max} to 2.1 dB L_{max} at the closest existing residential uses. The calculated increases in ambient maximum noise levels at the nearest sensitive receptors are below the applied increase significance criterion of 3 dB. Therefore, construction activities associated with the proposed project would not result in a temporary increase in ambient noise levels in excess of the standards established in the City's General Plan, and a less-than-significant impact would occur.

Project Operational Noise

The proposed project consists of a car wash facility in Parcel E, a quick service restaurant with a drive-through in Parcel F, and a quick service restaurant/retail building with a drive-through in Parcel G. According to the ENVA, the primary noise sources associated with project operations are drive-through operations (i.e., idling vehicles and amplified menu speak boards), delivery truck circulation, truck delivery activities, car wash tunnel operations, vehicle vacuum equipment, and building mechanical equipment (heating, ventilation, and air conditioning [HVAC]). As discussed above, the proposed car wash facility would operate from 7:00 AM to 7:00 PM during winter months, and from 7:00 AM to 8:00 PM during summer months. The quick service restaurant within Parcel F would operate from 10:00 AM to 11:00 PM, and the quick service restaurant/retail building within Parcel G would operate from 10:45 AM to 11:00 PM. As part of the proposed amendment to PD-04-05, the proposed project would be required to comply with the foregoing hours of operations as a Condition of Approval.

An analysis of each of the identified project operational noise sources at the nearby existing single-family residential uses (Sites 1, 2, and 3) and the future multi-family residential use is provided below.

Drive-Through Noise

As discussed above, the proposed project would include the development of Parcels F and G with two quick service restaurants with drive-throughs. The two drive-through lanes would have amplified menu speaker posts, the locations of which are shown in Figure 5.

Although the amplified speaker menu models have not yet been determined, in order to quantify the noise emissions of the proposed drive-through speaker usage, BAC utilized noise level measurements from the speaker manufacturer of a commonly installed model. BAC determined that the speaker posts have the ability to incorporate automatic volume control (AVC), which adjusts outbound volume based on the ambient noise level environment. For example, assuming an outdoor ambient noise level of 45 dB, the speaker would adjust the volume of the system to 45 dB for a resulting overall sound level of 48 dB at a distance of four feet. Without the AVC option, the speaker reference noise level would be 72 dB at four feet. Based on data collected for similar drive-through operations, the ENVA determined that drive-through vehicle passages, including vehicle idling, have median and maximum noise levels of 60 dB L_{eq} at a distance of five feet.

To calculate the project drive-through operations noise level exposure relative to the City's CNEL standard, the ENVA conservatively assumed that project drive-through menu speaker and vehicle noise from both quick service restaurants, combined, would occur during every hour of the proposed hours of operations, and that speaker posts would operate without the AVC option enabled (i.e., worst-case speaker post noise exposure).

Using the foregoing information, and assuming a standard spherical spreading loss of -6 dB per doubling of distance, data were projected from the proposed drive-through lanes and speaker posts to the nearest existing and planned noise-sensitive residential uses. The results of such projections are summarized in Table 4, below.

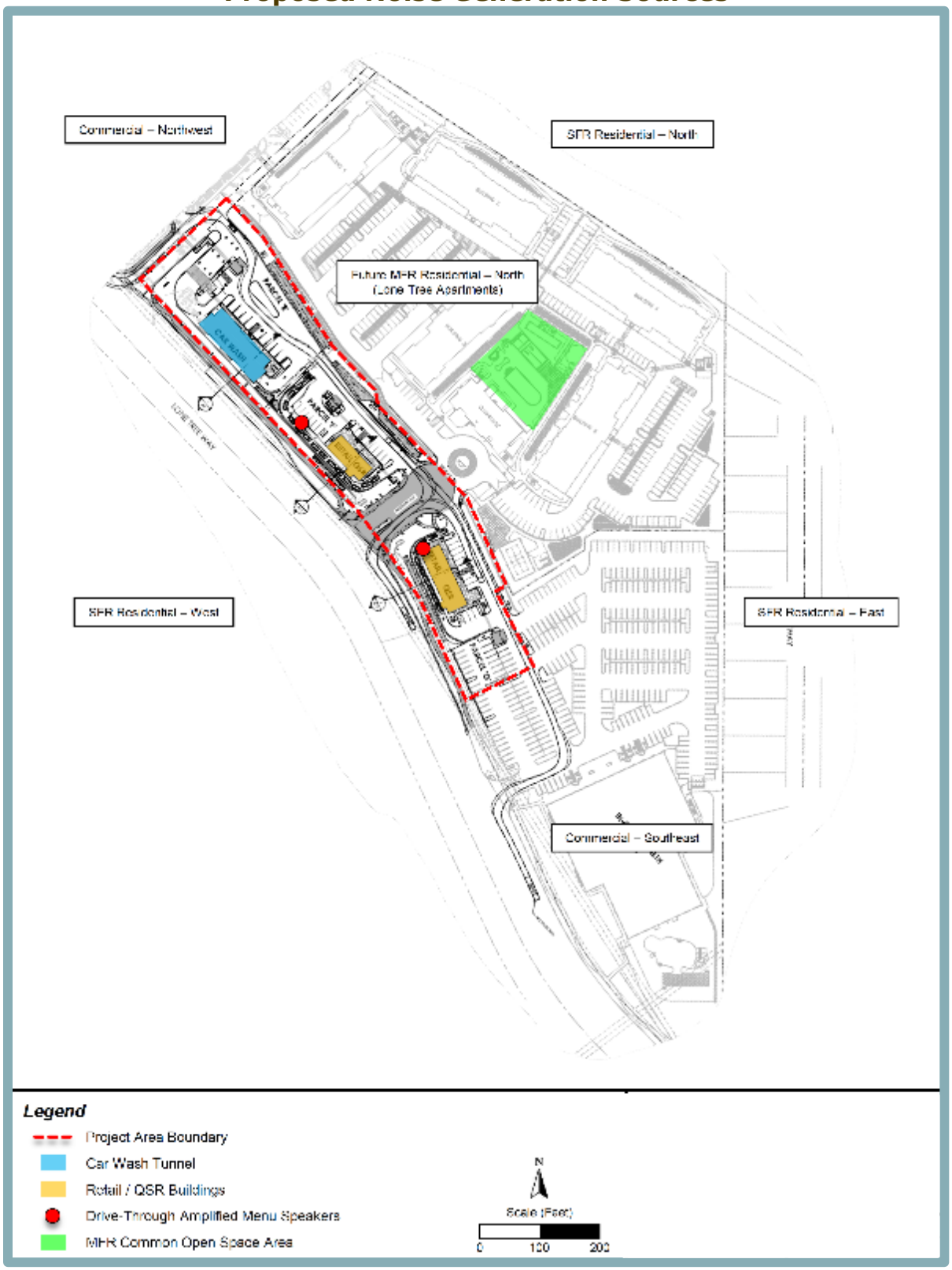
Table 4
Predicted Combined Drive-Through Noise Levels at Nearby Residential Uses

Receiver[1]	Predicted Combined Noise Level, CNEL (dB)[2,3,4]	City Noise Standard, CNEL (dB)
Site 1	32	**60**
Site 2	24	
Site 3	39	
Future Multi-Family Residential	34	

Notes:
1 Noise survey site locations are shown in Figure 4.
2 Predicted combined CNEL assumes continuous quick service restaurant/retail building operation during all proposed hours of operation.
3 Predicted noise levels at Site 2 include a -10 dB offset to account for the existing 10-foot wall.
4 Predicted noise levels at the future multi-family residential development include a -5 dB offset for screening of pool area by buildings.

Source: Bollard Acoustical Consultants, Inc. 2024.

Figure 5
Proposed Noise Generation Sources



Source: Bollard Acoustical Consultants, Inc. 2024.

As shown in Table 4, drive-through operational noise is predicted to be below the applicable City of Antioch 60 dB CNEL exterior noise level standard at the closest noise-sensitive receptors. It is noted that activation of the drive-through speaker model's AVC option would further reduce speaker noise level exposure. In addition, using the ambient noise measurements presented in Table 2, the ENVA determined that drive-through related increases in ambient noise levels would be less than 0.1 CNEL at the closest existing and planned noise-sensitive residential uses. The calculated increase in ambient noise levels indicated above is well below the General Plan ambient noise level increase significance criterion of 3 dB. Therefore, impacts related to noise generated by the proposed drive-through operations would be less than significant.

On-Site Truck Circulation Noise

BAC anticipates that deliveries of product to the proposed quick service restaurant and quick service restaurant/retail building would occur at the front of the buildings with medium-duty vendor trucks/vans. On-site truck passbys are expected to be relatively brief and would occur at low speeds. The ENVA determined that single-event medium truck passby noise levels are approximately 66 dB L_{max} and 76 dB SEL at a reference distance of 50 feet. In order to calculate hourly average noise level exposure from truck circulation, the ENVA assumes that the quick service restaurant and quick service restaurant/retail building could each receive two deliveries from a medium duty truck/van during a worst-case busy hour of deliveries, for a total of four project-generated truck deliveries during a given busy hour. Given an SEL of 76, and assuming four medium truck passbys during a given hour, BAC calculated the hourly average to be 46 dB L_{eq}. In order to calculate CNEL exposure, the ENVA conservatively assumed that the four truck deliveries could occur during nighttime hours, which would be the worst-case CNEL exposure. Based on the foregoing information, and assuming a standard spherical spreading loss of -6 dB per doubling of distance, project-generated on-site truck circulation noise exposure at the nearest existing and planned noise-sensitive residential uses was calculated. The results of such calculations are presented in Table 5, below.

Table 5
Predicted On-Site Truck Circulation Noise Levels at Nearby Residential Uses

Receiver[1]	Predicted Noise Level, CNEL (dB)[2,3,4]	City Noise Standard, CNEL (dB)
Site 1	<20	**60**
Site 2	<20	
Site 3	28	
Future Multi-Family Residential	25	

Notes:
1 Noise survey site locations are shown in Figure 4.
2 Predicted CNEL assumes a total of four truck deliveries all occurring during nighttime hours.
3 Predicted noise levels at Site 2 include a -10 dB offset to account for the existing 10-foot wall.
4 Predicted noise levels at the future multi-family residential development include a -5 dB offset for screening of pool area by buildings.

Source: Bollard Acoustical Consultants, Inc. 2024.

As shown in Table 5, on-site truck circulation noise is predicted to be below the applicable City of Antioch 60 dB CNEL exterior noise level standard at the closest noise-sensitive receptors. In addition, using the ambient noise measurements presented in Table 2, the ENVA determined that increases in ambient noise levels related to on-site truck circulation would be less than 0.1 CNEL at the closest existing and planned noise-sensitive residential uses. The calculated increase in

ambient noise levels indicated above is well below the General Plan ambient noise level increase significance criterion of 3 dB. Therefore, impacts related to noise generated by the on-site truck circulation associated with operation of the proposed project would be less than significant.

Truck Delivery Activity Noise

As discussed above, BAC anticipates that deliveries of product to the proposed quick service restaurant and quick service restaurant/retail building would occur at the front of the buildings with medium-duty vendor trucks/vans. The primary noise sources associated with delivery activities are trucks stopping (air brakes), trucks backing into position (back-up alarms), and trucks pulling away from the loading/unloading area (revving engines). The ENVA states that noise levels associated with truck deliveries are approximately 76 dB SEL at a distance of 100 feet. In order to conservatively estimate noise level exposure from truck delivery activity, the ENVA assumes that the quick service restaurant and the quick service restaurant/retail building could each receive two deliveries from a medium duty truck/van during a worst-case busy hour of deliveries, for a total of four project-generated truck deliveries during a given busy hour. In order to calculate CNEL exposure, the ENVA conservatively assumed that the four truck deliveries could occur during nighttime hours, which would be the worst-case CNEL exposure. Based on the foregoing information, and assuming a standard spherical spreading loss of -6 dB per doubling of distance, project-generated truck activity noise level exposure at the nearest existing and planned noise-sensitive residential uses was calculated. The results of such calculations are presented in Table 6, below.

Table 6
Predicted Truck Delivery Activity Noise Levels at Nearby Residential Uses

Receiver[1]	Predicted Noise Level, CNEL (dB)[2,3,4]	City Noise Standard, CNEL (dB)
Site 1	26	60
Site 2	20	
Site 3	30	
Future Multi-Family Residential	30	

Notes:
1 Noise survey site locations are shown in Figure 4.
2 Predicted CNEL assumes a total of four truck deliveries all occurring during nighttime hours.
3 Predicted noise levels at Site 2 include a -10 dB offset to account for the existing 10-foot wall.
4 Predicted noise levels at the future multi-family residential development include a -5 dB offset for screening of pool area by buildings.

Source: Bollard Acoustical Consultants, Inc. 2024.

As shown in Table 6, truck delivery activity noise is predicted to be below the applicable City of Antioch 60 dB CNEL exterior noise level standard at the closest noise-sensitive receptors. In addition, using the ambient noise measurements presented in Table 2, the ENVA determined that increases in ambient noise levels related to truck delivery activity would be less than 0.1 CNEL at the closest existing and planned noise-sensitive residential uses. The calculated increase in ambient noise levels indicated above is well below the General Plan ambient noise level increase significance criterion of 3 dB. Therefore, impacts related to noise generated by the truck delivery activity associated with operation of the proposed project would be less than significant.

Car Wash Drying Assembly Noise

According to BAC, noise levels generated by car washes are primarily due to the drying portion of the operation. Based on information obtained from the project applicant about the models proposed to be used in the drying portion of the proposed car wash, the blower assembly generates a maximum noise level of 75 dB L_{max} at a distance of 100 feet. The car wash cycle lasts approximately 1.5 minutes, with the drying assembly in operation during the last 0.5 minutes of the cycle. Based on the forgoing information, the ENVA calculated that the car wash would go through 40 full cycles and the drying would operate for approximately 20 minutes during a busy hour of operations. Based on 20 minutes of dryer operations per hour, the resulting hourly average (L_{eq}) drying assembly noise level was calculated to be approximately 5 dB lower than the equipment's 75 dB L_{max} referenced above. In order to calculate project-generated car wash drying assembly noise levels relative to the General Plan's CNEL descriptor, a 24-hour average standard, BAC conservatively assumed that the hourly average car wash drying operations noise identified above could occur during every hour of proposed car wash operations during the summer hours (7:00 AM to 8:00 PM). Furthermore, BAC determined that the noise level generation of car wash drying assemblies vary depending on the orientation of the measurement position relative to the tunnel opening. Worst-case drying assembly noise levels occur at a position directly facing the car wash exit, considered to be 0 degrees off-axis. At off-axis positions, the tunnel building facade provides varying degrees of noise level reduction. At positions 45 degrees off-axis relative to the facade of the car wash exit and entrance, drying assembly noise levels are approximately 5 dB lower. At 90 degrees off-axis, drying assembly noise levels are approximately 10 dB lower.

Based on the foregoing information, and assuming a standard spherical spreading loss of -6 dB per doubling of distance, worst-case project-generated car wash drying assembly noise exposure at the nearest existing and planned noise-sensitive residential uses was calculated. The results of such calculations are presented in Table 7, below.

Table 7
Predicted Car Wash Drying Assembly Noise Levels at Nearby Residential Uses

Receiver[1]	Predicted Noise Level, CNEL (dB)[2,3,4]	City Noise Standard, CNEL (dB)
Site 1	39	60
Site 2	38	
Site 3	48	
Future Multi-Family Residential	43	

Notes:
1 Noise survey site locations are shown in Figure 4.
2 Predicted CNEL based on drying assembly in operation during every hour from 7:00 AM to 8:00 PM.
3 Predicted noise levels at Site 2 include a -10 dB offset to account for the existing 10-foot wall.
4 Predicted noise levels at the future multi-family residential development include a -5 dB offset for screening of pool area by buildings.

Source: Bollard Acoustical Consultants, Inc. 2024.

As shown in Table 7, project-generated car wash drying assembly noise exposure is predicted to be below the applicable City of Antioch 60 dB CNEL exterior noise level standard at the closest noise-sensitive receptors. In addition, using the ambient noise measurements presented in Table 2, the ENVA determined that increases in ambient noise levels related to project-generated car

wash drying assembly noise would range from 0.1 CNEL to 0.3 CNEL at the closest existing and planned noise-sensitive residential uses.

The calculated increase in ambient noise levels indicated above is well below the General Plan ambient noise level increase significance criterion of 3 dB. Therefore, impacts related to project-generated car wash drying assembly noise would be less than significant.

Vacuum System Noise

As part of the proposed car wash facility, the proposed project would include the installation of a central vacuum piping system consisting of a vacuum area containing a total of nine vacuum stalls with 10 vacuum suction nozzles. The vacuum piping system's noise-generating vacuum turbine producer is proposed to be contained within an eight-foot solid masonry enclosure located adjacent to the vacuum area. Measured and projected noise levels from the proposed vacuum turbine producer, as well as the vacuum suction nozzles when hanging off of the nozzle hangers, are provided in Appendices H and G, respectively, of the ENVA. In order to calculate project-related vacuum equipment noise levels relative to the General Plan's CNEL descriptor, BAC conservatively assumed that all of the proposed vacuum suction nozzles and system turbine producer would be in concurrent operation during every hour of proposed car wash operations during the summer hours (7:00 AM to 8:00 PM). Based on the foregoing information, and assuming a standard spherical spreading loss of -6dB per doubling of distance, worst-case project-generated vacuum equipment noise exposure at the nearest existing and planned noise-sensitive residential uses was calculated. The results of such calculations are presented in Table 8, below.

Table 8
Predicted Vacuum System Noise Levels at Nearby Residential Uses

Receiver[1]	Predicted Noise Level, CNEL (dB)[2,3,4]	City Noise Standard, CNEL (dB)
Site 1	33	60
Site 2	22	
Site 3	36	
Future Multi-Family Residential	32	

Notes:
1 Noise survey site locations are shown in Figure 4.
2 Predicted CNEL based on vacuum equipment in concurrent operation during every hour from 7:00 AM to 8:00 PM.
3 Predicted noise levels at Site 2 include a -10 dB offset to account for the existing 10-foot wall.
4 Predicted noise levels at the future multi-family residential development include a -5 dB offset for screening of pool area by buildings.

Source: Bollard Acoustical Consultants, Inc. 2024.

As shown in Table 8, project-generated vacuum equipment noise exposure is predicted to be below the applicable City of Antioch 60 dB CNEL exterior noise level standard at the closest noise-sensitive receptors. In addition, using the ambient noise measurements presented in Table 2, the ENVA determined that increases in ambient noise levels related to project-generated car wash drying assembly noise would be less than 0.1 CNEL at the closest existing and planned noise-sensitive residential uses.

The calculated increase in ambient noise levels indicated above is well below the General Plan ambient noise level increase significance criterion of 3 dB. Therefore, impacts related to project-generated vacuum equipment noise would be less than significant.

Mechanical Equipment Noise

In preparing the ENVA, BAC determined that HVAC requirements for the proposed quick service restaurant and quick service restaurant/retail building would most likely be met using packaged roof-mounted systems. BAC reference file data for HVAC systems indicate that a 12.5-ton packaged unit would be expected to generate an A-weighted sound power level of 85 dB. In order to calculate project-generated HVAC equipment noise levels relative to the General Plan's CNEL descriptor, BAC conservatively assumed that the HVAC equipment would be in continuous operation during a 24-hour period. Based on the foregoing information, and assuming a standard spherical spreading loss of -6 dB per doubling of distance, project HVAC equipment noise exposure at the nearest existing and planned noise-sensitive residential uses was calculated. The results of such calculations are presented in Table 9, below.

As shown in Table 9, project-generated HVAC equipment noise exposure is predicted to be below the applicable City of Antioch 60 dB CNEL exterior noise level standard at the closest noise-sensitive receptors. In addition, using the ambient noise measurements presented in Table 2, the ENVA determined that increases in ambient noise levels related to project-generated HVAC equipment noise would range from 0.1 CNEL to 0.2 CNEL at the closest existing and planned noise-sensitive residential uses.

Table 9
Predicted HVAC Equipment Noise Levels at Nearby Residential Uses

Receiver[1]	Predicted Noise Level, CNEL (dB)[2,3,4]	City Noise Standard, CNEL (dB)
Site 1	38	**60**
Site 2	31	
Site 3	45	
Future Multi-Family Residential	40	

Notes:
1 Noise survey site locations are shown in Figure 4.
2 Predicted CNEL based on continuous HVAC equipment usage from both quick service restaurant/retail buildings for a 24-hour period.
3 Predicted noise levels at Site 2 include a -10 dB offset to account for the existing 10-foot wall.
4 Predicted noise levels at the future multi-family residential development include a -5 dB offset for screening of pool area by buildings.

Source: Bollard Acoustical Consultants, Inc. 2024.

The calculated increase in ambient noise levels indicated above is well below the General Plan ambient noise level increase significance criterion of 3 dB. Therefore, impacts related to project-generated HVAC equipment noise would be less than significant.

Combined On-Site Operational Noise

The calculated combined noise levels from all foregoing analyzed on-site operations at the closest existing and planned noise-sensitive residential uses are presented in Table 10, below.

Table 10
Combined On-Site Noise Levels at Nearby Residential Uses

Receiver[1]	Predicted Noise Levels, CNEL (dB)						Cumulative CNEL (dB)[3]	City Noise Standard, CNEL (dB)
	Drive-Through[2]	On-Site Truck Circulation	Truck Deliveries	Car Wash Dryers	Vacuum System	HVAC		
Site 1	32	19	26	39	33	38	43	**60**
Site 2	24	13	20	38	22	31	39	
Site 3	39	28	30	48	36	45	50	
Future Multi-Family Residential	34	25	30	43	32	40	46	

Notes:
1 Noise survey site locations are shown in Figure 4.
2 Combined noise levels from drive-through operations sources (i.e., menu speakers and vehicles).
3 Calculated combined noise levels are based on the predicted noise levels presented in the analysis above.

Source: Bollard Acoustical Consultants, Inc. 2024.

As indicated in Table 10, calculated combined noise level exposure from project operations would be below the applicable City of Antioch 60 dB CNEL exterior noise level standard at the closest noise-sensitive receptors. Furthermore, the ENVA determined that combined project-related increases in ambient noise levels would range from 0.1 CNEL to 0.6 CNEL at the closest existing and planned noise-sensitive residential uses. The calculated increase in ambient noise levels indicated above is well below the General Plan ambient noise level increase significance criterion of 3 dB. Therefore, impacts related to combined noise level exposure from project operations would be less than significant.

Based on the above, implementation of the proposed project would not result in the generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project site in excess of standards established in the City's General Plan. Therefore, impacts related to noise associated with the proposed project would be within the scope of what was anticipated for the project site in the 2004 IS/MND, and the proposed project would not result in a new or more severe significant impact related to noise than what was anticipated in the 2004 IS/MND.

Vibration

Similar to noise, vibration involves a source, a transmission path, and a receiver. However, noise is generally considered to be pressure waves transmitted through air, whereas vibration usually consists of the excitation of a structure or surface. As with noise, vibration consists of an amplitude and frequency.

A person's perception to the vibration depends on their individual sensitivity to vibration, as well as the amplitude and frequency of the source and the response of the system which is vibrating. Vibration is measured in terms of acceleration, velocity, or displacement. A common practice is to monitor vibration in terms of the velocity in decibels in root-mean-square (VdB, RMS).

During project construction, heavy equipment would be used for grading, excavation, paving, and building construction, which would generate localized vibration in the immediate vicinity of construction activities. According to the ENVA, the nearest existing residential structure to the project site has been identified as the single-family residence located west of the project site. The nearest existing commercial structure has been identified as the commercial building located northwest of the project site. Because the foregoing structures have been engineered relatively recently and were constructed in compliance with the current building code, neither are highly susceptible to damage by vibration.

Table 11 shows the typical vibration levels produced by construction equipment at 25 feet, as well as projected equipment vibration levels at the nearest existing residential and commercial structures identified above. The ENVA notes that construction of the proposed project is not anticipated to require pile driving activities, or any other construction activities that would create substantial vibration.

Based on the data presented in Table 11, vibration levels generated from on-site construction activities are predicted to be below the applicable threshold for damage to engineered structures (98 VdB). In addition, construction-related vibration levels at the nearest existing residential and commercial buildings are predicted to be below or barely approach the 65 VdB threshold of human perception. Therefore, on-site construction is not anticipated to result in excessive groundbourne vibration levels at nearby existing residential or commercial structures. With respect to groundbourne vibrations generated by project operations, due to the commercial nature of the proposed project, such operations are not anticipated to generate significant vibration.

Table 11
Reference and Project Vibration Levels for Construction Equipment

Type of Equipment	Reference Maximum Vibration at 25 feet, VdB (rms)	Projected Maximum Vibration Level VdB (RMS)	
		Single-Family Residence (340 feet west)	Commercial Building (80 feet northwest)
Hoe Ram	87	57	66
Large bulldozer	87	57	66
Caisson drilling	57	57	66
Loaded trucks	86	56	65
Jackhammer	79	<55	60
Small bulldozer	58	<55	<55

Source: 2018 Federal Transit Administration Transit Noise and Vibration Impact Assessment Manual and BAC calculations.

Based on the above, impacts related to vibration associated with the proposed project would be within the scope of what was anticipated for the project site in the 2004 IS/MND, and the proposed project would not result in any additional significant impacts or more severe significant impacts related to vibration as compared to the 2004 IS/MND.

Transportation

Since the release of the 2004 IS/MND, the law has changed with respect to how transportation-related impacts may be addressed under CEQA. At the beginning of 2019, updated CEQA Guidelines went into effect. The updated CEQA Guidelines require lead agencies such as the City of Antioch to transition from using "level of service" (LOS) to vehicle miles travelled (VMT) as the metric for assessing transportation impacts under CEQA (see Section 15064.3). The State's requirement to transition from LOS to VMT is aimed at promoting infill development, public health through active transportation, and a reduction in GHG emissions. Pursuant to CEQA Guidelines, any project that did not initiate CEQA public review prior to July 1, 2020 must use VMT rather than LOS as the metric to analyze transportation impacts. However, LOS remains an important metric used by the City for the purpose of determining consistency with General Plan goals and policies including, but not limited to, General Plan Policies 3.4.4(d), 3.4.4(e), 7.3.2(a), and 7.3.2(d). Although no longer used for determining significant impacts under CEQA, the LTA prepared for the proposed project includes both a LOS and VMT analysis.

Section 15064.3 of the CEQA Guidelines provides specific considerations for evaluating a project's transportation impacts. Pursuant to Section 15064.3, analysis of VMT attributable to a project is the most appropriate measure of transportation impacts, with other relevant considerations consisting of the effects of the project on transit and non-motorized travel. VMT is the total miles of travel by personal motorized vehicles a project is expected to generate in a day. VMT measures the full distance of personal motorized vehicle-trips, with one end within the project site. Typically, development projects that are farther from other, complementary land uses (such as a business park far from housing) and in areas without transit or active transportation infrastructure (bike lanes, sidewalks, etc.) generate more driving than development near complementary land uses with more robust transportation options. Therefore, development projects located in a central business district with high density and diversity of complementary land uses and frequent transit services are expected to internalize trips and generate shorter and fewer vehicle trips than developments located in a suburban area with low density of residential developments and no transit service in the project vicinity.

Consistent with the State's legislation, the City of Antioch adopted the Transportation and VMT Impact Analysis Guidelines (VMT Guidelines) in June 2023.[3] The VMT Guidelines provide screening threshold recommendations that are intended to identify when a project can be determined to cause a less-than-significant impact without conducting a detailed VMT evaluation. The screening threshold recommendations are based on project type and size, location in low VMT areas, and proximity to transit. One such recommendation is that local-serving retail developments (considered to be less than 50,000 sf in size) may be assumed to cause a less-than-significant impact on VMT. Because the buildings proposed for construction as part of the proposed project would not exceed 50,000 sf, both individually and combined, the proposed project qualifies for screening pursuant to the City's VMT Guidelines, and a significant VMT impact would not occur.

Furthermore, according to the LTA, it is reasonable to assume that the location of the proposed project along Lone Tree Way would offer services for the traveling public that are already on the roadway system and need to stop for services. As such, it is reasonable to assume that the proposed project would not generate new demand, but would satisfy existing demand in the region, and would therefore shorten the distance that customers would otherwise travel.

With respect to site access and circulation, site access would be provided from three existing intersections: the signalized Lone Tree Way/Antioch Town Center intersection, and the right in/right out Lone Tree Way/In-Shape Health Club Driveway and Lone Tree Way/Commercial Driveway North intersections. According to the LTA, sufficient storage will be provided within the existing turn pockets to contain anticipated queues following project buildout. In addition, the LTA determined that the proposed project includes adequate access to buildings to accommodate emergency vehicles and refuse services. Furthermore, the LTA determined that the drive-through within Parcel G would have a seven-vehicle queueing capacity; based on the site design, Kimley-Horn concluded that the probability of exceeding the queuing capacity is between one and five percent, and the average queue length would range from 1.1 to 2.2 vehicles, which can be accommodated within the available storage. Similarly, the probability that the queue within the drive-through in Parcel F would exceed the nine-vehicle queuing capacity would range from four to 26 percent, with average queue length ranging from 2.7 to seven vehicles, which can be accommodated by the available storage. Finally, the probability that the queue for the automated car wash within Parcel E would exceed the nine-vehicle capacity would range from two to seven percent, with average queue lengths ranging from two to 3.3 vehicles, which can be accommodated within the available storage. As such, the LTA concluded that the configurations of the proposed drive-throughs and car wash are unlikely to result in on-site queuing issues. Therefore, although the proposed car wash, quick service restaurant, and quick service restaurant/retail building were not anticipated in the 2004 IS/MND, the LTA concluded that impacts related to site circulation and site access would be less than significant.

It is noted that all mitigation measures included in the 2004 IS/MND related to transportation have already been implemented, and, therefore, do not apply to the proposed project. For example, the longer southbound left turn lane from Lone Tree Way into the project entrance required by Mitigation Measure 14a.1 was constructed at the same time as the In-Shape Family Fitness Center. Similarly, the right turn deceleration lane in to the site's signalized entrance on Lone Tree Way, as required by Mitigation Measure 14a.3, has already been constructed.

Based on the above, impacts related to transportation associated with the proposed project would be within the scope of what was anticipated for the project site in the 2004 IS/MND, and the

[3] City of Antioch. *Transportation and VMT Impact Analysis Guidelines*. June 2023.

proposed project would not result in any additional significant impacts or more severe significant impacts related to transportation as compared to the 2004 IS/MND.

Remaining Impact Areas

In addition to the CEQA topics discussed in the previous sections of this Consistency Memorandum, the 2004 IS/MND included analysis of the following issue areas:

- Aesthetics;
- Agriculture and Forestry Resources;
- Biological Resources;
- Cultural Resources;
- Energy;
- Geology and Soils;
- Hazards and Hazardous Materials;
- Hydrology and Water Quality;
- Land Use and Planning;
- Mineral Resources;
- Population and Housing;
- Public Services;
- Recreation;
- Tribal Cultural Resources;
- Utilities and Service Systems; and
- Wildfire.

As discussed previously, construction and operation activities associated with the proposed project would occur within a site previously analyzed as part of the 2004 IS/MND and would not result in any increase to the area of disturbance previously anticipated by the 2004 IS/MND. For these reasons, and given that site conditions, as well as conditions in the project vicinity, have remained the same since adoption of the 2004 IS/MND, or, in the case of Parcel G, have been partially developed consistent with what was anticipated in the 2004 IS/MND, the proposed project would not result in new significant impacts or substantially more significant impacts related to the following environmental issue areas: aesthetics, agriculture and forestry resources, cultural resources, geology and soils, hazards and hazardous materials, hydrology and water quality, mineral resources, public services, recreation, tribal cultural resources, and wildfire. For example, new scenic vistas have not appeared within the project vicinity subsequent to the adoption of the 2004 IS/MND, and project design would be required to comply with applicable General Plan policies and City of Antioch regulations related to building height, setback, and lighting. Similarly, the project site has not undergone changes related to farmland, subsurface conditions, or hydrology since adoption of the 2004 IS/MND. The existing uses within the project vicinity are the same or similar to those that existed during preparation of the 2004 IS/MND; the surrounding single-family residences were generally constructed prior to 2000, and construction of the medical offices and commercial uses to the north began in 2004. As such, project construction would not be anticipated to result in substantial increases in impacts to existing sensitive receptors beyond the levels anticipated by the 2004 IS/MND. Therefore, the proposed project would not result in any additional significant impacts or more severe significant impacts related to the aforementioned environmental topics as compared to the 2004 IS/MND, and further environmental review related to such is not required.

Similarly, the biological resources in the project vicinity and at the project site have remained the same since adoption of the 2004 IS/MND. The 2004 IS/MND determined that the only special-

status species protected under State and/or federal regulations with the potential to occur on-site is the burrowing owl. The 2004 IS/MND concluded that implementation of Mitigation Measures 4-a.1 through 4-a.3, which require preconstruction surveys for the species and appropriate actions should burrowing owl be discovered on-site, would reduce potential impacts to the species to a less-than-significant level. As shown below, the aforementioned mitigation measures have been revised to be consistent with the most recent standards and regulations. Compliance with such mitigation would ensure that new or substantially more significant impacts beyond what was identified in the 2004 IS/MND would not occur. Therefore, the proposed project would not result in any additional significant impacts or more severe significant impacts related to biological resources as compared to the 2004 IS/MND, and further environmental review related to such is not required.

With respect to energy, the proposed project would be subject to the currently adopted 2022 California Green Building Standards Code (CALGreen Code) and the Building Energy Efficiency Standards (Title 24, Part 6 of the California Code of Regulations), which include more stringent requirements related to energy efficiency than previous iterations of the aforementioned regulations to move the State closer to its net-zero energy goals. The 2022 Building Energy Efficiency Standards are designed to move the State closer to its net-zero energy goals for new development by requiring indoor water use consumption to be reduced through the establishment of maximum fixture water use rates, diversion of 65 percent of construction and demolition waste from landfills, and mandatory use of low-pollutant emitting interior finish materials such as paints, carpet, vinyl flooring, and particle board. Energy reductions relative to previous Building Energy Efficiency Standards are achieved through various regulations, including requirements for the use of high-efficacy lighting, improved water heating system efficiency, and high-performance attics and walls. As incorporated in the 2019 Building Energy Efficiency Standards, the 2022 Building Energy Efficiency Standards require that that certain non-residential developments be constructed with solar readiness for the future installation of rooftop solar panels. Additionally, all construction equipment and operation thereof would be regulated per the CARB In-Use Off-Road Diesel Vehicle Regulation. The In-Use Off-Road Diesel Vehicle Regulation is intended to reduce emissions from in-use, off-road, heavy-duty diesel vehicles in California by imposing limits on idling, requiring all vehicles to be reported to CARB, restricting the addition of older vehicles into fleets, and requiring fleets to reduce emissions by retiring, replacing, or repowering older engines, or installing exhaust retrofits. The In-Use Off-Road Diesel Vehicle Regulation would subsequently help to improve fuel efficiency and reduce GHG emissions. Technological innovations and more stringent standards are being researched, such as multi-function equipment, hybrid equipment, or other design changes, which could help to reduce demand on oil and emissions associated with construction. Therefore, the proposed project would not result in any additional significant impacts or more severe significant impacts related to energy as compared to the 2004 IS/MND, and further environmental review related to such is not required.

Finally, with respect to land use and planning and population and housing, the proposed project would not physically divide an established community. In addition, because the proposed uses would be consistent with the General Plan land use and zoning designations for the site, the proposed project would be generally consistent with the uses anticipated in the 2004 IS/MND. New utility lines installed as part of the proposed project would be extended from existing lines in the adjacent roadway network and would be constructed consistent with the City's applicable engineering design standards. Additionally, any new utility lines associated with the proposed project would be sized to accommodate only the project, thereby ensuring the project does not induce substantial unplanned population growth. Furthermore, the proposed project would be subject to applicable development impact fees, ensuring the project's fair-share contribution for any improvements to various public services and utilities. Therefore, the proposed project would

not result in any additional significant impacts or more severe significant impacts related to land use and planning and population and housing as compared to the 2004 IS/MND, and further environmental review related to such is not required.

Overall, the proposed project would not result in any additional significant impacts or more severe significant impacts as compared to the 2004 IS/MND, and further environmental review related to aesthetics, agriculture and forestry resources, biological resources, cultural resources, energy, geology and soils, hazards and hazardous materials, hydrology and water quality, land use and planning, mineral resources, population and housing, public services, recreation, Tribal cultural resources, and wildfire is not required.

It should be noted that the 2004 IS/MND did not identify any significant impacts and associated mitigation measures beyond those discussed above related to biological resources and transportation. Therefore, the 2004 IS/MND does not include any additional mitigation measures that would be applicable to the proposed project.

Thus, with respect to the foregoing issue areas, the proposed project would result in similar impacts as those identified within the 2004 IS/MND. Compliance with applicable federal, State, and local policies, regulations, and standards would ensure impacts related to the aforementioned issue areas would be reduced to a less-than-significant level.

F. CONCLUSION

As established in the discussions above, the proposed project would be within the scope of the 2004 IS/MND analysis related to each CEQA Appendix G environmental resource area. The proposed project would not result in any new significant information of substantial importance, new impacts, new or revised alternatives, or an increase in the severity of previously identified significant impacts that would require major revisions to the 2004 IS/MND. As such, the proposed project would not result in any conditions identified in CEQA Guidelines Sections 15162 or 15164. Therefore, additional environmental review under CEQA would not be required for the proposed project.

G. APPLICABLE MITIGATION MEASURES

As stated above, transportation related mitigation measures contained in the 2004 IS/MND have been fully implemented by the existing project. The following biological mitigation measures from the 2004 IS/MND have been revised to comply with current standards and to provide clarity for the enforcement agencies.

Mitigation Measure 4-a.1.

> *If construction is scheduled to begin during the non-breeding season (late September through the end of January) for burrowing owl, a qualified biologist shall conduct a survey for burrowing owls and burrows or debris that represent suitable nesting or refugia habitat for burrowing owls within areas of proposed ground disturbance. Should owls be present, construction activities shall avoid the refugia by 250 feet until the burrowing owl vacates the site. If burrow exclusion/passive relocation is required during the non-breeding season, the project applicant shall consult with the CDFW pursuant to Fish and Game Code Section 2081. Avoidance and minimization measures prescribed as part of the consultation process would include recommendations provided in the CDFW Staff Report on Burrowing Owl*

Mitigation (2012). Survey results shall only be valid for the year in which they are conducted.

If clearing and construction activities are planned to occur during the nesting period for burrowing owls (February 1–August 31), a qualified biologist shall conduct a targeted burrowing owl nest survey of all accessible areas within 500 feet of the proposed construction area no more than 14 days prior to construction initiation, as described in the CDFW Staff Report on Burrowing Owl Mitigation (2012). Surveys shall be repeated if project activities are suspended or delayed for more than 14 days during nesting season. The results of the surveys shall be submitted to the City of Antioch Community Development Department. If burrowing owls are not detected, further mitigation is not required. Survey results shall only be valid for the year in which they are conducted.

If an active burrowing owl nest burrow (i.e., occupied by more than one adult owl, and/or juvenile owls are observed) is found within 250 feet of a construction area, construction shall cease within 250 feet of the active burrow until a qualified biologist determines that the young have fledged and adult has vacated, or it is determined that the nesting attempt has failed. If the applicant desires to work within 250 feet of the nest burrow, a qualified biologist shall make recommendations on an appropriate buffer and consult with the City and CDFW to determine whether and/or how the nest buffer can be reduced.

If nesting burrowing owls are found during the pre-construction survey, a habitat assessment shall be conducted and mitigation for the permanent loss of burrowing owl habitat, as determined by a qualified biologist, shall be accomplished consistent with the recommendations in the CDFW Staff Report on Burrowing Owl Mitigation.

A report detailing compliance with the provisions established herein shall be submitted for review and approval to the City of Antioch Community Development Department within 30 days of completion of all such provisions.

~~*Mitigation Measure 4-a.2.*~~

~~*During the non-nesting season (defined as September 1 - January 31) and prior to any construction on the site, the project sponsor shall complete a survey within the project's impact areas including areas on the East Bay Municipal Utility District easement which may experience disturbance during construction.*~~

~~*If owls are found within the project area during the non- nesting season, a qualified ornithologist, in consultation with regulatory agencies, could evict any owls within 250 feet of construction zones and other associated impact areas, to avoid mortality of any owls or destruction of occupied burrows. If breeding owls are found on the site during the nesting season (February 1 - August 31), no activity within 250 feet shall be allowed until an ornithologist has determined all young have fledged. Any eviction activities shall be dependent on a signed Mitigation Agreement (MA) between the project sponsor and CDFG. If owls are known to have nested or been resident on the project site within three years prior to site alteration, the project sponsor shall comply with the off-site habitat compensation measures described in Mitigation 4-A.3, below.*~~

~~*Mitigation Measure 4-a.3.*~~

> ~~*If occupied burrows are present at the project site the project applicant shall compensate for the loss of suitable burrowing owl nesting and foraging habitat present on the project site. CDFG recommends that 6.5 acres of mitigation be required for a pair or single owl. To implement this mitigation measure, CDFG recommends that the City of Antioch require the applicant to establish a conservation easement or purchase credits at an approved mitigation bank for the loss of burrowing owl habitat.*~~
>
> ~~*Prior to the issuance of a grading permit for the project, the applicant shall post a performance bond with the City guarantying that they will either establish a conservation easement for burrowing owls on a suitable parcel (approved by CDFG) or purchase the required amount of credits (one credit equals one acre) at the Haera Wildlife Conservation Bank in eastern Alameda County (just south of I-580), which is certified as a mitigation bank by CDFG.*~~

New Mitigation Measures

None required.

