Hall & Foreman, Inc.
Engineering ▪ Planning ▪ Surveying

June 23, 2014 Job No. VV.130048.0000

To: Mark Roberts
Acting Chief
Community and Regional Planning (IGR)
Caltrans District 8

From: Robert A. Kilpatrick, PE/TE
Vice President/Associate

RE: Response to Comments – Caltrans June 2, 2014 Letter
Eagle Ridge Market – SR 38 & State Lane – Erwin Lake, California
08-SBd-38-PM 46.57

This is our response to the comments outlined in the June 2, 2014 Comment letter. A copy of the letter is attached for reference.

The June 2, 2014 Caltrans comment letter consisted of the following items to be responded to.

- A request that a left-turn pocket on southbound SR-38 onto State Lane.
- Truck turning template for northbound right-turn on SR-38 onto State Lane.
- A left-turn lane is warrant analysis per the FHWA Output Table 15: *Volume Warrants for Left-Turn Lanes* and Caltrans Access Management Plan Table 17.B-3: *Criteria for Left-Turn Deceleration Lanes.*

Truck Turning Template

Exhibit A presents the truck turning template illustrating the turn movements for the northbound right-turn, southbound left turn, westbound left turn, and westbound right turn at the intersection of SR 38 and State Lane. A custom fuel tanker was modeled to represent the model vehicle with dimensions and specifications provided on the exhibit. As presented some widening of the shoulder at the southeast corner of the intersection will be needed to accommodate the north to east right turn movement.

Left Turn Lane Analysis

Several Left Turn Warrant Analysis Methodologies are available. As referenced in the Caltrans June 2, 2014 letter, the Left Turn Warrant Analysis methodologies to be used are the Federal Highway Administration (FHWA) Output Table 15: *Volume Warrants for Left-Turn Lanes,* and the methodology presented in the California State Department of Transportation (Caltrans) "Access Management Plan" Table 17.B-3: *Criteria for Left-Turn Deceleration Lanes. Table 1* presents the volumes used in the analysis.

Tustin
17782 17th Street, Suite 200
Tustin, CA 92780-1947
Tel 714.665.4500 • Fax 714.665.4501

Los Angeles
811 Wilshire Blvd., Suite 1450
Los Angeles, CA 90017-2606
Tel 213.785.7887

Santa Clarita
25152 Springfield Court, Suite 350
Santa Clarita, CA 91355-1096
Tel 661.284.7400 • Fax 661.284.7401

Temecula
41951 Remington Avenue, Suite 130
Temecula, CA 92590-2553
Tel 951.294.9300 • 951.294.9301

Victorville
14297 Cajon Avenue, Suite 101
Victorville, CA 92392-2335
Tel 760.524.9100 • 760.524.9101

Table 1: Volume Comparison for FHWA Analysis
Greenspot Blvd (Highway 38) and State Lane/Mitchelle Lane Intersection

Intersection	Weekday AM Peak			Weekday PM Peak			Winter Friday PM Peak			Winter Sunday PM Peak		
	V_A[1]	V_L (%)[2]	V_O[3]	V_A[1]	V_L (%)[2]	V_O[3]	V_A[1]	V_L (%)[2]	V_O[3]	V_A[1]	V_L (%)[2]	V_O[3]
Existing Condition	125	56%	60	265	68%	75	310	69%	130	330	44%	85
Existing plus Background	145	52%	65	280	66%	95	340	66%	140	350	43%	110
Project Year 2014	165	61%	70	305	70%	100	365	70%	145	375	48%	115
Year 2035 without Project	200	53%	85	395	66%	125	470	67%	190	485	43%	145
Year 2035 with Project	220	59%	90	420	69%	130	495	70%	195	510	47%	150

(1) V_A – Advancing Volume (veh/h)
(2) V_L (%) – Percentage of Advancing Vehicles turning Left
(3) V_o –Opposing Volume (veh/h)
Source: **Hall & Foreman Inc**

The values presented in *Table 1* were then used with the previously mentioned FHWA Output Table 15. The FHWA Output Table 15 does not provide the 55 mph Operating Speed as needed to evaluate the intersection of Greenspot Blvd (Highway 38) and State Lane/Mitchelle Lane Intersection. As a result values for a 55 mph Operating Speed were interpolated from the 50 and 60-mph Operating Speed values. The Left turn percentage for each condition were well above the percentages provided in the table and several of the opposing volume and advancing volume pairs were below the values provided in the reference table. Analyses for several conditions were inconclusive. The reference table is attached.

It should be noted that as presented in the Caltrans "Access Management" document, that the document is not a guideline or manual. The satisfaction of a warrant should not in of itself require the implementation of a traffic control devise or geometric feature. Considerations should be made to all of the circumstances for the implementation of the recommendations.

Table 2 below presents the Volume Comparison for the Caltrans Access Management Plan Analysis. The values provided in *Table 2* were then used with the previously mentioned Caltrans Access Management Plan Table 17.B-3. For all conditions the Advancing Vehicles turning left are greater than 26 vehicles per hour (vph). The reference table is attached.

