

*Circulation Assessment Permit Traffic Study*

*For*

*800 Magnolia Avenue Reuse  
City of Larkspur*

*Submitted to  
The City of Larkspur*

*Submitted by  
Dowling Associates, Inc.*

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## **INTRODUCTION**

Dowling Associates, Inc. was retained to conduct a Circulation Assessment Permit traffic analysis for a proposed project at 800 Magnolia Avenue, Larkspur, California. This report meets the requirements of the City's CAP guidelines. The CAP study guidelines and required findings were adopted by the City of Larkspur in June 1994. In accordance with section 18.14.050 of the city code, a CAP study is required for this project.

The scope of work for this traffic study is defined under section 18.14.070 of the city code. The traffic analysis methods stipulated within the City's Circulation Assessment Permit Code Chapter 18.14 were used throughout this study. Intersection levels of service were calculated using the methods found in the 2000 and 1994 Highway Capacity Manuals. Institute of Transportation Engineers, *Trip Generation, and 7th Edition* was used to determine daily, AM and PM peak hour traffic generated by the project.

A traffic model was created for the study area so that the AM and PM peak hour levels of service could be determined at each of the analysis intersections under a number of growth scenarios. These scenarios include: existing, with and without project, and cumulative (build-out of the City current policy) with and without project.

## **CIRCULATION ASSESSMENT PERMIT (CAP)**

The City code includes specific criteria to be used to determine if a project can qualify for a Circulation Assessment Permit (CAP). The criteria can be found under City code 18.14.050. It should be noted that a General Plan amendment will need to be adopted to permit the proposed land use at the site. This study assumes the approval of the General Plan amendment. Six finding options are listed. Of these, the following finding, from City code Section 18.14.100, should be made:

- *18.14.100 D – The agreement by the project sponsor to provide the project specific system improvements as may be required by the City and to pay traffic impact fees as described in Chapter 18.15 which will provide the project's proportionate share of the funds necessary to construct the transportation improvements as shown on the programmed transportation improvement list will adequately mitigate the project's adverse impacts.*

**Code Section 18.14.100 D**

In consultation with the City Traffic Consultant, the following intersections were identified as those where the project may produce the impacts cited under the City code.

1. Magnolia Avenue at Doherty Drive
2. Magnolia Avenue at Bon Air Road
3. Magnolia Avenue at Skylark Drive
4. Magnolia Avenue at Murray Drive
5. Magnolia Avenue at Frances Avenue
6. Magnolia Avenue at Estelle Avenue
7. Bon Air Road at South Eliseo Drive
8. Bon Air Road at Sir Francis Drake Boulevard

**Peak Hour Traffic Volumes**

As part of this study, two sources of traffic counts were used to establish the intersections turning movement volumes at each location. For all of the PM peak-hour, the City Traffic Consultant provided traffic counts. Wiltec (an independent traffic counting consulting firm) conducted new traffic counts for the AM and PM peak hour at two locations: Magnolia Avenue at Bon Air Road and Bon Air Road at Sir Francis Drake Boulevard. The new counts were compared to the data from the City and it was agreed to use the new counts at Magnolia Avenue and Bon Air Road and the City's counts at all of the other locations.

For the AM peak hour turn movements, the PM peak hour volumes were revised at all locations except for Magnolia Avenue at Bon Air Road where the new counts were used. The only adjustment made to the counts was at Magnolia Avenue at Frances Avenue, where the northbound through movement volume was reduced by 100 vehicles to better match new counts at Bon Air Road. These adjustments were made in consultation with the City Traffic Consultant.

**PROJECT DESCRIPTION**

The proposed project is the relocation of the existing Corbet's Hardware store at 1155 Magnolia Avenue to the northwest corner of Magnolia Avenue and Bon Air Road. The new Hardware store would occupy 6,802 gross square feet and is projected to generate 350 daily, 8 AM and 33 PM peak hour trips. The proposed project would modify the existing building by adding 490 gross square feet for a total 6,802 gross square feet of Hardware store use.

