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Lamorinda Transportation Improvement Program

Draft
Lafayette Downtown Feasibility Study

Prepared for the
City of Lafayette

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I. Introduction

This report is the initial phase of the Lafayette Downtown Feasibility Study (DFS) as required by the Lamorinda Traffic Study (LTS) Transportation Improvement Program (TIP). This phase of the DFS is intended to identify and evaluate those transportation improvements that are consistent with the goals and policies of the revised General Plan and that would provide a significant transportation service for downtown Lafayette.

The DFS is described in the final report of the LTS as the first step in a "Feasibility study and preliminary engineering of a project to reduce traffic congestion in downtown Lafayette through the Moraga Road / Mt. Diablo Boulevard intersection"[1]. This phase of the DFS is a planning level feasibility study. That is, potential transportation improvements are evaluated at a planning level for consistency with the goals and policies of the General Plan and for their potential to improve the transportation system relative to costs. Those improvements that appear to be worthy of further study based on the results of this analysis are recommended to undergo the next phase of project development and preliminary engineering. Transportation improvements that do not appear to meet the requirements of the planning level criteria used in this report are not recommended for further consideration by the City.

The next step in the project development process is the review and approval of the recommendations made in this report by the Lafayette City Council and by the Lamorinda Project Management Committee (LPMC). Those improvement projects that are approved by the City and by the LPMC would be submitted to the Southwest Area Transportation Planning Committee (SWAT) and to the Contra Costa Transportation Authority (CCTA) to be included in the Measure C *Strategic Plan*. The City would then apply for use of Measure C Gateway / Lamorinda funds to prepare preliminary and final engineering and to implement the recommended transportation system improvements.

This report is organized as follows. Following this introduction is an evaluation of the existing traffic conditions found in central Lafayette in 1997. Criteria for the evaluation and ranking of transportation projects is provided in third section of the report. The identification and evaluation of roadway improvement projects is presented in the fourth major section of this report. The report concludes with a comparison of the improvement projects studied and recommendations for those projects that should be included in the Measure C *Strategic Plan*.

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[1] Lamorinda Traffic Study -- Final Report, *Transportation Improvement Program*, August 1, 1994, Table 1, page 9.

II. Evaluation of Existing Conditions

In order to determine the current traffic conditions throughout Lafayette, existing traffic was counted at all signalized intersections for both morning and afternoon peak hour conditions. Intersections on important traffic corridors that are not currently signalized were also counted to determine where new traffic signals may be warranted. Several of the signalized intersections counted to establish the overall existing conditions in Lafayette are not in the downtown or central area of the City. In particular, the Pleasant Hill Road corridor is included in the existing traffic count base but is not part of the DFS. Pleasant Hill Road is the subject of the study known as the *Pleasant Hill Road Action Plan*. Other roadway corridors such as the Burton Valley or Deer Hill Road Corridors are studied in the environmental analysis prepared for the revised General Plan. This phase of the DFS focuses on only those intersections in the Mt. Diablo Boulevard and Moraga Road corridors.

Existing Roadway Network

The Lafayette downtown is located along Mt. Diablo Boulevard, a four lane east-west divided arterial with left turn pockets at major intersections. The downtown adjoins State Route (SR) 24, an eight lane east-west freeway with an off ramp at Oak Hill Road and an on ramp at First Street in the eastbound direction and ramps onto Deer Hill Road for westbound traffic. Oak Hill Road and First Street are four lane north-south arterials connecting Mt. Diablo Boulevard and Deer Hill Road. Deer Hill Road is a four lane undivided east-west arterial north of SR 24. The areawide street network is shown on Figure 1.

Traffic to and from the south of downtown is served by Moraga Road, a four lane undivided arterial from its intersection with Mt. Diablo Boulevard to St. Marys Road. South of St. Marys Road Moraga Road is a two lane undivided arterial. The available right-of-way on Moraga Road does not allow for separate left turn lanes at important intersections. Moraga Road intersects Mt. Diablo Boulevard between the Oak Hill Road and First Street intersections.

The core of the downtown is defined by the Lafayette "Y". The legs of the "Y" are Oak Hill Road on the northwest, First Street on the northeast and Moraga Road on the south. Mt. Diablo Boulevard connects the three legs of the "Y" together. The Lafayette "Y" and the Moraga Road Corridor are shown on Figure 1.

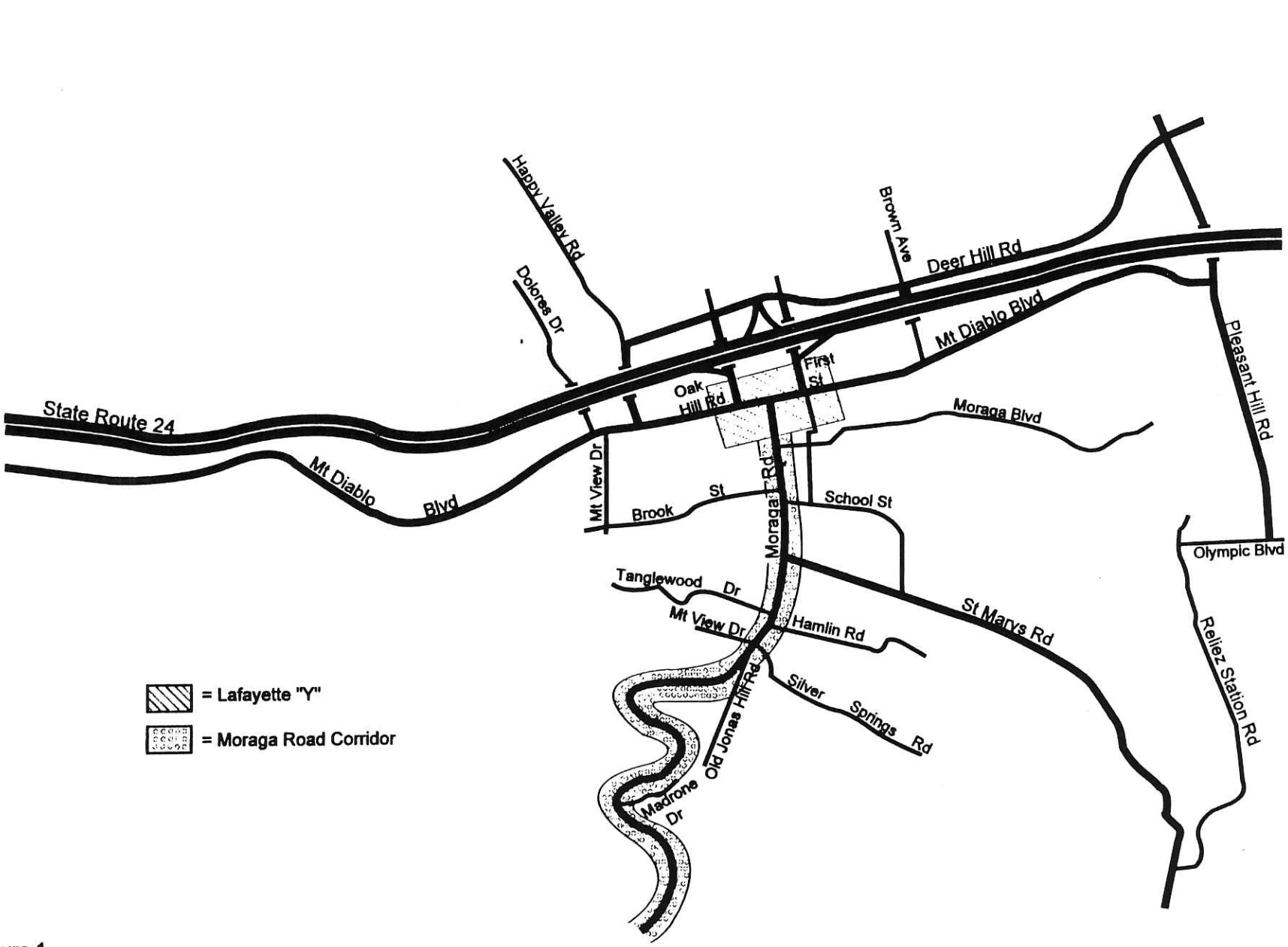

Figure 1

Area Wide Street Network

Level of Service

The best measure of how well an urban street system is working is to determine the amount of congestion or delay experienced by motorists at important intersections. The quality of traffic movement is reported in terms of Level of Service (LOS) ranging from a letter grade of A to a grade of F. At LOS A an intersection experiences little or no congestion while LOS E and F indicate long and unacceptable delays for drivers. A description of LOS is given in Table 1.

Table 1
DESCRIPTION OF INTERSECTION LEVEL OF SERVICE

Signalized Intersections

Level of Service	HCM (1) Vehicle Delay (Seconds)	CCTA (2) Volume to Capacity Ratio	Description
A	0 - 5.0	0.00-0.59	Free Flow - Insignificant Delays.
B	5.1-15.0	0.60-0.69	Stable Operation - Minimal Delays.
C	15.1-25.0	0.70-0.79	Stable Operation - Acceptable Delays.
D	25.1-40.0	0.80-0.89	Approaching Unstable Operation
E	40.1-60.0	0.90-0.99	Unstable Operation - Significant Delays.
F	>60.0	>1.00	Forced Flow - Excessive Delays.

Stop Sign Controlled Intersections

Level of Service	HCM (1) Vehicle Delay (Seconds)	Description
A	0 - 5.0	Little or no delay.
B	5.1-10.0	Short traffic delay.
C	10.1-20.0	Average traffic delay.
D	20.1-30.0	Long traffic delay.
E	30.1-45.0	Very long traffic delays.
F	>45.0	Excessive traffic delays.

Sources: 1 - HCM = Highway Capacity Manual. Transportation Research Board, 3rd Edition 1994.
2 - CCTA = Contra Costa Transportation Authority. Modified TRB Circular 212 1980.

The CCTA requires the use of the Volume to Capacity (V/C) Ratio method to determine LOS at signalized intersections. This method is described in the Transportation Research Board, Circular 212, dated January 1980. The CCTA procedures use a modified Circular 212 method. The method relies on a comparison of the critical traffic turning movements in an intersection with the capacity of the intersection to serve these movements. As shown in Table 1, a LOS letter grade is established based on the V/C ratio that is found for the intersection under study.

The most recent Highway Capacity Manual (HCM), 1994 Edition, describes a different procedure to determine LOS at signalized intersections. The HCM procedures use the average stopped delay at an intersection to define the appropriate LOS letter grade. The HCM delay criteria are also shown on Table 1.

This report uses both the CCTA methods and the HCM methods for all of the signalized intersections studied. As is shown below by the results of these studies, the CCTA LOS calculation method tends to underestimate the congestion found at the intersections in downtown Lafayette. The revised General Plan recommends the use of both CCTA and HCM methods in order to fulfill the requirements of the CCTA and to have a reliable locally developed LOS procedure.

LOS for unsignalized intersections is also based on the average stopped delay experienced by motorists. As shown on Table 1, the delay allowed at stop sign controlled intersections tends to be less for most letter grades as compared to the delay defined for each signalized intersection LOS letter grade. This is explained by the reasoning that drivers expect less traffic congestion and delay at unsignalized intersections and thus the LOS standards for these intersections should be higher as compared to signalized intersections.

The Lafayette standards for LOS are established in the recommended revised General Plan as shown in Table 2. The LOS standards and Volume to Capacity (V/C) Ratios are consistent with the requirements of the CCTA Measure C Growth Management Program. The time of stopped delay is based on the HCM procedures to calculate LOS and provides Lafayette with a more realistic procedure to measure intersection delay in the downtown core.

Table 2
Revised General Plan Level of Service Standards

Location of Intersection	LOS Standard	CCTA Volume to Capacity Ratio	HCM Stopped Delay at Peak Hours
Downtown Core: Lafayette "Y"	E	0.90 to 0.94	40 to 60 Seconds
Other Downtown Intersections	D	0.85 to 0.90	33 to 40 Seconds
Intersections Outside Downtown	D	0.80 to 0.84	25 to 33 Seconds

Source: GPAC Recommended Preferred Plan Alternative, May 18, 1994, Page 7.

Existing Level of Service

Existing LOS for all signalized intersections and for important unsignalized intersections is shown in Table 3. LOS is reported for the peak morning and afternoon traffic hours. Peak 15 minute traffic counts are used to develop peak hour data. Counts are adjusted for right turns on the red portion of the traffic signal phasing where appropriate. The LOS calculation worksheets are provided in an Appendix to this report under separate cover.

From the LOS results shown on Table 3 it is apparent that there are two areas in Lafayette where existing traffic congestion is unacceptable or approaches unacceptable conditions. These are on Pleasant Hill Road and in the downtown core, the Lafayette "Y". Some delay is experienced in other areas, primarily at unsignalized intersections, but the greatest traffic problems are located in the core of the downtown and on Pleasant Hill Road. As described above, this report is intended to study the projects that may be able to relieve the problem in the downtown area and along Moraga Road. Pleasant Hill Road is studied in the Pleasant Hill Road Action Plan. Other areas of the City are analyzed in the General Plan and in the environmental impact report on the Plan.

Table 3
Existing Intersection Level of Service (LOS)

Intersection	AM Peak Hour HCM Method LOS	AM Peak Hour HCM Method Delay (1)	AM Peak Hour CCTA Method LOS	AM Peak Hour CCTA Method V/C (2)	PM Peak Hour HCM Method LOS	PM Peak Hour HCM Method Delay (1)	PM Peak Hour CCTA Method LOS	PM Peak Hour CCTA Method V/C (2)
Downtown Area								
Mount Diablo Blvd with:								
1 - Dolores/Mt View Drive	B	14	A	0.39	C	21	A	0.55
2 - Happy Valley Road	C	18	A	0.39	C	24	B	0.64
3 - Oak Hill Road	C	21	A	0.54	D	32	B	0.65
4 - Moraga Road	E	41	B	0.66	E	43	C	0.78
5 - First Street	C	23	C	0.71	C	19	A	0.55
6 - Second Street	B	12	A	0.36	B	12	A	0.31
Pleasant Hill Road Corridor								
Pleasant Hill Road with:								
7 - Mt. Diablo Blvd	B	13	A	0.40	B	15	B	0.62
8 - Olympic Boulevard (4)	C	12	(3)	(3)	C	18	(3)	(3)
9 - Deer Hill Rd/Stanley Blvd.	F	70	F	1.15	E	53	F	1.10
10 - Spring Hill Road	D	36	F	1.10	D	28	F	1.28
11 - Reliez Valley Road	B	10	B	0.65	B	10	D	0.82
Deer Hill Road Corridor								
Deer Hill Road with:								
12 - Happy Valley Road (5)	A/F	2/>60	(3)	(3)	A/C	3/10	(3)	(3)
13 - Oak Hill Road (4)	C	12	(3)	(3)	D	25	(3)	(3)
14 - SR 24 Westbound Ramps (4)	E	35	(3)	(3)	D	23	(3)	(3)
15 - First Street	B	11	A	0.43	B	13	A	0.55
Moraga Road Corridor								
Moraga Road with:								
16 - Moraga Boulevard (5)	C/F	18/>60	(3)	(3)	B/F	9/>60	(3)	(3)
17 - School/Brook Streets	D	32	C	0.75	C	16	A	0.59
18 - St. Marys Road	B	14	C	0.74	B	13	B	0.63
19 - Tanglewood/Hamlin(5)	B/D	6/27	(3)	(3)	B/E	7/43	(3)	(3)
25 - Silver Springs/Mt.View Dr. (5)	B/E	6/40	(3)	(3)	B/D	5/28	(3)	(3)
Burton Valley Corridor								
Reliez Station Road with:								
20 - Olympic Boulevard (4)	C	15	(3)	(3)	C	20	(3)	(3)
21 - Glenside Drive (4)	D	24	(3)	(3)	D	29	(3)	(3)
Glenside Drive with:								
22 - Burton Valley Drive (4)	D	26	(3)	(3)	C	20	(3)	(3)
23 - St. Marys Road North (4)	C	13	(3)	(3)	C	15	(3)	(3)
24 - St. Marys Road South (4)	B	7	(3)	(3)	B	8	(3)	(3)

Notes:
(1) Average stopped delay per vehicle in seconds calculated using the HCS software.
(2) V/C = Volume to Capacity Ratio calculated using the CCTA approved VCCC computer software.
(3) LOS for stop sign controlled intersections not calculated using the CCTA Method.
(4) LOS and average stopped delay shown for all vehicles at these all-way stop intersections.
(5) LOS and delay shown for major street left turn and for side street traffic at these one-way or two-way stop intersections. Through traffic experiences little or no delay at these intersections.

