

Approved: 
Dennis Hunter, Deputy Director



**County of Los Angeles
Department of Public Works**

**Access Management For
Private Developments
Guidelines Manual**

May 2011

Revised: June 2011

Record of Revisions

NO.	DESCRIPTION OF REVISION	REVISION EFFECTIVE DATE:
1	<p>Revised originally approved May 2011 "Left-Turn Lane Implementation For Private Development Fronting Two-Lane, Rural Undivided Highways Guidelines Manual" to reflect a chapter layout that would be more conducive to adding additional guideline material (in the form of additional chapters) at a later date. The Manual title has changed to "Access Management For Private Development" and the original Left-Turn Manual has now become Chapter 1. Added Chapter 2, "Right-Turn Lane Implementation For Private Development Fronting Two-Lane, Rural, Undivided Highways.</p>	<p style="text-align: center;">June 2011</p>

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Section 1 Introduction

Increased development within Los Angeles County has resulted in a rise in the demand for direct access connections from developed lots to the County highway network. It is these access points, if not designed, managed, and located appropriately, that could contribute to traffic delays and conflicts among the various users of a roadway.

The content within this manual shall serve as a standardized approach for the design of access points for development within Los Angeles County and shall be used as a guideline to aid private developers, their engineers, and consultants in designing a project access point that not only will benefit the County's highway system but also the project itself. Public Works staff will also use this guideline manual to assist in the formulation and preparation of conditions of approval for tentative maps, parcel maps, and plot plans (associated with conditional use permits, and other single-lot developments, subject to conditions).

These guidelines shall be applicable for all private developments, subject to discretionary approval or those projects subject to improvement requirements under Los Angeles County Code Title 22, Chapter 22.48, Part 4 (Section 22.48.220, et seq.).

Public Works' vision for this manual is to add content whenever the needs arise or to initiate updates as dictated by changes to technology or engineering practices. Therefore this manual shall be a living document and will be subject to periodic changes.

Section 2 Acknowledgements

Document Preparation Team

As stated in Section 1, the document preparation team for each individual chapter will be included at the end of each chapter. However, the following were contributing members of a committee that were involved in the creation of the overall introduction for the Guidelines Manual as shown on the previous pages:

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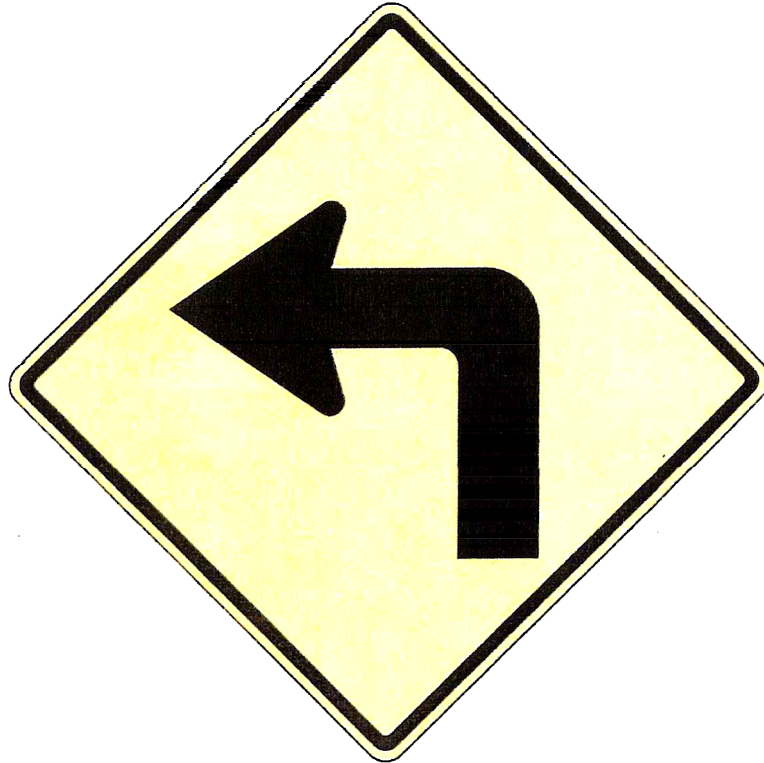
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Access Management For Private Developments Guidelines Manual



Chapter 1 Left-Turn Lane Implementation For Private Development Fronting Two-Lane Rural Undivided Highways

May 2011

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Section 1 Introduction

Private developments are increasingly being proposed throughout the rural areas of Los Angeles County, along highways that are not built to ultimate width and/or lack exclusive left-turn lanes. Many of these proposed projects, once analyzed, could benefit from the installation of a exclusive left-turn lane on the frontage roadway to facilitate ingress vehicular movement at the project's access point.

The refuge area provided by exclusive left-turn lanes can also lead to enhanced traffic operation by minimizing potential conflicts between various users of the roadway.

These guidelines have been established for the following reasons:

- To assist in the formulation and preparation of conditions of approval for tentative maps, parcel maps, and plot plans (associated with conditional use permits and other single-lot developments, subject to conditions).
- To provide a standardized approach in analyzing the need for implementation of left-turn lanes on two-lane rural highways fronting private developments.

These guidelines shall be applicable for all private developments, subject to discretionary approval or those projects subject to improvement requirements under Los Angeles County Code Title 22, Chapter 22.48, Part 4 (Section 22.48.220, et seq.). For projects where a detailed traffic study is required by the County of Los Angeles Department of Public Works' Traffic and Lighting Division, an analysis of the sight distance and traffic volumes at the proposed access point, based on these guidelines, should be included in the study to verify if the need for a dedicated left-turn lane exists.

The following references were used to develop these left-turn lane implementation guidelines:

- Los Angeles County Code Title 21
- Los Angeles County Code Title 22
- AASHTO
- California Department of Transportation (Caltrans) Highway Design Manual
- Harmelink, M.D., *Aspects of Traffic Control Devices: Volume Warrants for Left-Turn Storage Lanes at Unsignalized Grade Intersections*, Highway Research Board Report No. 211, Washington, DC, Highway Research Board, National Research Council, 1967.

Design speeds and the corresponding sight distance criteria utilized for these guidelines are based on standards referenced in Chapter 200 of the Caltrans Highway Design Manual. Minimum design speeds assigned for each classification of roadway, as referenced in these guidelines, are based on current design practices being used at the County of Los Angeles Department of Public Works (Public Works).

This chapter will be a living document and may be periodically revised or updated.

Section 2 Left-Turn Lane Implementation Guidelines

This section establishes prescribed steps to be used in evaluating whether conditions related to the implementation of left-turn lanes on rural two-lane highways, fronting proposed developments within the County of Los Angeles, should be imposed.

The main factors identified in these guidelines that contribute to the need for left-turn lane implementation are the design speed of the fronting roadway; stopping sight distance (both horizontal and vertical) at the project's access point; and the correlation between the opposing, advancing, and left-turn projected traffic volumes, post-project implementation, as analyzed at the project access point.

A step-by-step process to evaluate these factors can be found on the following pages:

The guidelines found in this chapter shall in no way preclude the use of sound engineering judgment in analyzing the need for left-turn lane implementation at a particular project entrance. Each project shall be reviewed on a case-by-case basis and be thoroughly evaluated to determine if a left-turn lane should be installed or not. Other factors that should be taken into consideration that are outside the scope of this chapter include, but are not limited to, accident history, existing traffic operations, and other geometric constraints in the general vicinity of the proposed project. In addition, due to the uniqueness of each project, imposing vehicular access restrictions at a particular project site may be necessary and this manual shall not preclude Public Works from conditioning a project in this manner.

Step 1 - Record the Project Information and Determine the Design Parameters

Step 1A – General Project Information – Please fill in all applicable project information. Denote "N/A" if an item does not apply.

Type of Project: Subdivision–TR# _____, PM# _____
 Conditional Use Permit–CUP# _____
 Single Lot Development–Zone _____

Project Address: _____

Assessor's Parcel Number(s) _____

Street name where access is being proposed: _____

Step 1B–Determine the Classification of the Roadway–Please check the box of the corresponding highway classification of the roadway where access is being proposed.

- Major Highway–100 feet minimum Right of Way Width
- Parkway–80 feet minimum Right-of-Way Width
- Secondary Highway–80 feet minimum Right of Way Width
- Limited Secondary Highway–64 feet to 80 feet of Standard Right of Way Width

Roadway classifications throughout the County of Los Angeles can be found on the County's Highway Plan. Depending on where the proposed project is located, you may access the appropriate Highway Plan at the following web addresses:

North County Highway Plan:

http://planning.lacounty.gov/assets/upl/data/map_t04-hwy-plan-north-existing.pdf

South County Highway Plan:

http://planning.lacounty.gov/assets/upl/data/map_t05-hwy-plan-south-existing.pdf

Step 1C – Determine the Design Speed of the Roadway–The design speed chosen should reflect the minimum design speed corresponding to the roadway classification determined/recorded in Step 1B. These design speeds are shown below.

Major Highway: 65 mph (60 mph*)
Secondary Highway or Parkway: 60 mph (55 mph*)
Limited Secondary Highway: 55 mph (45mph*)

* Lower design speed exception may be made based on roadway constraints such as topography, intersection spacing, and other road conditions, subject to Public Works approval.

Please record the design speed of the roadway below:

The Design Speed of _____
(Name of Roadway where Access is Being Proposed)
is _____ mph.