Tustin
17782 17th Street, Suite 200
Tustin, CA 92780-1947
Tel 714.665.4500 • Fax 714.665.4501

Los Angeles
811 Wilshire Blvd., Suite 1450
Los Angeles, CA 90017-2606
Tel 213.785.7887

Santa Clarita
25152 Springfield Court, Suite 350
Santa Clarita, CA 91355-1096
Tel 661.284.7400 • Fax 661.284.7401

Temecula
41951 Remington Avenue, Suite 130
Temecula, CA 92590-2553
Tel 951.294.9300 • 951.294.9301

Victorville
14297 Cajon Avenue, Suite 101
Victorville, CA 92392-2335
Tel 760.524.9100 • 760.524.9101

Table 2: Volume Comparison for Caltrans Access Management Plan Analysis
Greenspot Blvd (Highway 38) and State Lane/Mitchelle Lane Intersection

Intersection	Weekday AM Peak		Weekday PM Peak		Winter Friday PM Peak		Winter Sunday PM Peak	
	V_A	V_L	V_A	V_L	V_A	V_L	V_A	V_L
Existing Condition	125	70	265	180	310	215	330	145
Existing plus Background	145	75	280	185	340	225	350	150
Project Year 2014	165	100	305	215	365	255	375	180
Year 2035 without Project	200	105	395	260	470	315	485	210
Year 2035 with Project	220	130	420	290	495	345	510	240

(1) V_A – Advancing Volume (veh/h)
(2) V_L –Advancing Vehicles turning Left (veh/h)
Source: **Hall & Foreman Inc**

Overriding Considerations

The capacity analysis of a two way stop controlled intersection provides the LOS for the critical movement. This is typically the stop controlled left turn from the minor street. The capacity analysis also provides LOS and delay by approach. The LOS and delay for the southbound approach is provided in *Table 3.*

Table 3: Southbound Approach Level of Service and Delay
Greenspot Blvd (Highway 38) and State Lane/Mitchelle Lane Intersection

Intersection	Weekday AM Peak		Weekday PM Peak		Winter Friday PM Peak		Winter Sunday PM Peak	
	LOS[1]	Delay[2]	LOS[1]	Delay[2]	LOS[1]	Delay[2]	LOS[1]	Delay[2]
Existing Condition	A	7.5	A	7.7	A	8.0	A	7.7
Existing plus Background	A	7.5	A	7.8	A	8.1	A	7.7
Project Year 2014	A	7.6	A	7.9	A	8.2	A	7.9
Year 2035 without Project	A	7.6	A	8.0	A	8.5	A	8.0
Year 2035 with Project	A	7.7	A	8.1	A	8.6	A	8.1

(1) LOS – HCM Level of Service for approach
(2) Delay –In Seconds per vehicle for approach
Source: **Hall & Foreman Inc**

As provided in *Table 3*, the southbound approach of the unsignalized intersection of Greenspot Blvd (Highway 38) and State Lane/Mitchelle Lane consistently operates at the same level of service and similar delay per vehicle for all conditions and peak periods analyzed. The inclusion of project traffic or regional growth significantly impact to cause a delay to the southbound traffic.

Tustin
17782 17th Street, Suite 200
Tustin, CA 92780-1947
Tel 714.665.4500 • Fax 714.665.4501

Los Angeles
811 Wilshire Blvd., Suite 1450
Los Angeles, CA 90017-2606
Tel 213.785.7887

Santa Clarita
25152 Springfield Court, Suite 350
Santa Clarita, CA 91355-1096
Tel 661.284.7400 • Fax 661.284.7401

Temecula
41951 Remington Avenue, Suite 130
Temecula, CA 92590-2553
Tel 951.294.9300 • 951.294.9301

Victorville
14297 Cajon Avenue, Suite 101
Victorville, CA 92392-2335
Tel 760.524.9100 • 760.524.9101

The issue at hand is that the southbound turn movement is the predominate movement. As presented in *Table 1* the southbound left turn movement consists of 43 to 70% the total southbound traffic. The additional southbound left turning vehicles will not cause additional delays to the southbound approach. In addition, based on the crash data that was obtained from the Transportation Injury Mapping System (TIMS) there appears to not have a substantial crash history at the intersection that would indicate the need for exclusive left turn lanes.

As a recommendation, additional pavement can be provided at the intersection for wider shoulders at the approaches on Greenspot Blvd (Highway 38). The wider shoulders would accommodate the minimal instances when a vehicle traveling through on Greenspot Blvd (Highway) at the intersection needs to get around another vehicle making a southbound left turn. The recommended intersection geometrics are illustrated in *Exhibit B*.