Source: Robert L. Harrison Transportation Planning

Downtown Core - The Lafayette "Y"

The problem of traffic congestion in the downtown area is probably the most frequently mentioned traffic problem in Lafayette. The problem is compounded by the fact that not only are motorists inconvenienced by traffic delay but the vitality of the commercial area is also threatened by the congestion on downtown streets. The data presented in this report confirm the low service levels and significant delays that are experienced on the existing downtown street system.

The source of the traffic problem in the downtown area is clear enough. Local shoppers, virtually all of whom arrive by car, must compete with traffic passing through the downtown on the way to the SR 24 freeway or to the BART station. The north-south through traffic is particularly difficult to serve because of the layout of the downtown street system. The Lafayette "Y" requires that all north-south traffic must dog leg through two heavily used downtown intersections. The legs of the "Y" are Moraga Road to the south and Oak Hill Road on the northwest and First Street on the northeast. Mt. Diablo Boulevard connects the three legs of the "Y" together.

The traffic pattern formed by the "Y" means the segment of Mt. Diablo Boulevard between Oak Hill Road and First Street must carry both the north-south and east-west traffic flows. Local shopper traffic by itself would nearly fill the street system. When combined with through traffic, the total number of vehicles in the downtown area exceeds the comfortable capacity of the street system.

When significant traffic congestion exists, the ambiance of the downtown area is more like a busy traffic arterial than a thriving commercial center. Pedestrian activity, so necessary in successful downtowns, can be hazardous for those who venture to cross major intersections and frustrates motorists who find the time they must wait at intersections is extended as someone walks across a wide arterial roadway. The width of Mount Diablo Boulevard is such that it separates the two sides of the street's commercial activity into almost unrelated areas. The time needed for the pedestrian to cross the street significantly reduces the amount of time available at congested intersections for traffic movements.

As shown on Table 3, existing service level and congestion are most significant at the intersection of Mt. Diablo Boulevard and Moraga Road. Using the HCM procedures, this intersection operates at LOS E with over 40 seconds of average delay for motorists in both the morning and afternoon peak hours. Field observations at the intersection confirm there are significant queues of traffic, particularly on the eastbound and northbound approaches to the intersection, that do not clear in every cycle of the traffic signal at peak hours.

The LOS procedures of the CCTA result in a level B in the morning peak hour and level C in the afternoon peak hours at this intersection. It is clear that the CCTA methods underestimate the congestion and delay that is found at this intersection.

Using the HCM procedures, the intersection of Mt. Diablo Boulevard with Oak Hill Road operates at LOS D in the afternoon peak hour and at LOS C in the morning peak hour. The operation of this intersection is closely tied to the ability of the intersection at Moraga Road to clear all traffic in the block between the intersections. When Moraga Road does not clear the LOS at Oak Hill Road can be worse for short time periods than as shown in Table 3.

The LOS procedures of the CCTA result in service level A in the morning peak hour and service level B in the afternoon peak hour at this intersection. Again, these procedures result in LOS that is not representative of the conditions observed in the field.

The third intersection in the "Y", Mt. Diablo Boulevard at First Street, operates at LOS C in both the morning and afternoon peak hours. The CCTA methods result in LOS C for the morning peak hour and LOS A for the afternoon peak hour at this intersection.

It should be noted that while there is significant delay at the Lafayette "Y" in 1996, none of the intersections currently fail to meet the LOS standards that are recommended in the revised General Plan. There is, however, very little capacity to accommodate any traffic growth, particularly at the Moraga Road intersection. The improvements studied below for this area are intended to not only improve existing conditions but to also allow for the development of the downtown as is recommended in the revised General Plan.

Moraga Road Corridor

The Moraga Road Corridor extends from Mt. Diablo Boulevard to the southerly Lafayette city limit. The Corridor includes Moraga Road and parallel streets such as First Street that also serve to move traffic through the downtown area. Daily traffic volumes on Moraga Road range from about 13,000 at the city limit line to nearly 30,000 vehicles per day in the downtown area.

While the Corridor serves a high volume of traffic, much of the area is residential or rural in character. Of particular concern to the residents of Lafayette is the high proportion of traffic on Moraga Road that uses the Corridor to pass through the area on the way to SR 24 or to BART. The high volume of through traffic makes it difficult for residents to get onto Moraga Road from many of the residential side streets.

It is important to achieve a balance between the potentially conflicting goals of improving traffic flow and maintaining and enhancing the City's quality and sense of place. The neighborhood around Moraga Road is commercial at its intersection with Mt. Diablo Boulevard but quickly transitions to residential just south of the downtown. The maintenance of the quality of both the Downtown Core and residential neighborhoods are important goals of the General Plan.

There are two schools located in the Corridor, Lafayette Elementary School fronts Moraga Road and Stanley Intermediate School is located on School Street just east of First Street. The schools generate significant flows of pedestrian and bicycle traffic. Pedestrian and bicycle access to these schools is an issue because much of existing walkway and bike path system is undeveloped, particularly in the area from St. Marys Road to the south. The Lafayette School will undergo extensive remodeling and expansion over the next two years. The primary student drop-off area for the school after the improvements have been completed will continue to be at its present location on Moraga Road.

The ability of pedestrians to cross the high traffic volume roadway is also an issue at several locations. Safe pedestrian crossings of Moraga Road for school children need to be provided at the School and Brook Street intersections. Other locations also need safe pedestrian crossings including at Moraga Boulevard and in the area nearer to downtown. Pedestrian access is also important for the residential neighborhoods along Moraga Road.

The transportation projects recommended by the DFS for the Moraga Road Corridor are not only intended to serve the flow of traffic through the Corridor, and through the downtown area as well, but will also provide better access to the Corridor from the side streets, protect the adjacent neighborhoods from through traffic, and provide safe pedestrian and bicycle paths, particularly on the access routes to the two schools located in the Corridor.

Roadway Intersections

There are several points of traffic congestion in the Moraga Road Corridor that relate to the ability of the Lafayette street system to serve the north-south traffic through downtown Lafayette. Each location on Moraga Road where roadway improvements were recommended by the LTS is described below. In addition, the existing conditions at the intersections of Moraga Road with Silver Springs Road, Mt. View Drive and Old Jonas Hill Road are also discussed below.

Moraga Boulevard

This "T" intersection with Moraga Road is controlled by a stop sign on Moraga Boulevard. There can be long delays for traffic attempting to enter the major traffic flows from Moraga Boulevard. In both the morning and afternoon peak traffic hours the traffic on Moraga Boulevard experiences LOS F. The southbound left turn traffic from Moraga Road into Moraga Boulevard can cause delay for southbound through traffic. There is little or no delay for northbound through traffic on Moraga Road.

This intersection experiences an accident rate that warrants study to determine if improvements are needed for safety reasons. There were 50 accidents over the period from 1991 through September 30, 1996 at this intersection. Nearly half of the accidents were rear-end collisions typically caused when a vehicle has to wait for long periods in order to make a left turn into or out of Moraga Boulevard.

The accident rate for the intersection during the period 1991 through 1996 was 0.88 accidents per million vehicles (A/MV). This rate exceeds the "basic expected accident rate" for this type of intersection of 0.34 A/MV found in the statewide study of accidents by Caltrans.

Because the traffic count on the side street, Moraga Boulevard, is low, the intersection does not meet the Caltrans minimum standard for the peak hour volume traffic signal warrant. However, the need for a safe pedestrian crossing at this intersection is apparent as it is the only crossing of Moraga Road between Mount Diablo Boulevard and Brook Street.

School and Brook Streets

The intersections of Moraga Road with School and with Brook Streets are separated by approximately 150 feet. Because the two "T" intersections are located in close proximity, they function as a single four legged intersection. The existing traffic signal system has been designed to control both intersections under a single operating design.

Left turns from northbound Moraga Road onto Brook Street are prohibited from 7:00 a.m. until 4:00 p.m. Southbound left turns from Moraga Road onto School Street are permitted at all times. The left turns from Moraga Road reduce the capacity of the intersection to serve through north-south traffic.

There is a significant pedestrian crossing of Moraga Road at these intersections. The primary generators of pedestrian traffic are the Lafayette and Stanley Intermediate Schools. An adult school crossing guard is stationed at Brook Street at school arrival and dismissal hours.

As shown on Table 3, under the HCM procedures the combined intersections are found to operate at LOS D in the morning peak hour and LOS C in the late afternoon peak hour. The CCTA LOS method finds the intersection operating at service levels C and A in the morning and afternoon peak hours respectively. The average delay for north-south through traffic is about 20 seconds or less at peak hours. However, delay on the side streets is much greater.

The primary traffic delay observed at this intersection is for parents that drop-off students at Stanley Intermediate School, located approximately one quarter mile east of Moraga Road on School Street, and then have to wait at the traffic signal before entering Moraga Road in either north or southbound directions. The queue of vehicles attempting to drive onto Moraga Road extends from the intersection back past Stanley School. This traffic queue lasts for about 20 minutes each school day morning. These vehicles experience significant delay and LOS F.

Most vehicles leaving Stanley School, about 90% of the total westbound traffic, turn right onto Moraga Road. This large volume of traffic adds to the already heavy morning peak hour northbound traffic flow that causes delays at the next signalized intersection at Mt. Diablo Boulevard. The queue on Moraga Road back from Mt. Diablo Boulevard frequently extends south of Moraga Boulevard and occasionally as far south as the Lafayette School driveway.

Hamlin Road and Tanglewood Drive

The intersections of Hamlin Road and Tanglewood Drive with Moraga Road are separated by about 75 feet. A southbound left turn pocket is provided for turns from Moraga Road into Hamlin Road. Sight distances from the side streets are somewhat restricted making the turning movement onto Moraga Road difficult.

There is little or no delay for traffic on Moraga Road. Traffic turning left into Hamlin Road has a left turn pocket so it is removed from the southbound through traffic lane. Northbound left turn traffic into Tanglewood is very light and thus northbound through traffic experiences little delay.

Traffic attempting to enter Moraga Road from the side streets experiences some significant delay, particularly at morning or afternoon peak hours. LOS for traffic on Hamlin Road is D, average delay of 27 seconds, at morning peak hour and E, average delay of 43 seconds, in afternoon peak hour. The delay for side street traffic is exacerbated for short time periods by the blockage of the intersection due to the queue of northbound traffic backed up from the St. Marys Road traffic signal.

The accident rate at this intersection was 0.12 A/MV for the period between 1991 and 1996. This rate is lower than the statewide basic expected rate for this kind of roadway of 0.50 A/MV. Roadway improvements based on the recent accident data are not clearly warranted.

The traffic volumes on the side streets at this intersection are so low that the intersection does not meet the Caltrans minimum standard peak hour traffic volume traffic signal warrant.

Silver Springs Road / Mt. View Drive / Old Jonas Hill Road

Silver Springs Road is the easterly leg and Mt. View Drive is the westerly leg of a standard four legged intersection with Moraga Road. Old Jonas Hill Road intersects Moraga Road approximately 180 feet south of Silver Springs Road / Mt. View Drive intersection. The intersections are close enough, however, to be evaluated as a single intersection for traffic operations purposes.

Each of the side streets are controlled by a stop sign. Through traffic on Moraga Road does not stop at these intersections. Separate lanes are provided for both northbound and southbound left turning traffic on Moraga Road. Because left turns are provided on Moraga Road there is no delay for northbound or southbound through traffic. There is little delay for left turning traffic from Moraga Road into the side streets. However, significant delay is experienced by the traffic attempting to enter the traffic flows on Moraga Road from each of the side streets. In the morning peak hour the maximum delay for side street traffic is 40 seconds or LOS F. The afternoon peak hour delay for left turning side street traffic is 28 seconds or LOS D.

There were eight accidents recorded at this intersection in the five plus year period between 1991 and September 1996. The accident rate at this intersection for this period is 0.24 A/MV. This rate is lower than the statewide expected rate for this kind of roadway intersection of 0.50 A/MV. While the accident rate does not indicate a significant safety problem at this intersection, it is interesting to note that six of the ten recorded accidents happened at the Old Jonas Hill Road leg of the intersection. This appears to indicate that the greatest safety issue in this area is at the intersection of Old Jonas Hill Road with Moraga Road.

The acute angle formed by the intersection of Old Jonas Hill Road with Moraga Road requires extra effort by drivers to look over their left shoulders for approaching traffic.

The traffic volumes on the side streets at this intersection are just below the Caltrans minimum standard for a peak hour traffic volume signal warrant. However, because the delay for side street traffic is excessive not only at these intersections but is also unacceptable at the Hamlin Road and Tanglewood Drive intersections discussed above, a traffic signal would be useful to provide a gap in the continuous flow of northbound traffic on Moraga Road, particularly during the morning peak traffic hours.

Madrone Drive

There is no delay for traffic on Moraga Road at this intersection. The limited number of vehicles attempting to enter the traffic flow on Moraga Road from Madrone Drive experience delay and inconvenience. The sight distances for traffic on Madrone Drive is restricted adding to the problems experienced by these drivers. The existing plantings should be trimmed on a regular basis.

The existing accident record for this intersection shows a total of four accidents over the five plus year period 1991 through September 1996 or a rate of 0.16 A/MV. This compares to the statewide expected rate of 0.34 A/MV for this kind of intersection. Traffic safety does not appear to be a significant problem based on the recent accident history.

The traffic volume on Madrone Drive is significantly below the minimum Caltrans standard for the peak hour volume traffic signal warrant.

Pedestrian and Bicycle Facilities

A sidewalk and bike lanes are provided on Moraga Road from Mt. Diablo Boulevard to St. Marys Road. The bike lanes, however, are not of standard width and do not provide a fully satisfactory space to ride bicycles. A safe northbound bike lane will be built on First Street from Golden Gate Way to School Street. Southbound bicycle traffic will use the existing southbound travel lanes. This project will provide a replacement for the narrowest section of the existing bike route on Moraga Road.

South of St. Marys Road there is a pathway on the east side of Moraga Road to Silver Springs and Old Jonas Hill Road area.

Traffic signal protected pedestrian crossings of Moraga Road are provided at Mt. Diablo Boulevard, Brook Street, School Street and St. Marys Road. Unprotected crossings are provided at Plaza Drive, Moraga Boulevard and at Rosedale Avenue. In addition, two mid-block unprotected crossings are provided between Plaza Drive and Moraga Boulevard.

The unprotected pedestrian crossings can be hazardous at times of peak traffic flows. This is particularly true for the pedestrian crossing at Plaza Drive. This crosswalk is located just 150 feet south of Mt. Diablo Boulevard. Neither the motorists turning from Mt. Diablo Boulevard onto Moraga Road nor the pedestrians using the crosswalk have clear visibility of one another until the approaching vehicle has turned onto Moraga Road and the pedestrian has emerged from between the northbound vehicles stopped at the traffic signal. The location of the crosswalk provides just barely adequate space for a driver to safely stop and yield the right-of-way to the pedestrians. The LTS recommended the removal of the pedestrian crossing of Moraga Road at Plaza Drive under the Intersection Safety Component of that study.

III. DFS Project Evaluation Criteria

In response to the traffic congestion problems found to exist in the Lafayette downtown core and along Moraga Road, several transportation system improvements are studied to determine their feasibility in relieving the existing congestion. Feasibility is defined in this report as the ability of a transportation improvement to meet the requirements of the following criteria:

1. Consistency with the General Plan. The goals and policies of the draft revised General Plan in terms of impacts on the natural and built environments and on circulation system service levels are considered under this criteria.