Step 2 – Analyze the Horizontal and Vertical Stopping Sight Distance

Stopping sight distance as defined in the Caltrans Highway Design Manual is the distance required by the driver of a vehicle traveling at a given speed to bring the vehicle to a stop after an object on the road becomes visible.

Line of sight should be based on the minimum design speeds for each roadway classification as determined in Step 1C above.

Table 1 below shows the stopping sight distance lengths for corresponding design speeds based on standards referenced in Chapter 200 of the Caltrans Highway Design Manual. The values shown should be increased by 20 percent on sustained downgrades steeper than 3 percent and longer than one mile to be consistent with the Caltrans standard found in the Highway Design Manual.

Table 1 – Stopping Sight Distance Standards

Design Speed (MPH)	Stopping Sight Distance (ft) ¹
65	660
60	580
55	500
50	430
45	360
40	300
35	250
30	200
25	150
20	125

Since the purpose of this chapter is to evaluate if a left-turn lane is necessary considering current and projected vehicular traffic conditions, the measurement of stopping sight distance is essentially from the driver's eye of one vehicle to the bumper of another vehicle. Therefore, the evaluation of stopping sight distance within the context of this chapter should utilize a driver's eye and the target object height of 3.5 feet and 2.0 feet above the surface of the roadway respectively.

¹ Stopping sight distance values are based on CALTRANS Highway Design Manual, January 4, 2007 edition, Table 201.1.

An appropriate line-of-sight exhibit analyzing the horizontal and vertical stopping sight distance in both directions should be submitted for evaluation along with the proposed plot plan. The line-of-sight exhibit should show the location of the back bumper for the left-turning vehicle (vehicle 1), which is presumed to be located in the center of the travel lane, 20 feet (for a typical passenger car) back from the nearside curb prolongation of the proposed driveway. Should the proposed use of the site involve vehicles other than typical passenger cars, the assumed location of the back bumper of vehicle 1 would change accordingly based on the typical length of the project's design vehicle. Design vehicle lengths should be obtained from AASHTO's, *A Policy on Geometric Design of Highways and Streets* (latest edition). In addition, the line-of-sight exhibit should show the driver's eye for the advancing vehicle (vehicle 2), which can be presumed to be 3.5 feet above the pavement surface, 4 feet from the centerline (or center lane line as appropriate), and positioned at the appropriate stopping sight distance (as determined from Table 1 above) away from the back bumper of vehicle 1.

The use of stopping sight distance shall be based on the evaluation of the existing and proposed field conditions and constraints subject to Public Works' review and approval.

Sight Distance Evaluation Outcome Based on Table 1:

Is There Adequate Sight Distance?	Action To Be Taken
No	Exclusive Left-Turn Lane should be installed on the fronting roadway
Yes	Continue evaluation with STEP 2

Please note that a similar analysis should be performed to evaluate the stopping sight distance between the driver's eye of vehicle 1 and the front bumper or conflict point of a vehicle traveling in the opposite direction, vehicle 3. If adequate stopping sight distance cannot be achieved between a vehicle making a left turn (vehicle 1) and an on-coming vehicle (vehicle 3) then additional traffic control measures such as a traffic signal should be considered. If said measure cannot be achieved or is not warranted, access restrictions may be imposed.

Step 3 – Analyze the Correlation between Opposing Volume, Advancing Volume, and Left-Turn Volumes for a Given Design Speed

The relationship between the opposing traffic volume², advancing traffic volume³, left-turn volume⁴, and design speed is critical in determining if a left-turn lane is

² Opposing traffic volume as used in this context shall refer to the volume of traffic that is traveling in the opposite direction of where a left-turn lane is being considered at the proposed project access point.

³ Advancing traffic volume as used in this context shall refer to the volume of traffic that is traveling in the same direction of where the left-turn lane is being considered at the proposed project access point.

⁴ Left-turn volume as used in this context shall refer to the volume of traffic that is anticipated to make a left-turn into the proposed project access point.

warranted at a proposed driveway or street along an two-lane rural undivided highway and can be evaluated by using the appropriate Harmelink nomograph shown in Figures 1 through 5 on the following pages. These nomographs were developed by M.D. Harmelink (documented in the *Aspects of Traffic Control Devices: Volume Warrants for Left-Turn Storage Lanes at Unsignalized Grade Intersections*, Highway Research Board Report No. 211, Washington, DC, Highway Research Board, National Research Council, 1967). These nomographs have been accepted as a basic guideline by other entities and are included in publications developed by other states. Instructions on how to utilize these nomographs to determine the minimum threshold for which a left-turn lane should be implemented can be found under each figure. Please note that due to the absence of a 65 mph nomograph the 60 mph nomograph may be used for evaluation of roadways with a 65 mph design speed.

Examples on how to use the nomographs can be found below. The Total Advancing Volume (V_A) and the Total Opposing Volume (V_O) values referenced are to be provided by the applicant using volumes obtained from a current traffic count in the vicinity of the proposed project. Said traffic counts should be performed from an independent traffic count company at the applicant's expense. These traffic counts are to be taken along the property frontage in the vicinity of the proposed project access during the AM and PM peak hours on appropriate days as determined by Public Works. The Total Left-turn Volumes, (V_L) should be projected for the project build out year by the applicant using an independent traffic consultant. For projects with a build out year of 2015 or beyond, the applicable traffic volume growth factor, which can be found in Table 2 of this chapter, shall be applied. The design speed as referenced in the following examples is the speed determined in Step 1C above.

Example 1

Determined Values as indicated above:

- Design Speed = 50mph
- Total Advancing Volume including all turning movements, $V_A=480$ vph
- Total Opposing Volume including all turning movements, $V_O=96$ vph
- Total Left-turn Volumes into the project site for the projected build out year, $V_L = 50$ vph

Project Location = Agoura Hills
Build out Year = 2020

Analyze:

If an exclusive left-turn lane into the project site is warranted.

Solution:

Step A: Determine the applicable Traffic Volume Growth Factor from Table 2.

The corresponding Growth Factor from Table 2 for a buildout year of 2020 in the City of Agoura Hills is 1.041.

Step B: Apply the growth factor found in Step A to the total advancing and opposing volumes determined from a traffic count company.

Total Advancing Volume with ambient growth factor applied:

$$V_A = 480\text{vph} \times 1.041 = 500\text{vph}$$

Total Opposing Volume with ambient growth factor applied:

$$V_O = 96\text{vph} \times 1.041 = 100\text{vph}$$

Step C: Calculate the percentage of left-turns.

$$\begin{aligned} (V_L / V_A) \times 100 &= \\ (50\text{vph} / 500\text{vph}) \times 100 &= \\ 0.10 \times 100 &= 10\% \end{aligned}$$

Step D: Using Figure 3, find the intersection point of V_A (500vph) and V_O (100vph).

Step E: Determine the location of the point found in Step D relative to the 10% curve found in Step C. If the intersection point lies to the right of the curve then a left-turn lane is warranted based on volumes. If it lies to the left of the curve then a left-turn lane is not warranted based on volumes. In this case, the intersection point of V_A (500vph) and V_O (100vph) lies to the right of the 10% curve on Figure 3 and, therefore, a left-turn lane is warranted.

Example 2 below utilizes the same values as Example 1; however, this method compares the actual percentage of vehicles making a left-turn to the percentage found to be the threshold for warranting a left-turn lane. As in Example 1, Example 2 shows the same outcome; a left-turn lane is warranted.

Example 2

Determined Values as indicated above:

- Design Speed = 50mph
- Total Advancing Volume including all turning movements, $V_A = 480\text{vph}$
- Total Opposing Volume including all turning movements, $V_O = 96\text{vph}$
- Total Left turn volumes into the project site for the projected build out year, $V_L = 50\text{vph}$

Project Location = Agoura Hills

Build out Year = 2020

Analyze:

If an exclusive left-turn lane into the project site is warranted.

Solution:

Step A: Determine the applicable Traffic Volume Growth Factor from Table 2.

The corresponding Growth Factor from Table 2 for a build out year of 2020 in the City of Agoura Hills is 1.041.

Step B: Apply the growth factor found in Step A to the total advancing and opposing volumes determined from a traffic count company.

Total Advancing Volume with ambient growth factor applied:
 $V_A = 480\text{vph} \times 1.041 = 500\text{vph}$

Total Opposing Volume with ambient growth factor applied:
 $V_O = 96\text{vph} \times 1.041 = 100\text{vph}$

Step C: Using Figure 3, find the intersection point of V_A (500vph) and V_O (100vph) and determine the corresponding "percentage left-turn curve" that applies (e.g., determine the curve that would pass through the intersection point). In this case, the corresponding percentage of left-turns that would warrant a left-turn lane would be approximately 8.5%.

Step D: Determine the actual percentage of left turns based on the determined values of the total advancing volume (V_A) and the total left-turn volumes, (V_L).

$$\begin{aligned} (V_L / V_A) \times 100 &= \\ (50\text{vph} / 500\text{vph}) \times 100 &= \\ 0.10 \times 100 &= 10\% \end{aligned}$$

Step E: Compare the actual percentage of left turns as determined in Step D with the percentage of left turns that would warrant a left-turn lane as determined in Step C. In this case, the actual left-turn volume of 10% is higher than 8.5% (which is the threshold for which a left-turn lane is warranted); therefore, the project should install a left-turn lane.