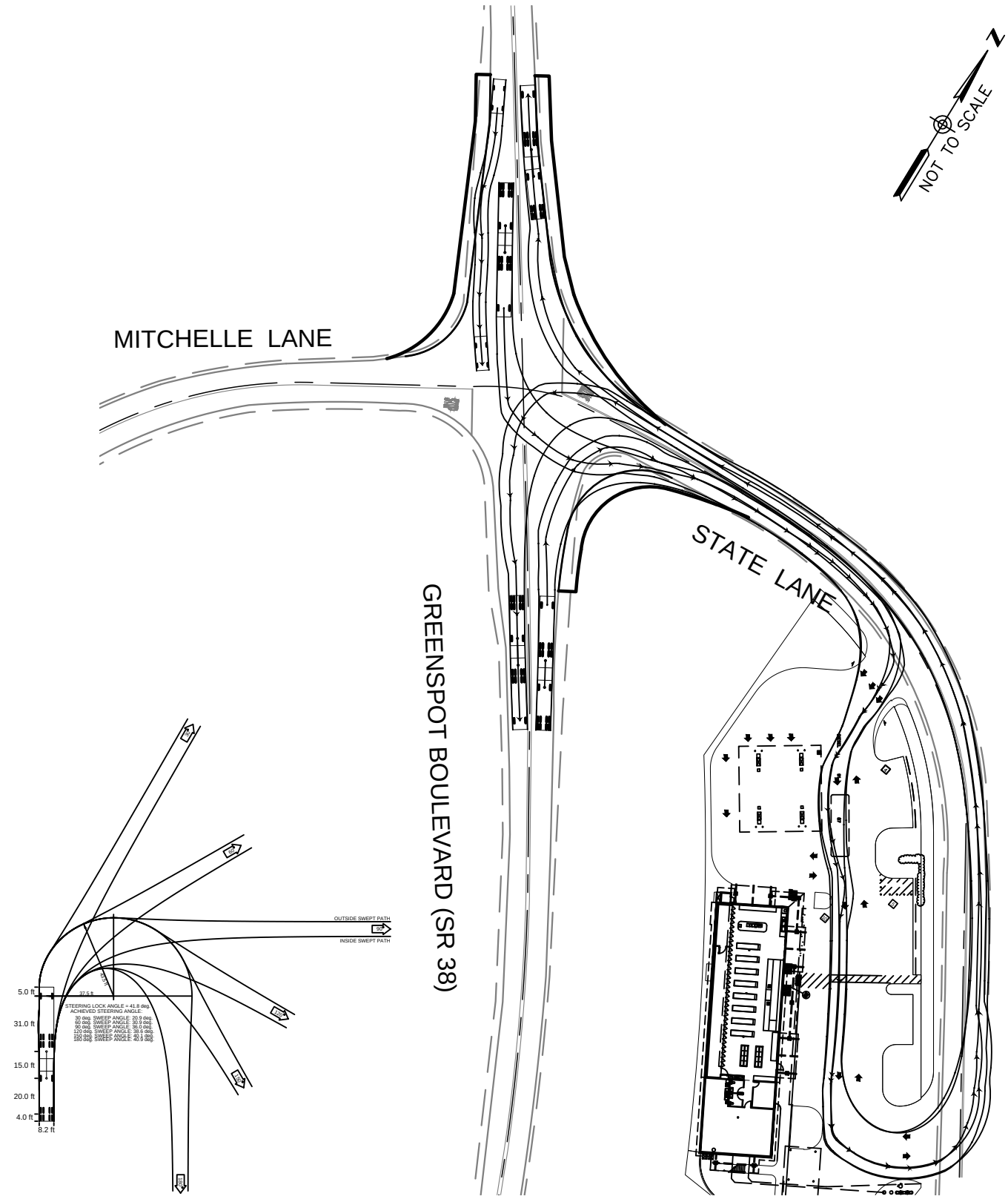
Tustin
17782 17th Street, Suite 200
Tustin, CA 92780-1947
Tel 714.665.4500 • Fax 714.665.4501

Los Angeles
811 Wilshire Blvd., Suite 1450
Los Angeles, CA 90017-2606
Tel 213.785.7887

Santa Clarita
25152 Springfield Court, Suite 350
Santa Clarita, CA 91355-1096
Tel 661.284.7400 • Fax 661.284.7401

Temecula
41951 Remington Avenue, Suite 130
Temecula, CA 92590-2553
Tel 951.294.9300 • 951.294.9301

Victorville
14297 Cajon Avenue, Suite 101
Victorville, CA 92392-2335
Tel 760.524.9100 • 760.524.9101



Hall & Foreman, Inc.
Engineering • Surveying • Planning
14297 Cajon St., Suite 101 Victorville, CA., 92392-2335
Phn. 760-524-9100 Fax. 760-524-9101