APPENDIX A

Kimley»Horn

Memorandum

To: Paul Rothbard

From: Stephen Dillon, P.E.
Pedro Cortes

Re: ***Antioch Lone Tree Shopping Center***
Local Transportation Analysis (LTA)

Date: May 2, 2024

The purpose of this memorandum is to document the findings of a transportation analysis completed for the Antioch Lone Tree Shopping Center project (the "proposed project" or "project") proposed to be located east of Lone Tree Way between Golf Course Road/Bluerock Drive and Dallas Ranch Road/Eagleridge Drive in Antioch, California (**Exhibit 1**). The project proposes to develop existing vacant parcels with approximately 1,460-square feet (sf) of general retail, approximately 4,850-sf of fast-food restaurants with drive-through, and a single lane automated carwash. Up to 245-units of multi-family residential development are also anticipated to be constructed on the vacant property adjacent to the project site as part of a separate effort (**Exhibit 2**). Based on the City of Antioch's guidelines[1], our September 25, 2023, scoping meeting, and consistent with the traffic scoping memorandum provided to the City for review[2], this study evaluates the weekday AM and PM peak-hours under Existing (2023), Existing (2023) plus Project, and Existing (2023) plus Project plus Residential conditions. Written concurrence on this scope of study was received from the City of Antioch[3] on October 24, 2023.

Study Facilities and Analysis Methodology

Study Facilities

Exhibit 3 illustrates the existing study intersections, traffic control, and lane geometry. A level of service (LOS) analysis was completed for the following intersections:

1. Lone Tree Way at Antioch Town Center
2. Lone Tree Way at In-Shape Health Club Driveway
3. Lone Tree Way at Commercial Driveway North

Current signal plan and coordination timing plan sheets for Intersection #1 (Lone Tree Way at Antioch Town Center) were obtained from the City and used to establish the Existing (2023) analysis scenario. The cycle lengths obtained from the coordination plan were used to optimize the phasing splits for Existing (2023) turning movement volumes during both AM and PM peak-hours due to a lack of base timing information. The AM and PM peak-hour base signal timing established for Existing (2023) was then carried forward to evaluate the two plus Project scenarios.

[1] *Transportation and VMT Impact Analysis Guidelines*, City of Antioch, June 2023.
[2] *Antioch Lone Tree Shopping Center – Traffic Scoping Memorandum*, Kimley-Horn, September 29, 2023.
[3] Email correspondence with Kevin Van Katwyk, City of Antioch, October 24, 2023.

Level of Service (LOS) Definitions

The LOS of a facility is a qualitative measure used to describe operational conditions. LOS ranges from A, which represents minimal delay, to F, which represents heavy delay and a facility that is operating at or near its functional capacity. Due to the relatively close spacing between study intersections, Levels of Service for this study were determined using methods defined in the *Highway Capacity Manual* (HCM) using micro-simulation (SimTraffic® traffic analysis software).

The HCM includes procedures for analyzing side-street stop controlled (SSSC), all-way stop controlled (AWSC), and signalized intersections. The SSSC procedure defines LOS as a function of average control delay for the worst (most delay) minor street approach or movement. The AWSC and signalized intersection procedures define LOS as a function of average control delay for the intersection as a whole. **Table 1** presents intersection LOS definitions as defined in the HCM.

Table 1 – Intersection Level of Service Criteria

Level of Service (LOS)	Un-Signalized	Signalized
	Average Control Delay* (sec/veh)	Average Control Delay (sec/veh)
A	≤ 10	≤ 10
B	> 10 – 15	> 10 – 20
C	> 15 – 25	> 20 – 35
D	> 25 – 35	> 35 – 55
E	> 35 – 50	> 55 – 80
F	> 50	> 80

Source: Highway Capacity Manual, 6th Edition

* Applied to the worst lane/lane group(s) for SSSC

Per the City of Antioch's guidelines[1], the LOS threshold for all study intersections is LOS D or better.

Assessment of Proposed Project

Trip Generation, Distribution, and Assignment

The number of trips anticipated by the proposed project was approximated using data included in the *Trip Generation Manual, 11th Edition*, published by the Institute of Transportation Engineers (ITE). Data for an automated carwash published in the *San Diego Municipal Code Land Development Code Trip Generation Manual* (SDMC LDC)[4] was used to supplement ITE data due to an insufficient sample size within ITE's data for this land use. SDMC LDC data are included in **Attachment A**. ITE Land Use Codes 822 (Retail Strip Plaza), 934 (Fast-Food Restaurant with Drive-Through Window), and data published in the SDMC LDC[4] were used to approximate trips generated by this project.

The trips generated by the proposed project are presented in **Table 2**. As the timeline for the adjacent residential development (completed as part of a separate effort) is anticipated to closely follow the project, the residential development's trips are also included in **Table 2.** As shown in **Table 2**, the proposed project is estimated to generate 1,542 new daily external trips, with 152 net new external trips during the AM peak-hour and 173 net new external trips during the PM peak-hour. In combination with the proposed residential component, the combined development area is expected to produce 4,368 daily driveway trips, with 356 driveway trips during the AM peak-hour and 357 driveway trips during the PM peak-hour. The trip generation methodology was included in the prior traffic scoping memorandum[2].

[4] *San Diego Municipal Code Land Development Code Trip Generation Manual,* City of San Diego, revised May 2003.

Kimley»Horn

Table 2 – Proposed Project Trip Generation

Land Use (ITE Code[1])	Size (KSF/SITE/ # Units)	Daily Trips	AM Peak-Hour					PM Peak-Hour				
			Total Trips	In		Out		Total Trips	In		Out	
				%	Trips	%	Trips		%	Trips	%	Trips
Retail Strip Plaza (822)[1]	1.46	79	8	60%	5	40%	3	20	50%	10	50%	10
Fast-Food Restaurant with Drive-Through Window (934)[1]	4.85	2,267	216	51%	110	49%	106	160	52%	83	48%	77
Carwash (SDMC LDC)[2]	1	900	36	50%	18	50%	18	81	50%	40	50%	41
Subtotal (Project Driveway Trips):		***3,246***	***260***	-	***133***	-	***127***	***261***	-	***133***	-	***128***
Fast-Food Restaurant with Drive-Through Window Pass-By (50% AM, 55% PM)[1]		1,704	-108	-	-55	-	-53	-88	-	-46	-	-42
Net New Project External Trips:		***1,542***	***152***	-	***78***	-	***74***	***173***	-	***87***	-	***86***
Multifamily Housing (Mid-Rise) (221)[1]	*245*	*1,122*	*96*	*23%*	*22*	*77%*	*74*	*96*	*61%*	*59*	*39%*	*37*
Subtotal (Project plus Residential Driveway Trips)		***4,368***	***356***	-	***155***	-	***201***	***357***	-	***192***	-	***165***

KSF = 1,000 SF GFA, SITE = Number of sites

Sources: [1]*Trip Generation Manual, 11th Edition*, ITE

[2]SDMC LDC = San Diego Municipal Code Land Development Code Trip Generation Manual

The distribution of project traffic was developed based on the access/egress restrictions, and engineering judgement. The project trip distribution is shown in Exhibit 4. The trip distribution was reviewed by City staff[3]. Project trips were assigned to the study intersections and the surrounding roadway network according to these patterns and access conditions. Project trip assignment is reflected in Exhibit 5.

Analysis Results

Data Collection

To establish Existing (2023) conditions, traffic counts were collected for the existing study intersections. Weekday AM and PM peak-period intersection turning movement counts were collected on Tuesday, November 7, 2023. This data is included in Attachment B.

Intersection Level of Service (LOS)

Existing (2023) peak-hour traffic volumes are illustrated in Exhibit 6. Proposed project trips shown in Exhibit 5 were added to the Existing (2023) peak-hour traffic volumes to establish the Existing (2023) plus Project peak-hour traffic volumes, presented in Exhibit 7. Residential development trips were added to the Existing (2023) plus Project peak-hour traffic volumes to establish the Existing (2023) plus Project plus Residential peak-hour traffic volumes, presented in Exhibit 8. Analysis worksheets for the Existing (2023), Existing (2023) plus Project, and Existing (2023) plus Project plus Residential conditions are provided in Attachment C, Attachment D, and Attachment E, respectively.

Table 3 presents the peak-hour intersection LOS analysis results. As indicated in Table 3, the study intersections operate at LOS A in the Existing (2023) and Existing (2023) plus Project scenarios, and between LOS A and B in the Existing (2023) plus Project plus Residential scenario.

Table 3 – Existing (2023), Existing (2023) plus Project, and Existing (2023) plus Project Plus Residential Intersection LOS Summary

ID	Intersection	Peak Hour	LOS Threshold	Control	Existing (2023)		Existing (2023) plus Project		Existing (2023) plus Project plus Residential	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
1	Lone Tree Way at Antioch Town Center	AM	D	Signal	5.9	A	11.9	B	12.9	B
		PM			4.7	A	10.6	B	12.3	B
2	Lone Tree Way at In-Shape Health Club Dwy	AM		SSSC	0.9(4.1 WBR)	A(A)	1.2(4.4 WBR)	A(A)	1.2(4.3 WBR)	A(A)
		PM			0.9(3.2 WBR)	A(A)	1.1(3.4 WBR)	A(A)	1.1(4.1 WBR)	A(A)
3	Lone Tree Way at Commercial Dwy North	AM		SSSC	1.1(5.3 WBR)	A(A)	1.6(6.2 WBR)	A(A)	1.7(7.6 WBR)	A(A)
		PM			1.3(7.9 WBR)	A(A)	1.8(9.1 WBR)	A(A)	1.9(9.8 WBR)	A(A)

Note: Side Street Stop Controlled (SSSC) reported as intersection delay followed by worst movement delay.
Bold represents unacceptable operations.

Queuing Analysis Results

Select vehicle queuing at all study intersections was evaluated for the analysis scenarios as summarized in Table 4. 95th-percentile queue results developed using SimTraffic® were utilized to perform this evaluation. As shown in Table 4, queueing in the westbound-left lane at Intersection #1 (Lone Tree Way at Antioch Town Center) exceeds available capacity as measured from the stop bar to the Commercial and Residential entrance during the PM peak-hour in the Existing (2023) plus Project scenario and during both AM and PM peak-hours in the Existing (2023) plus Project plus Residential scenario. Queuing in the westbound-right lane at Intersection #2 (Lone Tree Way at In-Shape Health Club Driveway) is reported to be contained within the available capacity as measured from the stop bar to the parking lot curb return. Queuing in the westbound-right lane at Intersection #3 (Lone Tree Way at Commercial Driveway North) is reported to be contained within the available capacity as measured from the stop bar to the existing retail center driveway for the existing development north of the project. Although the project increases the queue, it is not anticipated to extend beyond the existing north retail center driveway and impair its operations.

Deficiencies/Improvements

As shown in Table 3, the addition of the project does not result in deficient intersection delay or LOS conditions at any of the study facilities under the included analysis scenarios.

As shown in Table 4, queueing in the westbound-left lane at Intersection #1 (Lone Tree Way at Antioch Town Center) exceeds available capacity as measured from the stop bar to the Commercial and Residential entrance during the PM peak-hour in the Existing (2023) plus Project scenario and during both AM and PM peak-hours in the Existing (2023) plus Project plus Residential scenario. To improve the deficient queueing conditions at Intersection #1, it is recommended that the existing dedicated westbound right-turn lane be restriped as a shared westbound right and left-turn lane. While the proposed restriping will not require modifications to the existing signal phasing at Intersection #1, it will require that the westbound signal faces be modified to appropriately reflect the new condition per the most recent version of the California Manual on Uniform Traffic Control Devices (CA MUTCD) and the intersection phasing splits be retimed. To capture the dynamics of steadier westbound approach traffic demand with the addition of Project and Residential traffic, the deficient queue scenarios were also reevaluated using a Synchro standard peak-hour factor (PHF) of 0.90. With these modifications to the analysis, the westbound approach 95th-percentile queues are found to be contained within the available capacity provided by the development. Improved queueing results for the westbound left movement are reflected in Table 5. Analysis worksheets reflecting the improved conditions are included in Attachment F.

Table 4 – Queuing Analysis Results

Intersection / Analysis Scenario	Movement	AM Peak-Hour		PM Peak-Hour	
		Available Storage (ft)	95th % Queue (ft)	Available Storage (ft)	95th % Queue (ft)
#1 Lone Tree Way at Antioch Town Center	NBR				
Existing (2023)		280	25	280	25
Existing (2023) plus Project			45		35
Existing (2023) plus Project plus Residential			50		50
	SBL				
Existing (2023)		555	175	555	120
Existing (2023) plus Project			275		205
Existing (2023) plus Project plus Residential			285		240
	WBR				
Existing (2023)		100	40	100	50
Existing (2023) plus Project			55		65
Existing (2023) plus Project plus Residential			75		80
	WBL				
Existing (2023)		100	45	100	50
Existing (2023) plus Project			120		140
Existing (2023) plus Project plus Residential			160		155
#2 Lone Tree Way at In-Shape Health Club Dwy	WBR				
Existing (2023)		40	25	40	30
Existing (2023) plus Project			30		30
Existing (2023) plus Project plus Residential			25		30
#3 Lone Tree Way at Commerical Dwy North	WBR				
Existing (2023)		105	40	105	55
Existing (2023) plus Project			50		65
Existing (2023) plus Project plus Residential			55		70

Notes: For approaches with dual lanes, the longest queue length is reported. Shaded cell indicates queue exceeds storage by > 25' (one vehicle length)

Table 5 – Improved Queueing Analysis Results

Intersection / Analysis Scenario	Movement	AM Peak-Hour		PM Peak-Hour	
		Available Storage (ft)	95th % Queue (ft)	Available Storage (ft)	95th % Queue (ft)
#1 Lone Tree Way at Antioch Town Center	WBL				
Existing (2023)		100	45	100	50
Existing (2023) plus Project			120		140
Existing (2023) plus Project plus Residential			160		155
Existing (2023) plus Project - Improved			-		110
Existing (2023) plus Project plus Residential - Improved			125		125

Notes: For approaches with dual lanes, the longest queue length is reported. Shaded cell indicates queue exceeds storage by > 25' (one vehicle length)

Quick Service Restaurant (QSR) Drive-Through Queuing

The project proposes two (2) quick service restaurants with single drive-through lanes. As shown in **Exhibit 2**, the southernmost drive-through (Drive-Through #1) is shown to wrap the proposed restaurant in a counterclockwise manner and provide approximately 180-feet of queue capacity (7 vehicles, conservatively assuming 25-feet per vehicle). As shown in **Exhibit 2**, the northernmost drive-through (Drive-Through #2) is shown to wrap the proposed restaurant in a counterclockwise manner and provide approximately 240-feet of queue capacity (9 vehicles, conservatively assuming 25-feet per vehicle). A drive-through queuing analysis was conducted for each building to determine if the drive-through capacity provided is adequate for the anticipated demand. The queue length was determined using queuing analysis formulas published in the Institute of Transportation Engineers (ITE) *Transportation Planning Handbook, 3rd Edition* and is based on the M/M/1 single service model.

The M/M/1 single service model is a commonly used method to estimate vehicle queues in drive-through facilities. This model is based on queuing theory and estimates the average queue length based on a Poisson distribution for arrival rate (λ), exponential distribution for the service rate (μ), and average wait time. The model also estimates the probability that a specific queue (i.e. drive-through storage length) would be exceeded. This model is equation-based and allows for the estimation of queues without running a simulation. The following summary provides definitions of the terms used in the M/M/1 model:

Arrival Rate, λ

The arrival rate, λ, was assumed to be the highest number of peak-hour inbound trips generated by the project drive-through land uses (the AM peak-hour). Different scenarios were analyzed assuming 100%, 75%, and 50% of the trips generated for each QSR use the drive-through.

Service Rate, μ

The average service rate, μ, was based on the average wait time for the drive-through restaurants, as documented in QSR Magazine[5], and the average arrival rate, λ, as developed previously. For M/M/1, the average wait time is calculated by the following equation:

$$W = \frac{1}{\mu - \lambda}$$

Where:

W = Average total wait time (i.e. in queue & being served), hr
μ = Average service rate, veh/hr
λ = Average arrival rate, veh/hr

The equation was rearranged to solve for two different values of μ using two different values of W developed from QSR Magazine data: the industry average wait time of 5.68 minutes, and the industry maximum wait time of 7.27 minutes. The industry average and industry maximum wait times were applied to both drive-through buildings. A prospective tenant for Drive-Through #1 has provided proprietary processing data showing an average wait time of 2.55 minutes for drive-through users as the window will only service pre-paid mobile orders.

[5] *The 2023 QSR® Drive-Thru Report*, https://www.qsrmagazine.com/reports/2023-qsr-drive-thru-report, accessed November 2023.

Average Queue, Q

The average queue length was determined by the following equation:

$$Q = \frac{\lambda}{\mu - \lambda}$$

Where:

Q = Average queue length, veh
λ = Average arrival rate, veh/hr
μ = Average service rate, veh/hr

Probability queue exceeds drive-through storage, p(Q>n)

The probability the drive-through queue will exceed the storage capacity was determined by the following equation:

$$p(Q > n) = \left(\frac{\lambda}{\mu}\right)^{n+1}$$

Where:

Q = Average queue length, veh
n = Queuing capacity, veh
λ = Average arrival rate, veh/hr
μ = Average service rate, veh/hr

The results of the analysis using the M/M/1 model for each of the two quick service restaurants are summarized in **Table 6** and **Table 7**.

Table 6 – Drive-Through #1 Queuing Analysis Summary

Total Wait Time	Industry Average*	Industry Maximum*	User Specific+	Industry Average*	Industry Maximum*	User Specific+	Industry Average*	Industry Maximum*	User Specific+
% of Trips using Drive-through lane	100%			75%			50%		
Avg. arrival rate, λ (veh/hr)	52	52	52	39	39	39	26	26	26
Avg. service rate, μ (veh/hr)	62.6	60.3	75.5	49.6	47.3	62.5	36.6	34.3	49.5
Avg. total wait time, W (min)*,+	5.68	7.27	2.55	5.68	7.27	2.55	5.68	7.27	2.55
Avg. total wait time, W (hr)	0.09	0.12	0.04	0.09	0.12	0.04	0.09	0.12	0.04
Avg. queue length, Q (veh)	4.9	6.3	2.2	3.7	4.7	1.7	2.5	3.1	1.1
Queue capacity, n (veh)	7	7	7	7	7	7	7	7	7
Probability Queue exceeds n, p(Q>n)	0.23	0.31	0.05	0.15	0.22	0.02	0.07	0.11	0.01

**The 2023 QSR Drive-Thru Report*, QSR Magazine

Table 7 – Drive-Through #2 Queuing Analysis Summary

Total Wait Time	Industry Average	Industry Maximum	Industry Average	Industry Maximum	Industry Average	Industry Maximum
% of Trips using Drive-through lane	100%		75%		50%	
Avg. arrival rate, λ (veh/hr)	58	58	44	44	29	29
Avg. service rate, μ (veh/hr)	68.6	66.3	54.1	51.8	39.6	37.3
Avg. total wait time, W (min)*	5.68	7.27	5.68	7.27	5.68	7.27
Avg. total wait time, W (hr)	0.09	0.12	0.09	0.12	0.09	0.12
Avg. queue length, Q (veh)	5.5	7.0	4.1	5.3	2.7	3.5
Queue capacity, n (veh)	9	9	9	9	9	9
Probability Queue exceeds n, p(Q>n)	0.19	0.26	0.11	0.18	0.04	0.08

**The 2023 QSR Drive-Thru Report*, QSR Magazine

The arrival rate was approximated using data included in the *Trip Generation Manual, 11th Edition*, published by the Institute of Transportation Engineers (ITE) and the higher of the peak-hours was used (AM peak-hour). As shown in Table 6, using general industry data, the probability that the Drive-Through #1 queue will exceed the queuing capacity of seven vehicles ranges from 7-31% depending on service rate and percentage of trips using the drive-through. The average queue length ranges from 2.5-6.3 vehicles depending on the scenario, which can be accommodated within the available storage. Based on general industry data, the proximity of the drive-through entrance to the primary Commercial and Residential internal intersection could result in vehicles waiting to access the drive-through interfering with traffic operations at the intersection. To alleviate the potential effects of drive-through queueing on the internal intersection, the drive-through entrance has been moved an additional 10-feet away from the internal intersection in comparison to the site plan provided during the pre-submittal process, resulting in 25-feet of vehicle clearance (one car length) between the intersection and drive-through entrance. Using proprietary data from a prospective user, the probability of exceeding the seven-vehicle queueing capacity is reduced to between 1-5% and the average queue length ranges from 1.1-2.2 vehicles, which can be accommodated within the available storage. Based on the available data and analysis parameters, it is reasonably concluded that the configuration of Drive-Through #1 is unlikely to result in on-site queueing issues.

As shown in Table 7, the probability that the Drive-Through #2 queue will exceed the queuing capacity of 9-vehicles ranges from 4-26% depending on service rate and percentage of trips using the drive-through. The average queue length ranges from 2.7-7 vehicles depending on the scenario, which can be accommodated within the available storage. While the combination of Industry Maximum wait time and 100% of trips using the drive-through results serve as a point of comparison, it is reasonable to expect drive-through operations to more closely follow the analysis provided by the Industry Average numbers and a lower percentage of trips using the drive-through. It is recommended that the drive-through window be located as far from the drive-through entrance as possible within the building footprint in order to maximize available queue capacity within the drive-through lane. Based on the analysis parameters, it is unlikely that the configuration of Drive-Through #2 will result in on-site queueing issues.

Carwash Queuing

A carwash queuing analysis was conducted to determine if the storage lane capacity is adequate for the anticipated demand. The queue length was determined using queuing analysis formulas published in the Institute of Transportation Engineers (ITE) *Transportation Planning Handbook, 3rd Edition* and is based on the M/M/1 single service model that was presented in the preceding section. The arrival rate, λ, was assumed to be the highest peak-hour inbound trips generated by the carwash land use. The service rate, μ, was based on the average time for a vehicle to pass through an automated carwash (estimated to be three minutes[6]) and arrival rate. To allow for potential variations in wash time, additional scenarios were developed assuming wait times of four and five minutes. The results of the analysis using the M/M/1 model for the carwash are summarized in Table 8.

As shown in Table 8, the probability that the automated carwash queue will exceed the available capacity of nine vehicles ranges from 2-7% depending on service rate. The average queue length ranges from 2.0-3.3 vehicles, which can be accommodated within the available storage. Based on the analysis parameters, any instance of the carwash queue exceeding the available capacity is expected to be both infrequent and of short duration.

[6] How does the car wash work? - FAQ, Quick Quack Car Wash, accessed November 2023.

Table 8 – Carwash Queuing Analysis Summary

Variable	Total Wait Time		
	3 min	4 min	5 min
Avg. arrival rate, λ (veh/hr)	40	40	40
Avg. service rate, μ (veh/hr)	60.0	55.0	52.0
Avg. total wait time, W (min)	3.00	4.00	5.00
Avg. total wait time, W (hr)	0.05	0.07	0.08
Avg. queue length, Q (veh)	2.0	2.7	3.3
Queue capacity, n (veh)	9	9	9
Probability Queue exceeds n, p(Q>n)	0.02	0.04	0.07

Site Access and Circulation

The site plan (Exhibit 2) was qualitatively reviewed for access and on-site circulation concerns. Vehicles may access the site at three (3) existing intersections. Intersection #1 (Lone Tree Way at Antioch Town Center) is a signalized intersection. Intersection #2 (Lone Tree Way at In-Shape Health Club Driveway) and Intersection #3 (Lone Tree Way at Commercial Driveway North) are Right-In/Right-Out (RIRO), side-street stop controlled (SSSC) driveways. As shown in Table 4 and Table 5, there is sufficient storage within the existing turn pockets to contain anticipated queues with and without the project. To improve on-site circulation, the following additions to the site plan are recommended:

1. The internal Commercial and Residential intersection should be signed for side-street stop control (SSSC) at the southbound and northbound approaches. As eastbound Commercial and Residential traffic from Lone Tree Way will not be controlled to allow for efficient ingress and control for the Residential leg of the intersection is not known at the time of this study, the SSSC approaches will also include W4-4P ("Cross Traffic Does Not Stop") signage per the California Manual on Uniform Traffic Control Devices (CA MUTCD). These sign locations are identified in Exhibit 9.
2. To facilitate efficient ingress movements and prevent vehicle spillback onto Lone Tree Way, the single Antioch Town Center eastbound lane approaching the internal Commercial and Residential intersection will be striped to include a dedicated left-turn pocket and a shared through-right lane after the existing concrete planter median. These intersection approach striping conditions are reflected in Exhibit 9.

Emergency Vehicle and Refuse Service Access

The site plan (Exhibit 2) was qualitatively reviewed for emergency vehicle and refuse service access. The project site appears to include adequate access to buildings to accommodate emergency vehicles. All parcels provide adequate access and circulation for refuse services as depicted in Exhibit 2.

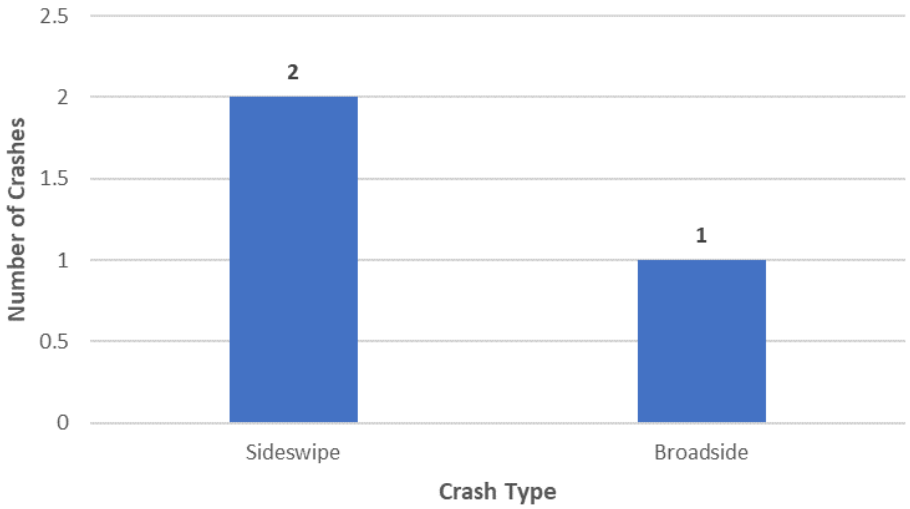
Pedestrian and Bicycle Access

Sidewalks are present at all study intersections and are continuous along Lone Tree Way. Class III bike routes are present in both northbound and southbound directions on Lone Tree Way.

Safety Evaluation

Based on the collision data provided by the City, there were three collisions at Intersection #1 (Lone Tree Way at Antioch Town Center) within the five-year period between 2017 and 2021. As shown in **Figure 1**, of the three crashes, the two crash types were sideswipe (2) and broadside (1). These crashes resulted in no reported incidences of severe injuries or fatalities. The provided crash data was combined with intersection entering average daily traffic (ADT) to develop an existing intersection crash rate of 0.07 crashes per million entering vehicles. Per available Caltrans data[7], the basic average crash rate for an urban signalized tee-intersection is 0.20 crashes per million entering vehicles.

Figure 1 – Intersection #1 (Lone Tree Way at Antioch Town Center) Collision Summary



CEQA/SB 743 Assessment

This section documents the Vehicle Miles Traveled (VMT) analysis which was completed for the purpose of determining Senate Bill 743 (SB 743) compliance for the project. With the passage of SB 743, VMT has become an important indicator for determining if new development will result in a "significant transportation impact" as defined by the California Environmental Quality Act (CEQA).

Methodology and Assumptions

Based on the proposed project's land use information and for the purposes of completing this SB 743 analysis to identify transportation-related significant impacts, the project was analyzed as a "Retail" land use. Based on the nature of the land use description provided, the retail use was analyzed qualitatively. The City of Antioch's *Transportation and VMT Impact Analysis Guidelines*[1] was used as the basis for the analysis documented herein.

Analysis

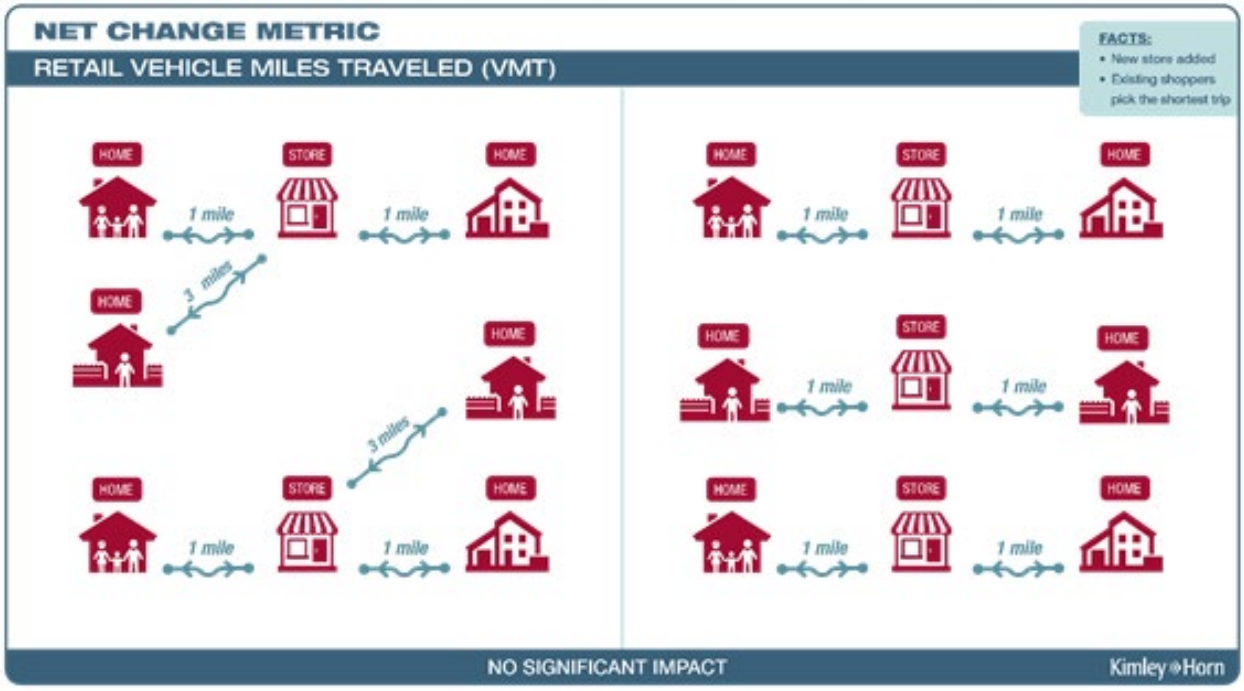
Page 19 of the *Guidelines* specifically provides three screening criteria for projects and notes that a project need only meet one of the three provided criteria to be screened out. One of the three screening criteria, Project Type, addresses some of the key issues surrounding how small-scale, local-serving retail should be evaluated in terms of its VMT impact. For the purposes of this analysis, the proposed project can be defined as locally serving retail as it is intended to serve the needs of the local community. As described, the threshold for significance is "a net increase." This threshold means that, if the proposed retail use results in additional VMT, it would therefore result in a finding of significance.

[7] *2019 Crash Data on California State Highways*, Caltrans.

Local-serving retail primarily serves pre-existing needs (i.e. they do not generate new trips because they meet existing demand). Because of this dynamic, local-serving retail uses can be presumed to reduce trip lengths when a new use is proposed. Essentially, the assumption is that someone will travel to a newly constructed, local-serving establishment because of a its proximity, rather than the proposed retail store fulfilling an unmet need (i.e. the person had an existing need that was met by the retail located farther away and is now traveling to the new use because it is closer to the person's origin location). This relationship results in a trip on the roadway network becoming shorter, rather than a new trip being added to the roadway network. Conversely, residential and office land uses often drive new trips given that they introduce new participants to the transportation system. The *Guidelines* provides a threshold of 50,000-square feet (sf) per establishment as an indicator as to whether a retail use can be considered local-serving or not. Based on the understanding that no single building within the Proposed Project will exceed 50,000-sf, it is presumed that the proposed retail uses will not result in a significant VMT impact.

Figure 2 is provided to visually demonstrate the basis of this finding. As shown in Figure 2, the introduction of a new retail use often has the effect of redistributing existing customer trips in a manner that reduces average trip lengths, thereby resulting in a VMT reduction (i.e. trip segments that were 3 miles prior to the new retail store are reduced to 1 mile with the addition of the new retail store).

Figure 2 – Illustration of the VMT Reducing Effect of Local-Serving Retail



In terms of employee trips, most often an important strategy for reducing VMT is to improve the local jobs/housing balance by increasing the number of employment opportunities. As such, it is reasonable to expect that increasing local employment opportunities will reduce the average commuter trip lengths of residents, thereby resulting in a net decrease to regional net VMT.

The California Governor's Office of Planning and Research (OPR) *Technical Advisory*[8] indicates that, although heavy vehicle traffic can be included for analysis convenience, the VMT analysis requirements

[8] *Technical Advisory on Evaluating Transportation Impacts in CEQA*, Governor's Office of Planning and Research, State of California, December 2018.

are specific to passenger-vehicles and light duty trucks. It is generally understood that Interstate commerce and related heavy vehicle traffic are regulated by the Federal government as it relates to commerce. Irrespective of this guidance, it is reasonable to assume that the location of this project adjacent to Lone Tree Way offers services for the traveling public that are already on the roadway system and need to stop for services. With the exception of employee commute trips, the trips for this type of use are generally pass-by or diverted link. Accordingly, it is reasonable to assume that the proposed commercial development would not generate new demand, rather it would satisfy existing demand that would therefore shorten the distance that customers would otherwise travel.

Other site-related trips, often the smallest number and shortest distance of trips for a facility such as the project, include employee lunches offsite, maintenance teams for on-site infrastructure, supply deliveries, etc. As such, their impact to the overall VMT of the site is likely minimal and it is not likely that they are impactful to the local transportation system and are secondary to the other two trip types discussed above.

Finally, as noted above, while this facility is expected to provide additional jobs and some related trips to the area, the facility itself is not expected to be the principal catalyst for new trips. Rather, it is anticipated that these trips would most likely occur regardless of whether this location were developed. The proposed project is reasonably considered to be proposed in response to an existing demand for services for road users already on the roadway network. Accordingly, if this site were not developed, a similar site will be developed elsewhere to meet this demand and, as such, the alternative to this development would likely not eliminate any related VMT. In consideration of this and the other points discussed above, the project is not anticipated to result in a significant impact under CEQA pursuant to SB 743.

Conclusions

The following are the primary conclusions based on the analyses discussed herein:

- The addition of the proposed project with and without the residential development does not cause any of the study intersections to operate at unacceptable levels delay beyond published City standards[1].
- All 95th-percentile queues are anticipated to be contained within their respective storage, except the westbound-left lane at Intersection #1 (Lone Tree Way at Antioch Town Center). To improve this condition, it is recommended that the existing dedicated westbound right-turn pocket be restriped and repurposed as a shared westbound right and left-turn pocket, that the existing westbound signal faces at the intersection be modified for consistency with the new condition per the most recent version of the CAMUTCD, and that the intersection phasing splits be retimed.
- As documented, any instances of vehicle queueing extending beyond the available storage capacity at Drive-Through #1, Drive-Through #2, and the carwash are expected to be an infrequent occurrence of short duration.
- The site plan should incorporate proposed additions provided in the Site Access and Circulation section of the memo. Priority items to reflect in the site plan are included in Exhibit 9.
- Per data provided by the City, the study intersections have a limited crash history. Intersection #1 (Lone Tree Way at Antioch Town Center) exhibits a crash rate below the statewide average for intersections of similar type. The project is not anticipated to significantly alter this existing condition.
- As the project land uses are identified as “local serving retail”, the project is not anticipated to result in a significant VMT impact under CEQA pursuant to SB 743.