Example 3 below, again utilizes the same volumes as both Example 1 and 2; however, this method compares the actual volume of vehicles making a left-turn to the volume found to be the threshold for warranting a left-turn lane. The outcome of Example 3 is the same as that of the preceding examples; a left-turn lane is warranted.

Example 3

Determined Values as indicated above:

- Design Speed = 50mph
- Total Advancing Volume including all turning movements, $V_A = 480\text{vph}$
- Total Opposing Volume including all turning movements, $V_O = 96\text{vph}$
- Total Left-turn volumes into the project site for the projected build out year, $V_L = 50\text{vph}$

Project Location = Agoura Hills
Build out Year = 2020

Analyze:

If an exclusive left-turn lane into the project site is warranted.

Solution:

Step A: Determine the applicable Traffic Volume Growth Factor from Table 2.

The corresponding Growth Factor from Table 2 for a build out year of 2020 in the City of Agoura Hills is 1.041.

Step B: Apply the growth factor found in Step A to the total advancing and opposing volumes determined from a traffic count company.

Total Advancing Volume with ambient growth factor applied:

$$V_A = 480\text{vph} \times 1.041 = 500\text{vph}$$

Total Opposing Volume with ambient growth factor applied:

$$V_O = 96\text{vph} \times 1.041 = 100\text{vph}$$

Step C: Using Figure 3, find the intersection point of V_A (500vph) and V_O (100vph) and determine the corresponding "percentage left-turn curve" that applies (e.g., determine the curve that would pass through the intersection point). In this case, the corresponding percentage of left-turns that would warrant a left-turn lane would be approximately 8.5%.

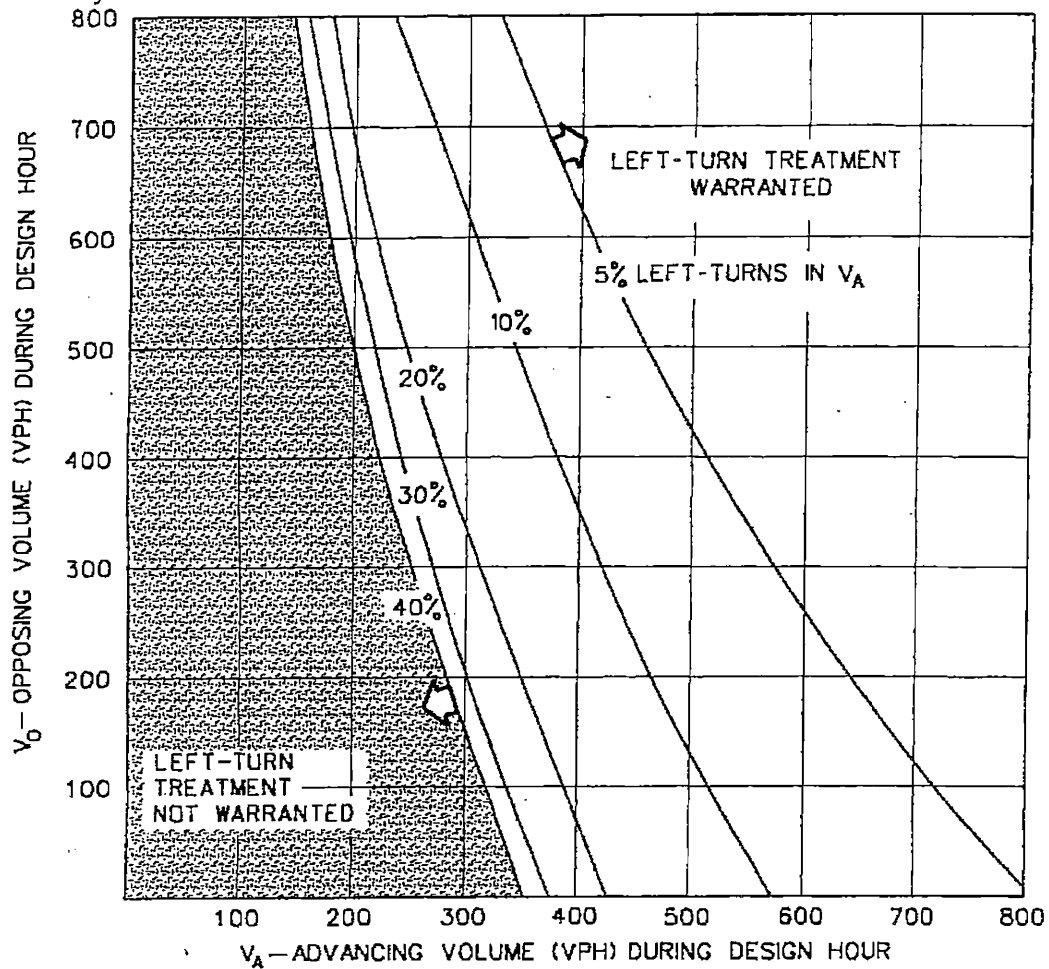
Step D: Determine the volume threshold for which a left-turn lane would be warranted by multiplying the approaching volume (V_A) by the percentage found in Step C.

$$\begin{aligned} V_A \times 8.5\% \\ 500\text{vph} \times (8.5/100) = \\ 500\text{vph} \times 0.085 = \\ 42.5 \text{ vph} \end{aligned}$$

Step E: Compare the actual volume of left turns (V_L) with the volume of left turns that would warrant a left-turn lane as determined in Step D. In this case, the actual left-turn volume of 50 vph is higher than 42.5vph, which is the threshold for which a left-turn lane is warranted; therefore, the project should install a left-turn lane.

V_A = TOTAL ADVANCING
TRAFFIC VOLUME
INCLUDING ALL
TURNING TRAFFIC

V_O = TOTAL OPPOSING
TRAFFIC VOLUME
INCLUDING ALL
TURNING TRAFFIC



Instructions:

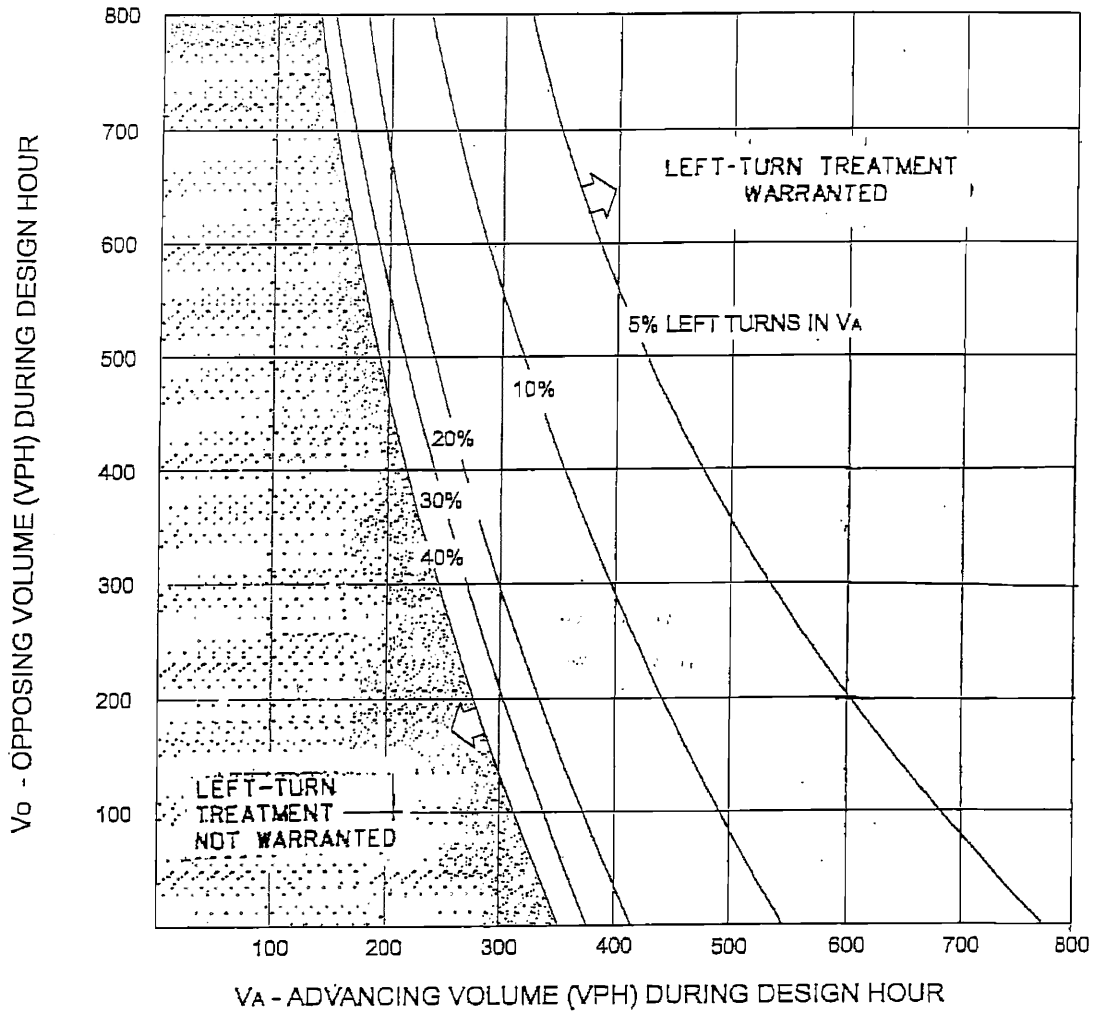
1. The family of curves represent the percent of left turns in the advancing volume (V_A). The designer should locate the curve for the actual percentage of left turns. When this is not an even increment of 5, the designer should estimate where the curve lies.
2. Read V_A and V_O into the chart and locate the intersection of the two volumes.
3. Note the location of the point in #2 relative to the line in #1. If the point is to the right of the line, then a left-turn lane is warranted. If the point is to the left of the line, then a left-turn lane is not warranted based on traffic volumes.