2. Improvements in transportation service. Transportation service is measured primarily in terms of intersection Level of Service (LOS) or the impacts on average delay for motorists at key intersections.

3. Costs of the transportation improvement. The cost of each improvement is measured relative to other improvements and in terms of the funds available to construct the improvement.

The criteria are more completely described below.

General Plan Goals and Policies

The preferred revised General Plan alternative recommended by the General Plan Advisory Committee (GPAC) includes policies that shape the character and transportation capacity of any system improvements that may be recommended for construction in central Lafayette. For example, Goal T-1 states "Develop a safe and efficient circulation system for Lafayette consistent with the City's other goals related to quality of life and community character". This goal is elucidated by the following text:

"Lafayette experiences a significant amount of regionally-generated through traffic. It is important to achieve a balance between the potentially conflicting goals of improving traffic flow and maintaining and enhancing the City's quality of life and sense of place, particularly in the downtown core."

"The basic concept of the transportation plan for Lafayette is to make the existing system work as efficiently as possible. This means that the existing layout of the roadway network will not be changed. The Lafayette "Y" formed by Moraga Road, Mt. Diablo Boulevard, Oak Hill Road and First Streets will remain as it is today. ..."

"Specific intersection improvements such as an added turning lane to speed vehicles or curb bulbs to reduce pedestrian crossing times will be considered on a case-by-case basis. The overall intent of the [General Plan] Transportation Element will be to serve both vehicular and pedestrian traffic without adding any new streets or freeway connections".

In addition to specifying the limited nature of transportation improvements that would be acceptable under the General Plan, the Plan also specifies the LOS standards for signalized intersections though out the City. The LOS standards established in the recommended revised General Plan are shown above in Table 2.

The LOS standards and Volume to Capacity (V/C) Ratios shown in Table 2 are consistent with the requirements of the CCTA Measure C Growth Management Program. As described above, the CCTA technical procedures require the use of a modified Circular 212 method that compares critical turning movement traffic volumes to intersection capacity.

The revised General Plan also requires that the average stopped delay and LOS at each intersection be calculated using the Highway Capacity Manual (HCM) Operational Analysis procedures. The HCM procedures provide a locally adopted standard that more closely reflects actual conditions that are found in Lafayette. This report provides the LOS for all signalized intersections using both the CCTA and the HCM procedures.

It is clear from the revised General Plan Goal T-1 and its supporting policy statements that the City does not wish to consider any large scale transportation system capacity improvements such as new or significantly widened roadways or freeway ramp connections. This policy sets a major limiting criteria in terms of the transportation system improvements that can be considered in the Lamorinda Transportation Improvement Program.

Improvements in Transportation Service

Each roadway improvement project studied in this report is tested in terms of its ability to better transportation service. For the DFS in the downtown area, improvements to the transportation system are measured in terms of reduced congestion or delay on the street system. The impact on congestion and delay is shown by the calculation of LOS and average stopped delay at signalized intersections. Each proposed improvement is compared in terms of its ability to reduce average delay for motorists.

While the primary emphasis of the analysis of transportation improvements is in terms of service to motorists, improvements to non-automotive modes of transportation is also considered in qualitative terms.

Costs of Transportation Improvements

The third category of criteria that is used to test the worthiness of each transportation improvement is cost. A rough estimate of the total capital cost is provided and compared to all other improvements. The relative advantage of each improvement in terms of transportation service provided is compared with its cost. Cost estimates are provided in 1996 dollars.

The Measure C Gateway/Lamorinda program of projects includes $3,096,000 in 1988 dollars for projects at the intersection of Mt. Diablo Boulevard and Moraga Road and in the Moraga Road corridor. The program of projects included in the 1995 update of the Measure C *Strategic Plan* for downtown Lafayette and for the Moraga Road Corridor is shown in Table 4. The roadway projects recommended in this report are measured in terms of the availability of funding from the Measure C Gateway / Lamorinda capital projects program.

Table 4
Contra Costa Transportation Authority
Gateway/Lamorinda Program of Projects
In the Lafayette Downtown and Moraga Road Corridor

Project Description	Funds Projected for FY96 Through FY03 (1988$ x 1,000)
"Small Projects"	
Eastbound through lane on Mt. Diablo Boulevard Between Oak Hill and Moraga Roads	824
Traffic Signal at Moraga Road and Hamlin Road / Tanglewood Drive	208
Improvements at Moraga Road and Brook/School Streets	2,064
Total Funds Projected	3,096

Source: Contra Costa Transportation Authority, 1995 Strategic Plan Update, Page A2.

IIII. Evaluation of Transportation System Improvements

The LTS suggested several improvements for the downtown core and along Moraga Road. Each of these improvements is discussed in this report in terms of its potential to meet the feasibility criteria described above. In addition to the LTS recommended projects, other projects that could improve traffic or pedestrian service are also evaluated.

It should be noted that large-scale capacity improvements such as new roadways or freeway ramps are not evaluated in this report. The policies of the revised General Plan make it clear that these kind of major projects are not acceptable in Lafayette.

Downtown Core - The Lafayette "Y"

Add third eastbound through lane on Mt. Diablo Boulevard between Oak Hill and Moraga Roads. The LTS included this one major roadway improvement for the intersection of Mt. Diablo Boulevard and Moraga Road. The project would be constructed by moving the median of Mt. Diablo Boulevard approximately 12 feet to the north and adding 12 feet of pavement width on the north side of the road. This widening would use most of the existing planter strip now located between the Safeway / Lucky Plaza parking lot and the street. The existing parking lot would not be effected by the roadway widening. The proposed improvement is shown in Figure 2.

In order to maintain the existing westbound right turn lane at Oak Hill Road and to provide a continuous width roadway section on Mt. Diablo Boulevard, a portion of the new right-of-way would have to be purchased from the gas station on the corner of Oak Hill Road and Mt. Diablo Boulevard. An advantage of the proposed project is that the existing sidewalk and on-street parking located on the south side of Mt. Diablo Boulevard between Oak Hill and Moraga Roads would be maintained as currently exists.

Ability to Meet Feasibility Criteria

Conformance with the General Plan. This improvement would provide a significant advantage in terms of transportation service, result in limited long term disruption to existing development, and cause no significant impact on the natural environment. The improvement would, therefore, be in conformance with the polices of the revised General Plan.

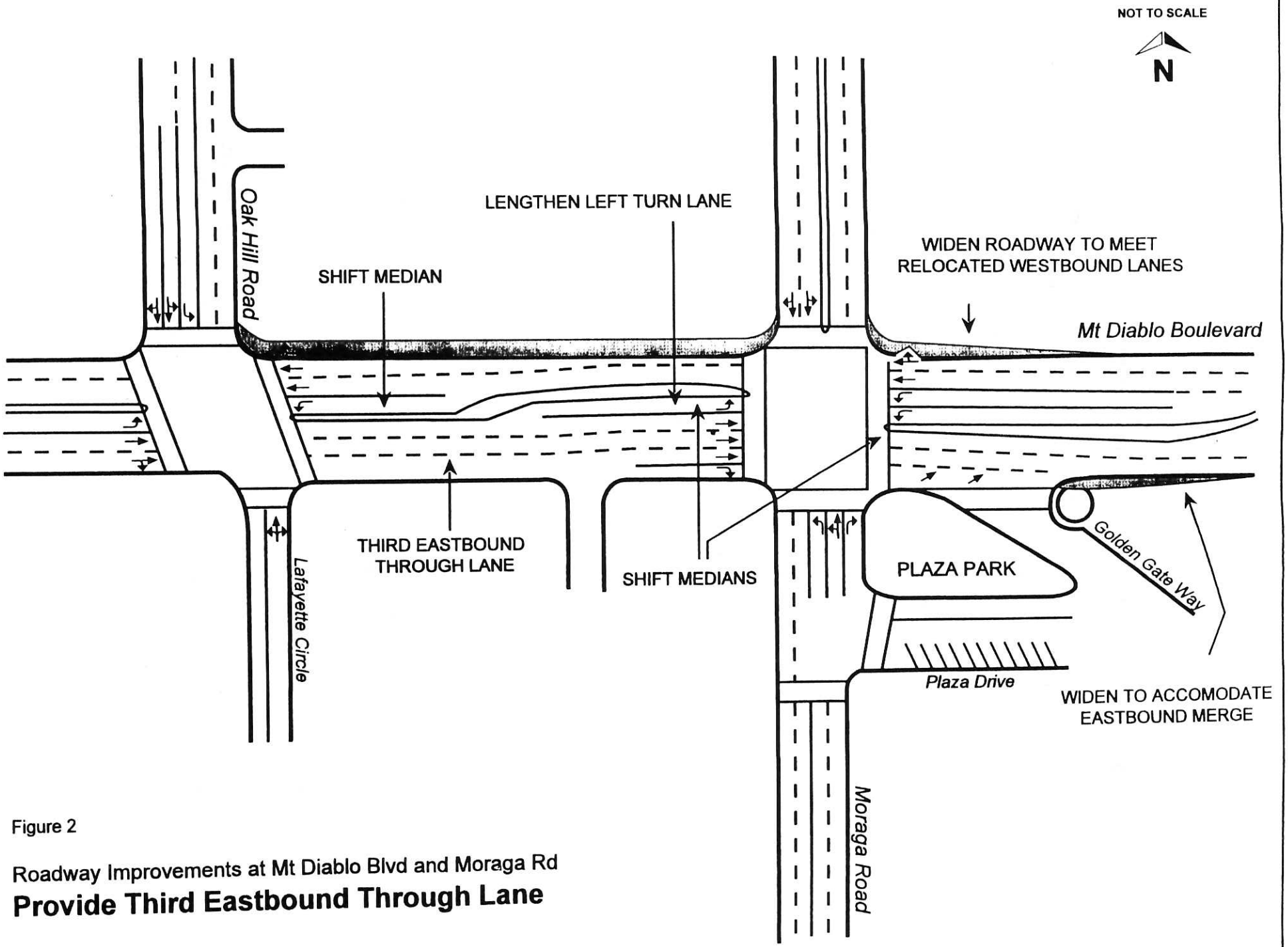

Figure 2

Roadway Improvements at Mt Diablo Blvd and Moraga Rd

Provide Third Eastbound Through Lane

Impact on Traffic Service. The addition of an eastbound through lane on Mt. Diablo Boulevard would improve existing traffic operations by about 28%. Average stopped delay at the intersection with Moraga Road would drop by about 12 seconds from about 42 seconds to 30 seconds. As shown on Table 5, should this improvement be combined with a northbound right turn arrow, about a 17 second reduction in delay from existing conditions would result. LOS would improve from level E to level D or better. This improvement in traffic service would be significant.

Costs. The LTS estimated the cost of this improvement at $824,000 in 1988 dollars. The project is estimated to cost $1,250,000 in 1997. The worksheets used to calculate the cost of recommended roadway improvements are provided in the Appendix to this report. These funds would potentially be available from the Measure C Gateway / Lamorinda project funds.

Alternative Intersection Operation With Added Eastbound Lane. An alternative to adding an eastbound lane for through traffic lane would be to widen the eastbound approach and operate the intersection with two through lanes and two right turn lanes. This alternative would provide a slight advantage for traffic passing through the downtown from north to south as compared to traffic traveling on Mt. Diablo Boulevard from west to east. The total average delay at the intersection would be from 2 to 5 seconds longer if the eastbound approach were operated with two through and two right turn lanes as compared to operating it with three through and one right turn lanes. If the eastbound approach is to be widened, it is recommended that the added lane be used as a through traffic lane.

Other Improvements at the Lafayette "Y"

Two other potential improvements to the intersection of Mt. Diablo Boulevard and Moraga Road are recommended for consideration in this report. These are:

1 -- Provide three southbound lanes. (one left turn, one through, one through-right).
2 -- Provide two northbound right turn lanes by rebuilding and expanding Plaza Park.

Each proposed roadway improvement is described below. In addition, the construction of a bicycle path to divert bicycle traffic away from the Mt. Diablo Boulevard / Moraga Road intersection is also discussed below.

Provide three southbound lanes. The southbound approach to the intersection is located in the parking lot for the Safeway / Lucky Plaza shopping center. The existing southbound driveway is about 22 feet wide and provides two lanes for traffic approaching the intersection. The existing parking lot is currently fully utilized. This means no reduction in parking spaces should be considered in order to improve the southbound approach to the intersection.

The proposed improvement would add 10 feet of pavement to the driveway width for a total of 32 feet and provide one left turn lane, one through lane and one through-right lane. The added driveway width could be achieved by narrowing the existing driveway median from 8 feet to 4 feet, narrowing the planter area on the west side of the driveway from 4 feet to 2 feet and narrowing the parking bay aisle just west of the driveway from 28 feet to 24 feet. This plan would leave the parking lot with the same number of spaces as currently exist and would accommodate plant materials in both the median and along the west side of the driveway. The east side of the driveway would remain exactly as it currently exists. The proposed improvement is shown in Figure 3.

The operators of the stores in this center have indicated a desire to increase available parking. A further stage in this project could be to redesign the areas around the driveway in order to accommodate added parking spaces.

A comprehensive re-design of the parking lot is beyond the scope of this report. However, it appears that it would be possible to add a limited number of spaces by changing the first bay of parking west of the driveway from angle to right angle spaces. In addition, the existing driveway located on the west side of the main driveway could be operated as outbound only and reduced in width thus providing one or two more parking spaces. If the southbound approach to the intersection is to be rebuilt, the potential to redesign the parking lot should also be considered as part of that project.

Ability to Meet Feasibility Criteria

Conformance with the General Plan. This improvement would provide some advantage in terms of transportation service, result in limited long term disruption to existing development, and cause no significant impact on the natural environment. The improvement would, therefore, be in conformance with the polices of the revised General Plan.

Impact on Traffic Service. The addition of a southbound lane at the intersection of Mt. Diablo Boulevard and Moraga Road would improve traffic operations by about 12%. Average stopped delay at the intersection would drop by about 5 seconds from about 42 seconds to 37 seconds in the afternoon peak hour. LOS would improve from level E to level D.