To insure a conservative analysis, no reduction in the background existing or cumulative traffic volumes was applied as part of the existing hardware store relocation. The existing site can be occupied by another retail use, which is assumed for this study, to generate, at minimum, the current traffic levels from the existing hardware store.

Access is taken at two existing driveways which are shared with 5 Bon Air Road. One driveway is located on Bon Air Road while the other is on Magnolia Avenue. Magnolia Avenue is a divided roadway with a solid median. Therefore, vehicles cannot turn left from the driveway onto Magnolia Avenue. Further, Bon Air Road has a solid median between the most easterly access to the site and Magnolia Avenue. Therefore, vehicles using the first driveway at the site east of Magnolia Avenue cannot make a left turn. The second driveway on Bon Air Road does accommodate all turn movements.

## **METHODOLOGY**

The City of Larkspur code suggests the use of the Transportation Research Board Circular 212 – Interim Materials on Highway Capacity, January 1980 to determine v/c ratios. Circular 212 calculates level of service using the critical movement method. The transportation profession has found that the level of service calculated using this method does not accurately simulate actual conditions observed in the field. This finding has led to the update of the *Highway Capacity Manual* and the adoption of average vehicle delay rather than critical movement as a more appropriate and accurate method for determining intersection performance.

At the direction of the City Traffic Consultant, this study used the procedures found in the 2000 Highway Capacity Manual to evaluate the effectiveness of the recommended mitigation measures needed to insure LOS D or better conditions at signalized intersections. For unsignalized intersections, where the acceptable intersection level of service is C or better, the 1994 Highway Capacity Manual procedures were used. The City Traffic Consultants believes that the underlying capacity assumptions applied in the 1994 Highway Capacity Manual provide more accurate results for the peak hour intersection level of service in the City of Larkspur.

### **Level of Service Definitions**

Table 1 describes the various levels of service categories and defines the ranges for each level of service. The values for delay represent the average delay per vehicle in seconds.

Table 1- Level of Service Definitions

LOS	Delay	Signalized Average Delay (sec)	Unsignalized Average Delay (sec)
A	Very slight or no delay. If signalized, conditions are such that no approach phase is fully utilized by traffic and no vehicle waits longer than one red indication.	≤10	≤5
B	Slight delay. If signalized, an occasional approach phase is fully utilized.	>10 and ≤20	>5 and ≤10
C	Acceptable delay. If signalized, a few drivers arriving at the end of a queue may occasionally have to wait through one signal cycle.	>20 and ≤35	>10 and ≤20
D	Tolerable delay. Delays may be substantial during short periods, but excessive back ups do not occur.	>35 and ≤55	>20 and ≤30
E	Intolerable delay. Delay may be great--up to several signal cycles.	>55 and ≤80	>30 and ≤45
F	Excessive delay	>80	>45

Source: Transportation Research Board. Highway Capacity Manual, 2000 and 1994.

**EXISTING CONDITIONS**

Table 2 details the AM and PM peak hour levels of service at each of the analysis locations. All other intersections operate at LOS C or better. Therefore, no mitigation measures are required at either the signalized or unsignalized intersections. The levels of service calculation sheets are included in the technical appendix to this report.

Table 2- Existing Levels of Service

Intersection	Control	AM Peak Hour	PM Peak Hour
Magnolia Avenue at Doherty Drive	Signal	C (22.8)	C (28.5)
Magnolia Avenue at Bon Air Road	Signal	C (20.1)	B (18.2)
Magnolia Avenue at Skylark Drive	All-way Stop	B (6.5)	B (8.7)
Magnolia Avenue at Murray Avenue	Two-way Stop	B (7.8)	B (9.2)
Magnolia Avenue at Frances Avenue	All-way Stop	B (8.2)	C (15.0)
Magnolia Avenue at Estelle Avenue	All-way Stop	C (19.6)	C (15.5)
Bon Air Road at South Eliseo Drive	Signal	B (19.7)	C (21.8)
Bon Air Road at Sir Francis Drake Boulevard	Signal	C (25.4)	C (25.8)

Source: 2000 Highway Capacity Manual (signal) and 1994 Highway Capacity Manual (stop controlled)  
 – Dowling Associates, Inc.