VOLUME WARRANTS FOR LEFT-TURN LANE AT UNSIGNALIZED INTERSECTIONS ON 2-LANE HIGHWAYS (40 mph)

Figure 1

V_A = TOTAL ADVANCING
TRAFFIC VOLUME
INCLUDING ALL
TURNING TRAFFIC

V_O = TOTAL OPPOSING
TRAFFIC VOLUME
INCLUDING ALL
TURNING TRAFFIC



Instructions:

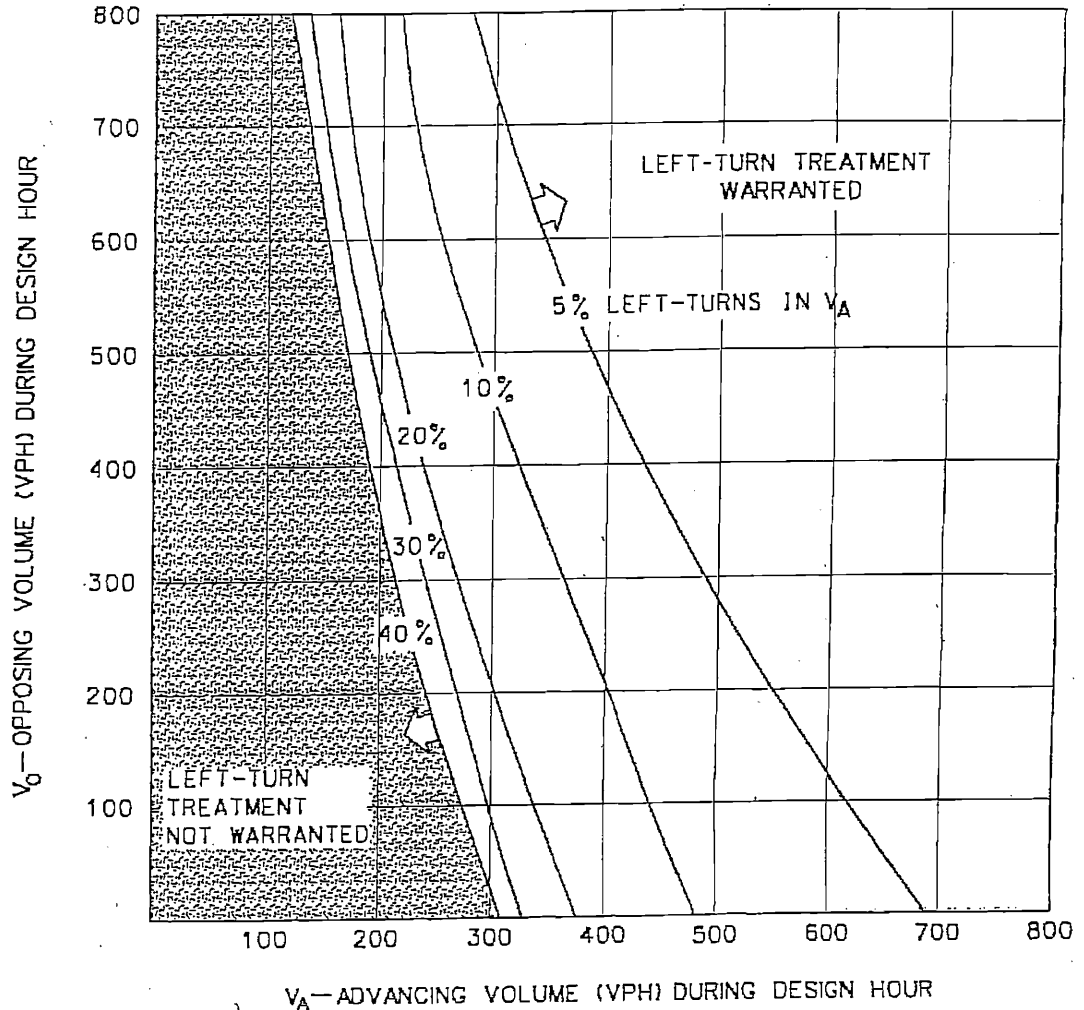
1. The family of curves represent the percent of left turns in the advancing volume (V_A). The designer should locate the curve for the actual percentage of left turns. When this is not an even increment of 5, the designer should estimate where the curve lies.
2. Read V_A and V_O into the chart and locate the intersection of the two volumes.
3. Note the location of the point in #2 relative to the line in #1. If the point is to the right of the line, then a left-turn lane is warranted. If the point is to the left of the line, then a left-turn lane is not warranted based on traffic volumes.

VOLUME WARRANTS FOR LEFT-TURN LANE AT UNSIGNALIZED INTERSECTIONS ON 2-LANE HIGHWAYS (45 mph)

Figure 2

V_A = TOTAL ADVANCING
TRAFFIC VOLUME
INCLUDING ALL
TURNING TRAFFIC

V_O = TOTAL OPPOSING
TRAFFIC VOLUME
INCLUDING ALL
TURNING TRAFFIC



Instructions:

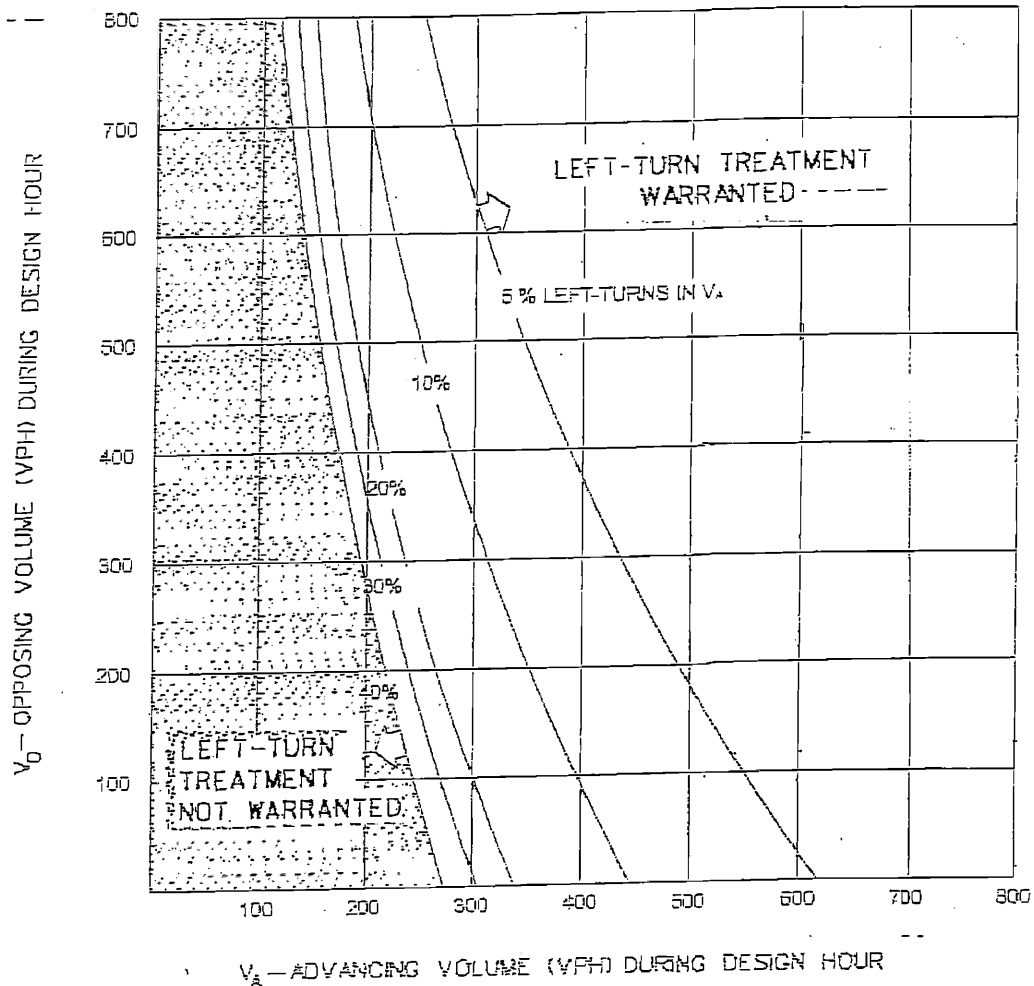
1. The family of curves represent the percent of left turns in the advancing volume (V_A). The designer should locate the curve for the actual percentage of left turns. When this is not an even increment of 5, the designer should estimate where the curve lies.
2. Read V_A and V_O into the chart and locate the intersection of the two volumes.
3. Note the location of the point in #2 relative to the line in #1. If the point is to the right of the line, then a left-turn lane is warranted. If the point is to the left of the line, then a left-turn lane is not warranted based on traffic volumes.