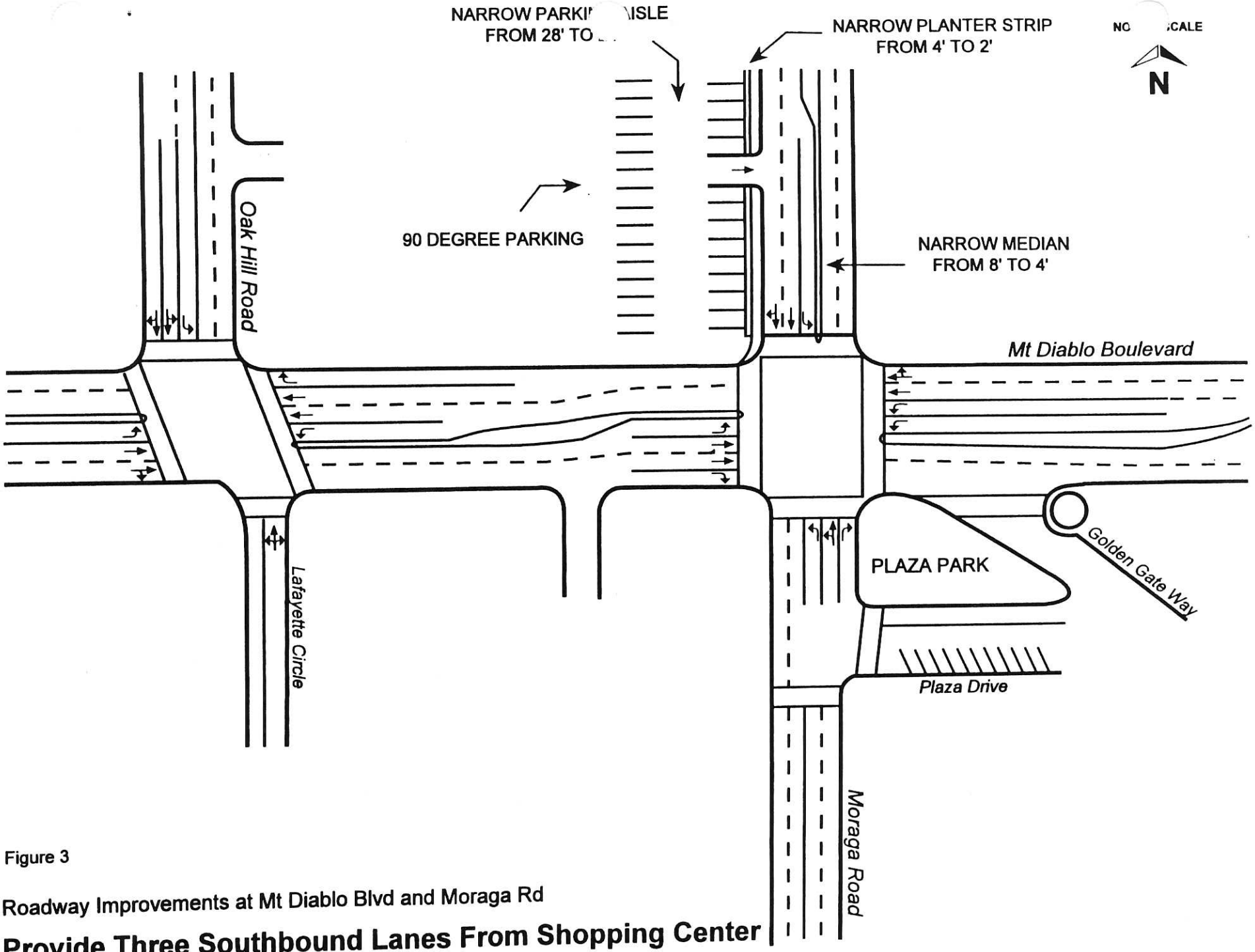

Figure 3

Roadway Improvements at Mt Diablo Blvd and Moraga Rd

Provide Three Southbound Lanes From Shopping Center

A more significant improvement in intersection operation would be achieved if this improvement were combined with a northbound right turn arrow. As shown on Table 5, this combination of improvements would provide about a 15 second reduction in delay at this intersection.

Costs. The estimated the cost of this improvement is $180,000 in 1997. These funds would be potentially available from the Measure C Gateway / Lamorinda funds.

Provide two northbound right turn lanes and rebuild Plaza Park. This project would provide relief for the existing long queues of traffic that are formed by motorists northbound on Moraga Road attempting to turn right at Mt. Diablo Boulevard. This problem is most severe during the morning peak traffic hour.

The space for the added right turn lane would be provided by re-building Plaza Park. The new Plaza Park would provide about 14,400 sq. ft. of landscaped and sidewalk area as compared to the existing park that provides about 10,800 sq. ft. of landscaped and sidewalk area. Not only would the park be increased in size but the revised design would provide a single larger park area as compared to the existing park that is divided into two segments. The recommended ultimate plan for the park, as shown in Figure 4, would expand the landscaped and park area to incorporate the existing Plaza Drive. Plaza Drive and its associated parking would be abandoned. This option for the expanded park would be feasible only if the parking removed by the project can be replaced with adequate nearby parking.

The increase in the size of the park would be accomplished by re-aligning the most westerly portion of Golden Gate Way. The existing street bisects the park area at an approximately 40 degree angle with Mt. Diablo Boulevard. This section of street could be re-located to the easterly end of the park, re-aligned to approximately a right angle with Mt. Diablo Boulevard and shortened from about 125 feet to 90 feet. The re-aligned Golden Gate Way would permit the park to be developed as a single unit with an increase in landscape and sidewalk area. The increase park area would be provided along with the added northbound right turn lane on Moraga Road. The existing northbound bicycle lane on Moraga Road could be maintained or re-located as part of the park improvements.

Another option for expanding the park would be to leave Plaza Drive open but narrow it to a one lane one-way street. As a one-way eastbound street access to the parking on the south side of Plaza Drive would be from northbound Moraga Road only. Plaza Drive could be a one-way westbound lane but all traffic should then be required to turn right at Moraga Road. However, the sight distance for westbound vehicles at the intersection of Plaza Drive and Moraga Road would be limited by the existing building located on the southeast corner of the intersection. Either one-way plan would limit the usefulness of the parking located on the south side of the street.

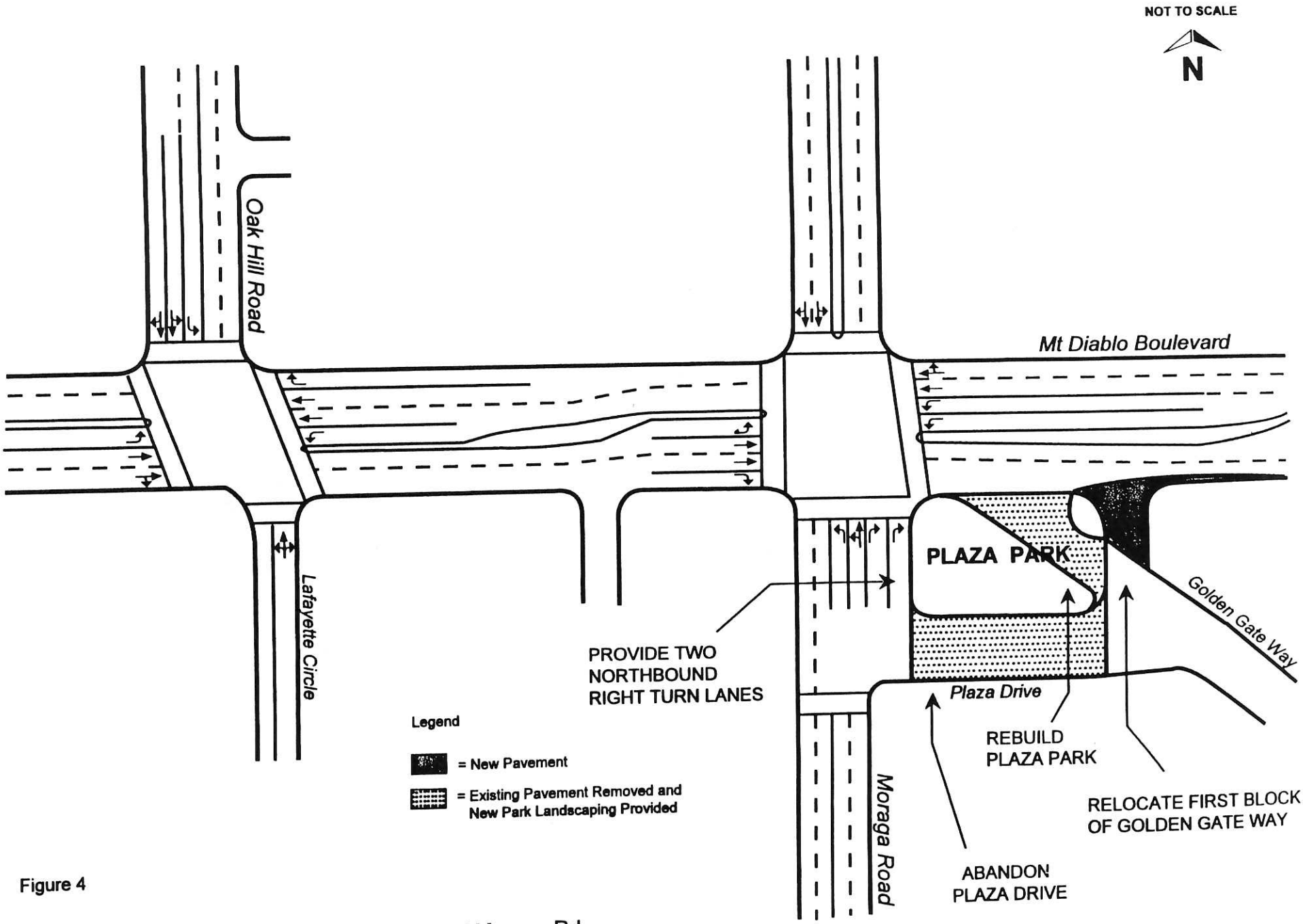

Figure 4

Roadway Improvements at Mt. Diablo Blvd and Moraga Rd

Provide Two Northbound Right Turn Lanes and Rebuild Plaza Park - Abandon Plaza Drive

If the issue of restricting access to the existing parking on Plaza Drive can be resolved, the benefits of additional park space could be realized by narrowing the street. Traffic operations on the narrowed one-way eastbound street would be acceptable assuming the restrictions to turning movements as described above were implemented. A one-way westbound street is not recommended. The option that maintains Plaza Drive as a one-way eastbound street is shown in Figure 5.

An third alternative that would continue a two-way Plaza Drive and would also improve traffic operations on Moraga Road would be to block-off access to Plaza Drive from Moraga Road and provide 90 degree parking on the south side of Plaza Drive with access from Golden Gate Way. The westerly end of the existing Plaza Drive could be repaved with a decorative material and used to increase the area of Plaza Park.

The ultimate develop of Plaza Park should be the expansion of the park to incorporate most of the existing Plaza Drive. Assuming adequate parking could be provided within easy access of the park, Plaza Drive and its parking area would be abandoned to create a pedestrian area and larger park. The new pedestrian area could be paved with brick or other decorative materials and used for outdoor dining or other public gatherings. The park could revitalize the historic center of Lafayette.

The project to add a northbound right turn lane and to rebuild Plaza Park would provide some transportation service but would be even more important in that it would improve the design of the most important public space in downtown Lafayette, Plaza Park.

Ability to Meet Feasibility Criteria

Conformance with the General Plan. This improvement would provide some advantage in terms of transportation service, result in an improved downtown public space, and cause no significant impact on the natural environment. The improvement would, therefore, be in conformance with the polices of the revised General Plan.

Impact on Traffic Service. The addition of a second northbound right turn lane at the intersection of Mt. Diablo Boulevard and Moraga Road would improve traffic operations by 10% to 24%. The largest improvement would occur in the morning peak hour where average intersection delay would decrease from about 40 seconds to about 30 seconds. Most of this improvement would be for the northbound right turn traffic on Moraga Road. A smaller improvement would occur in the afternoon peak hour when an average 7 second reduction in delay would be achieved. LOS would improve from level E to level D in both the morning and after noon peak hours.

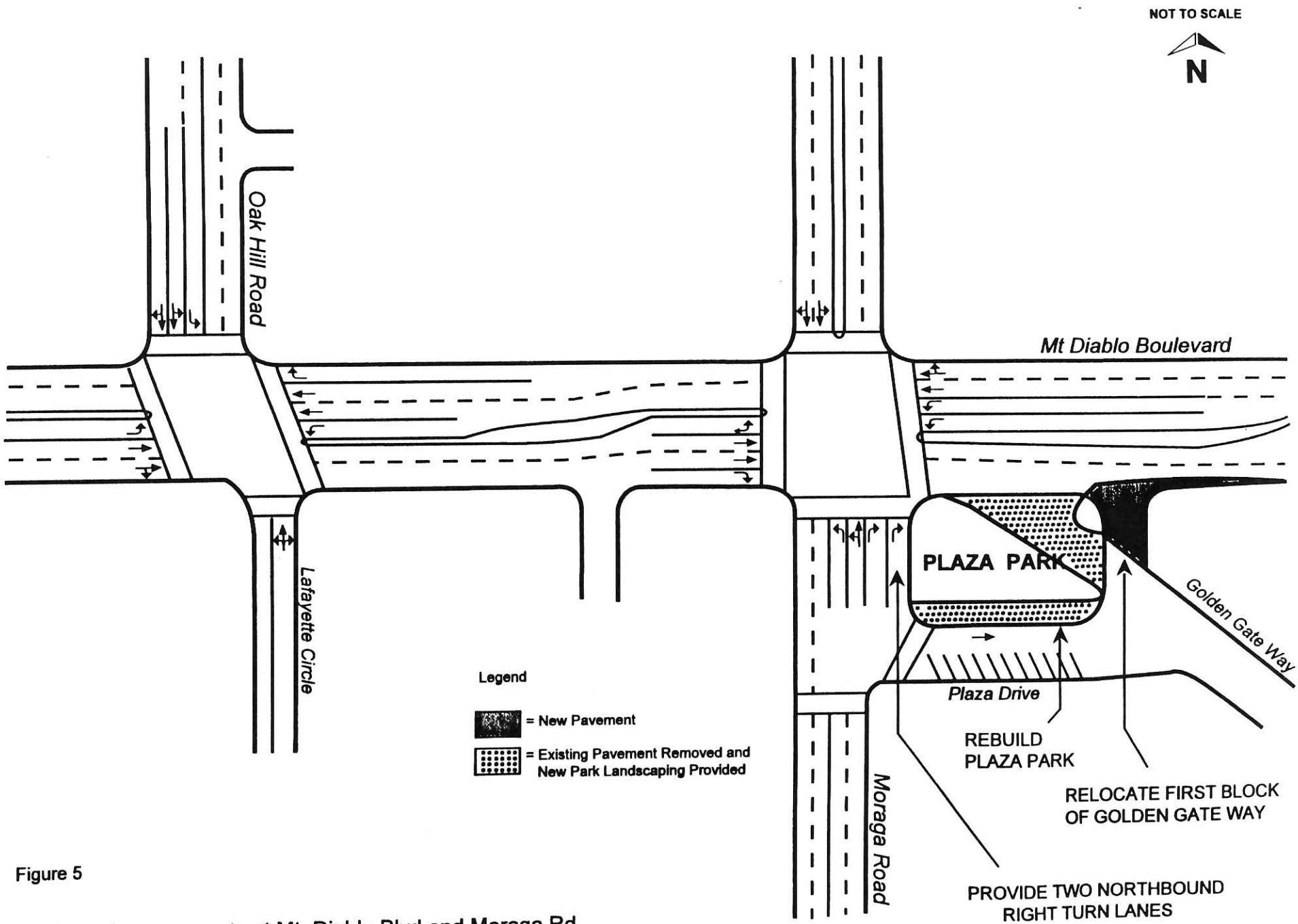

Figure 5

Roadway Improvements at Mt. Diablo Blvd and Moraga Rd

Provide Two Northbound Right Turn Lanes and Rebuild Plaza Park - Maintain Plaza Drive

Pedestrian crossings would be maintained at this intersection. Assuming the double northbound right turn lanes would be installed along with a northbound right turn arrow, northbound right turns would be allowed only on the arrow. At other times northbound right turns on red would be prohibited improving the safety for pedestrians at the intersection of Moraga Road with Mt. Diablo Boulevard.

Costs. The estimated the cost of this improvement is greatly dependent on the re-construction of Plaza Park. The recommended option that maximizes the park area and abandons Plaza Drive is estimated to cost $720,000. An allowance of $275,000 is made for the landscaping work required for this project. At least a portion of these funds would be available from the Measure C Gateway / Lamorinda funds. The option that would maintain Plaza Drive is estimated to cost $490,000.

Provide the Mt. Diablo Boulevard Bike and Pedestrian Trail. This eight feet wide paved trail would run for about one mile parallel to Mt. Diablo Boulevard from Brown Avenue to Happy Valley Road using a right-of-way available on the East Bay Municipal Utilities District (EBMUD) aqueduct. The trail would provide safe bicycle access to the Lafayette BART station. The trail would also connect to the existing trail system at the Briones to Las Trampas Regional Trail near Brown Avenue and to the Lafayette-Moraga Regional Trail by Golden Gate Way. A schematic depiction of the trail is shown on Figure 8, at the end of this report.

Safe pedestrian and bicycle crossings would be provided at each of the major north-south streets crossed by the trail. The trail would use the traffic signal planned at the Safeway / Lucky Plaza driveway to cross First Street. A new traffic signal would be installed at the intersection of the SR 24 off-ramp with Oak Hill Road to permit bicycle and pedestrian traffic to safely cross Oak Hill Road at this location.

