SOUTHWEST TRAFFIC
ENGINEERING, LLC

FINAL SITE PLAN CASE #2201777
GRADING PERMIT #2500131

REVIEWED - SEE COMMENTS

Engineering: chuelle 04/11/2025

The issuance of a permit shall not be construed to be a permit or approval of any violation of the codes or ordinances of the Town of Oro Valley

21 July 2022

David Laws, PE
Town of Oro Valley
11000 N. La Canada Drive
Oro Valley, Arizona 85338

SUBJECT: SUNDARA RIDGE
LAMBERT LANE/LA CHOLLA BOULEVARD
TRAFFIC IMPACT STATEMENT

Dear Mr. Laws,

Please find enclosed a brief traffic impact statement (TIS) regarding the proposed Sundara Ridge project located on the southeast corner of Lambert Lane/La Cholla Boulevard in Oro Valley, Arizona. The site vicinity is located as shown in **Figure 1**. The project will consist of a ninety-one (91) unit single family home development as shown in **Figure 2**. This site will be served by two (2) proposed access points.

Traffic impacts of the proposed site were originally evaluated in the approved *Lambert La Cholla Traffic Impact Analysis* (Original TIA) dated 1 October 2014 and completed by Southwest Traffic Engineering, LLC (**SWTE**). As the project has moved through the development process, planned portions of the project site have been revised. The project was initially planned to include 154 single family homes. The updated plan for this project proposes the construction of ninety-one (91) single family homes, as shown in **Figure 2**.

The purpose of this traffic impact statement is to estimate the traffic generation associated with the new development plan, compare the new trip generation estimate to the assumptions made in the Original TIA, and outline the possible impacts of the site on the immediate area.

Existing Conditions

The proposed development is located on undeveloped land on the southeast corner of Lambert Lane/La Cholla Boulevard in Oro Valley, Arizona.

La Cholla Boulevard is rolling, aligned north/south, and offers two through lanes in each direction separated by a raised median. Median breaks are provided along La Cholla Boulevard to allow for u-turns and left turns. A multi-use pathway and overhead utilities are present on the west side of La Cholla Boulevard in the vicinity of the project site. The posted speed limit on La Cholla Boulevard is 45 miles per hour (mph).

Lambert Lane travels east to west and provides one through lane in each direction adjacent to the project site. Approximately one-half mile east of La Cholla Boulevard, Lambert Lane widens to provide two through lanes for each direction of travel, separated by a raised median. Overhead utilities and a multi-use pathway are located on the south side of Lambert Lane adjacent to the project site. Excess pavement is provided on the north and south sides of Lambert Lane at the intersection of Lambert Lane/La Cholla Boulevard in anticipation of the future widening of Lambert Lane. This pavement extends approximately 130 feet east and west of La Cholla Boulevard. There is a posted speed limit of 45 mph on the roadway.

Owl Head Place is a two-lane residential roadway that serves eight (8) homes west of La Cholla Boulevard. This roadway ends in a cul-de-sac after approximately one quarter mile. The posted speed limit on Owl Head Place is 25 mph.

Lambert Lane/La Cholla Boulevard is a four-leg signalized intersection. Eastbound and westbound vehicles are offered an exclusive left turn lane and a shared through/right turn lane. The northbound and southbound approaches to the intersection are provided with an exclusive left turn lane, two through lanes, and an exclusive right turn lane.

The intersection of Owl Head Place/La Cholla Boulevard is a three-leg un-signalized intersection. Eastbound vehicles are STOP controlled and provided with a shared left/right turn lane. Northbound traffic makes use of an exclusive left turn lane and two through lanes while southbound vehicles are offered an exclusive u-turn lane, one through lane, and a shared through/right turn lane. Northbound and southbound traffic on La Cholla Boulevard is free flow.

Access

The Sundara Ridge development will be served by one proposed and one existing intersection.

Monarch Grove is proposed on the south side of Lambert Lane, approximately 1,565 feet east of La Cholla Boulevard. Eastbound vehicles approaching the intersection of Monarch Grove/Lambert Lane will be provided with a shared through/right turn lane while westbound traffic will make use of an exclusive left turn lane and one through lane. Northbound vehicles exiting the site will be STOP controlled and offered space for an exclusive left turn lane and right turn lane.

A new east leg will be constructed at the existing intersection of Owl Head Place/La Cholla Boulevard. The eastbound approach to Owl Head Place/La Cholla Boulevard will provide a shared left turn/through/right turn lane. Westbound traffic will make use of an exclusive left turn lane and a shared through/right turn lane. Northbound and southbound vehicles will be offered an exclusive left turn lane, one through lane, and a shared through/right turn lane. The eastbound and westbound approaches to the intersection will be STOP controlled.

Figure 3 shows the locations, geometry, and spacing for the proposed access points and existing intersections that will serve the site.

Trip Generation

Trip generation for the project was developed utilizing nationally agreed upon data contained in the Institute of Transportation Engineers (ITE) publication *Trip Generation, 11th Edition*, 2021. Trip generation was estimated for the original development plan of 154 single-family homes using Land Use Code 210 (LUC 210) Single-Family Detached Housing.

It should be noted that in the Original TIA, the trip generation was calculated using *Trip Generation, 9th Edition,* 2012. For the purposes of comparison, the original calculation was updated to the *Trip Generation, 11th Edition,* 2021.

The result is the expected weekday trip generation for the original development plan, as shown in **Table 1**. The complete trip generation calculations can be found attached to this statement.

Table 1 – Original Trip Generation

Time Period	Original Site
Average Daily, Inbound (vtpd)	727
Average Daily, Outbound (vtpd)	727
Total Daily	**1,454**
AM Peak Hour, Inbound (vtph)	28
AM Peak Hour, Outbound (vtph)	80
Total AM Peak	**108**
PM Peak Hour, Inbound (vtph)	91
PM Peak Hour, Outbound (vtph)	54
Total PM Peak	**145**

vtpd - vehicle trips per day, vtph - vehicle trips per hour

Trip generation was then estimated for the updated development plan of 91 single-family homes based on LUC 210 Single-Family Detached Housing.

Table 2 shows the results of the trip generation for updated development plan.

Table 2 – Updated Trip Generation

Time Period	Updated Site
Average Daily, Inbound (vtpd)	430
Average Daily, Outbound (vtpd)	430
Total Daily	**860**
AM Peak Hour, Inbound (vtph)	17
AM Peak Hour, Outbound (vtph)	47
Total AM Peak	**64**
PM Peak Hour, Inbound (vtph)	54
PM Peak Hour, Outbound (vtph)	32
Total PM Peak	**86**

vtpd - vehicle trips per day, vtph - vehicle trips per hour

Table 3 shows the difference in trips between the original development plan (**Table 1**) and the updated development plan (**Table 2**).

Table 3 –Estimated Site Trip Generation Difference

Time Period	Original Site	Updated Site	Difference
Average Daily, Inbound (vtpd)	727	430	-297
Average Daily, Outbound (vtpd)	727	430	-297
Total Daily	**1,454**	**860**	-594
AM Peak Hour, Inbound (vtph)	28	17	-11
AM Peak Hour, Outbound (vtph)	80	47	-33
Total AM Peak	**108**	**64**	-44
PM Peak Hour, Inbound (vtph)	91	54	-37
PM Peak Hour, Outbound (vtph)	54	32	-22
Total PM Peak	**145**	**86**	-59

vtpd - vehicle trips per day, vtph - vehicle trips per hour

Conclusion

The updated development plan is expected to generate 594 fewer daily trips, 44 fewer AM peak hour trips, and 59 fewer PM peak hour trips when compared to the trip generation from the Original TIA. Furthermore, the Original TIA noted that the two proposed access points would operate at an adequate level of service (LOS) with both La Cholla Boulevard and Lambert Lane being two lane roadways. Since then, La Cholla Boulevard has been improved to a five-lane median divided roadway, and this project will add a westbound left turn lane at Monarch Grove/Lambert Lane.

These roadway capacity improvements, coupled with fewer expected trips for the project, are anticipated to further improve levels of service not only at each of the two proposed access points but also at the adjacent intersections in the area. The conclusions and recommendations in the Original TIA are expected to accommodate this update to the development plan.

Thank you again for your time and review of this TIS. If you have any questions regarding the TIS, please feel free to contact me at 602.266.7983.

Respectfully Submitted,

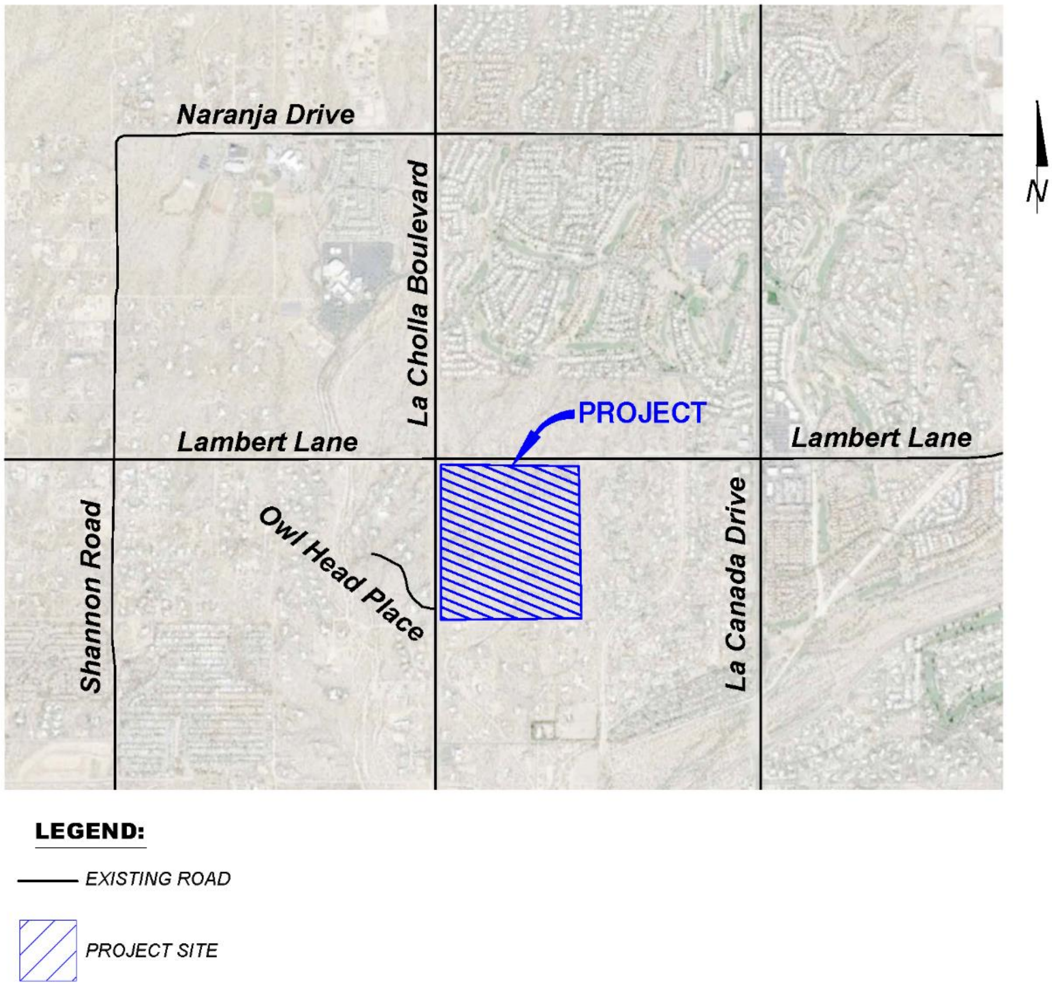
Shane Gutknecht, PE, PTOE
Southwest **T**raffic **E**ngineering LLC
Traffic Engineer

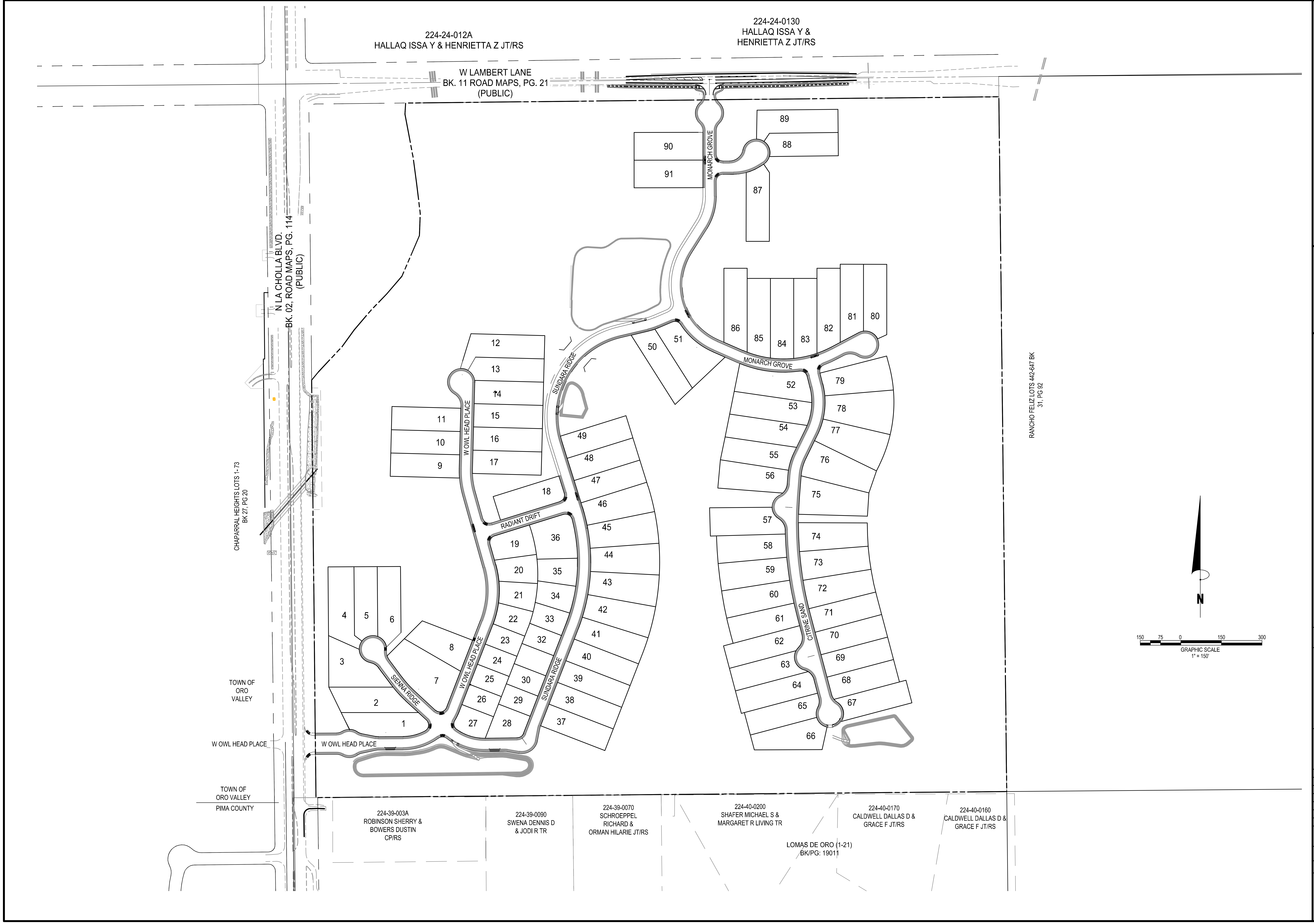
66779
SHANE M.
GUTKNECHT
Date Signed 7/21/22

cc: Alexis Fasseas, Future Arizona, Inc (by email)
Rob Schlicher, Bowman (by email)

Attachments:
- Figure 1 – Vicinity Map
- Figure 2 – Site Plan
- Figure 3 – Access Point and Intersection Configuration Assumptions
- Trip Generation Calculations
- Original TIA Site Plan

Figure 1 – Vicinity Map





Bowman

Bowman Consulting Group, Ltd.
7464 N. La Cholla Blvd.
Tucson, Arizona 85741

Phone: (520) 463-3200

www.bowman.com

OVERALL SITE PLAN EXHIBIT

SUNDARA RIDGE

A PORTION OF THE NORTHWEST QUARTER OF SECTION 15, TOWNSHIP 12 SOUTH,
RANGE 13 EAST, G&SRB&M TOWN OF ORO VALLEY, PIMA COUNTY, ARIZONA
2101153

ORO VALLEY, AZ

PIMA COUNTY

050980-01-001
PROJECT NUMBER

PLAN STATUS		
DATE	DESCRIPTION	
DESIGN	DRAWN	CHKD
SCALE	H: 1"=150' V:	
JOB No.	050980-01-001	

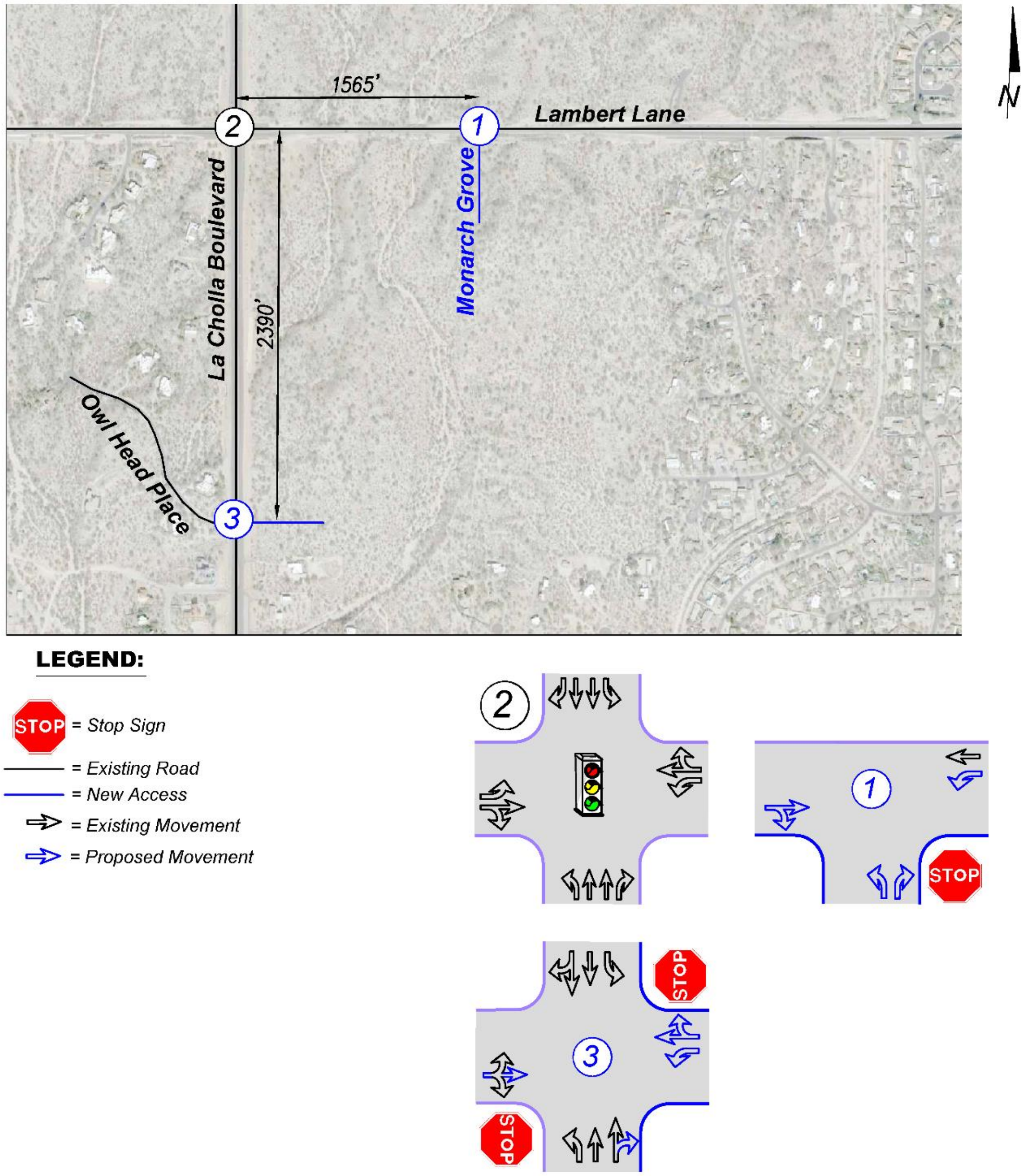
DATE : 07/12/21

C.I. = 2'

SHEET 01 OF 01

V:\050980 - SE La Cholla Lambert Residential 92 lots\050980-01-001 (ENG) - SE La Cholla Lambert Residential 92 lots\Engineering\Exhibits\Building Limits Area071522.dwg 07/15/2022

Figure 3 – Access Point and Intersection Configuration Assumptions



Single-Family Detached Housing

LAND USE: 154 Dwelling Units Single-Family Detached Housing
Original Plan
TRIP GENERATION CALCULATIONS ARE BASED ON THE INSTITUTE OF TRANSPORTATION ENGINEERS' TRIP GENERATION, 11TH EDITION. THE ITE LAND USE CODE IS
Single-Family Detached Housing (210), General Urban/Suburban

WEEKDAY

Average Rate = 9.43 Trips per Dwelling Unit (DU)
T = 9.43 Trips x 154 DU
T = 1,454 VTPD
ENTER: (0.5)*(1454) = **727 VTPD**
EXIT: (0.5)*(1454) = **727 VTPD**

AM PEAK HOUR (ONE HOUR BETWEEN 7 AND 9 AM)

Average Rate = 0.7 Trips per Dwelling Unit (DU)
T = 0.7 Trips x 154 DU
T = 108 VPH
ENTER: (0.26)*(108) = **28 VPH**
EXIT: (0.74)*(108) = **80 VPH**

PM PEAK HOUR (ONE HOUR BETWEEN 4 AND 6 PM)

Average Rate = 0.94 Trips per Dwelling Unit (DU)
T = 0.94 Trips x 154 DU
T = 145 VPH
ENTER: (0.63)*(145) = **91 VPH**
EXIT: (0.37)*(145) = **54 VPH**

*where, T = trip ends

TRIP GENERATION SUMMARY

WEEKDAY	**1,454**	**VTPD**
AM PEAK HOUR (ONE HOUR BETWEEN 7 AND 9 AM)	**108**	**VPH**
PM PEAK HOUR (ONE HOUR BETWEEN 4 AND 6 PM)	**145**	**VPH**

Single-Family Detached Housing

LAND USE: 91 Dwelling Units Single-Family Detached Housing
Original Plan
TRIP GENERATION CALCULATIONS ARE BASED ON THE INSTITUTE OF TRANSPORTATION ENGINEERS' TRIP GENERATION, 11TH EDITION. THE ITE LAND USE CODE IS
Single-Family Detached Housing (210), General Urban/Suburban

WEEKDAY

Average Rate = 9.43 Trips per Dwelling Unit (DU)
T = 9.43 Trips x 91 DU
T = 860 VTPD
ENTER: (0.5)*(860) = **430 VTPD**
EXIT: (0.5)*(860) = **430 VTPD**

AM PEAK HOUR (ONE HOUR BETWEEN 7 AND 9 AM)

Average Rate = 0.7 Trips per Dwelling Unit (DU)
T = 0.7 Trips x 91 DU
T = 64 VPH
ENTER: (0.26)*(64) = **17 VPH**
EXIT: (0.74)*(64) = **47 VPH**

PM PEAK HOUR (ONE HOUR BETWEEN 4 AND 6 PM)

Average Rate = 0.94 Trips per Dwelling Unit (DU)
T = 0.94 Trips x 91 DU
T = 86 VPH
ENTER: (0.63)*(86) = **54 VPH**
EXIT: (0.37)*(86) = **32 VPH**

*where, T = trip ends

TRIP GENERATION SUMMARY

WEEKDAY	**860**	**VTPD**
AM PEAK HOUR (ONE HOUR BETWEEN 7 AND 9 AM)	**64**	**VPH**
PM PEAK HOUR (ONE HOUR BETWEEN 4 AND 6 PM)	**86**	**VPH**

ORIGINAL TIA SITE PLAN

TRAFFIC IMPACT ANALYSIS

LAMBERT LA CHOLLA

1 OCTOBER 2014

Registered Professional Engineer (Civil)
CERTIFICATE NO.
32339
ANDREW R.
SMIGIELSKI
Date Signed 1 Oct 14
ARIZONA, U.S.A.
Expires 3-31-16

PREPARED FOR
THE WLB GROUP
4444 EAST BROADWAY BOULEVARD
TUCSON, ARIZONA 85711

SOUTHWEST TRAFFIC ENGINEERING, LLC
3838 NORTH CENTRAL AVENUE, SUITE 1810
PHOENIX, AZ 85012
T 602.266.SWTE (7983) F 602.266.1115

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Turn Lane Analysis

TRAFFIC IMPACT ANALYSIS
PROPOSED NEIGHBORHOOD
SOUTHEAST OF LA CHOLLA BOULEVARD/LAMBERT LANE

Executive Summary

The purpose of this traffic study is to evaluate the current and future transportation system within the project study area surrounding the site without and with the proposed neighborhood project and analyze traffic operations at the existing project study intersections.