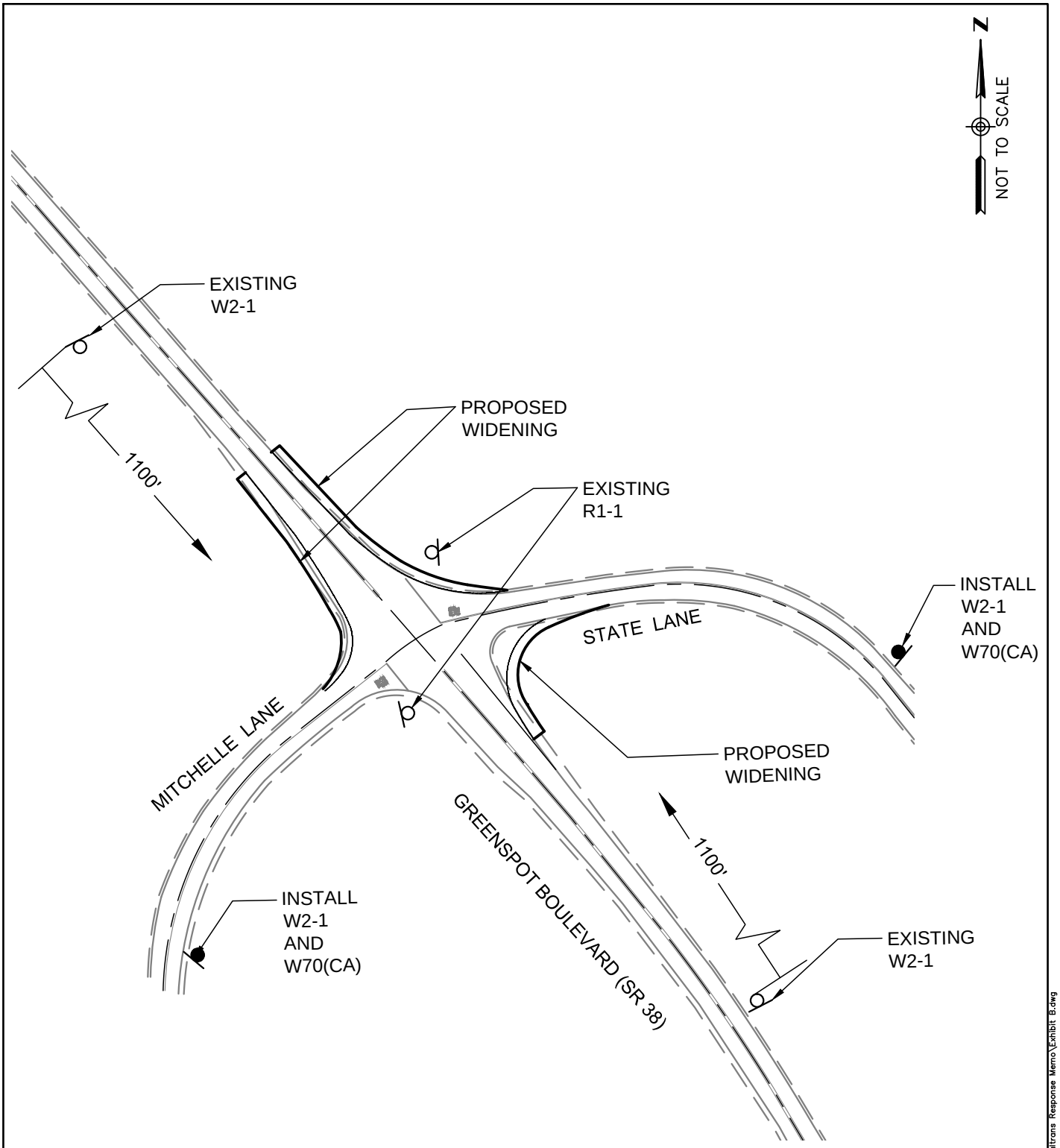
TRUCK TURNING TEMPLATES GREENSPOT BOULEVARD (SR 38) AND STATE LANE/MITCHELLE LANE

EAGLE RIDGE MARKET
ERWIN LAKE, CALIFORNIA

EXHIBIT

A

Drawing Name: C:\Users\Munoz\appdata\roaming\autodesk\ifl_cad\autosave\AcPublish_7372\Exhibit A.dwg
Last Opened: Jun 23, 2014 - 3:34pm by: TMunoz



Hall & Foreman, Inc.
Engineering • Surveying • Planning
14297 Cajon St., Suite 101 Victorville, CA., 92392-2335
Phn. 760-524-9100 Fax. 760-524-9101

PROPOSED INTERSECTION GEOMETRICS

EAGLE RIDGE MARKET
ERWIN LAKE, CALIFORNIA

EXHIBIT

B

Drawing Name: V:\130048\Eng\130048-000\Exhibit\03 Caltrans Response Memo\Exhibit B.dwg
Last Opened: Jun 23, 2014 - 3:34pm by: TMunoz

Hall & Foreman, Inc.