The advantage of the trail would be to provide a safe route for bicycle traffic through the downtown area. The mix of motor vehicle and bicycle traffic at the Lafayette "Y" could exacerbate a safety problem for the bicyclists and a congestion problem for motorists.

Ability to Meet Feasibility Criteria

Conformance with the General Plan. The construction of the Mt. Diablo Boulevard Trail would be in full conformance with the policies of the General Plan.

Impact on Traffic Service. The bike trail could have an impact on attaining the desired traffic service levels in the downtown. If significant numbers of bicyclists attempt to use Mt. Diablo Boulevard through this area, the LOS for autos at key intersections could be reduced. To the extent that the trail could attract bicyclists away from the congested downtown intersections it would assist in maintaining service levels for motor vehicle traffic.

Costs. The cost of the Mt. Diablo Boulevard Bike Trail is estimated to be $530,000. A portion of these funds would be potentially available from the Measure C Gateway / Lamorinda funds.

Combination of Improvements

When considered separately, each of the above projects would provide an important improvement in transportation service. The advantages of each project would be increased when combined with other proposed improvements. The result of analyzing various combinations of roadway improvements in terms of intersection delay and LOS is shown in Table 5. The combination of recommended improvements is shown on Figure 6.

The impact on delay shown in Table 5 is based on adjusting the existing traffic counts to account for the prohibition of all left turns at the intersection of Moraga Road with Brook Street, an improvement recommended in the next section of this report. The prohibition of all left turns at Moraga Road and Brook Street would remove a few vehicles from northbound Moraga Road and slightly improve the morning peak hour condition at Mt. Diablo Boulevard. In the afternoon peak hour, the prohibition of all left turns at Brook Street adds a few cars to the northbound traffic on Moraga Road causing a slight degradation of conditions at the intersection of Mt. Diablo Boulevard with Moraga Road.

A further assumption used to calculate the delay as shown in Table 5 is that all of the roadway improvement projects include a northbound right turn arrow to be added to the existing traffic signal. The northbound right turn arrow would operate at the same time as the westbound left turns on Mt. Diablo Boulevard. Westbound U-turns would be prohibited to provide added green time on the signal for the northbound right turn flow of traffic.

The improvement in transportation service is compared to the cost of each improvement in Table 5. The proposed improvement alternatives are listed in the order of lowest to highest costs. In order to gain the greatest advantage in terms of transportation service it would be necessary to provide all three of the projects studied in this report.

The addition of one eastbound through lane, one southbound lane and one northbound right turn lane would result in the greatest reduction in delay in both the morning and afternoon peak hours. However, this combination of projects also has the highest price tag, $2,150,000.

Table 5

Comparison of Improvements at Mt. Diablo Boulevard and Moraga Road

The Delay Calculations for all Proposed Alternatives Assume a Northbound Right Turn Arrow and that the Traffic Volumes are Adjusted Due to the Prohibition of All Left Turns at the Intersection of Moraga Road and Brook Street.

Project Condition	Morning Peak Hour Delay (1)	LOS	Afternoon Peak Hour Delay	LOS	Costs
Existing - No Improvements	41	E	43	E	None
Existing - No Improvements With All Left Turns Prohibited at Moraga Road and Brook Street	40	D/E	44	E	None
Proposed Improvement Alternatives					
1 - Provide 3 Southbound Lanes	25	C/D	29	D	$180,000
2 - Provide 2 Northbound Right Turn Lanes - Rebuild Plaza Park	30	D	37	D	$720,000
3 - Provide 3 Southbound Lanes and 2 Northbound Right Turn Lanes	18	C	28	D	$900,000
4 - Provide 3 Eastbound Through Lanes (Recommended in **LTS**)	23	C	26	D	$1,250,000
5 - Provide 3 Eastbound Through and 3 Southbound Lanes	20	C	24	C	$1,430,000
6 - Provide 3 Eastbound Through and 2 Northbound Right Turn Lanes	18	C	25	C/D	$1,970,000
Recommended Improvements					
7 - Provide 3 Eastbound Through Lanes; 3 Southbound Lanes; and 2 Northbound Right Turn Lanes	17	C	24	C	$2,150,000

Notes: (1) Seconds of Average Stopped Delay per Vehicle.

Source: Robert L. Harrison Transportation Planning

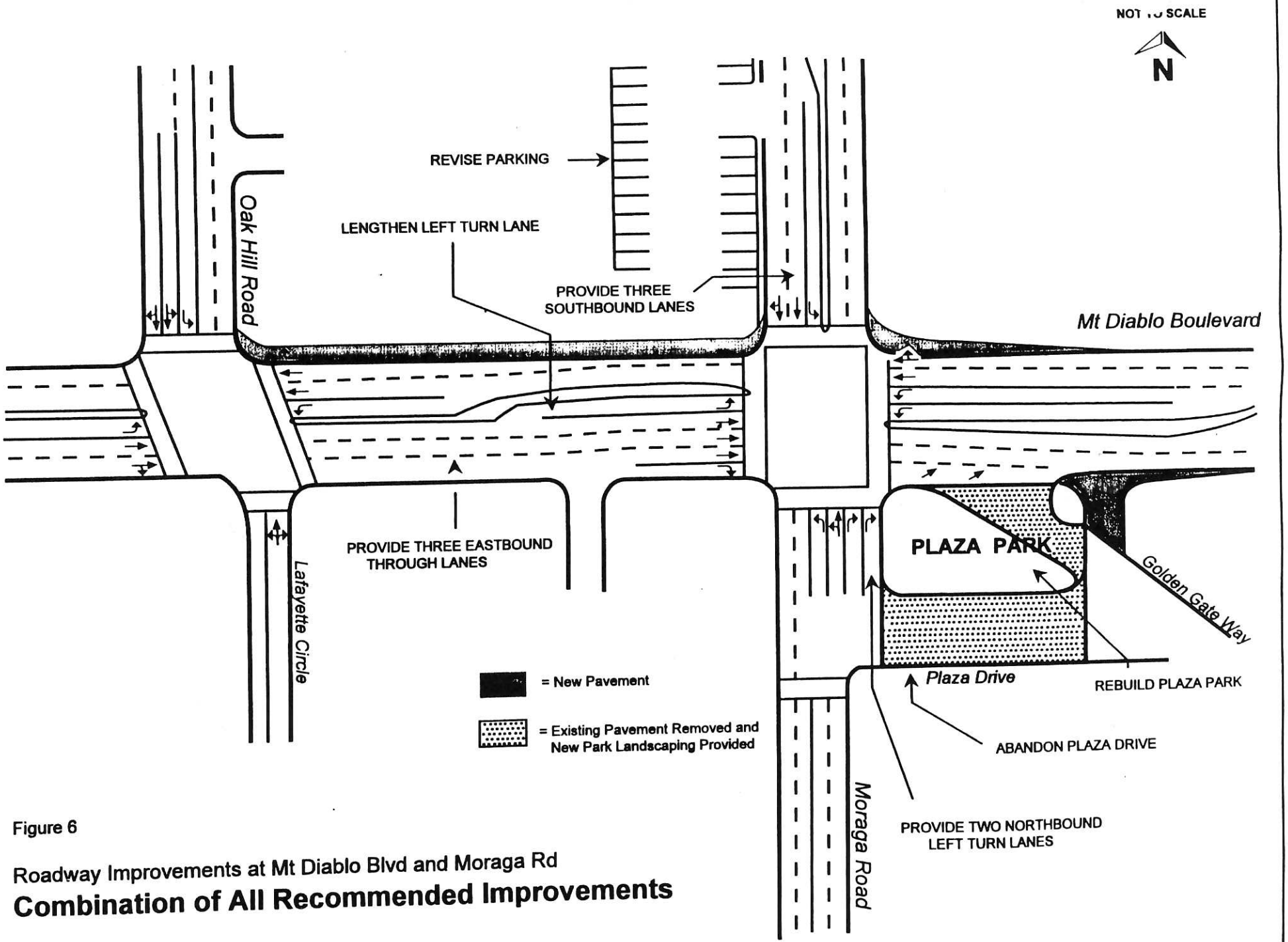

Figure 6

Roadway Improvements at Mt Diablo Blvd and Moraga Rd

Combination of All Recommended Improvements

Moraga Road Corridor

Several traffic and pedestrian / bicycle improvements are recommended for the Moraga Road Corridor below. These improvements are intended to not only improve traffic service but also to facilitate pedestrian safety, to protect local neighborhoods from through traffic and to make it easier for local residents to get onto Moraga Road. Traffic improvements on Moraga Road will encourage through traffic to stay on the arterial street system and to avoid neighborhood streets such as First Street, Avalon Avenue and Topper Lane.

The analysis of the Moraga Road Corridor in this report begins with an evaluation of the recommendations made in the LTS. Each of these recommendations is discussed in terms of its potential to meet the feasibility criteria described above. In addition to the LTS recommended projects, other projects that could improve traffic or pedestrian service are also evaluated.

Moraga Boulevard Intersection

Restrict left turn access. The LTS recommended that left turns be restricted at this intersection in order to reduce delay, congestion and safety hazards. Two alternative plans were suggested:

Alternative 1: Prohibit left turns from Moraga Road to Moraga Boulevard during the peak hours; or

Alternative 2: Prohibit left turns from Moraga Road to Moraga Boulevard at all times and prohibit left turns from Moraga Boulevard by constructing a median.

Provide pedestrian crossing traffic signal. A third alternative is proposed by the DFS for consideration. In order to provide a safe pedestrian crossing at this location while still having the minimal impact on traffic operations, it is recommended that a pedestrian actuated traffic signal be considered.

Ability to Meet Feasibility Criteria

Conformance with the General Plan. This restriction on left turns would provide some advantage in terms of transportation service, result in minimum disruption to existing neighborhoods, and cause no significant impact on the natural environment. The improvement would, therefore, be in conformance with the polices of the revised General Plan.

Impact on Traffic Service. Motorists on Moraga Boulevard attempting to cross the through traffic on Moraga Road experience the longest delays at this intersection.

There is also delay caused by the left turn from Moraga Road into Moraga Boulevard. While only 60 vehicles make the southbound left turn from Moraga Road in the afternoon peak hour, this turning movement reduces the through capacity of the street at a point when the traffic flow is large compared to the capacity of the roadway.

In addition, the accident rate at this intersection exceeds what would be expected when compared to statewide data and suggests that conflicting traffic movements should be reduced or eliminated.

The elimination of all left turns in the intersection would remove all important conflicting traffic movements and thus increase traffic safety and reduce delay for through traffic on Moraga Road. Most of the 60 peak hour vehicles that currently make the left turn from Moraga Road into Moraga Boulevard would be diverted to Golden Gate Way and First Street to Moraga Boulevard. Through traffic that uses the Carol Lane to Moraga Boulevard to Brook Street route as a by-pass around congestion in the downtown area would be eliminated. Traffic on Moraga Boulevard, particularly in the block between Moraga Road and First Street, would be reduced if all left turns are prohibited at Moraga Road and Moraga Boulevard.

Residents of the block between Moraga Road and First Street would, however, need to use a less direct route via First Street to access their homes from downtown. The remainder of the Moraga Boulevard neighborhood would use First or Second Streets for their trips from the downtown area.

A pedestrian actuated traffic signal would have an impact on traffic service levels. The signal would stop all traffic at the intersection during a 24 second pedestrian phase. Assuming approximately 20 activations of the signal in the traffic peak hour, the capacity of Moraga Road would be reduced by about 18% due to the pedestrian crossings. This reduction in capacity would result in the traffic on Moraga Road operating at LOS B as compared to LOS A if no signal were installed.

Costs. The cost to implement elimination of left turns at this intersection would be low, about $1,000, to post no left turn traffic control signs. There would be an ongoing cost for enforcement of the left turn prohibition. If the costs of enforcement were found to be high, a more permanent solution to prohibit left turns could be implemented. This would involve the installation of a median barrier on Moraga Road opposite Moraga Boulevard. The costs of the median barrier would be approximately $8,000 dependent on the exact type of barrier used. The cost of a pedestrian crossing traffic signal would be $50,000 to $80,000 dependent on the complexity of the signal system. The higher cost estimate will be used in this report.

In summary, it is recommended to prohibit all left turns and install a pedestrian crossing traffic signal at Moraga Road and Moraga Boulevard to:

1 -- Improve the flow of through traffic on Moraga Road;
2 -- Reduce the use of Moraga Boulevard as a by-pass route for through traffic;
3 -- Provide a signal protected pedestrian crossing of Moraga Road.

The elimination of all left turns at Moraga Boulevard will impact the traffic that now uses the Moraga Boulevard to Carol Lane by-pass route. If the above improvements are approved, a study of the impact of the left turn prohibitions on the Carol Lane at Mt. Diablo Boulevard intersection should be conducted.

A summary of the Moraga Road at Moraga Boulevard improvement options is shown in Table 6 at the end of this report.

School and Brook Street Intersections

The LTS recommended consideration of a wide a range of alternative improvements be completed at this intersection. These LTS improvements range from low cost measures such as prohibiting left turns to high capital cost projects such as the realignment of Brook Street so that it meets Moraga Road at School Street in a four legged intersection. Each of the LTS recommended improvements is discussed below in terms of its potential to meet the feasibility criteria established in this report. Because each of the LTS alternatives would not fully meet the goals of the draft General Plan, two additional roadway improvement options are recommended for consideration.

LTS Alternative 1: Prohibit all left turns from Moraga Road during peak traffic hours.

Ability to Meet Feasibility Criteria

Conformance with the General Plan. This improvement would provide some advantage in terms of transportation service at School and Brook Streets and would cause no significant impact on the natural or built environments. However, the southbound left turn is important to maintain because it provides access to Stanley Intermediate School and the School Street neighborhood. Prohibiting this turn in the morning peak hour would require traffic destined to the School to use First Street and Avalon Avenue and impact those residential neighborhoods. The added impacts on established residential areas means that this improvement would not be in full conformance with the polices of the revised General Plan.

Impact on Traffic Operations. Left turns at this intersection have been partially restricted since the LTS report was published. Northbound left turns are prohibited into Brook Street from 7:00 am to 4:00 pm. This permits the intersection to function at higher northbound capacity at the time of the highest northbound traffic flows, the morning peak hours. In the afternoon peak hours after 4:00 p.m., the northbound left turn is permitted in order that the heavily congested intersection of Moraga Road at Mt. Diablo Boulevard not be further burdened with the traffic that would otherwise turn left at Brook Street.

Currently there are 50 vehicles that turn left into Brook Street in the afternoon peak hour. Some of this traffic is destined to the Brook Street neighborhood but a portion of the motorists are, no doubt, using this route to bypass the congested downtown core area. The current intersection operation that allows a left turn into Brook Street during afternoon peak hours does not protect the Brook Street neighborhood from the vehicles that may use it to bypass the downtown core.

The prohibition of all left turns would improve traffic operations on Moraga Road. Total average delay for vehicles would be reduced from 37 to 31 seconds in the morning peak hour with the LOS would remaining at level D, In the afternoon peak hour the total average delay would be reduced from 19 to 17 seconds with the LOS remaining at C. See Table 6 for a comparison of the traffic service provided by each of the LTS and recommended alternatives.

Costs. The costs of this improvement would be about $20,000 to install appropriate traffic signs and modify the existing traffic signal.

LTS Alternative 2: Prohibit northbound left turns into Brook Street and provide southbound left turn lane for turns into School Street. Eliminate the bike lanes on Moraga Road.

Ability to Meet Feasibility Criteria

Conformance with the General Plan. This plan is a modification of Alternative 1. The southbound left turn into School Street, a primary access route to Stanley School, would be maintained. This means the potential for added traffic impacts on First Street or Avalon Avenue would be avoided. However, the southbound left turn lane would be provided by eliminating the substandard bike lanes on Moraga Road and restriping the pavement for a left turn lane.