## **PROJECT TRAFFIC IMPACTS**

This section presents the impacts of the project traffic on the surrounding street system and at each of the analysis intersections.

### **Trip Generation**

The Institute of Transportation Engineers (ITE) has developed traffic generation rates for a wide variety of land uses. The ITE publication, *Trip Generation, 7<sup>th</sup> Edition* is required by City of Larkspur code to be used to determine the daily, AM and PM peak hour traffic generated by the project. ITE land use code 816 was used for the Hardware use. The trip generation rates for the Hardware use follow:

- *Hardware Store - ITE code 816 - daily = 51.29 trips/ksf (1,000 gross square feet), AM peak hour = 1.08 trips/ksf, and PM peak hour = 4.84 ksf.*

On a daily basis, the project will generate about 350 trips. During the AM peak hour, the project would generate about 8 trips. During the PM peak hour, the project would generate 33 trips.

The site has been approved for an office use. The office use would generate 70 daily and 10 AM and PM peak hour trips; Therefore, the net new number of trips being added by the proposed project is 280 addition daily, 2 less AM and 23 additional PM peak hour trips. For the purposes of this analysis, no reduction in trips was applied. As a result, the impacts cited in this report, for the project, are slightly overstated.

### **Pass-By Trips**

There are instances when the total number of trips generated by a site is different from the amount of new traffic added to the street system by the generator. For example, retail-oriented developments such as the proposed Hardware Store often locate adjacent to busy streets in order to attract motorists already on the street. These sites attract a portion of trips from traffic passing the site on the way from an origin to an ultimate destination. These retail trips may not add new traffic to the adjacent street system. The trips attracted from traffic passing the site on an adjacent street are called pass-by trips.

The Institute of Transportation Engineers, *Trip Generation Handbook, 2<sup>nd</sup> Edition*, page 41, cites an average pass-by rate of 25% for the weekday PM peak period. No data is reported for the AM peak period. Therefore, the resultant number of project generated PM peak hour trips to the adjacent street system would be 25 new trips, which is an increase of 15 trips over the approved use. The office use does not have a pass-by trip component.

**Trip Distribution**

Traffic from the project was assigned to the surrounding street system based upon the existing traffic patterns in the area. Table 3 details the traffic patterns used for this study.

Table 3- Traffic Patterns for Project Land Uses

Origin or Destination of Trips	Hardware
North on Magnolia Avenue	35%
South on Magnolia Avenue	40%
East on Sir Francis Drake	15%
West on Sir Francis Drake	10%

Source: Dowling Associates, Inc.

**Existing Plus Project Impacts**

The addition of the AM and PM peak hour traffic generated by the project to existing traffic levels will exacerbate the delays at each of the analysis locations. However, no additional impacts will result from the addition of project traffic at the analysis intersections. Table 4 details the levels of service for both the existing and existing plus project conditions. The levels of service calculation sheets are included in the technical appendix to this report.

Table 4- Existing Plus Project Levels of Service (before mitigation)

Intersection	Existing Condition		Existing Plus Project	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Magnolia Avenue at Doherty Drive (1)	C (22.8)	C (28.5)	C (22.8)	C (28.6)
Magnolia Avenue at Bon Air Road (1)	C (20.1)	B (18.2)	C (20.2)	B (18.5)
Magnolia Avenue at Skylark Drive (2)	B (6.5)	B (8.7)	B (6.5)	B (8.8)
Magnolia Avenue at Murray Avenue (2)	B (7.8)	B (9.2)	B (7.8)	B (9.3)
Magnolia Avenue at Frances Avenue (2)	B (8.2)	C (15.0)	B (8.3)	C (15.4)
Magnolia Avenue at Estelle Avenue (2)	C (19.6)	C (15.5)	C (19.7)	C (15.9)
Bon Air Road at South Eliseo Drive (1)	B (19.7)	C (21.8)	B (19.7)	C (21.9)
Bon Air Road at Sir Francis Drake Boulevard (1)	C (25.4)	C (25.8)	C (25.4)	C (25.9)

Source: 2000 Highway Capacity Manual (signal) and 1994 Highway Capacity Manual (stop controlled)  
 – Dowling Associates, Inc.