VOLUME WARRANTS FOR LEFT-TURN LANE AT UNSIGNALIZED INTERSECTIONS ON 2-LANE HIGHWAYS (50 mph)

Figure 3

V_A = TOTAL ADVANCING
TRAFFIC VOLUME
INCLUDING ALL
TURNING TRAFFIC

V_O = TOTAL OPPOSING
TRAFFIC VOLUME
INCLUDING ALL
TURNING TRAFFIC



Instructions:

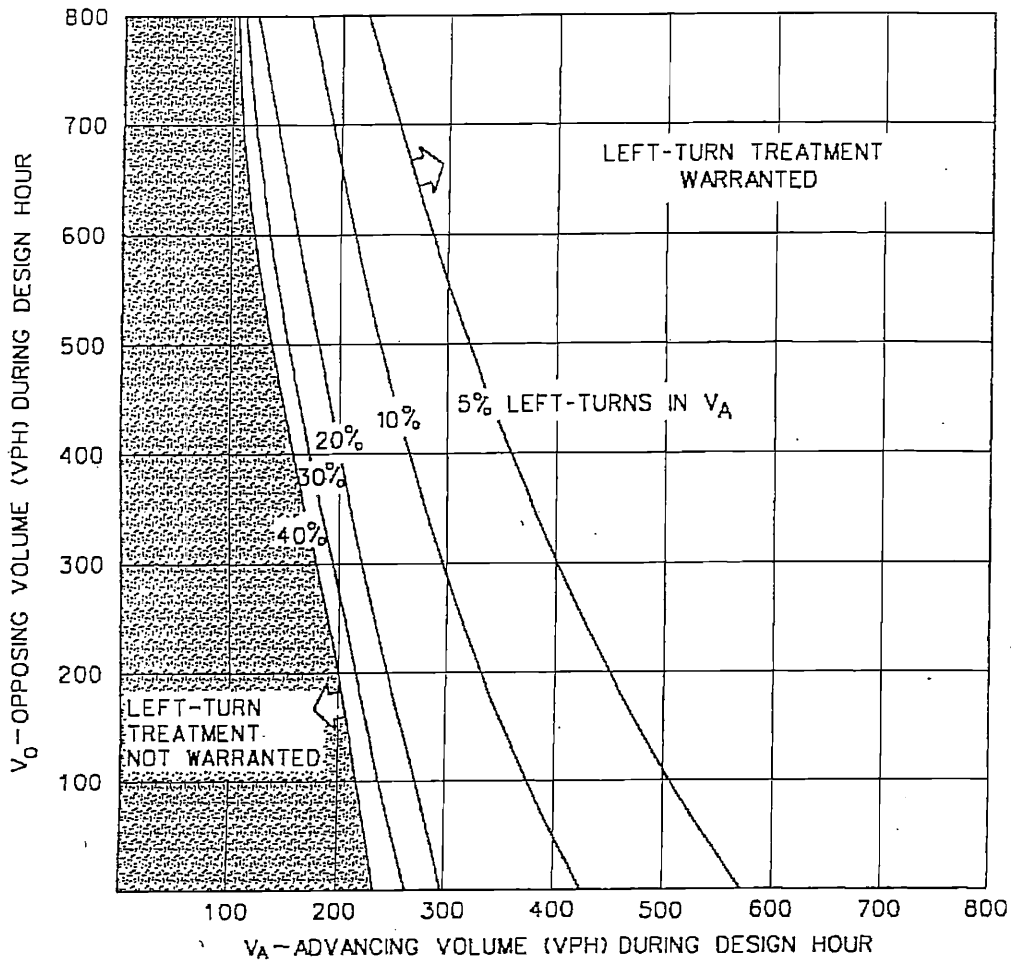
1. The family of curves represent the percent of left turns to the advancing volume (V_A). The designer should locate the curve for the actual percentage of left turns. When this is not an even increment of 5, the designer should estimate where the curve lies.
2. Read V_A and V_O into the chart and locate the intersection of the two volumes.
3. Note the location of this point in #2 relative to the line in #1. If the point is to the right of the line, then a left-turn lane is warranted. If the point is to the left of the line, then a left-turn lane is not warranted based on traffic volumes.

VOLUME WARRANTS FOR LEFT-TURN LANE AT UNSIGNALIZED
INTERSECTIONS ON 2-LANE HIGHWAYS (55 mph)

Figure 4

V_A = TOTAL ADVANCING
TRAFFIC VOLUME
INCLUDING ALL
TURNING TRAFFIC

V_O = TOTAL OPPOSING
TRAFFIC VOLUME
INCLUDING ALL
TURNING TRAFFIC



Instructions:

1. The family of curves represent the percent of left turns in the advancing volume (V_A). The designer should locate the curve for the actual percentage of left turns. When this is not an even increment of 5, the designer should estimate where the curve lies.
2. Read V_A and V_O into the chart and locate the intersection of the two volumes.
3. Note the location of the point in #2 relative to the line in #1. If the point is to the right of the line, then a left-turn lane is warranted. If the point is to the left of the line, then a left-turn lane is not warranted based on traffic volumes.

**VOLUME WARRANTS FOR LEFT-TURN LANE AT UNSIGNALIZED
INTERSECTIONS ON 2-LANE HIGHWAYS (60 mph)**

Figure 5

Table 2 - Traffic Volume Growth Factors

Representative City/Place	2010	Compound Annual Growth (%)	2015	Compound Annual Growth (%)	2020	Compound Annual Growth (%)	2025	Compound Annual Growth (%)	2030	Compound Annual Growth (%)	2035
Agoura Hills	1,000	0.40	1,020	0.41	1,041	0.21	1,052	0.21	1,063	0.22	1,075
Santa Clarita	1,000	2.75	1,145	2.43	1,291	0.87	1,348	0.83	1,405	0.78	1,461
Lancaster	1,000	3.95	1,214	3.29	1,427	3.27	1,676	2.80	1,924	2.45	2,172
Palmdale	1,000	2.55	1,134	2.24	1,267	1.47	1,363	1.36	1,458	1.27	1,553
Angelen Forest	1,000	2.85	1,151	2.48	1,301	1.39	1,394	1.30	1,487	1.22	1,580
West S.F. Valley	1,000	0.53	1,027	0.52	1,054	0.26	1,068	0.28	1,083	0.26	1,097
Burbank	1,000	0.48	1,024	0.48	1,049	0.27	1,063	0.26	1,077	0.28	1,092
Sylmar	1,000	0.48	1,024	0.48	1,049	0.42	1,071	0.41	1,093	0.38	1,114
Mallbu	1,000	0.53	1,027	0.52	1,054	0.40	1,075	0.39	1,096	0.38	1,117
Santa Monica	1,000	0.28	1,014	0.27	1,028	0.19	1,038	0.21	1,049	0.19	1,059
West/Central L.A.	1,000	0.14	1,007	0.14	1,014	0.20	1,024	0.19	1,034	0.19	1,044
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Pomona	1,000	1.57	1,081	1.44	1,161	0.49	1,190	0.48	1,219	0.47	1,248

Volume Evaluation Outcome Based on Appropriate Harmelink Nomograph:

Is a Left-Turn Treatment Warranted?	Action To Be Taken
No	No action required, Installation of a Exclusive Left-Turn Lane on the fronting roadway is not necessary
Yes	Exclusive Left-Turn Lane should be installed on the fronting roadway

Section 3 Project Implementation

This section establishes the procedures and process for the planning and evaluation of implementation of left-turn lanes for private developments fronting a two-lane, rural highway.

a) Tentative Map Review and Plot Plan Review

All proposed subdivisions and plot plans will be reviewed by Public Works' Land Development Division, Road and Grading Section, for adherence to the left-turn lane implementation criteria established in these guidelines. The applicant is, however, responsible for coordinating the review with, and incorporating design criterion imposed by, any other agency including, but not limited to, the Department of Regional Planning and the County of Los Angeles Fire Department.

All Conditions of Approval related to left-turn lanes at private developments will be prepared in accordance with these guidelines.

The applicant shall be responsible for preparing and submitting the appropriate engineering plans, studies, and/or analyses to allow adequate review in accordance with these guidelines by Public Works staff. In addition, the applicant shall bear the entire cost associated with the preparation of said plans/documents as well as depositing any necessary funds to allow Public Works' staff to recover the actual costs of review.

b) Final Engineering

Should a left-turn lane be required of a project, conditions of approval will be prepared accordingly and the applicant will be 100 percent responsible for submitting the appropriate final engineering plans. All plans shall be prepared by a licensed Civil Engineer.

Street Improvement Plans and Striping Plans associated with the implementation of left-turn lanes at private driveways will be reviewed by the Land Development Division, Road and Grading Section. Grading plans associated with subdivisions and Conditional Use Permits (CUP) will also be reviewed by the Land Development Division, Road and Grading Section. However, grading plans associated with single-lot developments (other than CUPs) will be reviewed by the applicable Building and Safety district office. Plan check fees for road, striping, and grading plans will be based on fee schedules in effect at the time of submittal.

Should additional pavement be necessary to implement a left-turn lane, a soils report or materials test may be needed to adequately analyze the pavement structural sections. Any proposed structural section is subject to approval by Public Works' Geotechnical and Materials Engineering Division, Soils and Geology Section. It is also the applicant's responsibility to verify the adequacy of the existing road right of way to accommodate any needed improvements and to acquire, prior to tentative map approval (for subdivision related projects), any additional right of way required to implement the left-turn lane.