The LTS recommends the elimination of the bike lanes on Moraga Road between School Street and Mt. Diablo Boulevard for safety reasons. The lanes are located next to 10 feet wide through traffic lanes and thus do not provide the minimum separation from automobile traffic that is recommended by Caltrans for safe riding conditions. Public agencies generally do not stripe and sign a bike lane unless all minimum safety standards are met. This is because the formal striping and signing of a bike lane indicates that it provides a safe place to ride. Posting a bike lane that does not meet minimum standards could result in a jurisdiction facing questions of liability should an accident occur.

The revised General Plan includes Goal T-5, "Encourage bicycling for recreation, commuting, and travel to school and shopping", and several policies intended to increase the use of bicycles in Lafayette. The need for a safe bicycle path system designed in conformance with appropriate standards is made clear in General Plan Policy T-5.2, "Bike Trail Standards: Construct bike trails according to the standards established by Caltrans' Planning and Design Criteria for Bikeways for the roadway system where feasible."

The elimination of existing bike lanes is not in conformance with the revised General Plan Goal T-5. However, Policy T-5.2 makes it clear that the bikeway system should be implemented in accord with established Caltrans safety standards. It would appear that the formal striping and signing of bike lanes on Moraga Road should be eliminated for safety reasons but the space now designated for bike lanes in this corridor should be maintained so that the use of bicycles will not be wholly discouraged.

This improvement would require the elimination of the space currently used for bicycle traffic adjacent to the through automobile lanes in order to provide the southbound left turn lane. This LTS alternative is, therefore, not recommended because of its lack of conformance with the policies of the General Plan.

Impact on Traffic Operations. The restriction of left turns at Brook Street and the provision of a southbound left turn lane into School Street would improve traffic operations to approximately the same degree as found for LTS Alternative 1. See Table 6 for a comparison of the traffic service provided by each of the LTS and recommended alternatives.

Costs. The cost of this alternative is estimated to be $30,000 to provide appropriate directional signs, modify the existing traffic signal and restripe the traffic lanes.

LTS Alternative 3: Provide southbound left turn lane into School Street, eliminate all left turns at Brook Street and consolidate all pedestrian crossings to School Street.

Ability to Meet Feasibility Criteria

Conformance with the General Plan. As is the case with Alternative 2, this alternative would provide the southbound left turn lane by eliminating the space now designated as a bike lane on Moraga Road. The elimination of space for bicycles in this corridor is not in conformance with the General Plan. LTS Alternative 3 is not recommended for the same reasons described above for LTS Alternative 2.

Impact on Traffic Operations. This alternative would significantly improve traffic operations over Alternative 2 and over existing conditions because all pedestrian crossings would occur at School Street and there would be no traffic signal at Brook Street. Total average delay for vehicles would be reduced from the existing 37 seconds to 17 seconds in the morning peak hour. LOS would be improved from level D to level C. In the afternoon peak hour the total average delay would be reduced from 19 to 9 seconds with the LOS improved from C to B. See Table 6 for a comparison of the traffic service provided by each of the LTS and recommended alternatives.

Costs. The cost of this alternative is estimated to be $90,000 to provide appropriate directional signs, to modify the existing traffic signal including the removal of signal poles and heads from Brook Street and to restripe the traffic lanes.

LTS Alternative 4: Provide both southbound and northbound left turn lanes on Moraga Road.

Ability to Meet Feasibility Criteria

Conformance with the General Plan. This alternative would require widening Moraga Road by 14 feet and the removal of the space now used by the existing bike lanes. To accommodate the widening of Moraga Road both the Masonic Hall and the old Lafayette Town Hall would have to be demolished or moved to another location. The project would require significant changes to the built environment. Both the elimination of the space used by bicyclists and the significant changes to the built environment would not be in conformance with the policies of the revised General Plan.

Impact on Traffic Operations. This alternative would improve traffic operations over existing conditions but to a much lessor degree than Alternative 3 discussed above. Total average delay for vehicles would be reduced from the existing 37 seconds to 33 seconds in the morning peak hour. LOS would remain at level D. In the afternoon peak hour the total average delay would be reduced from 19 to 17 seconds with the LOS remaining at level C. See Table 6 for a comparison of the traffic service provided by each of the LTS and recommended alternatives.

Costs. The cost of this alternative is estimated to be $950,000 to construct the additional roadway width, remove existing buildings, modify the existing traffic signal and re-stripe the lane lines.

LTS Alternative 5: Re-align Brook Street to intersect Moraga Road at School Street and form a standard four leg intersection.

Ability to Meet Feasibility Criteria

Conformance with the General Plan. This alternative would require the widening of Moraga Road, the removal of the Masonic Hall, the removal of four condominium residential units west of the Masonic Hall and the removal of the building south of the Masonic Hall. While this project has the potential to provide the greatest improvement in transportation service it would also impose the greatest impact on the built environment. In addition, the direct connection of Brook and School Streets could encourage the use of this route by through traffic.

As is the case with Alternative 4, this alternative is not in conformance with the policies of the General Plan because of its significant impacts on the built environment. Specifically, the alternative is not in conformance with General Plan Goal LU-2: "Protect the character of existing Lafayette neighborhoods" because it would encourage the use of School and Brook Streets as a by-pass route for through traffic. It is also not in conformance with Goal CD-2: "Ensure capital improvement projects are carried out with sensitivity to the character of surrounding areas" because of its significant impact on the built environment.

Impact on Traffic Operations. This alternative would significantly improve traffic operations over existing conditions. All traffic turning movements and all pedestrian crossings would be consolidated to a single location. Total average delay for vehicles would be reduced from the existing 37 seconds to 18 seconds in the morning peak hour. LOS would be improved from level D to level C. In the afternoon peak hour the total average delay would be reduced from 19 to 15 seconds with the LOS improved from C to B. See Table 6 for a comparison of the traffic service provided by each of the LTS and recommended alternatives.

Costs. The cost of this alternative was estimated to be $2,064,000 in 1988 dollars by the LTS. The costs are high because of the extensive building removal or relocation, new pavement areas and total remodeling of the existing traffic signal.

None of the LTS Alternatives are recommended for this intersection. Each LTS Alternative fails to be in full conformance with the policies of the revised General Plan, some provide limited improvement in traffic service and others have high costs. The following improvements are recommended for consideration in the development of the DFS.

Recommended DFS Improvement Alternative

Eliminate all left turns at Brook Street, allow left turns at School Street, maintain space for bicycle traffic on informal unstriped bike lanes on Moraga Road and provide signs to direct bicycle traffic to use First Street north of School Street. The improvements recommended for this intersection incorporate features that would be confined within the existing street right-of way and would not require large expenditures for major traffic capacity enhancement.. The recommendations would result in improved transportation service, no reduction in pavement space for bicycle traffic and no routing of through motor vehicle traffic into residential areas. The recommended DFS alternatives are compared with each of the LTS alternatives in Table 6.

Two recommended options are presented for consideration. The first would consolidate all pedestrian crossings of Moraga Road at School Street and remove the traffic signal at Brook Street. This approach would provide the highest service for through traffic but would require Lafayette School students walking to school on Brook Street to divert south to School Street to cross Moraga Road and then walk north to the school.

The second option would maintain pedestrian crossings at both Brook and School Streets. Because there would be a split traffic signal between Brook and School Streets there would be added delay for through traffic. About five seconds would be added to the average delay for through traffic if pedestrian crossing signals were provided at each of these intersections.

Ability to Meet Feasibility Criteria

Conformance with the General Plan. This improvement would provide some advantage in terms of transportation service, maintain the space on the roadway for bicycle traffic, result in minimum disruption to existing neighborhoods, and cause no significant impact on the natural environment. The improvement would, therefore, be in conformance with the polices of the revised General Plan.

Impact on Traffic Service. A major advantage of this alternative is the significant improvement provided for motorists on School Street attempting to enter Moraga Road during the morning peak hour. The average delay for these vehicles would be reduced from the existing nearly two minutes to less than one minute.

Northbound and southbound through traffic would also experience a significant improvement in service. In the morning peak hour intersection LOS would improve from D to C and in the afternoon peak hour the LOS would improve from C to B. It is important to note that the advantage for through traffic, particularly in the northbound direction, could be fully achieved at this intersection only if the improvements recommended above for the intersection of Moraga Road with Mt. Diablo Boulevard were also implemented.

In order to provide the maximum advantage for southbound through traffic in the afternoon peak hour the southbound left turn into School Street could be restricted between 4:00 p.m. and 6:00 p.m. There is relatively little school traffic at this time of day so there would not be a large number of vehicles diverted into existing residential neighborhoods. It is generally in the best interest of Lafayette to provide a means for through traffic to leave the central area of the City as quickly and efficiently as possible. Restricting southbound left turns into School Street in the afternoon peak traffic hour would be consistent with this philosophy.

A further advantage of the improvements recommended at this intersection is the Brook Street neighborhood would be protected from northbound through traffic at all hours throughout the day. Left turns from Moraga Road are currently permitted into Brook Street after 4:00 p.m. This existing traffic would be removed from the Brook Street neighborhood if the recommended improvements are implemented. In addition, through traffic that now uses the Brook Street to Moraga Boulevard route to by-pass the downtown area would be eliminated.

The elimination of all left turns at Brook Street would cause a disadvantage for auto traffic that is destined to the downtown or to Lafayette School from the easterly end of Brook Street. These motorists would no longer be allowed to turn left onto northbound Moraga Road. This means that traffic destined to the downtown area from Brook Street would use other local streets such as Hough or Dewing Avenues. At peak traffic times the trips added to these other local street would average less than one vehicle per minute.

Costs. The cost to modify the intersection as described including the re-design of the existing traffic signal, the consolidation of all Moraga Road crosswalks to School Street, and the left turn restrictions at Brook Street is estimated at $90,000. If the existing pedestrian crossing is maintained at Brook Street there would be less traffic signal modification work required. The cost of

the improvements assuming the Brook Street pedestrian crossing were maintained would be about $75,000. These funds would be potentially available from the Measure C Gateway / Lamorinda project funds.

Summary of DFS Recommendations for School and Brook Streets

The project to eliminate all left turns at Brook Street and maintain the left turns and space for bicycle traffic at School Street would have the following characteristics:

1 -- The Brook Street neighborhood would be protected from most through traffic throughout the day;

2 -- A major access route to and from Stanley School via Moraga Road would be maintained;

3 -- The existing space for bicycle traffic would be maintained but the bicycle lane designation would be removed from Moraga Road. Bicycle route directional signs should be installed to direct northbound bike traffic on Moraga Road to use the signed bike route on First Street north of School Street;

4 -- Intersection LOS would be improved and average delay for traffic, particularly on School Street, would be reduced;

5 -- There would be no significant impact on the built or natural environments;

6 -- A limited number of motorists from the Brook Street neighborhood would experience some inconvenience because the left turn from Brook Street onto Moraga Road would be eliminated.

Based on a weighing of the advantages and disadvantages of each of the projects suggested in the LTS and of the project described in this report, it is recommended that major vehicle capacity increases not be pursued at the School / Brook Streets intersection with Moraga Road but that the intersection be improved as follows:

1 -- Eliminate <u>all</u> left turns at Brook Street. Initially this should be accomplished by installing appropriate traffic control signs. If violations are found to be a problem, a barrier could be installed on the centerline of Moraga Road opposite Brook Street.

2a -- To maximize traffic service, consolidate all pedestrian crosswalks to the School Street intersection, the recommended option, <u>or</u>

2b -- Maintain the existing pedestrian crossings of Moraga Road at both Brook and School Streets. This would maintain pedestrian service at the cost of a somewhat reduced traffic service.

3 -- Redesign the traffic signal to control only the intersection of School Street and Moraga Road. Remove all unneeded traffic signal heads, standards and directional signs.

4 -- Remove the signs and pavement markings for the sub-standard bicycle lanes on Moraga Road from School Street to Mt. Diablo Boulevard. Maintain the space now provided for bicycle traffic on Moraga Road.

5 -- Provide directional signs on Moraga Road that route bicyclists to the bike path on First Street north of School Street.

Hamlin Road and Tanglewood Drive Intersections

Provide traffic signal at this split intersection. The LTS recommended signalization of this intersection and relocation of the bus stop from north of Tanglewood Drive to south of Hamlin Road with a more formalized pedestrian access from Hamlin Road. This recommendation was based in part on the findings of the *Moraga Road Traffic Safety Study*, prepared by Omni Means in March 1989, that the intersection volumes were "approaching the minimum level at which a traffic signal could be warranted". The Caltrans standard for the traffic signal peak hour volume warrant is 100 vehicles per hour as the lower threshold volume for a one lane minor street approach to the intersection. The maximum peak hour traffic volume observed on Hamlin Road is 75 vehicles in the peak hour. Traffic on Tanglewood Drive is lower than on Hamlin Road. The side street traffic volumes counted in 1996 are no more than 75% of the minimum threshold for the peak hour volume warrant for a traffic signal at this intersection.

As indicated above the accident rate at this intersection was 0.12 A/MV for the period between 1991 and 1996. This rate is well below the statewide basic expected accident rate of 0.50 A/MV for this kind of intersection .

Ability to Meet Feasibility Criteria

Conformance with the General Plan. This project would provide limited transportation service and would have no significant impact on the built or natural environment. The project would be in general conformance with the Plan.

Impact on Traffic Service. A traffic signal would improve traffic service for side street traffic and degrade the service level of through traffic. The existing maximum delay for side street left turning traffic is 27 seconds in the morning peak hour and 43 seconds in the afternoon peak hour. With a traffic signal this delay would be reduced to about an average of 20 seconds in both morning and afternoon peak hours. Through traffic conditions would be degraded from the existing condition of little or no delay to peak direction delays of about 25 to 30 seconds. The north-south through traffic queues caused by a signal at this location would extend several hundred feet to the south in the morning peak hour and to the north in the afternoon peak hour. A potential problem would be the blockage of other side streets due to the traffic queues caused by a traffic signal at Hamlin Road / Tanglewood Drive.

Costs. The costs of a traffic signal at this location is estimated at $150,000. The cost of the traffic signal and the re-building of the bus stop and pedestrian access at the intersection was estimated by the LTS as $208,000 in 1988 dollars. The cost of this improvement could be met with funds designated for the project in the Measure C Gateway / Lamorinda "small projects" program.

Because of the failure to meet the existing peak hour traffic signal warrant and the potential impact on upstream intersections, the installation of a traffic signal at this intersection is not recommended at this time. Traffic volumes and accident data should be monitored on an ongoing basis to determine if signalization may be warranted in the future. To provide the best possible sight distances, the trees and shrubs at this intersection should be trimmed on an annual basis.

Silver Springs Road / Mt. View Drive / Old Jonas Hill Road Intersections

Provide traffic signal at this split intersection. Old Jonas Hill Road intersects Moraga Road approximately 180 feet south of Silver Springs Road / Mt. View Drive intersection with Moraga Road. The intersections are close enough, however, to be evaluated as a single intersection for traffic operations purposes.

The traffic volumes on the side streets at this intersection are just below the Caltrans minimum standard for a peak hour traffic volume signal warrant. However, because the delay for side street traffic is excessive not only at these intersections, but is also unacceptable at the Hamlin Road and Tanglewood Drive intersections discussed above, a traffic signal would be useful to provide a gap in the continuous flow of traffic on Moraga Road. If all of the side street traffic approaching Moraga Road between Old Jonas Hill Road and St. Marys Road is considered, a signal could be warranted under Caltrans Traffic Signal Warrant #2, Interruption of Continuous Traffic.

From the Caltrans Traffic Manual, "The Interruption of Continuous Traffic Warrant applies to operating conditions where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or hazard in entering or crossing the major street."[2] Normally this warrant is intended to apply to a single intersection. In this case, however, the signal would be installed at the furthest upstream intersection, Moraga Road and Old Jonas Hill Road, and thereby improve conditions for side street traffic at all of the intersections downstream from the traffic signal. In order to insure that the southbound traffic queues that will form behind the proposed traffic signal do not block access for side street traffic at the Hamlin Road / Tanglewood Drive or any other intersection, it may be necessary to install "Keep Clear" intersection pavement markings at all effected intersections.