Existing and Future Traffic Data Without Project

In order to document current traffic volumes, traffic counts were taken at the existing signalized intersection of La Cholla Boulevard/Lambert Lane as well as at the un-signalized intersection of La Cholla Boulevard/Owl Head Place.

The traffic counts included turning movement counts during the weekday AM and PM peak hours of 7:00 AM – 9:00 AM and 4:00 PM – 6:00 PM.

24 hour traffic counts were taken on Lambert Lane, east of La Cholla and on La Cholla, south of Lambert Lane.

Both of the existing study intersections and study roadway segments currently operate at an adequate level of service (LOS) during the weekday AM and PM peak hours and are predicted to continue doing so in 2016, without traffic from the project.

Future Traffic Data With Project

All of the existing study intersections and study roadway segments are anticipated to continue operating at an adequate LOS during the weekday AM and PM peak hours in 2016, with traffic from the proposed neighborhood project.

Turn Lane Analysis

The turn lane analysis shows that a southbound left turn lane is warranted at the intersection of South Driveway (Owl Head Place)/La Cholla Boulevard. A westbound left turn lane is warranted at the intersection of North Driveway/La Cholla Boulevard.

Recommendations

Exclusive left turn lanes should be provided for vehicles entering the project site at both access intersections.

New STOP signs and associated STOP bar pavement markings are recommended for both northbound vehicles exiting the project through the North Driveway and westbound vehicles exiting through the south driveway.

Another improvement which should be considered is removing impediments to driver sight lines. In particular, vegetation near the northwest and southwest corners of the intersection of La Cholla Boulevard/Owl Head Place should be removed to maximize driver visibility. In addition, sight distances at the future proposed access points and internal intersections should be verified during the design process.

TRAFFIC IMPACT ANALYSIS
PROPOSED NEIGHBORHOOD
SOUTHEAST OF LA CHOLLA BOULEVARD/LAMBERT LANE

Project Description

Future Arizona, LLC proposes a new residential development on an undeveloped piece of property located on the southeast corner of La Cholla Boulevard/Lambert Lane in Oro Valley, Arizona. The vicinity of the project is shown in **Figure 1**. The site is located as shown in **Figure 2**. The project will consist of 154 new single-family homes with an expected opening year of 2016. Access to the project site will be from the existing intersection of La Cholla Boulevard/Owl Head Lane as well as one new access point on Lambert Lane.

The purpose of this traffic impact analysis is to:

- Evaluate the future operational characteristics of the adjacent roadway network surrounding the project site.
- Estimate the traffic generation associated with the project and assign that traffic to the existing roadway system.
- Analyze traffic operations at the existing intersections of La Cholla Boulevard/Lambert Lane and La Cholla Boulevard/Owl Head Lane as well as an additional new project access point.
- Analyze traffic operations for the roadway segments of Lambert Lane, east of La Cholla Boulevard and La Cholla Boulevard, south of Lambert Lane.
- Determine the need for auxiliary turn lanes into the project site at the two access intersections.

The author of this report is a registered professional engineer (civil) in the State of Arizona having specific expertise and experience in the preparation of traffic impact analyses.

Study Methodology

In order to analyze and evaluate the potential traffic impacts of the proposed development, the following tasks were undertaken:

- Field observation of the proposed site and surrounding area was conducted to evaluate the existing physical and operational characteristics of the adjacent roadway network.
- Site traffic volumes generated by the proposed site were calculated using the *Institute of Transportation Engineers (ITE) Trip Generation Manual, 9th Edition,* 2012.
- Trip distribution assignments were made and used to assign the site traffic to the primary roadways within the project study limits.

Figure 1 – Vicinity Map

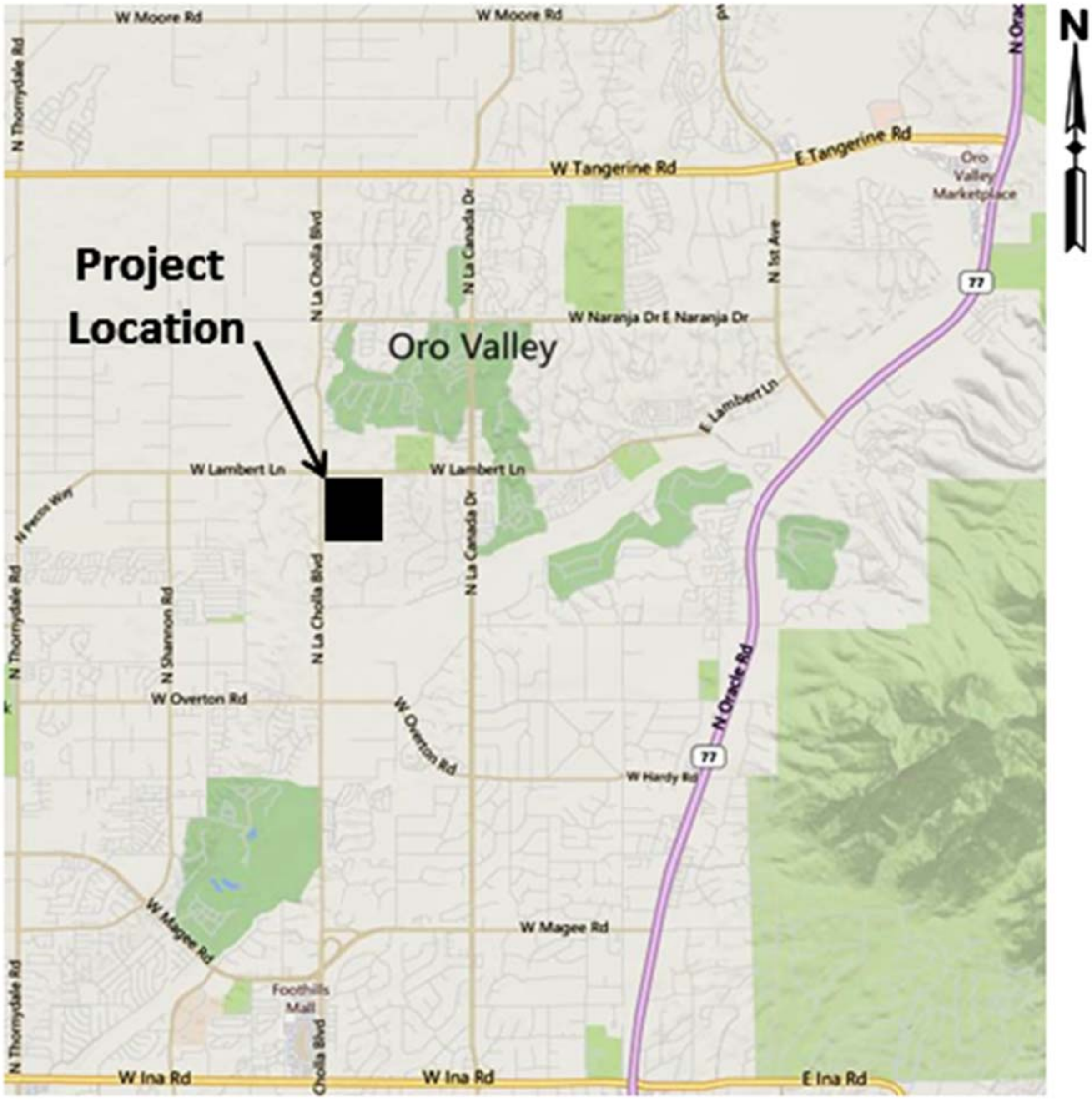


Figure 2 – Site Plan

- Capacity analyses were performed for the existing conditions and future conditions without and with the project based on an opening year of 2016.
- The intersections and roadway segments were analyzed using the methodology presented in the *2010 Highway Capacity Manual (HCM)*.
- The need for auxiliary turn lanes at the proposed access intersections was evaluated using Pima County guidelines.

Existing Conditions

The study location includes the signalized intersection La Cholla Boulevard/Lambert Lane as well as the un-signalized intersection of La Cholla Boulevard/Owl Head Place.

The project site is located on the southeast corner of La Cholla Boulevard/Lambert Lane.

In the vicinity of the project La Cholla Boulevard is a rolling roadway with a posted speed limit of 45 miles per hour (mph). Near Lambert Lane, La Cholla Boulevard is a two-lane roadway with one lane in each direction. A dirt shoulder exists along both sides of the La Cholla Boulevard and overhead power is present on the west side of the roadway. North of the project La Cholla Boulevard provides access to residential homes for approximately three miles before ending at Moore Road. To the south, La Cholla Boulevard leads to the City of Tucson. Near Owl Head Road, La Cholla Boulevard has large amounts of shrubs and vegetation in close proximity to the west side of the roadway.

Lambert Lane is a two-way roadway with overhead power lines located on the east side of the road. A dirt shoulder is provided on both sides of Lambert Lane and the posted speed limit is 45 mph. One and one half miles west of the project, Lambert Lane becomes Pecos Way before continuing for another one half mile and ending at Thornydale Road. Lambert Lane runs approximately four miles to the east of the project location before ending at Oracle Road (State Route 77).

Owl Head Place is an unstriped, two-way street, with a posted speed limit of 25 mph. Owl Head Place exists to provide access to seven residences and is approximately one quarter mile long. There are no curb, gutter, lighting or sidewalk facilities provided on Owl Head and the roadway is bordered on both sides by desert.

La Cholla Boulevard/Lambert Lane is a signalized intersection that provides crosswalk facilities across all four legs of the intersection. All of the approaches are offered an exclusive left turn lane and a shared through/right turn lane. Protected/permitted left turn phasing is exists for all four approaches of the intersection.

The intersection of La Cholla Boulevard/Owl Head Place is located approximately 2,500 feet south of the intersection of La Cholla Boulevard/Lambert Lane. This un-signalized "T" intersection is STOP sign controlled for the eastbound approach while the northbound/southbound traffic on La Cholla Boulevard is free-flow. Northbound vehicles turning onto Owl Head Place from La Cholla Boulevard are provided with a shared through/left turn lane while southbound vehicles have a shared though/right turn lane.

Existing lane configurations and traffic control are shown in **Figure 3**.

Existing Traffic Data

In order to form a basis for analysis of the project impacts, weekday AM and PM peak hour turning movement counts were conducted at the existing intersections of La Cholla Boulevard/Lambert Lane and La Cholla Boulevard/Owl Head Place.

In addition, weekday 24-hour bi-directional traffic counts were taken on Lambert Lane, east of La Cholla Boulevard and on La Cholla Boulevard, south of Lambert Lane.

The weekday turning movement counts were conducted from 7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM in August 2014.

The existing weekday AM and PM peak hour traffic volumes are shown in **Figure 4**. The complete traffic count summaries can be found in the Appendix.

Planned Town of Oro Valley Improvements

Proposed Oro Valley improvements to La Cholla Boulevard are in the initial planning phase. These improvements will include the installation of a center raised median along La Cholla Boulevard, adjacent to the project site. This median will restrict left turns on La Cholla Boulevard except at planned median breaks at major intersections, including La Cholla Boulevard/Lambert Lane and La Cholla Boulevard/Owl Head Place.

Improvements to Lambert Lane are also in the initial planning phase and will extend the existing roadway improvements (5-lane roadway section with median), just east of La Cañada Drive, to the west. The improvements will include a 4-lane, median separated road with bike lanes, a multi-use path on the south side of the roadway and sidewalk on the north side of the roadway that will taper down to two lanes starting at Rancho Sonora Drive.

The planned roadway improvements to La Cholla Boulevard and Lambert lane are in very early design stages and are not anticipated to begin until no sooner than 2020.

Access

Access to the proposed neighborhood will be provided by the existing intersection of La Cholla Boulevard/Owl Head Place as well as one new access point on Lambert Lane.

The new access point, North Driveway, will be located on the south side of Lambert Lane, approximately 2,000 feet east of La Cholla Boulevard. Vehicles exiting the proposed neighborhood through the North Driveway will be provided with a left turn lane and a right turn lane while eastbound and westbound traffic on Lambert Lane will have use of a single shared through/turn lane. Northbound vehicles will be STOP sign controlled while eastbound and westbound traffic on La Cholla Boulevard will remain free-flow.

Figure 3 – Existing Lane Configurations and Traffic Control

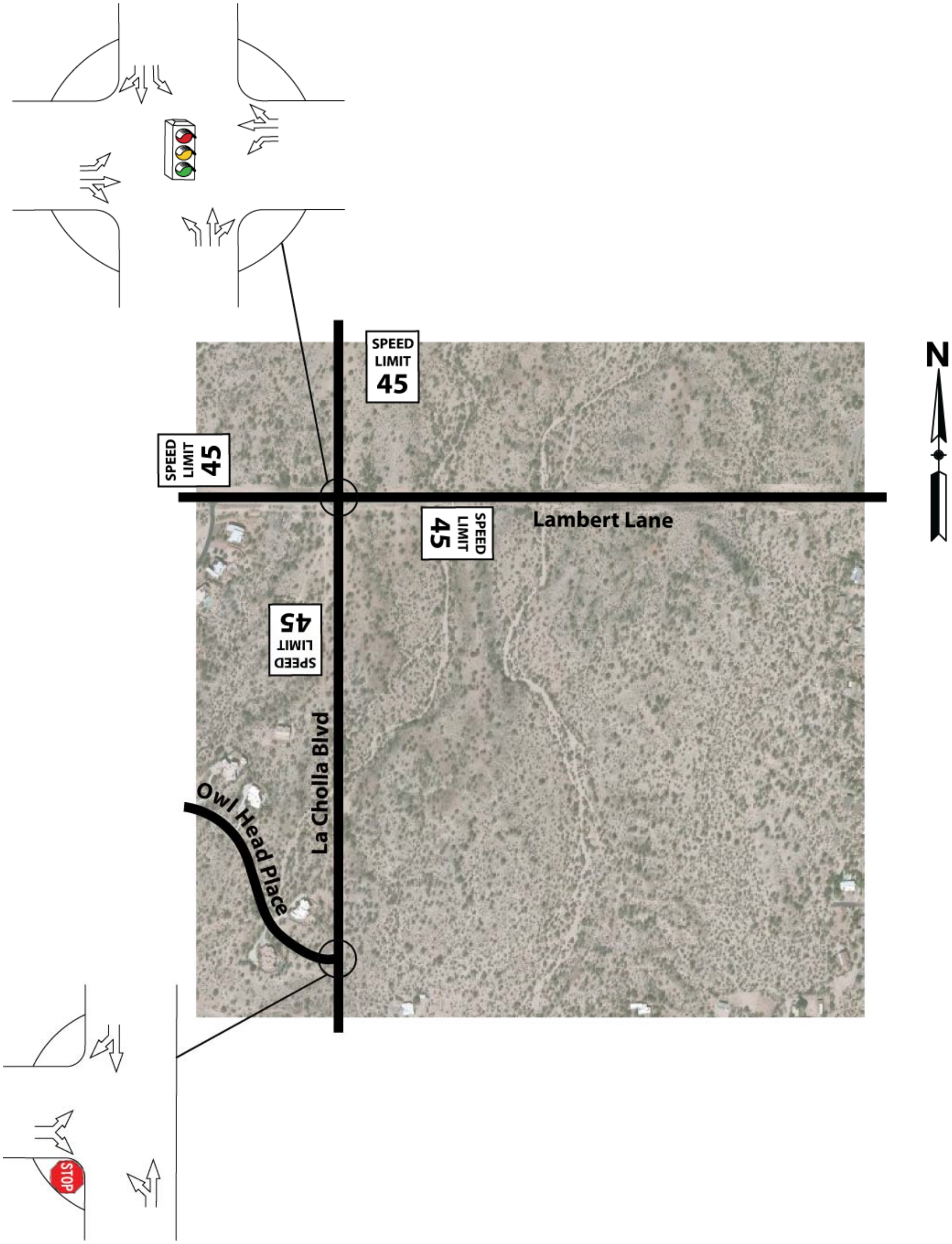
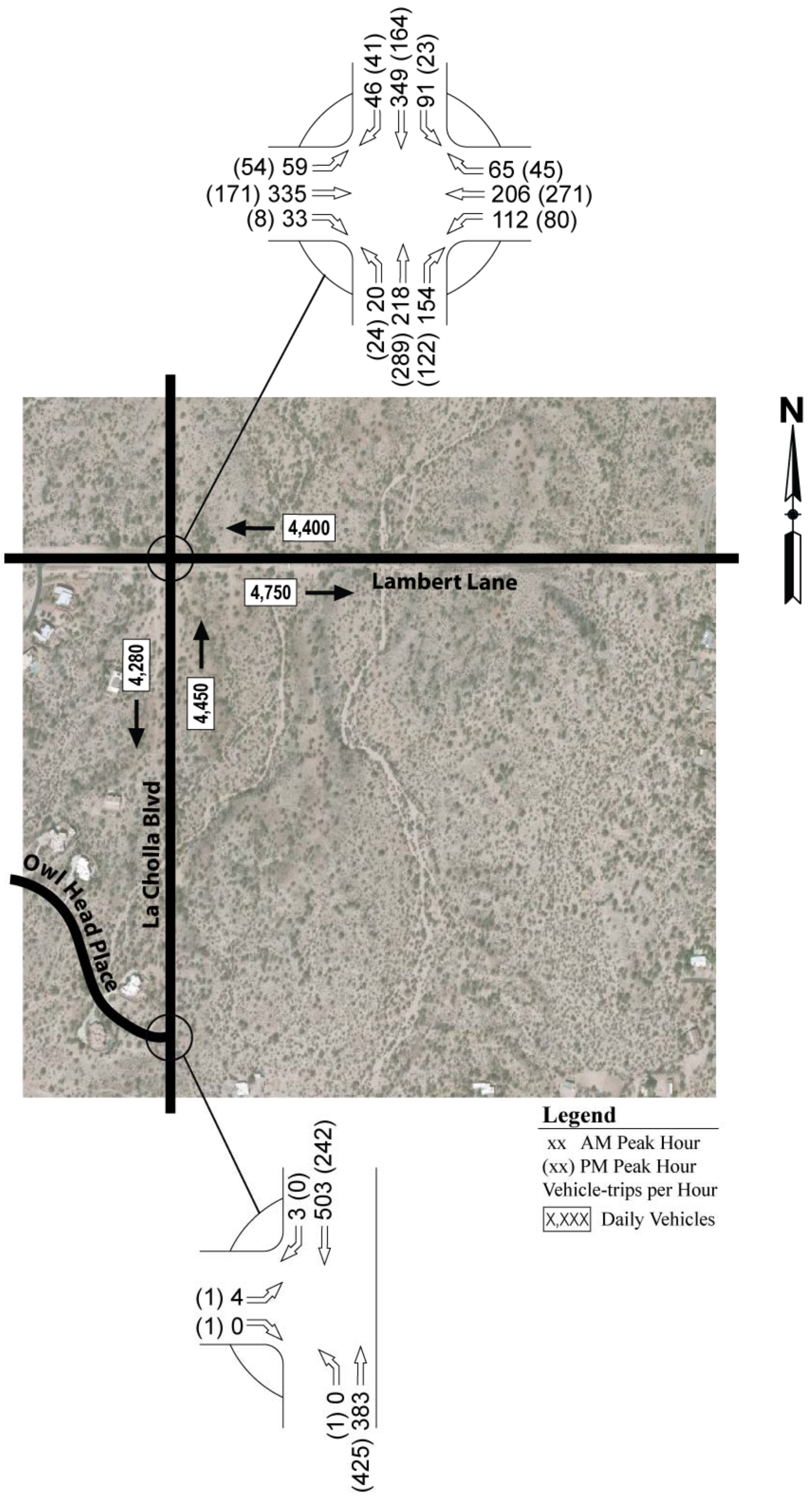


Figure 4 – Existing Weekday Peak Hour Traffic Volumes



A second access point will become the east leg of the existing intersection of La Cholla Boulevard/Owl Head Place. This new leg of the intersection will provide westbound vehicles with a left turn lane and a shared through/right turn lane. Eastbound and westbound vehicles will be free-flow while northbound and southbound traffic on La Cholla Boulevard will remain free-flow.