The applicant shall be solely responsible for submitting, coordinating, and processing each applicable plan review through each reviewing division/section.

c) Construction

It is the responsibility of the applicant to apply for and obtain the necessary encroachment permits for any required work within the public right of way and to pay all applicable fees prior to permit issuance.

Section 4 Acknowledgements

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Road Maintenance Division:

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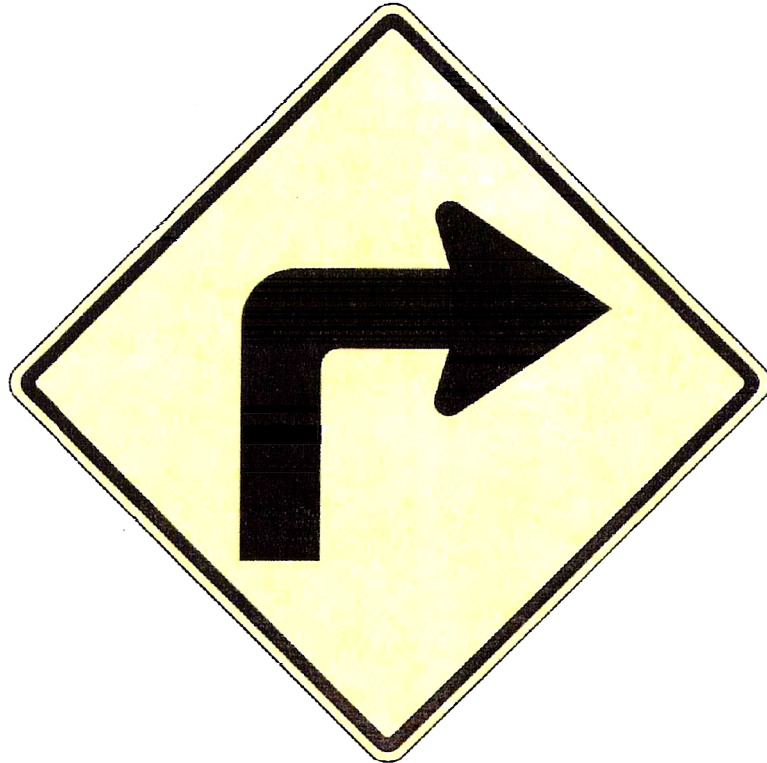
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Approved: 
Dennis Hunter, Deputy Director

County of Los Angeles Department of Public Works

Access Management For Private Developments Guidelines Manual



Chapter 2 Right-Turn Lane Implementation For Private Development Fronting Two-Lane Rural Undivided Highways

June 2011

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Document Preparation Team	

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Section 1 Introduction

Private developments are increasingly being proposed throughout the rural areas of Los Angeles County, along highways that are not built to ultimate width and/or lack exclusive right-turn lanes. Many of these proposed projects, once analyzed, could benefit from the installation of an exclusive right-turn lane on the frontage roadway to facilitate ingress vehicular movement at the project's access point.

The refuge area provided by exclusive right-turn lanes can also lead to enhanced traffic operation by minimizing potential conflicts between various users of the roadway.

These guidelines have been established for the following reasons:

- To assist in the formulation and preparation of conditions of approval for tentative maps, parcel maps, and plot plans (associated with conditional use permits and other single-lot developments, subject to conditions).
- To provide a standardized approach in analyzing the need for implementation of right-turn lanes on two-lane rural highways fronting private developments.

These guidelines shall be applicable for all private developments, subject to discretionary approval or those projects subject to improvement requirements under Los Angeles County Code Title 22, Chapter 22.48, Part 4 (Section 22.48.220, et seq.). For projects where a detailed traffic study is required by the County of Los Angeles Department of Public Works' Traffic and Lighting Division, an analysis of the sight distance and traffic volumes at the proposed access point, based on these guidelines, should be included in the study to verify if the need for a dedicated right-turn lane exists.

The following references were used to develop these right-turn lane implementation guidelines:

- Los Angeles County Code Title 21
- Los Angeles County Code Title 22
- AASHTO
- California Department of Transportation (Caltrans) Highway Design Manual
- Traffic Volume Warrants for Right Turn Auxillary Lanes At Unsignalized Intersections, (Willey, L.B., 1989), in Vermont Agency of Transportation Guidelines for Engineering Issues, Attachment G, 1994.
- *Turn Lane Warrants: Concepts, Standards, Application in Review*, presented by David J. DeBaie P.E., P.T.O.E at the 2004 ITE, District Meeting in Burlington Vermont.

- Harmelink, M.D., *Aspects of Traffic Control Devices: Volume Warrants for Left-Turn Storage Lanes at Unsignalized Grade Intersections*, Highway Research Board Report No. 211, Washington, DC, Highway Research Board, National Research Council, 1967.

Design speeds and the corresponding sight distance criteria utilized for these guidelines are based on standards referenced in Chapter 200 of the Caltrans Highway Design Manual. Minimum design speeds assigned for each classification of roadway, as referenced in these guidelines, are based on current design practices being used at the County of Los Angeles Department of Public Works (Public Works).

This chapter will be a living document and may be periodically revised or updated.

Section 2 Right-Turn Lane Implementation Guidelines

This section establishes prescribed steps to be used in evaluating whether conditions related to the implementation of right-turn lanes on rural, two-lane highways, fronting proposed developments within the County of Los Angeles, should be imposed.

The main factors identified in these guidelines that contribute to the need for right-turn lane implementation are the design speed of the fronting roadway; stopping sight distance (both horizontal and vertical) at the project's access point; and the correlation between the advancing and right-turn projected traffic volumes, post-project implementation, as analyzed at the project access point.

A step-by-step process to evaluate these factors can be found on the following pages:

The guidelines found in this chapter shall in no way preclude the use of sound engineering judgment in analyzing the need for right-turn lane implementation at a particular project entrance. Each project shall be reviewed on a case-by-case basis and be thoroughly evaluated to determine if a right-turn lane should be installed or not. Other factors that should be taken into consideration that are outside the scope of this chapter include, but are not limited to, accident history, existing traffic operations, and other geometric constraints in the general vicinity of the proposed project. In addition, due to the uniqueness of each project, imposing vehicular access restrictions at a particular project site may be necessary and this chapter shall not preclude Public Works from conditioning a project in this manner.

Step 1 - Record the Project Information and Determine the Design Parameters

Step 1A – General Project Information – Please fill in all applicable project information. Denote "N/A" if an item does not apply.

Type of Project: Subdivision–TR# _____, PM# _____
 Conditional Use Permit–CUP# _____
 Single Lot Development–Zone _____

Project Address: _____

Assessor's Parcel Number(s) _____

Street name where access is being proposed: _____

Step 1B–Determine the Classification of the Roadway–Please check the box of the corresponding highway classification of the roadway where access is being proposed.

- Major Highway–100 feet minimum Right of Way Width
- Parkway–80 feet minimum Right-of-Way Width
- Secondary Highway–80 feet minimum Right of Way Width
- Limited Secondary Highway–64 feet to 80 feet of Standard Right of Way Width

Roadway classifications throughout the County of Los Angeles can be found on the County's Highway Plan. Depending on where the proposed project is located, you may access the appropriate Highway Plan at the following web addresses:

North County Highway Plan:
http://planning.lacounty.gov/assets/upl/data/map_t04-hwy-plan-north-existing.pdf

South County Highway Plan:
http://planning.lacounty.gov/assets/upl/data/map_t05-hwy-plan-south-existing.pdf

Step 1C – Determine the Design Speed of the Roadway–The design speed chosen should reflect the minimum design speed corresponding to the roadway classification determined/recorded in Step 1B. These design speeds are shown below.

- Major Highway: 65 mph (60 mph*)
- Secondary Highway or Parkway: 60 mph (55 mph*)
- Limited Secondary Highway: 55 mph (45mph*)

* Lower design speed exception may be made based on roadway constraints such as topography, intersection spacing, and other road conditions, subject to Public Works approval.

Please record the design speed of the roadway below:

The Design Speed of _____
(Name of Roadway where Access is Being Proposed)
is _____ mph.

Step 2 – Analyze the Horizontal and Vertical Stopping Sight Distance

Stopping sight distance as defined in the Caltrans Highway Design Manual is the distance required by the driver of a vehicle traveling at a given speed to bring the vehicle to a stop after an object on the road becomes visible.

Line of sight should be based on the minimum design speeds for each roadway classification as determined in Step 1C above.

Table 1 below shows the stopping sight distance lengths for corresponding design speeds based on standards referenced in Chapter 200 of the Caltrans Highway Design Manual. The values shown should be increased by 20 percent on sustained downgrades steeper than 3 percent and longer than one mile to be consistent with the Caltrans standard found in the Highway Design Manual.

Table 1 – Stopping Sight Distance Standards

Design Speed (MPH)	Stopping Sight Distance (ft) ¹
65	660
60	580
55	500
50	430
45	360
40	300
35	250
30	200
25	150
20	125

Since the purpose of this chapter is to evaluate if a right-turn lane is necessary considering current and projected vehicular traffic conditions, the measurement of stopping sight distance is essentially from the driver's eye of one vehicle to the bumper of another vehicle. Therefore, the evaluation of stopping sight distance within the context of this chapter should utilize a driver's eye and the target object height of 3.5 feet and 2.0 feet above the surface of the roadway respectively.