- (1) = signalized intersection
- (2) = unsignalized intersection

**Mitigation Measures – Existing Plus Project Condition**

No mitigation measures are required for the existing plus project condition as all intersections operate at acceptable levels of service.

**DAILY TRAFFIC CONDITIONS**

To estimate daily traffic along Magnolia Avenue, the PM peak hour traffic volumes were divided by 10%. Table 5 shows the results of applying this factor to the existing and existing plus project peak hour volumes. The project is expected to increase daily traffic on Magnolia Avenue south of Bon Air Road.

Table 5 - Two-Way Daily Traffic Volumes

Roadway Segment	Existing	Existing Plus Project	Project Contribution	Percent Change
Magnolia Avenue				
North of Bon Air Road	12,360	12,420	60	0.49
South of Bon Air Road	17,460	17,590	130	0.74
Bon Air Road				
West of Sir Francis Drake Boulevard	19,500	19,590	90	0.46
Sir Francis Drake Boulevard				
West of Bon Air Road	36,240	36,280	40	0.11
East of Bon Air Road	36,220	36,270	50	0.14

*Source: Dowling Associates, Inc.*

**PERMITTED USE IMPACTS**

The site has been approved for a general office use. The existing building has 6,312 gross square feet. This use would generate 70 daily, 10 AM and 10 PM peak hour trips. The impacts of the permitted use under existing plus project condition are similar to those of the proposed project. Given that the peak hour traffic from the permitted use is less than for the project, the amounts of delay at each analysis intersection are slightly better. No additional significant impacts are produced with the proposed project.

**CUMULATIVE TRAFFIC CONDITIONS**

The City of Larkspur traffic consultant provided Dowling Associates, Inc. with traffic projections at all of the analysis intersections for the PM peak hour condition. These

projections included traffic generated from growth within the City and the Ross Valley. The City only evaluated the PM peak hour condition for the cumulative analysis. The AM peak hour cumulative condition has been found to be less significant than the afternoon PM peak hours. However, the CAP requires an assessment of both the AM and PM peak hour conditions. To create the AM peak hour conditions, the existing PM peak hour and projected future growth intersection turning movement volumes were reversed (for example, the PM peak hour northbound right turn volume was reassigned as the AM eastbound left turn volume) at each of the analysis intersections.

**Cumulative Without Project**

Under the cumulative without project condition, two unsignalized intersections operate at unacceptable LOS. These include: Magnolia Avenue at Estelle Avenue (AM and PM peak hour), and Magnolia Avenue at Frances Avenue (PM peak hour). Table 6 details the AM and PM peak hour levels of service for the cumulative without project condition. The levels of service calculation sheets are included in the technical appendix to this report.

Table 6- Cumulative Without Condition

Intersection	AM Peak Hour	PM Peak Hour
Magnolia Avenue at Doherty Drive (1)	C (25.2)	D (40.3)
Magnolia Avenue at Bon Air Road (1)	C (20.9)	C (20.6)
Magnolia Avenue at Skylark Drive (2)	B (9.5)	C (15.0)
Magnolia Avenue at Murray Avenue (2)	C (10.2)	C (12.3)
Magnolia Avenue at Frances Avenue (2)	C (12.9)	D (26.5)
Magnolia Avenue at Estelle Avenue (2)	E (36.0)	D (24.0)
Bon Air Road at South Eliseo Drive (1)	B (19.9)	C (22.6)
Magnolia Avenue at Doherty Drive (1)	C (31.0)	C (30.0)

Source: 2000 Highway Capacity Manual (signal) and 1994 Highway Capacity Manual (stop controlled)

– Dowling Associates, Inc.

(1) = signalized intersection

(2) = unsignalized intersection

**Mitigation Measures – Cumulative Without Project Condition**

To mitigate this condition, a traffic signal would normally be constructed at each location. The City’s Capital Improvement Program includes the installation of a traffic signal at each of the impacted intersections. Table 7 shows the resultant peak hour levels of service if a signal is installed at each location.