Sight distances at the future proposed access points and internal intersections should be verified during the design process.

Trip Generation

Trip generation for the project was developed utilizing nationally agreed upon data contained in the Institute of Transportation Engineers (ITE) publication *Trip Generation, 9th Edition*, 2012.

So as to provide analysis for the full build-out of the project, trip generation was estimated for the construction of 154 single-family homes based on ITE Land Use Code (LUC) 210, Single-Family Detached Housing.

The result is the expected weekday trip generation for the new project, as shown in **Table 1**. The complete trip generation calculations can be found in the Appendix.

Table 1 – Weekday Project Site Generated Trips

Time Period	Single Family Housing
Average Daily, Inbound (vtpd)	782
Average Daily, Outbound (vtpd)	782
Total Daily	**1,564**
AM Peak Hour, Inbound (vtph)	30
AM Peak Hour, Outbound (vtph)	89
Total AM Peak	**119**
PM Peak Hour, Inbound (vtph)	98
PM Peak Hour, Outbound (vtph)	57
Total PM Peak	**155**

vtpd - vehicle trips per day, vtph - vehicle trips per hour

Trip Distribution & Assignment

Trip distribution for the project was based on existing traffic volumes patterns near the proposed site. **Figure 5** shows the weekday trip distribution for the project as a percentage of net new primary trips.

Figure 6 shows the assignment of the new site generated trips to the project intersections within the study area.

Figure 5 – Weekday Peak Hour Trip Distribution

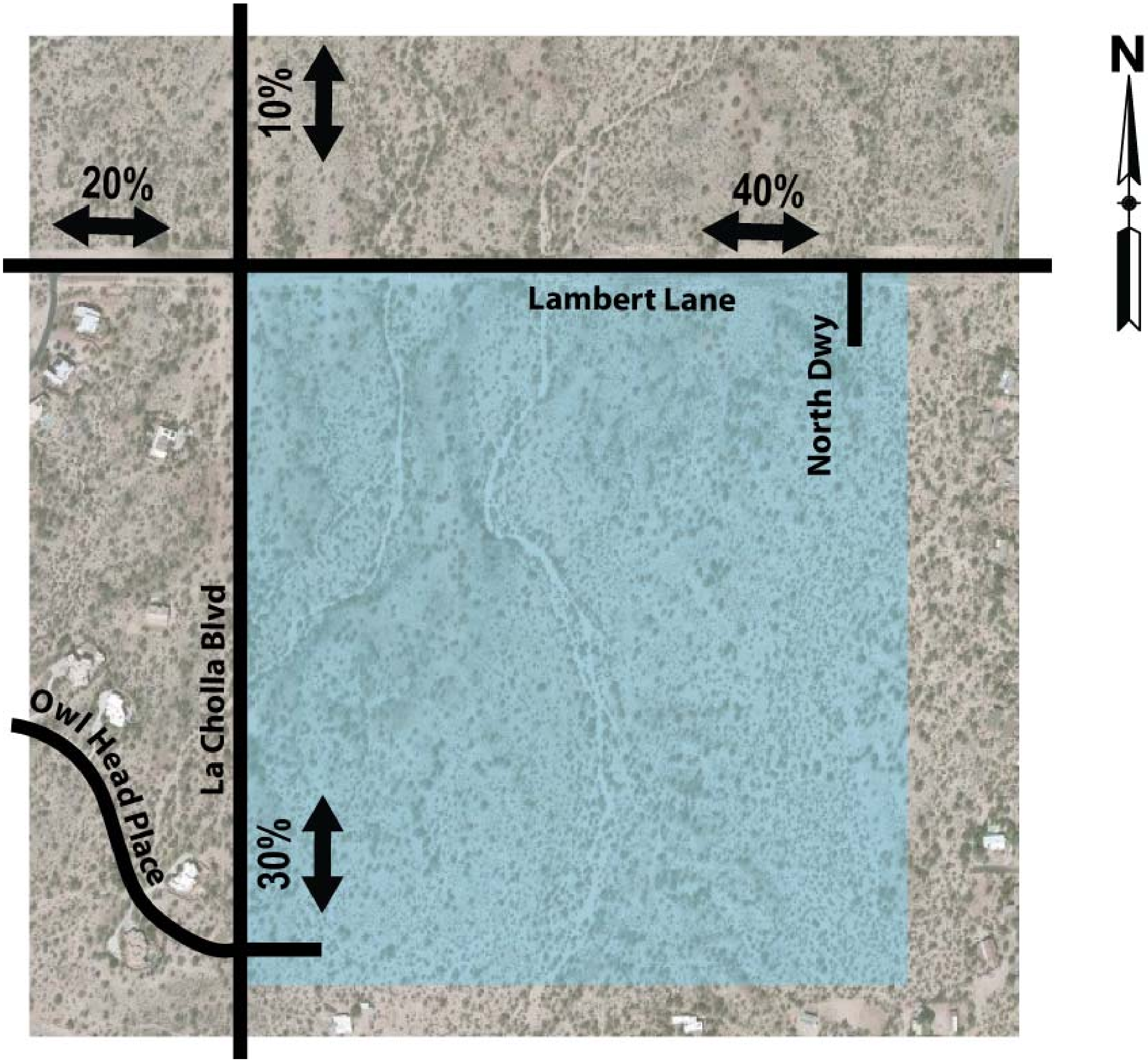
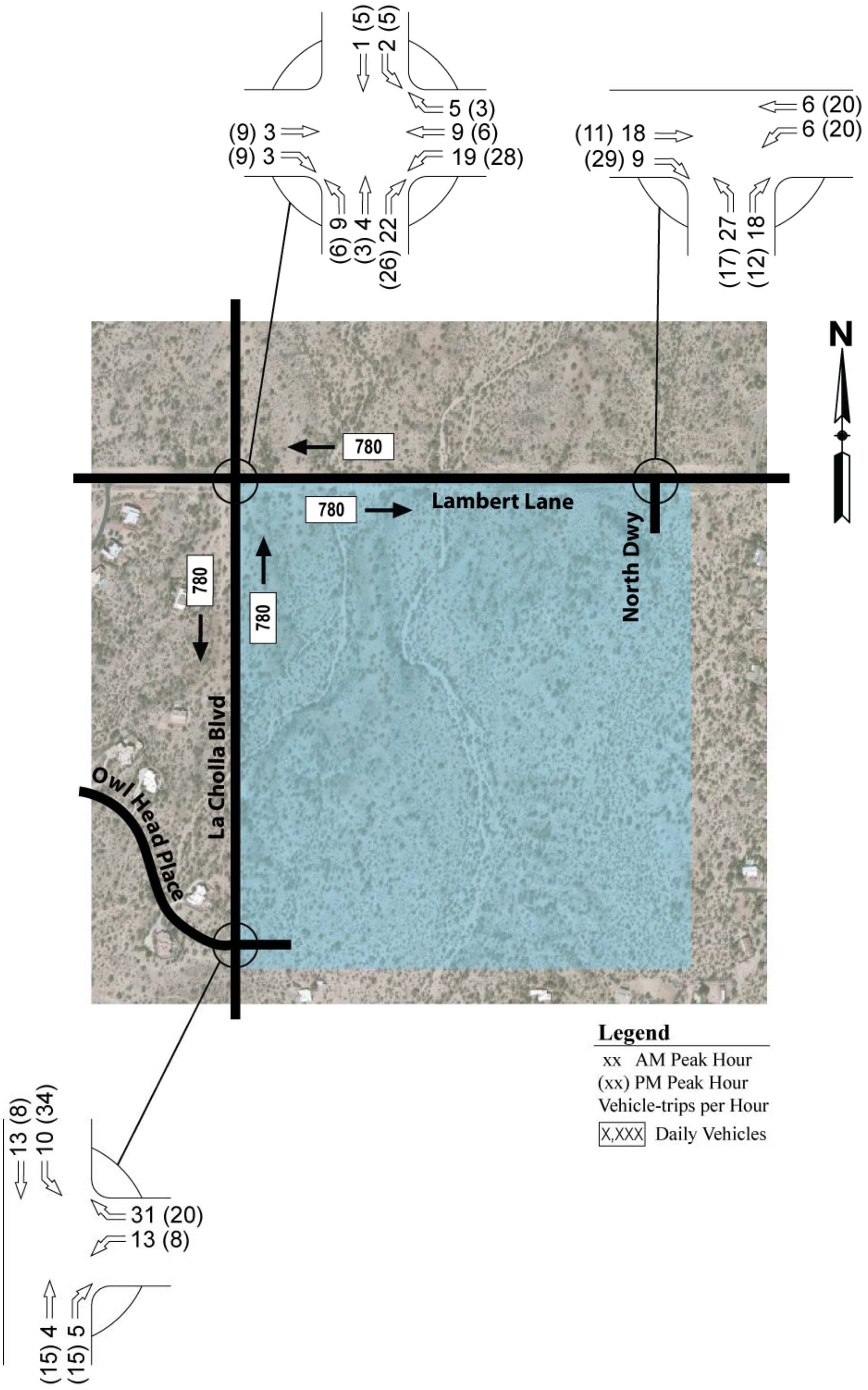


Figure 6 – Weekday Peak Hour Trip Assignment



Existing Traffic Operations

Analysis of current intersection operations was conducted for the weekday AM and PM peak hours using the nationally accepted methodology set forth in the *Highway Capacity Manual,* Transportation Research Board, 2010. The computer software Synchro 8 was utilized to calculate the levels of service for individual movements, approaches, and for the intersections as a whole. The computer software HCS 2010 was used to calculate the levels of service for the project roadway segments.

Level of service (LOS) is a qualitative measure of the traffic operations at an intersection or on a roadway segment. Level of service is ranked from LOS A, which signifies little or no congestion and is the highest rank, to LOS F, which signifies congestion and jam conditions. LOS D is typically considered adequate operation at signalized and un-signalized intersections in developed areas.

At signalized intersections, level of service is calculated for each movement and then is summed in a weighted fashion to yield the LOS for the approach and for the intersection as a whole. The criteria for level of service at signalized intersections are shown in **Table 2.**

Table 2 - Level of Service Criteria – Signalized Intersections

Level-of-Service	Average Total Delay
A	≤ 10.0 seconds
B	> 10.0 and ≤ 20.0 seconds/vehicle
C	> 20.0 and ≤ 35.0 seconds/vehicle
D	> 35.0 and ≤ 55.0 seconds/vehicle
E	> 55.0 and ≤ 80.0 seconds/vehicle
F	> 80.0 seconds per vehicle

In calculating the levels of service, assumed signal phasing and timing data was used. Other assumptions included:

- Cycle length – 90 seconds
- Lane widths – 12 feet
- Approach grade – 0%
- Right turn on red allowed

At un-signalized intersections, level of service is predicted/calculated for those movements which must either stop for or yield to oncoming traffic and is based on average control delay for the particular movement. Control delay is the portion of total delay attributed to traffic control measures such as stop signs and traffic signals. The criteria for level of service at un-signalized intersections are shown below in **Table 3**.

Table 3 – Level of Service Criteria – Un-signalized Intersections

Level-of-Service	Delay
A	≤ 10 seconds
B	> 10 and ≤ 15 seconds/vehicle
C	> 15 and ≤ 25 seconds/vehicle
D	> 25 and ≤ 35 seconds/vehicle
E	> 35 and ≤ 50 seconds/vehicle
F	> 50 seconds per vehicle

Existing levels of service were calculated for the project intersections within the study area. The results of this analysis are shown in **Table 4**. Complete capacity calculations are included in the Appendix.

Table 4 – Existing Peak Hour Levels of Service

Intersection	AM Peak		PM Peak	
	LOS	Delay	LOS	Delay
Signalized Intersections				
Lambert Lane/La Cholla Boulevard				
Overall Intersection	B	12.2	A	9.1
Eastbound Left	B	13.4	B	11.9
Eastbound Through/Right	B	11.6	A	8.3
Westbound Left	B	16.8	A	9.9
Westbound Through/Right	B	10.7	A	9.6
Northbound Left	B	15.0	A	8.3
Northbound Through/Right	B	11.7	A	9.2
Southbound Left	B	16.6	B	11.6
Southbound Through/Right	B	11.7	A	7.3
Un-Signalized Intersections				
La Cholla Boulevard/Owl Head Place				
Eastbound Left/Right	C	18.4	B	12.1
Northbound Left/Through	A	0.0	A	7.8

Delay - seconds per vehicle

As shown in **Table 4**, both of the existing study intersections currently operate at an adequate LOS C or better during the weekday AM and PM peak hours.

In order to verify existing roadway segment LOS on La Cholla Boulevard and Lambert Lane, an analysis was performed using existing traffic counts. The LOS on two-lane Type III highway segments is based on percent of free-flow speed (PFFS) which represents the average percentage of time that vehicles must travel in platoons behind slower vehicles due to their inability to pass. In order to perform a LOS analysis for the roadway segment analysis, the following assumptions were used:

- La Cholla Boulevard and Lambert Lane are classified as Type III Highways
- Free Flow Speed of 45 miles per hour (posted speed limit)
- Hourly factor (K) based on traffic counts

- Directional distribution based on traffic counts
- Rolling terrain

The level of service criteria for two-lane roadways with the above criteria is provided in **Table 5** based on values from Exhibit 15-3 of the *Highway Capacity Manual.*

Table 5 – Level of Service Criteria – Two-Lane Roadways

Level-of-Service	PFFS (%)
A	>91.7
B	>83.3-91.7
C	>75.0-83.3
D	>66.7-75.0
E	≤66.7

Table 6 shows the existing LOS for the roadway segments of La Cholla Boulevard, south of Lambert Lane and Lambert Lane, east of La Cholla Boulevard.

Table 6 – Existing Roadway Segment Levels of Service

Street	Segment	AM Peak		PM Peak	
		LOS	PFFS	LOS	PFFS
Lambert Lane	East of La Cholla Boulevard (Westbound)	C	77.3	C	80.8
	East of La Cholla Boulevard (Eastbound)	C	76.5	C	81.3
La Cholla Boulevard	South of Lambert Lane (Northhbound)	C	78.8	C	81.1
	South of Lambert Lane (Southbound)	C	78.3	C	81.9

As shown in **Table 6**, the existing roadway segments of La Cholla Boulevard and Lambert Lane currently operate at an adequate LOS C.

Future Traffic Operations Without Project

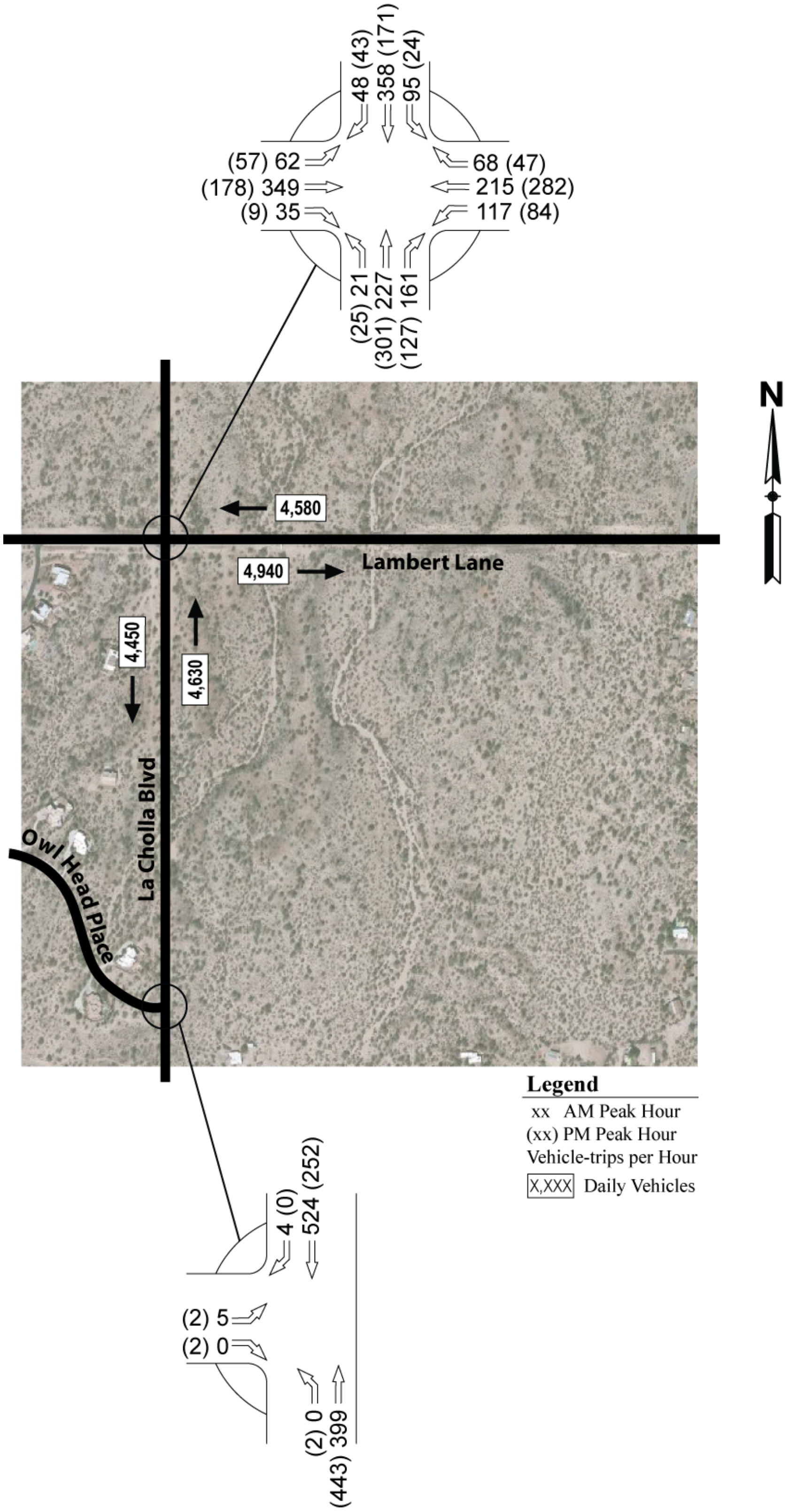
In order to assess the impacts of the project on future traffic operations, traffic projections were made for the year 2016, which is the year the project is expected to open.

A review of historical traffic data along La Cholla Boulevard and Lambert Lane taken from the Pima Association of Governments (PAG) traffic count program showed a pattern of increasing and decreasing traffic volumes on the project roadways from 2010 to 2013. In light of this, a 2% annual traffic growth rate was used.

Using a 2% annual traffic growth rate, 2016 weekday peak hour traffic volumes without the project were estimated as shown in **Figure 7.**

As with the current volumes, levels of service were calculated for each of the intersections and roadway segments in the study area for 2016 without the project.

Figure 7 – 2016 Weekday Peak Hour Traffic Volumes Without Project



Intersection levels of service for 2016 without the project are shown in **Table 7**. Roadway segment levels of service for 2016 without the project are shown in **Table 8**. Complete capacity calculations are included in the Appendix.

Table 7 – 2016 Peak Hour Levels of Service Without Project

Intersection	AM Peak		PM Peak	
	LOS	Delay	LOS	Delay
Signalized Intersections				
Lambert Lane/La Cholla Boulevard				
Overall Intersection	B	13.2	A	9.5
Eastbound Left	B	14.5	B	12.6
Eastbound Through/Right	B	12.5	A	8.6
Westbound Left	B	18.5	B	10.4
Westbound Through/Right	B	11.4	B	10.0
Northbound Left	B	16.4	A	8.8
Northbound Through/Right	B	12.7	A	9.7
Southbound Left	B	18.4	B	12.4
Southbound Through/Right	B	12.6	A	7.6
Un-Signalized Intersections				
La Cholla Boulevard/Owl Head Place				
Eastbound Left/Right	C	19.1	B	12.4
Northbound Left/Through	A	0.0	A	7.8

Delay - seconds per vehicle

Table 7 shows that the two existing study intersections are predicted to continue to operate at an adequate LOS C or better during the weekday peak hours of 2016, without traffic from the project.