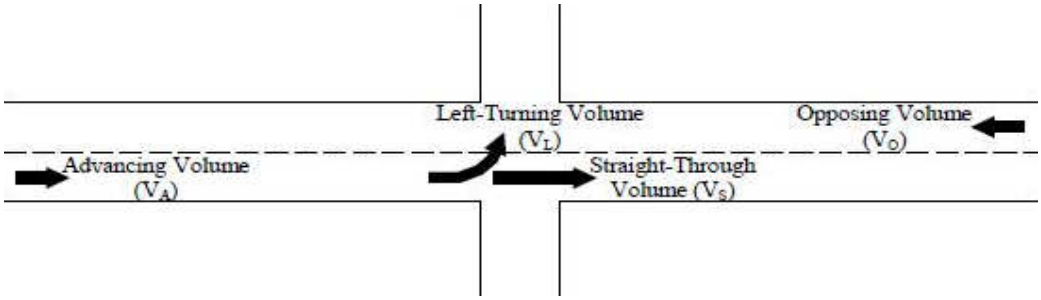
Engineering • Surveying • Planning • Landscape Architecture

SUBJECT	BY	DATE	JOB NO.
LEFT TURN WARRANT	TM	19-Jun-14	VV.130048.0000

E/W STREET : STATE LANE DRIVE
N/S STREET : HIGHWAY 38

DESIGN SPEED : 55MPH
CONDITION : WEEKDAY AM PEAK HOUR

CONDITION DIAGRAMS



CONDITION	EXISTING TRAFFIC	EXISTING + BACKGROUND TRAFFIC	EXISTING + BACKGROUND + PROJECT	YEAR 2035 WITHOUT PROJECT	YEAR 2035 WITH PROJECT
V_A	125	145	165	200	220
V_L	70	75	100	105	130
V_L (%)	60%	50%	60%	50%	60%
V_S	55	70	65	95	90
V_O	60	65	70	85	90

Tustin Office: 714.665.4500 Tel/ 714.665.4501 Fax
Santa Clarita Office: 661.284.7400 Tel/ 661.284.7401 Fax
Victorville Office: 760.524.9100 Tel/ 760.524.9101 Fax
Temecula Office: 951.294.9300 Tel/ 951.294.9301 Fax

Hall & Foreman, Inc.

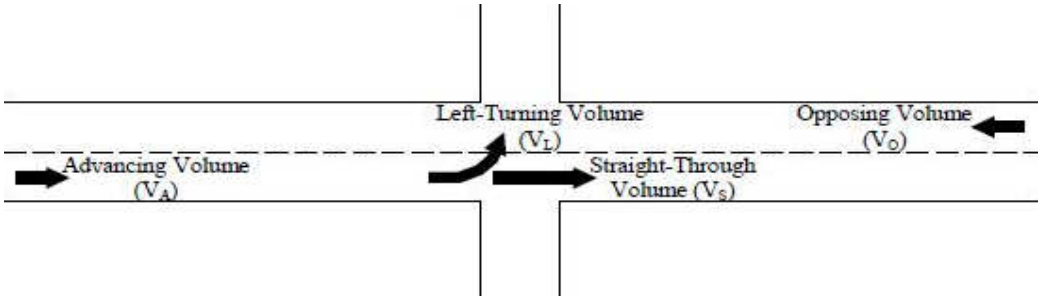
Engineering • Surveying • Planning • Landscape Architecture

SUBJECT	BY	DATE	JOB NO.
LEFT TURN WARRANT	TM	19-Jun-14	VV.130048.0000

E/W STREET : STATE LANE DRIVE
N/S STREET : HIGHWAY 38

DESIGN SPEED : 55MPH
CONDITION : WEEKDAY PM PEAK HOUR

CONDITION DIAGRAMS



CONDITION	EXISTING TRAFFIC	EXISTING + BACKGROUND TRAFFIC	EXISTING + BACKGROUND + PROJECT	YEAR 2035 WITHOUT PROJECT	YEAR 2035 WITH PROJECT
V_A	265	280	305	395	420
V_L	180	185	215	260	290
V_L (%)	70%	70%	70%	70%	70%
V_S	85	95	90	135	130
V_O	75	95	100	125	130

Tustin Office: 714.665.4500 Tel/ 714.665.4501 Fax
Santa Clarita Office: 661.284.7400 Tel/ 661.284.7401 Fax
Victorville Office: 760.524.9100 Tel/ 760.524.9101 Fax
Temecula Office: 951.294.9300 Tel/ 951.294.9301 Fax

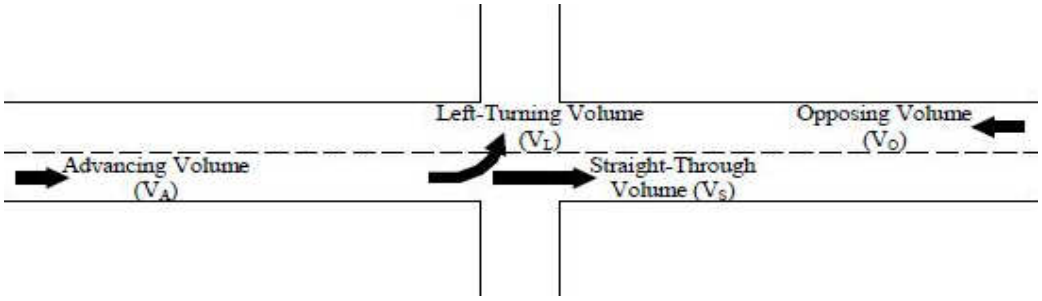
Hall & Foreman, Inc.
Engineering • Surveying • Planning • Landscape Architecture