¹ Stopping sight distance values are based on CALTRANS Highway Design Manual, January 4, 2007 edition, Table 201.1.

An appropriate line-of-sight exhibit analyzing the horizontal and vertical stopping sight distance in both directions should be submitted for evaluation along with the proposed plot plan. The line-of-sight exhibit should show the location of the back bumper for the right-turning vehicle (vehicle 1), which is presumed to be located in the center of the travel lane, 20 feet (for a typical passenger car) back from the nearside curb prolongation of the proposed driveway. Should the proposed use of the site involve vehicles other than typical passenger cars, the assumed location of the back bumper of vehicle 1 would change accordingly based on the typical length of the project's design vehicle. Design vehicle lengths should be obtained from AASHTO's, *A Policy on Geometric Design of Highways and Streets* (latest edition). In addition, the line-of-sight exhibit should show the drivers eye for the advancing vehicle (vehicle 2), which can be presumed to be 3.5 feet above the pavement surface, 4 feet from the centerline (or center lane line as appropriate), and positioned at the appropriate stopping sight distance (as determined from Table 1 above) away from the back bumper of vehicle 1.

The use of stopping sight distance shall be based on the evaluation of the existing and proposed field conditions and constraints subject to Public Works' review and approval.

Sight Distance Evaluation Outcome Based on Table 1:

Is There Adequate Sight Distance?	Action To Be Taken
No	Exclusive Right-Turn Lane should be installed on the fronting roadway
Yes	Continue evaluation with STEP 2

Step 3 – Analyze the Correlation between the Advancing Volume and the Right-Turn Volumes for a Given Design Speed

The relationship between the advancing traffic volume², right-turn volume³, and design speed is critical in determining if a right-turn lane is warranted at a proposed driveway or street along an two-lane rural undivided highway and can be evaluated by using the Volume Warrant for Right-Turn Lanes at Unsignalized Intersections for 2-lane Highways as shown in Figure 1 on page 2-11. This nomograph was adopted by the Vermont Agency of Transportation (documented in the Traffic Volume Warrants for Right Turn Auxillary Lanes At Unsignalized Intersections, (Willey, L.B., 1989), in Vermont Agency of Transportation Guidelines for Engineering Issues, Attachment G, 1994) and was modified to reflect only the curves related to the two-lane highways. It is based on the same concepts used by M.D Harmelink to create the largely popular Harmelink nomographs for left-turn warrants (documented in the *Aspects of Traffic Control Devices: Volume Warrants for Left-Turn Storage Lanes at Unsignalized Grade*

² Advancing traffic volume as used in this context shall refer to the volume of traffic that is traveling in the same direction of where the right-turn lane is being considered at the proposed project access point.

³ Right-turn volume as used in this context shall refer to the volume of traffic that is anticipated to make a right-turn into the proposed project access point.

Intersections, Highway Research Board Report No 211, Washington, DC, Highway Research Board, National Research Council, 1967). The concept behind the Harmelink nomographs for left-turn implementation, involves using the design speed and the opposing⁴, advancing⁵, and left-turn traffic volumes⁶ to evaluate the relationship between the arrival of a vehicle approaching the intersection⁷ that is forced to queue behind a slow moving or stopped vehicle that is waiting for a large enough gap in the opposing traffic to turn left. The Harmelink nomographs for left-turn implementation can be found in Chapter 1 this Guidelines Manual.

Since drivers of right-turning vehicles do not need to wait for gaps in opposing traffic to negotiate the turn, the nomograph shown in Figure 1 simply compares three critical design criteria; advancing traffic volume⁸, right-turn traffic volume⁹, and design speed. Similar nomographs using the same basic concepts are being utilized by other entities and are included in publications developed by other states. Instructions on how to use the nomograph shown in Figure 1 to determine the minimum threshold for which a right-turn lane should be implemented can be found under the figure. Please note that due to the absence of a 65 mph speed curve the 60 mph speed curve may be used for evaluation of roadways with a 65 mph design speed.

It is important to note that the term advancing traffic volume as used above has different meanings depending on the context that they are used.

The advancing traffic volume is the volume of traffic that is traveling in the same direction of the vehicle negotiating the turn movement (left or right) being analyzed. For example, if one was to evaluate the need for a right turn lane into a project driveway located on the south side of a highway that runs in the east/west direction, the advancing traffic volume would be the volume of traffic traveling in the eastbound direction. Conversely, if one was to evaluate the need for a left-turn lane into the same project driveway, the advancing traffic volume would be the volume of traffic traveling in the westbound direction.

Similarly, the term opposing traffic volume is the volume of traffic that is traveling in the opposite direction of any given vehicle.

Examples on how to use the nomograph shown in Figure 1 can be found below. The Total Advancing Volume (V_A) value referenced is to be provided by the applicant using volumes obtained from a current traffic count in the vicinity of the proposed project. Said traffic counts should be performed by an independent

⁴ Opposing traffic volume as used in this context shall refer to the volume of traffic that is traveling in the opposite direction of where a left-turn lane is being considered at the proposed project access point.

⁵ Advancing traffic volume as used in this context shall refer to the volume of traffic that is traveling in the same direction of where the left-turn lane is being considered at the proposed project access point.

⁶ Left-turn volume as used in this context shall refer to the volume of traffic that is anticipated to make a left-turn into the proposed project access point.

⁷ Intersection in this context refers to the converging of the project driveway access to the 2-lane highway.

⁸ Advancing traffic volume as used in this context shall refer to the volume of traffic that is traveling in the same direction of where the right-turn lane is being considered at the proposed project access point.

⁹ Right-turn volume as used in this context shall refer to the volume of traffic that is anticipated to make a right-turn into the proposed project access point.

traffic count company at the applicant's expense. Please note that it may also be necessary for the developer of private development to analyze the need for a left-turn lane (see chapter 1 of this manual for evaluation procedures). If this is the case, it is important to recognize that the Total Opposing Volume (V_O) data collected during the left-turn lane analysis under the Chapter 1 guidelines is the same as the Total Advancing Volume (V_A) referenced herein. The traffic counts are to be taken along the property frontage in the vicinity of the proposed project access during the AM and PM peak hours on appropriate days as determined by Public Works.

The total right-turn Volumes, (V_R) should be projected for the project build out year by the applicant using an independent traffic consultant. For projects with a build out year of 2015 or beyond, the applicable traffic volume growth factor, which can be found in Table 2 of this chapter, shall be applied. The design speed as referenced in the following examples is the speed determined in Step 1C above.

Example 1

Determined Values as indicated above:

- Design Speed = 60mph
- Total Advancing Volume including all turning movements, $V_A = 384\text{vph}$
- Total Right-turn Volumes into the project site for the projected build out year, $V_R = 80\text{vph}$

Project Location = Agoura Hills
Build out Year = 2020

Analyze:

If an exclusive right-turn lane into the project site is warranted.

Solution:

Step A: Determine the applicable Traffic Volume Growth Factor from Table 2.

The corresponding Growth Factor from Table 2 for a build out year of 2020 in the City of Agoura Hills is 1.041.

Step B: Apply the growth factor found in Step A to the total advancing volume determined from a traffic count company.

Total Advancing Volume with ambient growth factor applied:
 $V_A = 384\text{vph} \times 1.041 = 400\text{vph}$

Step C: Calculate the percentage of right-turns in the advancing volume.
 $(V_R / V_A) \times 100 =$
 $(80\text{vph} / 400\text{vph}) \times 100 =$
 $0.20 \times 100 = 20\%$

- Step D: Using Figure 1, find the intersection point of V_A (400vph) and the percentage found in Step C (20%).
- Step E: Determine the location of the point found in Step D relative to the 60 mph design speed curve. If the intersection point lies above or to the right of the curve then a right-turn lane is warranted based on volumes. If it lies below or to the left of the curve then a right-turn lane is not warranted based on volumes. In this case, the intersection point of V_A (400vph) and 20% lies above the 60mph design speed curve on Figure 1 and, therefore, a right-turn lane is warranted.

Example 2 below utilizes the same values as Example 1; however, this method compares the design speed of the roadway to the design speed found to be the threshold for warranting a right-turn lane. As in Example 1, Example 2 shows the same outcome; a right-turn lane is warranted.

Example 2

Determined Values as indicated above:

- Design Speed = 60mph
- Total Advancing Volume including all turning movements, $V_A = 384\text{vph}$
- Total Right-turn Volumes into the project site for the projected build out year, $V_R = 80\text{vph}$

Project Location = Agoura Hills
Build out Year = 2020

Analyze:

If an exclusive right-turn lane into the project site is warranted.

Solution:

Step A: Determine the applicable Traffic Volume Growth Factor from Table 2.