Table 8 – 2016 Roadway Segment Levels of Service Without Project

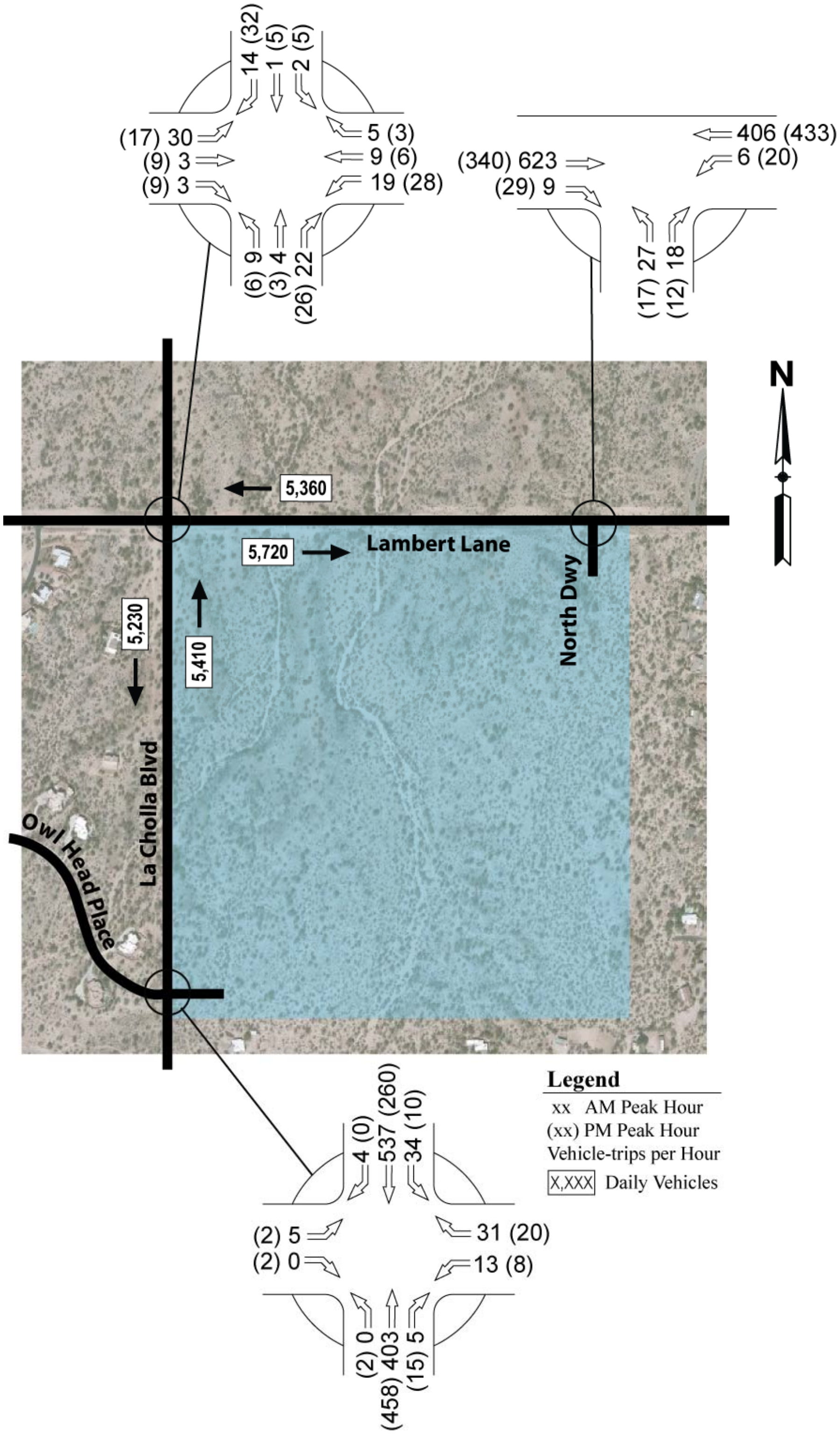
Street	Segment	AM Peak		PM Peak	
		LOS	PFFS	LOS	PFFS
Lambert Lane	East of La Cholla Boulevard (Westbound)	C	76.7	C	80.4
	East of La Cholla Boulevard (Eastbound)	C	76.0	C	80.8
La Cholla Boulevard	South of Lambert Lane (Northbbound)	C	78.2	C	80.6
	South of Lambert Lane (Southbound)	C	77.7	C	81.5

As shown in **Table 8,** all of the study roadway segments are predicted to continue to operate at an adequate LOS C in 2016, without traffic from the project.

Future Traffic Operations With Project

In order to assess the impacts of the project on future traffic operations, levels of service were calculated for each project intersection for 2016, with the project. Weekday peak hour traffic volumes for 2016 without the project were combined with the estimated trips generated by the project to yield weekday peak hour traffic volumes with the project as shown in **Figure 8.**

Figure 8 – 2016 Weekday Peak Hour Traffic Volumes With Project



Weekday intersection levels of service for 2016, with the project were then calculated as shown in **Table 9**. Roadway segment levels of service for 2016 without the project are shown in **Table 10**. Complete capacity calculations are included in the Appendix.

Table 9 – 2016 Peak Hour Levels of Service With Project

Intersection	2016 Without Project				2016 With Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Signalized Intersections								
Lambert Lane/La Cholla Boulevard								
Overall Intersection	B	13.2	A	9.5	B	14.7	B	10.3
Eastbound Left	B	14.5	B	12.6	B	16.1	B	13.9
Eastbound Through/Right	B	12.5	A	8.6	B	13.5	A	9.5
Westbound Left	B	18.5	B	10.4	C	20.9	B	12.1
Westbound Through/Right	B	11.4	B	10.0	B	12.5	B	10.9
Northbound Left	B	16.4	A	8.8	B	18.2	A	9.2
Northbound Through/Right	B	12.7	A	9.7	B	14.3	B	10.3
Southbound Left	B	18.4	B	12.4	C	21.3	B	13.7
Southbound Through/Right	B	12.6	A	7.6	B	13.8	A	7.9
Un-Signalized Intersections								
South Driveway (Owl Head Place)/La Cholla Boulevard								
Eastbound Left/Right	C	19.1	B	12.4	N/A		N/A	
Eastbound Left/Through/Right	N/A		N/A		D	25.6	B	14.9
Westbound Left					C	24.8	C	19.6
Westbound Through/Right					B	11.3	B	11.7
Northbound Left/Through	A	0.0	A	7.8	N/A		N/A	
Northbound Left/Through/Right	N/A		N/A		A	0.0	A	7.8
Southbound Left/Through/Right					A	8.3	A	8.6
North Driveway/Lambert Lane								
Westbound Left	N/A		N/A		A	9.1	A	8.2
Northbound Left					B	14.9	B	11.8
Northbound Right					B	13.6	B	10.6

Delay - seconds per vehicle

Table 9 shows that all of the study intersections are anticipated to operate at an adequate LOS during the weekday peak hours of 2016, with traffic from the project.

Table 10 – 2016 Roadway Segment Levels of Service With Project

Street	Segment	2015 Without Project				2015 With Project			
		AM Peak		PM Peak		AM Peak		PM Peak	
		LOS	PFFS	LOS	PFFS	LOS	PFFS	LOS	PFFS
Lambert Lane	Westbound	C	76.3	C	79.9	C	76.3	C	79.9
	Eastbound	C	75.6	C	80.4	C	75.6	C	80.4
La Cholla Boulevard	Northbbound	C	77.3	C	79.3	C	77.3	C	79.3
	Southbound	C	76.9	C	80.3	C	76.9	C	80.3

As shown in **Table 10,** all of the study roadway segments are predicted to continue to operate at an adequate LOS C in 2016, with traffic from the project.

Turn Lane Analysis

A key element of this study is to determine if turn lanes are required at the two proposed project access points.

The latest edition of the *Pima County Subdivision and Development Street Standards* provides warrants for the inclusion of turn lanes at subdivision or development access points. The criteria for determining if turn lanes are needed are based on vehicle speeds, total daily traffic and the turning traffic volume during the peak hour. **Table 11** shows the maximum turn volumes in the peak hour allowed without a right turn lane, and **Table 12** shows the maximum turn volumes in the peak hour allowed without a left turn lane, per the *Pima County Subdivision and Development Street Standards.* When needed, turn lanes remove the slowing turning traffic from the through traffic stream, improving capacity and reducing rear-end accidents. **Table 13** shows the locations that were evaluated for turn lanes.

Table 11 – Maximum Peak Hour Right Turn Volume Without Right Turn Lane

Average Daily Traffic (vpd)	Turning Volume
2,500-5,000	100
5,000-10,000	70
>10,000	40

VPD - Vehicles Per Day

Table 12 – Maximum Peak Hour Left Turn Volume Without Right Turn Lane

	Average Daily Traffic (vpd)			
Posted Speed (mph)	<2,500	2,500-5,000	5,000-10,000	>10,000
< 35	75	50	30	15
40-50	75	40	20	10
> 55	75	30	10	5

VPD - Vehicles Per Day

Table 13 – Turn Lane Warrants

Intersection	Turn Treatments Warranted?	Direction	Turn Treatment Analyzed
South Driveway (Owl Head Place)/La Cholla Boulevard	No	Northbound	Right Turn Lane
North Driveway/Lambert Lane	No	Eastbound	Right Turn Lane
South Driveway (Owl Head Place)/La Cholla Boulevard	Yes	Southbound	Left Turn Lane
North Driveway/Lambert Lane	Yes	Westbound	Left Turn Lane

Based on the 2016 weekday peak hour traffic volumes with the project, **Table 13** shows that a southbound left turn lane is warranted at the intersection of South Driveway/La Cholla Boulevard. A westbound left turn lane is warranted at the intersection of North Driveway/La Cholla Boulevard.

Another key element of this study is to determine the storage length required for the warranted turn lanes.

The queue storage requirements for the area roadways were calculated using the following methods as recommended in *A Policy of Geometric Design of Highways and Streets* (AASHTO, 2011).

For un-signalized intersections, storage for vehicles likely to arrive in an average two-minute period within the peak hour should be provided.

Vehicles per 2 min. period = (vehicles/hour)÷(30 periods/hour)
Storage length = vehicles per 2 min. period x 25 feet

Based on the 2016 weekday peak hour traffic volumes with the project, the storage lengths were found for the warranted left turn lanes. The computed value is typically rounded up to the nearest 25 feet. **Table 14** shows the calculated queue length for the warranted turn lanes. Complete storage length calculations can be found in the Appendix.

Table 14 – Calculated Queue Lengths

Intersection	Left Turn Storage			
	NB	SB	EB	WB
South Driveway (Owl Head Place)/La Cholla Bouelvard				
Turning Volume (vph)		34		
$S_{calculated}$ =		28		
$S_{rounded}$ =		50		
North Driveway/Lambert Lane				
Turning Volume (vph)				20
$S_{calculated}$ =				17
$S_{rounded}$ =				25

S - storage in feet, vph - vehicles per hour

Table 14 shows that a minimum of 50 feet of vehicle storage space was calculated for vehicles making a southbound left into the project site at the South Driveway and a minimum of 25 feet of vehicle storage was calculated for vehicles making a westbound left into the project at the North Driveway.

The *Pima County Pavement Marking Standards* require a minimum turn lane storage length of 150 feet. Therefore, 150 feet is the recommended length for both left turn lanes into the project.

Conclusion

When fully completed, the proposed residential development project is predicted to generate an additional 1,564 vehicle trips per day (vtpd) on weekdays to the adjacent street system from the new project site. Fifty percent of these new trips (782 vehicle trips) will be into the project and fifty percent will be out of the project.

Both of the existing study intersections and study roadway segments currently operate at an adequate level of service (LOS) during the weekday AM and PM peak hours and are predicted to continue doing so in 2016, without traffic from the project.

All of the existing study intersections and study roadway segments are anticipated to continue operating at an adequate LOS during the weekday AM and PM peak hours in 2016, with traffic from the proposed neighborhood project.

The turn lane analysis shows that a southbound left turn lane with 150 feet of storage is warranted at the intersection of South Driveway (Owl Head Place)/La Cholla Boulevard. A westbound left turn lane with 150 of storage is warranted at the intersection of North Driveway/La Cholla Boulevard.

New STOP signs and associated STOP bar pavement markings are recommended for both northbound vehicles exiting the project through the North Driveway and westbound vehicles exiting through the south driveway.

Another improvement which should be considered is removing impediments to driver sight lines. In particular, vegetation near the northwest and southwest corners of the intersection of La Cholla Boulevard/Owl Head Place should be removed to maximize driver visibility. In addition, sight distances at the future proposed access points and internal intersections should be verified during the design process.

Proposed lane configurations and traffic control are shown in **Figure 9**.

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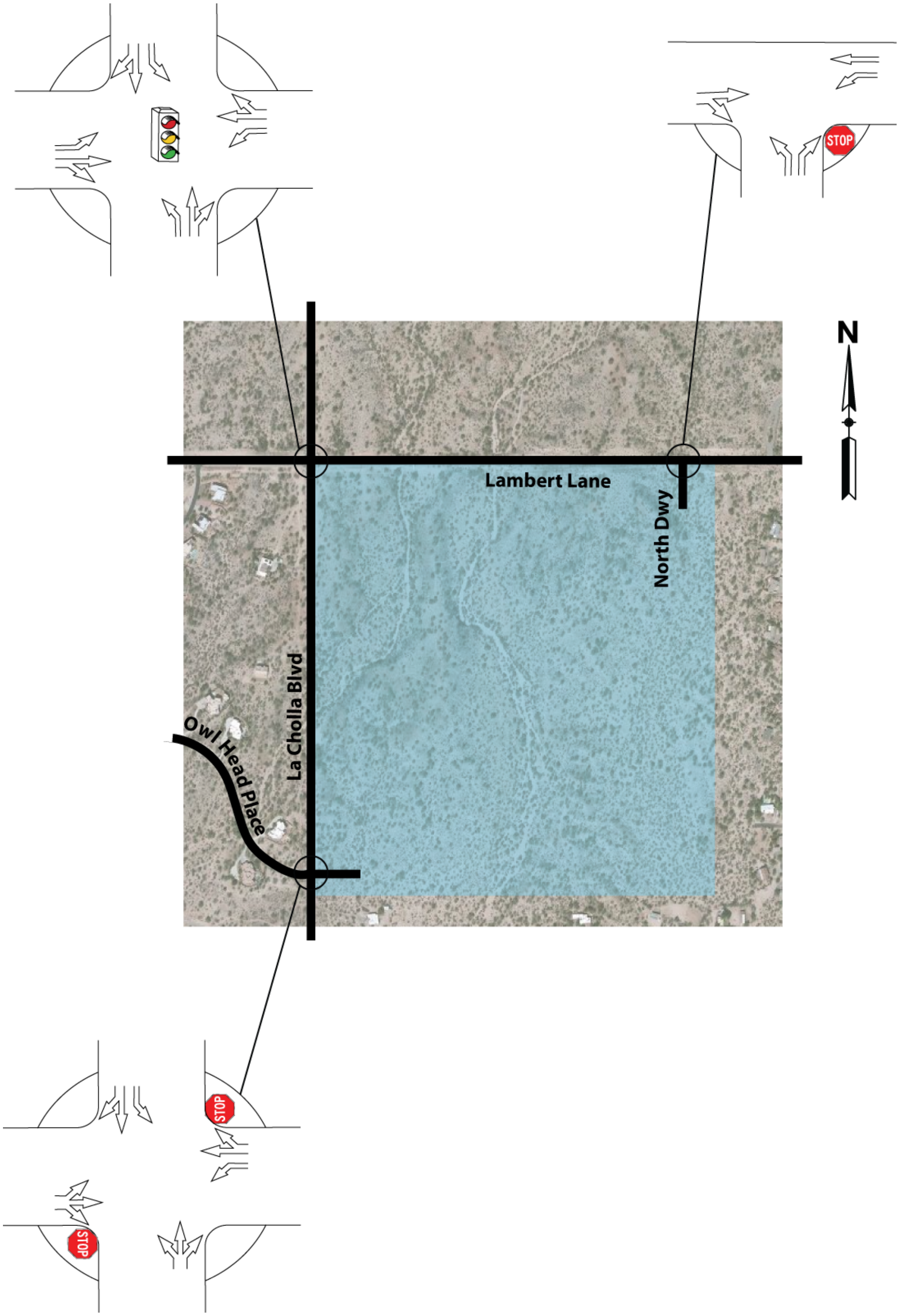
Figure 9 – Proposed Lane Configurations and Traffic Control



TRAFFIC IMPACT ANALYSIS
PROPOSED NEIGHBORHOOD
SOUTHEAST OF LA CHOLLA BOULEVARD/LAMBERT LANE

APPENDIX

Traffic Counts

Trip Generation Calculations

Capacity Calculations

Turn Lane Analysis

TRAFFIC IMPACT ANALYSIS
PROPOSED NEIGHBORHOOD
SOUTHEAST OF LA CHOLLA BOULEVARD/LAMBERT LANE

APPENDIX

Traffic Counts

Intersection Turning Movement
Prepared by:

Field Data Services of Arizona, Inc.
520.316.6745

Project #: 14-1250-001

TMC SUMMARY OF La Cholla Blvd. & Lambert Ln.

N

La Cholla Blvd. (north)

APPROACH LANES

		0	1	1
TOTAL		87	508	114
PM		41	164	23
MD				
AM		46	344	91

Lambert Ln. (west)

APPROACH LANES

APPROACH LANES	TOTAL	AM	MD	PM
1	113	59		54
1	506	335		171
0	41	33		8

CONTROL

Signalized

Lambert Ln. (east)

AM	MD	PM	TOTAL	APPROACH LANES
62		45	107	0
206		271	477	1
112		80	192	1

La Cholla Blvd. (south)

PM	24	289	122	
MD				
AM	20	218	154	
TOTAL	44	507	276	
	1	1	0	

APPROACH LANES

LOCATION #: 14-1250-001

TURNING MOVEMENT COUNT

La Cholla Blvd. & Lambert Ln.
(Intersection Name)

WEDNESDAY
Day

08/27/2014
Date

COUNT PERIODS

AM	700AM	-	900AM
NOON		-	
PM	400PM	-	600PM

AM PEAK HOUR 715 AM

NOON PEAK HOUR

PM PEAK HOUR 430 PM

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET: La Cholla Blvd.
DATE: 08/27/2014
LOCATION: Oro Valley

E-W STREET: Lambert Ln.
DAY: WEDNESDAY
PROJECT# 14-1250-001

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	0	1	1	0	1	1	0	1	1	0	
6:00 AM													
6:15 AM													
6:30 AM													
6:45 AM													
7:00 AM	1	35	40	8	82	11	9	73	5	15	46	6	331
7:15 AM	0	56	35	12	60	13	22	116	5	26	44	15	404
7:30 AM	10	60	52	24	90	8	17	77	6	35	69	22	470
7:45 AM	8	67	38	33	109	15	12	64	15	30	56	17	464
8:00 AM	2	35	29	22	85	10	8	78	7	21	37	8	342
8:15 AM	4	26	20	9	67	8	2	57	2	19	28	10	252
8:30 AM	0	31	18	0	70	3	10	49	4	17	47	9	258
8:45 AM	5	31	13	8	52	7	8	32	1	16	22	6	201
9:00 AM													
9:15 AM													
9:30 AM													
9:45 AM													
10:00 AM													
10:15 AM													
10:30 AM													
10:45 AM													
11:00 AM													
11:15 AM													
11:30 AM													
11:45 AM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	30	341	245	116	615	75	88	546	45	179	349	93	2722
Approach %	4.87	55.36	39.77	14.39	76.30	9.31	12.96	80.41	6.63	28.82	56.20	14.98	
App/Depart	616	/	522	806	/	839	679	/	907	621	/	454	

AM Peak Hr Begins at: 715 AM

PEAK													
Volumes	20	218	154	91	344	46	59	335	33	112	206	62	1680
Approach %	5.10	55.61	39.29	18.92	71.52	9.56	13.82	78.45	7.73	29.47	54.21	16.32	

PEAK HR. FACTOR:	0.803	0.766	0.747	0.754	0.894

CONTROL: Signalized
COMMENT 1:
GPS: 32.395309,-111.01293

Intersection Turning Movement

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET: La Cholla Blvd.
DATE: 08/27/2014
LOCATION: Oro Valley

E-W STREET: Lambert Ln.
DAY: WEDNESDAY
PROJECT# 14-1250-001

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	0	1	1	0	1	1	0	1	1	0	
1:00 PM													
1:15 PM													
1:30 PM													
1:45 PM													
2:00 PM													
2:15 PM													
2:30 PM													
2:45 PM													
3:00 PM													
3:15 PM													
3:30 PM													
3:45 PM													
4:00 PM	5	36	24	14	43	8	13	46	2	31	87	9	318
4:15 PM	3	57	22	9	44	11	6	28	2	18	57	9	266
4:30 PM	6	62	42	7	46	7	10	42	2	22	61	9	316
4:45 PM	5	80	18	6	29	11	14	50	2	15	65	11	306
5:00 PM	4	68	32	5	48	14	17	42	1	18	69	13	331
5:15 PM	9	79	30	5	41	9	13	37	3	25	76	12	339
5:30 PM	1	61	29	3	21	7	9	48	1	17	58	12	267
5:45 PM	6	74	27	17	31	13	11	39	6	20	37	12	293
6:00 PM													
6:15 PM													
6:30 PM													
6:45 PM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	39	517	224	66	303	80	93	332	19	166	510	87	2436
Approach %	5.00	66.28	28.72	14.70	67.48	17.82	20.95	74.77	4.28	21.76	66.84	11.40	
App/Depart	780	/	697	449	/	488	444	/	622	763	/	629	

PM Peak Hr Begins at: 430 PM

PEAK Volumes	24	289	122	23	164	41	54	171	8	80	271	45	1292
Approach %	5.52	66.44	28.05	10.09	71.93	17.98	23.18	73.39	3.43	20.20	68.43	11.36	
PEAK HR. FACTOR:		0.922			0.851			0.883			0.876		0.953

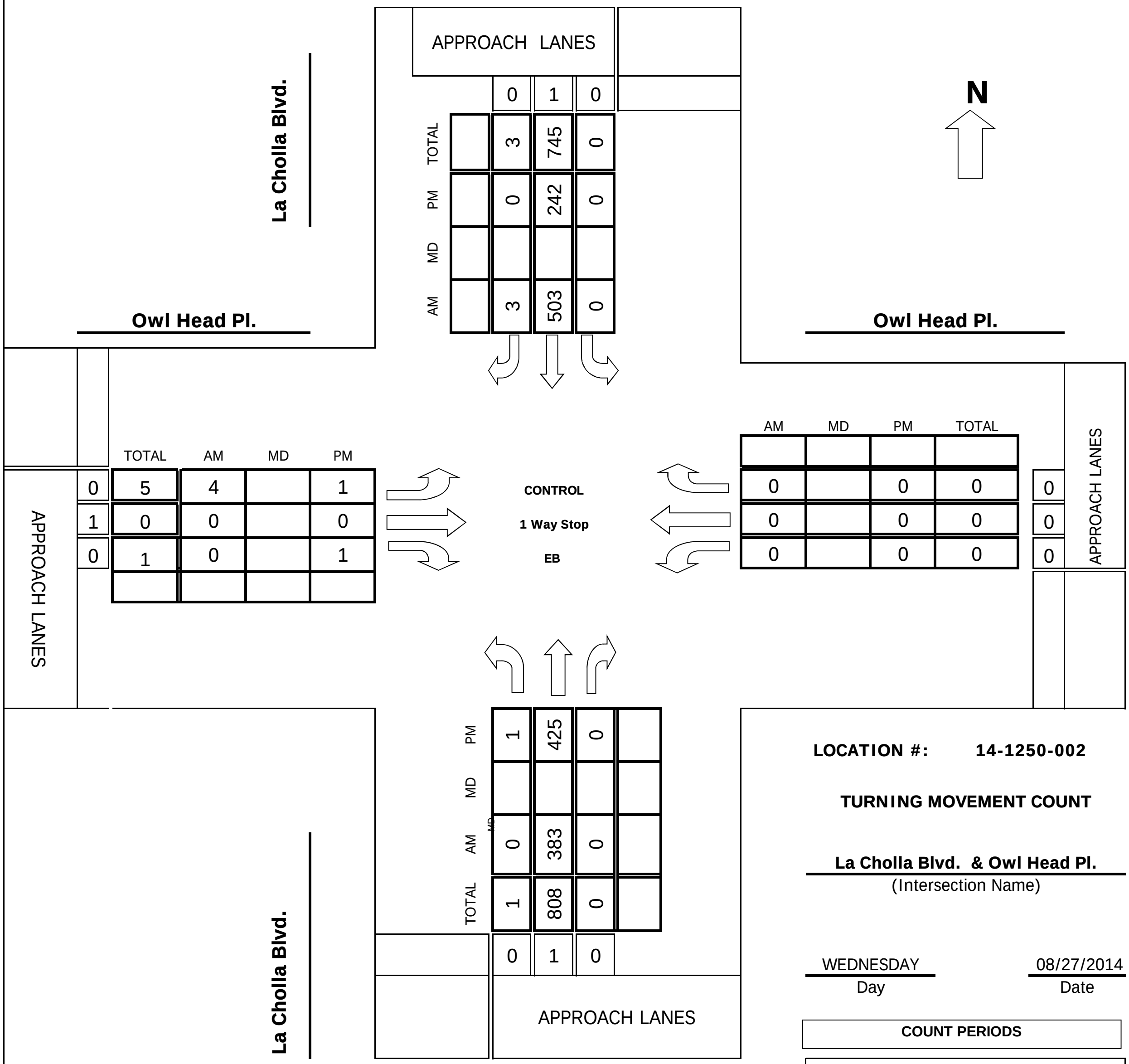
CONTROL: Signalized
COMMENT 1: 0
GPS: 32.395309,-111.01293

Intersection Turning Movement
Prepared by:

Field Data Services of Arizona, Inc.
520.316.6745

Project #: 14-1250-002

TMC SUMMARY OF La Cholla Blvd. & Owl Head Pl.