SUBJECT	BY	DATE	JOB NO.
LEFT TURN WARRANT	TM	19-Jun-14	VV.130048.0000

E/W STREET : STATE LANE DRIVE
N/S STREET : HIGHWAY 38

DESIGN SPEED : 55MPH
CONDITION : WINTER FRIDAY PM PEAK HOUR

CONDITION DIAGRAMS



CONDITION	EXISTING TRAFFIC	EXISTING + BACKGROUND TRAFFIC	EXISTING + BACKGROUND + PROJECT	YEAR 2035 WITHOUT PROJECT	YEAR 2035 WITH PROJECT
V_A	310	340	365	470	495
V_L	215	225	255	315	345
V_L (%)	70%	70%	70%	70%	70%
V_S	95	115	110	155	150
V_O	130	140	145	190	195

Tustin Office: 714.665.4500 Tel/ 714.665.4501 Fax
Santa Clarita Office: 661.284.7400 Tel/ 661.284.7401 Fax
Victorville Office: 760.524.9100 Tel/ 760.524.9101 Fax
Temecula Office: 951.294.9300 Tel/ 951.294.9301 Fax

Hall & Foreman, Inc.

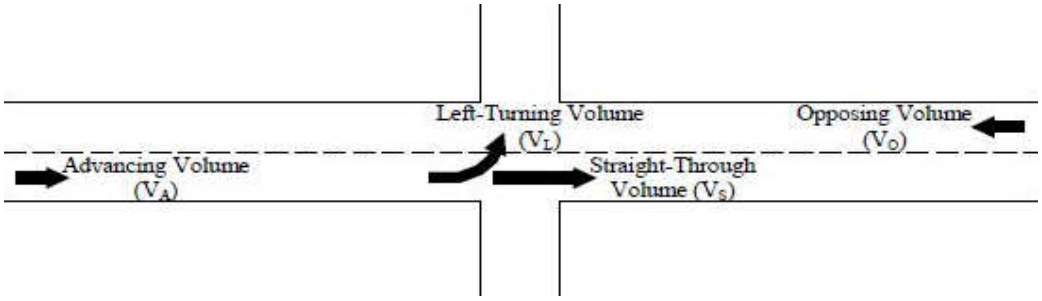
Engineering • Surveying • Planning • Landscape Architecture

SUBJECT	BY	DATE	JOB NO.
LEFT TURN WARRANT	TM	19-Jun-14	VV.130048.0000

E/W STREET : STATE LANE DRIVE
N/S STREET : HIGHWAY 38

DESIGN SPEED : 55MPH
CONDITION : WINTER SUNDAY PM PEAK HOUR

CONDITION DIAGRAMS



CONDITION	EXISTING TRAFFIC	EXISTING + BACKGROUND TRAFFIC	EXISTING + BACKGROUND + PROJECT	YEAR 2035 WITHOUT PROJECT	YEAR 2035 WITH PROJECT
V_A	330	350	375	485	510
V_L	145	150	180	210	240
V_L (%)	40%	40%	50%	40%	50%
V_S	185	200	195	275	270
V_O	85	110	115	145	150

Tustin Office: 714.665.4500 Tel/ 714.665.4501 Fax
Santa Clarita Office: 661.284.7400 Tel/ 661.284.7401 Fax
Victorville Office: 760.524.9100 Tel/ 760.524.9101 Fax
Temecula Office: 951.294.9300 Tel/ 951.294.9301 Fax

Interpolation of (FHWA) Output Table 15: *Volume Warrants for Left-Turn Lanes*

U.S. Customary				
Opposing Volume (veh/h)	Advancing Volume (veh/h)			
	5% Left Turns	10% Left Turns	20% Left Turns	30% Left Turns
40-mph Operating Speed				
800	330	240	180	160
600	410	305	225	200
400	510	380	275	245
200	640	470	350	305
100	720	515	390	340
50-mph Operating Speed				
800	280	210	165	135
600	350	260	195	170
400	430	320	240	210
200	550	400	300	270
100	615	445	335	295
60-mph Operating Speed				
800	230	170	125	115
600	290	210	160	140
400	365	270	200	175
200	450	330	250	215
100	505	370	275	240

55-mph Operating Speed				
800	255	190	145	125
600	320	235	180	155
400	400	295	220	195
200	500	365	275	245
100	560	410	305	270

Table 9-23. Guide for Left-Turn Lanes on Two-Lane Highways (*10*)