Attachments

Exhibit 1 – Project Vicinity Map
Exhibit 2 – Project Site Plan
Exhibit 3 – Study Intersections, Traffic Control, and Lane Geometry
Exhibit 4 – Project Trip Distribution
Exhibit 5 – Project Trip Assignment
Exhibit 6 – Existing (2023) Peak-Hour Traffic Volumes
Exhibit 7 – Existing (2023) plus Project Peak-Hour Traffic Volumes
Exhibit 8 – Existing (2023) plus Project plus Residential Peak-Hour Traffic Volumes
Exhibit 9 – Recommended Internal Intersection Signing and Striping Configuration

Attachment A – SDMC LDC Trip Generation Data
Attachment B – Traffic Count Data Sheets
Attachment C – Analysis Worksheets for Existing (2023) Conditions
Attachment D – Analysis Worksheets for Existing (2023) plus Project Conditions
Attachment E – Analysis Worksheets for Existing (2023) plus Project plus Residential Conditions
Attachment F – Analysis Worksheets for Improved Conditions

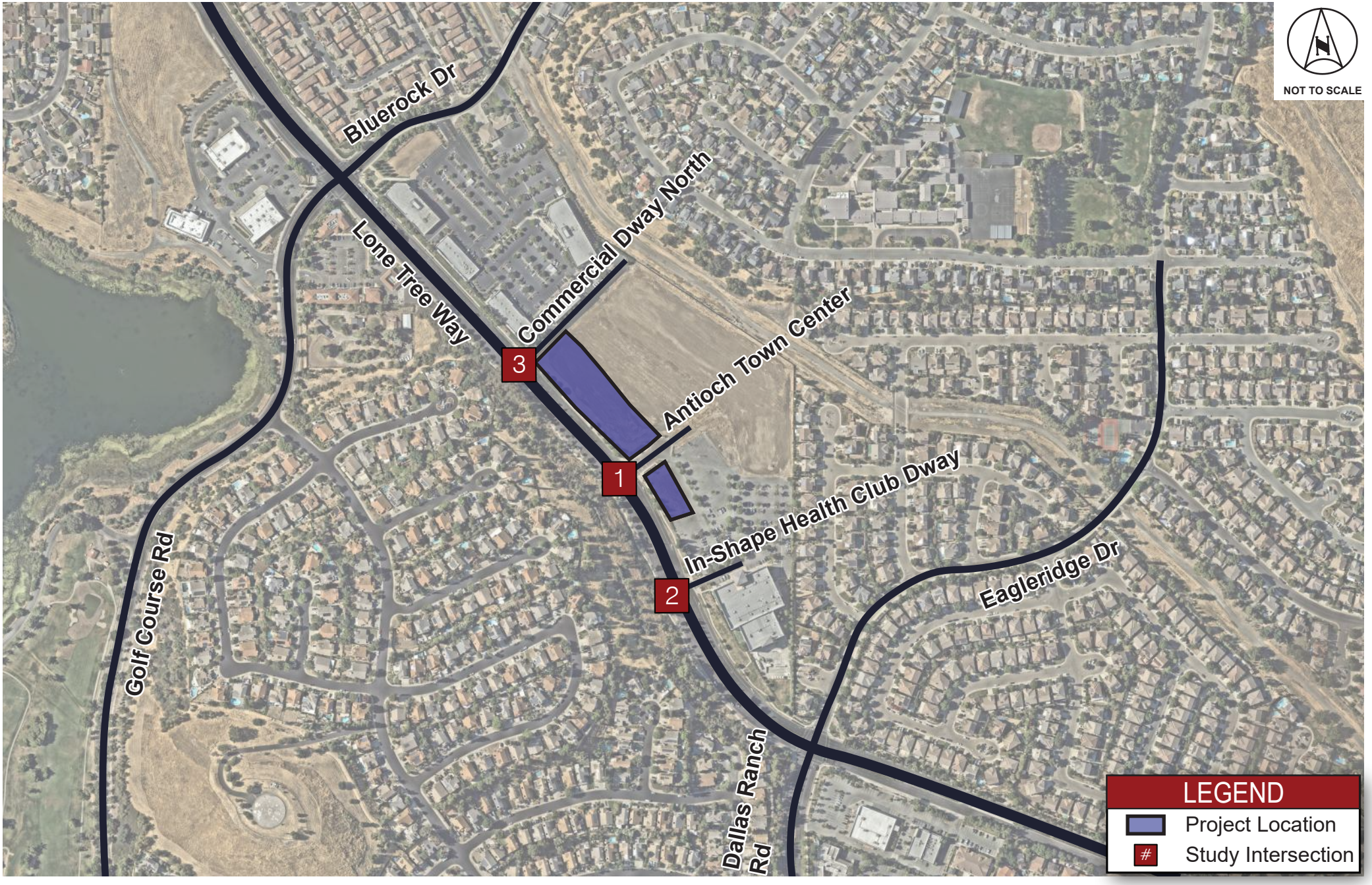


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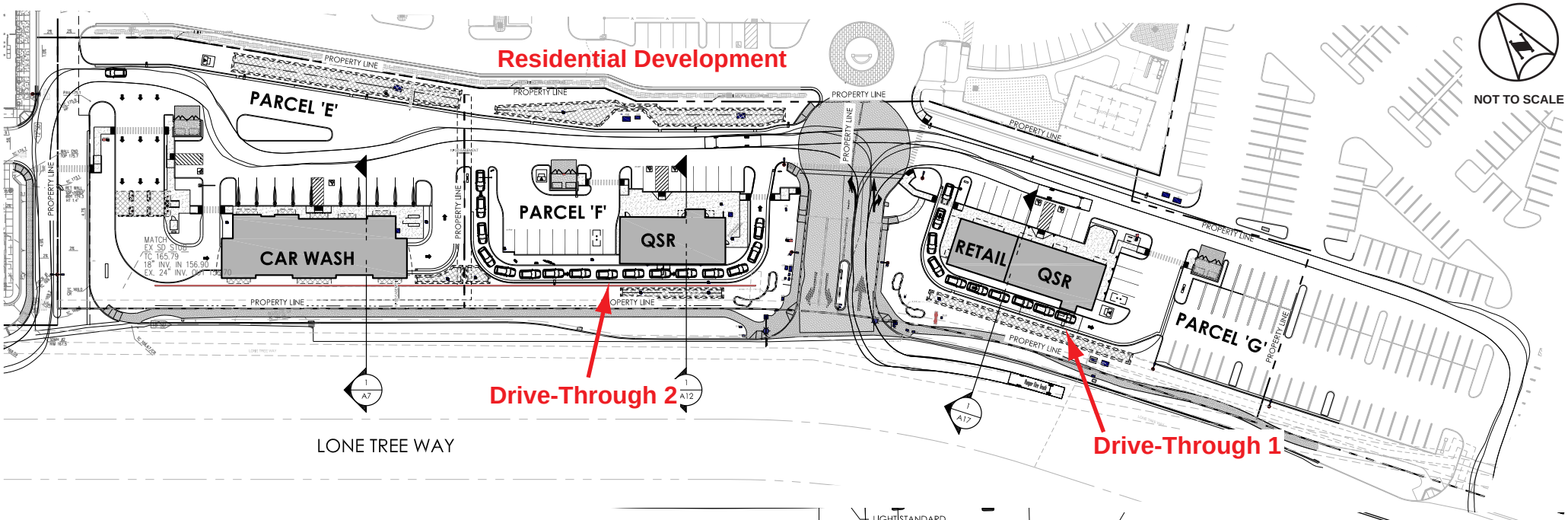
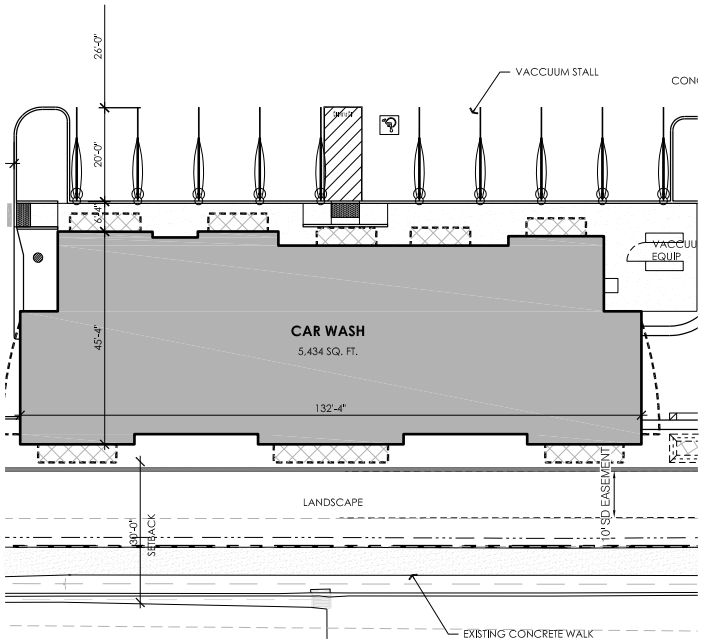
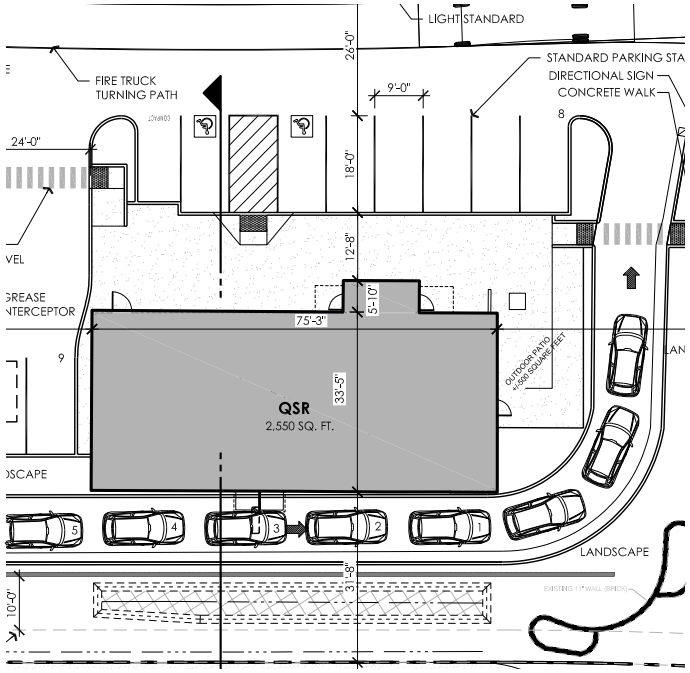
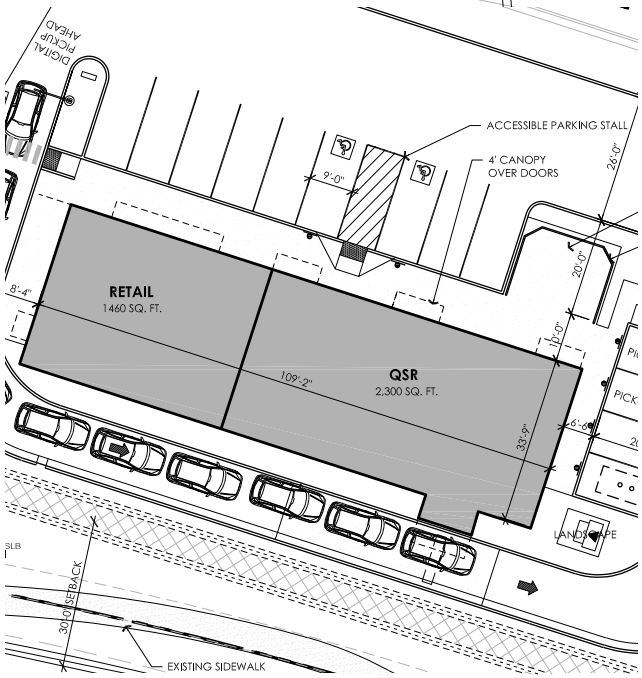
Exhibit 1
Project Vicinity Map









Site Plan Source: API, 04/30/2024

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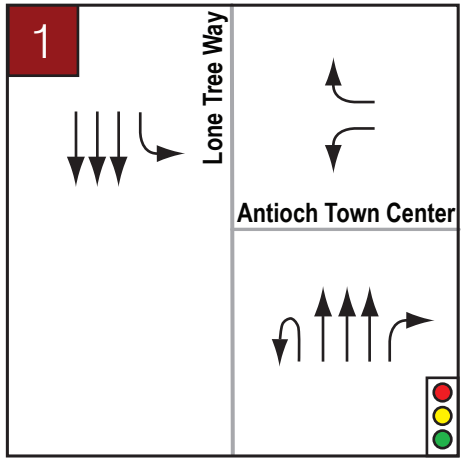
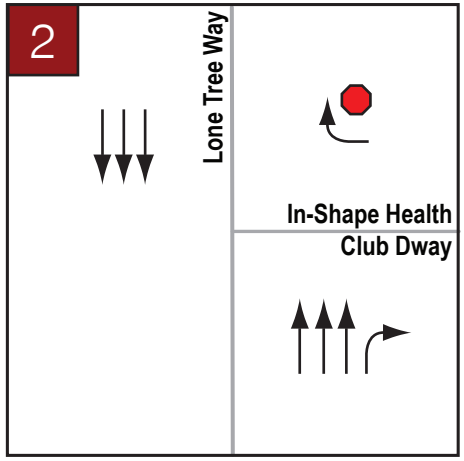
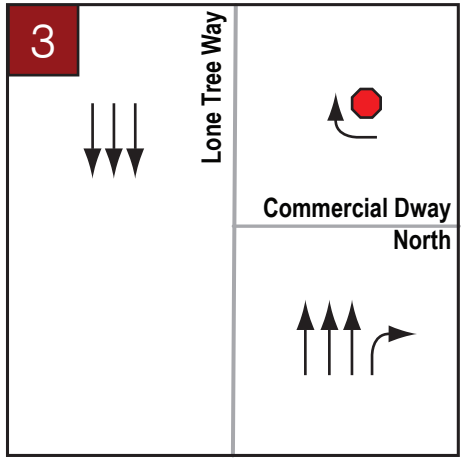
Exhibit 2
Project Site Plan







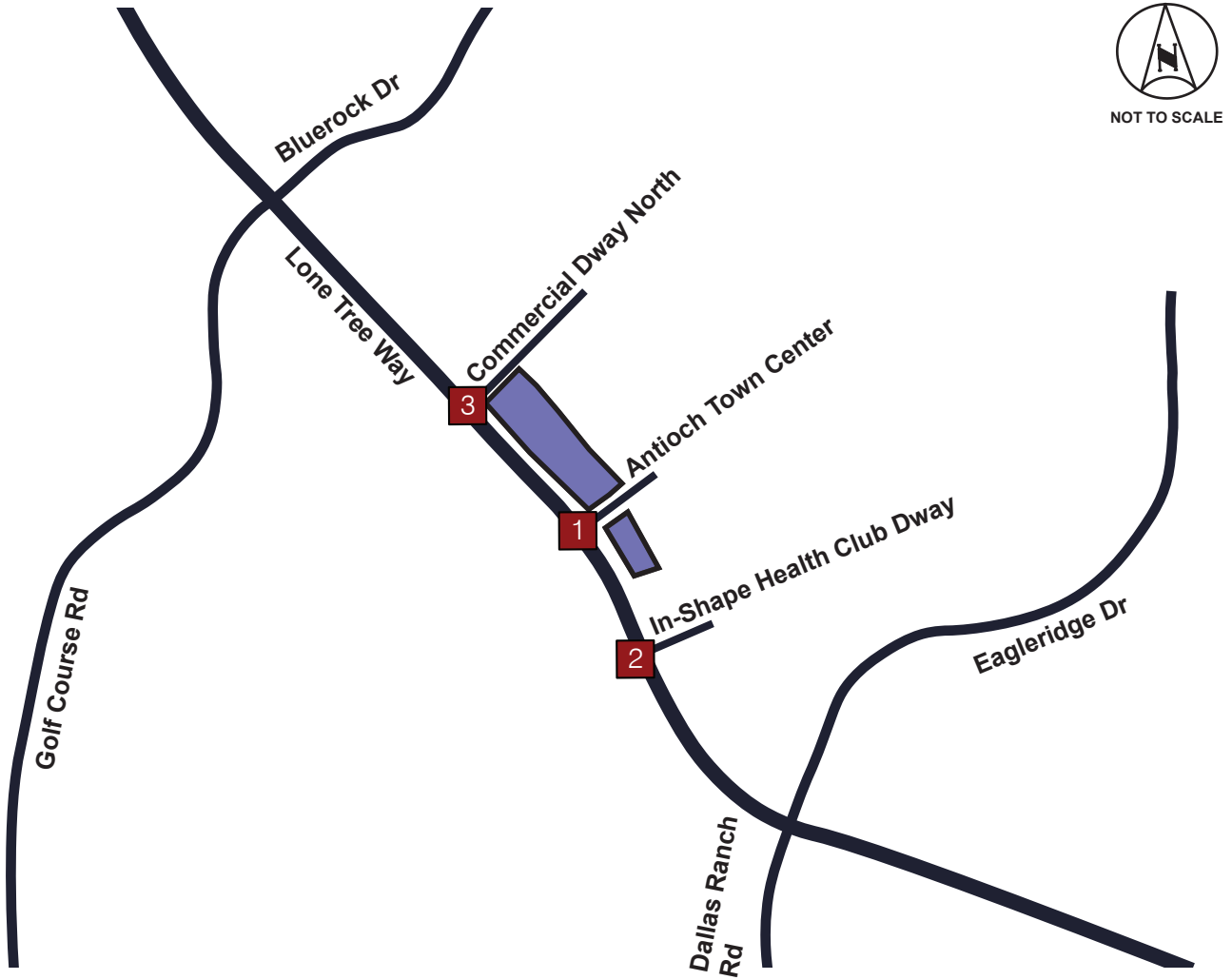


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Exhibit 3

Study Intersections, Traffic Control, and Lane Geometry

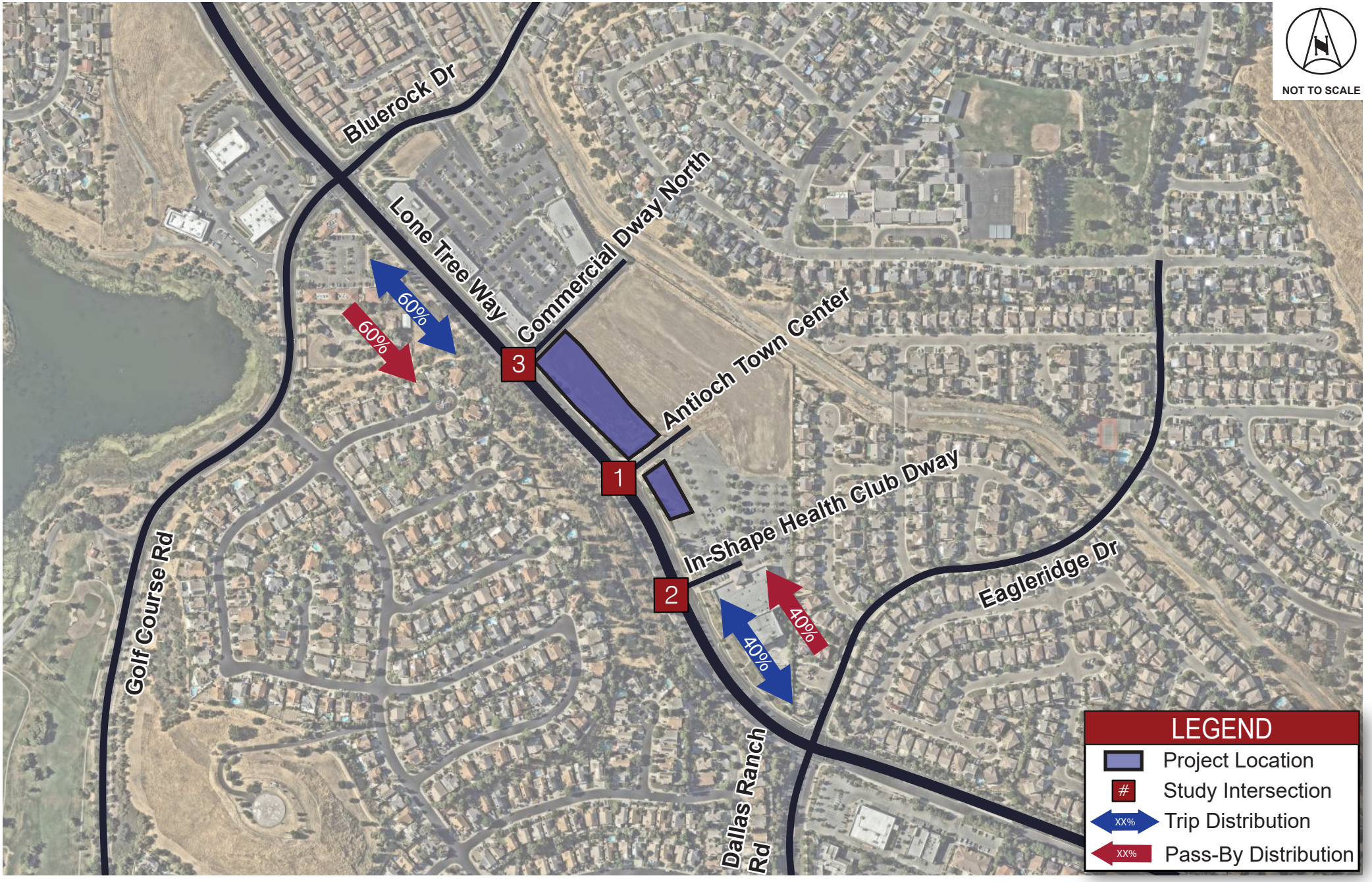

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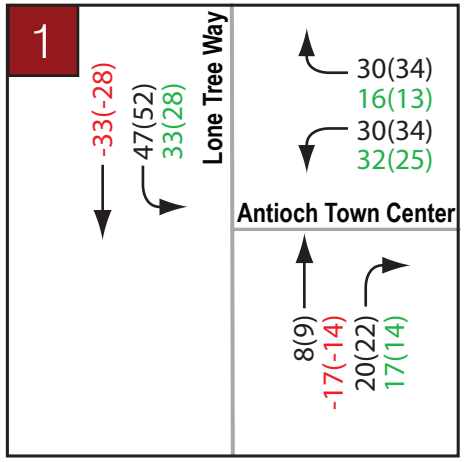
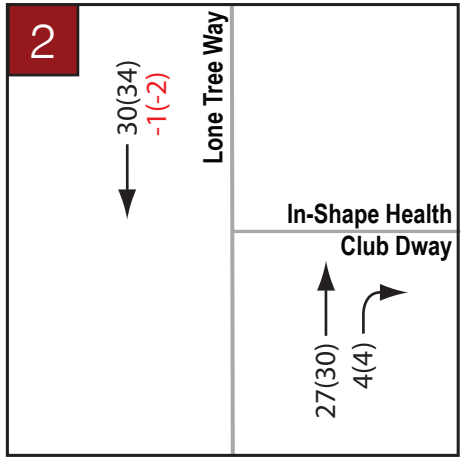
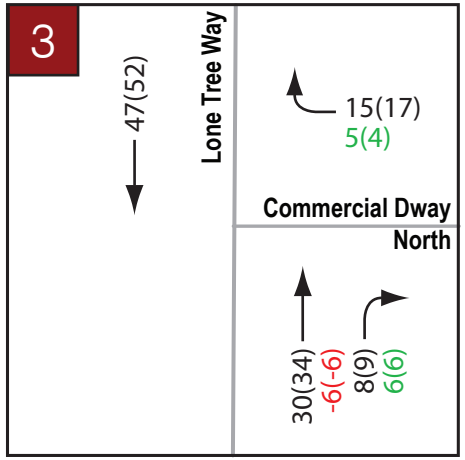
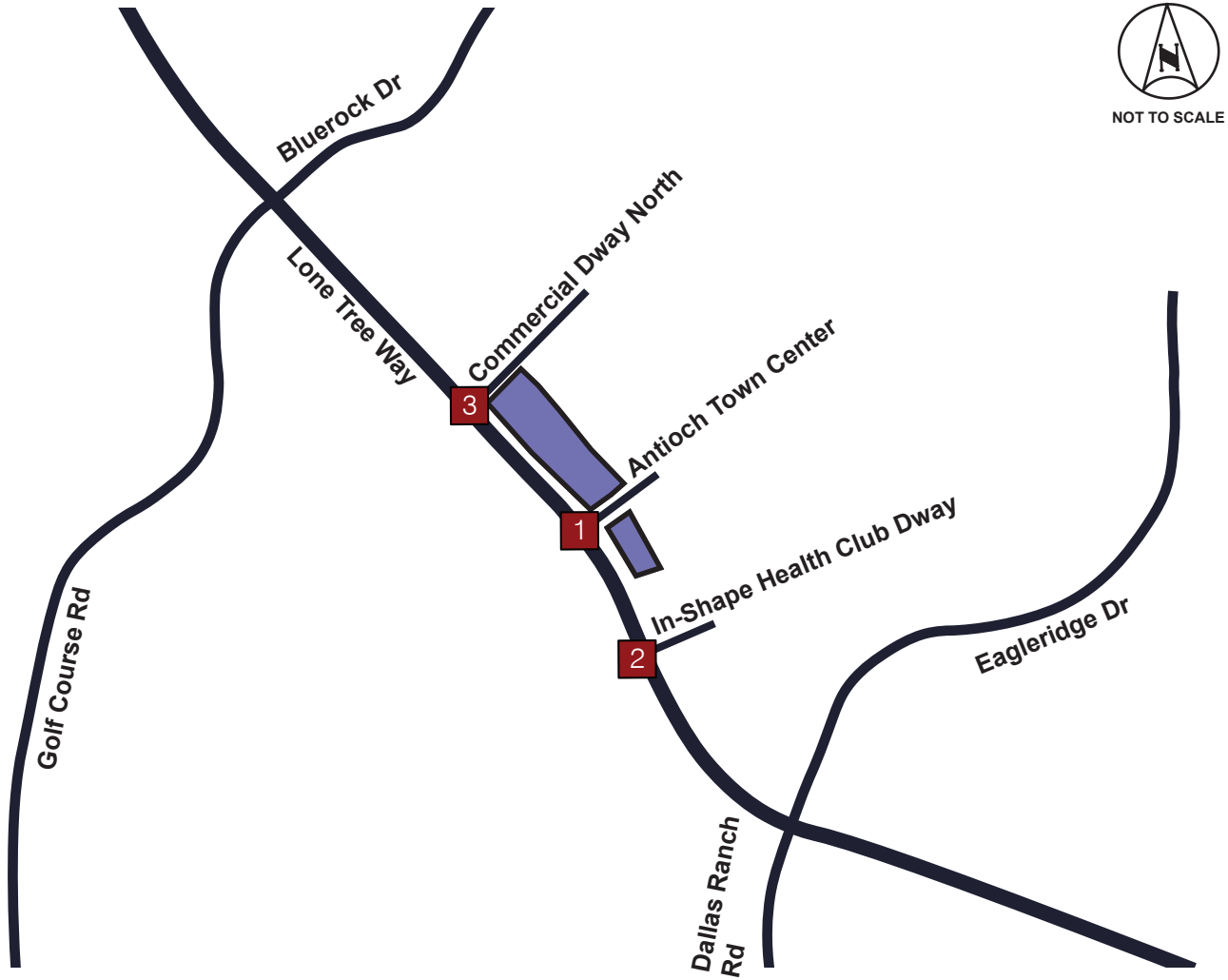
Exhibit 4
Project Trip Distribution









LEGEND

- Project Location
- # Study Intersection
- XX(YY) AM(PM) Project Trip Assignment
- XX(YY) AM(PM) Pass-By Assignment
- XX(YY)

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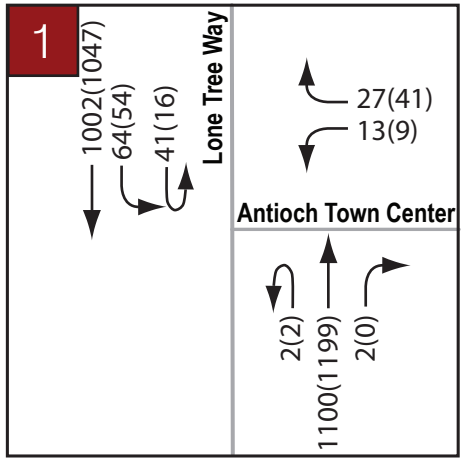
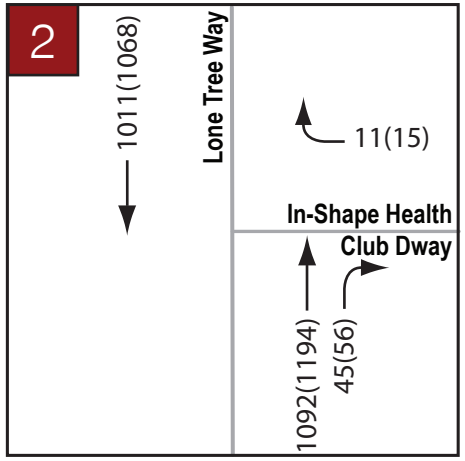
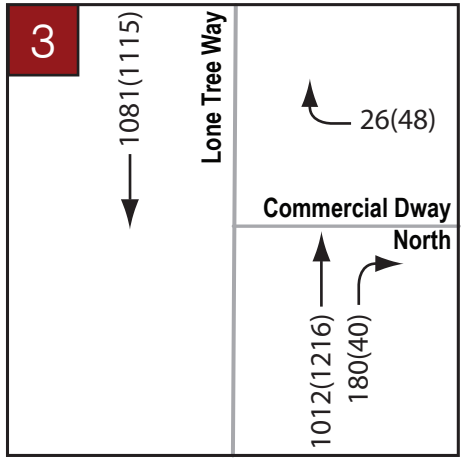
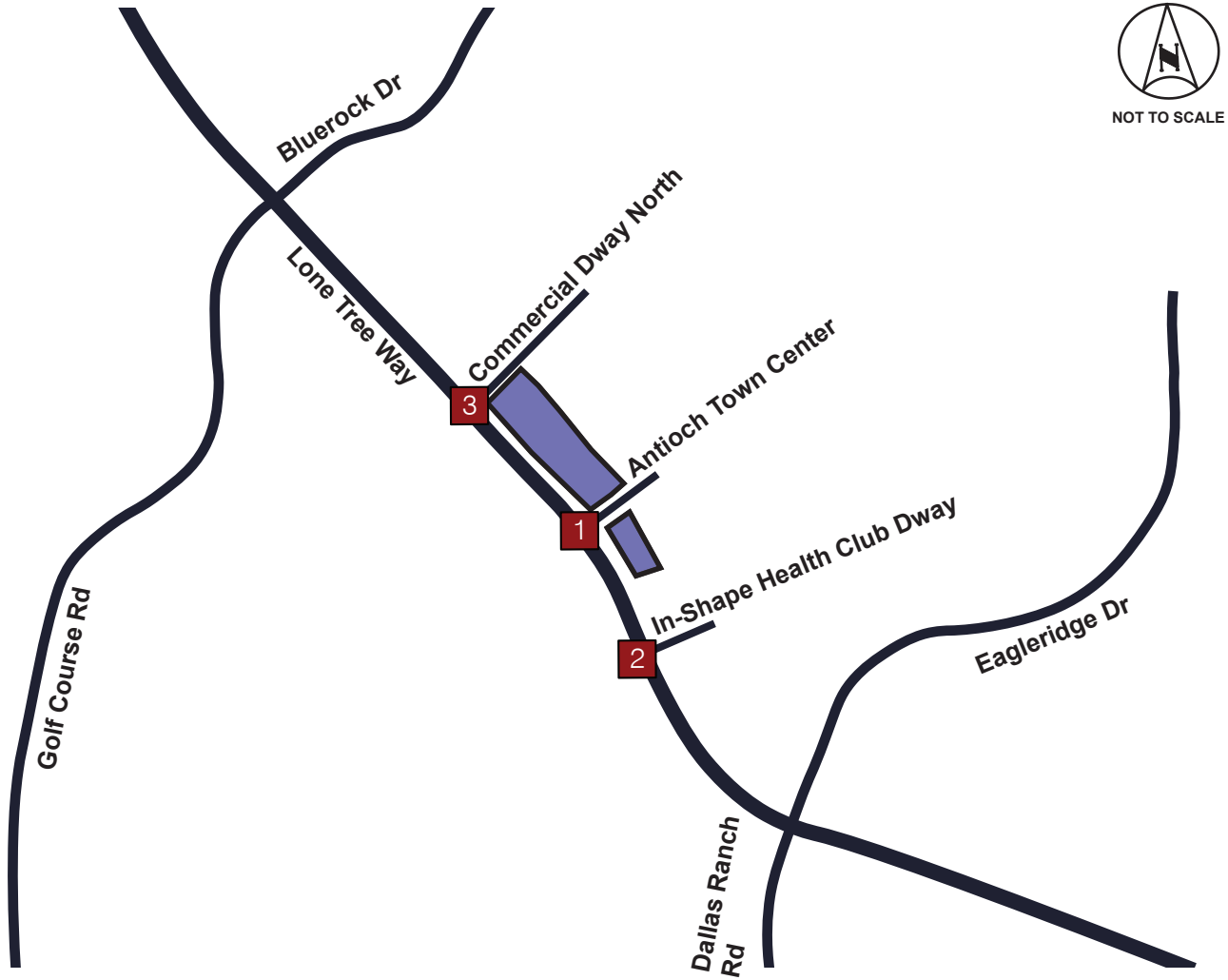
Exhibit 4
Project Trip Assignment









LEGEND

- Project Location
- # Study Intersection
- XX(YY) AM(PM) Peak-Hour Volumes

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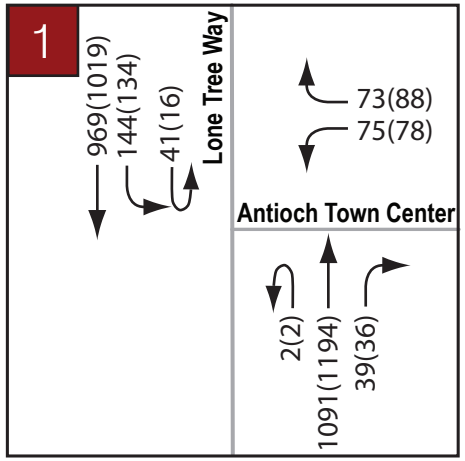
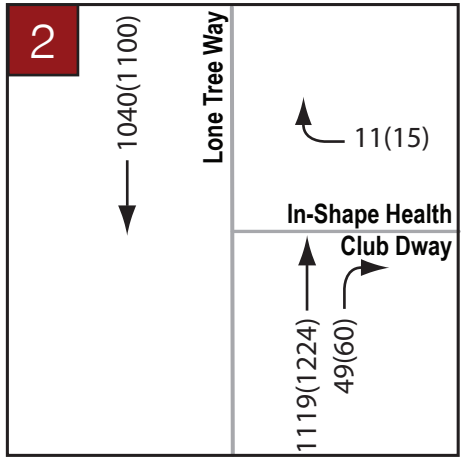
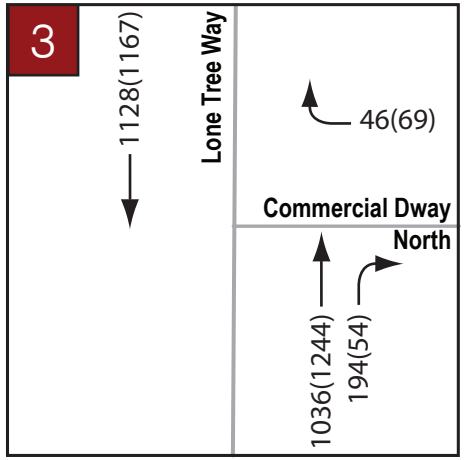
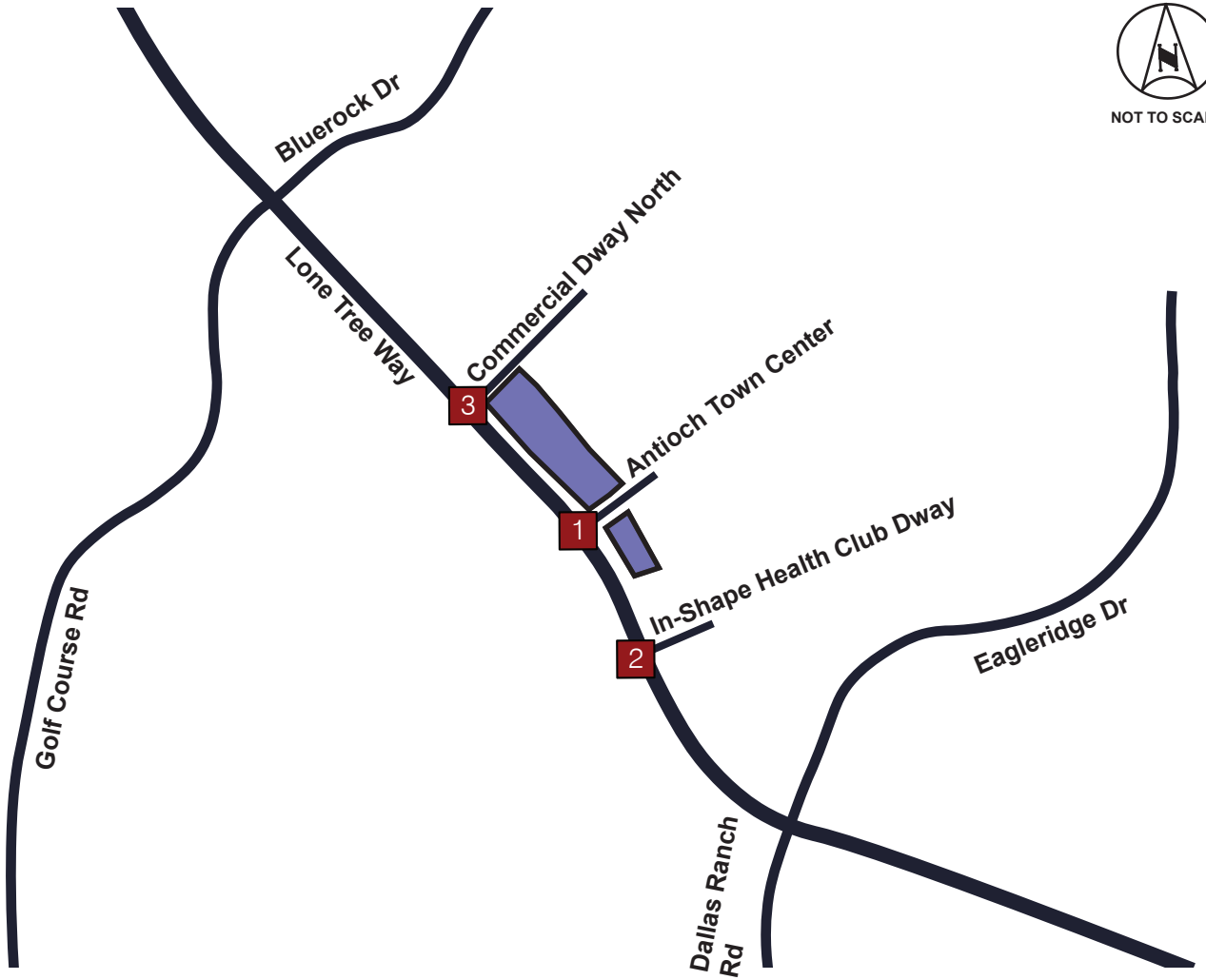
Exhibit 6

Existing (2023) Peak-Hour Traffic Volumes









LEGEND

- Project Location
- # Study Intersection
- XX(YY) AM(PM) Peak-Hour Volumes

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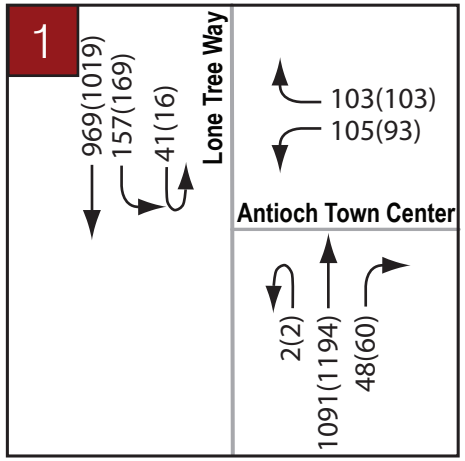
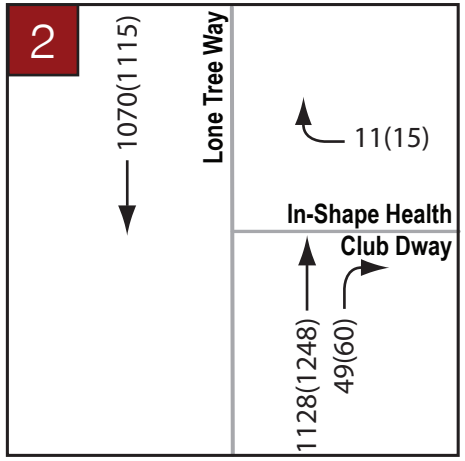
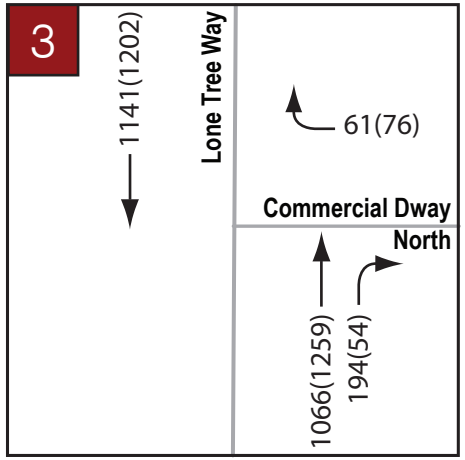
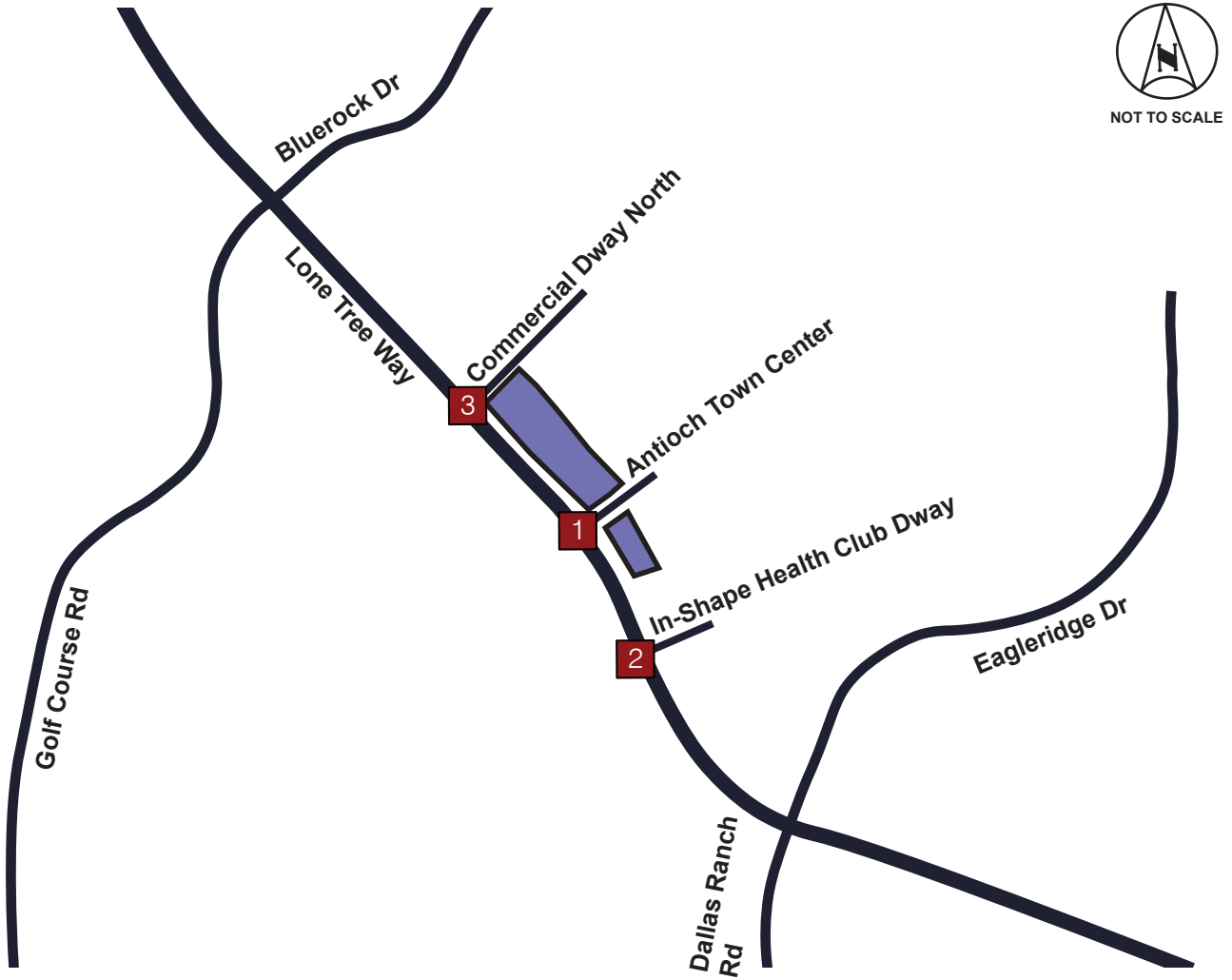
Exhibit 7

Existing (2023) plus Project Peak-Hour Traffic Volumes









NOT TO SCALE

LEGEND

- Project Location
- # Study Intersection
- XX(YY) AM(PM) Peak-Hour Volumes

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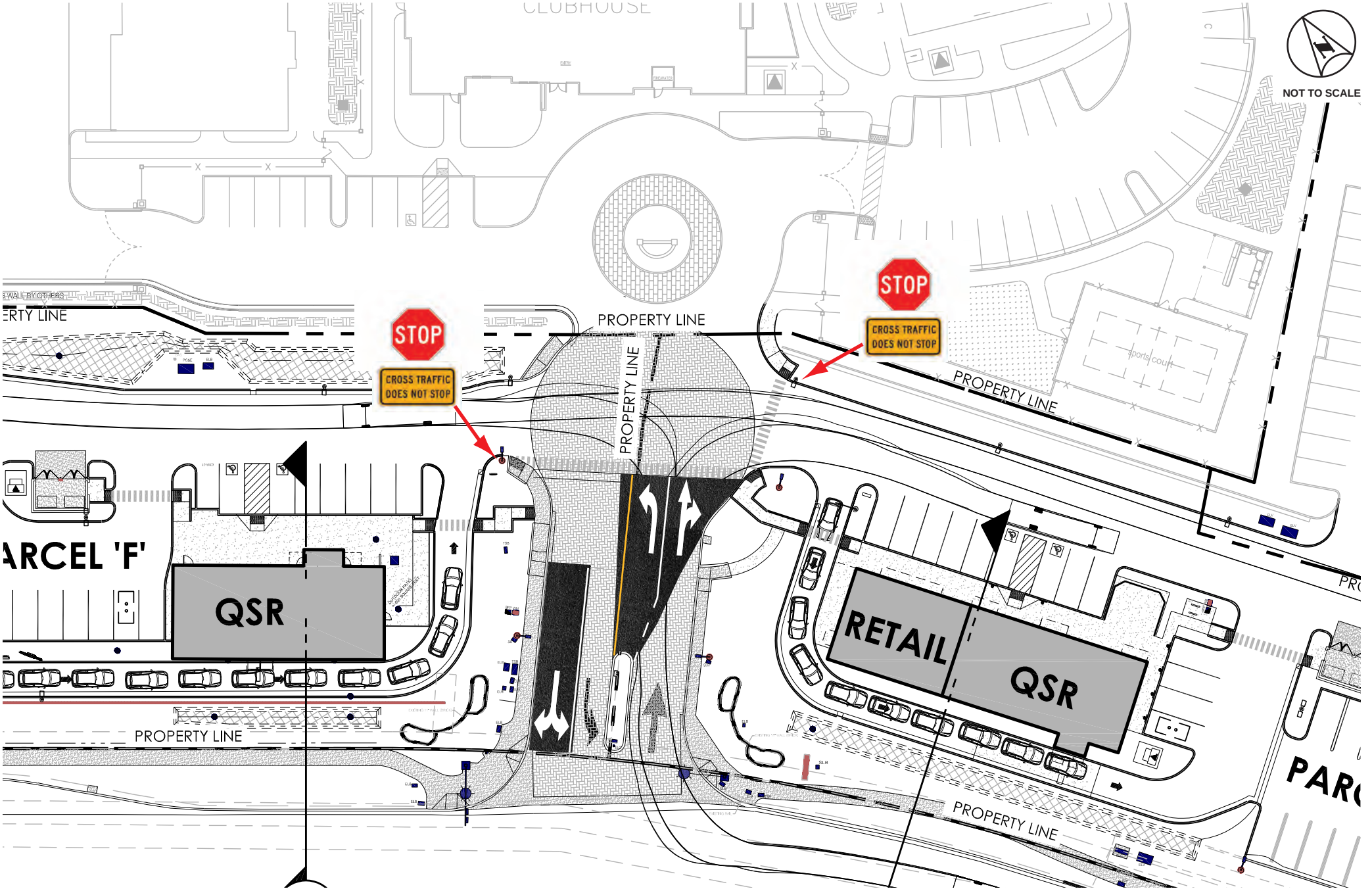
Exhibit 8