APPROACH LANES (La Cholla Blvd., north approach)

	0	1	0
TOTAL	3	745	0
PM	0	242	0
MD			
AM	3	503	0

APPROACH LANES (Owl Head Pl., west approach)

	TOTAL	AM	MD	PM
0	5	4		1
1	0	0		0
0	1	0		1

APPROACH LANES (Owl Head Pl., east approach)

AM	MD	PM	TOTAL	
0		0	0	0
0		0	0	0
0		0	0	0

APPROACH LANES (La Cholla Blvd., south approach)

PM	1	425	0
MD			
AM	0	383	0
TOTAL	1	808	0
	0	1	0

LOCATION #: 14-1250-002

TURNING MOVEMENT COUNT

La Cholla Blvd. & Owl Head Pl.
(Intersection Name)

WEDNESDAY	08/27/2014
Day	Date

COUNT PERIODS

AM	700AM	-	900AM
NOON		-	
PM	400PM	-	600PM

AM PEAK HOUR 715 AM

NOON PEAK HOUR

PM PEAK HOUR 430 PM

Intersection Turning Movement
Prepared by:

Field Data Services of Arizona, Inc.
520.316.6745

veracitytrafficgroup

N-S STREET: La Cholla Blvd.

E-W STREET: Owl Head Pl.

DATE: 08/27/2014

DAY: WEDNESDAY

LOCATION: Oro Valley

PROJECT# 14-1250-002

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	0	0	1	0	0	1	0	0	0	0	
6:00 AM													
6:15 AM													
6:30 AM													
6:45 AM													
7:00 AM	0	73	0	0	120	0	1	0	0	0	0	0	194
7:15 AM	0	89	0	0	111	1	0	0	0	0	0	0	201
7:30 AM	0	139	0	0	127	0	4	0	0	0	0	0	270
7:45 AM	0	96	0	0	130	0	0	0	0	0	0	0	226
8:00 AM	0	59	0	0	135	2	0	0	0	0	0	0	196
8:15 AM	0	56	0	0	86	0	0	0	0	0	0	0	142
8:30 AM	0	66	0	0	83	0	0	0	1	0	0	0	150
8:45 AM	0	49	0	0	73	0	0	0	0	0	0	0	122
9:00 AM													
9:15 AM													
9:30 AM													
9:45 AM													
10:00 AM													
10:15 AM													
10:30 AM													
10:45 AM													
11:00 AM													
11:15 AM													
11:30 AM													
11:45 AM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	0	627	0	0	865	3	5	0	1	0	0	0	1501
Approach %	0.00	100.00	0.00	0.00	99.65	0.35	83.33	0.00	16.67	####	####	####	
App/Depart	627	/	632	868	/	866	6	/	0	0	/	3	

AM Peak Hr Begins at: 715 AM

PEAK													
Volumes	0	383	0	0	503	3	4	0	0	0	0	0	893
Approach %	0.00	100.00	0.00	0.00	99.41	0.59	100.00	0.00	0.00	####	####	####	
PEAK HR. FACTOR:		0.689			0.923			0.250			0.000		0.827

CONTROL: 1 Way Stop (EB)

COMMENT 1:

GPS: 32.388623,-111.012865

Intersection Turning Movement

Field Data Services of Arizona, Inc.
520.316.6745

veracitytrafficgroup

N-S STREET: La Cholla Blvd.
DATE: 08/27/2014
LOCATION: Oro Valley

E-W STREET: Owl Head Pl.
DAY: WEDNESDAY
PROJECT# 14-1250-002

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	0	0	1	0	0	1	0	0	0	0	
1:00 PM													
1:15 PM													
1:30 PM													
1:45 PM													
2:00 PM													
2:15 PM													
2:30 PM													
2:45 PM													
3:00 PM													
3:15 PM													
3:30 PM													
3:45 PM													
4:00 PM	0	65	0	0	83	0	0	0	2	0	0	0	150
4:15 PM	0	84	0	0	60	2	0	0	0	0	0	0	146
4:30 PM	0	109	0	0	65	0	1	0	0	0	0	0	175
4:45 PM	0	102	0	0	44	0	0	0	0	0	0	0	146
5:00 PM	0	113	0	0	68	0	0	0	1	0	0	0	182
5:15 PM	1	101	0	0	65	0	0	0	0	0	0	0	167
5:30 PM	0	92	0	0	34	0	0	0	0	0	0	0	126
5:45 PM	0	105	0	0	54	0	0	0	0	0	0	0	159
6:00 PM													
6:15 PM													
6:30 PM													
6:45 PM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	1	771	0	0	473	2	1	0	3	0	0	0	1251
Approach %	0.13	99.87	0.00	0.00	99.58	0.42	25.00	0.00	75.00	####	####	####	
App/Depart	772	/	772	475	/	476	4	/	0	0	/	3	

PM Peak Hr Begins at: 430 PM

PEAK	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	1	425	0	0	242	0	1	0	1	0	0	0	670
Approach %	0.23	99.77	0.00	0.00	100.00	0.00	50.00	0.00	50.00	####	####	####	
PEAK HR. FACTOR:		0.942			0.890			0.500			0.000		0.920

CONTROL: 1 Way Stop (EB)
COMMENT 1: 0
GPS: 32.388623,-111.012865

Prepared by: Field Data Services of Arizona/Veracity Traffic Group (520) 316-6745

Volumes for: Wednesday, August 27, 2014
City: Oro Valley
Project #: 14-1250-002

Location: La Cholla Blvd. south of Lambert Ln.

AM Period	NB		SB		EB	WB		PM Period	NB		SB		EB	WB	
00:00	3		3					12:00	59		70				
00:15	1		1					12:15	75		109				
00:30	2		0					12:30	91		90				
00:45	2	8	1	5			13	12:45	67	292	71	340			632
01:00	0		1					13:00	73		82				
01:15	2		0					13:15	81		74				
01:30	0		1					13:30	62		90				
01:45	1	3	0	2			5	13:45	68	284	101	347			631
02:00	1		0					14:00	79		66				
02:15	1		1					14:15	82		84				
02:30	4		2					14:30	104		79				
02:45	2	8	2	5			13	14:45	112	377	94	323			700
03:00	1		1					15:00	103		84				
03:15	3		2					15:15	92		79				
03:30	0		0					15:30	87		78				
03:45	0	4	2	5			9	15:45	54	336	84	325			661
04:00	8		5					16:00	83		66				
04:15	15		10					16:15	95		62				
04:30	9		24					16:30	110		56				
04:45	7	39	18	57			96	16:45	97	385	65	249			634
05:00	20		15					17:00	113		71				
05:15	18		33					17:15	95		40				
05:30	34		32					17:30	108		58				
05:45	30	102	38	118			220	17:45	82	398	46	215			613
06:00	42		39					18:00	62		46				
06:15	49		61					18:15	71		32				
06:30	58		73					18:30	60		40				
06:45	56	205	92	265			470	18:45	56	249	26	144			393
07:00	92		122					19:00	37		22				
07:15	110		132					19:15	35		19				
07:30	121		118					19:30	35		11				
07:45	78	401	154	526			927	19:45	37	144	19	71			215
08:00	59		84					20:00	26		24				
08:15	53		103					20:15	25		20				
08:30	61		65					20:30	31		13				
08:45	49	222	71	323			545	20:45	28	110	15	72			182
09:00	52		71					21:00	14		15				
09:15	58		79					21:15	19		15				
09:30	57		62					21:30	18		7				
09:45	49	216	72	284			500	21:45	11	62	12	49			111
10:00	49		64					22:00	10		6				
10:15	68		62					22:15	8		8				
10:30	77		68					22:30	10		8				
10:45	73	267	69	263			530	22:45	8	36	4	26			62
11:00	59		70					23:00	6		2				
11:15	66		76					23:15	4		2				
11:30	80		55					23:30	3		1				
11:45	87	292	55	256			548	23:45	1	14	5	10			24
Total Vol.		1767		2109			**3876**			2687		2171			**4858**

GPS Coordinates:

Daily Totals

NB	SB	EB	WB	**Combined**
4454	4280			**8734**

	AM			**PM**		
Split %	45.6%	54.4%	**44.4%**	55.3%	44.7%	**55.6%**
Peak Hour	07:00	07:00	**07:00**	16:15	12:15	**14:30**
Volume	401	526	**927**	415	352	**747**
P.H.F.	0.83	0.85	**0.96**	0.92	0.81	**0.91**

Prepared by: Field Data Services of Arizona/Veracity Traffic Group (520) 316-6745

Volumes for: Wednesday, August 27, 2014 City: Oro Valley Project #: 14-1250-001

Location: Lambert Ln. east of La Cholla Blvd.

AM Period	NB	SB	EB		WB			PM Period	NB	SB	EB		WB		
00:00			4		2			12:00			59		60		
00:15			2		0			12:15			75		66		
00:30			3		1			12:30			72		60		
00:45			2	11	2	5	16	12:45			71	277	51	237	514
01:00			1		3			13:00			63		78		
01:15			2		0			13:15			66		82		
01:30			3		0			13:30			76		81		
01:45			0	6	2	5	11	13:45			61	266	94	335	601
02:00			2		2			14:00			70		70		
02:15			0		2			14:15			90		78		
02:30			3		1			14:30			114		88		
02:45			3	8	0	5	13	14:45			113	387	91	327	714
03:00			0		2			15:00			108		110		
03:15			1		0			15:15			91		104		
03:30			2		0			15:30			97		107		
03:45			1	4	1	3	7	15:45			83	379	118	439	818
04:00			11		3			16:00			80		101		
04:15			9		3			16:15			65		93		
04:30			22		14			16:30			85		83		
04:45			11	53	5	25	78	16:45			76	306	109	386	692
05:00			18		6			17:00			82		109		
05:15			34		19			17:15			78		102		
05:30			45		22			17:30			89		81		
05:45			33	130	26	73	203	17:45			71	320	70	362	682
06:00			55		28			18:00			65		76		
06:15			71		30			18:15			59		54		
06:30			93		56			18:30			55		57		
06:45			82	301	54	168	469	18:45			45	224	61	248	472
07:00			145		79			19:00			53		55		
07:15			126		121			19:15			46		33		
07:30			202		133			19:30			39		42		
07:45			152	625	100	433	1058	19:45			29	167	46	176	343
08:00			98		62			20:00			33		51		
08:15			84		43			20:15			25		39		
08:30			78		39			20:30			30		26		
08:45			39	299	55	199	498	20:45			27	115	36	152	267
09:00			69		47			21:00			11		30		
09:15			57		41			21:15			14		39		
09:30			67		50			21:30			21		25		
09:45			60	253	65	203	456	21:45			13	59	14	108	167
10:00			58		66			22:00			10		10		
10:15			62		50			22:15			6		8		
10:30			61		54			22:30			12		10		
10:45			67	248	50	220	468	22:45			11	39	7	35	74
11:00			63		51			23:00			10		11		
11:15			59		51			23:15			2		6		
11:30			72		65			23:30			3		3		
11:45			58	252	62	229	481	23:45			4	19	8	28	47
Total Vol.				2190		1568	**3758**					2558		2833	**5391**

GPS Coordinates:

Daily Totals

NB	SB	EB	WB	**Combined**
		4748	4401	**9149**

	AM			**PM**		
Split %	58.3%	41.7%	**41.1%**	47.4%	52.6%	**58.9%**
Peak Hour	07:00	07:00	**07:00**	14:30	15:00	**14:45**
Volume	625	433	**1058**	426	439	**821**
P.H.F.	0.77	0.81	**0.79**	0.93	0.93	**0.94**

TRAFFIC IMPACT ANALYSIS
PROPOSED NEIGHBORHOOD
SOUTHEAST OF LA CHOLLA BOULEVARD/LAMBERT LANE

APPENDIX

Trip Generation Calculations

Single-Family Detached Housing

LAND USE: 154 Dwelling Units Single-Family Detached Housing

TRIP GENERATION CALCULATIONS ARE BASED ON THE INSTITUTE OF TRANSPORTATION ENGINEERS' TRIP GENERATION, 9TH EDITION. THE ITE LAND USE CODE IS
Single-Family Detached Housing (210)

WEEKDAY

Rate Based on Equation: Ln(T) = 0.92Ln(X) + 2.72

Rate = 10.15 Trips per Dwelling Unit (DU)
T = 10.15 Trips x 154 DU
T = 1564 VPD
ENTER: (0.5)*(1564) = **782 VPD**
EXIT: (0.5)*(1564) = **782 VPD**

AM PEAK HOUR (ONE HOUR BETWEEN 7 AND 9 AM)

Rate Based on Equation: T = 0.70 (X) + 9.74

Rate = 0.76 Trips per Dwelling Unit (DU)
T = 0.76 Trips x 154 DU
T = 119 VPH
ENTER: (0.25)*(119) = **30 VPH**
EXIT: (0.75)*(119) = **89 VPH**

PM PEAK HOUR (ONE HOUR BETWEEN 4 AND 6 PM)

Rate Based on Equation: Ln(T) = 0.90Ln(X) + 0.51

Rate = 1.01 Trips per Dwelling Unit (DU)
T = 1.01 Trips x 154 DU
T = 155 VPH
ENTER: (0.63)*(155) = **98 VPH**
EXIT: (0.37)*(155) = **57 VPH**

*where, T = trip ends

TRIP GENERATION SUMMARY

WEEKDAY	**1564 VPD**
AM PEAK HOUR (ONE HOUR BETWEEN 7 AND 9 AM)	**119 VPH**
PM PEAK HOUR (ONE HOUR BETWEEN 4 AND 6 PM)	**155 VPH**

TRAFFIC IMPACT ANALYSIS
PROPOSED NEIGHBORHOOD
SOUTHEAST OF LA CHOLLA BOULEVARD/LAMBERT LANE

APPENDIX

Capacity Calculations

HCM 2010 Signalized Intersection Summary
3: La Cholla Boulevard & Lambert Lane

9/10/2014

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Volume (veh/h)	59	335	33	112	206	65	20	218	154	91	349	46
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	66	372	37	124	229	72	22	242	171	101	388	51
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	464	698	69	386	569	179	371	432	305	379	684	90
Arrive On Green	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
Sat Flow, veh/h	1074	1668	166	973	1360	428	946	1017	719	969	1613	212
Grp Volume(v), veh/h	66	0	409	124	0	301	22	0	413	101	0	439
Grp Sat Flow(s),veh/h/ln	1074	0	1833	973	0	1787	946	0	1736	969	0	1825
Q Serve(g_s), s	2.3	0.0	8.5	5.6	0.0	6.0	0.9	0.0	9.1	4.5	0.0	9.3
Cycle Q Clear(g_c), s	8.3	0.0	8.5	14.1	0.0	6.0	10.2	0.0	9.1	13.6	0.0	9.3
Prop In Lane	1.00		0.09	1.00		0.24	1.00		0.41	1.00		0.12
Lane Grp Cap(c), veh/h	464	0	767	386	0	748	371	0	736	379	0	774
V/C Ratio(X)	0.14	0.00	0.53	0.32	0.00	0.40	0.06	0.00	0.56	0.27	0.00	0.57
Avail Cap(c_a), veh/h	902	0	1515	783	0	1477	714	0	1366	730	0	1436
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.2	0.0	11.1	16.3	0.0	10.3	15.0	0.0	11.1	16.2	0.0	11.1
Incr Delay (d2), s/veh	0.1	0.0	0.6	0.5	0.0	0.3	0.1	0.0	0.7	0.4	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	4.3	1.5	0.0	3.0	0.2	0.0	4.5	1.2	0.0	4.8
LnGrp Delay(d),s/veh	13.4	0.0	11.6	16.8	0.0	10.7	15.0	0.0	11.7	16.6	0.0	11.7
LnGrp LOS	B		B	B		B	B		B	B		B
Approach Vol, veh/h		475			425			435			540	
Approach Delay, s/veh		11.9			12.5			11.9			12.7	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		25.6		25.3		25.6		25.3
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0
Max Green Setting (Gmax), s		40.0		42.0		40.0		42.0
Max Q Clear Time (g_c+I1), s		12.2		10.5		15.6		16.1
Green Ext Time (p_c), s		6.2		5.4		6.0		5.2

Intersection Summary			
HCM 2010 Ctrl Delay			12.2
HCM 2010 LOS			B

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	4	0	0	383	503	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	0	0	426	559	3

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	987	561	562	0	-	0
Stage 1	561	-	-	-	-	-
Stage 2	426	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	274	527	1009	-	-	-
Stage 1	571	-	-	-	-	-
Stage 2	659	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	274	527	1009	-	-	-
Mov Cap-2 Maneuver	274	-	-	-	-	-
Stage 1	571	-	-	-	-	-
Stage 2	659	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	18.4	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1009	-	274	-	-
HCM Lane V/C Ratio	-	-	0.016	-	-
HCM Control Delay (s)	0	-	18.4	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

HCM 2010 Signalized Intersection Summary
3: La Cholla Boulevard & Lambert Lane

9/10/2014

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Volume (veh/h)	54	171	8	80	271	45	24	289	122	23	164	41
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	60	190	9	89	301	50	27	321	136	26	182	46
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	420	644	30	542	568	94	575	510	216	393	590	149
Arrive On Green	0.36	0.36	0.36	0.36	0.36	0.36	0.41	0.41	0.41	0.41	0.41	0.41
Sat Flow, veh/h	1026	1764	84	1179	1558	259	1148	1243	527	931	1436	363
Grp Volume(v), veh/h	60	0	199	89	0	351	27	0	457	26	0	228
Grp Sat Flow(s),veh/h/ln	1026	0	1848	1179	0	1817	1148	0	1770	931	0	1799
Q Serve(g_s), s	1.7	0.0	2.7	2.1	0.0	5.4	0.6	0.0	7.3	0.8	0.0	3.0
Cycle Q Clear(g_c), s	7.2	0.0	2.7	4.8	0.0	5.4	3.6	0.0	7.3	8.1	0.0	3.0
Prop In Lane	1.00		0.05	1.00		0.14	1.00		0.30	1.00		0.20
Lane Grp Cap(c), veh/h	420	0	674	542	0	663	575	0	727	393	0	739
V/C Ratio(X)	0.14	0.00	0.30	0.16	0.00	0.53	0.05	0.00	0.63	0.07	0.00	0.31
Avail Cap(c_a), veh/h	1256	0	2179	1502	0	2143	1393	0	1988	1056	0	2020
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.7	0.0	8.1	9.8	0.0	8.9	8.3	0.0	8.3	11.6	0.0	7.1
Incr Delay (d2), s/veh	0.2	0.0	0.2	0.1	0.0	0.7	0.0	0.0	0.9	0.1	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	1.4	0.7	0.0	2.8	0.2	0.0	3.6	0.2	0.0	1.5
LnGrp Delay(d),s/veh	11.9	0.0	8.3	9.9	0.0	9.6	8.3	0.0	9.2	11.6	0.0	7.3
LnGrp LOS	B		A	A		A	A		A	B		A
Approach Vol, veh/h		259			440			484			254	
Approach Delay, s/veh		9.1			9.6			9.2			7.8	
Approach LOS		A			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		18.6		17.0		18.6		17.0
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0
Max Green Setting (Gmax), s		40.0		42.0		40.0		42.0
Max Q Clear Time (g_c+I1), s		9.3		9.2		10.1		7.4
Green Ext Time (p_c), s		4.5		3.8		4.5		3.9