Metric					U.S. Customary				
	Advancing Volume (veh/h)					Advancing Volume (veh/h)			
Opposing Volume (veh/h)	5% Left Turns	10% Left Turns	20% Left Turns	30% Left Turns	Opposing Volume (veh/h)	5% Left Turns	10% Left Turns	20% Left Turns	30% Left Turns
60-km/h Operating Speed					**40-mph Operating Speed**				
800	330	240	180	160	800	330	240	180	160
600	410	305	225	200	600	410	305	225	200
400	510	380	275	245	400	510	380	275	245
200	640	470	350	305	200	640	470	350	305
100	720	515	390	340	100	720	515	390	340
80-km/h Operating Speed					**50-mph Operating Speed**				
800	280	210	165	135	800	280	210	165	135
600	350	260	195	170	600	350	260	195	170
400	430	320	240	210	400	430	320	240	210
200	550	400	300	270	200	550	400	300	270
100	615	445	335	295	100	615	445	335	295
100-km/h Operating Speed					**60-mph Operating Speed**				
800	230	170	125	115	800	230	170	125	115
600	290	210	160	140	600	290	210	160	140
400	365	270	200	175	400	365	270	200	175
200	450	330	250	215	200	450	330	250	215
100	505	370	275	240	100	505	370	275	240

Additional information on left-turn lanes, including their suggested lengths, can be found in *Highway Research Record 211*, NCHRP Report 225, and NCHRP Report 279 (*10*, *19*, *17*). In the case of double left-turn lanes, a capacity analysis of the intersection should be performed to determine what traffic controls are needed in order for it to function properly.

Local conditions and the cost of right-of-way often influence the type of intersection selected as well as many of the design details. Limited sight distance, for example, may make it desirable to control traffic by yield signs, stop signs, or traffic signals when the traffic densities are less than those ordinarily considered appropriate for such control. The alignment and grade of the intersecting roads and the angle of intersection may make it advisable to channelize or use auxiliary pavement areas, regardless of the traffic densities. In general, traffic service, highway design designation, physical conditions, and cost of right-of-way are considered jointly in choosing the type of intersection.

For the general benefit of through-traffic movements, the number of crossroads, intersecting roads, or intersecting streets should be minimized. Where intersections are closely spaced on a two-way facility, it is seldom practical to provide signals for completely coordinated traffic movements at reasonable speeds in opposing directions on that facility. At the same time, the resultant road or street patterns should permit travel on roadways other than the predominant highway without too much inconvenience. Traffic analysis

The following general steps would be undertaken by IDRM to evaluate the left-turn lane warrants:

1. For each unstopped approach to an intersection, determine whether a left-turn lane is present or not.
2. From data provided by the designer, determine the peak-hour volume of each unstopped approach. If peak-hour volume is not available, use design-hour volume.
3. Determine the 85th percentile speed. The speed can be determined from actual data, from a speed prediction model like those developed for the IHSDM design consistency module, or from engineering judgment by the user. (Note that both directions of travel need to be evaluated.)
4. Look up the appropriate warranting condition and display an appropriate message.

No formulas or calculations are required to obtain output from the left-turn lane warrant model. Model output is obtained via a look-up table.

Model Output

Model output is summarized in Table 15 . Determination of whether a left-turn lane is warranted is based on consulting the table for a particular operating speed and opposing design-hour volume. If the advancing volume is greater than the value shown (for a given percentage of left turns), a left-turn lane is warranted.

Table 15. Volume Warrants for Left-Turn Lanes

Advancing Volume/Hour				
Opposing Volume/Hour	**5% Left Turns**	**10% Left Turns**	**20% Left Turns**	**30% Left Turns**
60-km/h Operating Speed				
800	330	240	180	160
600	410	305	225	200
400	510	380	275	245
200	640	470	350	305
100	720	515	390	340
80-km/h Operating Speed				
800	280	210	165	135
600	350	260	195	170
400	430	320	240	210
200	550	400	300	270
100	615	445	335	295
100-km/h Operating Speed				
800	230	170	125	115
600	290	210	160	140
400	365	270	200	175
200	450	330	250	215
100	505	370	275	240

References

1. *A Policy on Geometric Design of Highways and Street (Green Book)*. American Association of State Highway and Transportation Officials, Washington, DC, 1994 (Table II-1: Design Vehicle Dimensions, p. 21).
2. *Intersection Channelization Design Guide*, NCHRP Report 279. Transportation Research Board, Washington, DC (Figure 4-12 [Harmelink study]).

DEPARTMENT OF TRANSPORTATION
DISTRICT 8
PLANNING (MS 725)
464 WEST 4th STREET, 6th FLOOR
SAN BERNARDINO, CA 92401-1400
PHONE (909) 388-7017
FAX (909) 383-5936
TTY 711
www.dot.ca.gov/dist8

Serious Drought.
Help save water!

June 02, 2014

Mr. Oxso Shahriari
County of San Bernardino Land Use Services Department
Planning Division
385 North Arrowhead Ave.
San Bernardino, CA 92415

Dear Mr. Shahriari,

Subject: Final Traffic Report September 19, 2013 and Winter Weekend Traffic Analysis Addendum dated January 15, 2014 for Eagle Ridge Market, Erwin Lake, CA.