Existing (2023) plus Project plus Residential Peak-Hour Traffic Volumes



Site Plan Source: API, 04/30/2024

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Exhibit 9

Recommended Internal Intersection Signing and Striping Configuration

Attachment A

SDMC LDC Trip Generation Data

TABLE 1

May 2003

TRIP GENERATION RATE SUMMARY
(WEEKDAY)

LAND USE	DRIVEWAY [1] [2] VEHICLE TRIP RATE	CUMULATIVE [8] VEHICLE TRIP RATE	PEAK HOUR AND IN/OUT RATIO AM (IN:OUT)	PM IN:OUT)
AGRICULTURE (OPEN SPACE) [3]	2 trips/acre	2 trips/acre	- -	- -
AIRPORT [3]				
Commercial	100 trips/flight; 60 trips/acre	100 trips/flight; 60 trips/acre	6% (6:4)	7% (5:5)
General Aviation	2 trips/flight; 6 trips/acre	2 trips/flight; 6 trips/acre	- -	- -
CEMETERY	5 trips/acre	5 trips/acre	- -	- -
COMMERCIAL-RETAIL [4] [5]				
Automobile Services:				
Car Dealer	50 trips/1,000 sq. ft.; 300 trips/acre	45 trips/1,000 sq. ft.; 297 trips/acre	5% (7:3)	8% (4:6)
Carwash:				
Full service	900 trips/site; 600 trips/acre	450 trips/site; 300 trips/acre	4% (5:5)	9% (5:5)
Self service	100 trips/wash stall	50 trips/wash stall	4% (5:5)	8% (5:5)
Gasoline Stations:	130 trips/vehicle fueling space; 750 trips/station	26 trips/vehicle fueling space; 150 trips/station	7% (5:5)	11% (5:5)
With food mart	150 trips/vehicle fueling space	30 trips/vehicle fueling space	8% (5:5)	8% (5:5)
With fully automated carwash	135 trips/vehicle fueling space	27 trips/vehicle fueling space	- -	- -
With food mart & fully automated carwash	155 trips/vehicle fueling space	31 trips/vehicle fueling space	8% (5:5)	9% (5:5)
Parts Sale	62 trips/1,000 sq. ft.	56 trips/1,000 sq. ft.	4% (5:5)	10% (5:5)
Repair Shop	20 trips/1,000 sq. ft.; 20 trips/service stall; 400 trips acre	18 trips/1,000 sq. ft.; 19 trips/service stall	8% (7:3)	11% (4:6)
Tire Store	25 trips/1,000 sq. ft.; 30 trips/service stall	23 trips/1,000 sq. ft.; 27 trips/service stall	7% (6:4)	11% (5:5)
Convenience Market Chain:				
Open Up to 16 Hours Per Day	500 trips/1,000 sq. ft.	250 trips/1,000 sq. ft.	8% (5:5)	8% (5:5)
Open 24 Hours	700 trips/1,000 sq. ft.	350 trips/1,000 sq. ft.	9% (5:5)	7% (5:5)
Discount Store/Discount Club	70 trips/1,000 sq. ft.	49 trips/1,000 sq. ft.	2% (6:4)	10% (5:5)
Drugstore	90 trips/1,000 sq. ft.	40 trips/1,000 sq. ft.	4% (6:4)	10% (5:5)
Furniture Store	6 trips/1,000 sq. ft.; 100 trips/acre	5.4 trips/1,000 sq. ft.	4% (7:3)	9% (5:5)
Lumber/Home Improvement Store	30 trips/1,000 sq. ft.; 150 trips/acre	27 trips/1,000 sq. ft.; 135 trips/acre	7% (6:4)	9% (5:5)
Nursery	40 trips/1,000 sq. ft.; 90 trips/acre	36 trips/1,000 sq. ft.; 81 trips/acre	3% (6:4)	10% (5:5)
Restaurant:				
Quality	100 trips/1,000 sq. ft.; 3 trips/seat; 500 trips/acre	90 trips/1,000 sq. ft.; 2.7 trips/seat; 450 trips/acre	1% (6:4)	8% (7:3)
High Turnover (sit-down)	130 trips/1,000 sq. ft.; 7 trips/seat; 1,200 trips/acre	104 trips/1,000 sq. ft.; 5.6 trips/seat; 460 trips/acre	8% (5:5)	8% (6:4)
Fast Food (with or without drive-through)	700 trips/1,000 sq. ft.; 22 trips/seat; 3,000 trips/acre	420 trips/1,000 sq. ft.; 13.2 trips/seat; 1,800 trips/acre	4% (6:4)	8% (5:5)
Shopping Center:				
Neighborhood (30,000 sq. ft. or more GLA on 4 or more acres)	120 trips/1,000 sq. ft. GLA; 1,200 trips/acre	72 trips/1,000 sq. ft.; 720 trips/acre	4% (6:4)	11% (5:5)
Community (100,000 sq. ft. or more GLA on 10 or more acres)	70 trips/1,000 sq. ft. GLA; 700 trips/acre	49 trips/1,000 sq. ft.; 490 trips/acre	3% (6:4)	10% (5:5)
Regional (300,000 sq. ft. or more GLA) (6)	Ln(T) = 0.756 Ln(x) + 5.25 *	0.8 [Ln (T) = 0.756 Ln (x) + 5.25] *	2% (7:3)	9% (5:5)
Specialty Retail Center/Strip Commercial	40 trips/1,000 sq. ft.; 400 trips/acre	36 trips/1,000 sq. ft.; 360 trips/acre	3% (6:4)	9% (5:5)
Supermarket	150 trips/1,000 sq. ft.; 2,000 trips/acre	90 trips/1,000 sq. ft.; 2,000 trips/acre	4% (7:3)	10% (5:5)

* See Table 2

TRIP GENERATION RATE SUMMARY
(WEEKDAY)

LAND USE	DRIVEWAY [1] [2] VEHICLE TRIP RATE	CUMULATIVE [8] VEHICLE TRIP RATE	PEAK HOUR AND IN/OUT RATIO AM (IN:OUT)	PM (IN:OUT)
EDUCATION [3]				
University (4 years or higher)	2.5 trips/student; 100 trips/acre	2.5 trips/student; 100 trips/acre	10% (9:1)	9% (3:7)
Community College (2 years)	1.6 trips/student; 18 trips/1,000 sq. ft.; 80 trips/acre	1.6 trips/student; 18 trips/1,000 sq. ft.; 80 trips/acre	12% (9:1)	8% (3:7)
High School	1.8 trips/student; 50 trips/acre; 11 trips/1,000 sq. ft.	1.8 trips/student; 50 trips/acre; 11 trips/1,000 sq. ft.	20% (8:2)	14% (3:7)
Junior High/Middle School	1.4 trip/student; 12 trips/1,000 sq. ft.; 40 trips/acre	1.4 trips/student; 12 trips/1,000 sq. ft.; 40 trips/acre	24% (7:3)	7% (3:7)
Elementary School	2.9 trips/student; 39 trips/1,000 sq. ft.; 136 trips/acre	2.9 trips/student; 39 trips/1,000 sq ft.; 136 trips/acre	31% (6:4)	19% (4:6)
Day Care Center	5 trips/child; 80 trips/1,000 sq. ft.	5 trips/child; 80 trips/1,000 sq. ft.	19% (5:5)	18% (5:5)
FINANCIAL INSTITUTION (Bank or Credit Union) [5]				
Excluding drive-through	150 trips/1,000 sq. ft.; 1,000 trips/acre	112.5 trips/1,000 sq. ft.; 750 trips/acre	4% (7:3)	8% (4:6)
With drive-through	200 trips/1,000 sq. ft.; 1,500 trips/acre	150 trips/1,000 sq. ft.; 1,125 trips/acre	5% (6:4)	10% (5:5)
Drive-through only	250 trips/lane	187.5 trips/lane	3% (5:5)	13% (5:5)
HOSPITAL [3]				
Convalescent/Nursing	3 trips/bed	3 trips/bed	7% (6:4)	7% (4:6)
General	20 trips/bed; 20 trips/1,000 sq. ft.; 300 trips/acre	20 trips/bed; 20 trips/1,000 sq. ft.; 300 trips/acre	9% (7:3)	10% (3:7)
HOUSE OF WORSHIP [4]				
General	15 trips/1,000 sq. ft.; quadruple rates for days of	9 trips/1,000 sq. ft.; quadruple rate for days of	4% (8:2)	8% (5:5)
Without School or Day Care	5 trips/1,000 sq. ft.; quadruple rates for days of assembly	5 trips/1,000 sq. ft.; quadruple rate for days of	4% (8:2)	8% (5:5)
INDUSTRIAL				
Industrial/Business Park (some commercial included) [3]	16 trips/1,000 sq. ft.; 200 trips/acre	16 trips/1,000 sq. ft.; 200 trips/acre	12% (8:2)	12% (2:8)
Small Industrial Park [7] *	15 trips/1,000 sq. ft.; 120 trips/acre	15 trips/1,000 sq. ft.; 120 trips/acre	11% (9:1)	12% (2:8)
Large Industrial Park *	8 trips/1,000 sq. ft.; 100 trips/acre	8 trips/1,000 sq. ft.; 100 trips/acre	11% (9:1)	12% (2:8)
Manufacturing/Assembly	4 trips/1,000 sq. ft.; 50 trips/acre	4 trips/1,000 sq. ft.; 50 trips/acre	20% (9:1)	20% (2:8)
Rental Storage	2 trips/1,000 sq. ft.; 30 trips/acre	2 trips/1,000 sq. ft.; 30 trips/acre	6% (5:5)	9% (5:5)
Scientific Research and Development	8 trips/1,000 sq. ft.; 80 trips/acre	8 trips/1,000 sq. ft.; 80 trips/acre	16% (9:1)	14% (1:9)
Truck Terminal	10 trips/1,000 sq. ft.; 7 trips/bay; 80 trips/acre	10 trips/1,000 sq. ft.; 7 trips/bay; 80 trips/acre	9% (4:6)	8% (5:5)
Warehousing	5 trips/1,000 sq. ft.; 60 trips/acre	5 trips/1,000 sq. ft.; 60 trips/acre	15% (7:3)	16% (4:6)
LIBRARY [3]	50 trips/1,000 sq. ft.; 400 trips/acre		2% (7:3)	10% (5:5)
Less than 100,000 sq. ft.		20 trips/1,000 sq. ft.	2% (7:3)	10% (5:5)
100,000 sq. ft. or more		16 trips/1,000 sq. ft.	2% (7:3)	10% (5:5)

* Small amount of local serving commercial included. May have multiple shifts.

TRIP GENERATION RATE SUMMARY
(WEEKDAY)

LAND USE	DRIVEWAY [1] [2] VEHICLE TRIP RATE	CUMULATIVE [8] VEHICLE TRIP RATE	PEAK HOUR AND IN/OUT RATIO AM (IN:OUT)	PM (IN:OUT)
LODGING [3]				
Hotel (w/convention facilities/restaurant)	10 trips/room; 300 trips/acre	10 trips/room; 300 trips/acre	6% (6:4)	8% (6:4)
Motel	9 trips/room; 200 trips/acre	9 trips/room; 200 trips/acre	8% (4:6)	9% (4:6)
Resort Hotel	8 trips/room; 100 trips/acre	8 trips/room; 100 trips/acre	5% (6:4)	7% (6:4)
MILITARY BASE [3]	2.5 trips/employee (military or civilian)	2.5 trips/employee (military or civilian)	9% (9:1)	10% (6:4)
OFFICE				
Commercial Office [6]	Ln(T) = 0.756 Ln(x) + 3.95; 450 trips/acre	Ln(T) = 0.756 Ln(x) + 3.95; 450 trips/acre	13% (9:1)	14% (2:8)
Corporate Headquarters/Single Tenant Office	10 trips/1,000 sq. ft.	10 trips/1,000 sq. ft.	15% (9:1)	15% (1:9)
Department of Motor Vehicles	180 trips/1,000 sq. ft.; 900 trips/acre	18 trips/1,000 sq. ft.	6% (6:4)	11% (4:6)
Government Office (Civic Center):	30 trips/1,000 sq. ft.		9% (9:1)	12% (3:7)
Less than 100,000 sq. ft.		20 trips/1,000 sq. ft.	9% (9:1)	12% (3:7)
100,000 sq. ft. or more		16 trips/1,000 sq. ft.	9% (9:1)	12% (3:7)
Medical Office:	50 trips/1,000 sq. ft.; 500 trips/acre		6% (8:2)	10% (3:7)
Less than 100,000 sq. ft.		20 trips/1,000 sq. ft.	6% (8:2)	10% (3:7)
100,000 sq. ft. or more		16 trips/1,000 sq. ft.	6% (8:2)	10% (3:7)
Post Office:				
Distribution (central/walk-in only)	90 trips/1,000 sq. ft.	76 trips/1,000 sq. ft.	5%	7%
Community (without mail drop lane)	200 trips/1,000 sq. ft.; 1,300 trips/acre	168 trips/1,000 sq. ft.; 1,092 trips/acre	6% (6:4)	9% (5.5)
Community (with mail drop lane)	300 trips/1,000 sq. ft.; 2,000 trips/acre		7% (5:5)	9% (3.7)
Less than 100,000 sq. ft.		168 trips/1,000 sq. ft.; 1,092 trips/acre	7% (5:5)	7% (6:4)
100,000 sq. ft. or more		252 trips/1,000 sq. ft.; 1,680 trips/acre	7% (5:5)	8% (7:3)
RECREATION				
Bowling Center	30 trips/lane; 300 trips/acre	30 trips/lane; 300 trips/acre	7% (7:3)	10% (4:6)
Golf Course	600 trips/course; 40 trips/hole; 8 trips/acre	600 trips/course; 40 trips/hole; 8 trips/acre	6% (8:2)	9% (3:7)
Marina	4 trips/berth; 20 trips/acre	4 trips/berth; 20 trips/acre	3% (3:7)	7% (6:4)
Movie Theater	80 trips/1,000 sq. ft.; 1.8 trips/seat	80 trips/1,000 sq. ft.; 1.8 trips/seat	0.3%	8% (7:3)
Park:				
Beach, Ocean or Bay	600 trips/1,000 ft. shoreline; 60 trips/acre	600 trips/1,000 ft. shoreline; 60 trips/acre	- -	11% (4:6)
Developed	50 trips/acre	50 trips/acre	4%	8%
Undeveloped	5 trips/acre	5 trips/acre	4%	8%
Racquetball/Tennis/Health Club	40 trips/1,000 sq. ft.; 40 trips/court; 300 trips/acre	40 trips/1,000 sq. ft.; 40 trips/court; 300 trips/acre	4% (6:4)	9% (6:4)
San Diego Zoo	115 trips/acre	115 trips/acre	- -	- -
Sea World	80 trips/acre	80 trips/acre	- -	- -
Sport Facility:				
Indoor	30 trips/acre	30 trips/acre	- -	- -
Outdoor	50 trips/acre	50 trips/acre	- -	- -

TRIP GENERATION RATE SUMMARY
(WEEKDAY)

LAND USE	DRIVEWAY [1] [2] VEHICLE TRIP RATE	CUMULATIVE [8] VEHICLE TRIP RATE	PEAK HOUR AND IN/OUT RATIO AM (IN:OUT)	PM (IN:OUT)
RESIDENTIAL [3]				
Congregate Care Facility	2 trips/dwelling unit	2 trips/dwelling unit	3% (6:4)	8% (5:5)
Estate Housing	12 trips/dwelling unit	12 trips/dwelling unit	- -	- -
Mobile Home	5 trips/dwelling unit; 40 trips/acre	5 trips/dwelling unit; 40 trips/acre	9% (3:7)	12% (6:4)
Multiple Dwelling Unit:				
Under 20 dwelling units/acre	8 trips/dwelling unit	8 trips/dwelling unit	8% (2:8)	10% (7:3)
Over 20 dwelling units/acre	6 trips/dwelling unit	6 trips/dwelling unit	8% (2:8)	9% (7:3)
Retirement/Senior Citizen Housing	4 trips/dwelling unit	4 trips/dwelling unit	- -	- -
Single Family Detached:				
Urbanized Area [1]	9 trips/dwelling unit	9 trips/dwelling unit	8% (2:8)	10% (7:3)
Urbanizing Area [1]	10 trips/dwelling unit	10 trips/dwelling unit	8% (2:8)	10% (7:3)
TRANSPORTATION FACILITIES [3]				
Bus Depot	25 trips/1,000 sq. ft.	25 trips/1,000 sq. ft.		
Park & Ride Lots	400 trips/acre; 600 trips/paved acre	400 trips/acre; 600 trips/paved acre	14% (7:3)	15% (3:7)
Transit Station (rail)	300 trips/acre	300 trips/acre	14% (7:3)	15% (3:7)

Notes:

(1) From the 1990 Trip Generation Manual. Driveway rates reflect trips that are generated by a site. These rates are used to calculate the total number of trips that impact the project and its immediate vicinity.

(2) Does not include trip rates for Centre City area. See Table 5.

(3) San Diego Association of Governments (SANDAG), "Traffic Generators," San Diego, California, December 1996, and July 1998.

(4) City of San Diego memo, "Trip Generation Rate for Churches," December 9, 1992.

(5) Refer to Cumulative Vehicle Trip Rate column for reduced trip rates.

(6) Ln = Natural logarithm; fitted curve logarithmic equation is used for Commercial Office and Regional Shopping Center. For example, the trip generation of an Office Building with 100,000 sq. ft. of GLA is: Ln(T) = 0.756 Ln(100) + 3.95, or Ln(T) = 0.756 (4.60517) + 3.95, or Ln(T) = 3.481509 + 3.95, or Ln(T) = 7.431509, which is 1,688 trips. The trip generation of a Regional Shopping Center with 1,000,000 sq. ft. of GLA is: Ln(T) = 0.756 Ln(1,000) + 5.25, or Ln(T) = 0.756 (6.907755) + 5.25, or Ln(T) = 5.222263 + 5.25, or Ln(T) = 10.47226, which is 35,322 trips. See Table 2 for calculated trip generation for selected sizes of Regional Shopping Centers, and Table 3 for calculated trip generation for selected sizes of Commercial Offices. GLA = Gross Leasable Area; T = trips; x = GLA in 1,000 square feet.

(7) Institute of Transportation Engineers, "Trip Generation," 5th and 6th Editions, Washington, District of Columbia, 1991 and 1998.

(8) Trips made to a site are Pass-By and Cumulative trips. See Appendix A for definitions of these trips. Cumulative rates are used to determine the community-wide impact of a new project.

Kimley»Horn

Attachment B

Traffic Count Data Sheets

National Data & Surveying Services

Intersection Turning Movement Count

Location: Lone Tree Way & Antioch Town Center
City: Antioch
Control: Signalized

Project ID: 23-080336-001
Date: 11/7/2023

Data - Total

NS/EW Streets:	Lone Tree Way				Lone Tree Way				Antioch Town Center				Antioch Town Center				
AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	1	3	1	0	1	3	0	0	0	0	0	0	1	0	1	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
6:00 AM	0	154	0	1	6	53	0	0	0	0	0	0	3	0	4	0	221
6:15 AM	0	124	0	0	5	44	0	1	0	0	0	0	2	0	5	0	181
6:30 AM	0	153	0	0	11	69	0	0	0	0	0	0	3	0	3	0	239
6:45 AM	0	142	0	2	6	88	0	1	0	0	0	0	0	0	8	0	247
7:00 AM	0	131	0	1	9	74	0	0	0	0	0	0	1	0	5	0	221
7:15 AM	0	176	0	0	8	96	0	1	0	0	0	0	5	0	7	0	293
7:30 AM	0	185	0	0	5	156	0	5	0	0	0	0	3	0	13	0	367
7:45 AM	0	265	0	1	7	231	0	4	0	0	0	0	4	0	7	0	519
8:00 AM	0	248	0	0	16	345	0	10	0	0	0	0	6	0	6	0	631
8:15 AM	0	288	1	0	22	251	0	12	0	0	0	0	1	0	5	0	580
8:30 AM	0	299	1	1	19	175	0	15	0	0	0	0	2	0	9	0	521
8:45 AM	0	275	0	0	23	185	0	14	0	0	0	0	3	0	5	0	505
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	0	2440	2	6	137	1767	0	63	0	0	0	0	33	0	77	0	4525
APPROACH %'s :	0.00%	99.67%	0.08%	0.25%	6.96%	89.83%	0.00%	3.20%					30.00%	0.00%	70.00%	0.00%	
PEAK HR :	07:45 AM - 08:45 AM																TOTAL
PEAK HR VOL :	0	1100	2	2	64	1002	0	41	0	0	0	0	13	0	27	0	2251
PEAK HR FACTOR :	0.000	0.920	0.500	0.500	0.727	0.726	0.000	0.683	0.000	0.000	0.000	0.000	0.542	0.000	0.750	0.000	0.892
		0.917				0.746								0.833			

PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	1	3	1	0	1	3	0	0	0	0	0	0	1	0	1	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
4:00 PM	0	316	0	1	17	269	0	5	0	0	0	0	6	0	8	0	622
4:15 PM	0	312	0	0	11	264	0	6	0	0	0	0	5	0	8	0	606
4:30 PM	0	320	0	0	14	258	0	2	0	0	0	0	3	0	9	0	606
4:45 PM	0	251	0	1	12	256	0	3	0	0	0	0	5	0	16	0	544
5:00 PM	0	246	0	0	15	258	0	1	0	0	0	0	8	0	8	0	536
5:15 PM	0	242	1	0	10	268	0	0	0	0	0	0	9	0	9	0	539
5:30 PM	0	228	1	2	22	232	0	1	0	0	0	0	10	0	11	0	507
5:45 PM	0	202	1	0	22	276	0	1	0	0	0	0	8	0	7	0	517
6:00 PM	0	160	1	2	22	190	0	2	0	0	0	0	7	0	4	0	388
6:15 PM	0	184	0	4	15	203	0	3	0	0	0	0	11	0	12	0	432
6:30 PM	0	169	0	4	20	186	0	3	0	0	0	0	6	0	14	0	402
6:45 PM	0	140	1	4	11	160	0	3	0	0	0	0	6	0	18	0	343
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	0	2770	5	18	191	2820	0	30	0	0	0	0	84	0	124	0	6042
APPROACH %'s :	0.00%	99.18%	0.18%	0.64%	6.28%	92.73%	0.00%	0.99%					40.38%	0.00%	59.62%	0.00%	
PEAK HR :	04:00 PM - 05:00 PM																TOTAL
PEAK HR VOL :	0	1199	0	2	54	1047	0	16	0	0	0	0	19	0	41	0	2378
PEAK HR FACTOR :	0.000	0.937	0.000	0.500	0.794	0.973	0.000	0.667	0.000	0.000	0.000	0.000	0.792	0.000	0.641	0.000	0.956
		0.938				0.960								0.714			

National Data & Surveying Services

Intersection Turning Movement Count

Location: Lone Tree Way & In-Shape Health Club Dwy
City: Antioch
Control: 1-Way Stop(WB)

Project ID: 23-080336-002
Date: 11/7/2023

Data - Total

NS/EW Streets:	Lone Tree Way				Lone Tree Way				In-Shape Health Club Dwy				In-Shape Health Club Dwy				
AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	3	1	0	0	3	0	0	0	0	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
6:00 AM	0	149	11	0	0	55	0	0	0	0	0	0	0	0	4	0	219
6:15 AM	0	122	4	0	0	48	0	0	0	0	0	0	0	0	3	0	177
6:30 AM	0	151	6	0	0	71	0	0	0	0	0	0	0	0	1	0	229
6:45 AM	0	137	8	0	0	88	0	0	0	0	0	0	0	0	7	0	240
7:00 AM	0	131	5	0	0	78	0	0	0	0	0	0	0	0	4	0	218
7:15 AM	0	171	4	0	0	102	0	0	0	0	0	0	0	0	2	0	279
7:30 AM	0	193	8	0	0	159	0	0	0	0	0	0	0	0	0	0	360
7:45 AM	0	254	6	0	0	225	0	0	0	0	0	0	0	0	4	0	489
8:00 AM	0	253	7	0	0	362	0	0	0	0	0	0	0	0	3	0	625
8:15 AM	0	277	14	0	0	252	0	0	0	0	0	0	0	0	4	0	547
8:30 AM	0	308	18	0	0	172	0	0	0	0	0	0	0	0	0	0	498
8:45 AM	0	263	16	0	0	194	0	0	0	0	0	0	0	0	5	0	478
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	0	2409	107	0	0	1806	0	0	0	0	0	0	0	0	37	0	4359
APPROACH %'s :	0.00%	95.75%	4.25%	0.00%	0.00%	100.00%	0.00%	0.00%					0.00%	0.00%	100.00%	0.00%	
PEAK HR :	07:45 AM - 08:45 AM																TOTAL
PEAK HR VOL :	0	1092	45	0	0	1011	0	0	0	0	0	0	0	0	11	0	2159
PEAK HR FACTOR :	0.000	0.886	0.625	0.000	0.000	0.698	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.688	0.000	0.864
		0.872				0.698								0.688			

PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	3	1	0	0	3	0	0	0	0	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
4:00 PM	0	320	9	0	0	266	0	0	0	0	0	0	0	0	2	0	597
4:15 PM	0	308	18	0	0	279	0	0	0	0	0	0	0	0	2	0	607
4:30 PM	0	312	14	0	0	258	0	0	0	0	0	0	0	0	5	0	589
4:45 PM	0	254	15	0	0	265	0	0	0	0	0	0	0	0	6	0	540
5:00 PM	0	231	10	0	0	263	0	0	0	0	0	0	0	0	7	0	511
5:15 PM	0	240	18	0	0	280	0	0	0	0	0	0	0	0	3	0	541
5:30 PM	0	225	13	0	0	244	0	0	0	0	0	0	0	0	6	0	488
5:45 PM	0	201	10	0	0	274	0	0	0	0	0	0	0	0	4	0	489
6:00 PM	0	162	7	0	0	209	0	0	0	0	0	0	0	0	5	0	383
6:15 PM	0	169	13	0	0	218	0	0	0	0	0	0	0	0	13	0	413
6:30 PM	0	167	8	0	0	194	0	0	0	0	0	0	0	0	6	0	375
6:45 PM	0	142	12	0	0	172	0	0	0	0	0	0	0	0	9	0	335
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	0	2731	147	0	0	2922	0	0	0	0	0	0	0	0	68	0	5868
APPROACH %'s :	0.00%	94.89%	5.11%	0.00%	0.00%	100.00%	0.00%	0.00%					0.00%	0.00%	100.00%	0.00%	
PEAK HR :	04:00 PM - 05:00 PM																TOTAL
PEAK HR VOL :	0	1194	56	0	0	1068	0	0	0	0	0	0	0	0	15	0	2333
PEAK HR FACTOR :	0.000	0.933	0.778	0.000	0.000	0.957	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.625	0.000	0.961
		0.950				0.957								0.625			

National Data & Surveying Services

Intersection Turning Movement Count

Location: Lone Tree Way & Commercial Dwy North/Eye To Eye Optometry Dwy
City: Antioch
Control: 1-Way Stop(WB)

Project ID: 23-080336-003
Date: 11/7/2023

Data - Total

NS/EW Streets:	Lone Tree Way				Lone Tree Way				Commercial Dwy North/Eye To Eye Optometry Dwy				Commercial Dwy North/Eye To Eye Optometry Dwy				
AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	3	1	0	0	4	0	0	0	0	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
6:00 AM	0	148	8	0	0	58	0	0	0	0	0	0	0	0	1	0	215
6:15 AM	0	128	4	0	0	51	0	0	0	0	0	0	0	0	0	0	183
6:30 AM	0	147	5	0	0	79	0	0	0	0	0	0	0	0	1	0	232
6:45 AM	0	147	8	0	0	97	0	0	0	0	0	0	0	0	1	0	253
7:00 AM	0	127	8	0	0	81	0	0	0	0	0	0	0	0	2	0	218
7:15 AM	0	166	14	0	0	107	0	0	0	0	0	0	0	0	2	0	289
7:30 AM	0	190	18	0	0	164	0	0	0	0	0	0	0	0	4	0	376
7:45 AM	0	240	30	0	0	248	0	0	0	0	0	0	0	0	5	0	523
8:00 AM	0	242	28	0	0	366	0	0	0	0	0	0	0	0	5	0	641
8:15 AM	0	252	53	0	0	284	0	0	0	0	0	0	0	0	5	0	594
8:30 AM	0	272	50	0	0	211	0	0	0	0	0	0	0	0	4	0	537
8:45 AM	0	246	49	0	0	220	0	0	0	0	0	0	0	0	12	0	527
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	0	2305	275	0	0	1966	0	0	0	0	0	0	0	0	42	0	4588
APPROACH %'s :	0.00%	89.34%	10.66%	0.00%	0.00%	100.00%	0.00%	0.00%					0.00%	0.00%	100.00%	0.00%	
PEAK HR :	08:00 AM - 09:00 AM																TOTAL
PEAK HR VOL :	0	1012	180	0	0	1081	0	0	0	0	0	0	0	0	26	0	2299
PEAK HR FACTOR :	0.000	0.930	0.849	0.000	0.000	0.738	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.542	0.000	0.897
		0.925				0.738								0.542			

PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	3	1	0	0	4	0	0	0	0	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
4:00 PM	0	317	10	0	0	295	0	0	0	0	0	0	0	0	14	0	636
4:15 PM	0	315	13	0	0	277	0	0	0	0	0	0	0	0	8	0	613
4:30 PM	0	318	12	0	0	277	0	0	0	0	0	0	0	0	9	0	616
4:45 PM	0	266	5	0	0	266	0	0	0	0	0	0	0	0	17	0	554
5:00 PM	0	248	7	0	0	277	0	0	0	0	0	0	0	0	13	0	545
5:15 PM	0	240	4	0	0	294	0	0	0	0	0	0	0	0	7	0	545
5:30 PM	0	239	7	0	0	241	0	0	0	0	0	0	0	0	9	0	496
5:45 PM	0	208	3	0	0	305	0	0	0	0	0	0	0	0	3	0	519
6:00 PM	0	156	3	0	0	207	0	0	0	0	0	0	0	0	1	0	367
6:15 PM	0	200	6	0	0	222	0	0	0	0	0	0	0	0	3	0	431
6:30 PM	0	178	2	0	0	208	0	0	0	0	0	0	0	0	3	0	391
6:45 PM	0	162	5	0	0	174	0	0	0	0	0	0	0	0	2	0	343
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	0	2847	77	0	0	3043	0	0	0	0	0	0	0	0	89	0	6056
APPROACH %'s :	0.00%	97.37%	2.63%	0.00%	0.00%	100.00%	0.00%	0.00%					0.00%	0.00%	100.00%	0.00%	
PEAK HR :	04:00 PM - 05:00 PM																TOTAL
PEAK HR VOL :	0	1216	40	0	0	1115	0	0	0	0	0	0	0	0	48	0	2419
PEAK HR FACTOR :	0.000	0.956	0.769	0.000	0.000	0.945	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.706	0.000	0.951
		0.952				0.945								0.706			

Attachment C

Analysis Worksheets for Existing (2023) Conditions

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	6:50	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4	4
Vehs Entered	2794	2692	2636	2704	2657	2721	2640
Vehs Exited	2787	2707	2642	2699	2654	2739	2644
Starting Vehs	24	33	30	30	31	36	29
Ending Vehs	31	18	24	35	34	18	25
Travel Distance (mi)	1075	1040	1015	1039	1016	1055	1018
Travel Time (hr)	36.9	34.9	33.1	34.5	34.6	36.3	34.2
Total Delay (hr)	7.0	6.0	4.8	5.8	6.3	7.0	5.9
Total Stops	531	466	419	456	521	547	457
Fuel Used (gal)	35.4	34.3	33.1	33.9	33.9	34.9	33.4

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	5	5	5	5
# of Recorded Intervals	4	4	4	4
Vehs Entered	2643	2665	2617	2677
Vehs Exited	2656	2670	2621	2682
Starting Vehs	29	37	34	31
Ending Vehs	16	32	30	26
Travel Distance (mi)	1018	1028	1005	1031
Travel Time (hr)	34.2	34.3	33.8	34.7
Total Delay (hr)	6.0	5.8	5.7	6.0
Total Stops	487	447	449	478
Fuel Used (gal)	33.5	33.7	33.2	33.9

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	607	624	563	593	557	586	565
Vehs Exited	607	611	566	599	539	597	567
Starting Vehs	24	33	30	30	31	36	29
Ending Vehs	24	46	27	24	49	25	27
Travel Distance (mi)	240	242	222	233	215	233	223
Travel Time (hr)	7.7	8.2	7.2	7.6	7.1	7.6	7.1
Total Delay (hr)	1.0	1.5	1.1	1.1	1.1	1.1	0.9
Total Stops	83	125	100	96	93	95	75
Fuel Used (gal)	7.6	8.0	7.2	7.5	7.0	7.5	7.1

Interval #1 Information

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	567	566	599	584
Vehs Exited	558	578	597	581
Starting Vehs	29	37	34	31
Ending Vehs	38	25	36	32
Travel Distance (mi)	223	226	234	229
Travel Time (hr)	7.4	7.5	7.6	7.5
Total Delay (hr)	1.2	1.2	1.1	1.1
Total Stops	106	95	89	96
Fuel Used (gal)	7.3	7.4	7.5	7.4

Interval #2 Information

Start Time	7:15
End Time	7:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	792	760	729	758	738	757	750
Vehs Exited	785	776	720	740	755	743	734
Starting Vehs	24	46	27	24	49	25	27
Ending Vehs	31	30	36	42	32	39	43
Travel Distance (mi)	297	291	273	277	280	282	280
Travel Time (hr)	10.5	10.3	9.0	9.5	9.5	9.8	9.8
Total Delay (hr)	2.2	2.1	1.3	1.8	1.7	1.9	2.0
Total Stops	158	146	103	139	134	140	153
Fuel Used (gal)	10.0	9.7	8.9	9.3	9.3	9.5	9.4

Interval #2 Information

Start Time	7:15
End Time	7:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	768	759	695	750
Vehs Exited	773	746	704	748
Starting Vehs	38	25	36	32
Ending Vehs	33	38	27	35
Travel Distance (mi)	291	287	263	282
Travel Time (hr)	9.7	9.7	8.5	9.6
Total Delay (hr)	1.6	1.7	1.2	1.8
Total Stops	123	133	91	131
Fuel Used (gal)	9.5	9.5	8.7	9.4

Interval #3 Information

Start Time	7:30
End Time	7:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	765	729	764	772	768	755	758
Vehs Exited	765	720	762	763	760	750	768
Starting Vehs	31	30	36	42	32	39	43
Ending Vehs	31	39	38	51	40	44	33
Travel Distance (mi)	289	275	287	295	287	289	292
Travel Time (hr)	10.1	8.8	9.4	10.0	10.1	10.5	9.8
Total Delay (hr)	2.0	1.2	1.3	1.8	2.1	2.5	1.7
Total Stops	148	89	122	148	154	185	119
Fuel Used (gal)	9.7	8.9	9.5	9.7	9.8	9.8	9.6

Interval #3 Information

Start Time	7:30
End Time	7:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	773	730	766	758
Vehs Exited	752	715	754	752
Starting Vehs	33	38	27	35
Ending Vehs	54	53	39	43
Travel Distance (mi)	288	268	288	286
Travel Time (hr)	10.0	9.2	9.9	9.8
Total Delay (hr)	2.0	1.7	1.9	1.8
Total Stops	159	143	150	142
Fuel Used (gal)	9.5	8.8	9.8	9.5

Interval #4 Information Recording

Start Time	7:45
End Time	8:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	630	579	580	581	594	623	567
Vehs Exited	630	600	594	597	600	649	575
Starting Vehs	31	39	38	51	40	44	33
Ending Vehs	31	18	24	35	34	18	25
Travel Distance (mi)	248	232	232	233	234	251	222
Travel Time (hr)	8.7	7.6	7.6	7.4	8.0	8.4	7.5
Total Delay (hr)	1.8	1.2	1.1	1.0	1.5	1.5	1.3
Total Stops	142	106	94	73	140	127	110
Fuel Used (gal)	8.1	7.6	7.4	7.3	7.9	8.1	7.2

Interval #4 Information Recording

Start Time	7:45
End Time	8:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	535	610	557	586
Vehs Exited	573	631	566	602
Starting Vehs	54	53	39	43
Ending Vehs	16	32	30	26
Travel Distance (mi)	217	247	221	234
Travel Time (hr)	7.1	7.9	7.7	7.8
Total Delay (hr)	1.1	1.1	1.5	1.3
Total Stops	99	76	119	110
Fuel Used (gal)	7.1	8.0	7.2	7.6

1: Lone Tree Way & Antioch Town Center Performance by movement

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	0.2	0.1	0.0	1.6	0.0	0.7	1.0	0.5	4.1
Total Del/Veh (s)	51.1	6.5	67.8	4.9	1.1	50.2	48.6	1.5	5.9
Stop Delay (hr)	0.2	0.1	0.0	0.9	0.0	0.6	1.0	0.2	3.0
Stop Del/Veh (s)	49.7	6.6	67.6	2.7	1.1	48.0	45.1	0.5	4.2

2: Lone Tree Way & In-Shape Dwy Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.1
Denied Del/Veh (s)	0.1	0.1	2.3	0.0	0.1
Total Delay (hr)	0.0	0.1	0.0	0.5	0.6
Total Del/Veh (s)	4.1	0.4	0.2	1.4	0.9
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	4.2	0.0	0.0	0.0	0.0

3: Lone Tree Way & Commercial Dwy North Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Delay (hr)	0.1	0.6	0.1	0.0	0.8
Total Del/Veh (s)	5.3	2.1	1.8	0.1	1.1
Stop Delay (hr)	0.1	0.0	0.0	0.0	0.1
Stop Del/Veh (s)	5.3	0.1	0.1	0.0	0.1

Total Network Performance

Denied Delay (hr)	0.1
Denied Del/Veh (s)	0.2
Total Delay (hr)	5.9
Total Del/Veh (s)	7.8
Stop Delay (hr)	3.1
Stop Del/Veh (s)	4.1

Intersection: 1: Lone Tree Way & Antioch Town Center

Movement	WB	WB	NB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	R	U	T	T	T	R	UL	T	T	T
Maximum Queue (ft)	60	54	30	172	169	169	12	208	107	112	116
Average Queue (ft)	14	15	3	66	62	56	1	95	18	20	17
95th Queue (ft)	41	39	16	133	133	128	7	171	72	76	71
Link Distance (ft)	186	186		403	403	403		476	476	476	476
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)			155				280				
Storage Blk Time (%)				0							
Queuing Penalty (veh)				0							

Intersection: 2: Lone Tree Way & In-Shape Dwy

Movement	WB
Directions Served	R
Maximum Queue (ft)	25
Average Queue (ft)	7
95th Queue (ft)	24
Link Distance (ft)	258
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 3: Lone Tree Way & Commercial Dwy North

Movement	WB
Directions Served	R
Maximum Queue (ft)	51
Average Queue (ft)	18
95th Queue (ft)	39
Link Distance (ft)	219
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	4:50	4:50	4:50	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4	4
Vehs Entered	2674	2642	2620	2608	2601	2627	2564
Vehs Exited	2691	2661	2624	2595	2620	2656	2559
Starting Vehs	40	37	36	23	43	58	28
Ending Vehs	23	18	32	36	24	29	33
Travel Distance (mi)	1042	1031	1024	1018	1018	1032	1003
Travel Time (hr)	34.5	33.7	33.4	33.4	33.2	34.2	31.7
Total Delay (hr)	5.8	5.3	5.2	5.5	5.2	5.8	4.2
Total Stops	501	468	476	511	460	526	411
Fuel Used (gal)	33.5	33.2	32.8	32.9	32.9	33.4	31.9

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	5	5	5	5
# of Recorded Intervals	4	4	4	4
Vehs Entered	2614	2583	2631	2617
Vehs Exited	2613	2590	2628	2625
Starting Vehs	22	34	28	34
Ending Vehs	23	27	31	27
Travel Distance (mi)	1026	1009	1024	1023
Travel Time (hr)	33.2	32.8	33.6	33.4
Total Delay (hr)	5.1	5.0	5.3	5.2
Total Stops	445	469	484	473
Fuel Used (gal)	32.9	32.3	33.1	32.9