Intersection Summary	
HCM 2010 Ctrl Delay	9.1
HCM 2010 LOS	A

HCM 2010 TWSC
8: La Cholla Bouleavrd/La Cholla Boulevard & Owl Head Place

9/10/2014

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	1	1	1	425	242	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	1	1	472	269	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	743	269	269	0	-	0
Stage 1	269	-	-	-	-	-
Stage 2	474	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	383	770	1295	-	-	-
Stage 1	776	-	-	-	-	-
Stage 2	626	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	383	770	1295	-	-	-
Mov Cap-2 Maneuver	383	-	-	-	-	-
Stage 1	776	-	-	-	-	-
Stage 2	625	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12.1	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1295	-	512	-	-
HCM Lane V/C Ratio	0.001	-	0.004	-	-
HCM Control Delay (s)	7.8	0	12.1	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Volume (veh/h)	62	349	35	117	215	68	21	227	161	95	358	48
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	69	388	39	130	239	76	23	252	179	106	398	53
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	451	710	71	371	578	184	357	436	310	360	692	92
Arrive On Green	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Sat Flow, veh/h	1060	1666	167	957	1356	431	936	1015	721	953	1610	214
Grp Volume(v), veh/h	69	0	427	130	0	315	23	0	431	106	0	451
Grp Sat Flow(s),veh/h/ln	1060	0	1833	957	0	1787	936	0	1736	953	0	1825
Q Serve(g_s), s	2.7	0.0	9.7	6.5	0.0	6.8	1.1	0.0	10.4	5.3	0.0	10.4
Cycle Q Clear(g_c), s	9.5	0.0	9.7	16.2	0.0	6.8	11.4	0.0	10.4	15.7	0.0	10.4
Prop In Lane	1.00		0.09	1.00		0.24	1.00		0.42	1.00		0.12
Lane Grp Cap(c), veh/h	451	0	781	371	0	761	357	0	745	360	0	784
V/C Ratio(X)	0.15	0.00	0.55	0.35	0.00	0.41	0.06	0.00	0.58	0.29	0.00	0.58
Avail Cap(c_a), veh/h	804	0	1390	689	0	1355	630	0	1253	639	0	1318
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.4	0.0	11.9	17.9	0.0	11.1	16.3	0.0	12.0	18.0	0.0	12.0
Incr Delay (d2), s/veh	0.2	0.0	0.6	0.6	0.0	0.4	0.1	0.0	0.7	0.5	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	5.0	1.8	0.0	3.4	0.3	0.0	5.1	1.4	0.0	5.3
LnGrp Delay(d),s/veh	14.5	0.0	12.5	18.5	0.0	11.4	16.4	0.0	12.7	18.4	0.0	12.6
LnGrp LOS	B		B	B		B	B		B	B		B
Approach Vol, veh/h		496			445			454			557	
Approach Delay, s/veh		12.8			13.5			12.9			13.7	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		27.8		27.6		27.8		27.6
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0
Max Green Setting (Gmax), s		40.0		42.0		40.0		42.0
Max Q Clear Time (g_c+I1), s		13.4		11.7		17.7		18.2
Green Ext Time (p_c), s		6.4		5.7		6.1		5.4

Intersection Summary		
HCM 2010 Ctrl Delay		13.2
HCM 2010 LOS		B

HCM 2010 TWSC
8: La Cholla Bouleavrd/La Cholla Boulevard & Owl Head Place

9/10/2014

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	5	0	0	399	524	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	6	0	0	443	582	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1027	584	587	0	-	0
Stage 1	584	-	-	-	-	-
Stage 2	443	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	260	512	988	-	-	-
Stage 1	557	-	-	-	-	-
Stage 2	647	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	260	512	988	-	-	-
Mov Cap-2 Maneuver	260	-	-	-	-	-
Stage 1	557	-	-	-	-	-
Stage 2	647	-	-	-	-	-

Approach	EB		NB		SB	
HCM Control Delay, s	19.1		0		0	
HCM LOS	C					

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	988	-	260	-	-
HCM Lane V/C Ratio	-	-	0.021	-	-
HCM Control Delay (s)	0	-	19.1	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

HCM 2010 Signalized Intersection Summary
3: La Cholla Boulevard & Lambert Lane

9/10/2014

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Volume (veh/h)	57	178	9	84	282	47	25	301	127	24	171	43
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	63	198	10	93	313	52	28	334	141	27	190	48
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	407	652	33	531	578	96	564	519	219	377	598	151
Arrive On Green	0.37	0.37	0.37	0.37	0.37	0.37	0.42	0.42	0.42	0.42	0.42	0.42
Sat Flow, veh/h	1013	1758	89	1169	1558	259	1138	1245	525	915	1436	363
Grp Volume(v), veh/h	63	0	208	93	0	365	28	0	475	27	0	238
Grp Sat Flow(s),veh/h/ln	1013	0	1847	1169	0	1817	1138	0	1770	915	0	1799
Q Serve(g_s), s	2.0	0.0	3.0	2.3	0.0	6.0	0.6	0.0	8.1	0.9	0.0	3.3
Cycle Q Clear(g_c), s	7.9	0.0	3.0	5.3	0.0	6.0	4.0	0.0	8.1	9.0	0.0	3.3
Prop In Lane	1.00		0.05	1.00		0.14	1.00		0.30	1.00		0.20
Lane Grp Cap(c), veh/h	407	0	685	531	0	674	564	0	737	377	0	749
V/C Ratio(X)	0.15	0.00	0.30	0.17	0.00	0.54	0.05	0.00	0.64	0.07	0.00	0.32
Avail Cap(c_a), veh/h	1161	0	2061	1402	0	2027	1299	0	1881	968	0	1911
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.4	0.0	8.4	10.3	0.0	9.3	8.7	0.0	8.8	12.3	0.0	7.4
Incr Delay (d2), s/veh	0.2	0.0	0.2	0.2	0.0	0.7	0.0	0.0	0.9	0.1	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	1.5	0.7	0.0	3.1	0.2	0.0	4.0	0.2	0.0	1.7
LnGrp Delay(d),s/veh	12.6	0.0	8.6	10.4	0.0	10.0	8.8	0.0	9.7	12.4	0.0	7.6
LnGrp LOS	B		A	B		B	A		A	B		A
Approach Vol, veh/h		271			458			503			265	
Approach Delay, s/veh		9.6			10.1			9.7			8.1	
Approach LOS		A			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		19.7		18.0		19.7		18.0
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0
Max Green Setting (Gmax), s		40.0		42.0		40.0		42.0
Max Q Clear Time (g_c+I1), s		10.1		9.9		11.0		8.0
Green Ext Time (p_c), s		4.7		4.0		4.7		4.1

Intersection Summary	
HCM 2010 Ctrl Delay	9.5
HCM 2010 LOS	A

HCM 2010 TWSC
8: La Cholla Bouleavrd/La Cholla Boulevard & Owl Head Place

9/10/2014

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	2	2	2	443	252	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	2	2	492	280	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	777	280	280	0	-	0
Stage 1	280	-	-	-	-	-
Stage 2	497	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	365	759	1283	-	-	-
Stage 1	767	-	-	-	-	-
Stage 2	611	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	364	759	1283	-	-	-
Mov Cap-2 Maneuver	364	-	-	-	-	-
Stage 1	767	-	-	-	-	-
Stage 2	610	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12.4	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1283	-	492	-	-
HCM Lane V/C Ratio	0.002	-	0.009	-	-
HCM Control Delay (s)	7.8	0	12.4	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

HCM 2010 Signalized Intersection Summary
3: La Cholla Boulevard & Lambert Lane

9/10/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Volume (veh/h)	62	352	38	136	224	73	30	231	183	97	359	48
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	69	391	42	151	249	81	33	257	203	108	399	53
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	437	719	77	364	586	191	350	421	332	331	702	93
Arrive On Green	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
Sat Flow, veh/h	1046	1654	178	951	1347	438	935	966	763	928	1611	214
Grp Volume(v), veh/h	69	0	433	151	0	330	33	0	460	108	0	452
Grp Sat Flow(s),veh/h/ln	1046	0	1831	951	0	1785	935	0	1728	928	0	1825
Q Serve(g_s), s	3.0	0.0	10.9	8.7	0.0	7.9	1.7	0.0	12.7	6.3	0.0	11.5
Cycle Q Clear(g_c), s	11.0	0.0	10.9	19.5	0.0	7.9	13.2	0.0	12.7	19.0	0.0	11.5
Prop In Lane	1.00		0.10	1.00		0.25	1.00		0.44	1.00		0.12
Lane Grp Cap(c), veh/h	437	0	797	364	0	777	350	0	753	331	0	796
V/C Ratio(X)	0.16	0.00	0.54	0.42	0.00	0.42	0.09	0.00	0.61	0.33	0.00	0.57
Avail Cap(c_a), veh/h	690	0	1240	594	0	1209	545	0	1114	525	0	1177
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	16.0	0.0	13.0	20.2	0.0	12.1	18.1	0.0	13.4	20.7	0.0	13.1
Incr Delay (d2), s/veh	0.2	0.0	0.6	0.8	0.0	0.4	0.1	0.0	0.8	0.6	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	5.5	2.3	0.0	3.9	0.5	0.0	6.2	1.6	0.0	5.9
LnGrp Delay(d),s/veh	16.1	0.0	13.5	20.9	0.0	12.5	18.2	0.0	14.3	21.3	0.0	13.8
LnGrp LOS	B		B	C		B	B		B	C		B
Approach Vol, veh/h		502			481			493			560	
Approach Delay, s/veh		13.9			15.2			14.5			15.2	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		31.0		31.0		31.0		31.0
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0
Max Green Setting (Gmax), s		40.0		42.0		40.0		42.0
Max Q Clear Time (g_c+I1), s		15.2		13.0		21.0		21.5
Green Ext Time (p_c), s		6.7		6.0		6.1		5.5

Intersection Summary	
HCM 2010 Ctrl Delay	14.7
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	5	0	0	13	0	31	0	403	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	6	0	0	14	0	34	0	448	6

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	1089	1074	599	1072	1074	451	601	0	0
Stage 1	621	621	-	451	451	-	-	-	-
Stage 2	468	453	-	621	623	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	193	220	502	198	220	608	976	-	-
Stage 1	475	479	-	588	571	-	-	-	-
Stage 2	575	570	-	475	478	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	180	217	502	196	217	608	976	-	-
Mov Cap-2 Maneuver	180	217	-	196	217	-	-	-	-
Stage 1	475	472	-	588	571	-	-	-	-
Stage 2	542	570	-	468	471	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	25.6	15.3	0
HCM LOS	D	C	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	976	-	-	180	196	608	1108	-	-
HCM Lane V/C Ratio	-	-	-	0.031	0.074	0.057	0.01	-	-
HCM Control Delay (s)	0	-	-	25.6	24.8	11.3	8.3	0	-
HCM Lane LOS	A	-	-	D	C	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.2	0.2	0	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	10	537	4
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	90	90	90
Heavy Vehicles, %	2	2	2
Mvmt Flow	11	597	4

Major/Minor	Major2		
Conflicting Flow All	453	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.12	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.218	-	-
Pot Cap-1 Maneuver	1108	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1108	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0.2
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	623	9	6	6	27	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	692	10	7	7	30	20

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	702	0	717	697
Stage 1	-	-	-	-	697	-
Stage 2	-	-	-	-	20	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	895	-	396	441
Stage 1	-	-	-	-	494	-
Stage 2	-	-	-	-	1003	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	895	-	393	441
Mov Cap-2 Maneuver	-	-	-	-	393	-
Stage 1	-	-	-	-	494	-
Stage 2	-	-	-	-	995	-

Approach	EB	WB	NB
HCM Control Delay, s	0	4.5	14.4
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	393	441	-	-	895	-
HCM Lane V/C Ratio	0.076	0.045	-	-	0.007	-
HCM Control Delay (s)	14.9	13.6	-	-	9.1	-
HCM Lane LOS	B	B	-	-	A	-
HCM 95th %tile Q(veh)	0.2	0.1	-	-	0	-

HCM 2010 Signalized Intersection Summary
3: La Cholla Boulevard & Lambert Lane

9/10/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Volume (veh/h)	57	187	18	112	288	50	31	304	153	29	176	43
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	63	208	20	124	320	56	34	338	170	32	196	48
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	385	624	60	501	576	101	564	506	255	354	625	153
Arrive On Green	0.37	0.37	0.37	0.37	0.37	0.37	0.43	0.43	0.43	0.43	0.43	0.43
Sat Flow, veh/h	1003	1673	161	1148	1545	270	1131	1170	589	888	1446	354
Grp Volume(v), veh/h	63	0	228	124	0	376	34	0	508	32	0	244
Grp Sat Flow(s),veh/h/ln	1003	0	1834	1148	0	1815	1131	0	1759	888	0	1800
Q Serve(g_s), s	2.2	0.0	3.7	3.6	0.0	6.7	0.8	0.0	9.5	1.2	0.0	3.7
Cycle Q Clear(g_c), s	8.9	0.0	3.7	7.2	0.0	6.7	4.5	0.0	9.5	10.7	0.0	3.7
Prop In Lane	1.00		0.09	1.00		0.15	1.00		0.33	1.00		0.20
Lane Grp Cap(c), veh/h	385	0	684	501	0	677	564	0	761	354	0	778
V/C Ratio(X)	0.16	0.00	0.33	0.25	0.00	0.56	0.06	0.00	0.67	0.09	0.00	0.31
Avail Cap(c_a), veh/h	1035	0	1874	1246	0	1854	1175	0	1711	834	0	1752
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.7	0.0	9.2	11.8	0.0	10.2	9.1	0.0	9.3	13.6	0.0	7.7
Incr Delay (d2), s/veh	0.2	0.0	0.3	0.3	0.0	0.7	0.0	0.0	1.0	0.1	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	1.9	1.1	0.0	3.5	0.3	0.0	4.7	0.3	0.0	1.8
LnGrp Delay(d),s/veh	13.9	0.0	9.5	12.1	0.0	10.9	9.2	0.0	10.3	13.7	0.0	7.9
LnGrp LOS	B		A	B		B	A		B	B		A
Approach Vol, veh/h		291			500			542			276	
Approach Delay, s/veh		10.5			11.2			10.3			8.6	
Approach LOS		B			B			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		21.8		19.3		21.8		19.3
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0
Max Green Setting (Gmax), s		40.0		42.0		40.0		42.0
Max Q Clear Time (g_c+I1), s		11.5		10.9		12.7		9.2
Green Ext Time (p_c), s		5.1		4.4		5.1		4.5

Intersection Summary			
HCM 2010 Ctrl Delay			10.3
HCM 2010 LOS			B

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	2	0	2	8	0	20	2	458	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	0	2	9	0	22	2	509	17

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	897	894	289	888	886	517	289	0	0
Stage 1	364	364	-	522	522	-	-	-	-
Stage 2	533	530	-	366	364	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	261	280	750	264	284	558	1273	-	-
Stage 1	655	624	-	538	531	-	-	-	-
Stage 2	531	527	-	653	624	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	242	267	750	254	271	558	1273	-	-
Mov Cap-2 Maneuver	242	267	-	254	271	-	-	-	-
Stage 1	654	597	-	537	530	-	-	-	-
Stage 2	509	526	-	623	597	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	15	14	0
HCM LOS	C	B	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1273	-	-	366	254	558	1041	-	-
HCM Lane V/C Ratio	0.002	-	-	0.012	0.035	0.04	0.036	-	-
HCM Control Delay (s)	7.8	0	-	15	19.7	11.7	8.6	0	-
HCM Lane LOS	A	A	-	C	C	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.1	0.1	0.1	-	-

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	34	260	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	90	90	90
Heavy Vehicles, %	2	2	2
Mvmt Flow	38	289	0

Major/Minor	Major2		
Conflicting Flow All	526	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.12	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.218	-	-
Pot Cap-1 Maneuver	1041	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1041	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	1
HCM LOS	

Minor Lane/Major Mvmt

HCM 2010 TWSC
10: North Driveway & Lambert Lane

9/10/2014

Intersection	
Int Delay, s/veh	1.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	340	29	20	20	17	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	378	32	22	22	19	13

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	410	0	461	394
Stage 1	-	-	-	-	394	-
Stage 2	-	-	-	-	67	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1149	-	559	655
Stage 1	-	-	-	-	681	-
Stage 2	-	-	-	-	956	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1149	-	548	655
Mov Cap-2 Maneuver	-	-	-	-	548	-
Stage 1	-	-	-	-	681	-
Stage 2	-	-	-	-	938	-

Approach	EB	WB	NB
HCM Control Delay, s	0	4.1	11.3
HCM LOS			B

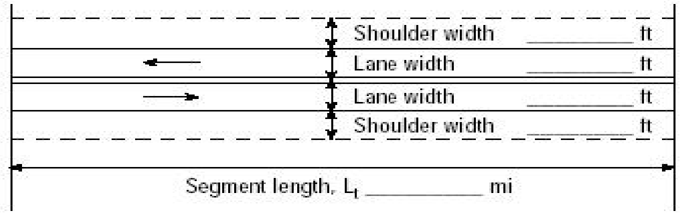
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	548	655	-	-	1149	-
HCM Lane V/C Ratio	0.034	0.02	-	-	0.019	-
HCM Control Delay (s)	11.8	10.6	-	-	8.2	-
HCM Lane LOS	B	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0.1	-

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Gutknecht*	Highway / Direction of Travel	*Lambert Lane (westbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*AM Peak Hour - existing*

Project Description: *Lambert Lane East of La Cholla*

Input Data



Analysis direction vol., V_d *383*veh/h

Opposing direction vol., V_o *580*veh/h

Shoulder width ft *2.0*
Lane Width ft *12.0*
Segment Length mi *0.5*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down
Peak-hour factor, PHF *0.90*
No-passing zone *0%*
% Trucks and Buses , P_T *6 %*
% Recreational vehicles, P_R *4%*
Access points *mi* *1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.9*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.945*	*0.956*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.91*	*0.97*
Demand flow rate[2], v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*495*	*695*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
		Base free-flow speed[4], BFFS	*45.0 mi/h*
		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Mean speed of sample[3], S_{FM}		Adj. for access points[4], f_A (Exhibit 15-8)	*0.3 mi/h*
Total demand flow rate, both directions, *v*		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*32.6 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.4 mi/h*	Percent free flow speed, PFFS	*77.3 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.4*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.977*	*1.000*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.92*	*0.98*
Directional flow rate[2], v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*474*	*658*
Base percent time-spent-following[4], $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*51.1*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.5*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*56.3*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.29*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1603*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1666*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*77.3*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*425.6*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.45*
Bicycle level of service (Exhibit 15-4)	*E*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

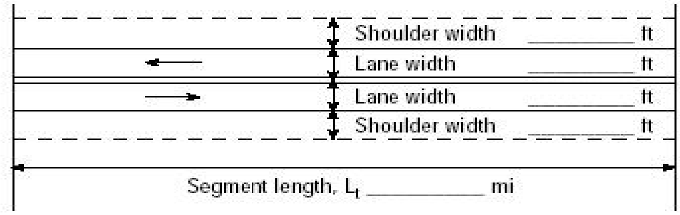
HCS 2010^{TM} Version 6.60 Generated: 9/12/2014 10:53 AM

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		**Site Information**	
Analyst	*Gutknecht*	Highway / Direction of Travel	*Lambert Lane (westbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*PM Peak Hour - existing*

Project Description: *Lambert Lane East of La Cholla*

Input Data



☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi	Up/down
Peak-hour factor, PHF	*0.90*
No-passing zone	*0%*
% Trucks and Buses , P_T	*6* %
% Recreational vehicles, P_R	*4%*
Access points *mi*	*1*/mi

Analysis direction vol., V_d	*396*veh/h
Opposing direction vol., V_o	*316*veh/h
Shoulder width ft	*2.0*
Lane Width ft	*12.0*
Segment Length mi	*0.5*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.9*	*2.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/\ (1+ P_T\ (E_T -1)+P_R\ (E_R -1)\ )$	*0.945*	*0.940*
Grade adjustment factor^1, $f_{g,ATS}$ (Exhibit 15-9)	*0.92*	*0.87*
Demand flow rate^2, v_i (pc/h) $v_i=V_i$ / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*506*	*429*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
		Base free-flow speed^4, BFFS	*45.0* *mi/h*
Mean speed of sample^3, S_{FM}		Adj. for lane and shoulder width,^{4} f_{LS}(Exhibit 15-7)	*2.6* *mi/h*
Total demand flow rate, both directions, *v*		Adj. for access points^4, f_A (Exhibit 15-8)	*0.3* *mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2* *mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.8* *mi/h*	Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*34.1* *mi/h*
		Percent free flow speed, PFFS	*80.8* *%*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.4*	*1.6*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/\ (1+ P_T(E_T-1)+P_R(E_R-1)\ )$	*0.977*	*0.965*
Grade adjustment factor^1, $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.92*	*0.88*
Directional flow rate^2, v_i(pc/h) $v_i=V_i$/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*490*	*413*
Base percent time-spent-following^4, $BPTSF_d$(%)=100(1-$e^{av_d^{\,b}}$)	*49.7*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*14.2*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*57.4*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.30*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1454*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1511*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*80.8*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*440.0*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.47*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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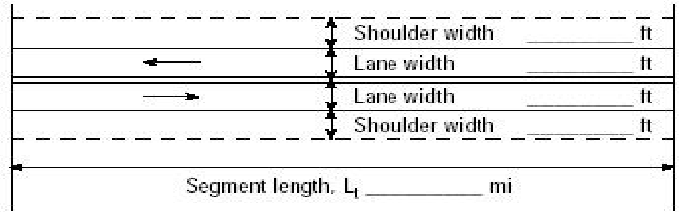
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Gutknecht*	Highway / Direction of Travel	*Lambert Lane (westbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*AM Peak Hour - 2016 without*

Project Description: *Lambert Lane East of La Cholla*

Input Data



Analysis direction vol., V_d *400*veh/h

Opposing direction vol., V_o *605*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.5*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.90*

No-passing zone *0%*

% Trucks and Buses , P_T *6* %

% Recreational vehicles, P_R *4%*

Access points *mi* *1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.9*	*1.6*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.945*	*0.962*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.92*	*0.98*
Demand flow rate[2], v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*511*	*713*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*45.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*0.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.3 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*32.3 mi/h*
		Percent free flow speed, PFFS	*76.7 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.4*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.977*	*1.000*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.93*	*0.98*
Directional flow rate[2], v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*489*	*686*
Base percent time-spent-following[4], $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*52.9*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.4*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*58.1*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.30*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1603*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1683*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*76.7*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*444.4*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.48*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If $v_i(v_d$ or $v_o)$ >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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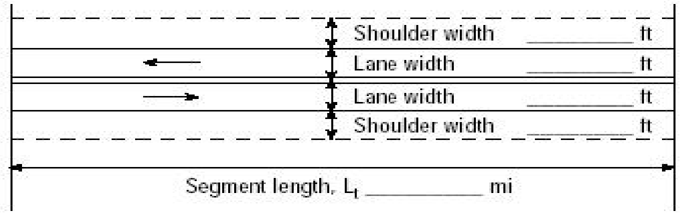
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		**Site Information**	
Analyst	*Gutknecht*	Highway / Direction of Travel	*Lambert Lane (westbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*PM Peak Hour - 2016 without*