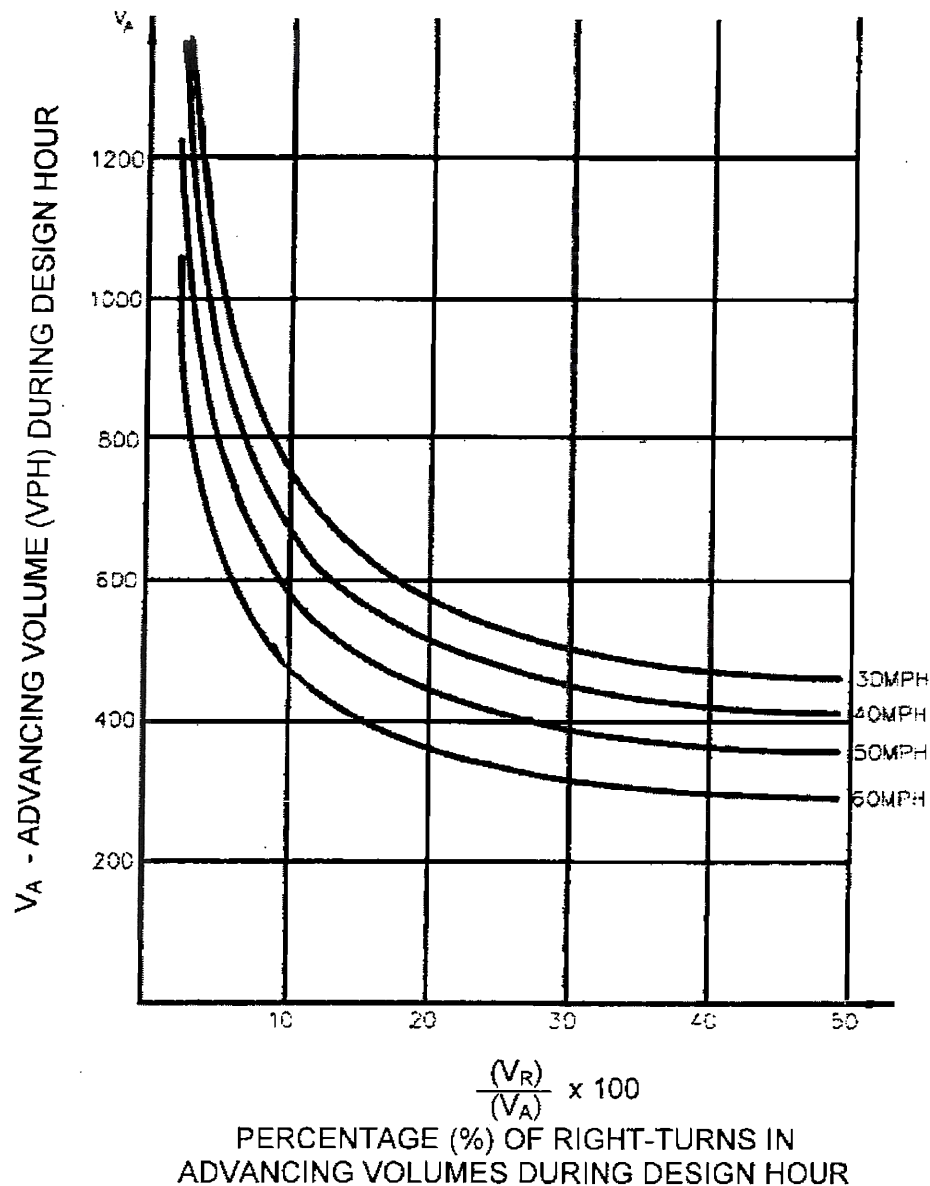
The corresponding Growth Factor from Table 2 for a build out year of 2020 in the City of Agoura Hills is 1.041.

Step B: Apply the growth factor found in Step A to the total advancing volume determined from a traffic count company.

Total Advancing Volume with ambient growth factor applied:
 $V_A = 384\text{vph} \times 1.041 = 400\text{vph}$

Step C: Calculate the percentage of right-turns in the advancing volume.
 $(V_R / V_A) \times 100 =$
 $(80\text{vph} / 400\text{vph}) \times 100 =$
 $0.20 \times 100 = 20\%$

- Step D: Using Figure 1, find the intersection point of V_A (400vph) and the percentage found in Step C (20%) and determine the corresponding “design speed curve” that applies (e.g., determine the curve that would pass through the intersection point). In this case, the corresponding design speed that would warrant a right-turn lane would be approximately 55mph.
- Step E: Compare the actual design speed of the roadway with the design speed that would warrant a right-turn lane as determined in Step D. In this case, the actual design speed of the roadway (60mph) is higher than 55mph (which is the threshold for which a right-turn lane is warranted); therefore, the project should install a right-turn lane.



Instructions:

1. The family of curves represent the design speed of the roadway as determined by the designer in Step 1C.
2. Determine the percentage (%) of right-turns (V_R) in the advancing volumes (V_A) during the design hour by dividing V_R by V_A and multiplying this value by 100. Please note V_A is the total advancing traffic volume including all turning traffic.
3. Read V_A and the percentage into the chart and locate the intersection of the two values.
4. Note the location of the point found in no. 3 above relative to the line described in no. 1 above. If the point is above or to the right of the line, then a right-turn lane is warranted based on traffic volumes. If the point is below or to the left of the line, then a right-turn lane is not warranted based on traffic volumes.

**Volume Warrant for Right-Turn Lane at Unsignalized
 Intersections on 2-lane Highways**
Figure 1

Table 2 - Traffic Volume Growth Factors

Representative City/Place	2010	Compound Annual Growth (%)	2015	Compound Annual Growth (%)	2020	Compound Annual Growth (%)	2025	Compound Annual Growth (%)	2030	Compound Annual Growth (%)	2035
Agoura Hills	1,000	0.40	1,020	0.41	1,041	0.21	1,052	0.21	1,063	0.22	1,075
Santa Clarita	1,000	2.75	1,145	2.43	1,291	0.87	1,348	0.83	1,405	0.78	1,461
Lancaster	1,000	3.95	1,214	3.29	1,427	3.27	1,676	2.80	1,924	2.45	2,172
Palmdale	1,000	2.55	1,134	2.24	1,267	1.47	1,363	1.36	1,458	1.27	1,553
Angeles Forest	1,000	2.85	1,151	2.48	1,301	1.39	1,394	1.30	1,487	1.22	1,580
West S.F. Valley	1,000	0.53	1,027	0.52	1,054	0.26	1,068	0.28	1,083	0.26	1,097
Burbank	1,000	0.48	1,024	0.48	1,049	0.27	1,063	0.26	1,077	0.28	1,092
Sylmar	1,000	0.48	1,024	0.48	1,049	0.42	1,071	0.41	1,093	0.38	1,114
Malibu	1,000	0.53	1,027	0.52	1,054	0.40	1,075	0.39	1,096	0.38	1,117
Santa Monica	1,000	0.28	1,014	0.27	1,028	0.19	1,038	0.21	1,049	0.19	1,059
West/Central L.A.	1,000	0.14	1,007	0.14	1,014	0.20	1,024	0.19	1,034	0.19	1,044
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Pomona	1,000	1.57	1,081	1.44	1,161	0.49	1,190	0.48	1,219	0.47	1,248

Volume Evaluation Outcome Based on Nomograph shown in Figure 1:

Is a Right-Turn Treatment Warranted?	Action To Be Taken
No	No action required, Installation of a Exclusive Right-Turn Lane on the fronting roadway is not necessary
Yes	Exclusive Right-Turn Lane should be installed on the fronting roadway

Section 3 Project Implementation

This section establishes the procedures and process for the planning and evaluation of implementation of right-turn lanes for private developments fronting a two-lane rural highway.

a) Tentative Map Review and Plot Plan Review

All proposed subdivisions and plot plans will be reviewed by Public Works' Land Development Division, Road and Grading Section, for adherence to the right-turn lane implementation criteria established in these guidelines. The applicant is, however, responsible for coordinating the review with, and incorporating design criterion imposed by, any other agency including, but not limited to, the Department of Regional Planning and the County of Los Angeles Fire Department.

All Conditions of Approval related to right-turn lanes at private developments will be prepared in accordance with these guidelines.

The applicant shall be responsible for preparing and submitting the appropriate engineering plans, studies, and/or analyses to allow adequate review in accordance with these guidelines by Public Works staff. In addition, the applicant shall bear the entire cost associated with the preparation of said plans/documents as well as depositing any necessary funds to allow Public Works' staff to recover the actual costs of review.

b) Final Engineering

Should a right-turn lane be required of a project, conditions of approval will be prepared accordingly and the applicant will be 100 percent responsible for submitting the appropriate final engineering plans. All plans shall be prepared by a licensed Civil Engineer.

Street Improvement Plans and Striping Plans associated with the implementation of right-turn lanes at private driveways will be reviewed by the Land Development Division, Road and Grading Section. Grading plans associated with subdivisions and Conditional Use Permits (CUP) will also be reviewed by the Land Development Division, Road and Grading Section. However, grading plans associated with single-lot developments (other than CUPs) will be reviewed by the applicable Building and Safety district office. Plan check fees for road, striping, and grading plans will be based on fee schedules in effect at the time of submittal.

Should additional pavement be necessary to implement a right-turn lane, a soils report or materials test may be needed to adequately analyze the pavement structural sections. Any proposed structural section is subject to approval by Public Works' Geotechnical and Materials Engineering Division, Soils and Geology Section. It is also the applicant's responsibility to verify the adequacy of the existing road right of way to accommodate any needed improvements and to acquire, prior to tentative map approval (for subdivision related projects), any additional right of way required to implement the right-turn lane.

The applicant shall be solely responsible for submitting, coordinating, and processing each applicable plan review through each reviewing division/section.

c) Construction

It is the responsibility of the applicant to apply for and obtain the necessary encroachment permits for any required work within the public right of way and to pay all applicable fees prior to permit issuance.

Section 4 Acknowledgements

Document Preparation Team

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