08-SBd-38-PM 46.57

The California Department of Transportation (Caltrans) received the Final Traffic Report dated September 19, 2013 and Winter Weekend Traffic Analysis Addendum dated January 15, 2014 for our review via email from County of San Bernardino Traffic Division on May 20, 2014.

According to our review of the Final Traffic Report dated September 19, 2013, we request that a left-turn pocket on southbound SR-38 onto State Lane and truck turning template for northbound right-turn on SR-38 onto State Lane are provided. A left-turn lane is warranted according to FHWA Model Output Table 15: *Volume Warrants for Left-Turn Lanes* and Caltrans Access Management Plan Table 17.B-3: *Criteria for Left-Turn Deceleration Lanes* (attached).

We have also reviewed the Winter Weekend Traffic Analysis Addendum dated January 15, 2014; the purpose of this report is to identify the winter weekend traffic generated by the Southern California motoring public. Due to the lack of rain and snow in our local mountains this past winter, the turning movement counts conducted on December 13 and 15, 2013 are not truly representative of the winter weekend traffic in the Big Bear Lake area and they are not much different than the week-day peak hour counts conducted on April 2013. Therefore, we cannot confirm these winter weekend traffic counts.

If you have any questions, please contact David Lee at 909-806-3955 or me at 909-388-7017.

Sincerely,

MARK ROBERTS
Acting Chief
Community and Regional Planning

c: Ed Petre, County of San Bernardino – Traffic Division

Model Output

Model output is summarized in Table 15 . Determination of whether a left-turn lane is warranted is based on consulting the table for a particular operating speed and opposing design-hour volume. If the advancing volume is greater than the value shown (for a given percentage of left turns), a left-turn lane is warranted.

Table 15. Volume Warrants for Left-Turn Lanes

	Advancing Volume/Hour			
Opposing Volume/Hour	5% Left Turns	10% Left Turns	20% Left Turns	30% Left Turns
60-km/h Operating Speed				
800	330	240	180	160
600	410	305	225	200
400	510	380	275	245
200	640	470	350	305
100	720	515	390	340
80-km/h Operating Speed				
800	280	210	165	135
600	350	260	195	170
400	430	320	240	210
200	550	400	300	270
100	615	445	335	295
100-km/h Operating Speed				
800	230	170	125	115
600	290	210	160	140
400	365	270	200	175
200	450	330	250	215
100	505	370	275	240

References

1. *A Policy on Geometric Design of Highways and Street (Green Book)*. American Association of State Highway and Transportation Officials, Washington, DC, 1994 (Table II-1: Design Vehicle Dimensions, p. 21).
2. *Intersection Channelization Design Guide*, NCHRP Report 279. Transportation Research Board, Washington, DC (Figure 4-12 [Harmelink study])

Table 17.B-3
Criteria for Left-turn Deceleration Lanes on
RURAL TWO-LANE HIGHWAYS

Left-Turn Volume [1] (vph)	LEFT-TURN DECELERATION LANE			
	Minimum Directional Volume in Through Lane (vphpl) [2]			
	≤ 30 mph	35 to 40 mph	45 to 55 mph	> 55 mph
< 5	Not Required	Not Required	Not Required	Not Required
5	400	220	120	60
10	240	140	80	40
15	160	100	60	Required
20	120	80	Required	Required
25	100	Required	Required	Required
≥ 26	Required	Required	Required	Required

Left-turn Deceleration Lanes are Required on Rural Two-lane Highways for the following Left-turn Volumes:

- ≤ 30 mph : 26 vph or more
- 35 to 40 mph : 21 vph or more
- 45 to 55 mph : 16 vph or more
- > 55 mph : 11 vph or more

Notes:

1. *Use linear interpolation for left-turn volumes between 5 and 25 vph.*
2. *The directional volume in the through lane includes through vehicles and turning vehicles.*

Table 17.B-4
Criteria for Left-turn Deceleration Lanes on
RURAL MULTI-LANE HIGHWAYS

Left-Turn Volume [1] (vph)	LEFT-TURN DECELERATION LANE			
	Minimum Volume in Adjacent Through Lane (vphpl) [2]			
	≤ 30 mph	35 to 40 mph	45 to 55 mph	> 55 mph
< 5	Not Required	Not Required	Not Required	Not Required
5	450	310	210	130
10	310	220	130	90
15	240	160	100	70
20	190	130	80	Required
25	150	110	Required	Required
30	130	Required	Required	Required
35	110	Required	Required	Required
≥ 36	Required	Required	Required	Required

Left-turn Deceleration Lanes are Required on Rural Multi-lane Highways for the following Left-turn Volumes:

- ≤ 30 mph : 36 vph or more
- 35 to 40 mph : 26 vph or more
- 45 to 55 mph : 21 vph or more
- > 55 mph : 16 vph or more

Notes:

1. *Use linear interpolation for left-turn volumes between 5 and 35 vph.*
2. *The volume in the adjacent through lane includes through vehicles and turning vehicles.*