Project Description: *Lambert Lane East of La Cholla*

Input Data



Analysis direction vol., V_d *413*veh/h

Opposing direction vol., V_o *329*veh/h

Shoulder width ft *2.0*
Lane Width ft *12.0*
Segment Length mi *0.5*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling
Grade Length mi Up/down
Peak-hour factor, PHF *0.90*
No-passing zone *0%*
% Trucks and Buses , P_T *6 %*
% Recreational vehicles, P_R *4%*
Access points *mi* *1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.9*	*2.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.945*	*0.940*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.93*	*0.88*
Demand flow rate[2], v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*522*	*442*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
		Base free-flow speed[4], BFFS	*45.0 mi/h*
		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Mean speed of sample[3], S_{FM}		Adj. for access points[4], f_A (Exhibit 15-8)	*0.3 mi/h*
Total demand flow rate, both directions, *v*		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*33.9 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.8 mi/h*	Percent free flow speed, PFFS	*80.4 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.4*	*1.6*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.977*	*0.965*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.94*	*0.88*
Directional flow rate[2], v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*500*	*430*
Base percent time-spent-following[4], $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*50.7*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*14.1*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*58.3*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.31*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1462*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1527*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*80.4*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*458.9*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.49*
Bicycle level of service (Exhibit 15-4)	*E*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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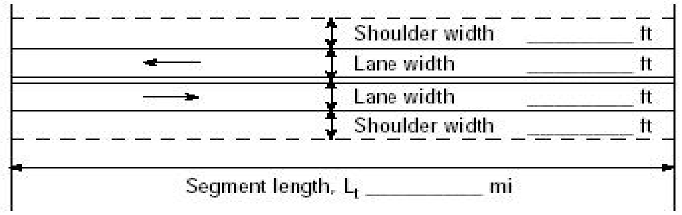
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		**Site Information**	
Analyst	*Gutknecht*	Highway / Direction of Travel	*Lambert Lane (westbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*AM Peak Hour - 2016 with*

Project Description: *Lambert Lane East of La Cholla*

Input Data



☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.90*

No-passing zone *0%*

% Trucks and Buses , P_T *6* %

% Recreational vehicles, P_R *4%*

Access points *mi* *1*/mi

Analysis direction vol., V_d *406*veh/h

Opposing direction vol., V_o *623*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.5*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.9*	*1.6*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.945*	*0.962*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.93*	*0.98*
Demand flow rate[2], v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*513*	*734*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
		Base free-flow speed[4], BFFS	*45.0* mi/h
		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*2.6* mi/h
Mean speed of sample[3], S_{FM}		Adj. for access points[4], f_A (Exhibit 15-8)	*0.3* mi/h
Total demand flow rate, both directions, *v*		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2* mi/h
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*32.1* mi/h
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.3* mi/h	Percent free flow speed, PFFS	*76.3* %

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.4*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.977*	*1.000*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.93*	*0.99*
Directional flow rate[2], v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*497*	*699*
Base percent time-spent-following[4], $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*53.9*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.2*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*59.0*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.30*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1603*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1683*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*76.3*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*451.1*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.48*
Bicycle level of service (Exhibit 15-4)	*E*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If $v_i(v_d$ or $v_o)$ >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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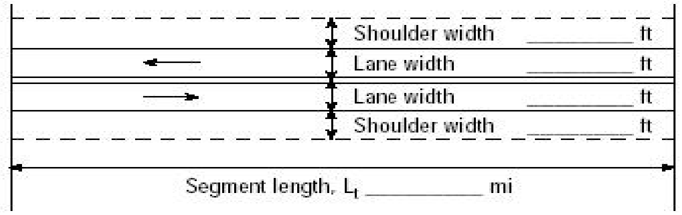
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Gutknecht*	Highway / Direction of Travel	*Lambert Lane (westbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*PM Peak Hour - 2016 with*

Project Description: *Lambert Lane East of La Cholla*

Input Data



☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Analysis direction vol., V_d	*433*veh/h
Opposing direction vol., V_o	*340*veh/h
Shoulder width ft	*2.0*
Lane Width ft	*12.0*
Segment Length mi	*0.5*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0%*
% Trucks and Buses , P_T	*6* %
% Recreational vehicles, P_R	*4%*
Access points *mi*	*1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.8*	*2.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.951*	*0.940*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.94*	*0.88*
Demand flow rate[2], v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*538*	*457*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*45.0* *mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*2.6* *mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*0.3* *mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.8* *mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2* *mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*33.7* *mi/h*
		Percent free flow speed, PFFS	*79.9* *%*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.4*	*1.6*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.977*	*0.965*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.95*	*0.89*
Directional flow rate[2], v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*519*	*440*
Base percent time-spent-following[4], $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*51.3*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*13.9*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*58.8*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.32*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1478*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1527*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*79.9*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*481.1*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.52*
Bicycle level of service (Exhibit 15-4)	*F*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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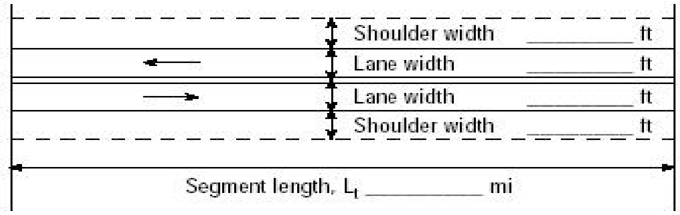
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Gutknecht*	Highway / Direction of Travel	*Lambert Lane (eastbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*AM Peak Hour - existing*

Project Description: *Lambert Lane East of La Cholla*

Input Data



Analysis direction vol., V_d *580*veh/h

Opposing direction vol., V_o *383*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.5*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.90*

No-passing zone *0%*

% Trucks and Buses , P_T *6* %

% Recreational vehicles, P_R *4%*

Access points *mi* *1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.7*	*1.9*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.956*	*0.945*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.97*	*0.91*
Demand flow rate[2], v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*695*	*495*

Free-Flow Speed from Field Measurement

Mean speed of sample[3], S_{FM}

Total demand flow rate, both directions, *v*

Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)

Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15) *0.7 mi/h*

Estimated Free-Flow Speed

Base free-flow speed[4], BFFS	*45.0 mi/h*
Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Adj. for access points[4], f_A (Exhibit 15-8)	*0.3 mi/h*
Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*32.3 mi/h*
Percent free flow speed, PFFS	*76.5 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*1.000*	*0.977*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.98*	*0.92*
Directional flow rate[2], v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*658*	*474*
Base percent time-spent-following[4], $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*59.8*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.5*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+f $_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*67.1*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.41*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1510*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1561*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*76.5*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*644.4*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.66*
Bicycle level of service (Exhibit 15-4)	*F*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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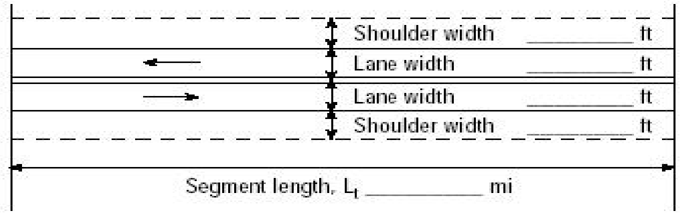
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Gutknecht*	Highway / Direction of Travel	*Lambert Lane (eastbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*PM Peak Hour - existing*

Project Description: *Lambert Lane East of La Cholla*

Input Data



☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Analysis direction vol., V_d	*316*veh/h
Opposing direction vol., V_o	*396*veh/h
Shoulder width ft	*2.0*
Lane Width ft	*12.0*
Segment Length mi	*0.5*
Grade Length mi	Up/down
Peak-hour factor, PHF	*0.90*
No-passing zone	*0%*
% Trucks and Buses , P_T	*6* %
% Recreational vehicles, P_R	*4%*
Access points *mi*	*1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*2.0*	*1.9*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.940*	*0.945*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.87*	*0.92*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*429*	*506*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed[4], BFFS	*45.0* mi/h
		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*2.6* mi/h
Mean speed of sample[3], S_{FM}		Adj. for access points[4], f_A (Exhibit 15-8)	*0.3* mi/h
Total demand flow rate, both directions, *v*		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2* mi/h
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*34.3* mi/h
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.6* mi/h	Percent free flow speed, PFFS	*81.3* %

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.6*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.965*	*0.977*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.88*	*0.92*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*413*	*490*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*45.5*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*14.2*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*52.0*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.25*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1520*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1577*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*81.3*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*351.1*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.36*
Bicycle level of service (Exhibit 15-4)	*E*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information

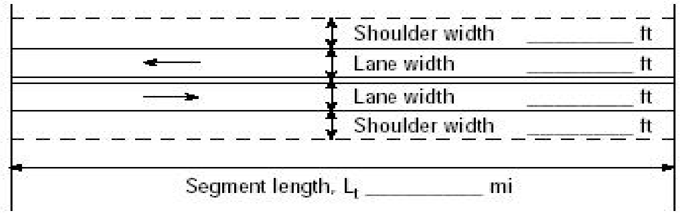
Analyst *Gutknecht*
Agency or Company *SWTE*
Date Performed *9/12/2014*
Analysis Time Period

Site Information

Highway / Direction of Travel *Lambert Lane (eastbound)*
From/To
Jurisdiction
Analysis Year *AM Peak Hour - 2016 without*

Project Description: *Lambert Lane East of La Cholla*

Input Data



Analysis direction vol., V_d *605*veh/h
Opposing direction vol., V_o *400*veh/h
Shoulder width ft *2.0*
Lane Width ft *12.0*
Segment Length mi *0.5*

☐ Class I highway ☐ Class II highway ☑ Class III highway
Terrain ☐ Level ☑ Rolling
Grade Length mi Up/down
Peak-hour factor, PHF *0.90*
No-passing zone *0%*
% Trucks and Buses , P_T *6* %
% Recreational vehicles, P_R *4%*
Access points *mi* *1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.6*	*1.9*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.962*	*0.945*
Grade adjustment factor^1, $f_{g,ATS}$ (Exhibit 15-9)	*0.98*	*0.92*
Demand flow rate^2, v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*713*	*511*

Free-Flow Speed from Field Measurement

Mean speed of sample^3, S_{FM}
Total demand flow rate, both directions, *v*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15) *0.6* *mi/h*

Estimated Free-Flow Speed

Base free-flow speed^4, BFFS *45.0* *mi/h*
Adj. for lane and shoulder width,^{4} f_{LS}(Exhibit 15-7) *2.6* *mi/h*
Adj. for access points^4, f_A (Exhibit 15-8) *0.3* *mi/h*
Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A) *42.2* *mi/h*
Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$ *32.0* *mi/h*
Percent free flow speed, PFFS *76.0* *%*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*1.000*	*0.977*
Grade adjustment factor^1, $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.98*	*0.93*
Directional flow rate^2, v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*686*	*489*
Base percent time-spent-following^4, $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*61.6*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.4*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*68.8*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.42*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1520*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1577*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*76.0*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*672.2*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.69*
Bicycle level of service (Exhibit 15-4)	*F*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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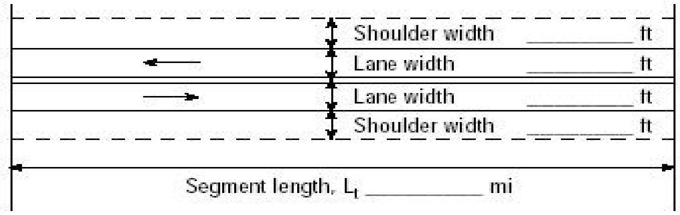
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		**Site Information**	
Analyst	*Gutknecht*	Highway / Direction of Travel	*Lambert Lane (eastbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*PM Peak Hour - 2016 without*

Project Description: *Lambert Lane East of La Cholla*

Input Data



☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length	mi	Up/down
Peak-hour factor, PHF		*0.90*
No-passing zone		*0%*
% Trucks and Buses , P_T		*6* %
% Recreational vehicles, P_R		*4%*
Access points *mi*		*1*/mi

Analysis direction vol., V_d	*329*veh/h
Opposing direction vol., V_o	*413*veh/h
Shoulder width ft	*2.0*
Lane Width ft	*12.0*
Segment Length mi	*0.5*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*2.0*	*1.9*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.940*	*0.945*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.88*	*0.93*
Demand flow rate[2], v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*442*	*522*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
		Base free-flow speed[4], BFFS	*45.0 mi/h*
		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Mean speed of sample[3], S_{FM}		Adj. for access points[4], f_A (Exhibit 15-8)	*0.3 mi/h*
Total demand flow rate, both directions, *v*			
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.6 mi/h*	Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*34.1 mi/h*
		Percent free flow speed, PFFS	*80.8 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.6*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.965*	*0.977*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.88*	*0.94*
Directional flow rate[2], v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*430*	*500*
Base percent time-spent-following[4], $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*46.1*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*14.1*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*52.6*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.26*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1536*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1594*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*80.8*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*365.6*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.38*
Bicycle level of service (Exhibit 15-4)	*E*

Notes

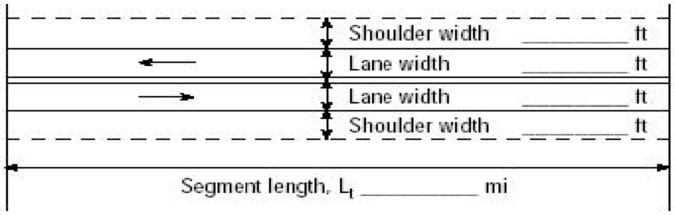
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Gutknecht*	Highway / Direction of Travel	*Lambert Lane (eastbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*AM Peak Hour - 2016 with*

Project Description: *Lambert Lane East of La Cholla*

Input Data



Analysis direction vol., V_d *623*veh/h

Opposing direction vol., V_o *406*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.5*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.90*

No-passing zone *0%*

% Trucks and Buses , P_T *6* %

% Recreational vehicles, P_R *4%*

Access points *mi* *1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.6*	*1.9*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.962*	*0.945*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.98*	*0.93*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*734*	*513*

Free-Flow Speed from Field Measurement

Mean speed of sample[3], S_{FM}

Total demand flow rate, both directions, *v*

Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$

Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15) *0.6* *mi/h*

Estimated Free-Flow Speed

Base free-flow speed[4], BFFS	*45.0* *mi/h*
Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*2.6* *mi/h*
Adj. for access points[4], f_A (Exhibit 15-8)	*0.3* *mi/h*
Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2* *mi/h*
Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*31.9* *mi/h*
Percent free flow speed, PFFS	*75.6* *%*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.977*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.99*	*0.93*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*699*	*497*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*61.8*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.2*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*68.9*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.43*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1536*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1594*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*75.6*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*692.2*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.70*
Bicycle level of service (Exhibit 15-4)	*F*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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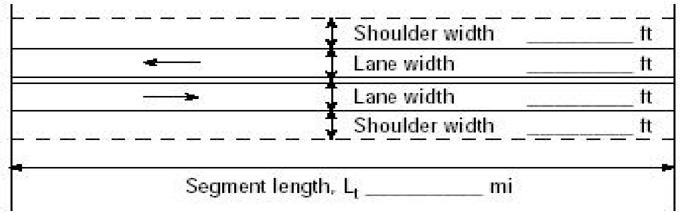
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Gutknecht*	Highway / Direction of Travel	*Lambert Lane (eastbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*PM Peak Hour - 2016 with*

Project Description: *Lambert Lane East of La Cholla*

Input Data



☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi	Up/down
Peak-hour factor, PHF	*0.90*
No-passing zone	*0%*
% Trucks and Buses , P_T	*6* %
% Recreational vehicles, P_R	*4%*
Access points *mi*	*1*/mi

Analysis direction vol., V_d	*340*veh/h
Opposing direction vol., V_o	*433*veh/h
Shoulder width ft	*2.0*
Lane Width ft	*12.0*
Segment Length mi	*0.5*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*2.0*	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.940*	*0.951*
Grade adjustment factor^1, $f_{g,ATS}$ (Exhibit 15-9)	*0.88*	*0.94*
Demand flow rate^2, v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*457*	*538*

Free-Flow Speed from Field Measurement

Mean speed of sample^3, S_{FM}

Total demand flow rate, both directions, *v*

Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)

Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15) *0.6 mi/h*

Estimated Free-Flow Speed

Base free-flow speed^4, BFFS	*45.0 mi/h*
Adj. for lane and shoulder width,^{4} f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Adj. for access points^4, f_A (Exhibit 15-8)	*0.3 mi/h*
Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*33.9 mi/h*
Percent free flow speed, PFFS	*80.4 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.6*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.965*	*0.977*
Grade adjustment factor^1, $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.89*	*0.95*
Directional flow rate^2, v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*440*	*519*
Base percent time-spent-following^4, $BPTSF_d(\%)=100(1-e^{av_d^b})$	*48.2*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*13.9*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*54.6*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.27*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1536*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1613*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*80.4*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*377.8*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.39*
Bicycle level of service (Exhibit 15-4)	*E*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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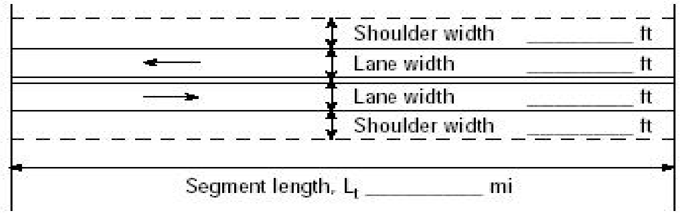
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Gutknecht*	Highway / Direction of Travel	*La Cholla (northbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*AM Peak Hour - existing*

Project Description: *La Cholla south of Lambert*

Input Data



Analysis direction vol., V_d *392*veh/h

Opposing direction vol., V_o *489*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.5*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.90*

No-passing zone *0%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.9*	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/ (1+ P_T (E_T -1)+P_R (E_R -1))$	*0.945*	*0.951*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.92*	*0.96*
Demand flow rate[2], v_i (pc/h) $v_i=V_i$ / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*501*	*595*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
		Base free-flow speed[4], BFFS	*45.0 mi/h*
		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Mean speed of sample[3], S_{FM}		Adj. for access points[4], f_A (Exhibit 15-8)	*0.3 mi/h*
Total demand flow rate, both directions, *v*		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*33.2 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.4 mi/h*	Percent free flow speed, PFFS	*78.8 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.4*	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*0.977*	*0.988*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.92*	*0.96*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}* f_{g,PTSF})$	*485*	*573*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^{b}})$	*51.6*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*13.6*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF} / v_{d,PTSF} + v_{o,PTSF})$	*57.8*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.29*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1560*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1629*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*78.8*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*435.6*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.47*
Bicycle level of service (Exhibit 15-4)	*E*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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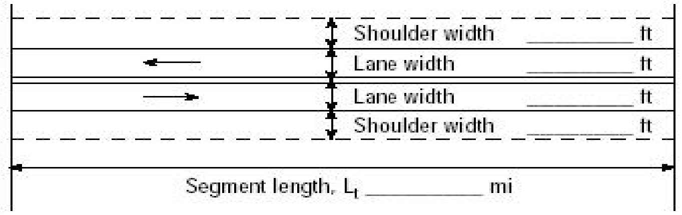
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Gutknecht*	Highway / Direction of Travel	*La Cholla (northbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*PM Peak Hour - existing*

Project Description: *La Cholla East of Lambert*

Input Data



Analysis direction vol., V_d *435*veh/h

Opposing direction vol., V_o *252*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.5*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.90*

No-passing zone *0%*

% Trucks and Buses , P_T *6* %

% Recreational vehicles, P_R *4%*

Access points *mi* *1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.8*	*2.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/ (1+ P_T (E_T -1)+P_R (E_R -1))$	*0.951*	*0.935*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.94*	*0.81*
Demand flow rate[2], v_i (pc/h) $v_i=V_i$ / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*541*	*370*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
		Base free-flow speed[4], BFFS	*45.0 mi/h*
		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Mean speed of sample[3], S_{FM}		Adj. for access points[4], f_A (Exhibit 15-8)	*0.3 mi/h*
Total demand flow rate, both directions, *v*		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*34.2 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.9 mi/h*	Percent free flow speed, PFFS	*81.1 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.4*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*0.977*	*0.960*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.95*	*0.84*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}* f_{g,PTSF})$	*521*	*347*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*50.3*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.3*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF} *(v_{d,PTSF} / v_{d,PTSF} + v_{o,PTSF})$	*57.7*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.32*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1367*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1428*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*81.1*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*483.3*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.52*
Bicycle level of service (Exhibit 15-4)	*F*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If $v_i(v_d$ or $v_o)$ >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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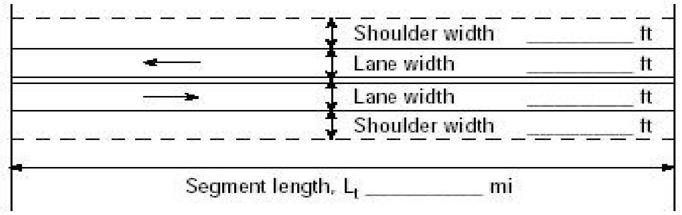
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Gutknecht*	Highway / Direction of Travel	*La Cholla (northbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*AM Peak Hour - 2016 without*

Project Description: *La Cholla south of Lambert*

Input Data



Analysis direction vol., V_d *409*veh/h

Opposing direction vol., V_o *510*veh/h

Shoulder width ft *2.0*
Lane Width ft *12.0*
Segment Length mi *0.5*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down
Peak-hour factor, PHF *0.90*
No-passing zone *0%*
% Trucks and Buses , P_T *6* %
% Recreational vehicles, P_R *4%*
Access points *mi* *1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.9*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.945*	*0.956*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.93*	*0.96*
Demand flow rate[2], v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*517*	*617*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
		Base free-flow speed[4], BFFS	*45.0 mi/h*
		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Mean speed of sample[3], S_{FM}		Adj. for access points[4], f_A (Exhibit 15-8)	*0.3 mi/h*
Total demand flow rate, both directions, *v*		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*33.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.4 mi/h*	Percent free flow speed, PFFS	*78.2 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.4*	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.977*	*0.988*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.93*	*0.97*
Directional flow rate[2], v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*500*	*591*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*52.5*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*13.5*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF} *(v_{d,PTSF} / v_{d,PTSF} + v_{o,PTSF})$	*58.7*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.30*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1576*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1629*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*78.2*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*454.4*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.49*
Bicycle level of service (Exhibit 15-4)	*E*