Interval #0 Information Seeding

Start Time	4:50
End Time	5:00
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	665	638	607	629	599	637	605
Vehs Exited	668	649	619	630	606	658	607
Starting Vehs	40	37	36	23	43	58	28
Ending Vehs	37	26	24	22	36	37	26
Travel Distance (mi)	258	246	242	249	238	253	239
Travel Time (hr)	8.4	8.2	7.6	8.2	7.7	8.0	7.7
Total Delay (hr)	1.3	1.5	0.9	1.4	1.1	1.0	1.1
Total Stops	118	110	89	116	90	93	111
Fuel Used (gal)	8.2	7.9	7.5	8.0	7.5	7.9	7.8

Interval #1 Information

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	591	640	631	625
Vehs Exited	579	643	631	628
Starting Vehs	22	34	28	34
Ending Vehs	34	31	28	26
Travel Distance (mi)	234	253	247	246
Travel Time (hr)	7.3	8.1	8.1	7.9
Total Delay (hr)	0.9	1.2	1.3	1.2
Total Stops	86	108	121	104
Fuel Used (gal)	7.4	8.0	8.0	7.8

Interval #2 Information

Start Time	5:15
End Time	5:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	681	711	705	689	681	666	672
Vehs Exited	681	687	698	694	693	672	656
Starting Vehs	37	26	24	22	36	37	26
Ending Vehs	37	50	31	17	24	31	42
Travel Distance (mi)	266	273	273	268	262	259	256
Travel Time (hr)	8.8	9.3	8.8	9.0	8.5	9.3	8.2
Total Delay (hr)	1.5	1.8	1.3	1.6	1.2	2.1	1.2
Total Stops	121	162	121	158	116	179	118
Fuel Used (gal)	8.7	9.0	8.8	8.7	8.4	8.8	8.2

Interval #2 Information

Start Time	5:15
End Time	5:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	661	658	674	680
Vehs Exited	671	647	680	677
Starting Vehs	34	31	28	26
Ending Vehs	24	42	22	29
Travel Distance (mi)	258	253	262	263
Travel Time (hr)	8.1	8.3	8.3	8.7
Total Delay (hr)	1.0	1.3	1.1	1.4
Total Stops	96	125	107	130
Fuel Used (gal)	8.2	8.2	8.5	8.5

Interval #3 Information

Start Time	5:30
End Time	5:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	709	670	696	658	701	688	672
Vehs Exited	712	679	681	647	689	684	683
Starting Vehs	37	50	31	17	24	31	42
Ending Vehs	34	41	46	28	36	35	31
Travel Distance (mi)	270	260	267	252	272	266	266
Travel Time (hr)	9.3	8.3	8.6	8.4	8.9	9.0	8.5
Total Delay (hr)	1.8	1.1	1.2	1.5	1.4	1.7	1.2
Total Stops	161	115	119	154	135	153	123
Fuel Used (gal)	8.9	8.4	8.7	8.3	8.8	8.6	8.5

Interval #3 Information

Start Time	5:30
End Time	5:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	690	658	689	683
Vehs Exited	677	659	671	679
Starting Vehs	24	42	22	29
Ending Vehs	37	41	40	37
Travel Distance (mi)	266	255	262	264
Travel Time (hr)	8.9	8.4	8.8	8.7
Total Delay (hr)	1.6	1.3	1.5	1.4
Total Stops	139	124	141	135
Fuel Used (gal)	8.7	8.2	8.5	8.6

Interval #4 Information Recording

Start Time	5:45
End Time	6:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	619	623	612	632	620	636	615
Vehs Exited	630	646	626	624	632	642	613
Starting Vehs	34	41	46	28	36	35	31
Ending Vehs	23	18	32	36	24	29	33
Travel Distance (mi)	247	252	242	248	246	254	242
Travel Time (hr)	8.0	7.8	8.4	7.8	8.2	8.0	7.2
Total Delay (hr)	1.2	1.0	1.8	0.9	1.4	1.0	0.7
Total Stops	101	81	147	83	119	101	59
Fuel Used (gal)	7.7	8.0	7.9	7.9	8.1	8.0	7.4

Interval #4 Information Recording

Start Time	5:45
End Time	6:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	672	627	637	630
Vehs Exited	686	641	646	638
Starting Vehs	37	41	40	37
Ending Vehs	23	27	31	27
Travel Distance (mi)	268	248	252	250
Travel Time (hr)	9.0	8.0	8.4	8.1
Total Delay (hr)	1.5	1.2	1.5	1.2
Total Stops	124	112	115	103
Fuel Used (gal)	8.7	7.9	8.2	8.0

1: Lone Tree Way & Antioch Town Center Performance by movement

Movement	WBL	WBR	NBU	NBT	SBU	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	0.3	0.1	0.0	1.4	0.2	0.8	0.5	3.3
Total Del/Veh (s)	50.4	6.5	53.3	4.0	39.5	45.7	1.7	4.7
Stop Delay (hr)	0.3	0.1	0.0	0.7	0.2	0.7	0.2	2.2
Stop Del/Veh (s)	48.8	6.5	53.2	2.0	38.2	43.2	0.6	3.2

2: Lone Tree Way & In-Shape Dwy Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.1
Denied Del/Veh (s)	0.1	0.1	2.3	0.0	0.1
Total Delay (hr)	0.0	0.2	0.0	0.4	0.6
Total Del/Veh (s)	3.2	0.4	0.2	1.4	0.9
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	3.4	0.0	0.0	0.0	0.0

3: Lone Tree Way & Commercial Dwy North Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Delay (hr)	0.1	0.8	0.0	0.0	0.9
Total Del/Veh (s)	7.9	2.1	1.1	0.1	1.3
Stop Delay (hr)	0.1	0.0	0.0	0.0	0.2
Stop Del/Veh (s)	7.8	0.1	0.1	0.0	0.2

Total Network Performance

Denied Delay (hr)	0.1
Denied Del/Veh (s)	0.2
Total Delay (hr)	5.1
Total Del/Veh (s)	6.9
Stop Delay (hr)	2.4
Stop Del/Veh (s)	3.3

Intersection: 1: Lone Tree Way & Antioch Town Center

Movement	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	R	U	T	T	T	UL	T	T	T
Maximum Queue (ft)	63	69	25	152	152	148	142	98	98	106
Average Queue (ft)	19	23	2	60	54	45	58	21	23	15
95th Queue (ft)	49	49	13	120	117	115	116	69	71	61
Link Distance (ft)	186	186		403	403	403	476	476	476	476
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)			155							
Storage Blk Time (%)				0						
Queuing Penalty (veh)				0						

Intersection: 2: Lone Tree Way & In-Shape Dwy

Movement	WB
Directions Served	R
Maximum Queue (ft)	27
Average Queue (ft)	10
95th Queue (ft)	28
Link Distance (ft)	258
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 3: Lone Tree Way & Commercial Dwy North

Movement	WB	SB
Directions Served	R	T
Maximum Queue (ft)	70	5
Average Queue (ft)	25	0
95th Queue (ft)	52	5
Link Distance (ft)	219	92
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Attachment D

Analysis Worksheets for Existing (2023) plus Project Conditions

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	6:50	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4	4
Vehs Entered	2959	2990	2957	2907	2933	2842	2873
Vehs Exited	2977	2990	2944	2910	2939	2847	2881
Starting Vehs	40	31	29	32	37	29	40
Ending Vehs	22	31	42	29	31	24	32
Travel Distance (mi)	1101	1103	1086	1079	1081	1054	1061
Travel Time (hr)	44.4	43.9	42.3	41.9	41.9	42.5	41.9
Total Delay (hr)	13.2	12.5	11.5	11.2	11.0	12.4	11.7
Total Stops	1002	997	942	892	931	975	955
Fuel Used (gal)	39.1	39.5	38.3	38.1	38.4	37.7	37.9

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	5	5	5	5
# of Recorded Intervals	4	4	4	4
Vehs Entered	2857	2945	2866	2913
Vehs Exited	2855	2951	2872	2917
Starting Vehs	29	43	36	33
Ending Vehs	31	37	30	30
Travel Distance (mi)	1055	1091	1067	1078
Travel Time (hr)	40.4	42.5	41.9	42.4
Total Delay (hr)	10.5	11.5	11.5	11.7
Total Stops	887	940	947	946
Fuel Used (gal)	37.1	38.6	37.6	38.2

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	654	673	610	613	634	617	625
Vehs Exited	659	661	595	617	625	603	630
Starting Vehs	40	31	29	32	37	29	40
Ending Vehs	35	43	44	28	46	43	35
Travel Distance (mi)	249	257	229	233	241	227	236
Travel Time (hr)	9.8	9.9	8.4	8.8	8.8	8.8	9.2
Total Delay (hr)	2.7	2.7	2.0	2.2	2.0	2.3	2.4
Total Stops	210	219	193	196	186	202	196
Fuel Used (gal)	8.7	8.9	7.9	8.2	8.4	7.9	8.4

Interval #1 Information

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	618	650	628	633
Vehs Exited	610	659	622	628
Starting Vehs	29	43	36	33
Ending Vehs	37	34	42	38
Travel Distance (mi)	232	251	237	239
Travel Time (hr)	8.6	9.5	8.9	9.1
Total Delay (hr)	2.0	2.5	2.1	2.3
Total Stops	196	209	197	201
Fuel Used (gal)	8.0	8.9	8.0	8.3

Interval #2 Information

Start Time	7:15
End Time	7:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	863	840	839	857	815	788	815
Vehs Exited	836	834	827	813	824	777	810
Starting Vehs	35	43	44	28	46	43	35
Ending Vehs	62	49	56	72	37	54	40
Travel Distance (mi)	309	298	300	300	294	291	293
Travel Time (hr)	12.5	12.2	11.5	12.6	11.5	11.9	12.1
Total Delay (hr)	3.7	3.7	3.0	4.0	3.0	3.6	3.8
Total Stops	271	284	240	298	250	278	290
Fuel Used (gal)	11.0	10.9	10.6	10.9	10.6	10.5	10.5

Interval #2 Information

Start Time	7:15
End Time	7:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	806	831	830	829
Vehs Exited	809	824	835	818
Starting Vehs	37	34	42	38
Ending Vehs	34	41	37	48
Travel Distance (mi)	289	298	306	298
Travel Time (hr)	11.6	11.7	12.4	12.0
Total Delay (hr)	3.3	3.2	3.6	3.5
Total Stops	276	266	278	272
Fuel Used (gal)	10.3	10.5	11.0	10.7

Interval #3 Information

Start Time	7:30
End Time	7:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	804	844	838	819	875	800	818
Vehs Exited	817	834	835	844	866	797	804
Starting Vehs	62	49	56	72	37	54	40
Ending Vehs	49	59	59	47	46	57	54
Travel Distance (mi)	297	305	302	305	310	291	293
Travel Time (hr)	12.8	12.2	12.2	11.8	12.7	11.5	11.5
Total Delay (hr)	4.4	3.5	3.5	3.1	3.9	3.2	3.2
Total Stops	333	279	279	253	304	254	271
Fuel Used (gal)	10.8	11.1	10.7	10.8	11.2	10.3	10.5

Interval #3 Information

Start Time	7:30
End Time	7:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	789	816	797	818
Vehs Exited	775	804	787	817
Starting Vehs	34	41	37	48
Ending Vehs	48	53	47	51
Travel Distance (mi)	286	296	291	298
Travel Time (hr)	10.7	11.7	11.4	11.9
Total Delay (hr)	2.6	3.2	3.1	3.4
Total Stops	212	269	260	271
Fuel Used (gal)	10.0	10.6	10.3	10.6

Interval #4 Information Recording

Start Time	7:45
End Time	8:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	638	633	670	618	609	637	615
Vehs Exited	665	661	687	636	624	670	637
Starting Vehs	49	59	59	47	46	57	54
Ending Vehs	22	31	42	29	31	24	32
Travel Distance (mi)	247	243	254	241	235	245	238
Travel Time (hr)	9.3	9.5	10.2	8.7	8.8	10.3	9.1
Total Delay (hr)	2.4	2.6	3.0	1.9	2.2	3.3	2.3
Total Stops	188	215	230	145	191	241	198
Fuel Used (gal)	8.5	8.7	9.2	8.1	8.2	8.9	8.5

Interval #4 Information Recording

Start Time	7:45
End Time	8:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	644	648	611	634
Vehs Exited	661	664	628	653
Starting Vehs	48	53	47	51
Ending Vehs	31	37	30	30
Travel Distance (mi)	248	247	234	243
Travel Time (hr)	9.6	9.6	9.3	9.4
Total Delay (hr)	2.6	2.6	2.7	2.6
Total Stops	203	196	212	201
Fuel Used (gal)	8.8	8.6	8.3	8.6

1: Lone Tree Way & Antioch Town Center Performance by movement

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	1.1	0.2	0.0	3.7	0.1	0.7	2.4	1.0	9.1
Total Del/Veh (s)	49.1	8.1	86.0	11.3	4.3	48.2	48.8	3.0	11.9
Stop Delay (hr)	1.1	0.2	0.0	2.5	0.0	0.6	2.1	0.4	7.0
Stop Del/Veh (s)	46.8	8.0	85.2	7.6	3.9	44.4	43.6	1.3	9.1

2: Lone Tree Way & In-Shape Dwy Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.1	0.0	0.0	0.1
Denied Del/Veh (s)	0.1	0.2	2.4	0.0	0.1
Total Delay (hr)	0.0	0.2	0.0	0.6	0.9
Total Del/Veh (s)	4.4	0.6	0.2	1.8	1.2
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	4.5	0.0	0.0	0.1	0.0

3: Lone Tree Way & Commercial Dwy North Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Delay (hr)	0.1	0.9	0.2	0.0	1.2
Total Del/Veh (s)	6.2	3.0	2.7	0.1	1.6
Stop Delay (hr)	0.1	0.0	0.0	0.0	0.1
Stop Del/Veh (s)	6.1	0.1	0.1	0.0	0.2

Total Network Performance

Denied Delay (hr)	0.2
Denied Del/Veh (s)	0.2
Total Delay (hr)	11.5
Total Del/Veh (s)	14.1
Stop Delay (hr)	7.2
Stop Del/Veh (s)	8.8

Intersection: 1: Lone Tree Way & Antioch Town Center

Movement	WB	WB	NB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	R	U	T	T	T	R	UL	T	T	T
Maximum Queue (ft)	131	64	29	231	216	225	53	308	132	139	139
Average Queue (ft)	65	28	3	110	106	103	13	162	34	42	33
95th Queue (ft)	120	54	16	192	185	191	41	272	89	98	93
Link Distance (ft)	186	186		403	403	403		476	476	476	476
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)			155				280				
Storage Blk Time (%)				2		0					
Queuing Penalty (veh)				0		0					

Intersection: 2: Lone Tree Way & In-Shape Dwy

Movement	WB
Directions Served	R
Maximum Queue (ft)	25
Average Queue (ft)	9
95th Queue (ft)	27
Link Distance (ft)	258
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 3: Lone Tree Way & Commercial Dwy North

Movement	WB	NB	SB
Directions Served	R	T	T
Maximum Queue (ft)	58	49	5
Average Queue (ft)	24	2	0
95th Queue (ft)	46	50	5
Link Distance (ft)	219	476	92
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 5: Bend

Movement	NW
Directions Served	T
Maximum Queue (ft)	3
Average Queue (ft)	0
95th Queue (ft)	3
Link Distance (ft)	92
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	4:50	4:50	4:50	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4	4
Vehs Entered	2824	2808	2802	2782	2816	2813	2865
Vehs Exited	2838	2805	2790	2771	2828	2813	2871
Starting Vehs	38	31	28	31	56	34	39
Ending Vehs	24	34	40	42	44	34	33
Travel Distance (mi)	1058	1053	1051	1042	1052	1053	1073
Travel Time (hr)	40.0	41.6	40.6	39.2	39.5	39.1	40.8
Total Delay (hr)	10.4	12.0	11.0	9.9	9.9	9.6	10.7
Total Stops	872	933	914	861	908	860	916
Fuel Used (gal)	36.6	37.1	36.7	35.9	36.5	35.9	37.3

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	5	5	5	5
# of Recorded Intervals	4	4	4	4
Vehs Entered	2797	2825	2822	2815
Vehs Exited	2797	2823	2814	2816
Starting Vehs	28	33	32	34
Ending Vehs	28	35	40	34
Travel Distance (mi)	1052	1056	1055	1055
Travel Time (hr)	39.5	40.0	40.3	40.0
Total Delay (hr)	10.1	10.3	10.7	10.4
Total Stops	870	939	918	899
Fuel Used (gal)	36.3	36.6	36.7	36.6

Interval #0 Information Seeding

Start Time	4:50
End Time	5:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	724	710	643	655	656	634	589
Vehs Exited	718	710	637	656	671	637	602
Starting Vehs	38	31	28	31	56	34	39
Ending Vehs	44	31	34	30	41	31	26
Travel Distance (mi)	273	273	245	250	251	240	225
Travel Time (hr)	10.4	10.6	8.9	9.3	9.1	8.6	7.8
Total Delay (hr)	2.8	3.0	2.1	2.3	2.1	1.9	1.5
Total Stops	224	231	174	207	202	174	133
Fuel Used (gal)	9.5	9.6	8.3	8.7	8.7	8.0	7.4

Interval #1 Information

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	625	711	688	663
Vehs Exited	631	723	676	666
Starting Vehs	28	33	32	34
Ending Vehs	22	21	44	31
Travel Distance (mi)	238	269	259	252
Travel Time (hr)	8.8	10.0	9.4	9.3
Total Delay (hr)	2.1	2.5	2.2	2.2
Total Stops	180	233	188	194
Fuel Used (gal)	8.1	9.2	8.7	8.6

Interval #2 Information

Start Time	5:15
End Time	5:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	705	714	749	749	745	730	776
Vehs Exited	713	711	720	735	749	732	765
Starting Vehs	44	31	34	30	41	31	26
Ending Vehs	36	34	63	44	37	29	37
Travel Distance (mi)	263	261	272	272	275	269	285
Travel Time (hr)	9.9	10.5	11.0	10.6	10.6	10.5	11.3
Total Delay (hr)	2.5	3.1	3.3	2.9	2.8	3.0	3.3
Total Stops	217	248	252	254	266	258	280
Fuel Used (gal)	9.1	9.2	9.7	9.5	9.6	9.4	10.1

Interval #2 Information

Start Time	5:15
End Time	5:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	716	777	745	740
Vehs Exited	700	745	752	732
Starting Vehs	22	21	44	31
Ending Vehs	38	53	37	40
Travel Distance (mi)	263	281	275	272
Travel Time (hr)	10.0	11.2	11.1	10.7
Total Delay (hr)	2.6	3.2	3.3	3.0
Total Stops	229	282	287	258
Fuel Used (gal)	9.0	9.9	10.0	9.6

Interval #3 Information

Start Time	5:30
End Time	5:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	716	743	737	698	757	755	806
Vehs Exited	705	719	739	709	741	752	794
Starting Vehs	36	34	63	44	37	29	37
Ending Vehs	47	58	61	33	53	32	49
Travel Distance (mi)	260	268	274	259	276	282	299
Travel Time (hr)	10.2	11.1	10.9	9.9	10.8	10.3	11.3
Total Delay (hr)	2.9	3.5	3.2	2.6	3.1	2.4	3.0
Total Stops	243	269	272	228	259	217	259
Fuel Used (gal)	9.2	9.5	9.8	9.0	9.6	9.7	10.5

Interval #3 Information

Start Time	5:30
End Time	5:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	749	670	726	735
Vehs Exited	742	679	723	731
Starting Vehs	38	53	37	40
Ending Vehs	45	44	40	45
Travel Distance (mi)	279	251	269	272
Travel Time (hr)	10.9	9.2	10.7	10.5
Total Delay (hr)	3.0	2.1	3.1	2.9
Total Stops	254	211	261	247
Fuel Used (gal)	9.9	8.6	9.5	9.5

Interval #4 Information Recording

Start Time	5:45
End Time	6:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	679	641	673	680	658	694	694
Vehs Exited	702	665	694	671	667	692	710
Starting Vehs	47	58	61	33	53	32	49
Ending Vehs	24	34	40	42	44	34	33
Travel Distance (mi)	263	251	261	261	250	261	264
Travel Time (hr)	9.5	9.4	9.8	9.4	8.9	9.6	10.4
Total Delay (hr)	2.2	2.4	2.5	2.1	1.9	2.3	3.0
Total Stops	188	185	216	172	181	211	244
Fuel Used (gal)	8.8	8.8	8.9	8.6	8.5	8.8	9.3

Interval #4 Information Recording

Start Time	5:45
End Time	6:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	707	667	663	676
Vehs Exited	724	676	663	684
Starting Vehs	45	44	40	45
Ending Vehs	28	35	40	34
Travel Distance (mi)	272	257	252	259
Travel Time (hr)	10.0	9.6	9.0	9.6
Total Delay (hr)	2.4	2.5	2.0	2.3
Total Stops	207	213	182	199
Fuel Used (gal)	9.3	8.8	8.5	8.8

1: Lone Tree Way & Antioch Town Center Performance by movement

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	1.3	0.2	0.0	3.1	0.0	0.2	2.1	0.8	7.9
Total Del/Veh (s)	50.9	7.8	44.7	9.2	2.2	48.1	53.2	2.8	10.6
Stop Delay (hr)	1.3	0.2	0.0	2.0	0.0	0.2	1.9	0.3	6.0
Stop Del/Veh (s)	48.6	7.7	44.4	5.8	1.9	45.4	49.4	1.2	8.1

2: Lone Tree Way & In-Shape Dwy Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.1
Denied Del/Veh (s)	0.1	0.1	2.1	0.0	0.1
Total Delay (hr)	0.0	0.2	0.0	0.5	0.8
Total Del/Veh (s)	3.4	0.6	0.2	1.7	1.1
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	3.4	0.0	0.0	0.1	0.0

3: Lone Tree Way & Commercial Dwy North Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.2	0.0	0.0	0.0	0.0
Total Delay (hr)	0.2	1.0	0.0	0.0	1.3
Total Del/Veh (s)	9.1	2.9	1.8	0.1	1.8
Stop Delay (hr)	0.2	0.0	0.0	0.0	0.2
Stop Del/Veh (s)	9.0	0.1	0.1	0.0	0.3

Total Network Performance

Denied Delay (hr)	0.2
Denied Del/Veh (s)	0.2
Total Delay (hr)	10.3
Total Del/Veh (s)	13.0
Stop Delay (hr)	6.3
Stop Del/Veh (s)	8.0

Intersection: 1: Lone Tree Way & Antioch Town Center

Movement	WB	WB	NB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	R	U	T	T	T	R	UL	T	T	T
Maximum Queue (ft)	156	84	26	204	199	191	41	238	110	117	119
Average Queue (ft)	71	33	2	107	100	91	9	116	37	41	30
95th Queue (ft)	136	65	13	181	171	168	32	203	89	95	86
Link Distance (ft)	186	186		403	403	403		476	476	476	476
Upstream Blk Time (%)	0										
Queuing Penalty (veh)	0										
Storage Bay Dist (ft)			155				280				
Storage Blk Time (%)				2							
Queuing Penalty (veh)				0							

Intersection: 2: Lone Tree Way & In-Shape Dwy

Movement	WB
Directions Served	R
Maximum Queue (ft)	27
Average Queue (ft)	10
95th Queue (ft)	29
Link Distance (ft)	258
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 3: Lone Tree Way & Commercial Dwy North

Movement	WB	SB
Directions Served	R	T
Maximum Queue (ft)	82	2
Average Queue (ft)	32	0
95th Queue (ft)	61	2
Link Distance (ft)	219	92
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0

Kimley»Horn

Attachment E

Analysis Worksheets for Existing (2023) plus Project plus Residential Conditions

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	6:50	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4	4
Vehs Entered	3002	3015	2986	3001	2976	2916	3070
Vehs Exited	3018	3021	2984	3009	2988	2911	3072
Starting Vehs	40	32	40	39	39	38	30
Ending Vehs	24	26	42	31	27	43	28
Travel Distance (mi)	1093	1092	1084	1089	1087	1059	1120
Travel Time (hr)	44.3	44.5	43.9	43.9	44.3	44.1	44.6
Total Delay (hr)	13.1	13.1	12.8	12.7	13.2	13.6	12.6
Total Stops	1081	1105	1063	1027	1078	1114	1030
Fuel Used (gal)	39.6	39.6	39.3	38.7	39.3	38.4	40.1

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	5	5	5	5
# of Recorded Intervals	4	4	4	4
Vehs Entered	2991	3008	2944	2990
Vehs Exited	2996	3001	2948	2996
Starting Vehs	27	31	45	34
Ending Vehs	22	38	41	34
Travel Distance (mi)	1099	1089	1074	1089
Travel Time (hr)	43.7	43.7	43.7	44.1
Total Delay (hr)	12.3	12.5	12.8	12.9
Total Stops	1013	1013	1044	1056
Fuel Used (gal)	39.1	39.2	38.8	39.2

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	678	640	662	680	643	632	659
Vehs Exited	680	629	655	675	651	633	648
Starting Vehs	40	32	40	39	39	38	30
Ending Vehs	38	43	47	44	31	37	41
Travel Distance (mi)	251	234	244	249	241	235	244
Travel Time (hr)	10.2	9.1	9.5	10.0	9.9	9.4	9.2
Total Delay (hr)	3.0	2.3	2.6	2.9	3.0	2.6	2.2
Total Stops	237	225	222	253	244	234	208
Fuel Used (gal)	9.0	8.3	8.7	8.7	8.8	8.4	8.6

Interval #1 Information

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	645	615	664	651
Vehs Exited	638	625	668	650
Starting Vehs	27	31	45	34
Ending Vehs	34	21	41	36
Travel Distance (mi)	245	233	250	243
Travel Time (hr)	9.2	9.2	9.8	9.6
Total Delay (hr)	2.2	2.6	2.7	2.6
Total Stops	206	219	230	228
Fuel Used (gal)	8.5	8.4	8.9	8.6

Interval #2 Information

Start Time	7:15
End Time	7:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	863	876	813	863	807	821	910
Vehs Exited	843	868	824	861	791	824	884
Starting Vehs	38	43	47	44	31	37	41
Ending Vehs	58	51	36	46	47	34	67
Travel Distance (mi)	306	305	290	306	285	293	319
Travel Time (hr)	12.8	12.8	11.9	12.6	11.6	12.5	13.6
Total Delay (hr)	4.2	4.0	3.5	3.8	3.4	4.0	4.5
Total Stops	321	343	277	300	263	311	338
Fuel Used (gal)	11.2	11.2	10.7	11.2	10.3	10.7	11.7

Interval #2 Information

Start Time	7:15
End Time	7:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	862	883	842	855
Vehs Exited	861	842	847	844
Starting Vehs	34	21	41	36
Ending Vehs	35	62	36	47
Travel Distance (mi)	311	305	299	302
Travel Time (hr)	12.5	12.7	12.6	12.6
Total Delay (hr)	3.7	3.9	3.9	3.9
Total Stops	281	304	318	305
Fuel Used (gal)	11.0	11.1	11.0	11.0

Interval #3 Information

Start Time	7:30
End Time	7:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	831	860	859	851	891	796	848
Vehs Exited	842	843	854	851	879	777	865
Starting Vehs	58	51	36	46	47	34	67
Ending Vehs	47	68	41	46	59	53	50
Travel Distance (mi)	296	304	306	303	315	282	310
Travel Time (hr)	12.2	12.8	13.2	12.7	13.2	11.7	11.8
Total Delay (hr)	3.6	4.0	4.3	3.9	4.2	3.6	3.0
Total Stops	317	320	355	296	327	292	245
Fuel Used (gal)	10.9	11.3	11.4	10.9	11.5	10.3	11.0

Interval #3 Information

Start Time	7:30
End Time	7:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	851	853	861	851
Vehs Exited	818	865	856	846
Starting Vehs	35	62	36	47
Ending Vehs	68	50	41	49
Travel Distance (mi)	295	305	309	302
Travel Time (hr)	12.3	12.4	13.2	12.5
Total Delay (hr)	3.7	3.6	4.3	3.8
Total Stops	311	304	330	309
Fuel Used (gal)	10.6	10.9	11.4	11.0

Interval #4 Information Recording

Start Time	7:45
End Time	8:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	630	639	652	607	635	667	653
Vehs Exited	653	681	651	622	667	677	675
Starting Vehs	47	68	41	46	59	53	50
Ending Vehs	24	26	42	31	27	43	28
Travel Distance (mi)	239	248	245	231	246	248	247
Travel Time (hr)	9.1	9.9	9.3	8.6	9.6	10.5	10.0
Total Delay (hr)	2.3	2.8	2.4	2.1	2.6	3.4	2.9
Total Stops	206	217	209	178	244	277	239
Fuel Used (gal)	8.4	8.9	8.6	7.9	8.8	9.1	8.8

Interval #4 Information Recording

Start Time	7:45
End Time	8:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	633	657	577	635
Vehs Exited	679	669	577	655
Starting Vehs	68	50	41	49
Ending Vehs	22	38	41	34
Travel Distance (mi)	248	246	216	241
Travel Time (hr)	9.7	9.4	8.1	9.4
Total Delay (hr)	2.7	2.3	1.9	2.5
Total Stops	215	186	166	213
Fuel Used (gal)	9.0	8.7	7.5	8.6

1: Lone Tree Way & Antioch Town Center Performance by movement

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	1.6	0.3	0.0	3.9	0.1	0.6	2.6	1.0	10.1
Total Del/Veh (s)	49.5	9.2	54.0	12.1	4.2	48.9	49.3	3.2	12.9
Stop Delay (hr)	1.5	0.3	0.0	2.7	0.1	0.6	2.3	0.4	7.8
Stop Del/Veh (s)	47.1	9.0	53.0	8.2	3.7	44.9	43.9	1.3	10.0

2: Lone Tree Way & In-Shape Dwy Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.1	0.0	0.0	0.1
Denied Del/Veh (s)	0.1	0.2	2.3	0.0	0.1
Total Delay (hr)	0.0	0.2	0.0	0.7	0.9
Total Del/Veh (s)	4.3	0.6	0.2	1.8	1.2
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	4.4	0.0	0.0	0.1	0.0

3: Lone Tree Way & Commercial Dwy North Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Delay (hr)	0.2	0.9	0.2	0.0	1.3
Total Del/Veh (s)	7.6	3.1	3.0	0.1	1.7
Stop Delay (hr)	0.2	0.0	0.0	0.0	0.2
Stop Del/Veh (s)	7.5	0.1	0.1	0.0	0.3

Total Network Performance

Denied Delay (hr)	0.2
Denied Del/Veh (s)	0.2
Total Delay (hr)	12.7
Total Del/Veh (s)	15.0
Stop Delay (hr)	8.1
Stop Del/Veh (s)	9.6

Intersection: 1: Lone Tree Way & Antioch Town Center

Movement	WB	WB	NB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	R	U	T	T	T	R	UL	T	T	T
Maximum Queue (ft)	176	87	23	228	219	224	63	350	119	120	116
Average Queue (ft)	87	37	2	115	112	113	15	164	42	48	39
95th Queue (ft)	156	72	13	192	188	195	46	285	94	99	94
Link Distance (ft)	186	186		403	403	403		476	476	476	476
Upstream Blk Time (%)	1										
Queuing Penalty (veh)	0										
Storage Bay Dist (ft)			155				280				
Storage Blk Time (%)				2		0					
Queuing Penalty (veh)				0		0					

Intersection: 2: Lone Tree Way & In-Shape Dwy

Movement	WB
Directions Served	R
Maximum Queue (ft)	25
Average Queue (ft)	8
95th Queue (ft)	25
Link Distance (ft)	258
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 3: Lone Tree Way & Commercial Dwy North

Movement	WB	SB
Directions Served	R	T
Maximum Queue (ft)	70	5
Average Queue (ft)	27	0
95th Queue (ft)	53	0
Link Distance (ft)	219	92
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: Bend

Movement	NW
Directions Served	T
Maximum Queue (ft)	11
Average Queue (ft)	0
95th Queue (ft)	3
Link Distance (ft)	92
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	4:50	4:50	4:50	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4	4
Vehs Entered	2897	2938	3016	2910	2943	2862	2893
Vehs Exited	2888	2927	2994	2949	2943	2872	2895
Starting Vehs	47	34	31	68	33	42	40
Ending Vehs	56	45	53	29	33	32	38
Travel Distance (mi)	1065	1082	1105	1084	1093	1064	1071
Travel Time (hr)	41.9	45.2	44.5	42.7	42.6	41.7	42.2
Total Delay (hr)	11.8	14.6	13.2	12.0	11.6	11.7	11.9
Total Stops	990	1154	1089	1006	988	997	995
Fuel Used (gal)	37.5	38.9	39.2	38.2	38.4	37.1	37.6

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	5	5	5	5
# of Recorded Intervals	4	4	4	4
Vehs Entered	2875	2968	2865	2917
Vehs Exited	2856	2963	2861	2914
Starting Vehs	35	40	41	40
Ending Vehs	54	45	45	41
Travel Distance (mi)	1061	1095	1061	1078
Travel Time (hr)	41.2	44.1	41.8	42.8
Total Delay (hr)	11.2	13.1	11.8	12.3
Total Stops	946	1084	998	1026
Fuel Used (gal)	37.2	38.9	37.3	38.0

Interval #0 Information Seeding

Start Time	4:50
End Time	5:00
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	701	701	652	713	704	675	679
Vehs Exited	704	698	649	745	718	683	689
Starting Vehs	47	34	31	68	33	42	40
Ending Vehs	44	37	34	36	19	34	30
Travel Distance (mi)	262	263	238	277	271	257	254
Travel Time (hr)	10.0	10.3	9.2	10.6	10.1	9.7	9.7
Total Delay (hr)	2.6	2.9	2.5	2.8	2.5	2.5	2.5
Total Stops	214	249	213	216	190	208	210
Fuel Used (gal)	9.1	9.2	8.2	9.7	9.5	8.8	8.8

Interval #1 Information

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	646	737	684	690
Vehs Exited	650	732	679	696
Starting Vehs	35	40	41	40
Ending Vehs	31	45	46	33
Travel Distance (mi)	241	280	255	260
Travel Time (hr)	8.9	11.2	9.6	9.9
Total Delay (hr)	2.2	3.3	2.4	2.6
Total Stops	195	257	221	218
Fuel Used (gal)	8.3	9.8	8.9	9.0

Interval #2 Information

Start Time	5:15
End Time	5:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	750	716	833	757	789	757	777
Vehs Exited	744	721	803	750	766	750	758
Starting Vehs	44	37	34	36	19	34	30
Ending Vehs	50	32	64	43	42	41	49
Travel Distance (mi)	273	260	296	270	285	274	288
Travel Time (hr)	10.6	11.0	12.3	11.0	11.6	11.2	11.4
Total Delay (hr)	2.9	3.6	3.9	3.4	3.5	3.4	3.3
Total Stops	260	302	336	278	290	296	285
Fuel Used (gal)	9.6	9.5	10.6	9.7	10.1	9.7	10.1

Interval #2 Information

Start Time	5:15
End Time	5:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	722	748	742	759
Vehs Exited	700	760	750	750
Starting Vehs	31	45	46	33
Ending Vehs	53	33	38	44
Travel Distance (mi)	261	272	272	275
Travel Time (hr)	10.2	10.8	11.4	11.2
Total Delay (hr)	2.7	3.0	3.7	3.3
Total Stops	245	268	289	285
Fuel Used (gal)	9.2	9.7	9.8	9.8

Interval #3 Information

Start Time	5:30
End Time	5:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	746	788	813	761	748	769	778
Vehs Exited	760	770	813	762	754	774	774
Starting Vehs	50	32	64	43	42	41	49
Ending Vehs	36	50	64	42	36	36	53
Travel Distance (mi)	272	286	300	279	272	284	282
Travel Time (hr)	10.9	12.3	12.4	11.4	10.4	11.2	11.2
Total Delay (hr)	3.2	4.2	3.9	3.5	2.7	3.2	3.2
Total Stops	266	312	304	299	253	279	266
Fuel Used (gal)	9.7	10.4	10.9	10.0	9.5	10.0	10.0

Interval #3 Information

Start Time	5:30
End Time	5:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	814	735	767	772
Vehs Exited	822	739	770	773
Starting Vehs	53	33	38	44
Ending Vehs	45	29	35	42
Travel Distance (mi)	299	265	282	282
Travel Time (hr)	12.2	10.8	11.2	11.4
Total Delay (hr)	3.7	3.3	3.2	3.4
Total Stops	283	277	273	282
Fuel Used (gal)	10.7	9.6	9.9	10.1

Interval #4 Information Recording

Start Time	5:45
End Time	6:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	700	733	718	679	702	661	659
Vehs Exited	680	738	729	692	705	665	674
Starting Vehs	36	50	64	42	36	36	53
Ending Vehs	56	45	53	29	33	32	38
Travel Distance (mi)	258	273	271	258	266	249	247
Travel Time (hr)	10.4	11.6	10.5	9.7	10.5	9.6	9.9
Total Delay (hr)	3.1	3.9	2.9	2.4	3.0	2.6	2.9
Total Stops	250	291	236	213	255	214	234
Fuel Used (gal)	9.0	9.9	9.4	8.7	9.4	8.6	8.8

Interval #4 Information Recording

Start Time	5:45
End Time	6:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	693	748	672	696
Vehs Exited	684	732	662	695
Starting Vehs	45	29	35	42
Ending Vehs	54	45	45	41
Travel Distance (mi)	260	278	252	261
Travel Time (hr)	9.8	11.2	9.6	10.3
Total Delay (hr)	2.6	3.5	2.5	2.9
Total Stops	223	282	215	240
Fuel Used (gal)	9.1	9.9	8.7	9.2

1: Lone Tree Way & Antioch Town Center Performance by movement

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	1.6	0.3	0.0	3.7	0.1	0.2	2.6	0.9	9.5
Total Del/Veh (s)	52.0	8.5	53.4	10.9	3.3	52.0	54.2	3.1	12.3
Stop Delay (hr)	1.5	0.3	0.0	2.4	0.0	0.2	2.4	0.4	7.4
Stop Del/Veh (s)	49.5	8.3	52.9	7.2	2.8	48.7	49.7	1.4	9.6

2: Lone Tree Way & In-Shape Dwy Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.1
Denied Del/Veh (s)	0.1	0.1	2.3	0.0	0.1
Total Delay (hr)	0.0	0.2	0.0	0.5	0.8
Total Del/Veh (s)	4.1	0.6	0.2	1.7	1.1
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	4.1	0.0	0.0	0.1	0.1

3: Lone Tree Way & Commercial Dwy North Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.2	0.0	0.0	0.0	0.0
Total Delay (hr)	0.3	1.1	0.0	0.0	1.5
Total Del/Veh (s)	9.8	3.1	2.1	0.1	1.9
Stop Delay (hr)	0.2	0.0	0.0	0.0	0.3
Stop Del/Veh (s)	9.6	0.1	0.1	0.0	0.4

Total Network Performance

Denied Delay (hr)	0.2
Denied Del/Veh (s)	0.2
Total Delay (hr)	12.1
Total Del/Veh (s)	14.7
Stop Delay (hr)	7.7
Stop Del/Veh (s)	9.4

Intersection: 1: Lone Tree Way & Antioch Town Center

Movement	WB	WB	NB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	R	U	T	T	T	R	UL	T	T	T
Maximum Queue (ft)	193	104	45	228	222	208	64	274	113	120	120
Average Queue (ft)	81	40	2	120	114	105	16	143	40	44	36
95th Queue (ft)	152	77	12	198	190	182	47	239	93	95	93
Link Distance (ft)	186	186		403	403	403		476	476	476	476
Upstream Blk Time (%)	1	0									
Queuing Penalty (veh)	0	0									
Storage Bay Dist (ft)			155				280				
Storage Blk Time (%)				3		0					
Queuing Penalty (veh)				0		0					

Intersection: 2: Lone Tree Way & In-Shape Dwy

Movement	WB
Directions Served	R
Maximum Queue (ft)	29
Average Queue (ft)	10
95th Queue (ft)	29
Link Distance (ft)	258
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 3: Lone Tree Way & Commercial Dwy North

Movement	WB
Directions Served	R
Maximum Queue (ft)	91
Average Queue (ft)	34
95th Queue (ft)	67
Link Distance (ft)	219
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 5: Bend

Movement	NW
Directions Served	T
Maximum Queue (ft)	7
Average Queue (ft)	0
95th Queue (ft)	5
Link Distance (ft)	92
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0

Attachment F

Analysis Worksheets for Improved Conditions

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	4:50	4:50	4:50	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4	4
Vehs Entered	2802	2772	2823	2776	2709	2803	2740
Vehs Exited	2784	2754	2800	2769	2697	2800	2755
Starting Vehs	38	27	35	36	26	35	50
Ending Vehs	56	45	58	43	38	38	35
Travel Distance (mi)	1053	1042	1062	1052	1020	1052	1034
Travel Time (hr)	40.3	38.8	39.8	39.2	37.5	40.0	39.6
Total Delay (hr)	10.9	9.6	10.3	9.7	8.8	10.5	10.6
Total Stops	911	828	903	830	814	863	892
Fuel Used (gal)	36.5	35.8	36.4	36.0	34.8	36.5	35.9

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	5	5	5	5
# of Recorded Intervals	4	4	4	4
Vehs Entered	2695	2771	2850	2774
Vehs Exited	2680	2782	2839	2766
Starting Vehs	24	47	29	33
Ending Vehs	39	36	40	41
Travel Distance (mi)	1011	1043	1080	1045
Travel Time (hr)	38.0	39.4	39.4	39.2
Total Delay (hr)	9.5	10.1	9.2	9.9
Total Stops	778	839	783	844
Fuel Used (gal)	34.5	35.8	36.6	35.9

Interval #0 Information Seeding

Start Time	4:50
End Time	5:00
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	663	678	662	662	652	676	645
Vehs Exited	660	677	656	666	639	678	658
Starting Vehs	38	27	35	36	26	35	50
Ending Vehs	41	28	41	32	39	33	37
Travel Distance (mi)	251	258	251	255	245	257	247
Travel Time (hr)	9.0	9.5	9.2	9.2	9.2	9.3	9.3
Total Delay (hr)	2.0	2.3	2.3	2.1	2.3	2.0	2.4
Total Stops	183	189	197	180	222	176	194
Fuel Used (gal)	8.5	8.8	8.5	8.7	8.4	8.7	8.5