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2 California Department of Transportation, *Traffic Manual*, page 9-2.

Ability to Meet Feasibility Criteria

Conformance with the General Plan. This project would provide some transportation service and would have no significant impact on the built or natural environments. The project would be in general conformance with the Plan.

Impact on Traffic Service. A traffic signal would improve traffic service for side street traffic and degrade the service level of through traffic. The existing maximum delay for side street left turning traffic is 40 seconds in the morning peak hour and 28 seconds in the afternoon peak hour. With a traffic signal, this delay would be reduced to about an average of 20 seconds in both morning and afternoon peak hours.

Through traffic conditions would be degraded from the existing condition of no delay to peak direction delays of about 25 to 30 seconds. The north-south through traffic queues caused by a signal at this location would extend several hundred feet to the south in the morning peak hour and to the north in the afternoon peak hour. A potential problem would be the blockage of other side streets, particularly in the afternoon peak hour, due to the traffic queues caused by a traffic signal at this location. As discussed above, installation of "Keep Clear" pavement markings at all impacted intersections should be accomplished when the traffic signal were installed. The signalized intersection is depicted on Figure 7.

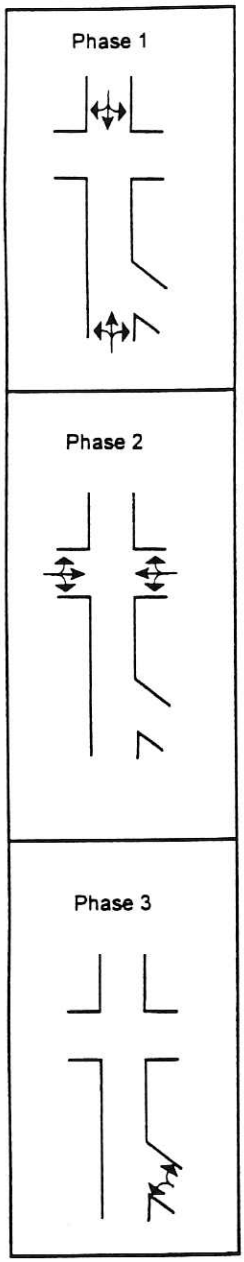
Costs. The costs of a traffic signal at this location is estimated at $275,000. This cost includes all traffic signal work on five legs of the intersection and the rebuilding of the existing bus stop and pedestrian access as needed. The cost of this improvement could be met with funds designated for the project in the Measure C Gateway / Lamorinda "small projects" program.

Madrone Drive Intersection

Add southbound left turn lane. The LTS and the *Moraga Road Traffic Safety Study* recommended that Moraga Road be widened to provide a southbound left turn at this intersection. The basis for this recommendation were safety considerations expressed in terms of limited sight distances for motorists attempting to enter or exit from Madrone Drive.

However, as described above, the recent record for accidents at this intersection indicates an accident rate well below what would be expected for this kind of intersection. The existing accident record for this intersection indicates a total of four accidents over the six year period 1991 through 1996 or a rate of 0.16 A/MV. This compares to the statewide expected rate of 0.34 A/MV for this kind of intersection.

Proposed Signal Phasing



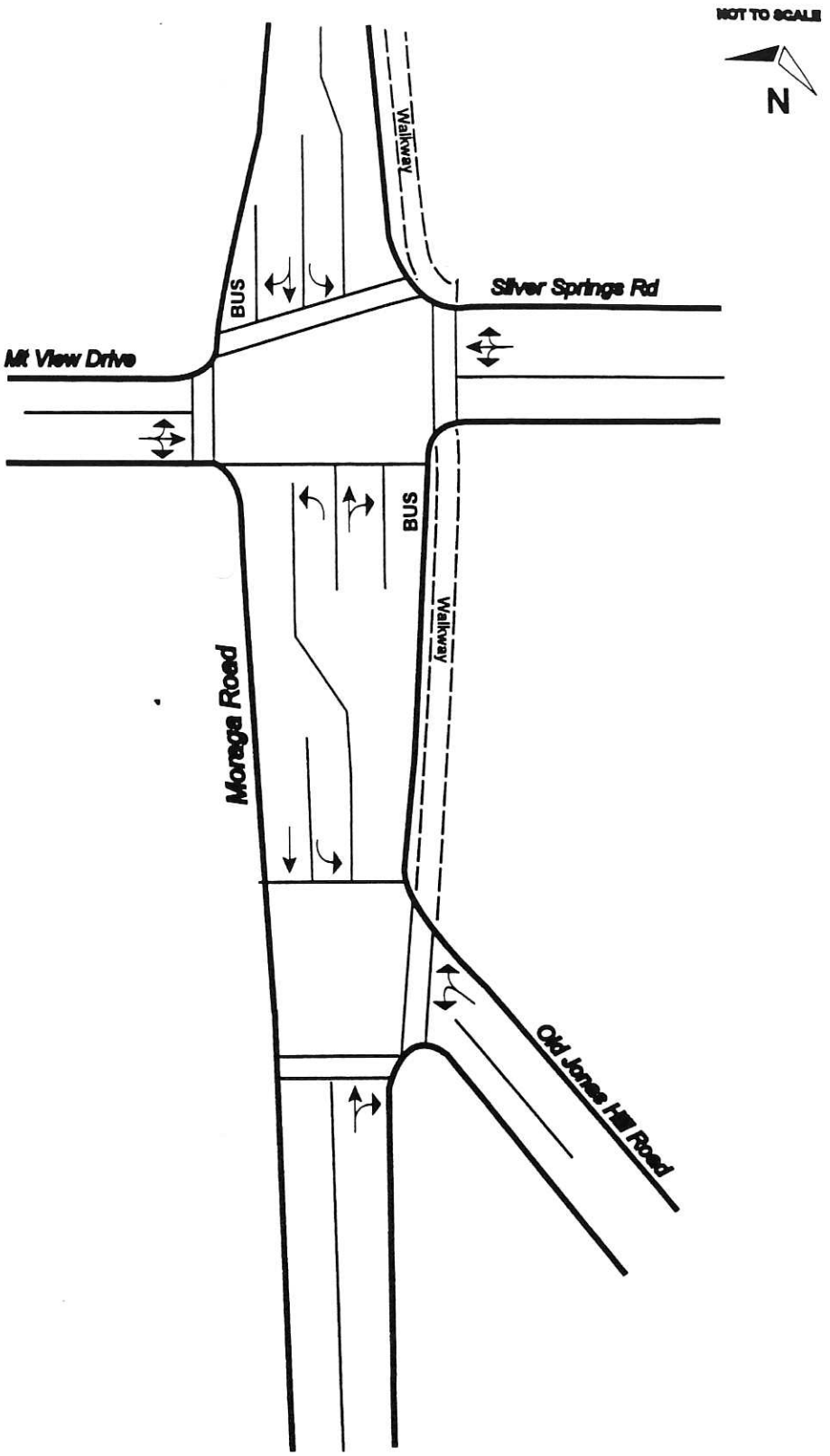


Figure 7

Roadway Improvements at Moraga Road/Silver Springs Road/
Mt View Drive/Old Jonas Hill Road Intersection

Provide Traffic Signal, Walkway and Crosswalks

When the recent accident history is taken into account, the need for roadway improvements based on traffic safety does not appear to be a high priority problem. The proposed left turn lane would appear to be at most a low priority project.

A further concern with regard to widening Moraga Road in this area is the amount of earthwork and vegetation removal that would be required. Because the roadway is relatively narrow and located on steep side hill the widening project may require some cut and fill work. At a minimum, the existing trees and shrubs that line the roadway would have to be significantly cut back. Some trimming of vegetation should be conducted at this intersection on a regular basis.

Conformance with the General Plan. This project would have limited benefit in terms of transportation service and has the potential to have a significant impact on the natural environment. Dependent on the exact design of the project, it may or may not be in conformance with the policies of the General Plan with regard to its impact on the environment.

Impact on Traffic Service. The existing accident data does not suggest a need for this kind of project on a high priority basis.

Costs. The cost of this project was estimated to be $45,000 by the LTS. The project may require significant earthwork and some retaining walls in order to widen the Moraga Road. If this were the case, the cost of the project could be more than double the estimate made in the LTS. Funds to pay this cost would be potentially available from the Measure C Gateway / Lamorinda program.

Based on its potential impact on the natural environment and limited transportation service, the southbound left turn lane at Madrone Drive is not recommended for immediate implementation. The traffic volumes and accident statistics should be monitored on an ongoing basis to determine if this improvement may be warranted at some time in the future.

Moraga Road Walkway

Provide sidewalk and/or path as needed to complete a safe walkway from Mt. Diablo Boulevard to Old Jonas Hill Road. This project is described in the "Draft Comprehensive Walkways Plan", dated December 1996. The project would provide a five feet minimum width hard surface sidewalk, curb and gutter from St. Marys Road to Tanglewood Drive on the west side of Moraga Road and from Rosedale Avenue to Hamlin Road on the east side of Moraga Road. In addition, an asphalt walkway without curb and gutter would be provided on the east side of Moraga Road between Hamlin Road and Silver Springs Road and an asphalt walkway with berm would be provided between Silver Springs Road and Old Jonas Hill Road.

Ability to Meet Feasibility Criteria

Conformance with the General Plan. The construction of the Moraga Road Walkway would be in full conformance with the policies of the General Plan.

Impact on Traffic Service. The existing shoulders on the section of Moraga Road south of St. Marys Road are narrow. Pedestrians and bicyclists are necessarily required to walk or ride close to or within the traffic lanes. The provision of a walkway would reduce accident potential by moving pedestrians a safe distance away from the through traffic lanes.

Costs. The cost of the Moraga Road Walkway is estimated to be $166,000. These funds would be potentially available from the Measure C Gateway / Lamorinda funds.

Moraga Road Corridor Traffic Signal Coordination

Conduct Signal Coordination Study and Adjust Signal Timing as Needed. With the provision of the recommended new traffic signal at the Silver Springs Road / Mt. View Drive / Old Jonas Hill Road intersection, there will be four traffic signals in the three-fourths mile long section of the Moraga Road Corridor between Mt. Diablo Boulevard and Old Jonas Hill Road. These signals should be adjusted to allow platoons of north-south through traffic to proceed efficiently through all of the signals and to provide for good access to and from the side streets along the Corridor.

Ability to Meet Feasibility Criteria

Conformance with the General Plan. Efficient traffic signals that ensure good access to and from side streets along a major transportation corridor are in accord with the policies of the General Plan.

Impact on Traffic Service. Carefully coordinated traffic signals can improve traffic operations, perhaps by as much as five per cent for through traffic. An objective of the Moraga Road signal coordination study should be to ensure that not only does the through traffic proceed efficiently, but that good access from the side streets is also provided.

Costs. The cost of the signal coordination study including analysis, design and drawings of required hardware is estimated to be $50,000.

Moraga Road Corridor Pedestrian and Bike Route Programs

Implement the School Safety Program. The LTS recommended that the California State Automobile Association's (CSAA) "Suggested Route to School" plan be developed for the Lafayette Elementary and Stanley Intermediate Schools. This plan would recommend the best pedestrian and bicycle routes to each school. The plan must be reviewed by a registered traffic engineer to insure that it does not create unsafe practices or designs before it is implemented.

Prepare a Comprehensive Analysis of Pedestrian and Bicycle Issues. There is ongoing concern for the safety of pedestrians and bicyclists using the Moraga Road Corridor. In order to properly deal with these concerns a comprehensive study should be conducted of all pedestrian and bicycle issues in the Corridor. The study would include collection of data on the number of pedestrians and bicyclists that cross and/or travel along the Corridor, locations where safety problems exist with emphasis on the areas near the Lafayette Elementary and Stanley Intermediate Schools, and recommendations on measures to improve pedestrian and bicycle facilities. Specific issues to be considered include:

1 -- Where should the pedestrian and bicyclists crossings of the Corridor be located? How should each crossing be controlled or managed?
2 -- Where are new facilities beyond those recommended in this report needed for safe pedestrian or bicycle travel?
3 -- What are the safety issues around the school areas and how can these problems be resolved?

Ability to Meet Feasibility Criteria

Conformance with the General Plan. Programs aimed to improve pedestrian and bicycle circulation and safety are in accord with the policies of the General Plan.

Impact on Traffic Service. Bicycle and pedestrian programs would have a significant impact on improving safety and could have a limited impact on improving traffic operations.

Costs. The cost of the recommended pedestrian and bicycle study is estimated to be $30,000.

V. Summary of Recommended Transportation Improvements

The following section provides a summary of the transportation improvements recommended in this study. The recommended projects are summarized on Figure 8.

A comparison of all of the improvement alternatives studied in this report in terms of: 1 -- Conformance with the General Plan; 2 -- Impact on Traffic Service; and, 3 -- Cost; is given in Table 6. The roadway improvements recommended for the next phase of project development and for inclusion in the Measure C *Strategic Plan* by this initial phase of the Downtown Feasibility Study (DFS) are shown in bold face type in Table 6.

Improvements Recommended by the DFS:

Mount Diablo Boulevard Corridor

1 -- Mount Diablo Boulevard at Moraga Road:
   a. Provide three southbound lanes from the Safeway / Lucky Plaza.
   b. Provide two northbound right turn lanes and rebuild and expand Plaza Park.
   c. Provide three eastbound through lanes by moving the north side of Mt. Diablo Boulevard between Moraga Road and Oak Hill Road 12 feet to the north. Do not remove parking on the south side of Mt. Diablo Boulevard.

2 -- Provide the Mt. Diablo Boulevard Bike and Pedestrian Trail.

The total cost of the above improvements is estimated at $2,680,000. A portion of these funds would be potentially available in the Measure C Gateway / Lamorinda capital projects fund.

Moraga Road Corridor

1 -- Prohibit all left turns at Moraga Boulevard at all hours. Provide a pedestrian crossing traffic signal at Moraga Boulevard.

2a -- Prohibit all left turns at Brook Street and consolidate the existing traffic signal to control only the intersection with School Street, the recommended option, or

2b -- Prohibit all left turns at Brook Street and maintain the pedestrian crossings at both Brook and School Streets.

3 -- Remove the sub-standard bicycle lanes on Moraga Road north of School Street but maintain the existing space on the roadway for bicycle traffic. Provide signs to direct bicycle traffic from Moraga Road north of School Street to the bicycle path on First Street.

4 -- Provide a traffic signal at Silver Springs Road / Mt. View Drive / Old Jonas Hill Road intersection.

5 -- Provide "Keep Clear" pavement markings at all intersections where needed to ensure traffic queues do not block access to side streets.

6 -- Provide sidewalk and/or path as needed to complete a safe walkway from Mt. Diablo Boulevard to Old Jonas Hill Road

7 -- Provide Traffic Signal Coordination.

8 -- Conduct Pedestrian and Bike Route Programs including the "Suggested Route to School Plan" and a Comprehensive Analysis of Pedestrian and Bicycle Issues.

9 -- Traffic signals at Hamlin Road / Tanglewood Drive are not recommended at this time.

10 -- A southbound left turn lane at Madrone Drive should not be a high priority project. This project could be accomplished at some future time based on continuous monitoring of traffic safety at this location.

The total cost of the recommended Moraga Road Corridor projects is estimated at $691,000.

The total cost of all of the improvements recommended in this report is $3,371,000. The CCTA projects $3,096,000 in 1988 dollars to be available from the Measure C Gateway / Lamorinda capital projects fund for projects in central Lafayette and in the Moraga Road corridor.

Impact of the Recommended Improvements on Signalized Intersection Operations

The CCTA requires that the impact of the recommended improvements on signalized intersection LOS be documented using the Circular 212 calculation method. The General Plan recommends use of the HCM method to calculate LOS. The impact of the recommended improvements at all intersections is compared to all of the alternatives tested using the HCM calculation method in Table 6.

The impact of the recommended improvements at intersections with existing traffic signals or where signals are proposed is calculated using both the Circular 212 and the HCM methods and is shown in Table 7. The recommended roadway projects would improve the existing LOS by at least one full letter grade. Even greater improvement would be realized at some locations.