Table 7 - Mitigated Cumulative Levels of Service

Intersection	Cumulative Condition	
	AM Peak Hour	PM Peak Hour
Magnolia Avenue at Frances Avenue	A (1.9)	A (2.4)
Magnolia Avenue at Estelle Avenue	A (3.6)	A (3.3)

Source: 2000 Highway Capacity Manual – Dowling Associates, Inc.

### Cumulative With Project

When the traffic generated by the project is added to the background cumulative condition, the same two unsignalized intersections operate at unacceptable LOS. No additional impacts would occur at any of the analysis intersections. Table 8 details the AM and PM peak hour levels of service for the cumulative with project condition. The levels of service calculation sheets are included in the technical appendix to this report.

Table 8- Cumulative With Project Condition

Intersection	Cumulative Condition		Cumulative Plus Project	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Magnolia Avenue at Doherty Drive (1)	C (25.2)	D (40.3)	C (25.2)	D (40.6)
Magnolia Avenue at Bon Air Road (1)	C (20.9)	C (20.6)	C (21.0)	C (20.8)
Magnolia Avenue at Skylark Drive (2)	B (9.5)	C (15.0)	B (9.5)	C (15.5)
Magnolia Avenue at Murray Avenue (2)	C (10.2)	C (12.3)	C (10.3)	C (12.5)
Magnolia Avenue at Frances Avenue (2)	C (12.9)	D (26.5)	C (12.9)	D (27.2)
Magnolia Avenue at Estelle Avenue (2)	E (36.0)	D (24.0)	E (36.2)	D (24.6)
Bon Air Road at South Eliseo Drive (1)	B (19.9)	C (22.6)	B (19.9)	C (22.6)
Magnolia Avenue at Doherty Drive (1)	C (31.0)	C (30.0)	C (31.1)	C (30.1)

Source: 2000 Highway Capacity Manual (signal) and 1994 Highway Capacity Manual (stop controlled) – Dowling Associates, Inc.

- (1) = signalized intersection
- (2) = unsignalized intersection

### Mitigation Measures – Cumulative With Project Condition

To mitigate this condition, a traffic signal would normally be constructed at each location. The City’s Capital Improvement Program includes the installation of a traffic

signal at each of the impacted intersections. Table 9 shows the resultant peak hour levels of service if a signal is installed at each location.

Table 9 - Mitigated Cumulative Levels of Service

Intersection	Cumulative Condition	
	AM Peak Hour	PM Peak Hour
Magnolia Avenue at Frances Avenue	A (1.9)	A (2.4)
Magnolia Avenue at Estelle Avenue	A (3.6)	A (3.3)

Source: *2000 Highway Capacity Manual* – Dowling Associates, Inc.

**Cumulative Impacts of Permitted Use**

A cumulative traffic assessment was also conducted for the permitted alternative. No additional impacts beyond those identified for the project would occur. Therefore, no additional mitigation is needed. Detailed level of service calculation sheets are available upon request.

**SUMMARY OF FINDINGS AND RECOMMENDATIONS**

The proposed project would result in 15 additional PM peak hour trips, beyond the approved office use, on the surrounding street system. The proposed project will not cause any significant impacts under existing plus project conditions. In the future, under the cumulative without-project condition, two stop-controlled intersections will operate at levels of service worse than the City’s standard of LOS C. These intersections are: Magnolia Avenue at Estelle Avenue and Magnolia Avenue at Frances Avenue. When the proposed project traffic is added to the background cumulative condition, these intersections will experience a slight increase in delay. However, no additional impacts will occur. The City’s Capital Improvement Program includes the signalization of both intersections. With the installation of new signals both intersections operate at acceptable levels of service during the AM and PM peak hour. With implementation of the City’s Traffic Impact Fee program for this project, the project would contribute to the costs of these signals.

**APPENDICES**

A comprehensive technical appendix that includes all of the worksheets for the level of service calculations cited within this report is available for review at the City of Larkspur Planning Department