Interval #1 Information

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	645	680	682	664
Vehs Exited	640	703	674	665
Starting Vehs	24	47	29	33
Ending Vehs	29	24	37	34
Travel Distance (mi)	245	264	257	253
Travel Time (hr)	8.7	9.7	9.3	9.2
Total Delay (hr)	1.9	2.4	2.1	2.2
Total Stops	158	193	170	187
Fuel Used (gal)	8.2	8.9	8.7	8.6

Interval #2 Information

Start Time	5:15
End Time	5:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	693	707	713	731	715	713	738
Vehs Exited	697	692	693	733	715	708	732
Starting Vehs	41	28	41	32	39	33	37
Ending Vehs	37	43	61	30	39	38	43
Travel Distance (mi)	260	262	265	273	268	267	276
Travel Time (hr)	10.0	10.2	9.7	10.3	9.9	9.6	10.8
Total Delay (hr)	2.7	2.8	2.3	2.7	2.4	2.2	3.0
Total Stops	233	247	205	220	218	202	251
Fuel Used (gal)	9.1	9.0	9.0	9.3	9.2	9.1	9.7

Interval #2 Information

Start Time	5:15
End Time	5:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	727	742	735	721
Vehs Exited	710	727	728	714
Starting Vehs	29	24	37	34
Ending Vehs	46	39	44	39
Travel Distance (mi)	268	273	276	269
Travel Time (hr)	10.2	10.8	10.6	10.2
Total Delay (hr)	2.6	3.1	2.9	2.7
Total Stops	233	250	240	229
Fuel Used (gal)	9.2	9.6	9.5	9.3

Interval #3 Information

Start Time	5:30
End Time	5:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	709	724	714	704	728	715	697
Vehs Exited	689	734	717	702	731	701	682
Starting Vehs	37	43	61	30	39	38	43
Ending Vehs	57	33	58	32	36	52	58
Travel Distance (mi)	259	271	265	259	273	264	259
Travel Time (hr)	10.4	10.4	10.2	10.2	9.7	10.1	9.4
Total Delay (hr)	3.1	2.8	2.7	2.8	2.1	2.7	2.2
Total Stops	245	232	254	250	197	213	196
Fuel Used (gal)	9.0	9.6	9.1	9.0	9.1	9.1	8.7

Interval #3 Information

Start Time	5:30
End Time	5:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	658	716	728	711
Vehs Exited	673	712	746	709
Starting Vehs	46	39	44	39
Ending Vehs	31	43	26	40
Travel Distance (mi)	249	263	278	264
Travel Time (hr)	9.4	10.0	9.7	10.0
Total Delay (hr)	2.4	2.7	2.0	2.6
Total Stops	184	231	183	218
Fuel Used (gal)	8.5	9.1	9.2	9.0

Interval #4 Information Recording

Start Time	5:45
End Time	6:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	737	663	734	679	614	699	660
Vehs Exited	738	651	734	668	612	713	683
Starting Vehs	57	33	58	32	36	52	58
Ending Vehs	56	45	58	43	38	38	35
Travel Distance (mi)	283	252	281	264	235	264	252
Travel Time (hr)	10.8	8.7	10.8	9.5	8.7	11.0	10.1
Total Delay (hr)	3.0	1.7	3.0	2.2	2.1	3.6	3.0
Total Stops	250	160	247	180	177	272	251
Fuel Used (gal)	9.9	8.4	9.9	9.0	8.0	9.6	9.0

Interval #4 Information Recording

Start Time	5:45
End Time	6:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	665	633	705	679
Vehs Exited	657	640	691	678
Starting Vehs	31	43	26	40
Ending Vehs	39	36	40	41
Travel Distance (mi)	250	243	268	259
Travel Time (hr)	9.6	8.7	9.7	9.8
Total Delay (hr)	2.6	1.9	2.2	2.5
Total Stops	203	165	190	210
Fuel Used (gal)	8.6	8.2	9.1	9.0

1: Lone Tree Way & Antioch Town Center Performance by movement

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	1.3	0.2	0.0	2.9	0.0	0.2	2.1	0.7	7.5
Total Del/Veh (s)	54.3	9.3	46.0	8.5	2.2	50.4	52.8	2.5	10.1
Stop Delay (hr)	1.2	0.2	0.0	1.8	0.0	0.2	1.9	0.3	5.7
Stop Del/Veh (s)	52.1	9.0	45.7	5.3	1.9	47.9	48.8	1.0	7.8

2: Lone Tree Way & In-Shape Dwy Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.1
Denied Del/Veh (s)	0.1	0.1	2.3	0.0	0.1
Total Delay (hr)	0.0	0.2	0.0	0.5	0.7
Total Del/Veh (s)	4.0	0.6	0.2	1.6	1.1
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	4.1	0.0	0.0	0.1	0.1

3: Lone Tree Way & Commercial Dwy North Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.2	0.0	0.0	0.0	0.0
Total Delay (hr)	0.2	1.0	0.0	0.0	1.3
Total Del/Veh (s)	8.6	2.8	1.8	0.1	1.7
Stop Delay (hr)	0.2	0.0	0.0	0.0	0.2
Stop Del/Veh (s)	8.4	0.1	0.1	0.0	0.3

Total Network Performance

Denied Delay (hr)	0.2
Denied Del/Veh (s)	0.2
Total Delay (hr)	9.8
Total Del/Veh (s)	12.5
Stop Delay (hr)	6.0
Stop Del/Veh (s)	7.7

Intersection: 1: Lone Tree Way & Antioch Town Center

Movement	WB	WB	NB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	LR	U	T	T	T	R	UL	T	T	T
Maximum Queue (ft)	126	117	28	193	192	188	49	243	108	122	109
Average Queue (ft)	60	38	2	99	95	85	9	117	22	43	30
95th Queue (ft)	109	83	12	169	165	161	34	201	69	91	83
Link Distance (ft)	186	186		399	399	399		481	481	481	481
Upstream Blk Time (%)		0									
Queuing Penalty (veh)		0									
Storage Bay Dist (ft)			155				280				
Storage Blk Time (%)				1							
Queuing Penalty (veh)				0							

Intersection: 2: Lone Tree Way & In-Shape Dwy

Movement	WB
Directions Served	R
Maximum Queue (ft)	25
Average Queue (ft)	10
95th Queue (ft)	28
Link Distance (ft)	258
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 3: Lone Tree Way & Commercial Dwy North

Movement	WB	SB
Directions Served	R	T
Maximum Queue (ft)	89	7
Average Queue (ft)	32	0
95th Queue (ft)	65	8
Link Distance (ft)	219	92
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	6:50	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4	4
Vehs Entered	2858	2896	2781	2811	2800	2813	2782
Vehs Exited	2857	2892	2769	2808	2792	2829	2791
Starting Vehs	23	33	36	35	35	47	46
Ending Vehs	24	37	48	38	43	31	37
Travel Distance (mi)	1053	1068	1020	1033	1032	1026	1027
Travel Time (hr)	42.2	43.7	41.0	40.5	41.0	42.5	39.8
Total Delay (hr)	12.2	13.2	11.8	10.9	11.6	12.9	10.5
Total Stops	1006	1029	978	908	942	1046	896
Fuel Used (gal)	37.8	38.6	36.7	36.7	36.8	37.4	36.2

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	5	5	5	5
# of Recorded Intervals	4	4	4	4
Vehs Entered	2684	2861	2811	2809
Vehs Exited	2682	2854	2801	2807
Starting Vehs	28	35	32	33
Ending Vehs	30	42	42	38
Travel Distance (mi)	991	1053	1041	1034
Travel Time (hr)	39.3	42.7	40.7	41.3
Total Delay (hr)	10.9	12.5	11.1	11.8
Total Stops	931	991	920	964
Fuel Used (gal)	35.1	37.6	37.0	37.0

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	683	705	630	651	667	657	641
Vehs Exited	667	697	627	648	659	655	646
Starting Vehs	23	33	36	35	35	47	46
Ending Vehs	39	41	39	38	43	49	41
Travel Distance (mi)	251	261	231	242	252	240	239
Travel Time (hr)	10.1	10.4	9.2	9.5	9.3	10.0	9.8
Total Delay (hr)	3.0	3.0	2.5	2.6	2.2	3.1	3.0
Total Stops	254	242	219	223	197	249	232
Fuel Used (gal)	9.0	9.3	8.2	8.6	8.6	8.7	8.6

Interval #1 Information

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	601	714	649	658
Vehs Exited	599	710	644	654
Starting Vehs	28	35	32	33
Ending Vehs	30	39	37	38
Travel Distance (mi)	224	267	241	245
Travel Time (hr)	8.8	10.8	9.5	9.7
Total Delay (hr)	2.4	3.2	2.7	2.8
Total Stops	211	250	235	231
Fuel Used (gal)	7.9	9.5	8.5	8.7

Interval #2 Information

Start Time	7:15
End Time	7:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	833	895	806	877	846	845	848
Vehs Exited	811	853	804	849	856	839	835
Starting Vehs	39	41	39	38	43	49	41
Ending Vehs	61	83	41	66	33	55	54
Travel Distance (mi)	295	315	292	306	302	303	302
Travel Time (hr)	12.4	13.7	11.4	12.6	12.0	13.0	11.8
Total Delay (hr)	4.0	4.6	3.1	3.8	3.3	4.3	3.1
Total Stops	300	352	250	282	269	309	265
Fuel Used (gal)	10.8	11.8	10.5	11.1	10.9	11.3	10.8

Interval #2 Information

Start Time	7:15
End Time	7:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	800	818	836	840
Vehs Exited	784	816	835	828
Starting Vehs	30	39	37	38
Ending Vehs	46	41	38	52
Travel Distance (mi)	283	292	302	299
Travel Time (hr)	11.3	12.4	11.8	12.2
Total Delay (hr)	3.2	4.0	3.2	3.7
Total Stops	268	300	260	285
Fuel Used (gal)	10.2	10.7	11.0	10.9

Interval #3 Information

Start Time	7:30
End Time	7:45
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	685	645	677	684	658	629	639
Vehs Exited	703	682	672	691	636	645	658
Starting Vehs	61	83	41	66	33	55	54
Ending Vehs	43	46	46	59	55	39	35
Travel Distance (mi)	255	246	248	254	241	231	244
Travel Time (hr)	9.9	9.7	10.1	10.1	9.9	9.4	9.0
Total Delay (hr)	2.6	2.7	2.9	2.8	3.0	2.7	2.1
Total Stops	233	218	264	256	247	240	185
Fuel Used (gal)	9.0	8.8	8.9	9.1	8.7	8.4	8.5

Interval #3 Information

Start Time	7:30
End Time	7:45
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	656	638	650	656
Vehs Exited	657	637	654	663
Starting Vehs	46	41	38	52
Ending Vehs	45	42	34	45
Travel Distance (mi)	244	238	246	245
Travel Time (hr)	10.1	9.0	9.5	9.7
Total Delay (hr)	3.1	2.3	2.5	2.7
Total Stops	264	195	217	230
Fuel Used (gal)	8.7	8.3	8.6	8.7

Interval #4 Information Recording

Start Time	7:45
End Time	8:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	657	651	668	599	629	682	654
Vehs Exited	676	660	666	620	641	690	652
Starting Vehs	43	46	46	59	55	39	35
Ending Vehs	24	37	48	38	43	31	37
Travel Distance (mi)	252	246	249	232	237	252	242
Travel Time (hr)	9.7	9.9	10.4	8.4	9.9	10.1	9.2
Total Delay (hr)	2.6	2.9	3.2	1.8	3.1	2.8	2.3
Total Stops	219	217	245	147	229	248	214
Fuel Used (gal)	8.9	8.8	9.1	8.0	8.6	9.1	8.4

Interval #4 Information Recording

Start Time	7:45
End Time	8:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	627	691	676	653
Vehs Exited	642	691	668	661
Starting Vehs	45	42	34	45
Ending Vehs	30	42	42	38
Travel Distance (mi)	240	256	252	246
Travel Time (hr)	9.0	10.4	9.9	9.7
Total Delay (hr)	2.2	3.0	2.7	2.7
Total Stops	188	246	208	217
Fuel Used (gal)	8.3	9.2	8.9	8.7

1: Lone Tree Way & Antioch Town Center Performance by movement

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	1.5	0.3	0.1	3.5	0.1	0.6	2.4	0.9	9.3
Total Del/Veh (s)	48.1	11.1	60.8	11.3	3.5	49.7	48.6	2.9	12.5
Stop Delay (hr)	1.4	0.3	0.1	2.4	0.0	0.6	2.1	0.4	7.3
Stop Del/Veh (s)	45.8	10.8	60.1	7.6	3.1	46.1	43.5	1.3	9.8

2: Lone Tree Way & In-Shape Dwy Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.1	0.0	0.0	0.1
Denied Del/Veh (s)	0.1	0.2	2.3	0.0	0.1
Total Delay (hr)	0.0	0.2	0.0	0.6	0.8
Total Del/Veh (s)	4.8	0.6	0.2	1.7	1.2
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	4.9	0.0	0.0	0.1	0.1

3: Lone Tree Way & Commercial Dwy North Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Delay (hr)	0.1	0.9	0.2	0.0	1.2
Total Del/Veh (s)	6.7	3.0	2.8	0.1	1.6
Stop Delay (hr)	0.1	0.0	0.0	0.0	0.2
Stop Del/Veh (s)	6.6	0.1	0.1	0.0	0.2

Total Network Performance

Denied Delay (hr)	0.2
Denied Del/Veh (s)	0.2
Total Delay (hr)	11.6
Total Del/Veh (s)	14.7
Stop Delay (hr)	7.5
Stop Del/Veh (s)	9.5

Intersection: 1: Lone Tree Way & Antioch Town Center

Movement	WB	WB	NB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	LR	U	T	T	T	R	UL	T	T	T
Maximum Queue (ft)	137	130	47	223	222	210	61	329	112	124	118
Average Queue (ft)	74	45	3	105	103	98	14	150	26	49	36
95th Queue (ft)	125	97	16	183	180	180	44	258	79	98	93
Link Distance (ft)	186	186		399	399	399		481	481	481	481
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)			155				280				
Storage Blk Time (%)				2							
Queuing Penalty (veh)				0							

Intersection: 2: Lone Tree Way & In-Shape Dwy

Movement	WB
Directions Served	R
Maximum Queue (ft)	26
Average Queue (ft)	7
95th Queue (ft)	24
Link Distance (ft)	258
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 3: Lone Tree Way & Commercial Dwy North

Movement	WB
Directions Served	R
Maximum Queue (ft)	60
Average Queue (ft)	24
95th Queue (ft)	46
Link Distance (ft)	219
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	4:50	4:50	4:50	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4	4
Vehs Entered	2908	2907	2854	2917	2858	2779	2796
Vehs Exited	2900	2896	2838	2921	2850	2784	2802
Starting Vehs	45	37	29	52	33	38	48
Ending Vehs	53	48	45	48	41	33	42
Travel Distance (mi)	1085	1079	1061	1088	1056	1033	1053
Travel Time (hr)	43.8	41.9	41.7	43.0	41.4	41.1	40.0
Total Delay (hr)	13.1	11.5	11.8	12.2	11.5	11.9	10.5
Total Stops	1051	963	996	1003	959	946	837
Fuel Used (gal)	38.3	37.7	37.3	38.2	37.2	36.2	36.3

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	4:50	4:50	4:50	4:50
End Time	6:00	6:00	6:00	6:00
Total Time (min)	70	70	70	70
Time Recorded (min)	60	60	60	60
# of Intervals	5	5	5	5
# of Recorded Intervals	4	4	4	4
Vehs Entered	2859	2886	2816	2857
Vehs Exited	2846	2886	2802	2853
Starting Vehs	34	39	36	39
Ending Vehs	47	39	50	43
Travel Distance (mi)	1063	1078	1051	1065
Travel Time (hr)	40.4	40.8	41.9	41.6
Total Delay (hr)	10.4	10.5	12.2	11.6
Total Stops	887	866	949	946
Fuel Used (gal)	36.6	36.9	36.9	37.2

Interval #0 Information Seeding

Start Time	4:50
End Time	5:00
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	701	766	732	714	700	696	674
Vehs Exited	710	769	717	720	710	707	671
Starting Vehs	45	37	29	52	33	38	48
Ending Vehs	36	34	44	46	23	27	51
Travel Distance (mi)	269	287	275	270	260	261	250
Travel Time (hr)	10.5	10.9	10.7	10.6	10.8	10.3	9.4
Total Delay (hr)	2.9	2.9	3.0	3.0	3.4	3.0	2.3
Total Stops	232	243	263	232	267	223	186
Fuel Used (gal)	9.4	9.8	9.6	9.4	9.4	9.2	8.6

Interval #1 Information

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	684	715	691	708
Vehs Exited	670	707	698	708
Starting Vehs	34	39	36	39
Ending Vehs	48	47	29	36
Travel Distance (mi)	251	266	259	265
Travel Time (hr)	9.3	9.8	10.3	10.3
Total Delay (hr)	2.2	2.4	2.9	2.8
Total Stops	202	191	232	226
Fuel Used (gal)	8.5	9.0	9.1	9.2

Interval #2 Information

Start Time	5:15
End Time	5:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	746	766	740	769	729	716	750
Vehs Exited	729	744	730	759	701	704	748
Starting Vehs	36	34	44	46	23	27	51
Ending Vehs	53	56	54	56	51	39	53
Travel Distance (mi)	271	279	267	281	259	259	281
Travel Time (hr)	10.9	11.3	10.7	11.1	10.1	10.9	10.8
Total Delay (hr)	3.3	3.4	3.1	3.2	2.7	3.5	3.0
Total Stops	259	285	261	276	246	286	231
Fuel Used (gal)	9.5	9.9	9.5	9.9	9.2	9.3	9.5

Interval #2 Information

Start Time	5:15
End Time	5:30
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	751	755	738	745
Vehs Exited	755	746	720	733
Starting Vehs	48	47	29	36
Ending Vehs	44	56	47	51
Travel Distance (mi)	282	278	269	273
Travel Time (hr)	10.8	10.7	11.4	10.9
Total Delay (hr)	2.8	2.9	3.7	3.2
Total Stops	242	236	284	261
Fuel Used (gal)	9.7	9.7	9.8	9.6

Interval #3 Information

Start Time	5:30
End Time	5:45
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	721	679	688	699	686	691	692
Vehs Exited	737	698	691	707	686	679	708
Starting Vehs	53	56	54	56	51	39	53
Ending Vehs	37	37	51	48	51	51	37
Travel Distance (mi)	273	255	262	266	253	258	266
Travel Time (hr)	11.2	9.7	10.1	10.5	9.6	9.9	10.1
Total Delay (hr)	3.5	2.5	2.8	3.0	2.4	2.6	2.6
Total Stops	284	214	217	238	215	218	216
Fuel Used (gal)	9.9	9.0	9.1	9.4	8.7	8.8	9.4

Interval #3 Information

Start Time	5:30
End Time	5:45
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	717	707	718	698
Vehs Exited	712	717	727	707
Starting Vehs	44	56	47	51
Ending Vehs	49	46	38	42
Travel Distance (mi)	266	267	271	264
Travel Time (hr)	10.4	10.0	10.4	10.2
Total Delay (hr)	3.0	2.5	2.8	2.8
Total Stops	231	218	227	226
Fuel Used (gal)	9.4	9.1	9.4	9.2

Interval #4 Information Recording

Start Time	5:45
End Time	6:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	740	696	694	735	743	676	680
Vehs Exited	724	685	700	735	753	694	675
Starting Vehs	37	37	51	48	51	51	37
Ending Vehs	53	48	45	48	41	33	42
Travel Distance (mi)	273	257	257	271	283	255	256
Travel Time (hr)	11.2	9.9	10.2	10.8	10.9	9.9	9.7
Total Delay (hr)	3.4	2.7	2.9	3.1	3.0	2.8	2.5
Total Stops	276	221	255	257	231	219	204
Fuel Used (gal)	9.6	9.0	9.1	9.5	9.9	8.9	8.8

Interval #4 Information Recording

Start Time	5:45
End Time	6:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	707	709	669	703
Vehs Exited	709	716	657	706
Starting Vehs	49	46	38	42
Ending Vehs	47	39	50	43
Travel Distance (mi)	264	267	251	263
Travel Time (hr)	9.9	10.2	9.8	10.3
Total Delay (hr)	2.4	2.8	2.8	2.8
Total Stops	212	221	206	229
Fuel Used (gal)	9.0	9.2	8.7	9.2

1: Lone Tree Way & Antioch Town Center Performance by movement

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	1.5	0.3	0.0	3.4	0.1	0.3	2.7	0.7	8.9
Total Del/Veh (s)	54.7	9.3	58.2	10.0	3.3	55.0	55.4	2.5	11.8
Stop Delay (hr)	1.4	0.3	0.0	2.2	0.0	0.3	2.5	0.3	7.0
Stop Del/Veh (s)	52.4	9.1	57.8	6.5	2.9	51.9	50.7	1.0	9.2

2: Lone Tree Way & In-Shape Dwy Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.1
Denied Del/Veh (s)	0.1	0.1	2.3	0.0	0.1
Total Delay (hr)	0.0	0.2	0.0	0.5	0.7
Total Del/Veh (s)	4.3	0.6	0.2	1.6	1.1
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	4.4	0.0	0.0	0.1	0.1

3: Lone Tree Way & Commercial Dwy North Performance by movement

Movement	WBR	NBT	NBR	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Delay (hr)	0.2	1.1	0.0	0.0	1.4
Total Del/Veh (s)	9.0	3.0	1.9	0.1	1.8
Stop Delay (hr)	0.2	0.0	0.0	0.0	0.2
Stop Del/Veh (s)	8.9	0.1	0.1	0.0	0.3

Total Network Performance

Denied Delay (hr)	0.2
Denied Del/Veh (s)	0.2
Total Delay (hr)	11.4
Total Del/Veh (s)	14.2
Stop Delay (hr)	7.3
Stop Del/Veh (s)	9.1

Intersection: 1: Lone Tree Way & Antioch Town Center

Movement	WB	WB	NB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	LR	U	T	T	T	R	UL	T	T	T
Maximum Queue (ft)	138	124	25	212	213	206	63	285	97	107	117
Average Queue (ft)	69	41	2	114	108	99	14	148	23	45	29
95th Queue (ft)	122	86	13	190	183	178	43	245	67	92	83
Link Distance (ft)	186	186		399	399	399		481	481	481	481
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)			155				280				
Storage Blk Time (%)				2		0					
Queuing Penalty (veh)				0		0					

Intersection: 2: Lone Tree Way & In-Shape Dwy

Movement	WB
Directions Served	R
Maximum Queue (ft)	27
Average Queue (ft)	10
95th Queue (ft)	28
Link Distance (ft)	258
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 3: Lone Tree Way & Commercial Dwy North

Movement	WB	NB
Directions Served	R	T
Maximum Queue (ft)	76	41
Average Queue (ft)	32	1
95th Queue (ft)	58	42
Link Distance (ft)	219	481
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0

APPENDIX B

Environmental Noise & Vibration Assessment

Lone Tree Retail Project

Antioch, California

BAC Job #2024-096

Prepared For:

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Principal Consultant
Elected Member, Institute of Noise Control Engineering (INCE)

December 12, 2024

BOLLARD
Acoustical Consultants

CEQA Checklist

***NOISE AND VIBRATION* – Would the Project Result in:**	**NA – Not Applicable**	**Less than Significant with Mitigation**	**Less Than Significant Impact**	**No Impact**
a) Generation of substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?			**X**	
b) Generation of excessive groundborne vibration or groundborne noise levels?			**X**	
c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?				**X**

Introduction

The proposed Lone Tree Retail Project (project) is located at 4099 Lone Tree Way in the City of Antioch, California (APN: 072-500-005-3, 072-500-006-1, 072-500-007-9). The project consists of the development of a car wash (Parcel E) and two (2) retail buildings containing quick serve restaurants (QSRs) with drive-throughs (Parcels F and G). Existing land uses in the immediate project vicinity include a combination of commercial and single-family residential. Future land uses in the project vicinity include multi-family residential to the north (Lone Tree Apartments). The project area and overall site plan are shown in Figures 1 and 2, respectively.

The purposes of this assessment are to quantify the existing noise and vibration environments, identify potential noise and vibration impacts resulting from the project, identify appropriate mitigation measures, and provide a quantitative and qualitative analysis of impacts associated with the project. Specifically, impacts are identified if project-related activities would cause a substantial increase in ambient noise levels at existing noise-sensitive uses in the project vicinity, or if project-generated noise or vibration levels would exceed applicable federal, state, or City of Antioch standards at nearby existing or future sensitive uses.

Noise and Vibration Fundamentals

Noise

Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and are designated as sound. The number of pressure variations per second is called the frequency of sound and is expressed as cycles per second, or Hertz (Hz). Definitions of acoustical terminology are provided in Appendix A.

Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals of pressure) as a point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers in a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Noise levels from common noise sources are shown in Figure 3.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable and can be approximated by filtering the frequency response of a sound level meter by means of the standardized A-weighting network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels.

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical

tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}). The L_{eq} is the foundation of the day-night average noise descriptor, DNL (or L_{dn}), and shows very good correlation with community response to noise.

The DNL is based upon the average noise level over a 24-hour day, with a +10-decibel weighting applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. DNL and Community Noise Equivalent Level (CNEL) -based noise standards are commonly used to assess noise impacts associated with traffic, railroad, and aircraft noise sources. The CNEL is usually within 1 dB of the DNL, and for all intents and purposes, the two are interchangeable (Note: The DNL is easier to compute and is more commonly used). A single noise event is an individual distinct loud activity, such as a train passage, vehicle passby, or any other brief and discrete noise-generating activity. Because most noise policies applicable to transportation noise sources are typically specified in terms of 24-hour-averaged descriptors, such as DNL or CNEL, the potential for annoyance or sleep disturbance associated with individual loud events can be masked by the averaging process.

Vibration

Vibration is like noise in that it involves a source, a transmission path, and a receiver. While vibration is related to noise, it differs in that noise is generally considered to be pressure waves transmitted through air, while vibration is usually associated with transmission through the ground or structures. As with noise, vibration consists of an amplitude and frequency. A person's response to vibration will depend on their individual sensitivity as well as the amplitude and frequency of the source.

Vibration can be described in terms of acceleration, velocity, or displacement. A common practice is to monitor vibration in terms of velocity in inches per second peak particle velocity (IPS, PPV) or root-mean-square (VdB, RMS). Standards pertaining to perception as well as damage to structures have been developed for vibration in terms of peak particle velocity as well as RMS velocities. As vibrations travel outward from the source, they excite the particles of rock and soil through which they pass and cause them to oscillate. Differences in subsurface geologic conditions and distance from the source of vibration will result in different vibration levels characterized by different frequencies and intensities. In all cases, vibration amplitudes will decrease with increasing distance. The maximum rate, or velocity of particle movement, is the commonly accepted descriptor of the vibration "strength".

Human response to vibration is difficult to quantify. Vibration can be felt or heard well below the levels that produce any damage to structures. The duration of the event has an effect on human response, as does frequency. Generally, as the duration and vibration frequency increase, the potential for adverse human response increases. According to the Transportation and Construction-Induced Vibration Guidance Manual (Caltrans, June 2004), operation of construction equipment and construction techniques generate ground vibration. Traffic traveling on roadways can also be a source of such vibration. At high enough amplitudes, ground vibration has the potential to damage structures and/or cause cosmetic damage. Ground vibration can also be a source of annoyance to individuals who live or work close to vibration-generating activities.

Legend

- Project Area Boundary (Approximate)
- Ambient Noise & Vibration Measurement Site
- Existing Masonry Sound Wall (6-feet)
- Existing Combination Retaining/Sound Wall (10-feet)

N

Scale (Feet)

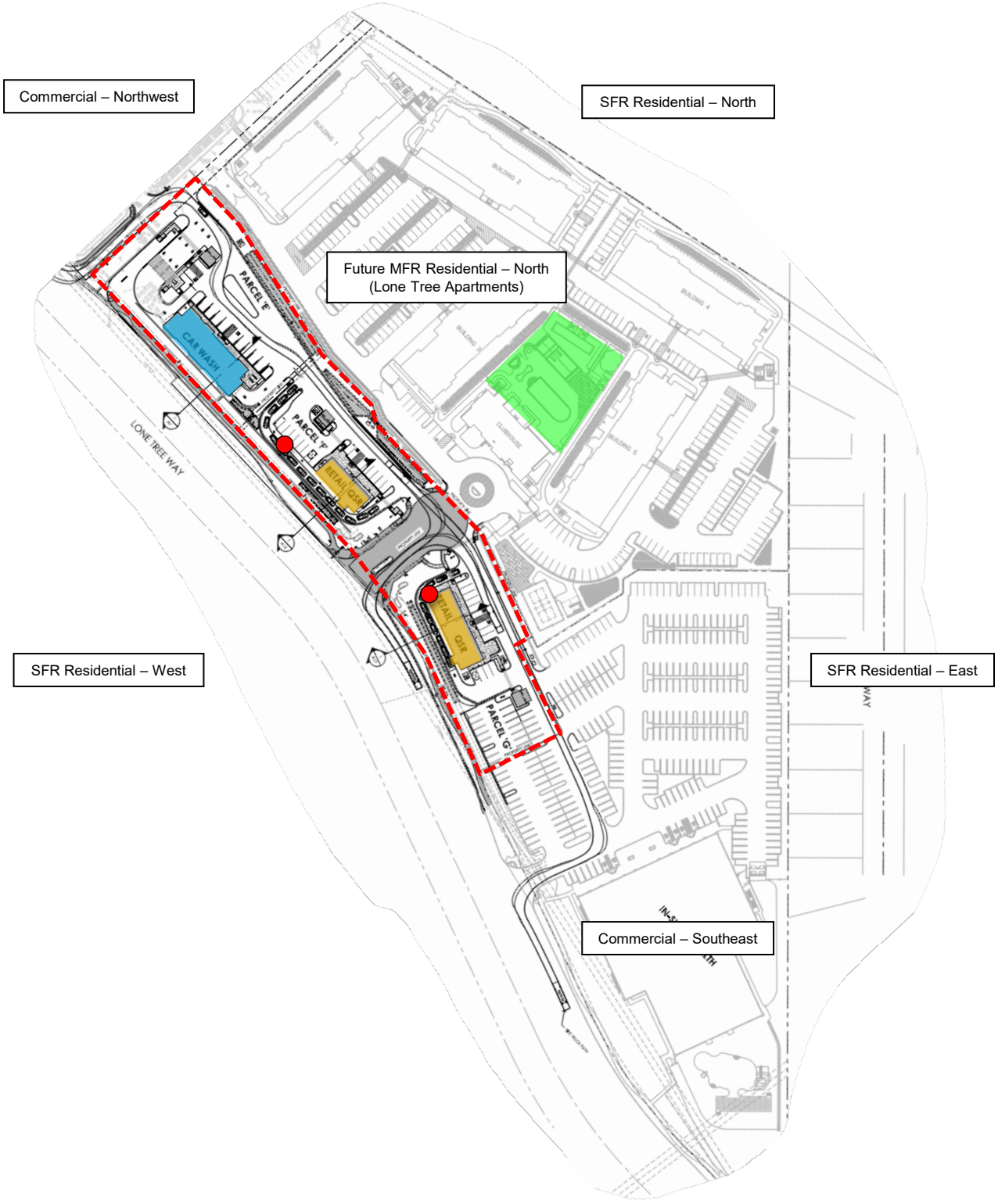
0 150 300

Lone Tree Retail Project
Antioch, California

Project Site & Surrounding Area

Figure 1

BOLLARD Acoustical Consultants



Legend

- Project Area Boundary
- Car Wash Tunnel
- Retail / QSR Buildings
- Drive-Through Amplified Menu Speakers
- MFR Common Open Space Area

N

Scale (Feet)

0 100 200

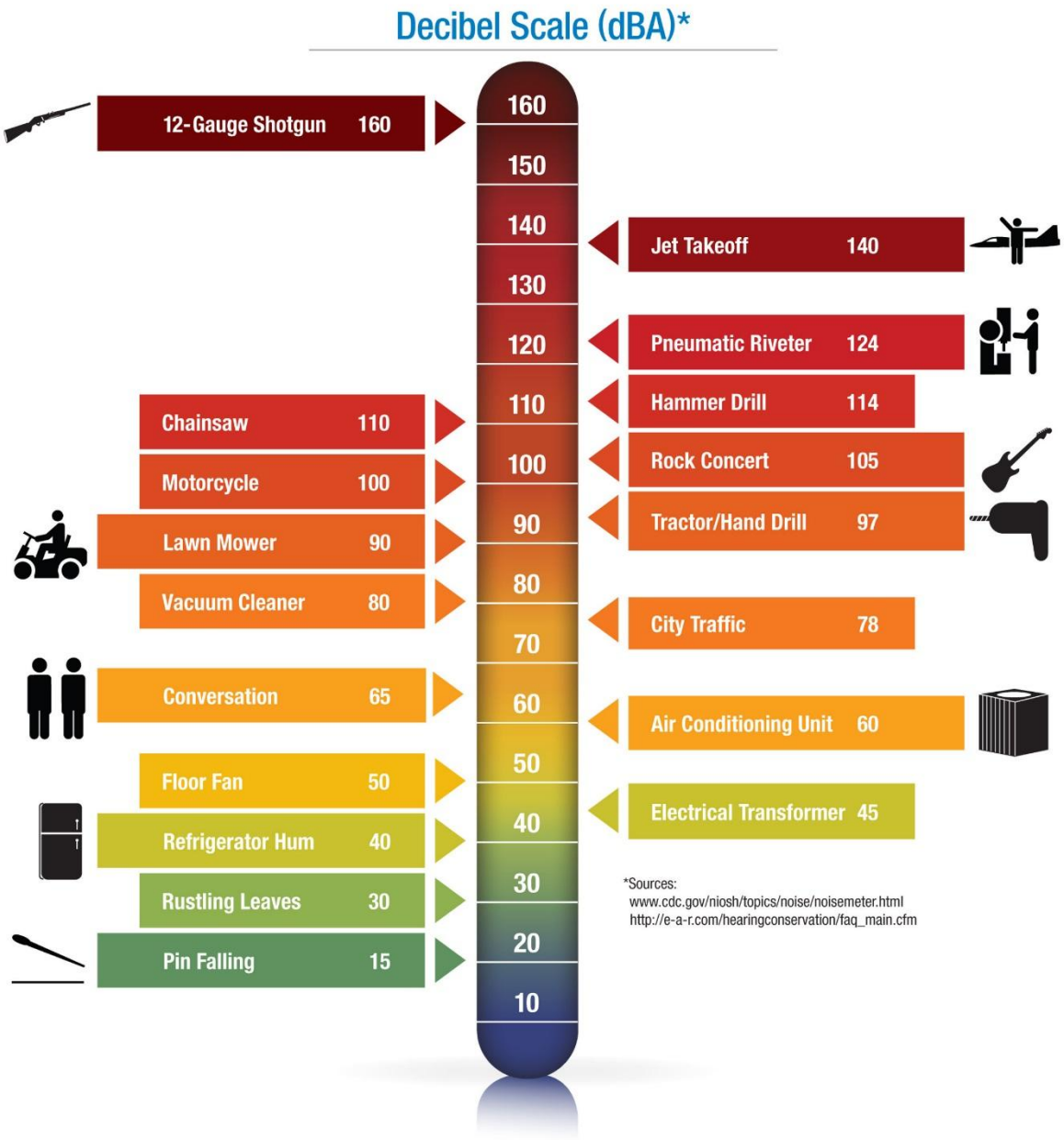
Lone Tree Retail Project
Antioch, California

Project Overall Site Plan

Figure 2

BOLLARD Acoustical Consultants

Figure 3
Noise Levels Associated with Common Noise Sources



Regulatory Setting: Criteria for Acceptable Noise and Vibration Exposure

Federal

There are no federal noise or vibration criteria which would be directly applicable to this project. However, the City of Antioch does not currently have adopted numeric standards for groundborne vibration. As a result, the following federal noise criteria was applied to the project.

Federal Transit Administration (FTA)

Vibration impact criteria developed by the Federal Transit Administration (FTA) were applied to the project. The FTA criteria applicable to damage and annoyance from vibration typically associated with construction activities are presented in Tables 1 and 2.

Table 1
FTA Criteria for Assessing Vibration Damage to Structures

Building Category	Level (VdB)[1]
I. Reinforced-concrete, steel or timber (no plaster)	102
II. Engineered concrete and masonry (no plaster)	98
III. Non-engineered timber and masonry buildings	94
IV. Buildings extremely susceptible to vibration damage	90

[1] RMS velocity in decibels (VdB) re 1 micro-inch/second

Source: Federal Transit Administration Noise and Vibration Manual, Table 12-3

Table 2
Groundborne Vibration Impact Criteria for General Assessment

	Impact Levels (VdB)		
Land Use Category	Frequent Events[a]	Occasional Events[b]	Infrequent Events[c]
Category 1: Buildings where vibration would interfere with interior ops.	65[d]	65[d]	65[d]
Category 2: Residences and buildings where people normally sleep	72	75	80
Category 3: Institutional land uses with primarily daytime uses	75	78	83

a. "Frequent Events" is defined as more than 70 vibration events of the same source per day.
b. "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day.
c. "Infrequent Events" is defined as fewer than 30 vibration events of the same source per day.
d. This criterion limit is based on levels that are acceptable for most moderately-sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels.

Source: Federal Transit Administration, Transit Noise Impact and Vibration Assessment, May 2006

State of California

California Environmental Quality Act (CEQA)

The State of California has established regulatory criteria that are applicable to this assessment. Specifically, Appendix G of the State of California Environmental Quality Act (CEQA) Guidelines

are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. According to Appendix G of the CEQA guidelines, the project would result in a significant noise or vibration impact if the following occur:

A. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or other applicable standards of other agencies.

B. Generation of excessive groundborne vibration or groundborne noise levels.

C. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, the project would expose people residing or working in the project area to excessive noise levels.

It should be noted that audibility is not a test of significance according to CEQA. If this were the case, any project which added any audible amount of noise to the environment would be considered significant according to CEQA. Because every physical process creates noise, the use of audibility alone as significance criteria would be unworkable. CEQA requires a substantial increase in noise levels before noise impacts are identified, not simply an audible change.

Local

City of Antioch General Plan

The Environmental Hazards Element of the City of Antioch General Plan contains objectives and policies to ensure that city residents are not subjected to noise beyond acceptable levels. The General Plan objectives and policies which are applicable to the project are reproduced below.

11.8.1 Noise Objective

Achieve and maintain exterior noise levels appropriate to planned land uses throughout Antioch, as described below:

- Residential: Single-Family – 60 dB CNEL within rear yards;
- Residential: Multi-Family – 60 dB CNEL within interior open space;
- Schools: Classrooms – 65 dB CNEL
- Schools: Play and Sports Areas – 70 dB CNEL
- Commercial/Industrial: 70 dB CNEL at the front setback

11.8.2 Noise Policies

Noise Compatibility Land Use and Circulation Patterns

a. Implementation of the noise objective contained in Section 11.8.1 (above) and the policies contained in Section 11.8.2 of this Environmental Hazards Element shall be based on

noise data contained in Section 4.9 of the General Plan EIR, unless a noise analysis conducted pursuant to the city's development and environmental review process provides more up-to-date and accurate noise projections, as determined by the city.

b. Maintain a pattern of land uses that separates noise-sensitive land uses from major noise sources to the extent possible, and guide noise-tolerant land uses into the noisier portions of the Planning Area.

c. Minimize motor vehicle noise in residential areas through proper route location and sensitive roadway design.

d. Provide planned industrial areas with truck access routes separated from residential areas to the maximum feasible extent.

e. Where needed, provide traffic calming devices to slow traffic speed within residential neighborhoods.

Noise Analysis and Mitigation

f. Where new development (including construction and improvement of roadways) is proposed in areas exceeding the noise levels identified in the General Plan Noise Objective, or where the development of proposed uses could result in a significant increase in noise, require a detailed noise attenuation study to be prepared by a qualified acoustical engineer to determine appropriate mitigation and ways to incorporate such mitigation into project design and implementation.

g. When new development incorporating a potentially significant noise generator is proposed, require noise analyses to be prepared by a qualified acoustical engineer. Require the implementation of appropriate noise mitigation when the proposed project will cause new exceedances of General Plan noise objectives, or an audible (3.0 dBA) increase in noise in areas where General Plan noise objectives are already exceeded as the result of existing development.

h. In reviewing noise impacts, utilize site design and architectural design features to the extent feasible to mitigate impacts on residential neighborhoods and other uses that are sensitive to noise. In addition to sound barriers, design techniques to mitigate noise impacts may include, but are not limited to:

- Increased building setbacks to increase the distance between the noise source and sensitive receptor.
- Orient buildings which are compatible with higher noise levels adjacent to noise generators or in clusters to shield more noise sensitive areas and uses.
- Orient delivery, loading docks, and outdoor work areas away from noise-sensitive uses.
- Place noise tolerant use, such as parking areas, and noise tolerant structures, such as garages, between the noise source and sensitive receptor.

- Cluster office, commercial, or multi-family residential structures to reduce noise levels within interior open space areas.
- Provide double glazed and double paned windows on the side of the structure facing a major noise source, and place entries away from the noise source to the extent possible.

i. Where feasible, require the use of noise barriers (walls, berms, or a combination thereof) to reduce significant noise impacts.

- Noise barriers must have sufficient mass to reduce noise transmission and high enough to shield the receptor from the noise source.
- To be effective, the barrier needs to be constructed without cracks or openings.
- The barrier must interrupt the line of sight between the noise source and noise receptor.
- The effects of noise "flanking" the noise barrier should be minimized by bending the end of the barrier back from the noise source.
- Require appropriate landscaping treatment to be provided in conjunction with noise barriers to mitigate their potential aesthetic impacts.

j. Continue enforcement of California Noise Insulation Standards (Title 25, Section 1092, California Administrative Code).