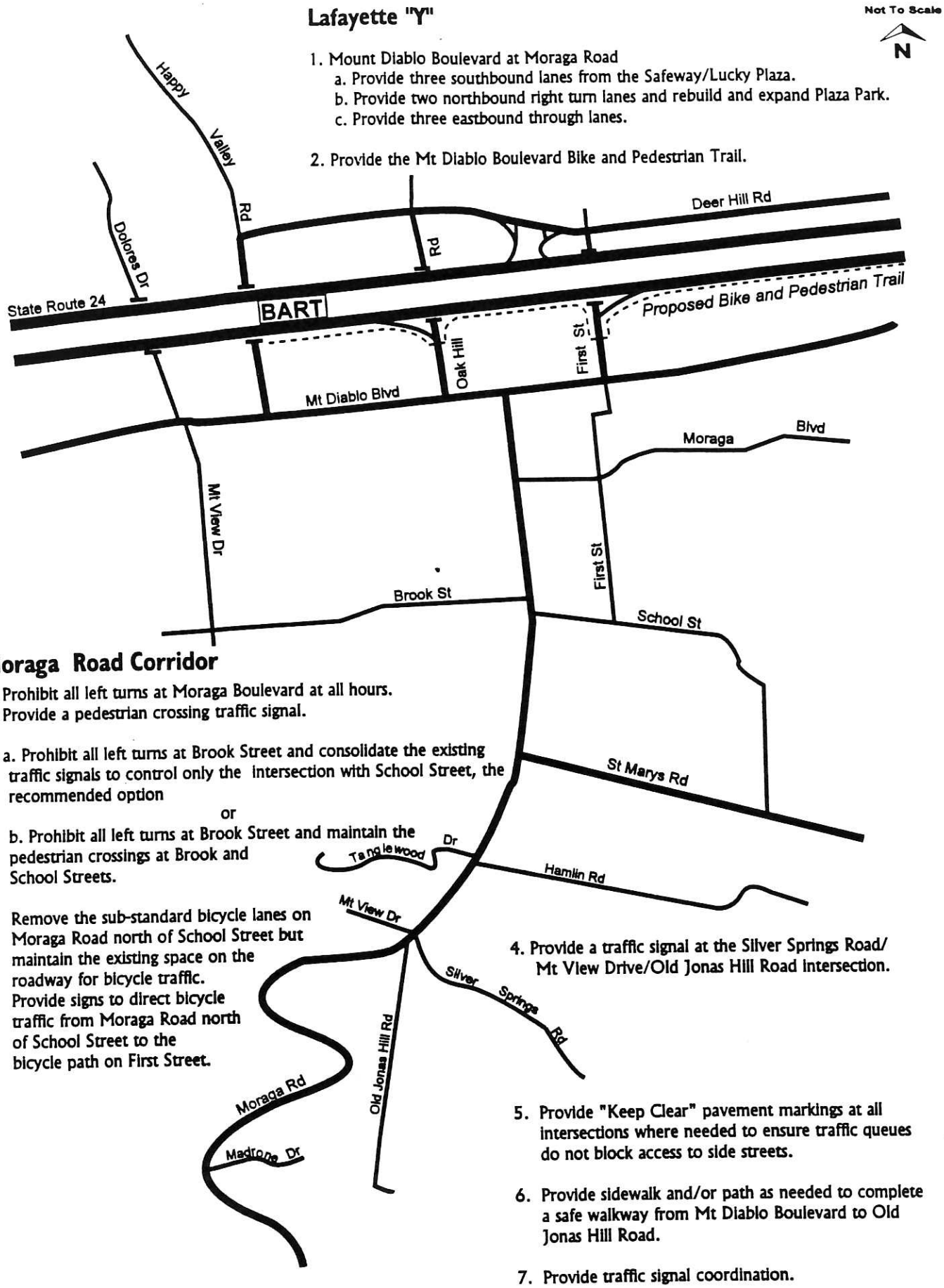


Figure 8

Recommended Improvements

Table 6 (Page 1 of 4)

Comparison of Improvement Alternatives

Recommended Improvements Shown in Bold Type

Mt. Diablo Boulevard at Moraga Road Improvement Option	Conformance With General Plan	Traffic Service Morning Peak Hour LOS	Morning Peak Hour Delay	Afternoon Peak Hour LOS	Afternoon Peak Hour Delay	Costs
Existing Conditions	Not Applicable	E	41	E	43	None
Lamorinda Traffic Study Alternative Provide Three Eastbound Through Lanes.	**Yes**	**C**	**23**	**D**	**26**	**$1,250,000**
Downtown Feasibility Study (DFS) Alternative #1 Provide Three Southbound Lanes.	**Yes**	**C/D**	**25**	**D**	**29**	**$ 180,000**
DFS Alternative #2 Provide Two Northbound Right Turn Lanes; Rebuild Plaza Park -- Abandon Plaza Drive.	**Yes**	**D**	**30**	**D**	**37**	**$ 720,000**
DFS Alternative #3 Provide Two Northbound Right Turn Lanes; Rebuild Plaza Park -- Maintain Plaza Drive.	Yes	D	30	D	37	$ 490,000
Recommended DFS Combination of Improvements	**Yes**	**C**	**17**	**C**	**24**	**$2,150,000**
Moraga Road at Moraga Boulevard Existing Conditions	Not Applicable	C/F	18/>60	B/F	9/>60	None
Lamorinda Traffic Study Alternative #1 Prohibit All Left Turns at Peak Hours.	Yes	A/B	0/7	A/B	0/5	$ 2,000
Lamorinda Traffic Study Alternative #2 Prohibit All Left Turns at All Hours.	Yes	A/B	0/7	A/B	0/5	$ 8,000
Recommended DFS Alternative Prohibit All Left Turns at All Hours; Provide Pedestrian Crossing Traffic Signal.	**Yes**	**B/B**	**5/7**	**B/B**	**5/5**	**$80,000**

Source: Robert L. Harrison Transportation Planning

Table 6 (Page 2 of 4)

Comparison of Improvement Alternatives

Recommended Improvements Shown in Bold Type

Moraga Road at School / Brook Streets

Improvement Option	Conformance With General Plan	Traffic Service: Morning Peak Hour LOS	Morning Peak Hour Delay	Afternoon Peak Hour LOS	Afternoon Peak Hour Delay	Costs
Existing Conditions	Not Applicable	D	37	C	19	None
Lamorinda Traffic Study Alternative #1 Prohibit Left Turns into both School and Brook Streets.	No	D	31	C	17	$20,000
Lamorinda Traffic Study Alternative #2 Prohibit Left Turns into Brook Street; Restripe Moraga Road to Provide Left Turn Lane into School Street.	No	D	31	C	17	$30,000
Lamorinda Traffic Study Alternative #3 Make Brook Street Right Turn In and Out Only; Relocate Signal and Ped Xing to School Street; Restripe Moraga Road to Provide Left Turn Lane into School Street.	No	C	17	B	9	$90,000
Lamorinda Traffic Study Alternative #4 Widen Moraga Road to provide side by side Left Turn Lanes at both School and Brook Streets; Relocate the Lafayette Town Hall and the Masonic Hall.	No	D	33	C	17	$950,000
Lamorinda Traffic Study Alternative #5 Re-align Brook Street to intersect Moraga Road at School Street and form a single standard four legged intersection. Remove or relocate the Masonic Hall, four condominiums, and the building immediately south of the Masonic Hall.	No	C	18	B	15	$2,064,000 (LTS 1988$)
Recommended DFS Alternative #1 **Make Brook Street Right Turn In and Out Only;** **Consolidate Traffic Signal and Ped Xing at School Street.**	**Yes**	**C**	**17**	**B**	**9**	**$90,000**
DFS Alternative #2 Maintain Ped Xing and limit traffic to Right Turn In and Out at Brook Street; Left Turn Traffic Movements at School Street only.	Yes	C	24	B	13	$75,000

Source: Robert L. Harrison Transportation Planning

Table 6 (Page 3 of 4)
Comparison of Improvement Alternatives
Recommended Improvements Shown in Bold Type

Moraga Road at Hamlin Road / Tanglewood Drive		Traffic Service				
	Conformance With	Morning Peak Hour		Afternoon Peak Hour		
Improvement Option	General Plan	LOS	Delay	LOS	Delay	Costs
Existing Conditions	Not Applicable	B/D	6/27	B/E	6/43	None
Lamorinda Traffic Study Alternative Provide Traffic Signal and Rebuild Bus Stop and Improve Pedestrian Access.	Yes	C*	19	D	33	$208,000 (LTS 1988$)

*LOS D for northbound traffic. Would cause lengthy traffic queues intermittently blocking the Silver Springs / Mountain View intersection.

Moraga Road at Silver Springs Road / Mountain View Drive / Old Jonas Hill Road						
Existing Conditions	Not Applicable	B/E	6/40	B/D	6/28	None
Recommended DFS Alternative **Provide Traffic Signal to control all three side streets; Rebuild Bus Stop and Improve Pedestrian Access.**	**Yes**	**C**	**21**	**C**	**23**	**$275,000**

Pedestrian Walkways and Bicycle Paths			
	Conformance With		
Recommended DFS Improvements	General Plan	Impact on Traffic Service	Costs
Mt. Diablo Boulevard Bike and Pedestrian Trail Provide separate trail 8 feet wide by one mile long from Brown Avenue to Happy Valley Road on the EBMUD aqueduct right-of-way.	Yes	Would provide a safe by-pass route for bicycles around the most congested section of the downtown street system thus improving safety reducing potential delays to traffic.	**$530,000**
Moraga Road Walkway Provide 5 feet wide sidewalk or path on the west side of Moraga Road from St.Marys Road to Tanglewood Drive, and from Rosedale Avenue to Old Jonas Hill Road on the east side of Moraga Road.	Yes	Would provide a safe route for pedestrians along a roadway with a high traffic volume and minimal existing walkways.	**$166,000**

Source: Robert L. Harrison Transportation Planning

Table 6 (Page 4 of 4)
Comparison of Improvement Alternatives
Recommended Improvements Shown in Bold Type

Other Moraga Road Corridor Projects

Recommended DFS Projects	Conformance With General Plan	Impact on Traffic Service	Costs
Provide Traffic Signal Coordination	Yes	Improve through traffic efficiency by up to 5%. Should be designed to provide good access to and from side streets.	**$50,000**
Provide Comprehensive Analysis of Pedestrian and Bicycle Issues	Yes	Limited impact on vehicle traffic service levels; Should improve safety for pedestrians and bicyclists.	**$30,000**

Source: Robert L. Harrison Transportation Planning

Table 7
Intersection Level of Service (LOS) With Roadway Improvements

Intersection	AM Peak Hour HCM Method LOS	Delay (1)	CCTA Method LOS	V/C(2)	PM Peak Hour HCM Method LOS	Delay (1)	CCTA Method LOS	V/C(2)
Mount Diablo Blvd with Moraga Road								
Existing Conditions	E	41	B	0.66	E	43	C	0.78
Existing Traffic (3) with All Recommended Improvements	C	17	A	0.58	C	24	B	0.66
Moraga Road with School and Brook Streets								
Existing Conditions	D	32	C	0.75	C	16	A	0.59
Existing Traffic with All Recommended Improvements	C	17	B	0.67	B	6	A	0.46
Moraga Road with Silver Springs Road / Mt. View Drive / Old Jonas Hill Road								
Existing Conditions	B/E	6/40	Note 4		B/D	6/28	Note 4	
Existing Traffic with All Recommended Improvements	C	21	A	0.48	C	23	A	0.47

Notes:
(1) Average stopped delay per vehicle in seconds calculated using the HCS computer software.
(2) Volume to Capacity Ratio calculated using the CCTA approved VCCC computer software.
(3) Existing traffic adjusted for the impact of the left turn prohibition at Brook Street.
(4) Unsignalized intersections not evaluated under the CCTA methods.

Source: Robert L. Harrison Transportation Planning

APPENDIX

Appendix Table A-1 (Page 1)
Lamorinda Transportation Improvement Program (LTIP)
Downtown Lafayette Phase I Feasibility Study

Project Improvement Cost Estimates

At the Intersection of Mt. Diablo Boulevard and Moraga Road

Item	Unit	Unit Price	Provide 3 Eastbound Lanes on Mt.Diablo Boulevard Quantity	Cost	Provide 3 Southbound Lanes from Safeway/ Lucky Plaza Parking Lot Quantity	Cost
New Pavement	Sq.Ft.	$6	12,750	$76,500	1,500	$9,000
Old Pavement - Remove	Sq.Ft.	$4	4,900	19,600	0	0
Curb and Gutter - Remove	L.F.	$13	1,800	23,400	430	5,590
Curb and Gutter	L.F.	$17	1,800	30,600	430	7,310
Sidewalk - Remove	Sq.Ft.	$2	5,500	11,000	720	1,440
Sidewalk	Sq.Ft.	$8	5,500	44,000	720	5,760
Excavation	C.Y.	$35	2,650	92,750	100	3,500
Pavement Striping	LS			20,000		5,000
Pavement Markers	LS			2,500		200
Signs	LS			5,000		1,000
Drainage	LS			20,000		0
Traffic Signal Modification	LS			50,000		40,000
Utilities	LS			25,000		0
Traffic Control	LS			30,000		10,000
Street Light Modification	LS			20,000		10,000
Landscaping	LS			50,000		20,000
SubTotal				$520,350		$118,800
Contingency @ 25%				$130,000		$30,000
Design @ 10%				$52,000		$12,000
Construction Management @10%				$52,000		$12,000
Construction SubTotal				$754,350		$172,800
Right-of-Way Purchase	Sq.Ft.	$85	5,800	$493,000	0	$0
Total				$1,247,350		$172,800
			SAY	$1,250,000		$180,000

Sources: 1 - Unit Prices - City of Lafayette
2 - Lump Sum Costs and Quantities - Robert L. Harrison Transportation Planning

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Appendix Table A-1 (Page 2)
Lamorinda Transportation Improvement Program (LTIP)
Downtown Lafayette Phase I Feasibility Study

Project Improvement Cost Estimates

At the Intersection of Mt. Diablo Boulevard and Moraga Road

			Provide 2 Northbound Right Turn Lanes and Rebuild Plaza Park			
			Abandon Plaza Drive		Maintain Plaza Drive	
			Remove Parking		And Existing Parking	
Item	Unit	Unit Price	Quantity	Cost	Quantity	Cost
New Pavement	Sq.Ft.	$6	1,790	$10,740	1,790	$10,740
Old Pavement - Remove	Sq.Ft.	$4	10,500	42,000	3,000	12,000
Curb and Gutter - Remove	L.F.	$13	640	8,320	340	4,420
Curb and Gutter	L.F.	$17	440	7,480	390	6,630
Sidewalk - Remove	Sq.Ft.	$2	1,950	3,900	1,200	2,400
Sidewalk	Sq.Ft.	$8	10,900	87,200	2,400	19,200
Excavation	C.Y.	$35	100	3,500	100	3,500
Pavement Striping	LS			0		2,000
Pavement Markers	LS			0		500
Signs	LS			2,500		1,500
Drainage	LS			0		0
Traffic Signal Modification	LS			30,000		30,000
Utilities	LS			0		0
Traffic Control	LS			10,000		10,000
Street Light Modification	LS			10,000		10,000
Landscaping	LS			275,000		225,000
SubTotal				$490,640		$337,890
Contingency @ 25%				$123,000		$84,000
Design @ 10%				$49,000		$34,000
Construction Management @10%				$49,000		$34,000
Construction SubTotal				$711,640		$489,890
Right-of-Way Purchase	Sq.Ft.	$85	N/A	$0	N/A	$0
Total				$711,640		$489,890
			SAY	$720,000	SAY	$490,000

Sources: 1 - Unit Prices - City of Lafayette
2 - Lump Sum Costs and Quantities - Robert L. Harrison Transportation Planning

03-Apr-97