Notes

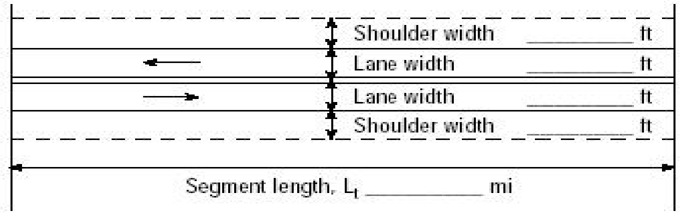
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		**Site Information**	
Analyst	*Gutknecht*	Highway / Direction of Travel	*La Cholla (northbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*PM Peak Hour - 2016 without*

Project Description: *La Cholla south of Lambert*

Input Data



☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi	Up/down
Peak-hour factor, PHF	*0.90*
No-passing zone	*0%*
% Trucks and Buses , P_T	*6* %
% Recreational vehicles, P_R	*4%*
Access points *mi*	*1*/mi

Analysis direction vol., V_d	*453*veh/h
Opposing direction vol., V_o	*264*veh/h
Shoulder width ft	*2.0*
Lane Width ft	*12.0*
Segment Length mi	*0.5*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.8*	*2.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.951*	*0.935*
Grade adjustment factor^1, $f_{g,ATS}$ (Exhibit 15-9)	*0.95*	*0.82*
Demand flow rate^2, v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*557*	*383*

Free-Flow Speed from Field Measurement

Mean speed of sample^3, S_{FM}	
Total demand flow rate, both directions, *v*	
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)	
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.9 mi/h*

Estimated Free-Flow Speed

Base free-flow speed^4, BFFS	*45.0 mi/h*
Adj. for lane and shoulder width,^{4} f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Adj. for access points^4, f_A (Exhibit 15-8)	*0.3 mi/h*
Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*34.0 mi/h*
Percent free flow speed, PFFS	*80.6 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.2*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.988*	*0.960*
Grade adjustment factor^1, $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.96*	*0.85*
Directional flow rate^2, v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*531*	*360*
Base percent time-spent-following^4, $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*50.2*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.3*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*57.5*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.33*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1390*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1444*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*80.6*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*503.3*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.54*
Bicycle level of service (Exhibit 15-4)	*F*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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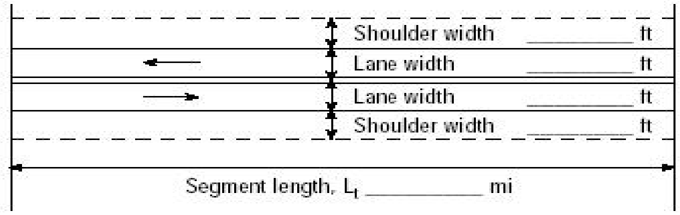
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Gutknecht*	Highway / Direction of Travel	*La Cholla (northbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*AM Peak Hour - 2016 with*

Project Description: *La Cholla south of Lambert*

Input Data



Analysis direction vol., V_d *444*veh/h

Opposing direction vol., V_o *533*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.5*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.90*

No-passing zone *0%*

% Trucks and Buses , P_T *6* %

% Recreational vehicles, P_R *4%*

Access points *mi* *1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.8*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.951*	*0.956*
Grade adjustment factor^1, $f_{g,ATS}$ (Exhibit 15-9)	*0.95*	*0.97*
Demand flow rate^2, v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*546*	*639*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
		Base free-flow speed^4, BFFS	*45.0 mi/h*
		Adj. for lane and shoulder width,^{4} f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Mean speed of sample^3, S_{FM}		Adj. for access points^4, f_A (Exhibit 15-8)	*0.3 mi/h*
Total demand flow rate, both directions, *v*		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*32.6 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.4 mi/h*	Percent free flow speed, PFFS	*77.3 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.4*	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.977*	*0.988*
Grade adjustment factor^1, $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.96*	*0.97*
Directional flow rate^2, v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*526*	*618*
Base percent time-spent-following^4, $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*54.0*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*13.4*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*60.2*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.32*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1576*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1649*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*77.3*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*493.3*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.53*
Bicycle level of service (Exhibit 15-4)	*F*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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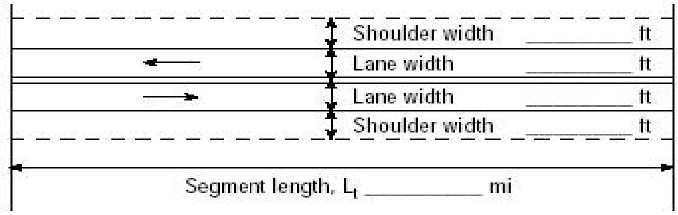
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Gutknecht*	Highway / Direction of Travel	*La Cholla (northbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*PM Peak Hour - 2016 with*

Project Description: *La Cholla south of Lambert*

Input Data



Analysis direction vol., V_d *488*veh/h

Opposing direction vol., V_o *306*veh/h

Shoulder width ft *2.0*
Lane Width ft *12.0*
Segment Length mi *0.5*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down
Peak-hour factor, PHF *0.90*
No-passing zone *0%*
% Trucks and Buses , P_T *6* %
% Recreational vehicles, P_R *4%*
Access points *mi* *1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.8*	*2.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.951*	*0.935*
Grade adjustment factor^1, $f_{g,ATS}$ (Exhibit 15-9)	*0.96*	*0.86*
Demand flow rate^2, v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*594*	*423*

Free-Flow Speed from Field Measurement

Mean speed of sample^3, S_{FM}
Total demand flow rate, both directions, *v*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15) *0.8 mi/h*

Estimated Free-Flow Speed

Base free-flow speed^4, BFFS	*45.0 mi/h*
Adj. for lane and shoulder width,^{4} f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Adj. for access points^4, f_A (Exhibit 15-8)	*0.3 mi/h*
Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*33.4 mi/h*
Percent free flow speed, PFFS	*79.3 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.2*	*1.6*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.988*	*0.965*
Grade adjustment factor^1, $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.96*	*0.87*
Directional flow rate^2, v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*572*	*405*
Base percent time-spent-following^4, $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*53.6*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.6*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*61.0*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.35*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1438*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1494*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*79.3*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*542.2*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.58*
Bicycle level of service (Exhibit 15-4)	*F*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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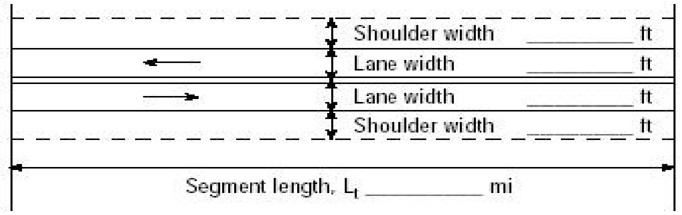
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		**Site Information**	
Analyst	*Gutknecht*	Highway / Direction of Travel	*La Cholla (southbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*AM Peak Hour - existing*

Project Description: *La Cholla south of Lambert*

Input Data



Analysis direction vol., V_d *489*veh/h
Opposing direction vol., V_o *392*veh/h
Shoulder width ft *2.0*
Lane Width ft *12.0*
Segment Length mi *0.5*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down
Peak-hour factor, PHF *0.90*
No-passing zone *0%*
% Trucks and Buses , P_T *6 %*
% Recreational vehicles, P_R *4%*
Access points *mi* *1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.8*	*1.9*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.951*	*0.945*
Grade adjustment factor^1, $f_{g,ATS}$ (Exhibit 15-9)	*0.96*	*0.92*
Demand flow rate^2, v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*595*	*501*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
		Base free-flow speed^4, BFFS	*45.0 mi/h*
		Adj. for lane and shoulder width,^{4} f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Mean speed of sample^3, S_{FM}		Adj. for access points^4, f_A (Exhibit 15-8)	*0.3 mi/h*
Total demand flow rate, both directions, *v*		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*33.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.6 mi/h*	Percent free flow speed, PFFS	*78.3 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.2*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.988*	*0.977*
Grade adjustment factor^1, $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.96*	*0.92*
Directional flow rate^2, v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*573*	*485*
Base percent time-spent-following^4, $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*55.9*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*13.6*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*63.3*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.35*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1520*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1577*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*78.3*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*543.3*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.58*
Bicycle level of service (Exhibit 15-4)	*F*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If $v_i(v_d$ or $v_o)$ >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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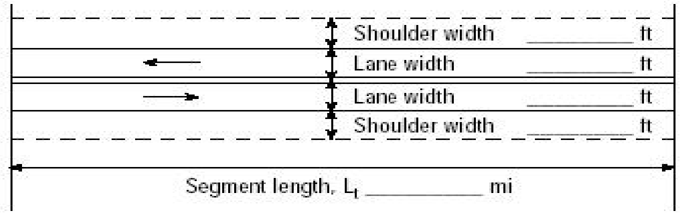
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Gutknecht*	Highway / Direction of Travel	*La Cholla (southbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*PM Peak Hour - existing*

Project Description: *La Cholla East of Lambert*

Input Data



Analysis direction vol., V_d *252*veh/h

Opposing direction vol., V_o *435*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.5*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.90*

No-passing zone *0%*

% Trucks and Buses , P_T *6* %

% Recreational vehicles, P_R *4%*

Access points *mi* *1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*2.1*	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.935*	*0.951*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.81*	*0.94*
Demand flow rate[2], v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*370*	*541*

Free-Flow Speed from Field Measurement

Mean speed of sample[3], S_{FM}

Total demand flow rate, both directions, *v*

Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)

Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15) *0.5 mi/h*

Estimated Free-Flow Speed

Base free-flow speed[4], BFFS	*45.0 mi/h*
Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Adj. for access points[4], f_A (Exhibit 15-8)	*0.3 mi/h*
Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*34.5 mi/h*
Percent free flow speed, PFFS	*81.9 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.7*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.960*	*0.977*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.84*	*0.95*
Directional flow rate[2], v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*347*	*521*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*41.3*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.3*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF} / v_{d,PTSF} + v_{o,PTSF})$	*46.2*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.22*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1536*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1613*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*81.9*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*280.0*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.24*
Bicycle level of service (Exhibit 15-4)	*E*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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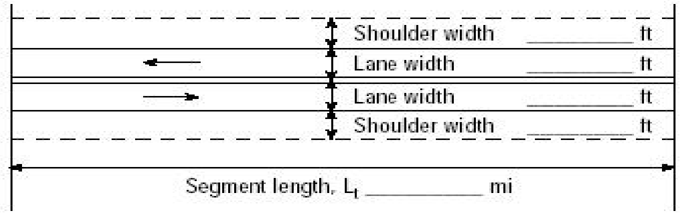
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Gutknecht*	Highway / Direction of Travel	*La Cholla (southbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*AM Peak Hour - 2016 without*

Project Description: *La Cholla south of Lambert*

Input Data



☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Analysis direction vol., V_d	*510*veh/h
Opposing direction vol., V_o	*409*veh/h
Shoulder width ft	*2.0*
Lane Width ft	*12.0*
Segment Length mi	*0.5*
Grade Length mi	Up/down
Peak-hour factor, PHF	*0.90*
No-passing zone	*0%*
% Trucks and Buses , P_T	*6* %
% Recreational vehicles, P_R	*4%*
Access points *mi*	*1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.7*	*1.9*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.956*	*0.945*
Grade adjustment factor^1, $f_{g,ATS}$ (Exhibit 15-9)	*0.96*	*0.93*
Demand flow rate^2, v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*617*	*517*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample^3, S_{FM}		Base free-flow speed^4, BFFS	*45.0* *mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,^{4} f_{LS}(Exhibit 15-7)	*2.6* *mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points^4, f_A (Exhibit 15-8)	*0.3* *mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.6* *mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2* *mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*32.7* *mi/h*
		Percent free flow speed, PFFS	*77.7* *%*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.2*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.988*	*0.977*
Grade adjustment factor^1, $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.97*	*0.93*
Directional flow rate^2, v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*591*	*500*
Base percent time-spent-following^4, $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*56.0*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*13.5*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+f $_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*63.3*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.36*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1536*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1594*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*77.7*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*566.7*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.60*
Bicycle level of service (Exhibit 15-4)	*F*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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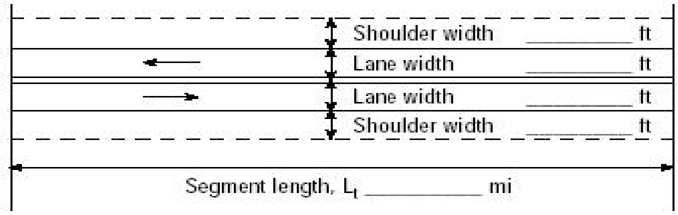
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		**Site Information**	
Analyst	*Gutknecht*	Highway / Direction of Travel	*La Cholla (southbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*PM Peak Hour - 2016 without*

Project Description: *La Cholla south of Lambert*

Input Data



☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Analysis direction vol., V_d	*264*veh/h
Opposing direction vol., V_o	*453*veh/h
Shoulder width ft	*2.0*
Lane Width ft	*12.0*
Segment Length mi	*0.5*
Grade Length mi	Up/down
Peak-hour factor, PHF	*0.90*
No-passing zone	*0%*
% Trucks and Buses , P_T	*6 %*
% Recreational vehicles, P_R	*4%*
Access points *mi*	*1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*2.1*	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.935*	*0.951*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.82*	*0.95*
Demand flow rate[2], v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*383*	*557*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
		Base free-flow speed[4], BFFS	*45.0 mi/h*
		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Mean speed of sample[3], S_{FM}		Adj. for access points[4], f_A (Exhibit 15-8)	*0.3 mi/h*
Total demand flow rate, both directions, *v*		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*34.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.5 mi/h*	Percent free flow speed, PFFS	*81.5 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.7*	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.960*	*0.988*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.85*	*0.96*
Directional flow rate[2], v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*360*	*531*
Base percent time-spent-following[4], $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*41.7*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.3*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*46.7*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.23*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1552*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1613*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*81.5*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*293.3*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.26*
Bicycle level of service (Exhibit 15-4)	*E*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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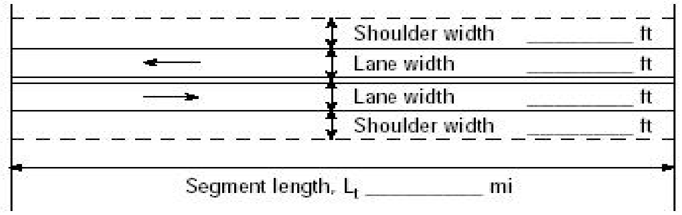
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Gutknecht*	Highway / Direction of Travel	*La Cholla (southbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*AM Peak Hour - 2016 with*

Project Description: *La Cholla south of Lambert*

Input Data



☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Analysis direction vol., V_d	*533*veh/h
Opposing direction vol., V_o	*444*veh/h
Shoulder width ft	*2.0*
Lane Width ft	*12.0*
Segment Length mi	*0.5*
Grade Length mi	Up/down
Peak-hour factor, PHF	*0.90*
No-passing zone	*0%*
% Trucks and Buses , P_T	*6* %
% Recreational vehicles, P_R	*4%*
Access points *mi*	*1*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.7*	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.956*	*0.951*
Grade adjustment factor^1, $f_{g,ATS}$ (Exhibit 15-9)	*0.97*	*0.95*
Demand flow rate^2, v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*639*	*546*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Mean speed of sample^3, S_{FM}		Base free-flow speed^4, BFFS	*45.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,^{4} f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points^4, f_A (Exhibit 15-8)	*0.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.5 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*32.4 mi/h*
		Percent free flow speed, PFFS	*76.9 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.2*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.988*	*0.977*
Grade adjustment factor^1, $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.97*	*0.96*
Directional flow rate^2, v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*618*	*526*
Base percent time-spent-following^4, $BPTSF_d$(%)=100(1-$e^{av_d{}^b}$)	*58.7*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*13.4*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+f $_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*65.9*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.38*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1552*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1613*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*76.9*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*592.2*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.62*
Bicycle level of service (Exhibit 15-4)	*F*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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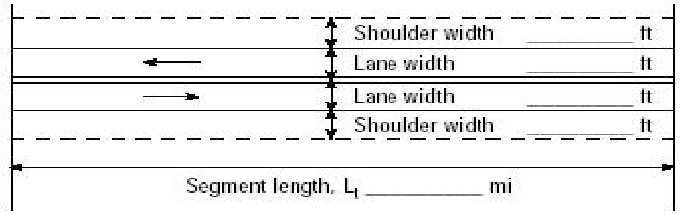
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Gutknecht*	Highway / Direction of Travel	*La Cholla (southbound)*
Agency or Company	*SWTE*	From/To	
Date Performed	*9/12/2014*	Jurisdiction	
Analysis Time Period		Analysis Year	*PM Peak Hour - 2016 with*

Project Description: *La Cholla south of Lambert*

Input Data



☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length	mi	Up/down
Peak-hour factor, PHF		*0.90*
No-passing zone		*0%*
% Trucks and Buses , P_T		*6 %*
% Recreational vehicles, P_R		*4%*
Access points *mi*		*1*/mi

Analysis direction vol., V_d	*306*veh/h
Opposing direction vol., V_o	*488*veh/h
Shoulder width ft	*2.0*
Lane Width ft	*12.0*
Segment Length mi	*0.5*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*2.1*	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.935*	*0.951*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.86*	*0.96*
Demand flow rate[2], v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*423*	*594*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*45.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*2.6 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*0.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.4 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*42.2 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*33.8 mi/h*
		Percent free flow speed, PFFS	*80.3 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.6*	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.965*	*0.988*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.87*	*0.96*
Directional flow rate[2], v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*405*	*572*
Base percent time-spent-following[4], $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*45.1*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.6*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*50.3*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.25*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1560*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1629*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*80.3*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*340.0*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.34*
Bicycle level of service (Exhibit 15-4)	*E*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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TRAFFIC IMPACT ANALYSIS
PROPOSED NEIGHBORHOOD
SOUTHEAST OF LA CHOLLA BOULEVARD/LAMBERT LANE

APPENDIX

Turn Lane Analysis

Signalized Intersection (Right Turn Storage)

Location: Lambert Lane/La Cholla Boulevard **2016 With Project**
Approach/Leg: Northbound

V = vehicles per hour Cycle Length = 90 sec

PM Peak Hour
V = 183 vph

Vehicles/cycle = 2 x (vehicles/hour)/cycles/hour
Storage length = vehicles/cycle x 25 feet

$$S\ (ft) = \frac{183\ vph*(2)*(25\ ft/veh)*(90 sec/cycle) =}{(3600 sec/hr)} \quad 229\ feet$$

Minimum Recommended Storage: 250 feet

Signalized Intersection (Left Turn Storage)

Location: Lambert Lane/La Cholla Boulevard **2016 With Project**
Approach/Leg: Eastbound

V = vehicles per hour Cycle Length = 90 sec

PM Peak Hour
V = 136 vph

Vehicles/cycle = 2 x (vehicles/hour)/cycles/hour
Storage length = vehicles/cycle x 25 feet

$$S\ (ft) = \frac{136\ vph*(2)*(25\ ft/veh)*(90 sec/cycle) =}{(3600 sec/hr)} \quad 170\ feet$$

Minimum Recommended Storage: 175 feet

Signalized Intersection (Left Turn Storage)

Location: Lambert Lane/La Cholla Boulevard **2016 With Project**
Approach/Leg: Westbound

V = vehicles per hour Cycle Length = 90 sec

PM Peak Hour
V = 62 vph

Vehicles/cycle = 2 x (vehicles/hour)/cycles/hour
Storage length = vehicles/cycle x 25 feet

$$S\ (ft) = \frac{62\ vph*(2)*(25\ ft/veh)*(90sec/cycle) =}{(3600sec/hr)}\quad 78\ feet$$

Minimum Recommended Storage: 100 feet

Signalized Intersection (Left Turn Storage)

Location: Lambert Lane/La Cholla Boulevard **2016 With Project**
Approach/Leg: Northbound

V = vehicles per hour Cycle Length = 90 sec

PM Peak Hour
V = 30 vph

Vehicles/cycle = 2 x (vehicles/hour)/cycles/hour
Storage length = vehicles/cycle x 25 feet

$$S\ (ft) = \frac{30\ vph*(2)*(25\ ft/veh)*(90sec/cycle) =}{(3600sec/hr)}\quad 38\ feet$$

Minimum Recommended Storage: 50 feet

Signalized Intersection (Left Turn Storage)

Location: Lambert Lane/La Cholla Boulevard **2016 With Project**
Approach/Leg: Southbound

V = vehicles per hour Cycle Length = 90 sec

PM Peak Hour

V = 97 vph

Vehicles/cycle = 2 x (vehicles/hour)/cycles/hour

Storage length = vehicles/cycle x 25 feet

S (ft) = $\dfrac{97\ \text{vph}*(2)*(25\ \text{ft/veh})*(90\text{sec/cycle})}{(3600\text{sec/hr})}$ = 121 feet

Minimum Recommended Storage: 125 feet

Un-Signalized Intersection (Left Turn Lane)
Location: South Driveway/Owl Head Place **2016 With Project**
Approach/Leg: Southbound

V = vehicles per hour

AM Peak Half Hour
V = 34 vtph

S = Storage = (V *2 min* 25 ft/veh)/60min/hr

S (ft) = 34 vph*(2 min)*(25 ft/veh) = / (60 min/halfhr) 28 feet

Minimum Recommended Storage: 50 feet

Un-Signalized Intersection (Left Turn Lane)
Location: North Driveway/Lambert Lane **2016 With Project**
Approach/Leg: Westbound

V = vehicles per hour

AM Peak Half Hour
V = 20 vtph

S = Storage = (V *2 min* 25 ft/veh)/60min/hr

S (ft) = $\dfrac{20 \text{ vph*(2 min)*(25 ft/veh)}}{\text{(60 min/halfhr)}}$ = 17 feet

Minimum Recommended Storage: 25 feet