Temporary Construction

k. Damage due to Construction Vibration. Where new development is proposed in areas adjacent to any vibration-sensitive land uses or adjacent to vibration-sensitive activities, require a screening level vibration analysis. If a screening level analysis shows that the project has the potential to result in damage to structures or where vibration could substantially interfere with normal operations, require a detailed vibration impact assessment prepared by a structural engineer or other appropriate professional to determine appropriate design means and methods of construction to avoid the potential damage, if feasible.

l. Ensure that construction activities and permitted hours of operation are regulated in order to avoid or mitigate noise impacts on adjacent noise-sensitive land uses.

m. Require proposed development projects adjacent to occupied noise-sensitive land uses to implement a construction-related noise mitigation plan. This plan would depict the location of construction equipment storage and maintenance areas, and document methods to be employed to minimize noise impacts on adjacent noise-sensitive land uses.

n. Require that all construction equipment utilize noise reduction features (e.g., mufflers and engine shrouds) that are no less effective than those originally installed by the manufacturer.

o. Prior to the issuance of any grading plans, the city shall include a Condition of Approval for subdivisions and non-residential development adjacent to any developed/occupied noise-sensitive land uses by requiring applicants to submit a construction-related noise mitigation plan to the city for review and approval. The plan should depict the location of construction equipment and how the noise from this equipment will be mitigated during construction of the project through the use of such methods as:

- The construction contractor shall use temporary noise attenuation fences, where feasible, to reduce construction noise impacts on adjacent noise sensitive land uses.
- During all project site excavation and grading on site, the construction contractors shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers, consistent with manufacturers' standards. The construction contractor shall place all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the project site.
- The construction contractor shall locate equipment staging in areas that will create the greatest distance between construction-related noise sources and noise sensitive receptors nearest the project site during all project construction.
- The construction contractor shall limit all construction-related activities that would result in high noise levels to between the hours of 7:00 a.m. and 7:00 p.m. Monday through Saturday. No construction shall be allowed on Sundays and public holidays.

p. The construction-related noise mitigation plan required shall also specify that haul truck deliveries be subject to the same hours specified for construction equipment. Additionally, the plan shall denote any construction traffic haul routes where heavy trucks would exceed 100 daily trips (counting those both to and from the construction site). To the extent feasible, the plan shall denote haul routes that do not pass sensitive land uses or residential dwellings. Lastly, the construction-related noise mitigation plan shall incorporate any other restrictions imposed by the city.

<u>City of Antioch Code of Ordinances</u>

The provisions of the City of Antioch Code of Ordinances which would be most applicable to this project are reproduced below.

5-17.04 Heavy construction equipment noise.

B. It shall be unlawful for any person to operate heavy construction equipment during the hours specified below:

1. On weekdays prior to 7:00 a.m. and after 6:00 p.m.
2. On weekdays within 300 feet of occupied dwelling space, prior to 8:00 a.m. and after 5:00 p.m.
3. On weekends and holidays, prior to 9:00 a.m. and after 5:00 p.m., irrespective of the distance from the occupied dwelling.

5-17.05 Construction activity noise.

B. It shall be unlawful for any person to be involved in construction activity during the hours specified below:

1. On weekdays prior to 7:00 a.m. and after 6:00 p.m.
2. On weekdays within 300 feet of occupied dwellings, prior to 8:00 a.m. and after 5:00 p.m.
3. On weekends and holidays, prior to 9:00 a.m. and after 5:00 p.m., irrespective of the distance from the occupied dwellings.

9-5.1901 Noise attenuation requirements.

A. Stationary noise sources. Uses adjacent to outdoor living areas (e.g., backyards for single-family homes and patios for multi-family units) and parks shall not cause an increase in background ambient noise which will exceed 60 CNEL.

D. Noise attenuation. The city may require noise attenuation measures be incorporated into a project to obtain compliance with this section. Measures outlined in the noise policies of the General Plan should be utilized to mitigate noise to the maximum feasible extent.

Environmental Setting – Existing Ambient Noise and Vibration Environment

Noise-Sensitive Land Uses in the Project Vicinity

Noise-sensitive land uses are generally defined as locations where people reside or where the presence of unwanted sound could adversely affect the primary intended use of the land. Places where people live, sleep, recreate, worship, and study are generally considered to be sensitive to noise because intrusive noise can be disruptive to these activities. The nearest existing noise-sensitive uses to the project have been identified as single-family residential to the north, east and west. The locations of the existing residential uses are shown in Figure 1.

Existing Overall Ambient Noise Environment within the Project Vicinity

The existing ambient noise environment within the project vicinity is defined primarily by noise from traffic on Lone Tree Way, and by nearby commercial activities. To generally quantify existing ambient noise environment within the project vicinity, BAC conducted long-term (48-hour) ambient noise level measurements at three (3) locations June 19th – 20th, 2024. The long-term noise survey locations are shown in Figure 1. Photographs of the noise survey locations are provided in Appendix B.

Larson Davis Laboratories (LDL) precision integrating sound level meters were used to complete the noise level measurements. The meters were calibrated immediately before use with an LDL Model CA200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all specifications of the American National Standards Institute requirements for Type

1 sound level meters (ANSI S1.4). The ambient noise level survey results are summarized below in Table 3.

Table 3
Summary of Long-Term Ambient Noise Survey Results – June 19-20, 2024[1]

Survey Location[2]	Date	CNEL (dB)	Average Measured Hourly Noise Levels (dB)[3]					
			Daytime		Evening		Nighttime	
			L_{eq}	L_{max}	L_{eq}	L_{max}	L_{eq}	L_{max}
Site 1: North of project area near existing residences	6/19/24	51	47	64	47	68	43	57
	6/20/24	51	46	63	47	64	43	59
Site 2: East of project area near existing residences	6/19/24	56	52	68	54	74	48	62
	6/20/24	55	52	68	52	74	47	64
Site 3: West of project area near existing residences	6/19/24	62	58	78	61	87	53	69
	6/20/24	62	59	77	58	80	54	72

[1] Detailed summaries of the noise monitoring results are provided in Appendices C and D.
[2] Long-term ambient noise monitoring locations are identified in Figure 1.
[3] Daytime: 7:00 AM to 7:00 PM | Evening: 7:00 PM to 10:00 PM | Nighttime: 10:00 PM to 7:00 AM

Source: BAC 2024

BAC noise survey site 1 is believed to be representative of the existing ambient noise level environment at the closest single-family residences located north of the project. Noise level measurements obtained at site 2 are believed to be representative of the existing ambient noise level environments at the closest single-family residences located east of the project. Finally, BAC noise survey site 3 is believed to be representative of the existing ambient noise level environment at the closest single-family residences located west of the project.

As shown in Table 3, measured community noise equivalent levels (CNELs) and average measured hourly average (L_{eq} and L_{max}) noise levels were consistent at each survey site during the 48-hour monitoring period (i.e., relatively small range of measured values).

Existing Ambient Vibration Environment within the Project Vicinity

During BAC site visits on June 18th and 21st, 2024, vibration levels were below the threshold of perception within the project vicinity. Nonetheless, to quantify existing vibration levels in the project vicinity, BAC conducted a short-term (15-minute) vibration measurements on June 18th, 2024, at the locations shown in Figure 1 (sites 1-3). A Larson-Davis Laboratories (LDL) precision integrating sound level meter equipped with a vibration transducer was used to complete the measurements. The results are summarized in Table 4.

Table 4
Summary of Short-Term Ambient Vibration Survey Results – June 18, 2024

Survey Location	Time	Highest Measured Vibration Level (VdB)
Site 1: North of project area near existing residences	12:27 p.m.	45
Site 2: East of project area near existing residences	11:42 a.m.	49
Site 3: West of project area near existing residences	1:15 p.m.	51

Source: BAC 2024

Table 4 data indicate that measured vibration levels were below the threshold of human perception (65 dB VdB), which is consistent with BAC field observations.

Impacts and Mitigation Measures

Thresholds of Significance

For the purposes of this report, a noise or vibration impact is considered significant if the project would result in:

- Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or other applicable standards of other agencies; or
- Generation of excessive groundborne vibration or groundborne noise levels; or
- For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, the project would expose people residing or working in the project area to excessive noise levels.

The project area is not within the vicinity of a private airstrip, an airport land use plan, or within two miles of a public airport. Therefore, the last threshold listed above is not discussed further.

The following criteria established by the Federal Transit Administration (FTA), City of Antioch General Plan, and City of Antioch Code of Ordinances were used to evaluate the significance of environmental noise and vibration resulting from the project:

- A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise criteria presented in the City of Antioch General Plan or City of Antioch Code of Ordinances.
- A significant impact would be identified if project-generated daily on-site operations would substantially increase noise levels at existing sensitive receptors in the vicinity. A substantial increase from daily on-site operations noise levels would be identified relative

to the numeric increase significance criteria contained in Policy 11.8.2.g of City of Antioch General Plan.

In terms of determining the temporary noise increase due to project on-site construction activities at existing sensitive receptors in the vicinity, an impact would occur if those activities would noticeably increase ambient noise levels above background levels at those locations. The threshold of perception of the human ear is approximately 3 to 5 dB – a 5 dB change is considered to be clearly noticeable. For the analysis of noise level increases associated with project on-site construction activities at existing noise-sensitive receptors, a noticeable increase in ambient noise levels is assumed to occur where those activities would result in an increase by 5 dB or more over existing ambient noise levels.

- A significant impact would be identified if on-site project construction activities or project operations would expose existing or proposed sensitive receptors to excessive groundborne vibration levels. Specifically, an impact would be identified if groundborne vibration levels due to these sources would exceed identified FTA vibration impact criteria.

Noise Impacts from On-Site Operations at Nearby Noise-Sensitive Land Uses

The project consists of the development of a car wash (Parcel E) and two (2) retail buildings containing quick serve restaurants (QSRs) with drive-throughs (Parcels F and G). The primary noise sources associated with project on-site operations have been identified as drive-thru operations (i.e., idling vehicles and amplified menu speaker boards), delivery truck circulation, truck delivery activities, car wash tunnel operations, vehicle vacuum equipment, and building mechanical equipment (HVAC).

It is the understanding of BAC that the car wash component of the project (Parcel E) proposes hours of operation from 7:00 a.m. to 7:00 p.m. during winter months, and 7:00 a.m. to 8:00 p.m. during summer months. It is our further understanding that the QSR/retail use component of the project proposes hours of operations from 10:00 a.m. to 11:00 p.m. (Parcel F) and 10:45 a.m. to 11:00 p.m. (Parcel G).

For noise generated by on-site operations, the City of Antioch establishes an exterior noise level standard of 60 dB CNEL at the outdoor areas (i.e., backyards) of single-family residential uses (11.8.1 Noise Objective of the General Plan; Section 9-5.1901 of the City of Antioch Code of Ordinances). The City of Antioch also establishes an exterior noise level standard of 60 dB CNEL at the common outdoor areas (i.e., interior open spaces) of multi-family residential uses (11.8.1 Noise Objective of the General Plan). The interior open space area for the adjacent future multi-family residential land use (Lone Tree Apartments) has been identified as a courtyard/pool area within the development. The location of the common outdoor space for the future apartment complex is identified in Figure 2. In terms of determining the significance of ambient noise level increases at nearby existing noise-sensitive uses, Policy 11.8.2.g of the General Plan establishes an increase significance criterion of 3 dB applicable to on-site operations.

Finally, existing sound walls are located to the north and east of the project site (illustrated in Figure 1). Specifically, the heights of the existing sound walls are 6-feet (north) and 10-feet (east).

It is estimated that the existing 10-foot-tall sound wall east of the project site would conservatively provide 10 dB of project on-site operations noise at the closest existing residential uses to the east. However, because the closest existing residential uses north of the project are elevated on the hillside, they would not receive shielding from the existing 6-foot-tall sound wall north of the project. Based on the information above, a conservative offset of -10 dB was applied to on-site operations noise predictions at the closest existing residential uses to the east. No sound wall shielding offsets were applied to noise level predictions at the nearest existing residential uses to the north or west, or at future multi-family residential uses to the north.

Analyses of each of the identified project on-site operations noise sources at nearby existing single-family residential (SFR) and future multi-family residential (MFR) land uses are provided in the following section.

Impact 1: Drive-Through Operations Noise at Nearby Noise-Sensitive Uses

The project proposes two buildings containing QSRs with drive-through services (Parcels F and G). Those two drive-through lanes will have amplified menu speaker posts, which locations are illustrated in Figure 2.

It is the understanding of BAC that the amplified menu speaker models have not yet been determined. To quantify the noise emissions of proposed QSR drive-through speaker usage, BAC utilized noise measurement data for a commonly installed menu speaker post model. Specifically, BAC utilized sound level data from a HME SPP2 speaker post for the purpose of this analysis. According to the manufacturers noise level data sheet, presented as Appendix E, the HME SPP2 speaker post can incorporate automatic volume control (AVC), which adjusts outbound volume based on the ambient noise level environment. For example, assuming an outdoor ambient noise level of 45 dB, the speaker will adjust the volume of the system to 45 dB for a resulting calculated overall sound level of 48 dB at a distance of 4 feet. Without the AVC option enabled, the speaker reference noise level is 72 dB at 4 feet. To quantify the noise emissions of QSR drive-through vehicle passages, BAC utilized noise measurement data collected for similar drive-through operations in the greater Sacramento area in recent years. BAC file data indicates that drive-through vehicle passages, including vehicle idling, have median and maximum noise levels of 60 dB L_{eq} at a distance of 5 feet.

To calculate project drive-through operations noise level exposure relative to the city's CNEL standard (a 24-hour average descriptor), it was conservatively assumed that project drive-through menu speaker and vehicle noise from both QSRs (combined) would occur during every hour of proposed hours of operations (i.e., 10:00 a.m. to 11:00 p.m.), and that the surrogate amplified menu speaker post identified above (HME SPP2) would operate with the AVC option not enabled (i.e., worst-case speaker post noise exposure).

Based on the drive-through vehicle passby data, speaker manufacturer noise level measurements, and operations assumptions presented above, and assuming standard spherical spreading loss (-6 dB per doubling of distance), data were projected from the proposed drive-through lanes and speaker posts to the nearest noise-sensitive uses (residential). The results of those projections are presented in Table 5.

Table 5
Predicted Combined Drive-Thru Operations Noise Levels at Nearby Noise-Sensitive Uses

Noise-Sensitive Use[1]	Direction	Predicted Combined Noise Level, CNEL[2,3,4]	City Noise Standard, CNEL (dB)
Existing Single-Family Residential	North	32	**60**
Existing Single-Family Residential	East	24	
Existing Single-Family Residential	South	39	
Future Mult-Family Residential	North	34	

[1] Noise-sensitive use locations shown in Figure 1.
[2] Predicted combined CNEL assumes continuous QSR operations during all proposed hours of operation.
[3] Predicted noise levels at existing SFR east include a -10 dB offset to account for the existing 10' wall.
[4] Predicted noise levels at future MFR north include a -5 dB offset for screening of pool area by buildings.

Source: BAC 2024

As indicated in Table 5, project QSR drive-through operations noise is predicted to satisfy the applicable City of Antioch 60 dB CNEL exterior noise level standard at the closest noise-sensitive uses by a wide margin. It should be noted that activation of the drive-through speaker model's AVC option would further reduce speaker noise level exposure at nearby noise-sensitive uses.

Table 3 of this report contains the results from the BAC long-term ambient noise survey, which are believed to be representative of the existing ambient noise environments at the closest existing noise-sensitive uses (i.e., single-family residential to the north, east and west). Using the results from the BAC ambient noise level survey (measured CNELs), and the predicted noise levels presented in Table 5, ambient plus project QSR drive-through noise level increases were calculated at the closest existing noise-sensitive uses. According to the results from that exercise, project-generated increases in ambient noise levels are calculated to range from less than 0.1 CNEL to 0.1 dB CNEL. The calculated increases above would be well below the General Plan ambient noise level increase significance criterion of 3 dB.

Based on the analysis provided above, this impact is identified as being ***less than significant***.

Impact 2: On-Site Truck Circulation Noise at Nearby Noise-Sensitive Uses

The project proposes two buildings that would each contain QSR/retail uses. It is the experience of BAC that deliveries of product to QSRs/retail uses such as those proposed by the project occur at the front of the store with medium-duty vendor trucks/vans. The proposed on-site truck circulation route is shown in Figure 2.

On-site truck passbys are expected to be relatively brief and will occur at low speeds. To predict noise levels generated by project on-site truck circulation, BAC utilized file data obtained from measurements conducted by BAC of medium duty truck passbys. According to BAC file data, single-event medium truck passby noise levels are approximately 66 dB L_{max} and 76 Sound Exposure Level (SEL) at a reference distance of 50 feet.

For a conservative assessment of project delivery truck circulation noise level exposure, it was assumed that each of the proposed QSR/retail uses could receive two deliveries from a medium duty truck/van during a worst-case busy hour of deliveries (i.e., a total of four project-generated truck deliveries during a given busy hour). Given an SEL of 76, and assuming four medium truck passbys during a given hour, the hourly average is calculated to be 46 dB L_{eq}. To calculate CNEL exposure, it was conservatively assumed that the four truck deliveries could occur during nighttime hours (believed to be worst-case CNEL exposure).

Based on the reference noise level data and operations assumptions presented above, and assuming standard spherical spreading loss (-6 dB per doubling of distance), project on-site truck circulation exposure at the nearest noise-sensitive uses (residential) was calculated and the results of those calculations are presented in Table 6.

Table 6
Predicted On-Site Truck Circulation Noise Levels at Nearby Noise-Sensitive Uses

Noise-Sensitive Use[1]	Direction	Predicted Noise Level, CNEL[2,3,4]	City Noise Standard, CNEL (dB)
Existing Single-Family Residential	North	<20	**60**
Existing Single-Family Residential	East	<20	
Existing Single-Family Residential	South	28	
Future Mult-Family Residential	North	25	

[1] Noise-sensitive use locations shown in Figure 1.
[2] Predicted CNEL assumes a total of four truck deliveries all occurring during nighttime hours.
[3] Predicted noise levels at existing SFR east include a -10 dB offset to account for the existing 10' wall.
[4] Predicted noise levels at future MFR north include a -5 dB offset for screening of pool area by buildings.

Source: BAC 2024

Table 6 data indicate that project on-site delivery truck circulation noise is predicted to satisfy the applicable City of Antioch 60 dB CNEL exterior noise level standard at the closest noise-sensitive uses by a wide margin.

Using the results from the BAC ambient noise level survey (measured CNELs), and the predicted noise levels presented in Table 6, ambient plus project on-site delivery truck circulation noise level increases were calculated at the closest existing noise-sensitive uses. According to the results from that exercise, project-generated increases in ambient noise levels are calculated to be less than 0.1 CNEL. The calculated increases above would be well below the General Plan ambient noise level increase significance criterion of 3 dB.

Based on the analysis provided above, this impact is identified as being ***less than significant***.

Impact 3: Truck Delivery Activity Noise at Nearby Noise-Sensitive Uses

As mentioned previously, it is the experience of BAC that deliveries of product to QSR/retail uses typically occur at the front of the store with medium-duty vendor trucks/vans. The primary noise

sources associated with delivery activities are trucks stopping (air brakes), trucks backing into position (back-up alarms), and pulling away from the loading/unloading area (revving engines).

For a conservative assessment of project truck delivery activity noise level exposure, it was assumed that each of the proposed QSR/retail uses could receive two deliveries from a medium duty truck/van during a worst-case busy hour of deliveries (i.e., a total of four project-generated truck deliveries during a given busy hour). To calculate CNEL exposure, it was conservatively assumed that those four truck deliveries could occur during nighttime hours (believed to be worst-case CNEL exposure).

BAC file data indicate that noise levels associated with medium-duty truck deliveries (including side-step vans) are approximately 76 dB SEL at 100 feet. Based on BAC file data and operations assumptions above, and assuming standard spherical spreading loss (-6 dB per doubling of distance), project truck delivery activity noise level exposure at the nearest noise-sensitive uses (residential) was calculated and the results of those calculations are presented in Table 7.

Table 7
Predicted Truck Delivery Activity Noise Levels at Nearby Noise-Sensitive Uses

Noise-Sensitive Use[1]	Direction	Predicted Noise Level, CNEL[2,3,4]	City Noise Standard, CNEL (dB)
Existing Single-Family Residential	North	26	**60**
Existing Single-Family Residential	East	20	
Existing Single-Family Residential	South	30	
Future Mult-Family Residential	North	30	

[1] Noise-sensitive use locations shown in Figure 1.
[2] Predicted CNEL assumes a total of four truck deliveries all occurring during nighttime hours.
[3] Predicted noise levels at existing SFR east include a -10 dB offset to account for the existing 10' wall.
[4] Predicted noise levels at future MFR north include a -5 dB offset for screening of pool area by buildings.

Source: BAC 2024

As shown in Table 7, project truck delivery activity noise levels are predicted to satisfy the applicable City of Antioch 60 dB CNEL exterior noise level standard at the closest noise-sensitive uses by a wide margin.

Using the results from the BAC ambient noise level survey (measured CNELs), and the predicted noise levels presented in Table 7, ambient plus project truck delivery activity noise level increases were calculated at the closest existing noise-sensitive uses. According to the results from that exercise, project-generated increases in ambient noise levels are calculated to be less than 0.1 CNEL. The calculated increases above would be well below the General Plan ambient noise level increase significance criterion of 3 dB.

Based on the analysis provided above, this impact is identified as being ***less than significant***.

Impact 4: Car Wash Drying Assembly Noise at Nearby Noise-Sensitive Uses

Based on the experience of BAC, noise levels generated by car washes are primarily due to the drying portion of the operation. Based on information obtained from the project applicant, the car wash component of the project proposes the installation of a Sonny's Enterprises 3-blower arch assembly (45 HP), Part # BL1-45HP-1. According to equipment manufacturer noise specifications, provided as Appendix F of this report, the blower assembly generates a maximum noise level of 75 dB L_{max} at a distance of 100 feet.

According to BAC conservations with Sonny's representatives in recent years, the car wash cycle is approximately 1.5 minutes in duration, with the drying assembly in operation during the last 30 seconds (0.5 minutes) of the cycle. Based on this information, the car wash is calculated to go through 40 full cycles (60 minutes ÷ 1.5 minutes per cycle) and the dryer would operate for approximately 20 minutes (40 car wash cycles x 0.5 minutes of drying) during a busy hour of operations. Based on 20 minutes of dryer operations per hour, the resulting hourly average (L_{eq}) drying assembly noise level is calculated to be approximately 5 dB lower than the equipment's reference maximum (L_{max}) noise level presented above and in Appendix F. To calculate project car wash drying assembly noise levels relative to the General Plan CNEL descriptor, a 24-hour average standard, it was conservatively assumed that hourly average (L_{eq}) car wash drying operations noise exposure as identified above could occur during every hour of proposed car wash operations (i.e., 7:00 a.m. to 8:00 p.m. – summer hours).

Finally, according to BAC noise level measurements conducted at various car wash facilities in recent years, the noise level generation of car wash drying assemblies vary depending on the orientation of the measurement position relative to the tunnel opening. Worst-case drying assembly noise levels occur at a position directly facing the car wash exit, considered to be 0 degrees off-axis. At off-axis positions, the tunnel building facade provides varying degrees of noise level reduction. At positions 45 degrees off-axis relative to the facade of the car wash exit and entrance, drying assembly noise levels are approximately 5 dB lower. At 90 degrees off-axis, drying assembly noise levels are approximately 10 dB lower.

Based on the equipment manufacturer sound level data provided above, the proposed car wash hours of operations, and assuming standard spherical spreading loss (-6 dB per doubling of distance from a stationary source), worst-case project car wash drying assembly noise exposure at the nearest noise-sensitive uses (residential) was calculated and the results of those calculations are presented in Table 8.

Table 8
Predicted Car Wash Drying Assembly Noise Levels at Nearby Noise-Sensitive Uses

Noise-Sensitive Use[1]	Direction	Predicted Noise Level, CNEL[2,3,4]	City Noise Standard, CNEL (dB)
Existing Single-Family Residential	North	39	**60**
Existing Single-Family Residential	East	38	
Existing Single-Family Residential	South	48	
Future Mult-Family Residential	North	43	

[1] Noise-sensitive use locations shown in Figure 1.
[2] Predicted CNEL based on drying assembly in operation during every hour from 7am to 8pm.
[3] Predicted noise levels at existing SFR east include a -10 dB offset to account for the existing 10' wall.
[4] Predicted noise levels at future MFR north include a -5 dB offset for screening of pool area by buildings.

Source: BAC 2024

Table 8 data indicate that project car wash drying assembly noise level exposure is predicted to satisfy the applicable City of Antioch 60 dB CNEL exterior noise level standard at the closest noise-sensitive uses by a wide margin.

Using the results from the BAC ambient noise level survey (measured CNELs), and the predicted noise levels presented in Table 8, ambient plus project car wash drying assembly noise level increases were calculated at the closest existing noise-sensitive uses. According to the results from that exercise, project-generated increases in ambient noise levels are calculated to range from 0.1 CNEL to 0.3 dB CNEL. The calculated increases above would be well below the General Plan ambient noise level increase significance criterion of 3 dB.

Based on the analysis provided above, this impact is identified as being ***less than significant***.

Impact 5: Vacuum System Noise at Nearby Noise-Sensitive Uses

The project applicant proposes the installation of a central vacuum piping system offered by Vacutech. The project site plan indicates that there will be a vacuum area containing a total of 9 vacuum stalls (10 vacuum suction nozzles). The project site plan further indicates that the system's noise-generating vacuum turbine producer will be contained within an 8' solid masonry enclosure adjacent to the vacuum area.

Based on noise level measurements conducted by BAC staff at recently completed car wash projects, one of the primary noise-generating aspects of central vacuum piping systems are use of the suction nozzles located at each of the stalls – specifically, noise associated with active suction nozzles hanging off nozzle hangers. Reference sound level data obtained from the proposed vacuum system manufacturer (Vacutech) is provided as Appendix G. The sound level data provided in Appendix G show measured and projected sound levels from 19 vacuum hoses off their respective nozzle hangers at distances ranging from 45 feet to 85 feet. Reference sound level data for the proposed vacuum turbine producer is provided as Appendix H, which shows measured equipment noise levels at distances ranging from 10 feet to 30 feet from the equipment (contained within an 8-foot-tall CMU enclosure).

To calculate project vacuum equipment noise levels relative to the General Plan CNEL descriptor, it was conservatively assumed that all of the proposed vacuum suction nozzles and system turbine producer would be in concurrent operation during every hour of proposed operations (i.e., 7:00 a.m. to 8:00 p.m. – summer hours). Based on the manufacturer sound level data in Appendix G (conservatively using measurement data for 19 hose nozzles) and Appendix H, the provided operations information above, and assuming standard spherical spreading loss (-6 dB per doubling of distance from a stationary source), worst-case project vacuum equipment noise exposure at the nearest noise-sensitive uses (residential) was calculated and the results of those calculations are presented in Table 9.

Table 9
Predicted Vacuum System Noise Levels at Nearby Noise-Sensitive Uses

Noise-Sensitive Use[1]	Direction	Predicted Noise Level, CNEL[2,3,4]	City Noise Standard, CNEL (dB)
Existing Single-Family Residential	North	33	**60**
Existing Single-Family Residential	East	22	
Existing Single-Family Residential	South	36	
Future Mult-Family Residential	North	32	

[1] Noise-sensitive use locations shown in Figure 1.
[2] Predicted CNEL based on vacuum equipment in concurrent operation during every hour from 7am to 8pm.
[3] Predicted noise levels at existing SFR east include a -10 dB offset to account for the existing 10' wall.
[4] Predicted noise levels at future MFR north include a -5 dB offset for screening of pool area by buildings.

Source: BAC 2024

As indicated in Table 9, project vacuum equipment noise levels are predicted to satisfy the applicable City of Antioch 60 dB CNEL exterior noise level standard at the closest noise-sensitive uses by a wide margin.

Using the results from the BAC ambient noise level survey (measured CNELs), and the predicted noise levels presented in Table 9, ambient plus project vacuum equipment noise level increases were calculated at the closest existing noise-sensitive uses. According to the results from that exercise, project-generated increases in ambient noise levels are calculated to be less than 0.1 CNEL. The calculated increases above would be well below the General Plan ambient noise level increase significance criterion of 3 dB.

Based on the analysis provided above, this impact is identified as being ***less than significant***.

Impact 6: Mechanical Equipment (HVAC) Noise at Nearby Noise-Sensitive Uses

Heating, ventilating, and air conditioning (HVAC) requirements for the QSR/retail buildings will most likely be met using packaged roof-mounted systems. As a means of determining noise exposure due to rooftop mechanical equipment, BAC utilized reference file data collected for previous studies. BAC reference file data for HVAC systems indicate that a 12.5-ton packaged unit can be expected to generate an A-weighted sound power level of 85 dB. To calculate project

HVAC equipment noise levels relative to the General Plan CNEL descriptor, it was conservatively assumed that the equipment would be in operation continuously during a 24-hour period.

Using the sound power data stated above, and assuming standard spherical spreading loss (-6 dB per doubling of distance), project HVAC equipment noise exposure at the nearest noise-sensitive uses (residential) was calculated and the results of those calculations are presented in Table 10.

Table 10
Predicted HVAC Equipment Noise Levels at Nearby Noise-Sensitive Uses

Noise-Sensitive Use[1]	Direction	Predicted Noise Level, CNEL[2,3,4]	City Noise Standard, CNEL (dB)
Existing Single-Family Residential	North	38	**60**
Existing Single-Family Residential	East	31	
Existing Single-Family Residential	South	45	
Future Mult-Family Residential	North	40	

[1] Noise-sensitive use locations shown in Figure 1.
[2] Predicted CNEL based on continuous HVAC equipment usage from both buildings for a 24-hour period.
[3] Predicted noise levels at existing SFR east include a -10 dB offset to account for the existing 10' wall.
[4] Predicted noise levels at future MFR north include a -5 dB offset for screening of pool area by buildings.

Source: BAC 2024

Table 10 data indicate that project HVAC equipment noise level exposure is predicted to satisfy the applicable City of Antioch 60 dB CNEL exterior noise level standard at the closest noise-sensitive uses by a wide margin.

Using the results from the BAC ambient noise level survey (measured CNELs), and the predicted noise levels presented in Table 10, ambient plus project HVAC equipment noise level increases were calculated at the closest existing noise-sensitive uses. According to the results from that exercise, project-generated increases in ambient noise levels are calculated to range from less than 0.1 CNEL to 0.2 dB CNEL. The calculated increases above would be well below the General Plan ambient noise level increase significance criterion of 3 dB.

Based on the analysis provided above, this impact is identified as being ***less than significant***.

Impact 7: Cumulative On-Site Operations Noise at Nearby Noise-Sensitive Uses

The calculated cumulative (combined) noise levels from analyzed on-site operations at the nearest noise-sensitive uses (residential) are presented in Table 11. It should be noted that due to the logarithmic nature of the decibel scale, the sum of two noise values which differ by 10 dB equates to an overall increase in noise levels of 0.4 dB. When the noise sources are equivalent, the sum would result in an overall increase in noise levels of 3 dB.

Table 11
Calculated Cumulative On-Site Operations Noise Levels at Nearby Noise-Sensitive Uses

	Predicted Noise Levels, CNEL (dB)							
Land Use	Drive-Thru[1]	Truck Circ.	Truck Deliveries	Car Wash Dryers	Vacuum System	HVAC	Cumulative, CNEL (dB)[2]	City Noise Standard, CNEL (dB)
Existing SFR-North	32	19	26	39	33	38	43	60
Existing SFR-East	24	13	20	38	22	31	39	
Existing SFR-West	39	28	30	48	36	45	50	
Future MFR-North	34	25	30	43	32	40	46	

[1] Combined noise levels from drive-through operations sources (i.e., menu speakers and vehicles).
[2] Calculated cumulative noise levels based on predicted noise levels presented in Impacts 1-6.

Source: BAC 2024

As shown in Table 11, calculated cumulative (combined) noise level exposure from analyzed project on-site operations would satisfy the applicable City of Antioch 60 dB CNEL exterior noise level standard at the closest noise-sensitive uses by a wide margin.

Using the results from the BAC ambient noise level survey (measured CNELs), and the calculated cumulative noise levels presented in Table 11, ambient plus cumulative (combined) project on-site operations noise level increases were calculated at the closest existing noise-sensitive uses. According to the results from that exercise, cumulative project-generated increases in ambient noise levels are calculated to range from 0.1 CNEL to 0.6 dB CNEL. The calculated cumulative increases above would be well below the General Plan ambient noise level increase significance criterion of 3 dB.

Based on the analysis provided above, this impact is identified as being ***less than significant***.

Noise Impacts Associated with Project Construction Activities

Impact 8: Project Construction Noise at Nearby Noise-Sensitive Uses

During project construction activities, heavy equipment would be used for grading excavation, paving, and building construction, which would increase ambient noise levels when in use. Noise levels would vary depending on the type of equipment used, how it is operated, and how well it is maintained. Noise exposure at any single point outside the project work area would also vary depending upon the proximity of equipment activities to that point.

Table 12 includes the range of maximum noise levels for equipment commonly used in general construction projects at full-power operation at a distance of 50 feet. It should be noted that not all of these construction activities would be required of this project. Table 12 data also include predicted maximum (L_{max}) equipment noise levels at the nearest noise-sensitive uses (residential), which assume a standard spherical spreading loss of 6 dB per doubling of distance.

Table 12
Reference and Projected Noise Levels for Typical Construction Equipment

Equipment	Reference Noise Level at 50 Feet, L_{max} (dB)	Projected Noise Level, L_{max} (dB) Existing SFR-North (575 ft)	Existing SFR-East (385 ft)[1]	Existing SFR-West (300 ft)	Future MFR-North (220 ft)[2]
Air compressor	80	59	52	64	62
Backhoe	80	59	52	64	62
Ballast equalizer	82	61	54	66	64
Ballast tamper	83	62	55	67	65
Compactor	82	61	54	66	64
Concrete mixer	85	64	57	69	67
Concrete pump	82	61	54	66	64
Concrete vibrator	76	55	48	60	58
Crane, mobile	83	62	55	67	65
Dozer	85	64	57	69	67
Excavator	85	64	57	69	67
Generator	82	61	54	66	64
Grader	85	64	57	69	67
Impact wrench	85	64	57	69	67
Loader	80	59	52	64	62
Paver	85	64	57	69	67
Pneumatic tool	85	64	57	69	67
Pump	77	56	49	61	59
Saw	76	55	48	60	58
Scarifier	83	62	55	67	65
Scraper	85	64	57	69	67
Shovel	82	61	54	66	64
Spike driver	77	56	49	61	59
Tie cutter	84	63	56	68	66
Tie handler	80	59	52	64	62
Tie inserter	85	64	57	69	67
Truck	84	63	56	68	66
	Low	55	48	60	58
	High	64	57	69	67
	Average	61	54	67	64

[1] Predicted noise levels at existing SFR east include a -10 dB offset to account for the existing 10' wall.
[2] Predicted noise levels at future MFR north include a -5 dB offset for screening of pool area by buildings.

Source: 2018 FTA Noise and Vibration Impact Assessment Manual, Table 7-1 and BAC calculations

Pursuant to Section 5-17.05 of the City of Antioch Code of Ordinances, it shall be unlawful for any person to be involved in construction activity on weekdays prior to 7:00 a.m. and after 6:00 p.m., prior to 8:00 a.m. and after 5:00 p.m. on weekdays within 300 feet of occupied dwellings, and prior to 9:00 a.m. and after 5:00 p.m. on weekends and holidays, irrespective of the distance from occupied dwellings. Additionally, Policy 11.8.2 of the City of Antioch General Plan contains specific construction-related noise abatement measures required for projects. It is reasonably assumed for the purpose of this analysis that all on-site noise-generating project construction equipment and activities would occur pursuant to Section 5-17.05 of the City of Antioch Code of Ordinances.

As mentioned previously, BAC ambient noise measurements obtained at sites 1-3 are believed to be representative of the existing ambient noise environments at the existing residential uses to the north, east and west the project. The complete results of those noise measurements are contained in Appendix C & D of this report. After a review of the measured ambient maximum (L_{max}) noise levels at sites 1-3 during the construction hours of 7:00 a.m. to 6:00 p.m., it was

revealed that the predicted construction activity noise levels presented in Table 12 are either below or within the range of those ambient measured maximum noise levels at the nearest residential uses.

However, noise from heavy equipment operations during on-site construction activities would add to the noise environment in the immediate vicinity of the work area. In terms of determining the temporary noise increase due to project-related construction activities, an impact would occur if those activities were to noticeably increase ambient noise levels above background levels at nearby noise-sensitive uses (i.e., residential). As mentioned previously in this report, the threshold of perception of the human ear is approximately 3 to 5 dB – a 5 dB change is considered to be clearly noticeable. For this analysis, a noticeable increase in ambient noise levels is assumed to occur where noise levels increase by 5 dB or more over existing ambient noise levels.

Using the calculated average measured maximum (L_{max}) noise levels at sites 1-3 during the construction hours of 7:00 a.m. to 6:00 p.m., and the calculated averages of predicted construction equipment maximum noise levels shown in Table 12, ambient plus project construction equipment noise level increases were calculated at the nearby existing residential uses. According to the results from that exercise, project-generated increases in ambient maximum noise levels are calculated to range from 0.2 dB L_{max} to 2.1 dB L_{max} at the closest existing residential uses. The calculated increases in ambient maximum noise levels indicated above are below the applied increase significance criterion of 5 dB.

Based on the analysis and results provided above, this impact is identified as being ***less than significant***. Nonetheless, to the reduce the potential for annoyance at nearby existing noise-sensitive uses, the following measures should be incorporated into project on-site construction operations:

- All on-site project construction activities shall occur pursuant to the criteria identified in Policy 11.8.2 of the City of Antioch General Plan and Section 5-17.05 of the City of Antioch Code of Ordinances.
- The project shall utilize temporary construction noise control measures including the use of temporary noise barriers, or other appropriate measures as mitigation for noise generated during construction of projects.
- All noise-producing project equipment and vehicles using internal-combustion engines shall be equipped with manufacturers-recommended mufflers and be maintained in good working condition.
- All mobile or fixed noise-producing equipment used on the project site that are regulated for noise output by a federal, state, or local agency shall comply with such regulations while in the course of project activity.
- Electrically powered equipment shall be used instead of pneumatic or internal-combustion-powered equipment, where feasible.
- Material stockpiles and mobile equipment staging, parking, and maintenance areas shall be located as far as practicable from noise-sensitive receptors.

- Project area and site access road speed limits shall be established and enforced during the construction period.

Vibration Impacts Associated with Project Activities

Impact 9: Vibration Generated by On-Site Project Construction & Operations

During project construction, heavy equipment would be used for grading, excavation, paving, and building construction, which would generate localized vibration in the immediate vicinity of the construction. The nearest existing residential structure has been identified as relatively newer engineered single-family residence located west of the project site (not highly susceptible to damage by vibration). The nearest existing commercial structure has been identified as relatively newer engineered commercial building located northwest of the project site (not highly susceptible to damage by vibration).

Table 13 includes the range of vibration levels for equipment commonly used in general residential construction projects at a distance of 25 feet. Table 13 data also include projected equipment vibration levels at the nearest existing structures to the project area, as identified above. It is the understanding of BAC that the project does not propose pile driving activities, or any other construction activities that would create substantial vibration.

Table 13
Reference and Projected Vibration Source Amplitudes for Construction Equipment

Equipment	Reference Maximum Vibration Level at 25 feet, VdB (rms)	Projected Maximum Vibration Level, VdB (rms)[1]	
		SFR-West (340 ft)	Commercial-Northwest (80 ft)
Hoe Ram	87	57	66
Large bulldozer	87	57	66
Caisson drilling	87	57	66
Loaded trucks	86	56	65
Jackhammer	79	<55	60
Small bulldozer	58	<55	<55

[1] RMS velocity in decibels (VdB) re 1 micro-inch/second.

Source: 2018 FTA Transit Noise and Vibration Impact Assessment Manual and BAC calculations

Based on the data presented in Table 13, vibration levels generated from on-site construction activities are predicted to be below the FTA threshold for damage to engineered structures (98 VdB) at a reference distance of 25 feet from those activities. Table 13 data also indicate that construction-related vibration levels are projected to be either below or barely approach the threshold of human perception (65 VdB) at the closest existing structures. Based on the analysis provided above, on-site construction within the project area is not expected to result in excessive groundborne vibration levels at nearby existing residential or commercial structures.

As shown in Table 4 of this report, measured vibration levels were below the 65 VdB threshold of human perception. Therefore, it is believed that persons within the project area (or proposed uses of the development) would not be exposed to excessive groundborne vibration levels. Finally, the

project proposes the development of commercial uses. It is the experience of BAC that commercial uses do not typically have equipment that generates appreciable vibration.

Because vibration levels due to and upon the project are expected to be satisfactory relative to the applicable FTA vibration impact criteria for damage to structures and annoyance, this impact is considered to be ***less than significant***.

This concludes BAC's noise and vibration assessment of the Lone Tree Retail Project in Antioch, California. Please contact BAC at (530) 537-2328 or dariog@bacnoise.com if you have any comments or questions regarding this report.

Appendix A

Acoustical Terminology

Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.
L_{dn}	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
L_{eq}	Equivalent or energy-averaged sound level.
L_{max}	The highest root-mean-square (RMS) sound level measured over a given period of time.
Loudness	A subjective term for the sensation of the magnitude of sound.
Masking	The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.
Noise	Unwanted sound.
Peak Noise	The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the Maximum level, which is the highest RMS level.
RT_{60}	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
Sabin	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin.
SEL	A rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy of the event into a 1-s time period.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.

Legend

A: Site 1: Looking north towards site 1 and residences
B: Site 1: Looking south from site 1 towards project site
C: Site 2: Looking east towards site 2 and residences
D: Site 2: Looking north near site 2 along existing retaining/sound wall

Lone Tree Retail Project
Antioch, California

Field Survey Photographs

Appendix B-1

BOLLARD
Acoustical Consultants

Legend

A: Site 3: Looking north from site 3
B: Site 3: Looking east from site 3 towards Lone Tree Way and project site

Lone Tree Retail Project
Antioch, California

Field Survey Photographs

Appendix B-2

BOLLARD
Acoustical Consultants

Appendix C-1
Long-Term Ambient Noise Monitoring Results - Site 1
Lone Tree Retail Project - Antioch, California
Wednesday, June 19, 2024

Hour	Leq	Lmax	L50	L90
12:00 AM	42	54	41	39
1:00 AM	42	59	41	39
2:00 AM	42	54	41	39
3:00 AM	39	54	38	36
4:00 AM	42	58	41	38
5:00 AM	45	59	44	40
6:00 AM	46	63	44	42
7:00 AM	44	63	42	39
8:00 AM	43	56	42	39
9:00 AM	42	55	41	39
10:00 AM	45	66	42	40
11:00 AM	47	70	44	41
12:00 PM	45	54	43	41
1:00 PM	46	60	45	42
2:00 PM	46	63	45	42
3:00 PM	50	69	45	42
4:00 PM	49	69	46	43
5:00 PM	48	64	45	43
6:00 PM	48	77	45	42
7:00 PM	47	68	45	42
8:00 PM	48	75	45	43
9:00 PM	47	61	46	44
10:00 PM	45	59	44	42
11:00 PM	43	56	42	40

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	50	42	47	48	47	47	46	39	43
Lmax (Maximum)	77	54	64	75	61	68	63	54	57
L50 (Median)	46	41	44	46	45	45	44	38	42
L90 (Background)	43	39	41	44	42	43	42	36	39

Computed CNEL, dB	51
% Daytime Energy	60%
% Evening Energy	18%
% Nighttime Energy	22%

GPS Coordinates	37°58'33.64"N
	121°47'51.26"W

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Appendix C-2
Long-Term Ambient Noise Monitoring Results - Site 1
Lone Tree Retail Project - Antioch, California
Thursday, June 20, 2024

Hour	Leq	Lmax	L50	L90
12:00 AM	45	68	41	39
1:00 AM	40	50	39	37
2:00 AM	40	61	39	37
3:00 AM	40	59	39	37
4:00 AM	42	52	41	38
5:00 AM	45	59	44	41
6:00 AM	46	62	44	42
7:00 AM	47	64	44	42
8:00 AM	48	73	44	41
9:00 AM	44	58	42	40
10:00 AM	44	58	43	40
11:00 AM	45	63	44	40
12:00 PM	42	52	41	38
1:00 PM	47	71	43	40
2:00 PM	46	59	45	42
3:00 PM	46	59	45	43
4:00 PM	47	69	45	42
5:00 PM	49	72	47	44
6:00 PM	47	62	46	43
7:00 PM	47	63	45	42
8:00 PM	49	68	45	42
9:00 PM	45	60	44	42
10:00 PM	43	53	43	41
11:00 PM	43	65	42	40

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	49	42	46	49	45	47	46	40	43
Lmax (Maximum)	73	52	63	68	60	64	68	50	59
L50 (Median)	47	41	44	45	44	45	44	39	41
L90 (Background)	44	38	41	42	42	42	42	37	39

Computed CNEL, dB	51
% Daytime Energy	59%
% Evening Energy	18%
% Nighttime Energy	22%

GPS Coordinates	37°58'33.64"N
	121°47'51.26"W

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Appendix C-3
Long-Term Ambient Noise Monitoring Results - Site 2
Lone Tree Retail Project - Antioch, California
Wednesday, June 19, 2024

Hour	Leq	Lmax	L50	L90
12:00 AM	46	59	44	39
1:00 AM	46	65	43	39
2:00 AM	44	56	42	38
3:00 AM	41	58	40	38
4:00 AM	46	59	45	42
5:00 AM	52	72	48	45
6:00 AM	50	68	48	46
7:00 AM	48	68	47	44
8:00 AM	50	62	47	43
9:00 AM	51	62	47	42
10:00 AM	49	70	47	44
11:00 AM	51	68	50	47
12:00 PM	50	63	49	46
1:00 PM	52	72	50	47
2:00 PM	53	68	52	48
3:00 PM	53	68	51	48
4:00 PM	53	69	52	48
5:00 PM	54	72	51	47
6:00 PM	53	75	51	46
7:00 PM	54	78	50	46
8:00 PM	53	76	50	47
9:00 PM	55	67	55	47
10:00 PM	51	64	48	44
11:00 PM	45	58	44	41

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	54	48	52	55	53	54	52	41	48
Lmax (Maximum)	75	62	68	78	67	74	72	56	62
L50 (Median)	52	47	49	55	50	52	48	40	45
L90 (Background)	48	42	46	47	46	46	46	38	41

Computed CNEL, dB	56
% Daytime Energy	57%
% Evening Energy	25%
% Nighttime Energy	18%

GPS Coordinates	37°58'26.97"N
	121°47'48.59"W

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Appendix C-4
Long-Term Ambient Noise Monitoring Results - Site 2
Lone Tree Retail Project - Antioch, California
Thursday, June 20, 2024

Hour	Leq	Lmax	L50	L90
12:00 AM	48	72	44	41
1:00 AM	41	55	40	37
2:00 AM	51	76	40	37
3:00 AM	43	62	41	38
4:00 AM	46	58	45	42
5:00 AM	48	60	47	45
6:00 AM	49	67	48	46
7:00 AM	49	68	48	46
8:00 AM	50	68	47	44
9:00 AM	47	60	45	43
10:00 AM	48	67	46	44
11:00 AM	49	70	47	44
12:00 PM	48	60	47	44
1:00 PM	55	80	50	46
2:00 PM	52	65	51	48
3:00 PM	54	71	52	49
4:00 PM	53	71	51	48
5:00 PM	54	68	53	49
6:00 PM	52	63	51	47
7:00 PM	53	77	50	46
8:00 PM	53	71	49	46
9:00 PM	51	75	48	45
10:00 PM	47	59	45	43
11:00 PM	47	67	45	42

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	55	47	52	53	51	52	51	41	47
Lmax (Maximum)	80	60	68	77	71	74	76	55	64
L50 (Median)	53	45	49	50	48	49	48	40	44
L90 (Background)	49	43	46	46	45	45	46	37	41

Computed CNEL, dB	55
% Daytime Energy	63%
% Evening Energy	19%
% Nighttime Energy	18%

GPS Coordinates	37°58'26.97"N
	121°47'48.59"W

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Appendix C-5
Long-Term Ambient Noise Monitoring Results - Site 3
Lone Tree Retail Project - Antioch, California
Wednesday, June 19, 2024

Hour	Leq	Lmax	L50	L90
12:00 AM	50	64	47	40
1:00 AM	50	68	44	38
2:00 AM	49	66	44	38
3:00 AM	49	69	43	38
4:00 AM	53	65	50	43
5:00 AM	55	66	53	48
6:00 AM	58	84	54	49
7:00 AM	57	73	54	46
8:00 AM	57	78	55	46
9:00 AM	57	72	55	47
10:00 AM	61	87	56	49
11:00 AM	59	80	57	51
12:00 PM	58	76	57	50
1:00 PM	59	81	56	50
2:00 PM	58	82	56	49
3:00 PM	58	76	57	49
4:00 PM	58	76	56	50
5:00 PM	58	73	57	50
6:00 PM	60	83	57	50
7:00 PM	63	91	57	50
8:00 PM	61	87	57	50
9:00 PM	58	82	55	49
10:00 PM	55	72	53	46
11:00 PM	53	68	50	43

Statistical Summary									
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	61	57	58	63	58	61	58	49	53
Lmax (Maximum)	87	72	78	91	82	87	84	64	69
L50 (Median)	57	54	56	57	55	56	54	43	49
L90 (Background)	51	46	49	50	49	50	49	38	42

Computed CNEL, dB	62
% Daytime Energy	59%
% Evening Energy	27%
% Nighttime Energy	14%

GPS Coordinates	37°58'27.26"N
	121°47'59.96"W

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Appendix C-6
Long-Term Ambient Noise Monitoring Results - Site 3
Lone Tree Retail Project - Antioch, California
Thursday, June 20, 2024

Hour	Leq	Lmax	L50	L90
12:00 AM	55	80	48	40
1:00 AM	49	66	42	39
2:00 AM	52	77	42	38
3:00 AM	50	67	45	38
4:00 AM	54	69	51	44
5:00 AM	57	75	55	48
6:00 AM	58	75	56	48
7:00 AM	56	69	55	47
8:00 AM	57	73	56	48
9:00 AM	57	72	55	48
10:00 AM	57	78	55	48
11:00 AM	59	82	56	49
12:00 PM	57	74	56	49
1:00 PM	65	91	57	50
2:00 PM	59	76	57	51
3:00 PM	59	74	57	51
4:00 PM	59	85	56	51
5:00 PM	58	75	56	50
6:00 PM	58	71	56	49
7:00 PM	59	81	56	49
8:00 PM	59	85	55	49
9:00 PM	56	75	54	48
10:00 PM	54	67	52	46
11:00 PM	53	71	51	44

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	65	56	59	59	56	58	58	49	54
Lmax (Maximum)	91	69	77	85	75	80	80	66	72
L50 (Median)	57	55	56	56	54	55	56	42	49
L90 (Background)	51	47	49	49	48	48	48	38	43

Computed CNEL, dB	62
% Daytime Energy	70%
% Evening Energy	14%
% Nighttime Energy	16%

GPS Coordinates	37°58'27.26"N
	121°47'59.96"W

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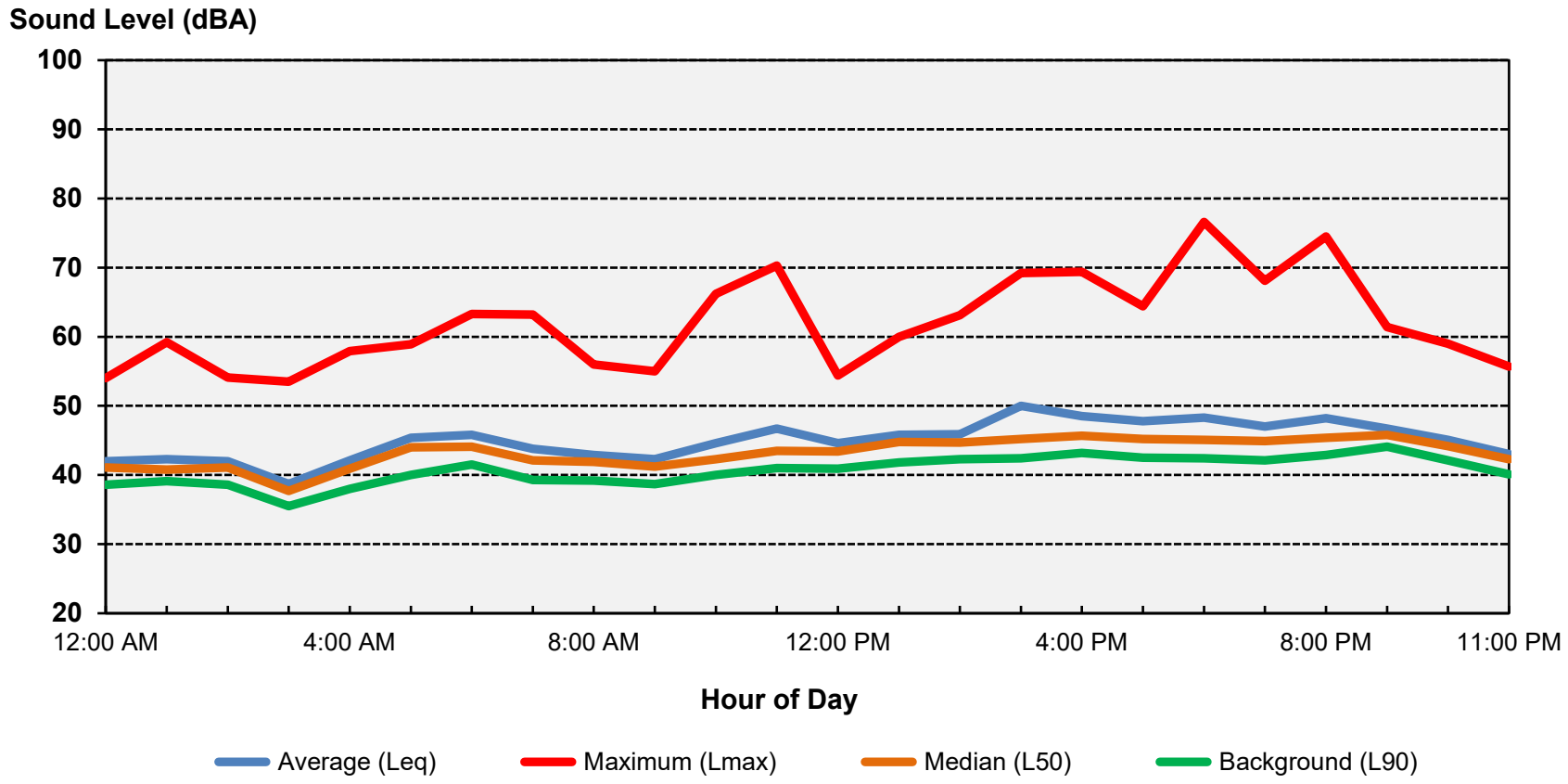
Appendix D-1
Long-Term Ambient Noise Monitoring Results - Site 1
Lone Tree Retail Project - Antioch, California
Wednesday, June 19, 2024



CNEL: 51 dB

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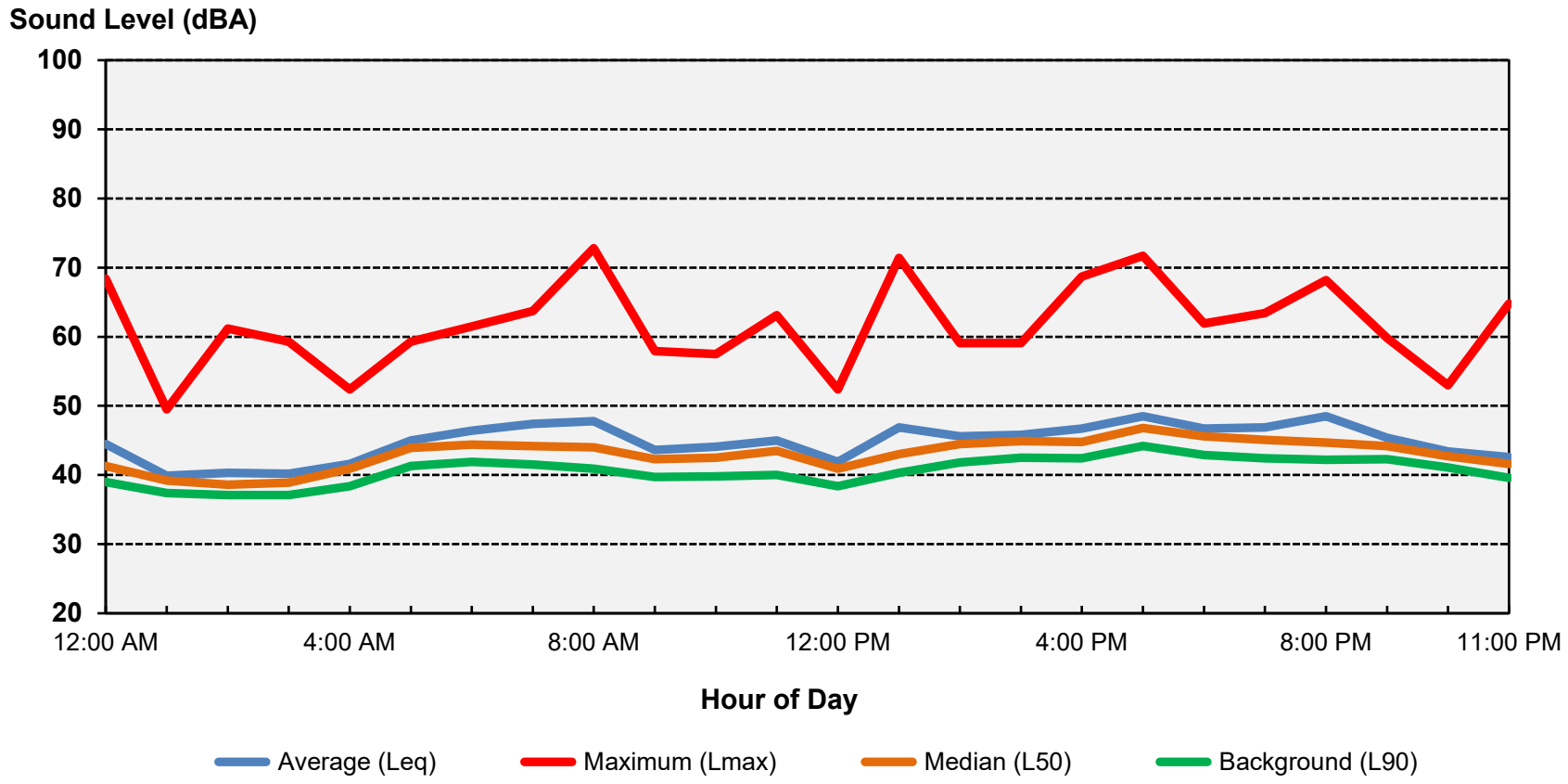
Appendix D-2
Long-Term Ambient Noise Monitoring Results - Site 1
Lone Tree Retail Project - Antioch, California
Thursday, June 20, 2024



CNEL: 51 dB

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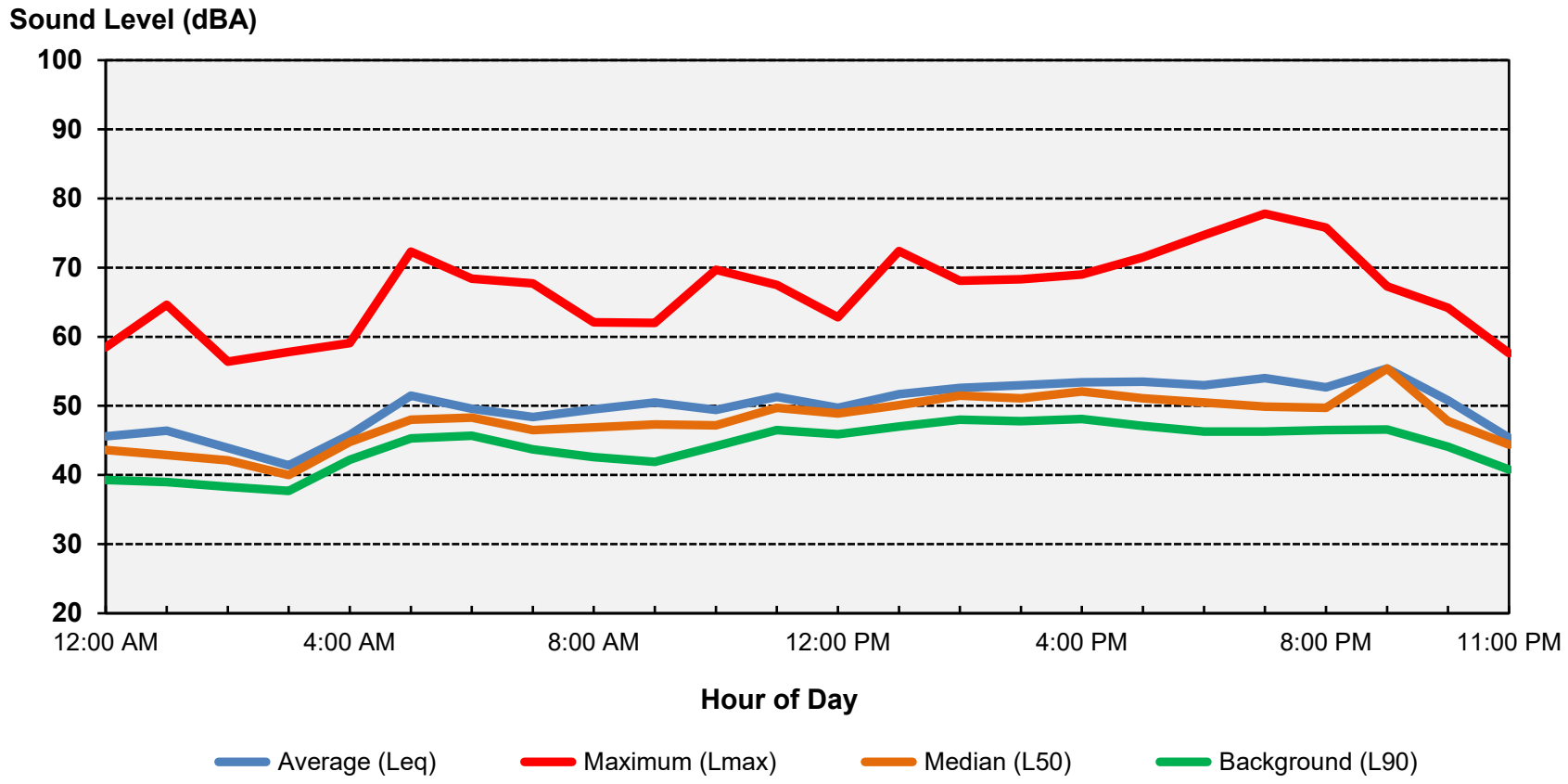
Appendix D-3
Long-Term Ambient Noise Monitoring Results - Site 2
Lone Tree Retail Project - Antioch, California
Wednesday, June 19, 2024



CNEL: 56 dB

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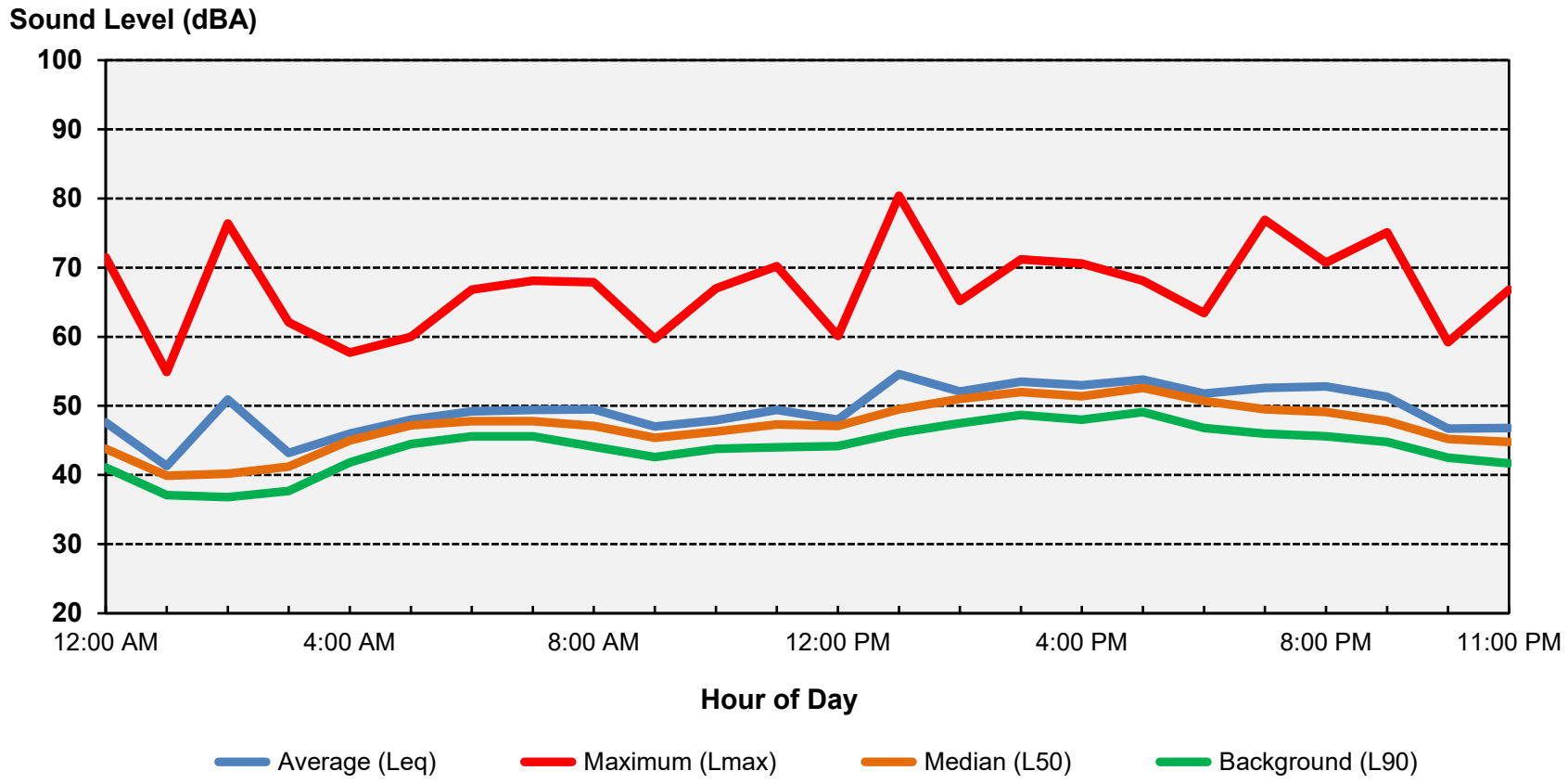
Appendix D-4
Long-Term Ambient Noise Monitoring Results - Site 2
Lone Tree Retail Project - Antioch, California
Thursday, June 20, 2024



CNEL: 55 dB

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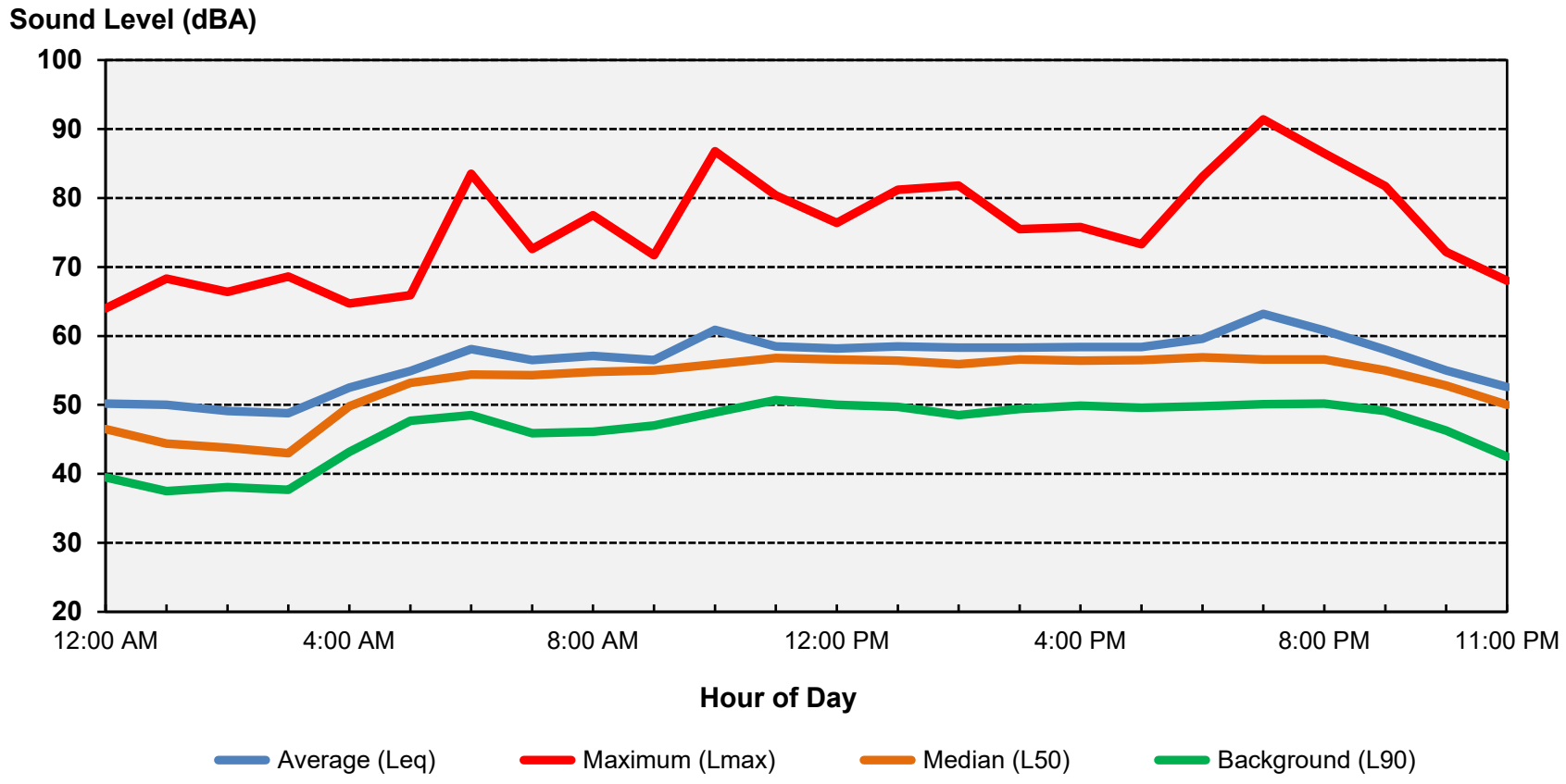
Appendix D-5
Long-Term Ambient Noise Monitoring Results - Site 3
Lone Tree Retail Project - Antioch, California
Wednesday, June 19, 2024



CNEL: 62 dB

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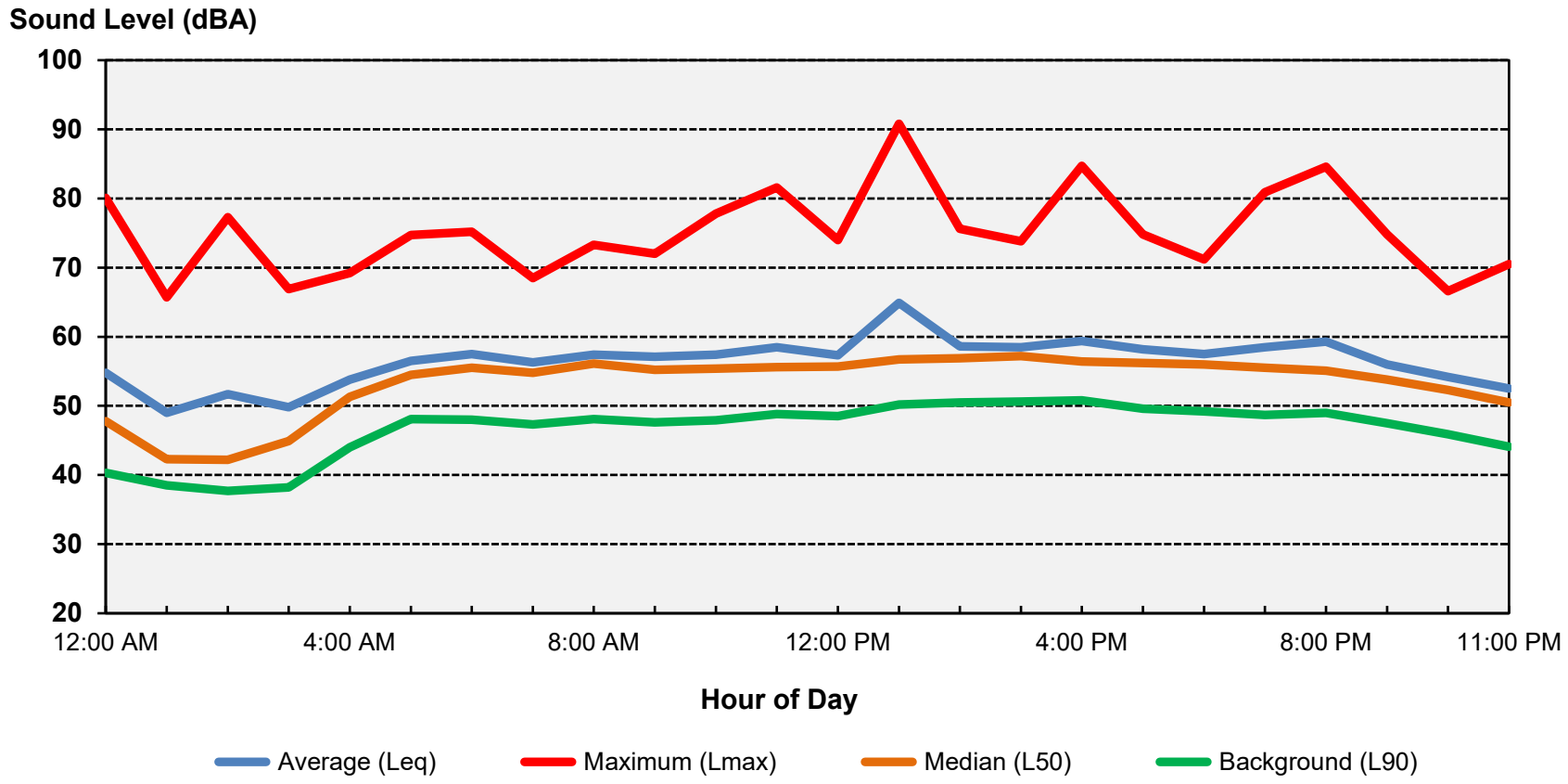
Appendix D-6
Long-Term Ambient Noise Monitoring Results - Site 3
Lone Tree Retail Project - Antioch, California
Thursday, June 20, 2024



CNEL: 62 dB

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Appendix E
Drive-Through Speaker Reference Noise Level Data

HME

Customer Driven

Memo

Re: Drive-Thru Sound Pressure Levels From the Menu Board or Speaker Post

The sound pressure levels from the menu board or speaker post are as follows:

1. Sound pressure level (SPL) contours (A weighted) were measured on a typical HME SPP2 speaker post. The test condition was for pink noise set to 84 dBA at 1 foot in front of the speaker. All measurements were conducted outside with the speaker post placed 8 feet from a non-absorbing building wall and at an oblique angle to the wall. These measurements should not be construed to guarantee performance with any particular speaker post in any particular environment. They are typical results obtained under the conditions described above.

2. The SPL levels are presented for different distances from the speaker post:

Distance from the Speaker (Feet)	SPL (dBA)
1 foot	84 dBA
2 feet	78 dBA
4 feet	72 dBA
8 feet	66 dBA
16 feet	60 dBA
32 feet	54 dBA

3. The above levels are based on factory recommended operating levels, which are preset for HME components and represent the optimum level for drive-thru operations in the majority of the installations.

Also, HME incorporates automatic volume control (AVC) into many of our Systems. AVC will adjust the outbound volume based on the outdoor, ambient noise level. When ambient noise levels naturally decrease at night, AVC will reduce the outbound volume on the system. See below for example:

Distance from Outside Speaker	Decibel Level of standard system with 45 dB of outside noise without AVC	Decibel level of standard system with 45 dB of outside noise with AVC active
1 foot	84 dBA	60 dBA
2 feet	78 dBA	54 dBA
4 feet	72 dBA	48 dBA
8 feet	66 dBA	42 dBA
16 feet	60 dBA	36 dBA

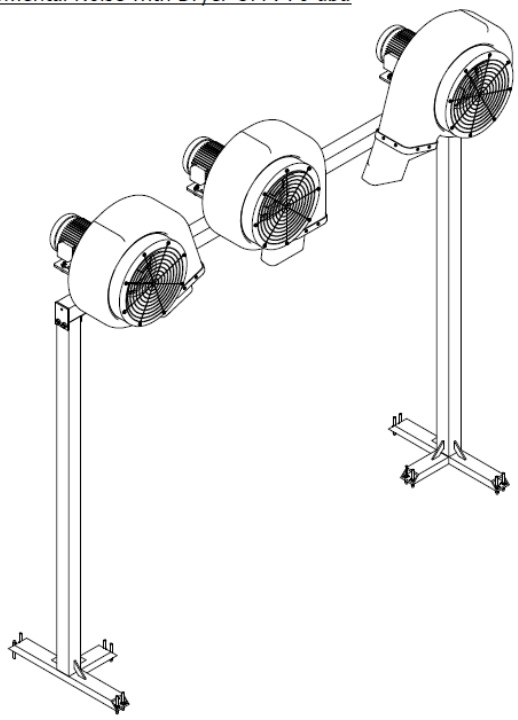
If there are any further questions regarding this issue please contact HME customer service at 1-800-848-4468.

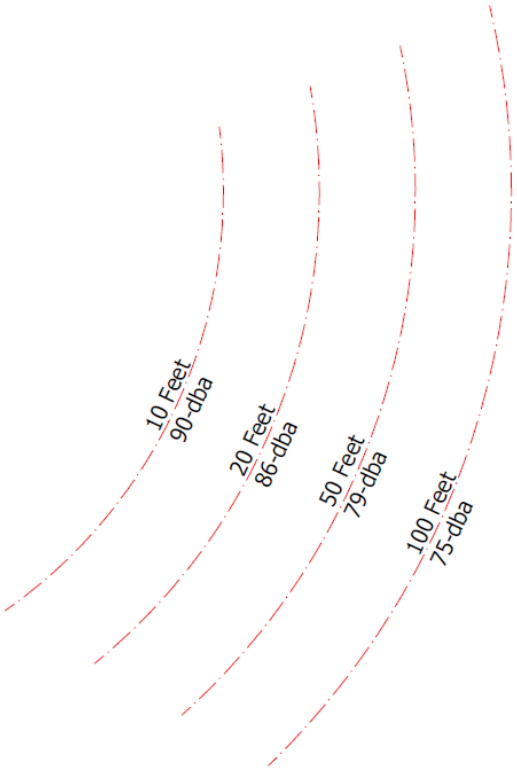
Thank you for your interest in HME's products.

HM Electronics, Inc. | 14110 Stowe Drive | Poway, CA 92064
phone: 800.848.4468 | fax: 858.452.7207 | www.hme.com

Appendix F
Car Wash Drying Assembly Manufacturer Documentation
Sonny's Enterprises: 45 HP Blower Assembly

Enviromental Noise with Dryer OFF: 70 dba





THIRD ANGLE PROJECTION BREAK ALL SHARP CORNERS. PART TO BE FREE OF BURRS. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES	MACHINING TOLERANCES FRACTION± 1/16" .XX DECIMAL ± 0.030 .XXX DECIMAL ± 0.005 ANGULARITY ± 2° FINISH 125	DRAWN LVerdecia 8/26/2011 APPROVED 8/1/2012 CATEGORY BLOWER THIS SHEET CONTAINS CONFIDENTIAL INFORMATION, IMAGES AND TRADE SECRETS OF SONNY'S ENTERPRISES, INC. ANY UNAUTHORIZED USE OR DISCLOSURE OF ANY PORTION THEREOF IS STRICTLY PROHIBITED. THIS WORK IS THE EXCLUSIVE PROPERTY OF SONNY'S ENTERPRISES, INC. ALL RIGHTS RESERVED.	**SONNY'S ENTERPRISES** THE CARWASH FACTORY DESCRIPTION BLOWER ASSEMBLY, ONE ARCH 45HP PART NUMBER BL1-45HP-1 SHEET 2 OF 2 SIZE A SCALE N.T.S.	
MATERIAL				

Appendix G
Vacuum System Manufacturer Documentation
Vacutech: Manufacturer Noise Level Measurements

February 10th, 2016

Re: Vacutech Sound Study Projections for Bella Terra Car Wash in Huntington Beach, CA

To: Chase Russell – Owner of Bella Terra Car Wash 16061 Beach Blvd. Huntington Beach, CA

The chart below shows a cumulative average of that data taken from express car washes of this type and size. It is presented in an incremental form based on the worst case scenario of the vacuum hoses being off the hook, so to speak. Based on the collective average of the 45' reading to the 85' reading and is presented in the chart below:

Vacutech Noise Study Projections	
Average of all 19 hoses off and in use	
Average @ 45'	52.3 db
Average @ 55'	54.6 db
Average @ 65'	52.1 db
Average @ 75'	49.2 db
Average @ 85'	49.0 db

SOUND LEVEL METER USED: SIMPSON MODEL #40003 – MSHA APPROVED. MEETS OSHA AND WALSH-HEALY REQUIREMENTS FOR NOISE CONTROL. CONFORMS TO ANSI S1.4 1983, IEC 651 SPECS FOR METER TYPE.

NOTE: Typical outside vacuum system with 1.5" x 15' vacuum nozzles (4" wide by ¾" opening) in use with customer vacuuming.

Appendix H
Vacutech Turbine Vacuum Producer Sound Level Data

SOUND LEVEL METER READINGS

MODEL: **FT-DD-T460HP4** (60HP TURBINE VACUUM PRODUCER)

READING ONE: 72 DB-A, 10 FEET FROM TURBINE @ 45° ANGLE
AND NO BACKGROUND NOISE OR OUTSIDE INTERFERENCE.

READING TWO: 65 DB-A, 20 FEET FROM TURBINE @ 45° ANGLE
AND NO BACKGROUND NOISE OR OUTSIDE INTERFERENCE.

READING THREE: 59 DB-A, 30 FEET FROM TURBINE @ 45° ANGLE
AND NO BACKGROUND NOISE OR OUTSIDE INTERFERENCE.

NOTE: THESE READINGS WERE TAKEN OUTSIDE OF 8'x10'x8' CMU ENCLOSURE WITH CONCRETE SLAB AND NO ROOF

SOUND LEVEL METER USED:

SIMPSON MODEL #40003 – MSHA APPROVED.
MEETS OSHA & WALSH-HEALY REQUIREMENTS FOR NOISE CONTROL.
CONFORMS TO ANSI S1.4-1983, IEC 651 SPECS FOR METER TYPE.

Vacutech
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EMAIL: info@vacutechllc
WEB SITE: vacutechllc.com